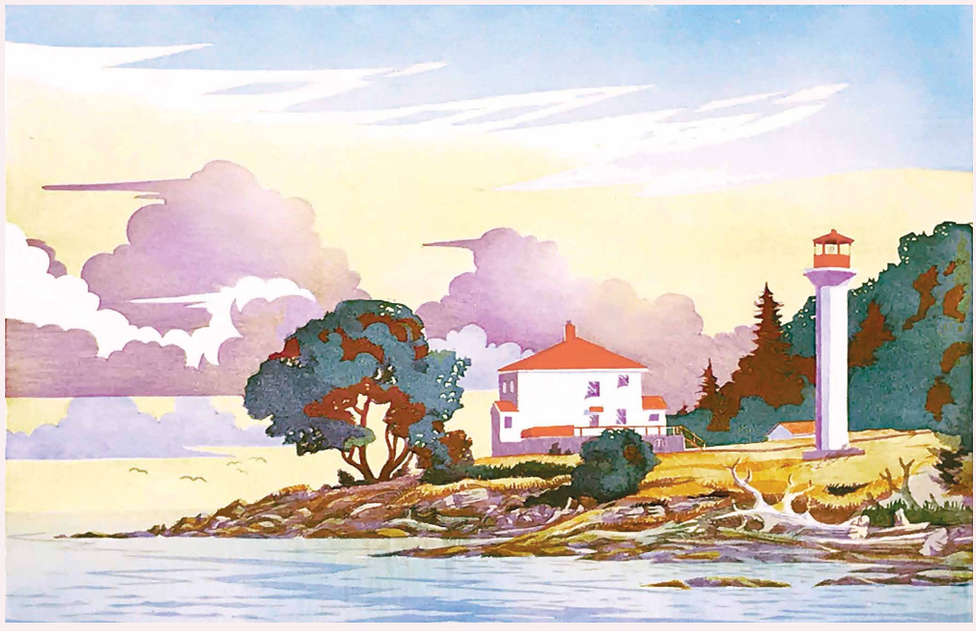


PICES-2019 Annual Meeting

Connecting Science and Communities in a Changing North Pacific

Program

Victoria, BC, Canada
October 16-27, 2019

FUTURE Science Program

FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems) is the integrative Scientific Program undertaken by the member nations and affiliates of PICES to understand how marine ecosystems in the North Pacific respond to climate change and human activities, to forecast ecosystem status based on a contemporary understanding of how nature functions, and to communicate new insights to its members, governments, stakeholders and the public.

FUTURE evolved from research conducted by its predecessor, the PICES/GLOBEC Climate Change and Carrying Capacity Program, which had a goal of increasing understanding of climate influences on marine ecosystems. FUTURE continues a focus on understanding climate impacts on marine systems and places additional emphasis on coastal anthropogenic influences, ecosystem forecasting, and engaging a broad user community with interests in North Pacific ecological and climate information.

The ultimate goal of FUTURE is to understand and communicate the present conditions and projected future states of North Pacific ecosystems and the potential impacts from human use and climate change. Implementation of FUTURE has two objectives:

- To increase understanding of climatic and anthropogenic impacts and consequences on marine ecosystems, with continued leadership at the frontiers of marine science.

- To develop activities that include the interpretation, clarity of presentation, peer review, dissemination, and evaluation of ecosystem products (e.g., status reports, outlooks, and forecasts).

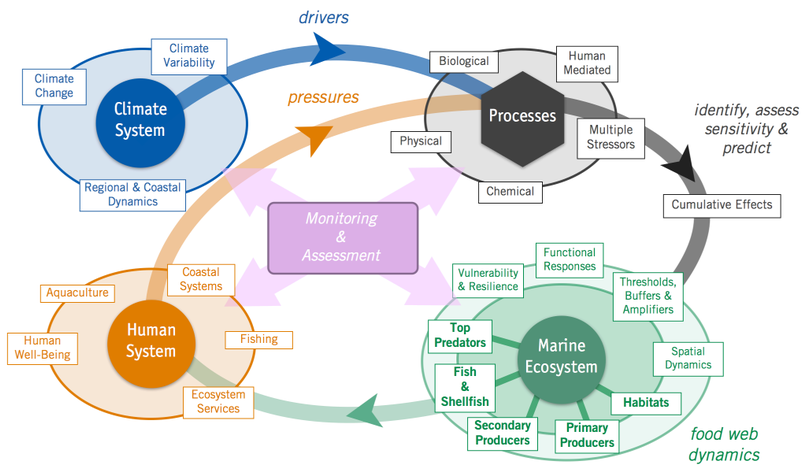
From a research perspective, FUTURE is guided by three key research questions:

- What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?

- How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

- How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

FUTURE has implemented a Social-Ecological-Environmental Systems (SEES) approach to addressing these research themes. This approach, characterized in the schematic below, increases the capacity for PICES to understand and communicate the processes that link climate change/variability and human activities to multi-scale ecosystem responses.



The FUTURE Scientific Steering Committee team members recently published an article that used the SEES approach to describe several "crisis" case studies in the North Pacific. See:

Bograd, S.J., S. Kang, E. Di Lorenzo, T. Horii, O.N. Katugin, J.R. King, V.B. Lobanov, M. Makino, G. Na, R.I. Perry, F. Qiao, R.R. Rykaczewski, H. Saito, T.W. Therriault, S. Yoo, H. Batchelder, 2019. Developing a social-ecological-environmental system framework to address climate change impacts in the North Pacific. *Frontiers in Marine Science*, 6:333, doi:10.3389/fmars.2019.00333.

For more information on the FUTURE program, visit:

https://scientific-programs.pices.int/FUTURE

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Photo, Front Cover: Active Pass, 18” x 13”, woodblock print, 1997. By Graham Scholes, Sidney, B.C., Canada. The right to reproduce this image was generously granted by the artist.

Notes for Guidance

The North Pacific Marine Science Organization (PICES) announces its 2019 Annual Meeting to be held October 16-27 2019, at Victoria Conference Centre. The meeting is hosted by the Canadian government and in coordination with PICES Secretariat. Local arrangements are made by the DFO and the PICES Secretariat.

Presentations

In order to allow the sessions to run smoothly, and in fairness to other speakers, please note that all presentations are expected to adhere strictly to the time allocated. All authors should designate at least 5 minutes for questions. Authors can download their presentations directly to the computers where the session/workshops will be held.

Important: Please rename your files - time-name.ppt (*e.g.* 0900-Smith.ppt, 1530-Kim.ppt).

Posters

Posters for all sessions and workshops can be hung on 23 October (4 pm) and will be on display until the end of October 24.

Poster presenters are expected to be available near their posters to answer questions during the Thursday Oct. 24 evening poster session, 18:00-21:00, for at least one hour (19:00-20:00).

Location of the Poster Session / Reception: Salon A, Level 2 of the Victoria Conference Centre.

Internet access

Internet access via wireless LAN will be available in the main venue.

Social activities

Monday, October 21 (18:30-21:00)
Royal BC Museum

Welcome Reception
The Welcome Reception for all participants (and registered guests)

Tuesday, October 22 (18:00-21:00)
to be announced at the Registration Desk

Sporting Event
Please sign up for participation at the Registration Desk

Thursday, October 24 (18:00-21:00)
Salon A, Level 2, of the Victoria Conference Centre

Wine & Cheese Poster Session Reception
The wine & cheese Poster Sessions at the meeting venue will allow participants to roam around the poster displays and chat with presenters while sipping beer or wine and nibbling on hot and cold hors d’eouvres. (Posters must be removed at end of evening)

