

## Report of the Fishery Science Committee

The Fishery Science Committee met on Sunday, October 18, 18:00-19:00 and Tuesday 20, 14:00-18:00, in Qingdao, China. Chair, Dr. Elizabeth (Libby) Logerwell (USA), led the meetings. Vice-Chairman Xianshi Jin (China) was also present. FIS welcomed two new members representing Japan, Drs. Tetsuichirou Funamoto and Masahito Hirota (*FIS Endnote 1*). Dr. Laura Brown (Canada) agreed to serve as rapporteur.

### AGENDA ITEM 2

#### **Adoption of agenda**

The agenda was adopted with no modifications (*FIS Endnote 2*).

### AGENDA ITEM 3

#### **Volunteers for Award Committees for PICES-2015**

Volunteers were sought to serve on subcommittees to select the FIS awards for Best Oral Presentation by an early career scientist and Best Poster Presentation during PICES-2015. Drs. Gordon Kruse (USA), Jacquelynne King (Canada) and John Field (USA) agreed to judge oral presentations. Drs. King, Field and Brown agreed to judge posters. The FIS Committee appreciates the work of these subcommittee members. The Best Oral Presentation Award was given to Ms. Shengle Yin (The University of Tokyo) for “*Selection of suitable coastal aquaculture sites with environmental and socio-economic consideration: A case study in the Menai Strait, UK*”. The Best Poster Presentation Award was given to Dr. Motomitsu Takahashi “*Interannual variations in growth trajectories of juvenile jack mackerel in the Tsushima Warm Current*” (see also [2015 Session Summaries](#)). This year’s selections were made from FIS-sponsored Topic Sessions S3, S8, S9 and the FIS-P Paper Session.

### AGENDA ITEM 4

#### **FIS Chair’s report**

Dr. Logerwell, presented some activities of PICES in 2015 that would be of interest to FIS Committee members.

At PICES-2015, FIS sponsored the following topic sessions:

- S3: FIS Topic Session (1-day) on “*Eastern-western approaches to fisheries: resource utilization and ecosystem impacts*”. Co-sponsor: International Council for the Exploration of the Sea (ICES). Co-Convenors: Gordon H. Kruse (USA), Shijie Zhou (Australia), Xianshi Jin (China), Jacquelynne King (Canada), Mitsutaku Makino (Japan), Marie-Joëlle Rochet (France);
- S8: FIS Topic Session (1-day) on “*Marine ecosystem services and economics of marine living resources*”. Co-sponsor: International Council for the Exploration of the Sea (ICES). Co-Convenors: Shang Chen (China), Sebastian Villasante (Spain/ICES), Minling Pan (USA), Ian Perry (Canada), Keith Criddle (USA), Mitsutaku Makino (Japan);
- S9: FIS Topic Session (½-day) on “*Experiences and lessons learned in managing shared/transboundary stock fisheries*”. Co-Convenors: Minling Pan (USA), Shang Chen (China), Keith Criddle (USA), Mitsutaku Makino (Japan);
- FIS Contributed Paper Session (½-day). Co-Convenors: Xianshi Jin (China), Elizabeth Logerwell (USA).

PICES co-sponsored the following sessions at the ICES Annual Science Conference 2015, Copenhagen, Denmark:

- “*Ecosystem monitoring in practice*” (Theme Session C). Co-Convenors: Matthias Schaber (Germany), Sven Gastauer (Australia), Jack Barth (PICES), Elena Eriksen (Norway);

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- “*Managing marine ecosystem services in a changing climate*” (Session G). Co-Convenors: Sebastian Villasante (Spain), Manuel Barange (UK), Keith Criddle (PICES);
- “*Ocean acidification: understanding chemical, biological and biochemical responses in marine ecosystems*” (Session H). Co-Convenors: Silvana Birchenough (UK), Pamela Walsham (UK), Klaas Kaag (The Netherlands), Tsuneo Ono (PICES).

