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 meeting on October 18, 2019 in Victoria, Canada. The participants at the meeting are listed in ***WG 36 Endnote 1*** and the meeting agenda is presented in ***WG 36 Endnote 2***. WG 36 Co-Chair, Dr. Mary Hunsicker welcomed everyone to the meeting.

WG 36 meeting participants at PICES-2019, Victoria, Canada. Clockwise, from top: Elliott Hazen, Vladimir Kulik, Mary Hunsicker, Jennifer Boldt, Jongseong Ryu, Shion Takemura.

AGENDA ITEM 2
Overview of WG accomplishments to date

WG members presented their individual accomplishments on ToRs since the previous workshop and business meeting.

AGENDA ITEMS 3 AND 4
Overview of expectations for WG final report and draft outline

WG members reviewed and revised a draft of the final WG report. The WG plans to organize the report according to the ToRs, with a general introduction and conclusions/recommendations bookending the report. The WG also assigned section leads and timelines for completing different sections of the report.

AGENDA ITEM 5
Future meetings, sessions, publication

The WG submitted a proposal for a topic session at PICES-2020 (***WG 36 Endnote 3***).

The WG also discussed proposing a workshop (possibly for the 2021 Annual Meeting) on collaborative coding and science. WG 36 is depending heavily on the open-source programming language R which is a programming language and free software environment for statistical computing and graphics supported by the R Foundation for Statistical Computing, and is entirely open source. The R language is widely used among scientists, statisticians, and data miners for exploring data and conducting statistical and data analysis. There has been a substantial increase in the popularity of R since its first release in 2000.

Our WG found that sharing of R-code and R-programming skills was paramount to the success of our efforts. As such, we have developed a shared code library via GitHub that has been available and accessed by members of the WG.

AGENDA ITEM 6
Workshop and meeting reports

WG members drafted and submitted the following reports and proposals:
- o MS Powerpoint slides to FUTURE documenting the group's activities to date,
- o Activity Report to FUTURE,
- o Topic Session proposal to Science Board (PICES-2020; *WG 36 Endnote 3*),
- o Workshop (W13: *Common Ecosystem Reference Points*) summary to the Secretariat (PICES-2019),
- o Request to FUTURE SSC/Science Board for a one-year extension to complete WG ToRs and final report.

In additional activities, WG members continued to work on their analyses for ToR 4 (Determine shapes or functional forms of driver - response relationships from available datasets, and quantify thresholds to identify potential ecosystem reference points). Jennifer Boldt and Elliott Hazen are assisting members with R code and interpretation of model results.

AGENDA ITEM 7
Other business

WG 36 requests Dr. Shion Takemura (Japan) to replace Dr. Mitsutaku Makino who has stepped down as member.

WG 36 Endnote 1
WG 36 participation list

Members	Members unable to attend
Mary Hunsicker (USA, Co-Chair)	China: Yanbin Gu, Xiujuan Shan (Co-Chair)
Jennifer Boldt (Canada)	Japan: Robert Blasiak, Mitsutaku Makino,
Vladimir Kulik (Russia)	Kazumi Wakita
Elliott Hazen (USA)	Korea: Sangchoul Yi
Jongseong Ryu (Korea)	

Observer

Shion Takemura (Japan)

WG 36 Endnote 2

WG 36 meeting agenda

1. Welcome and sign in
2. Overview of WG accomplishments to date and goals for business meeting
3. Overview of expectations for WG final report and deadline
4. Draft outline for final WG report
5. Planning for future meetings, sessions, publication
6. Write up workshop and business meeting reports
7. Other business

WG 36 Endnote 3

Proposal for a Topic Session on
"*Managing for pathways of resilience in a changing climate: recent examples and emerging approaches*"
at PICES-2020

Duration: 1 day

Convenors: Xiujuan Shan (China), Kirstin Holsman (USA), Jennifer Boldt (Canada), Mary Hunsicker, (USA)

Suggested Invited Speakers: Angelica Peña (Canada), Shin-ichi Ito (Japan), Manu Di Lorenzo (USA), Anne Solomon (Canada; SES; potential Keynote), Lisa Pfeiffer (economics; USA), Christoph Heinze (U. Bergen, EU tipping points project)

Climate change and compounding anthropogenic pressures pose a risk to marine social-ecological systems. Of increasing concern is the potential for systems to rapidly shift (often irreversibly) to new states in response to pressures. In some cases, such shifts can occur abruptly without much warning, despite years of mounting pressure and apparent system resilience. These nonlinear inflection points in pressure-response relationship, – *i.e.*, "tipping points" –, are defined by the IPCC SR15 as "critical thresholds in a system that, when exceeded, can lead to a significant change in the state of the system, often with an understanding that the change is irreversible." Identifying singular or compound, nonlinear, or contextual tipping points is of paramount importance to the IPCC as the likelihood of crossing tipping points increases with atmospheric carbon, climate instability, and ecological sensitivity, posing a significant risk for ecological and human wellbeing. Tools and methods for managing systems prone to tipping points are important for national, regional, and local resource management and climate adaptation. While identifying tipping points is challenging, there are multiple recent approaches that advance this objective, especially in terms of multivariate tipping points. We propose a topic session that will a) explore emergent tools and approaches for identifying multivariate thresholds and tipping points, 2) explore existing and potential social and ecological tipping points and responses, and 3) review approaches for managing systems prone to tipping points. This topic session will bring together international experts from oceanographic, ecological, and social sciences to compare methodologies and synergies across systems. Of particular focus will be methods to promote adaptation and resilience to climate change in marine systems increasingly being pushed towards extremes and tipping points.