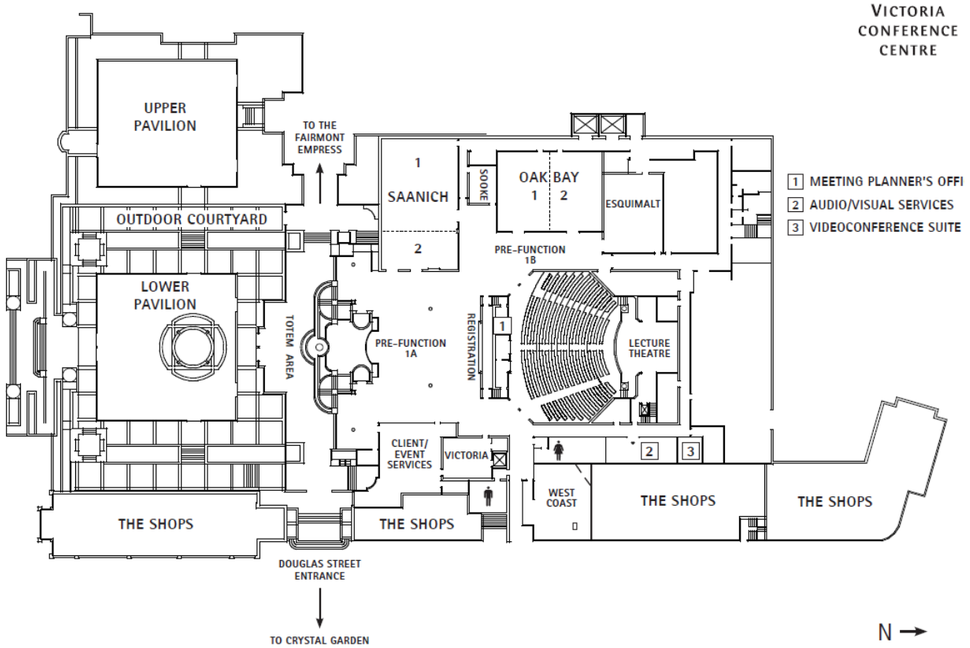
PICES Secretariat and Local Organizing Committee

are located in West Coast Room

(*) Identifies an Early Career Scientist

Victoria Conference Centre

LEVEL ONE | 23,500 ft² 2,183 m²



VICTORIA CONFERENCE CENTRE

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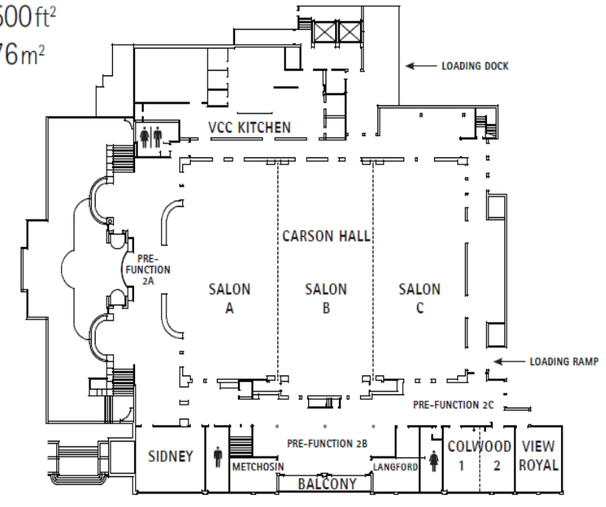
LEVEL TWO | 24,500 ft² 2,276 m²



VICTORIA CONFERENCE CENTRE

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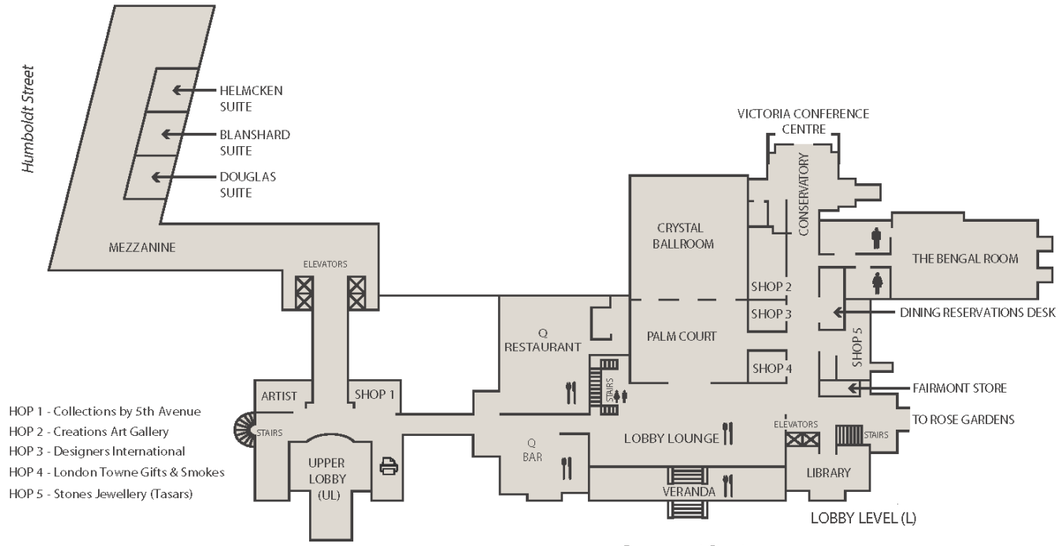
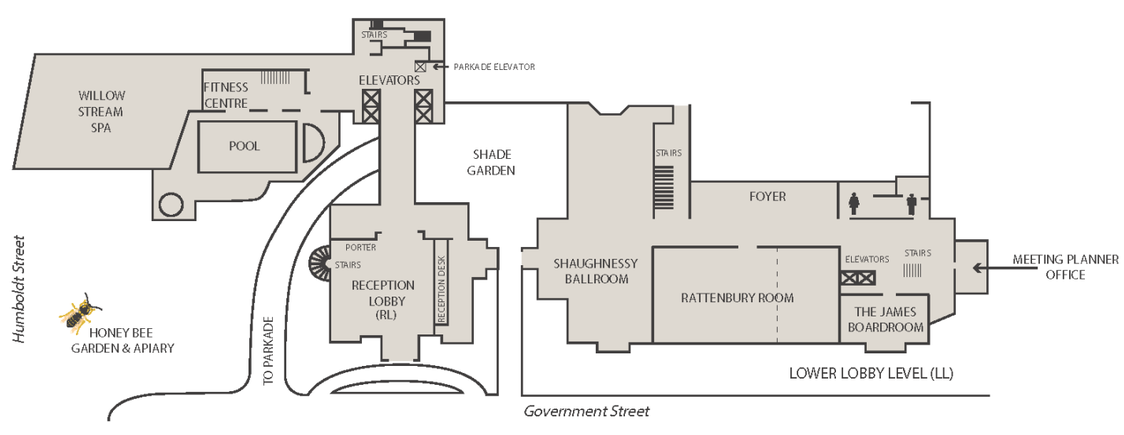
NOT TO SCALE





List of Sessions and Workshops

Plenary	Oct. 22, 24	
S1	Oct. 21	Connecting science and communities in a changing North Pacific
S2	Oct. 22	Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions
S3	Oct. 24	Coastal ocean modelling in the North Pacific
S4	Oct. 23	The impacts of marine transportation and their cumulative effects on coastal communities and ecosystems
S5	Oct. 22, 23	Trends in ocean and coastal ecosystems and their services and its future
S6	Oct. 24	Identifying thresholds and potential leading indicators of ecosystem change: The role of ecosystem indicators in ecosystem-based management
S7	Oct. 24	Environmental indicators of plastic pollution in the North Pacific
S8	Oct. 24	Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries
S9	Oct. 24	Coastal Ocean Observing Systems, Essential Biological Variables, and community-based monitoring
S10	Oct. 23	Linking changes in climate, nutrient distribution, phytoplankton ecology, and production of algal exudates in the North Pacific
S11	Oct. 23	Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century
S12	Oct. 22, 23	Impacts of meso-/submeso-scale processes on heat/material transport and on marine ecosystems
S13	Oct. 22, 23	Implications of prey consumption by marine birds, mammals, and fish in the North Pacific
S14	Oct. 22	Integrating economic and social objectives in marine resource management
S15	Oct. 22	Advances in North Pacific marine ecosystem prediction
BIO-P	Oct. 25	Biological Oceanography Committee contributed paper session
FIS-P	Oct. 25	Fisheries Science Committee contributed paper session
MEQ-P	Oct. 25	Marine Environmental Quality Committee contributed paper session
POC-P	Oct. 25	Physical Oceanography and Climate Committee contributed paper session
GP	Oct. 24	General Poster Session (part of the Poster Session)
Salon A Level 2	Oct. 24	**POSTER SESSION / RECEPTION**

W1	Oct. 19	Learn to effectively communicate your science
W2	Oct. 18	Integrating biological research, fisheries science and management of Pacific halibut and other widely distributed fish species across the North Pacific in the face of climate and environmental variability
W3	Oct. 18	Let's play the GAME! (to achieve sustainable fisheries development in the PICES regions)
W4	Oct. 18	Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)
W5	Oct. 18	Celebrating two decades of North Pacific CPR sampling, and future directions
W6	Oct. 19	Assessing marine ecosystem services: A comparative view across the North Pacific
W7	Oct. 17	PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)
W8	Oct. 17	Synthesis of bioacoustics programs for monitoring zooplankton and fisheries in the North Pacific
W9	Oct. 17	Monitoring non-indigenous species in PICES member countries: Towards best practices
W10	Oct. 16	PICES/ICES collaborative research initiative: Toward regional to global measurements and comparisons of zooplankton production using existing data sets
W11	Oct. 16	PICES/NPFC collaborative research: The influence of environmental changes on the potential for species distributional shifts and population dynamics of Pacific saury
W12	Oct. 18	Potential food competition between top predators and fisheries in the North Pacific
W13	Oct. 17	Common ecosystem reference points
W14	Oct. 16	New frontiers: The application of molecular approaches in marine ecology and fisheries science
W15	Oct. 17, 18	Application of machine learning to ecosystem change issues in the North Pacific
W16	Oct. 19, 20	Developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean
W17	Oct. 16	Scoping an IEA of the Northern Bering-Chukchi Seas LME
W18	Oct. 17, 18, 19	GlobalHAB: Evaluating, reducing and mitigating the cost of harmful algal blooms: A compendium of case studies
W19	Oct. 19	Impacts of mariculture on coastal ecosystems