### International Symposia in 2015

- March 21–27, 2015, 3<sup>rd</sup> PICES/ICES/IOC Symposium on “*Effects of climate change on the world's oceans*”, Santos City, Brazil
- Dr. Logerwell represented PICES at the 3<sup>rd</sup> meeting of Scientific Experts on “*Fish Stocks in the Central Arctic Ocean*”, April 14–16, 2015, Seattle (USA). Participants at the meeting acknowledged that there was some role for PICES in follow-up activities. There are components that look a lot like FUTURE for the Arctic.
- PICES supported the participation of Dr. Shoshiro Minobe at the NPAFC International Symposium on “*Pacific Salmon and Steelhead Production in a Changing Climate: Past, Present, and Future*” in Session 2, “*Climate change impacts on salmonid production and their marine ecosystems*”. The Symposium was held on May 17–19, 2015, in Kobe, Japan. Dr. Minobe presented the results of new research on climate effects on salmon ocean habitat initiated during Workshop 2 on “*Linkages between the winter distribution of Pacific salmon and their marine ecosystems and how this might be altered with climate change*” (co-sponsored by NPAFC) at PICES-2014.

### Publications

- Myers *et al.* Pacific salmon and steelhead: Life in a changing winter ocean. NPAFC Bulletin. Presented at the NPAFC International Symposium, 2015, Kobe. In review.

### Collaborations with other organizations

- NPAFC. PICES supported participation of Dr. Shoshiro Minobe at the NPAFC International Symposium, resulting in a publication in the NPAFC Bulletin (see details above).
- ISC. Drs. Logerwell and King attended a meeting of the Study Group for *Scientific Cooperation of ISC and PICES* on July 13–14, in Kona, USA, to develop a framework for cooperation between ISC and PICES. The framework was submitted to Science Board in September 2015 for consideration and approval during PICES-2015.
- ICES. ICES co-sponsored PICES-2015 S3: FIS Topic Session (1-day) on “*Eastern-western approaches to fisheries: resource utilization and ecosystem impacts.*”

### Outreach

- PICES-ISC Framework. Groups that would benefit from the results of collaborative research include tuna RFMOs in both the Pacific and Atlantic oceans, and ICES. If specific tools are developed, they could become part of the NMFS Stock Assessment Toolbox.
- PICES-NPAFC Framework. The International Year of the Salmon (a multi-year, internationally coordinated, interdisciplinary program) is going ahead. PICES contributed to its planning and PICES scientists are encouraged to play a greater role as it moves forward (see <http://www.npafc.org/new/publications/Newsletter/NL38/newsletter38%2819-20%29.pdf>).

## AGENDA ITEM 5

### Update on FUTURE activities

Dr. Logerwell provided a briefing to the Committee members on the FUTURE Mini-Symposium held on Sunday, October 18 (09:00–12:15). The agenda for the Mini-Symposium included reports from expert groups reporting to the FUTURE SSC (WG 27, WG 28, WG 29, WG 30, WG 31, WG 32; S-CCME, S-HAB, S-CC, S-HD; and AP-MBM, AP-CREAMS, AP-NPCOOS), followed by a general discussion.

FUTURE SSC liaison, Dr. Sukyung Kang (Korea), gave an update of FUTURE activities to the Committee. She provided a brief overview of the FUTURE research themes and the results of the 2014 evaluation of FUTURE. She then presented the terms of reference of the new FUTURE SSC, the list of expert group liaisons and a list of proposed new expert groups that would support FUTURE. She closed her presentation with a conceptual diagram that shows how the existing PICES expert groups map on to the elements of FUTURE.

