Report of Working Group
Common Ecosystem Reference Points across PICES Member Countries

The Working Group on *Common Ecosystem Reference Points across PICES Member Countries* (WG 36) held its second meeting from 9:00 to 17:30 h on October 26, 2018 in Yokohama, Japan. The meeting was co-chaired by Dr. Xiujuan Shan (China) and Dr. Mary Hunsicker (USA), participated remotely. Dr. Shan who welcomed members and participants to the meeting (**WG 36 Endnote 1**) where self-introductions were made. The agenda for the meeting is presented in **WG 36 Endnote 2**.

Participants of the second meeting of WG 36 at PICES-2018, Yokohama, Japan. Left to right: Xiujuan Shan, Sukyung Kang, Vladimir Kulik, Elliott Hazen, Robert Suryan, Jennifer Boldt, Jongseong Ryu. Missing from photo: Mary Hunsicker who participated by phone.

AGENDA ITEMS 2 AND 3
Review WG 36 terms of reference, activities and progress

WG members reviewed and discussed progress on WG 36 terms of reference (TORs):

1. TOR 1 is drafted by most member countries (excluding Russia); however, all members need to add one to two paragraphs on the research that has been done/is being done in his/her country that is relevant to ecosystem-based fishery management (EBFM) research and reference points.

Action: Members to revise TOR 1 and send to Drs. Hunsicker and Shan.

2. For TOR 2 (identifying core and optional indicators), a couple of notes were made about some indicators: 1) for temperature, raw data should be used, so a common baseline time period does not have to be established, 2) satellite data would be useful because of the broad spatial coverage, and 3) time series for analyses need to be longer than ~15 years.

Actions:
- Members to review the list of indicators and check off those indicators that they have (or double check the list if this was done during the business meeting;
- Jennifer Boldt to contact WG 35 (WG-NPSER3) to see what data is available for indicators;
- Rob Suryan and Elliott Hazen to check with Section on Marine Birds and Mammals on availability of diet and reproductive success data.

3. For TOR 3 (comparison of methodologies), we are in process of drafting a paper that presents the pros and cons of methodologies for identifying thresholds and reference points.

Actions:
- Members to add strengths and weaknesses to the table and send to Dr. Hunsicker;
- Vladimir Kulik to add Minerva to table with strengths and weaknesses outlined.

4. TOR 4 is still ongoing. WG members have made progress in terms of running R code. To keep the momentum going will require regular and frequent communication among members.

Actions:
- Members to run code and update indicator lists as needed;
- Dr. Hunsicker to send out email to members in early December to indicate how coding and analyses are going, and to send out frequent and regular emails (every 2 months) to check in with members; potentially have phone/internet meetings.

5. TORs 5 and 6 have not been addressed yet. The proposed topic session for PICES-2019 on identifying thresholds and leading indicators (**WG 36 Endnote 3**) could help us move towards TOR 5. In addition, over the next year WG members will continue to discuss the possibility of a one-year extension for our WG.

WG members reviewed related efforts and activities, including:
- 2-day Workshop (W11) on "*Quantifying thresholds in driver-response relationships to identify reference points*" at PICES/ICES/IOC/FAO 4th International Symposium on "*effects of climate change on the world's oceans*" (ECCWO-4) in Washington, D.C., June 2018 (Co-Convenors: Mary Hunsicker, Robert Blasiak, Elliott Hazen, Jennifer Boldt, and Xiujuan Shan);
- Theme Session ICES/PICES Theme session Q on "*Sustainability thresholds and ecosystem functioning: the selection, calculation, and use of reference points in fishery management*" (PICES Convenor: Xiujuan Shan) at the ICES ASC 2018 in Hamburg, Germany;
- WG members revised WG 36 TORs for a joint PICES/ICES WG-CERP and submitted to the FUTURE SSC and ICES leadership. The FUTURE SSC presented the request to Science Board which recommended that WG 36 complete its TORs and final report before submitting a new working group proposal to be joint with ICES. WG members will continue to discuss the possibility of a joint ICES/PICES WG and how to align new efforts with ICES WG CERP. The first meeting of the ICES WG CERP will be held at the 2019 ICES Annual Science Conference.

WG 36 Endnote 1

WG 36 participation list

Members   Members unable to attend

Jennifer Boldt (Canada)   China: Yanbin Gu
Vladimir Kulik (Russia)   Japan: Mitsutaku Makino, Kazumi Wakita
Elliott Hazen (USA)   Korea: Sangchoul Yi
Mary Hunsicker (USA, Co-Chair)*
Sukyung Kang (Korea)   Observer
Jongseong Ryu (Korea)
Xiujuan Shan (China, Co-Chair)   Robert Suryan (USA)
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*Participated remotely

WG 36 Endnote 2

WG 36 meeting agenda

1. Welcome and WG member introductions
2. Review WG 36 TORS (WG deliverables)
3. Review of WG 36 activities and progress on TORs and related efforts
4. Identify action items and develop work plan/timeline
5. Decide on workshops, topic sessions and training course and draft proposals
6. Review main highlights for the co-chairs' report to the FUTURE SSC
7. If extra time, work on TORs

WG 36 Endnote 3

Proposal for a Topic Session on
"*Identifying thresholds and potential leading indicators of ecosystem change: the role of ecosystem indicators in ecosystem-based management*" at PICES-2019

Co-sponsor: ICES (potentially)
Duration: 1 day

Convenors: Elliott Hazen (USA), Xiujuan Shan (China), Mary Hunsicker (USA), Jennifer Boldt (Canada)

Suggested Invited Speakers: Vladimir Kulik (Russia), Saskia Otto (ICES/Germany), Jamie Tam (Canada), Jeongsong Ryu (Korea)

Abrupt nonlinear change in ecosystem structure and function can dramatically alter human-derived benefits from the system and can have negative impacts on people's livelihoods and well-being. A growing number of driver-response relationships in marine ecosystems are being identified as strongly nonlinear, indicating that they are potentially prone to inflection points and threshold dynamics. Better knowledge of where such thresholds occur can advance our ability to anticipate future conditions and critically inform what management actions can maximize ecological, social or economic benefits. Moreover, thresholds common across analogous systems can be used to develop robust sets of reference points to prevent ecosystem components from tipping into undesirable states. We are interested in presentations on ecosystem indicators and thresholds, leading indicators of loss of resilience and ecosystem change, and the future of indicators, such as novel indicators from socio-ecological systems and examples of how indicators have been used in management. Transdisciplinary presentations are encouraged.