Meeting Timetable

Wednesday October 16

0900 1230 & 1400 1800	*Saanich-1*	*Saanich-2*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*Victoria*
	W14 Molecular Approaches	**W17** BeringChukchi LME	**W10** PICES-ICES ZP	**FishGIS Project** Bus. Mtg	**W11** PICES-NPFC Pacific Saury	**SG-IMCE** Bus. Mtg

Thursday, October 17

0900 1230	*Saanich-1*	*Saanich-2*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*View Royal*
	W7 Central Arctic Ocean	**W15** Machine Learning (Part-1)	**WG35** NPESR Bus. Mtg	**W9** NIS Best Practices	**W8** Bioacoustics	**W13** Ecosystem Reference Points
1400 1800	**W18 HABs** Economics: Case Studies (Part-1)					

Friday, October 18

0900 1230	*Saanich-1*	*Saanich-2*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*View Royal*	*Sidney*	*Colwood*
	W18 HABs Economics: Case Studies (Part-2) Saanich-1 [Breakouts to *Victoria & Langford*]	**W15** Machine Learning (Part-2)	**W2** PICES-IPHC Pacific Halibut	**W4** CREAMS	**W5** North Pacific CPR	**WG36** Bus. Mtg	**FUTURE** SSC Bus. Mtg	**W12** Food Competition
1400 1800					**W3** GAME Sustainable Fisheries			**S-MBM** Bus. Mtg

Saturday, October 19

0900 1230	*Saanich-1*	*Saanich-2*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*View Royal*	*Sidney*	*Colwood*
	W18 HABs Economics: Case Studies (Part-3) [Breakouts to *Victoria & Langford*]	**SG NPFC-PICES** Bus. Mtg	**W16** Salmon (Part-1)	**W6** Marine Ecosystem Services	**W19** Mariculture Impacts	**WG38** Meso-submeso Bus. Mtg	**W1** Communicate Science	**CLIVAR** Pacific Panel Bus. Mtg*
1400 1800		**S-CC** Bus. Mtg			**AP-CREAMS** Bus. Mtg	**Turtle Project** Bus. Mtg		

Sunday, October 20

	Esquimalt	*Saanich-1*	*Victoria*	*Oak Bay-1*	*Oak Bay-2*	*Upper Pavilion*	*Crystal Ballrm*	*Shaughnessy Bl*	*Saanich-2*
0900 1230	**S-HAB** Bus. Mtg	**WG39** Bus. Mtg	**AP-NIS** Bus. Mtg	**W16** Salmon (Part-2)	**WG41** Bus. Mtg	**WG40** Bus. Mtg	**AP-NPCOOS** Bus. Mtg	**S-CCME** Bus. Mtg	**WG42** Bus. Mtg
1400 1800	**Science Board** Bus. Mtg*	**WG37** Bus. Mtg					**WG34** Bus. Mtg (cancelled)	**WG36** Bus. Mtg	

	Saanich-2	*Saanich-1*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*Blanshard Suite*	*Shaughnessy Ballroom*
1800 2000	**HD** Bus. Mtg (Part-1)	**MEQ** Bus. Mtg (Part-1)	**FIS** Bus. Mtg (Part-1)	**MONITOR** Bus. Mtg (Part-1)	**POC** Bus. Mtg (Part-1)	**TCODE** Bus. Mtg (Part-1)	**BIO** Bus. Mtg (Part-1)

Monday, October 21 (Lecture Theater)

0845 1010	**OPENING SESSION**
1030 1830	**Plenary Science Board Symposium (S1-SB)** (*breaks 10:30, 14:00, 16:00*)
1830 2100	**WELCOME RECEPTION** **(open to all participants and registered guests; Royal BC Museum)**

* Closed meetings / activities
** Poster presenters are expected to be available to answer questions for at least one hour (19:00-20:00: Thursday, Oct. 24)
*** Award recipients for Best Oral/Poster presentations will be announced during the Closing Session

12:30-14:00 Lunch
10:30-10:50 and 16:00-16:20 Coffee Breaks

Meeting Timetable (*continued*)

Tuesday, October 22

0900 1030	**PLENARY SESSION** *Lecture Theater (3 Invited Speaker talks)*					
	Saanich-1	*Lecture Theater*	*Esquimalt*	*Oak Bay-1*	*Oak Bay-2*	*Saanich-2*
1050 1220	**S13** Prey Consumption (Part-1)	**S2** Marine Heatwaves	**S14** Marine Resource Management	**S15** Marine Ecosystem Prediction	**S5** Ocean & Coastal Ecosyst Trends (Part-1)	
1400 1600	**S12** Meso/submeso (Part-1)					**F&A** Meeting*
1620 1800						
1830 2100	**Sporting Event (Offsite)**					

Wednesday October 23 (Posters hung at 4 pm in *Salon A, Level 2*)

	Lecture Theater	*Saanich-1*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*Saanich-2*
0900 1030	**S13** Prey Consumption (Part-2)	**S12** Meso/submeso (Part-2)	**S11** Climate Var & Fisheries Mgmt (Part-1)	**S10** Algal Exudates & CC	**S4** Marine Transportation	**F&A** Meeting*
1100 1250		**S5** Ocean & Coastal Ecosyst Trends (Part-2)				

	Saanich-2	*Saanich-1*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*	*Library*	*Bengal*
1400 1800	**HD** Bus. Mtg (Part-2)	**MEQ** Bus. Mtg (Part-2)	**FIS** Bus. Mtg (Part-2)	**MONITOR** Bus. Mtg (Part-2)	**POC** Bus. Mtg (Part-2)	**TCODE** Bus. Mtg (Part-2)	**BIO** Bus. Mtg (Part-2)

	Lower Pavilion	*Esquimalt*
1800 2100	**FUTURE SSC Business Meeting**	

Thursday, October 24 (Posters available for viewing all day in *Salon A, Level 2*)**

0900 1030	**PLENARY SESSION** *Lecture Theater (3 Invited Speaker talks)*					
	Saanich-1	*Saanich-2*	*Lecture Theater*	*Oak Bay-1*	*Oak Bay-2*	*Esquimalt*
1050 1800	**S3** Coastal Ocean Modeling	**S7** Plastic Pollution	**S6** Ecosystem Indicators	**S11** Climate Var & Fisheries Mgmt (Part-2)	**S9** COOS-EBVs	**S8** Integrated Ecosystem Assessment
1800 2100	**POSTER SESSION / RECEPTION *****(Salon A, Level 2)* Posters must be removed from boards at end of evening					

Friday, October 25

	Saanich-1	*Oak Bay-1*	*Oak Bay-2*	*Saanich-2*	
0900 1250	**BIO-Paper**	**FIS-Paper**	**POC-Paper**	**MEQ-Paper**	**HD-Paper (cancelled)**
1250 1350	**CLOSING SESSION***** *Lecture Theater*				
1400 1800	**Science Board Business Meeting* (Part-2)** *Esquimalt*				
1830 2100	**Chairman's Reception***				

Saturday, October 26

0900 1800	**Science Board Meeting* (Part-3)** *Esquimalt*	**Governing Council Meeting*** *Oak Bay*

Snday, October 27

0900 1800	**Governing Council Meeting*** *Oak Bay*

PICES Acronyms

Committees

BIO	Biological Oceanography Committee
FIS	Fishery Science Committee
HD	Human Dimensions Committee
MEQ	Marine Environmental Quality Committee
MONITOR	Technical Committee on Monitoring
POC	Physical Oceanography and Climate Committee
TCODE	Technical Committee on Data Exchange

Advisory Panels

AP-CREAMS	Advisory Panel for a CREAMS/PICES Program in East Asian Marginal Seas (*reports to MONITOR and POC Committees*)
AP-NIS	Advisory Panel on Marine Non-indigenous Species (*reports to MEQ Committee*)
AP-NPCOOS	Advisory Panel on North Pacific Coastal Ocean Observing Systems (*reports to MONITOR and TCODE Committees*)

Sections

S-CC	Section on Carbon and Climate (*reports to BIO and POC Committees*)
S-CCME	Joint PICES/ICES Section on Climate Change Effects on Marine Ecosystems (*reports to BIO, FIS and POC Committees*)
S-HAB	Section on Ecology of Harmful Algal Blooms in the North Pacific (*reports to MEQ Committee*)
S-MBM	Section on Marine Birds and Mammals (*reports to BIO Committee*)