#### AGENDA ITEM 6

##### **Status reports of FIS-sanctioned groups**

S-CCME Chair, Dr. Anne Hollowed (USA), gave the Committee an update on the activities of the Joint PICES/ICES Section on *Climate Change Effects of Marine Ecosystems* (S-CCME). Dr. Shin-ichi Ito (Japan) replaced Dr. Suam Kim (Korea) as PICES S-CCME Co-Chair, and Dr. John Pinnegar replaced Dr. Manuel Barange as ICES S-CCME Co-Chair. S-CCME was very active in the 3<sup>rd</sup> PICES/ICES/IOC Symposium on the “*Effects of climate change on the world’s oceans*”, March 2015, Santos, Brazil. Dr. King, representing PICES, and Dr. Barange, representing ICES, were on the Symposium Steering Committee; and S-CCME members co-convoked several Theme Sessions. More information on the Symposium can be found in [PICES Press, Vol. 23, No. 2](#). S-CCME members were active in the 2015 annual meetings of both organizations, by convening theme sessions. Inter-session activities included a S-CCME organized workshop on “*Modelling effects of climate change on fish and fisheries*” in August 2015 in Seattle, USA, which will result in regional modeling nodes throughout the North Pacific and Atlantic. S-CCME was involved in several other international meetings including: World Oceans Day 2015 (Paris France); 3<sup>rd</sup> meeting of the World Meteorological Joint Technical Commission for Oceanography and Marine Meteorology/CAGM Task Team on Weather, Climate and Fisheries (San Sebastian, Spain); 2<sup>nd</sup> International Ocean Research Conference on “*One planet, one ocean*” (Barcelona, Spain); and International Scientific Conference on “*Our common future under climate change*” (Paris, France). Four papers from the PICES/ICES Workshop on “*Global assessment of the implications of climate change on the spatial distribution of fish and fisheries*” (2013, St. Petersburg, Russia) were published in the *ICES Journal of Marine Science* in 2015. (For more details see the [2015 S-CCME annual report](#).) In addition, the *ICES Journal of Marine Science* will publish a special issue on the Santos symposium. At least 4 papers resulting from the S-CCME workshop in Seattle will be submitted to the peer reviewed literature.

#### AGENDA ITEM 7

##### **Relations with other programs and organizations**

Committee members discussed the ICES ASC 2016 list of theme sessions for potential PICES co-sponsorship. The consensus was, in decreasing order of priority:

- FIS rank #1: (SCICOM ranked #2) Proposal 10 “*Seasonal-to-decadal prediction of marine systems: Opportunities, approaches and applications*”;
- FIS rank #2: (SCICOM ranked #9) Proposal 8 “*The inshore challenge – management of recreational and commercial fisheries accounting for social benefits, economic value, and biological sustainability*”;
- FIS rank #3: (SCICOM ranked #1) Proposal 11 “*What is a good pelagic habitat?*”

There was consensus to defer SCOR working group proposal recommendations for PICES affiliate status to the other Committees because none of the proposals had direct links to FIS.

Dr. King, PICES Co-Chair of Study Group for *Scientific Cooperation of ISC and PICES* (SG-SCISC), gave a presentation on the ISC-PICES Framework for Scientific Cooperation in the North Pacific. The Framework describes several scientific topics of joint interest to both organizations, grouped under the following three themes: 1) Oceanographic conditions and the distribution and productivity of pelagic fish; 2) Environmental interactions with fish and fishers; and 3) Effects of climate change on the distribution and productivity of pelagic fish. The Framework also described implementation procedures that would be effective, such as joint working groups and strategic initiatives. The FIS Committee unanimously recommended Science Board to endorse the Framework.

Dr. Franz Mueter briefed the Committee on the activities of the Ecosystem Studies of Arctic and Sub-Arctic Seas (ESSAS) program. There will be a special issue of *Polar Biology* for papers presented at the workshop on “*Biology and ecology of Arctic cods (Boreogadus saida and Arctogadus spp.)*” convened as part of the Ecosystem Studies of the Subarctic Seas Annual Science Meeting, April 9, 2014. Papers from the North Pacific are:

