Report of the Section on *Human Dimensions of Marine Systems*

The Section on *Human Dimensions of Marine Systems* (S-HD) held its second meeting on October 13, 2013, from 18:00–19:30 h and October 16, from 14:00–18:00 h in Nanaimo, Canada. Drs. Mitsutaku Makino and Keith Criddle acted as meeting Co-Chairs. The meeting began with brief self-introductions (S-*HD Endnote 1*) and the adoption of the meeting agenda (S-*HD Endnote 2*).

AGENDA ITEM 2
Introduction to the meeting

Dr. Makino provided a succinct review of the formation and activities of the human dimension related studies in PICES, TORs of S-HD, and the past activities since the second S-HD meeting (June 13–16, 2013) in Honolulu. The objective for this third meeting was to review progress from the Honolulu meeting, in particular, regarding: a) planning for the UN-WOA and NPESR–HD Chapter (TOR-3); b) advances in the works for TORs; and c) developing the work plan for 2014.

AGENDA ITEM 3
Progress report of the Year 1

The Co-Chairs reviewed the main outcomes from the S-HD's second (inter-sessional) meeting in Honolulu, *i.e.*, the Indicator studies in PICES member countries and the possible contributions of Human Dimension Chapters for the next North Pacific Ecosystem Status Report (the report of that meeting can be found in the products table on S-HD's webpage). Then, the main messages of the three articles from S-HD members in PICES Press articles (see also the products table at http://www.pices.int/members/sections/S-HD.aspx) were summarized.

The Co-Chairs reported on the status of a special issue of *Fisheries Science* that features papers presented at the PICES-2012 Session (S5) on "*Social-ecological systems on pollock under changing environment: an inter-disciplinary approach*" sponsored by SG-HD and at the 2012 Symposium of the Japanese Society of Fisheries Science. Publication is anticipated in 2014.

Dr. Juri Hori and Dr. Makino (Japan) presented the preliminary results of the Wellbeing Cube analyses conducted in Japan, Korea, and the USA. The presentation showed exciting results which clearly illustrated the differences in the perception of the "ideal marine ecosystem" and "ecosystem service needs" amongst three countries, which implied the differences in the types of scientific information needed to monitor changes in wellbeing in these three regions and suggests that it will be important to monitor unique factors in other regions as well.

Dr. Shang Chen (China) introduced the main objectives and the expected outcomes of the 1-day Topic Session (S5) on "*Marine ecosystem services and the contribution from marine ecosystems to the economy and human wellbeing*", which was co-sponsored by IMBER. This session was a very good opportunity to summarize ecosystem service related studies in the North Pacific. We found that there are mainly three pillars in marine ecosystem service studies: 1) economic evaluation, 2) indicators, and 3) links to ecosystem functions and human wellbeing.

Representatives of each PICES member country provided an update of recent activities in support of the S-HD TOR and the assembly of time series of HD-Indicators for inclusion in the next NPESR. Dr. Ekaterina Golovashchenko (Russia) presented a literature review of ecosystem service studies in Russia. Dr. Ninsheng Yang (China) introduced the international co-research project of ecosystem service based on GIS analysis. Dr. Grant Murray (Canada) summarized social science research activities conducted by his students in Vancouver Island University. Also, Dr. Alida Bundy, representing the IMBER WG on Human Dimensions, presented their works "ADApT", which is a good tool for comparative study on social-ecological responses against the global changes.

AGENDA ITEM 4
Work plan for the Year 2 forward

Development of time series observations (TSOs) of HD Indicators for the North Pacific ecosystem is one of the main activities of S-HD. The list of indicators was developed at the inter-sessional meeting in Hawaii (June 2013). China and Japan provided TSOs (as electronic files or webpage links) of all the indicators to the S-HD Co-Chairs in advance of PICES-2013. Russia provided sample observations of the principle indicators. Canada, Korea, and the U.S. committed to provide TSOs before the end of 2013. The Co-Chairs will organize the full set of TSOs, conduct preliminary trend analyses, and distribute the full data set and results of preliminary analyses to S-HD members in advance of the FUTURE OSM in Hawaii in April 2014. Based on review and discussion during the FUTURE OSM, S-HD members will agree on finalizing the TSOs of HD indicators and agree on undertaking additional analyses of the TSOs to develop a draft HD chapter for the NPESR. The draft chapter will be reviewed at the S-HD meeting during PICES-2014.

Human Well-Being Cube analysis is another major activity in S-HD; possible refinements of the analysis and work plans for Year 2 were discussed. Many constructive comments were made by the members. Also, because there are no psychologists other than Dr. Hori in this Section, it was recommended an academic article based on the initial project results be submitted to an appropriate international journal where the work will be subject to review by appropriate experts.

During 2014, the S-HD Co-Chairs will complete a draft white paper describing the legal and regulatory foundations of fisheries management in the PICES member countries. Short summaries of the legal and regulatory foundations of fisheries management in the U.S., Russia, and China have been received. It is anticipated that summaries for Canada, Korea, and Japan will be received before the end of 2013. This draft white paper will be reviewed during S-HD meetings during the FUTURE OSM or during PICES-2014. It is anticipated that the white paper will lead to a journal publication co-authored by members of S-HD who have contributed to the development of the six national summaries.

Proposals for two new study groups were discussed. Dr. Chen (China) summarized the importance of ecosystem service studies in S-HD, and its academic value to construct the inter-disciplinary framework for it as a new study group, *i.e.*, a Study Group on Marine Ecosystem Services. The six member countries unanimously supported his proposal. Dr. Emanuele Di Lorenzo (USA) proposed a new Study Group on Social-Ecological-Environmental systems (SG-SEES), which would conduct a one-year exploratory study to develop a conceptual model of a coastal hypoxia SEES in the California Current ecosystem.