Study Groups

SG-IMCE	Study Group on Impacts of Mariculture to Coastal Ecosystems (*reports to Science Board*)
SG-PICES-NPFC	Joint PICES-NPFC Study Group for Scientific Cooperation in the North Pacific Ocean (*reports to Science Board*)

PICES Acronyms

Working Groups

WG-34	Joint PICES/ISC Working Group on Ocean Conditions and the Distribution and Productivity of Highly Migratory Fish (*reports to FIS Committee*)
WG-35	Working Group on Third North Pacific Ecosystem Status Report (WG-NPESR3) (*reports to MONITOR Committee and FUTURE SSC*)
WG-36	Working Group on Common Ecosystem Reference Points across PICES Member Countries (*reports to FUTURE SSC*)
WG-37	Working Group on Zooplankton Production Methodologies, Applications and Measurements in PICES Regions (*reports to BIO Committee*)
WG-38	Working Group on Mesoscale and Submesoscale Processes (*reports to POC Committee*)
WG-39	Joint PICES/ICES/PAME Working Group on an Integrated Ecosystem Assessment for the Central Arctic Ocean (*reports to Science Board*)
WG-40	Working Group on Climate and Ecosystem Predictability (*reports to POC Committee and FUTURE SSC*)
WG-41	Working Group on Marine Ecosystem Services (*reports to HD Committee*)
WG-42	Working Group on Marine Microplastics (*reports to MEQ Committee*)

Scientific Program

FUTURE-SSC	**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems – Scientific Steering Committee

Sessions and Workshops Descriptions

S1: Science Board Symposium
Connecting science and communities in a changing North Pacific

Convenors:
Hiroaki Saito (SB) *corresponding,* Vera L. Trainer (SB), Se-Jong Ju (BIO), Xianshi Jin (FIS), Keith Criddle (HD), Guangshui Na (MEQ), Jennifer Boldt (MONITOR), Emanuele Di Lorenzo (POC), Joon-Soo Lee (TCODE), Steven Bograd (FUTURE), Sukyung Kang (FUTURE), Igor Shevchenko (Russia), and Motomitsu Takahashi (Japan)

Invited Speakers:
Sean Anderson (Pacific Biological Station, Fisheries and Oceans Canada, Nanaimo, BC, Canada)
Dohoon Kim (Pukyong National University, Korea)
Takeyoshi Nagai (Tokyo University of Marine Science and Technology, Japan)
Anna Zivian (Ocean Conservancy, WA, USA)

The North Pacific Ocean is rapidly changing due to an increasing number of stressors. This presents challenges for understanding, collaboration, and communication. More specifically: 1) What are the effects of human activities and climate change on ecosystems and the services they provide?, 2) Are there ways to improve collaboration among organizations and integrate a variety of knowledge sources to answer this question?, and 3) How can we communicate this knowledge effectively to the public? Climate change is an over-arching stressor that delivers a non-stationary background upon which other stressors act. Further, there are a wide variety of human stressors, such as fishing, aquaculture, microplastics/marine litter, invasive species, and shipping that can alter ecosystem structure, function, productivity, and biodiversity. Anticipating and detecting ecosystem responses to these stressors is a challenge, especially when responses may be non-linear and synergistic or antagonistic. Additional challenges include integrating the complexity of multiple spatial and temporal scales and incorporating climate change into sustainable ecosystem management. PICES provides a unique forum for collaboration among North Pacific member nations and other science organizations to address these challenges. There are, however, opportunities for further collaborations to better improve our understanding of the North Pacific, such as engagement with Indigenous people, citizen science programs, collaborative surveys, and coupled coastal - deep water oceanographic monitoring programs. Communicating the results of ecosystem science to the public and coastal societies is another area for advancement, as many scientists receive little or no training in communicating their results to a layperson audience or in two-way communication, where feedback can inform science.

We welcome submission of abstracts to S1 that address these integrative and complex issues. In particular, the PICES FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems) Integrative Science program would benefit from better information on: 1) the effects of human activities on coastal ecosystems, ecosystem services, and human societies; forecasting the effects of climate change on the distribution and productivity of species and communities; incorporating climate change, multiple stressors, and different temporal and spatial scales into sustainable resource and ecosystem management; tools to evaluate ecosystem response thresholds and common ecosystem reference points; and forecasting impacts of coastal stressors (e.g., microplastics, pollution, invasive species, shipping, aquaculture); 2) collaborative work with Indigenous people, with citizen science programs, with other science organizations, and across the western and eastern North Pacific; and 3) methods for more effectively communicating science to the public.

S2: POC Topic Session
Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions

Convenors:
Jennifer Jackson (Canada) *corresponding*, Tetjana Ross (Canada), Toshio Yamagata (Japan), Yun-Wei Dong (China), Emanuele di Lorenzo (USA)

Invited Speakers:
Simone Alin (Pacific Marine Environmental Laboratory, NOAA, USA)
Sonia Batten (CPR Survey, Marine Biological Association)
Eric C.J. Oliver (Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada))

Marine heatwaves have been occurring more frequently in recent decades and the biological impacts linked to these abnormally warm ocean temperatures have been making headlines, from sea cucumber die-offs in China to harmful algal blooms along the entire coast of North America. The occurrence of marine heatwaves can largely be explained by anomalous atmospheric conditions, however very little is known about the processes that cause marine heatwaves to persist or dissipate in the ocean. Thus, despite the damage marine heatwaves cause to the health of ocean ecosystems, their arrival, duration, and long-term impact has been difficult to predict without mechanistic knowledge of how they evolve. The focus of this session is to connect researchers studying the physics behind the evolution of marine heatwaves with those studying their impacts on coastal ocean properties and ecosystems, with the goal of improving predictions of future events. This session invites presentations on physical mechanisms that control the formation, spread, and dissipation of marine heatwaves, and on predictions of the future physical, chemical, and biological impacts of marine heatwaves in coastal regions. Presentations relevant to fisheries and aquaculture in the North Pacific are particularly encouraged.

S3: POC/MEQ/BIO Topic Session
Coastal ocean modelling in the North Pacific

Co-Sponsor: ICES

Convenors:
Laura Bianucci (Canada) *corresponding*, Tarang Khangaonkar (USA), Chan Joo Jang (Korea), Susan Allen (Canada), Fei Chai (China), YouYu Lu (Canada)

Invited Speaker:
Mike Foreman - Plenary S3 Speaker (Scientist Emeritus at the Institute of Ocean Sciences, Canada)

The coastal ocean is a dynamic, complex region where multi-scale processes interact and create conditions suitable for rich ecosystems. For instance, the combination of processes such as land and river runoff, local and remotely-forced upwelling, and wind and tidal mixing can bring nutrients to the surface waters, triggering high primary productivity rates. Coastal waters are subjected to the direct impact of human activities like fishing, aquaculture farming, wastewater runoff, etc. These anthropogenic perturbations along with other pressures exerted by climate change can lead to negative effects in the coastal ocean, such as pollution, hypoxia, ocean acidification, sea level rise, and loss of ecosystem biodiversity. Numerical models of the coastal ocean can be used to understand the physical and biogeochemical drivers in different regions, how these processes can change in the future, and what the implications of these changes are. The complexity of coastal regions, both in terms of geography and physical and biogeochemical dynamics, makes these modelling exercises challenging and region-specific. Nevertheless, commonalities can be drawn among different regions and models, such that the modelling community can benefit immensely by sharing experiences and results. Therefore, this session aims to bring together researchers interested in learning and discussing about the challenges and advances in coastal ocean models. We welcome contributions about any aspect related to these models, from applications in specific regions to regional intercomparisons, including hydrodynamics-only as well as coupled models (physical-biogeochemical, -ice, -sediments, etc.).

S4: HD Topic Session
The impacts of marine transportation and their cumulative effects on coastal communities and ecosystems

Co-Sponsor: ICES

Convenors:
Cathryn Murray (Canada) *corresponding*, Sarah Bailey (Canada), Hideaki Maki (Japan), Paula Doucette (Canada)

Invited Speaker:
Hideo Okamura (Research Center for Inland Seas, Kobe University, Japan)

The marine ecosystems of the North Pacific Ocean are connected by an international shipping and transportation network. Commercial shipping provides significant economic benefits and opportunities and the distribution and intensity of commercial shipping is increasing. There is a growing need to assess and mitigate the impacts of vessel activities on the marine environment to balance the benefits of this industry. Commercial and recreational vessel activities can produce stressors such as underwater noise, strikes, debris, aquatic invasive species, and chronic and episodic pollution. These impacts can act individually and together in space and time, resulting in cumulative effects – the collective effects caused by the combined results of past, current and future activities. Cumulative effects assessment is needed to address the sheer volume and frequency of vessel movements, the interaction and summation of multiple impact pathways, and cumulative effects through time. Vessel activities can have transboundary impacts and successful mitigation efforts require coordination and collaboration between trade partners. This session has links to the PICES Working Group on Emerging Topics in Marine Pollution (WG-31), the Advisory Panel on Marine Non-Indigenous Species (AP-NIS), and the Working Group on Marine Ecosystem Services (WG-41). The objective of the session is to convene expertise on the impacts of vessels and review the current state of knowledge and priority research needs for the future. Presentations will feature impacts of shipping-related stressors and applications of cumulative effects assessment frameworks, conceptual models, and management efforts related to marine shipping and vessel activities in the North Pacific. We solicit abstracts on both the perceived and documented environmental and socioeconomic impacts of marine transportation on marine ecosystems and coastal communities.