- Caroline Bouchard, Salomé Mollard, Keita Suzuki, Dominique Robert, Louis Fortier “*Contrasting the early life histories of sympatric Arctic gadids*”;
- Olafur Astthorsson “*Distribution, abundance, and biology of polar cod, Boreogadus saida, in Iceland-East Greenland waters*”;
- Maxime Geoffroy, Andrew Majewski, Mathieu LeBlanc, Stéphane Gauthier, Wojciech Walkusz, James D. Reist and Louis Fortier “*Vertical segregation of age-0 and age-1+ polar cod (Boreogadus saida) over the annual cycle in the Canadian Beaufort Sea*”;
- Tsubasa Nakano, Kohei Matsuno, Bungo Nishizawa, Yuka Iwahara, Yoko Mitani, Jun Yamamoto, Yasunori Sakurai, Yutaka Watanuki “*Environmental factors affecting the distribution of Arctic cod (Boreogadus saida) in the southeastern Chukchi Sea*”;
- Kessel S T, Hussey N E, Crawford R, O’Neill C, Yurkowski D, and Fisk A “*Environmental conditions associated with Arctic cod (Boreogadus saida) presence and absence in a high Arctic embayment revealed through acoustic telemetry*”;
- Carmen David, Hauke Flores, Benjamin Lange, Thomas Krumpen “*Under-ice distribution of polar cod, Boreogadus saida, in the Central Arctic Ocean and its association with sea ice properties*”.

ESSAS received funding for a synthesis activity under its RACArctic (Resilience and Adaptive Capacity of ARCTIC marine systems under a changing climate) Project through the Belmont Forum. The funding will support annual workshops in Japan, Alaska, and Norway. Also upcoming is an Open Science Meeting, to be held in Tromsø, Norway in 2017 (dates TBD). The meeting will focus on advection, the movement of water, animals and people. ESSAS will hold its Annual Science Meeting March 7–9, 2016 in Yokohama, Japan. The Theme will be “*Scientific challenges in changing Arctic and Subarctic*”.

Dr. Loh-Lee Low gave a presentation on potential collaboration between PICES and the North Pacific Anadromous Fish Commission (NPAFC) in the International Year of the Salmon (IYS). The IYS is proposed as an intensive burst of internationally coordinated, interdisciplinary, scientific research focused on salmon, and their relation to people. New technologies, new observations and new analytical methods, some developed exclusively during the IYS, will address knowledge gaps that prevent a clear and timely understanding of the future of salmon in a rapidly changing world. The theme of the IYS is “*Salmon and people in a changing world*” to focus on the intimate nature of the relationship between salmon and people and their joint future. IYS is a 7-year program. Planning stage is from 2015–2016; 2017 will be the start-up year; intensive field study will occur in 2018 and 2019; papers will be published in 2020–2022. PICES is invited to participate in IYS planning, in particular to attend a scoping meeting to refine the science objectives and to bring together potential partners to develop a business plan. The meeting will be held in March 2016 in Vancouver, British Columbia.

#### AGENDA ITEM 8

#### **PICES-2016 25<sup>th</sup> anniversary**

PICES-2016 will take place in San Diego, USA, from November 1–13, 2016. The theme is “*25 years of PICES Celebrating the past, imagining the future*”. The Committee discussed all the proposed topic sessions and workshops, with particular attention paid to those of which convenors had specifically requested FIS sponsorship. The Committee supports:

- Proposal #2, “*Species adaptation to climate change*” and Proposal #16, “*Resilience, transitions and adaptation in marine ecosystems under a changing climate*” but suggests combining #2 and #16; and that #2 adapt to #16, strengthening the broader proposal (#16); the Committee recommends a duration of 1 day.
- Proposal #8, “*Climate variability, climate change and the reproductive ecology of marine populations*”; 1 day.

- Proposal #3, “*Early life history stages as indicators and predictors of climate variability and ecosystem change*”; 1 day. The Committee strongly recommends that #8 should be followed by #3 and that they should NOT be concurrent sessions.
- The Committee would also like to hold a FIS contributed paper session.