Two proposals for topic sessions at PICES-2014 in Yeosu, Korea, were put forth for consideration. Dr. Masahito Hirota (Japan), as the lead co-convener, proposed a Topic Session on the "*Ecological and human social analyses and issues relating Integrated Multi-Trophic Aquaculture*" (S-*HD Endnote 3*), which will be co-sponsored by MarWeB Project (funded by MAFF, Japan). Dr. Chen (China) proposed a Topic Session on "*Marine Ecosystem Services*" (S-*HD Endnote 4*) as a follow-up on session S5 (*Marine ecosystem services and the contribution from marine ecosystems to the economy and human well-being*) during PICES-2013.

S-HD has provided three contributions to PICES Press: articles by Drs. Makino, Criddle, and Felthoven and Kasperski (see Agenda Item 3). S-HD will provide two articles during 2014. Dr. Grant Murray (Canada) and Ms. Ekaterina Kurilova (Russia) have volunteered to write these articles.

S-HD Endnote 1

S-HD participation list

Members

Shang Chen (China)
Keith Criddle (USA, Co-Chair)
Emanuele Di Lorenzo (USA)
Feiyan Du (China)
Ekaterina V. Golovashchenko (Russia)
Masahito Hirota (Japan)
Juri Hori (Japan)
Ekaterina Kurilova (Russia)
Mitsutaku Makino (Japan, Co-Chair)

Grant Murray (Canada)
Naesun Park (Korea)
Ian Perry (Canada)
Tatiana Semenova (Russia)
Ningsheng Yang (China)

Observers

Alida Bundy (Canada, IMBER)
Cuihua Wang (China, WG 28)

S-HD Endnote 2

S-HD meeting agenda

1. Adoption of the Agenda (Co-Chairs)
2. Introduction to the meeting (Co-Chairs)
3. Progress reports of the Year 1
   - Results of the S-HD 2nd Meeting in Hawaii (Co-Chair)
   - PICES Press (Co-Chair)
   - Well-being Cube (Hori)
   - Topic Session in PICES-2013 (Co-Chair)
   - Proposal of Topic Sessions for PICES-2014 (Sunny, Hirota, Mark)
   - Proposal of a new WG on Marine Ecosystems (Sunny)
   - Updates from each Member Countries
   - Other reports
4. Discussion for the work plan of the Year 2 forward (Co-Chairs)
   - Human well-being and ecosystem services in marine social-ecological systems (S-HD TOR1).
   - Social and economic impacts of climate-induced changes in marine ecosystems (S-HD TOR2 and FUTURE Key Question 3.4).
   - Human Dimension Chapters in the next NPESR (S-HD TOR 3) and contributions for the UN's First World Ocean Assessment (WOA).
   - Planning of the S-HD Symposium (S-HD TOR 4)
   - Others (PICES Press, *etc*.)
5. Concluding remarks (Co-Chairs)

S-HD Endnote 3

Proposal for a 1-day MarWeb Topic Session on
"*Ecological and human social analyses and issues relating Integrated Multi-Trophic Aquaculture*"
at PICES-2014 [later changed to ½ day]

Several recent studies and reports suggest that increased aquaculture production is essential if we are to meet the growing world demands for marine protein. However, the rapid current development of intensive fed aquaculture (*e.g.* finfish and shrimp), in both developed and developing countries, has generated concerns about the environmental impacts of these often monospecific practices. To help address such issues, Integrated Multi-Trophic Aquaculture (IMTA) has been attracting global attention as a means to conduct aquaculture activities, while at the same time improving/rehabilitating coastal environmental conditions and improving the well-being of the people living in coastal areas. By integrating fed aquaculture (finfish, shrimp) with inorganic and organic extractive aquaculture (seaweed and shellfish), the wastes of one resource become a resource (fertilizer or food) for the others. This "ecosystem-like" approach provides nutrient bioremediation capabilities, mutual benefits to the co-cultured organisms, economic diversification by production of other value-added marine products, and increased profitability and food security for the local community. This session seeks contributions and case studies of how to

implement and conduct integrated multi-trophic aquaculture activities, in particular that reduce negative impacts to the quality of the local environment and improve the well-being of the local human communities. Examples of activities in tropical and semi-tropical locations are particularly welcome, as well as examples of general methods and approaches that can be applied in many different environments. This session is a contribution of, and towards, the work of the PICES Project on Marine Ecosystem Health and Human Well-Being (MarWeB).

S-HD Endnote 4
Proposal for a 1-day S-HD Topic Session on "*Marine Ecosystem Services*" at PICES-2014

Marine ecosystem services (MES) are benefits people obtain from the seas and oceans. Marine ecosystems provide ecological products and services, such as seafood, regulation of climate, reducing storm disasters, waste purification, recreation and leisure, biodiversity maintenance and so on. Assessing the value of MES has become an emerging and somewhat challenging subject in the scientific world and is receiving increasing attention from politicians. The United Nations' millennium ecosystem assessment reports published in 2005 focused on discovering changes in global ecosystem status and services. The ongoing World Ocean Assessment has urgent need for knowledge on marine ecosystem services. The United Nations Environmental Programme formed the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) in 2012. The IPBES aims to develop and use the knowledge on ecosystem services and biodiversity to improve national, regional, and global ecosystem management. The goals of this session are to provide marine scientists, economists, and ecologists with a platform to exchange results from research on marine ecosystem services, economics of marine ecological resources, and the contribution of marine environment to blue economy.