S5: POC/BIO/FIS/FUTURE Topic Session
Trends in ocean and coastal ecosystems and their services and its future

Convenors:
Shin-ichi Ito (Japan) *corresponding*, Angelica Peña (Canada), Kirstin Holsman (USA), Xiujuan Shan (China) Igor Yashayaev (Canada)

Invited Speaker:
Naoki H. Kumagai, Plenary S5 Invited Speaker (National Institute for Environmental Sciences, Tsukuba, Japan)

Oceans and coastal ecosystems provide various ecosystem services to humans. However, ocean and coastal ecosystems are changing and showing trends in regional and synoptic scales responding to global climate change. It is urgent that we elucidate the mechanisms responsible for trends in ocean and coastal ecosystems and enable its future projections. We propose a topic session that involves participation from multiple PICES committees and focuses on trends in ocean and coastal ecosystems responding to global climate change. Specifically, we welcome presentations on topics such as (a) observational approaches to detect trends in ocean and coastal ecosystems, (b) elucidation of mechanisms of the ocean and coastal ecosystem responses, and (c) future projections of ocean and coastal ecosystems.

S6: FUTURE Topic Session
Identifying thresholds and potential leading indicators of ecosystem change: The role of ecosystem indicators in ecosystem-based management

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

Invited Speaker:
Saskia A. Otto - Plenary S6 speaker, (Institute of Marine Ecosystem and Fishery Science (IMF) Center for Earth System Research and Sustainability (CEN) University of Hamburg)

Abrupt nonlinear change in ecosystem structure and function can dramatically alter human-derived benefits from the ecosystem 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 might 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 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 socioecological systems and examples of how indicators have been used in management. Transdisciplinary presentations are encouraged.

S7: MEQ Topic Session
Environmental indicators of plastic pollution in the North Pacific

Co-Sponsor: NOWPAP

Convenors:
Matthew Savoca (USA) *corresponding*, Chengjsun Sun (China), Lev Neretin (NOWPAP)

Invited Speakers:
Stephanie Avery-Gomm - Plenary S7 Speaker, (University of Queensland, Australia)
Daoji Li (Plastics Marine Debris Research Center, East China Normal University, China)

Small fragments of plastic debris – known as meso- and microplastics – are pervasive in marine systems. These synthetic particles may transfer contaminants and pathogens to organisms that consume them; as such, meso- and microplastics are now considered hazardous, persistent marine pollutants. Sampling an entire system for debris is challenging; therefore, having environmental indicators of plastic debris is critical to assess the status and trends of plastic pollution in addition to predicting ecosystem risk and quantifying potential impacts. This session will identify and discuss potential organismal and non-organismal (e.g., sediments) indicators of small synthetic material in the marine environment, including the potential sources and input pathways of small plastic debris (e.g., wastewater effluent) to the North Pacific and its marginal seas. Presenters will also focus on indirect indicators of plastic pollution, such as plastic additives leading to chemical contamination in organismal tissues. A deeper understanding of these marine debris sentinels will help us elucidate the status and trends of small plastic pollution and their environmental impacts in the North Pacific and globally, thus allowing us to make informed decisions for plastic usage and litter management policies.

S8: FIS/BIO/POC Topic Session
Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries

Co-Sponsor: ICES

Convenors:
Alan Haynie (USA) *corresponding*, Libby Logerwell (USA), Shigeto Nishino (Japan)

Invited Speaker:
Phillip Levin (University of Washington and The Nature Conservancy)

Integrated Ecosystem Assessments (IEAs) are an adaptable approach to capture, understand, and communicate the diversity of interactions, ecosystem objectives, and resource trade-offs that occur within an ecosystem. While a core element of IEAs is the characterization of the natural ecosystem, humans are increasingly recognized as being central actors in most ecosystems, rather than an outside agent impacting the ecosystem. In this session, we are interested in elements of IEAs that capture how changes in the natural environment are being measured and the manner in which human activities are being incorporated into IEAs. IEAs have been implemented in a diversity of ecosystems in many PICES and ICES countries. In the United States, for example, IEAs are an important tool through which NOAA describes ecosystem trends and communicates the trade-offs of using marine resources for fisheries versus other uses. ICES, PICES and PAME have also recently worked to develop an IEA of the Central Arctic Ocean (WG 39). In addition, PICES scientists working in PAME have drafted practical guidelines for implementing the Ecosystem Approach across LMEs in the Arctic. Members and chairs of several ICES and PICES working groups are also active in IEA implementation. The goals of this session will be to 1) describe developments in IEAs across PICES countries and beyond, 2) identify opportunities to better integrate social and natural science in IEAs and communicate this with PICES scientists, and 3) discuss future directions for developing and comparing IEAs across PICES countries and LMEs, with the aim of building a foundation for further discussions at the MSEAS-2020 meeting in Yokohama. While the central focus of this session is IEAs, we also welcome presentations that demonstrate successes and challenges in interdisciplinary research. We also encourage submissions that discuss how climate impacts, including vulnerability analyses, can be effectively included in IEAs. We hope that the session will provide a roadmap for how social and natural scientists can more effectively work together in IEAs and in interdisciplinary projects in general. We will conclude the session with a discussion of next steps for IEA research in PICES countries.

S9: MONITOR Topic Session
Coastal Ocean Observing Systems, Essential Biological Variables and community-based monitoring

Convenors:
Charles Hannah (Canada) *corresponding*, Sung Yong Kim (Korea), Kim Juniper (Canada)

Invited Speakers:
Sanae Chiba (Japan Agency for Marine-Earth Science and Technology (JAMSTEC))
Eric Peterson (Hakai Institute, BC, Canada)

The goals of FUTURE require systematic and sustained observations of marine ecosystems, especially in the coastal regions where the interactions between humans and the marine environment are most intense. The goals also require the integration of physical, chemical and biological state of the ocean. The Advisory Panel on North Pacific Coastal Ocean Observing Systems is responsible for advising PICES on the linkages between coastal ocean observing systems and the PICES FUTURE Science Program, and the Pacific Ecosystem Status Report. We propose a Science Session that will assess the current state of coastal ocean observing systems in the north Pacific Ocean with respect to the biological and ecosystem Essential Ocean Variables (eEOVs) recently developed by the Global Ocean Observing System (Miloslavich et al 2018 DOI: 10.1111/gcb.14108), and evaluate the potential for expanding the inclusion of eEOVs in coastal ocean observing in the North Pacific. The session will provide a basis for identifying gaps in observing systems relative to FUTURE's goals of providing a synthesis of knowledge on: a) ecosystem resilience and vulnerability; b) ecosystems response to natural and anthropogenic forcing; and c) future ecosystem change. We invite contributions from researchers, community based monitoring programs, and data managers that will address the questions: 1) which eEOVs should be measured; 2) does the technology exist to make the required measurements in a systematic fashion; 3) how do we integrate eEOVs into current and future coastal ocean observing programs?

S10: MEQ Topic Session
Linking changes in climate, nutrient distribution, phytoplankton ecology, and production of algal exudates in the North Pacific

Convenors:
Andrew Ross (Canada) *corresponding*, Sayaka Yasunaka (Japan)

Invited Speaker:
Jun Nishioka - Plenary S10 Speaker, (Hokkaido University, Japan)

The unusual warming of NE Pacific surface waters in 2014 produced intense stratification that inhibited vertical mixing, reducing the availability of major nutrients and essential trace metals to phytoplankton. Significant changes in phytoplankton ecology were also observed during this event. Large and persistent phytoplankton blooms, some of which may be associated with the production of algal biotoxins, are also becoming more frequent in the coastal waters of the eastern North Pacific, raising concerns as to the potential impacts of harmful algal blooms (HABs) and associated biotoxins on marine ecosystems. Some biotoxins (e.g. domoic acid) and other algal exudates (organic ligands) are known to bind trace metals like iron and copper, affecting their availability to phytoplankton. The goal of the proposed session is to bring together scientists from across the North Pacific who are working on related aspects of plankton ecology, marine biogeochemistry and climate research to investigate potential linkages between changes in the distribution of nutrients, phytoplankton, and algal exudates; how these may affect, and be influenced by, primary productivity and climate change; and possible implications for the long-term health of fisheries and ecosystems in coastal waters and the open ocean.