The FIS Committee felt that the following proposals did not have direct links to FIS and therefore, could not support them: Proposal #10, “*Understanding our changing oceans through species distributions and habitat models based on remotely sensed data*” (more appropriate for POC or BIO); Proposal #11, “*What factors make or break trophic linkages?*” (POC or BIO); Proposal #14, “*New stage of ocean acidification studies: Responses of oceanic ecosystem including fisheries resources*”; Proposal #19, “*Social and economic assessment of migrated species fisheries*” (the Committee members noted that the convenors already had a Topic Session for 2015 that was very similar and they suggest it be submitted for 2017).

FIS supports the following Workshop proposals (in order of priority; however, FIS recommends supporting all three):

- Workshop proposal #5, “*Phase 1: Modeling effects of climate change on fish and fisheries*”;
- Workshop proposal #4, “*Methods relating oceanographic conditions to the distribution of highly migratory species*”;
- Workshop proposal #9, “*The role of the northern Bering Sea in modulating the Arctic environments: towards international interdisciplinary efforts*”.

#### AGENDA ITEM 9

##### **Proposals for new study groups, FIS working groups, and special projects**

Dr. Elliot Hazen asked FIS to support a proposal for a Study Group on “Ecosystem Reference Points as a Common Currency across PICES Social-Ecological Systems” (see *AP-MBM Endnote 4* elsewhere in the [2015 Annual Reports](#)) which would be also supported by BIO and POC, and would contribute to Objective 1.1 of the FUTURE Science Plan to understand what determines “an ecosystem’s intrinsic resilience and vulnerability to natural and anthropogenic forcing.” He argued that managing ecosystems under a changing climate requires flexibility in order to facilitate resilient ecosystems for ecological and societal goals. For example, high fishing rates under poor climatic conditions and high predation pressures are less likely to produce favorable management outcomes than the same fishing rates under good climatic conditions. This kind of observation motivates the need for dynamic reference points that reflect a dynamic marine environment and a coupled social-ecological system. The overall goal of this Study Group will be to work with PICES member countries to assess data and capacity to address this need effectively. If the Study Group is established, Dr. Hazen envisions the development of a Working Group to advance this work through the lifetime of the FUTURE program. The consensus of the Committee was to recommend this new Study Group to Science Board.

Dr. King (Canada) presented a proposal for a PICES/ISC Working Group on “Oceanographic Conditions and the Distribution and Productivity of Highly Migratory Fish” (*FIS Endnote 3*). An area of overlapping PICES/ISC research interest identified is the understanding of the oceanographic drivers of species distributions and productivity. The distribution and productivity of many commercial pelagic fish populations in the North Pacific Ocean are determined by large-scale oceanographic processes and climate variability. One hypothesis is that highly migratory pelagic species, such as albacore tuna (*Thunnus alalungus*), have environmental thresholds and preferences that drive their distribution and productivity. The highly migratory pelagic species of interest to the ISC occupy surface waters from coastal shelf to open ocean ecosystems and undertake large-scale feeding, spawning, and ontogenetic migrations linked to seasonal changes in oceanographic conditions. The proposed Joint Working Group will collaborate on deriving habitat models relating albacore tuna distributions to oceanographic conditions. Albacore tuna is the most temperate highly migratory species and much of its range overlaps the PICES domain. In addition, the stock is considered healthy and capable of supporting current exploitation. Thus, environmentally-driven distribution and productivity changes should be discernible from signals related to direct human impacts (fishing). The

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proposed Joint Working Group will also investigate mechanisms regulating albacore productivity by relating large-scale climate indices that describe North Pacific Ocean states to albacore tuna recruitment indices and demographic parameters. The consensus of the committee was to recommend this new Working Group to Science Board.

### AGENDA ITEM 10

#### **High priority projects and activities with policy implications**

Dr. Phillip Mundy gave a report from the Study Group on *North Pacific Ecosystem Status Report* (SG-NPESR3) on the NPESR draft Implementation Plan. The proposal is to build a web site for national and international ecosystem time series observations (ETSOs) that will constitute the basic web version of NPESR3. The web version of NPESR3 will contain the building blocks for follow-on synthesis papers, summary brochures and books. Software for receiving and processing ecosystem time series observations and conducting basic administrative functions will be developed and maintained by an independent contractor. Each Committee Chair (or Chair's nominee) will form a NPESR editorial board, reporting to the Science Board. The editorial board will assist the independent contractors in developing and maintaining a peer review network for the ETSOs. The basic web version of NPESR3 is a collection of national (continental shelf) and extra-national (oceanic) ETSOs. Reports for current systems and oceanic areas are to be produced during synthesis projects using the national contributions. The consensus was that the Committee supports this Implementation Plan.