S11: FIS/POC/BIO/HD Topic Session
Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century

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

Invited Speaker:
Stephani Zador (Alaska Fisheries Science Center, NOAA, USA)

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 seek examples describing how ecosystem variability and climate change have been considered in management advice qualitatively and/or quantitatively, or proposals on how management advice could consider those variables. Management applications could include the development or modification of stock assessment models, dynamic ocean management rules, bycatch mitigation, multi-species assessments, or other decision processes. This session will also address: how can qualitative information on ecosystem state be integrated with quantitative outputs from stock assessments? How can this information and the underlying uncertainties be effectively communicated to managers? In addition we seek examples of how decisions that consider ecosystem and climate variability and change have been or could be evaluated a priori (e.g., through management strategy evaluation) or retrospectively. Does management advice that accounts for theses variables result in better decisions? The session will begin with scientific presentations, followed by a discussion panel of scientists and natural resource managers, which will explore practical aspects of operationalizing EBFM, and promote exchange of ideas between the scientific and management communities.

S12: POC/BIO Topic Session
Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems

Convenors:
Hiromichi Ueno (Japan) *corresponding*, Tetjana Ross (Canada), Olga O. Trusenkova (Russia)

Invited Speaker:
Jody Klymak (School of Earth and Ocean Sciences, University of Victoria, BC, Canada)

Mesoscale and submesoscale processes (with scales of 0.1 – 100 km) are widely distributed in the world's oceans; from coastal regions to the open ocean. These phenomena can be examined using in-situ and satellite observations as well as high-resolution numerical models. However, there is still a lot to be learned about the detailed structure and dynamics of these fine-scale features. Studies indicate that mesoscale and submesoscale processes have a significant impact on horizontal heat and material transport, e.g. from coastal regions to the open ocean, as well as vertical transport, e.g. from subsurface to surface layers. The heat and material transport by mesoscale and submesoscale processes are important not only in the context of physics and chemistry, but also to marine ecosystems including plankton, nekton, birds and mammal. This topic session aims to discuss how the physics, chemistry, biology and fisheries of mesoscale and submesoscale processes interact and also how these processes mediate interaction between regions (lateral) and layers (vertical). We invite presentations based on both observations and modeling.

S13: BIO Topic Session
Implications of prey consumption by marine birds, mammals, and fish in the North Pacific

Convenors:
Andrew Trites (Canada) *corresponding*, Robert Suryan (USA), Tsutomu Tamura (Japan),
Kirstin Holsman (USA)

Invited Speaker:
David A Beauchamp (Western Fisheries Research Center, USA)

Consumption by marine birds, mammals and fish has implications for ecosystem health and sustainability of fisheries. It has the potential to induce trophic cascades and influence the dynamics of species sought by fisheries—and has bearing on how fish, seabirds and marine mammals will adapt to climate change. However, there is uncertainty about how much they currently consume, how their consumption has changed over time, and whether or not they compete with fisheries and impede the recovery of threatened and endangered species. This topic session invites papers that address 1) decadal changes in prey consumption by marine birds, mammals and fish, 2) direct and indirect effects of consumption on food webs and species recovery, 3) impacts of climate change and inter-annual variability on food consumption, 4) the influence of prey quality on the health and dynamics of top predators, and 5) potential competitive interactions between fisheries and marine birds, mammals and fish. This session is the culmination of a 4-year project to document diets and estimate amounts of prey consumed by seabirds and marine mammals in the North Pacific. Presenters will be encouraged to submit manuscripts from this session to a special issue proposed in a leading scientific journal.

S14: HD/FIS Topic Session
Integrating economic and social objectives in marine resource management

Convenors:
Keith Criddle (USA) corresponding, Alan Haynie (USA), Mitsutaku Makino (Japan)

Invited Speaker:
Sean Pascoe (Marine Resource Economics Team CSIRO Oceans and Atmosphere, Australia)

While sustainable resource management is a commonly expressed goal, this means many different things to different people. From a narrow single-species biological perspective, sustainable management means adopting regulatory measures that ensure that stock and recruitment levels do not fall below acceptable levels. More holistic goals have been articulated in many contexts, such as in the National Research Council report on Sustaining marine fisheries (NRC 1999), which characterizes sustainable fishing as "fishing activities that do not cause or lead to undesirable changes in biological and economic productivity, biological diversity, or ecosystem structure and functioning from one human generation to the next; sustainable fishing does not lead to ecological changes that foreclose options for future generations". Our experience has shown that fisheries policy that neglects social and economic considerations and objectives is unlikely to sustain fish, fishermen, or fishery-dependent communities and does not transparently consider the many goals of managers when they make decisions. This transdisciplinary approach has been embraced by ICES and PICES and is a central motivation for the MSEAS-2020 meeting. The session will also draw from the experiences of the ICES Strategic Initiative on the Human Dimension (SIHD). This session invites papers that address how we evaluate ecological, economic, and social goals in marine resource management. Possible specific topics include papers that 1) present examples of how social and economic goals have been integrated into fisheries management, 2) propose or discuss novel approaches to engage stakeholders in the specifying of management objectives, and 3) develop management tools to achieve those objectives. We welcome both empirical cases studies and more conceptual papers that illustrate how different countries or management agencies are approaching these challenges

S15: POC/FUTURE Topic Session
Advances in North Pacific marine ecosystem prediction

Convenors:
Mike Jacox (USA), corresponding, Fei Chai (China), Jinqiu Du (China), Shoshiro Minobe (Japan)

Invited Speakers:
Takeshi Doi (JAMSTEC, Japan)
Nicole Lovenduski - Plenary S15 Speaker (University of Colorado, USA)
Stephanie Brodie (UC Santa Cruz, USA)

Modern ocean and ecosystem models are rapidly developing the ability to make skillful forecasts of the physical, and more recently biogeochemical and higher trophic level, components of marine ecosystems at timescales from days to decades. Such forecasts often align with the tactical decision-making timescales of individuals, businesses, and governments, giving them significant potential to inform climate-ready management strategies. Much work has now been done to identify potentially predictable ecosystem components and to develop prototype forecast systems. This session will be a forum to learn and discuss how robust climate-ecosystem relationships are being (or can be) exploited for North Pacific marine ecosystem forecasts. We seek contributions that highlight recent advances in prediction of all earth system components that aid marine ecosystem forecasts, from physics to biogeochemistry, higher trophic levels, and potentially socioeconomic impacts (e.g., fish catch).

Presenters are encouraged to submit manuscripts from this session to a special issue proposed in a leading scientific journal.

BIO Contributed Paper Session

Convenors:
Se-Jong Ju (Korea), Akash Sastri (Canada)

The Biological Oceanography Committee (BIO) has a wide range of interests spanning from molecular to global scales. BIO targets all organisms living in the marine environment including bacteria, phytoplankton, zooplankton, micronekton, benthos and marine birds and mammals. In this session, we welcome all papers on biological aspects of marine science in the PICES region. Contributions from early career scientists are especially encouraged.

FIS Contributed Paper Session

Convenors:
Xianshi Jin (China), Jackie King (Canada)

This session invites papers addressing general topics in fishery science and fisheries oceanography in the North Pacific and its marginal seas, except those covered by Topic Sessions sponsored by the Fishery Science Committee (FIS).

MEQ Contributed Paper Session

Convenors:
Guangshui Na (China), Andrew Ross (Canada)

Papers are invited on all aspects of marine environmental quality research in the North Pacific and its marginal seas, except those covered by Topic Sessions sponsored by the Marine Environmental Quality Committee (MEQ).

POC Contributed Paper Session

Convenors:
Emanuele Di Lorenzo (USA), Yury I. Zuenko (Russia)

Papers are invited on all aspects of physical oceanography and climate in the North Pacific and its marginal seas, except those covered by Topic Sessions sponsored by the Physical Oceanography and Climate Committee (POC).

GP: General Poster Session

Papers that do not fit any other topic sessions / workshops.

W1: FUTURE Workshop
Learn to effectively communicate your science

Convenors:
Jackie King (Canada) *corresponding*, Manu Di Lorenzo (USA), Mitsutaku Makino (Japan), Matt Baker (USA)

Invited Speakers:
Cherisse Du Preez (IOS-DFO, Canada)
Alison Morrow (K5News, King County, WA, USA)

As the integrative Science Program of PICES, FUTURE ('Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems') facilitates research on how marine ecosystems in the North Pacific respond to climate change and human activities, and on forecasting ecosystem responses to those stressors. Another key objective of FUTURE is to effectively communicate new insights of PICES science to its members, governments, stakeholders and the public, a skill that is not broadly shared among PICES scientists. It is challenging to convey the complex and integrative research undertaken by PICES scientists, but it is essential that results of ecosystem science are accessible to diverse audiences in order for our science to have a meaningful impact on society. That accessibility requires us as scientists to develop our own ability to communicate science concepts and research with outreach products. In this workshop, professional science communicators will provide training on how PICES scientists can effectively communicate their science to diverse audiences. Workshop participants are encouraged to come prepared to discuss and develop communication strategies for their own research activities, and to help identify outreach products for FUTURE and PICES to develop.

W2: FIS Workshop
Integrating biological research, fisheries science and management of Pacific halibut and other widely distributed fish species across the North Pacific in the face of climate and environmental variability

Co-sponsor: IPHC

Convenors:
Josep Planas (International Pacific Halibut Commission - IPHC) *corresponding*, Gordon Kruse (University of Alaska Fairbanks, USA), Chris Rooper (DFO, Canada), Roman Novikov (Kamchatka Research Institute of Fisheries and Oceanography, Russia), Naoki Tojo (Hokkaido University, Japan)

Invited Speakers:
Janet Duffy-Anderson (NOAA, USA)
Mark Lomeli (PSMFC, USA)
David Wilson (IPHC)

The North Pacific Ocean is a large and productive ecosystem that is characterized by strong interdecadal climate variability. One of the key species in the North Pacific Ocean ecosystem is the Pacific halibut due to its wide distribution along the continental shelf throughout the North Pacific and to its important trophic position. In addition to its key ecological role, the Pacific halibut is highly relevant from a socio-economic and cultural perspective in the North Pacific Ocean region because it supports important commercial, recreational and ceremonial or subsistence fisheries. In the Northeastern Pacific Ocean, the Pacific halibut stock in waters off north American is managed by the International Pacific Halibut Commission (IPHC) that also conducts research on the biology of the species. Due to its highly migratory nature, its key ecological role and its wide distribution in the North Pacific Ocean, increased efforts are needed to expand and integrate information on the biology and the management of the Pacific halibut and interacting species across all countries involved in its fisheries, particularly in the face of a changing North Pacific. Therefore, the main objective of this Workshop is to provide state-of-the-art information on important current topics related to the biology and fishery of Pacific halibut and interacting species by bringing together researchers, scientists and managers from countries that are invested in this resource. The workshop will consist of a series of invited presentations on specific topics related to the biology of the Pacific halibut and interacting species as well as management and policy issues, followed by a discussion session on national and international research and management efforts that are currently in place as well as opportunities for establishing novel cooperative efforts at an international level.

W3: FIS Workshop
Let's play the GAME! (to achieve sustainable fisheries development in the PICES regions)

Convenors:
Aoi Sugimoto (JFRA, Japan) *corresponding*, Siri Hakala (NOAA, USA)

Invited Speaker:
Yuuki Terada (the University of Tokyo, Japan)

Sustainable fisheries development has been one of the most critical issues for marine sciences among PICES countries. Despite the obvious importance of this issue, it has been challenging to achieveecologically, economically, and socially balanced fisheries development in the PICES region. Given the complexity of the above three pillars for considering the issues related to sustainability of socio-ecological systems, serious games have increasingly proven their value in contributing to the analysis and design of such systems. One of the most significant examples among numerous projects is the series of MSP (Marine Spatial Planning) games which have been developed through EU transdisciplinary marine science platforms at an ICES Workshop, November 2011. Thus, serious games are now recognized as an influential tool to promote discussion on the sustainable use of marine resources among scientists, policy makers, business sectors, NGO/NPOs and local communities. Given this trend, we propose a serious game workshop focused on sustainable fisheries development, where we will play a game among policy makers, citizens, business sectors and PICES scientists to enhance the discussion on sustainable fisheries development in the North Pacific region. In this workshop, participants will be able to see the most significant challenges and opportunities to tackle this issue by discussing the background, design and playing process of the game. It is expected that this workshop will enhance the participant's understanding of potential similarities and differences of sustainable fisheries among PICES countries, which could lead to new research, education, and outreach projects among them.

W4: POC/BIO/FIS Workshop
Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)

Convenors:
SungHyun Nam (Korea) corresponding, Fei Yu (China), Joji Ishizaka (Japan), Yuri I. Zuenko (Russia)

Invited Speaker:
Kuh Kim (Formerly, Professor of Physical Oceanography at Seoul National University, Korea)

The western North Pacific, one of the areas of the global ocean most affected by climate change and anthropogenic activities, consists of several marginal seas. Two time series programs have contributed to significant advances in understanding of these seas/regions, named East Asian Seas Time-series (EAST-I and EAST-II regions) since the CREAMS (Circulation Research of East Asian Marginal Seas) program was initiated beyond the national borders several decades ago (early 1990s). This workshop will provide a forum for summarizing progress made during the decades of CREAMS and during the 15 years of the PICES Advisory Panel (AP-CREAMS; active since 2005), and for envisioning the future of CREAMS over the coming decades. This workshop is an opportunity to share the knowledge/findings and experience/lessons learned in hydrodynamics, biogeochemistry, ecosystem, and fisheries variability at multiple scales in the regions. We seek contributions from studies including, but not limited to, weakening of ventilation and decrease of dissolved oxygen in deep waters, eutrophication and development of hypoxia and acidification, changes of biological community structures, mixing and use of tracers as new methods, observational capabilities, and more. We will also discuss remaining issues, capacity building, new challenges, and future CREAMS plans during this workshop.

W5: BIO Workshop
Celebrating two decades of North Pacific CPR sampling, and future directions

Co-sponsor: CPR Survey at the MBA

Convenors:
Sonia Batten (Canada) corresponding, Sanae Chiba (Japan), Bill Sydeman (USA)

Invited Speaker:
Pierre Hélaouët (Marine Biological Association (MBA), UK)

The North Pacific Continuous Plankton Recorder (CPR) Survey marks its 20th year of collecting data in 2019. This workshop is a chance to celebrate the achievements of the first PICES project at the end of its first two decades and perhaps more importantly, to look forward to the next. We encourage presentations that present and review the results and diversity of applications resulting from the project to date. There have been 25 primary publications utilizing the North Pacific CPR data, spanning large scale oceanography based on satellite data, climate variability and trophic relationships with fish and birds as well as plankton-only foci. The workshop also invites presentations on what could be done with the CPR data and/or sample archive that are particularly relevant to the PICES community. Examples may include; further developments of past studies, developing indicators, or metrics for inclusion in ecosystem models, expansion to new parts of the PICES region, integration of plankton data with remote sensing, molecular analyses on specific taxa, or other novel analyses of the samples. One invited speaker will be asked to give a presentation on such a subject. The workshop will end with a discussion on future priorities for the survey, which will be summarized afterwards in a PICES Press article. It is hoped that these discussions will guide the development of the survey and its priorities over the next few years.

W6: HD Workshop
Assessing marine ecosystem services: A comparative view across the North Pacific

Convenors:
Daniel K. Lew (USA) *corresponding*, Shang Chen (China)

Invited Speaker:
Chanda Littles (US Army Corps of Engineers, USA)

The PICES Working Group on Marine Ecosystem Services (WG-MES/WG 41) was established to facilitate exchange of information and share the experiences and approaches used to identify, measure, value, and use marine ecosystem services (MES) information in North Pacific waters in order to promote ecosystem service science and improve the consideration of MES in decision making related to marine integrated management. To accomplish this, the working group is conducting two projects. One task is to review the range and types of MES found in the North Pacific region and compares the methods used to measure and value them using case studies for a subset of MES across countries. The second is a survey project that will collect information, opinions and experiences from resource managers, researchers, policy analysts and decision makers from multiple North Pacific countries. The information collected will provide country-specific insights into how MES information is valued and utilized in decision making, and provide guidance on prospects and potential for future use and integration in policy analyses and decision processes. The results of the survey should identify challenges and opportunities for improving the utility of MES information. This workshop has two primary goals: (1) to share and synthesize results of country-specific reviews of the MES literature in the North Pacific region and (2) to update progress on development of the survey to collect information on the knowledge, current and future utilization, challenges, and opportunities related to MES ecological, economic, and sociocultural information. To this end, the workshop presentations will focus on the progress and results for the working group's projects. Although the focus of the workshop presentations and discussion are on the working group's activities, other interested scientists interested in MES are highly encouraged to attend and participate.