The PICES Secretariat requested that each Committee nominate one candidate (< 5 years since PhD) to be on the SSC of the PICES/ICES Early Career Scientist Conference, to be held in May 2017 in Busan, Korea. The Committee was not comfortable putting a name forward at this time and will correspond by email in the month after the meeting to nominate a candidate. FIS suggests that in future, Science Board formalizes and clarifies the process of nominating candidates.

### AGENDA ITEMS 11 AND 12

#### **Proposals for new meetings/workshops/conferences and priority items with funding implications**

The committee considered all the requests made during previous agenda items. The following are recommended and supported by FIS:

- SG-NPESR3 inter-sessional workshop, early summer, location TBD;
- ICES/PICES inter-sessional workshop on economic modelling of the effects of climate change on fish and fisheries (WKSICCME\_Econ; in conjunction with the MSEAS Symposium, May 30–June 3, 2016, Brest, France (travel support);
- 1 day S-CCME meeting, prior to ICES ASC 2016, Latvia (travel support for PICES S-CCME member(s))

The following are deemed low priority by FIS and the Committee recommended that they not be funded, or at low levels of resources:

- International Conference on “*Species on the Move*”, February 2016, Hobart, Tasmania. Conference sponsors: University of Tasmania and Institute for Marine and Antarctic Studies;
- NPAFC IYS scoping meeting, March 2016, Vancouver, Canada;
- ESSAS Science Meeting, March 2016, Yokohama, Japan.

### AGENDA ITEM 13

#### **Proposed publications**

None proposed.

## AGENDA ITEM 14

**Intersessional activities and meetings, travel support requests**

None other proposed (see agenda item 11).

## AGENDA ITEM 15

**Other business**

None.

***FIS Endnote 1*****FIS participation list****Members**

Laura Brown (Canada)  
 John C. Field (USA)  
 Tetsuishiuro Funamoto (Japan)  
 Xianshi Jin (Vice-Chairman, China)  
 Sukgeun Jung (Korea)  
 Jacquelynne R. King (Canada)  
 Gordon H. Kruse (USA)  
 Elizabeth A. Logerwell (Chairman, USA)  
 Hirota Masahito (Japan)  
 Kazushi Miyashita (Japan)  
 Mikhail Stepanenko (Russia)

**Observers**

Yunlong Chen (China)  
 Anne Hollowed (USA)  
 Sukyung Kang (Korea)  
 Phillip Mundy (USA)  
 Shannon Obradovich (USA)  
 Yi Xu (IMBER)  
 Olga Zikunova (Russia)  
 Shijie Zhou (Australia)

***FIS Endnote 2*****FIS meeting agenda**

*October 18, 2015*

- 1) Welcome of new members, introductions, and nomination of a rapporteur
  - a) New members
    - i) Dr. Tetsuichirou Funamoto (Japan)
    - ii) Dr. Masahito Hirota (Japan)
- 2) Adoption of agenda
- 3) Volunteers for Award Committees for PICES-2015
  - a) FIS Best Presentation Award
  - b) FIS Best Poster
- 4) FIS Chair's report
- 5) Update on FUTURE activities
  - a) FIS Chair's report on FUTURE Mini-Symposium
  - b) FUTURE SSC liaison update on FUTURE, Sukyung Kang

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- 6) Status reports of S-CCME: Joint PICES/ICES Section on *Climate Change Effects of Marine Ecosystems*, Anne Hollowed
  - a) WKSICCME report
  - b) Review goals in light of new FUTURE structure.  
**Action Item:** Suggest updates/revisions to S-CCME goals
- 7) Relations with other programs and organizations
  - a) ICES ASC 2016 list of theme sessions for PICES co-sponsoring (TBD)  
**Action Item:** Which theme sessions does FIS recommend PICES supports?
  - b) SCOR Working Group proposals.  
**Action Item:** Assign “must fund”, “may fund” or “do not fund” rating for each proposal
  - c) ISC-PICES Framework for Scientific Cooperation in the North Pacific (Jacquelynne King)  
**Action Item:** Does FIS support the Framework? Suggest revisions, if necessary
  - d) Observers
    - i) Ecosystem Studies of Sub-Arctic Seas (ESSAS), Franz Mueter, Ken Drinkwater or Sei-Ichi Saitoh. Oral presentation.
    - ii) International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC), Chi-lu Sun. No presentation.
    - iii) North Pacific Anadromous Fish Commission (NPAFC), Loh-Lee Low. Oral presentation.
    - iv) North Pacific Fishery Management Council (NPFMC), Gordon Kruse. No presentation.  
**Action Item:** Does FIS endorse the observers’ requests for PICES financial support or other involvement?
- 8) PICES 2016 25<sup>th</sup> anniversary
  - a) San Diego, USA, November 1–13, 2016.
  - b) FIS committee rankings of Topic Sessions and Workshops.
    - i) Please review and rank proposals online before our meeting. Proposers are encouraged to submit proposals online before September 25. The online system closes on October 19. We will review any later submissions during the FIS meeting.
    - ii) Please review all proposals, but note that the conveners of the two session proposals below requested FIS sponsorship:
      - #3, Early life history stages as indicators and predictors of climate variability and ecosystem change (Corresponding Convenor, Richard Brodeur)
      - #2 Species adaptation to climate change (Corresponding Convenor, Lorenzo Cianelli)**Action Item:** Which proposals does FIS support? Suggest revisions to proposals, if necessary.
- 9) Proposals for new study groups, FIS working groups, and special projects
  - a) SG Ecosystem reference points as a common currency across PICES social-ecological systems, Elliot Hazen or Jameal Samhouri.  
**Action Item:** Does FIS support the new SG? Suggest revisions to proposal, if necessary.
  - b) PICES/ISC Working Group on “Oceanographic Conditions and the Distribution and Productivity of Highly Migratory Fish”, Jacquelynne King.  
**Action Item:** Does FIS support the new WG? Suggest revisions to proposal, if necessary.
- 10) High priority projects and activities with financial/policy implications
  - a) Report from SG-NPESR3, Jaebong Lee See Appendix V “NPESR Draft Implementation Plan”  
**Action Item:** Does FIS endorse the NPESR Implementation Plan?
- 11) Proposals for new meetings/workshops/conferences with PICES as co-sponsor
  - a) “Species on the Move International Conference”, Hobart Tasmania.  
**Action Item:** Should PICES support this conference?
- 12) Priority items with funding implications (meetings/workshops/conferences)
- 13) Proposed publications (PICES Scientific Report series and primary journals)
- 14) Intersessional activities and meetings, travel support requests
- 15) Other business



**FIS Endnote 3****Proposal for a PICES /ISC Working Group on  
Oceanographic Conditions and the Distribution and Productivity of Highly Migratory Fish**

PICES Parent Committee: FIS

ISC Parent Committee and Working Group: Plenary Committee; Albacore Working Group

Proposed Co-Chairmen: Gerard Dinardo (USA, ISC); Chi-lu Sun (ISC, Chinese Taipei) and Shingo Kumura, (PICES, Japan) and TBD (PICES, Korea)

Proposed members: TBD (Canada), TBD (China), Kenji Morinaga (Japan), Hidetada Kiyofuji (Japan), TBD (Korea), TBD (Russia), Minling Pan (S-HD, USA)

**Background**

The North Pacific Marine Science Organization (PICES) and the International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean (ISC) are two inter-governmental organizations that promote and coordinate marine scientific research on North Pacific marine ecosystem components. PICES is mandated to improve understanding of how marine ecosystems respond to climate change and human activities. The ISC is an independent regional fishery organization that provides scientific and stock assessment advice to the Western Central Pacific Fisheries Commission (Northern Committee) and the Inter-American Tropical Tuna Commission in support of fisheries management for highly migratory pelagic fish species in the North Pacific (*i.e.*, tuna and tuna-like species). In 2015, a Joint Study Group on Scientific Cooperation of ISC and PICES (SG-SCISC) identified broad research areas of mutual interest and outlined a framework to develop and implement activities of science cooperation in the North Pacific Ocean.

**Scientific Context**

One area of overlapping research interest identified by the SG-SCISC is understanding of the oceanographic drivers of species distributions and productivity. The distribution and productivity of many commercial pelagic fish populations in the North Pacific Ocean are determined by large-scale oceanographic processes and climate variability. One hypothesis is that highly migratory pelagic species, such as albacore tuna (*Thunnus alalungus*), have environmental thresholds and preferences that drive their distribution and productivity. The highly migratory pelagic species of interest to the ISC occupy surface waters from coastal shelf to open ocean ecosystems and undertake large-scale feeding, spawning, and ontogenetic migrations linked to seasonal changes in oceanographic conditions. The proposed Joint Working Group will collaborate on deriving habitat models relating albacore tuna distributions to oceanographic conditions. Albacore tuna is the most temperate highly migratory species and much of its range overlaps the PICES domain. In addition, the stock is considered healthy and capable of supporting current exploitation thus environmentally-driven distribution and productivity changes should be more easily discernible from signals related to direct human impacts (fishing). The proposed Joint Working Group will also investigate mechanisms regulating albacore productivity by relating large-scale climate indices that describe North Pacific Ocean states to albacore tuna recruitment indices and demographic parameters.

**Proposed Approaches**

Spatially-explicit environmental data are available as satellite and Argo float products, such as sea surface temperature, surface chlorophyll, frontal probability and mixed-layer depth, and can be used to index oceanographic conditions. Fishery catch per unit effort (CPUE) data are available by country and gear type and can be used to index species distribution patterns by life stage and season. These data can be used in a Generalized Additive Modeling (GAM) approach to identify oceanographic conditions that influence

distribution. Other approaches which could be investigated include Bayesian Hierarchical Modeling and zero-inflated standardization. There are several large-scale climate indices that describe low-frequency variability of the North Pacific (*i.e.*, Pacific Decadal Oscillation Index, North Pacific Gyre Oscillation) or describe teleconnections between the tropics and extratropics (*e.g.*, Multivariate ENSO Index). Model estimates of recruitment or demographic parameters, such as biomass or fishing mortality, are available for albacore tuna. Bayesian approaches could be employed, dependent on availability of uncertainty estimates for recruitment or demographic parameter estimates.

### **Scientific Outputs and Benefits**

- 1) Improved knowledge of the relationship between ocean conditions and distribution and productivity of albacore tuna will allow:
  - i) the ISC to incorporate spatially-explicit environmental data into future stock assessments of North Pacific albacore tuna. Inclusion of environmental variability in scientific advice is consistent with recent directions in stock assessment research.
  - ii) PICES to quantify how this important component of the marine ecosystem responds to human activities (fishing) and natural forcing. This quantification would support efforts to forecast ecosystem status, a key activity identified in the FUTURE Science Program.
- 2) Identification of fishery catch per unit effort (CPUE) hot spots by life stage, which could be used to identify prey hot spots.
- 3) Standardization of CPUE.
- 4) Primary scientific publications.
- 5) Working Group final report published as a PICES Scientific Report.

### **Draft 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;
- 2) Facilitate communication, regular exchange of information and organization of meetings to discuss and publish data, methodologies and results of research outlined above;
- 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';
- 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.
- 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;
- 6) Produce peer-reviewed publications of scientific results;
- 7) Publish a final report summarizing the results of the WG as a PICES Scientific Report.