W7: SB Workshop
PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)

Convenors:
Sei-Ichi Saitoh (Japan) *corresponding*, Hyoung-Chul Shin (Korea), Guangshui Na (China), Lisa Eisner (USA), Gordon Kruse (USA)

Invited Speaker:
Elena Eriksen (Institute of Marine Research, Norway)

The Central Arctic Ocean (CAO) is experiencing a rapid transition, largely driven by a changing North Pacific, that has led to substantial recent loss of sea ice cover, which has opened up the Central Arctic Ocean (CAO) for potential fishing opportunities. Debate and policy initiatives have already been launched for regulating fisheries that have not yet been implemented in the CAO. Scientific research in the CAO remains too scarce to inform and support policy decisions, in stark contrast to the abundance of research occurring in the neighboring North Pacific which informs and influences policy decisions. With substantial science and policy challenges present in the CAO, an integrated ecosystem assessment is a priority task. PICES joined with ICES and PAME for such an assessment by forming PICES WG-39 with its mission period ending in 2018. WG-39, despite its late start, intends to provide significant Pacific input into the final joint report expected toward the end of 2018. We also have an intersessional workshop in 2019. As a follow-up to these activities, a half day workshop is proposed to consolidate our findings and advice, connect it to those from ICES, and to report to the wider PICES community. The major emphasis of the third CAO workshop at PICES 2019 will be key locations in the Pacific Arctic and the critical processes to determine biological production, the characterization of major changes for recent decades, and the ramifications for ecosystem monitoring and management in the region. Ultimately, needed is sustainable monitoring by ice breakers and research ships in the CAO with coordination among PICES and ICES countries, including both Arctic and non-Arctic nations. One of the tasks for WG39 is to search for and make use of existing datasets and databases, aided by the general findings of previous reports and literature surveys encompassing the regions.

W8: BIO Workshop
Synthesis of bio-acoustics programs for monitoring zooplankton and fisheries in the North Pacific

Co-Sponsor: ONC (Ocean Networks Canada)

Convenors:
Lu Guan (Canada) *corresponding*, Mei Sato (Canada), Hidekatsu Yamazaki (Japan), Hyoung Sul La (Korea)

Invited Speakers:
Stéphane Gauthier (Institute of Ocean Sciences, Sidney, BC, Canada)
Kouichi Sawada (Fisheries Research and Education Agency (FRA) National Research Institute of Fisheries Engineering Japan)

Fixed and mobile echosounders offer greater temporal and vertical resolution for surveying and monitoring zooplankton and fish than traditional net sampling. Our ability to extract biological information from echosounder backscatter has improved over the last two decades with the continued development and more widespread use of these instruments. Technical advancements include (1) the use of continuously powered (fixed-cabled) instruments for high-resolution, long term time-series, and (2) improvements in multi-frequency and broadband instruments for fixed and mobile platforms that increase discrimination of backscatter targets on the basis of size, shape and in some instances, species. The goals of this workshop will be to share information on active acoustic biological monitoring programs in the North Pacific, and to form a community of practice to advance and promote use of this tool for ecosystem monitoring. We encourage contributions describing (1) existing or proposed monitoring programs, (2) instrument-specific applications, (3) approaches for size-class or species identification, (4) assessment of broader-scale trophic interactions, (5) tools for processing large-volume acoustic data sets, and (6) theoretical/modelling studies which take advantage of active acoustics data-sets.

W9: MONITOR/MEQ Workshop
Monitoring non-indigenous species in PICES member countries: Towards best practices

Convenors:
Thomas Therriault (Canada) *corresponding*, Hiroshi Kawai (Japan), Jeanette Davis (USA)

Invited Speaker:
Emily Grason (Washington Sea Grant, College of the Environment, University of Washington, USA)

Globally, marine non-indigenous species (NIS) introductions continue due to an increasing number of human-mediated vectors (e.g., shipping, recreational boating, aquaculture-related movements) and pathways that are connecting previously discrete marine ecosystems. Once introduced outside their native range, NIS can significantly reduce native biodiversity and ecosystem goods and services thereby negatively affecting coastal communities and economies. Management of new incursions is often most effective when NIS are detected early when populations are small and spatially constrained. One approach to early detection of new invaders or tracking the spread of existing invaders relies on the establishment of effective monitoring programs that consider the type of species/taxa most likely to be introduced and the areas they are most likely to be introduced to (such as ports and marinas) or vulnerable/sensitive areas (such as Marine Protected Areas). There is a long history of marine invasions in the North Pacific and among PICES member countries early detection monitoring programs for NIS are likely to vary. In this workshop we will explore the types of NIS monitoring programs that are in place (or are being planned) with a focus on the North Pacific. This workshop will include both traditional monitoring techniques (i.e., settlement plates, trapping or beach surveys) and more recent molecular approaches (i.e., high-throughput sequencing, qPCR). By reviewing the strengths and weaknesses of these various NIS monitoring approaches/programs we aim to identify best practices for NIS monitoring in the North Pacific thereby informing one of AP-NIS's Terms of Reference.

W10: BIO Workshop
PICES/ICES collaborative research initiative: Toward regional to global measurements and comparisons of zooplankton production using existing data sets

Convenors:
Toru Kobari (Japan) *corresponding*, Akash Sastri (Canada), Lidia Yebra (Spain)

Invited Speaker:
Shin-ichi Uye (Hiroshima University, Japan)

Material and energy transfer in the lower food web are integrated through zooplankton communities. The standing stock and productivity of this group represent a proxy for the functional response of marine ecosystems to regional and global climate change. A variety of methods and information on zooplankton production rates have been assembled over the past half century, however, we still struggle to evaluate zooplankton productivity and its driving forces. This workshop will discuss prospective tasks and collaborative research activities in an effort to improve and standardize zooplankton field (and laboratory) methods from both PICES and ICES nations. We encourage presentations and discussion on novel applications of traditional and biochemical methodologies and/or new approaches for evaluating zooplankton productivity in the field.

W11: FIS Workshop
PICES/NPFC collaborative research: The influence of environmental changes on the potential for species distribution shifts and population dynamics of Pacific saury

Convenors:
Chris Rooper (Canada) *corresponding,* Vladimir Kulik (Russia), Eddy Kennedy (Canada), Yong Chen (School of Marine Sciences, University of Maine, USA), Chih-hao Hsieh (National Taiwan University, Chinese Taipei), Kazuhiro Oshima (National Research Institute of Far Seas Fisheries, FRA, Japan)

Invited Speakers:
Chuanxiang Hua (College of Marine Science and Technology, Shanghai Ocean University (SOU), China)
Bai Li (NPFC; School of Marine Sciences, University of Maine, USA)
Kazuhiro Oshima (National Research Institute of Far Seas Fisheries, FRA, Japan)

This workshop is the inaugural joint activity to advance collaboration between PICES and NPFC. Under the proposed PICES-NPFC Framework for Enhanced Scientific Collaboration, the theme area of stock assessment support was identified as a priority area for future collaborative work. Pacific saury is a priority species for NPFC, and one that has experienced large fluctuations over the past several decades. Members of the NPFC have reported catches ranging from 124 to 629 kilotons between 1950 and 2017 with an average of 350 kilotons. In 2017, catch was reported to be 216 kilotons. The NPFC Technical Working Group on Pacific Saury Stock Assessment first met in 2017 to determine stock status by employing a Bayesian state-space biomass dynamic model; however consensus on stock status among members could not be reached in 2018. Collaboration of PICES and NPFC may enable recommendations for employing alternate models that incorporate environmental and ecosystem variables that might better explain stock fluctuations and predictions of stock abundance and distribution in space and/or time. The objectives of the workshop are to (1) provide an overview of environmental changes in areas that overlap Pacific saury distributions, (2) identify time periods with significantly different conditions (e.g., regime shifts) that could influence the abundance of Pacific saury, (3) outline projections and associated uncertainties of changes in habitat suitability for saury, and (4) propose mechanisms for further research to understand the interaction of ecosystem changes on Pacific saury distribution and associated consequences on estimating abundance.

W12: BIO Workshop
Potential food competition between top predators and fisheries in the North Pacific

Convenors:
Yutaka Watanuki (Japan) *corresponding,* William Sydeman (USA) , Elizabeth A. Logerwell (USA), Andrew Trites (Canada)

Invited Speakers:
Susanne McDermott (Alaska Fisheries Science Center, NMFS, NOAA, USA)
This Invited talk will be given by Elizabeth A. Logerwell (USA)

The potential for resource (food) competition between large predatory fish, marine mammals, seabirds, and fisheries is a long-standing concern in many marine ecosystems globally, but it is extremely difficult to study and document. These top predators and fisheries may target similar resources (e.g., small pelagic fish and euphausiid crustaceans), but simple overlap in prey species, consumptions and landings is insufficient to document competition. For example, changes in the forage fish and mesozooplankton populations targeted by both fisheries and upper trophic level predators may be primarily forced by climate more so than by consumption by top predators or harvest by fisheries. In this workshop, we seek presentations on the evidence and the non-evidence of resource competition between large predatory fish/squids, marine mammals, seabirds, and fisheries within PICES regions. We will review these works and conduct discussions on the best scientific approaches to document resource competition between these top predators and fisheries. This workshop will contribute to S-MBM program on Climate and the Trophic Ecology of Marine Birds and Mammals, production of comprehensive PICES North Pacific Ecosystem Status Reports, as well as interface with the fundamental goals of FUTURE to understand and predict the interaction of climate and anthropogenic factors on marine ecosystems.

W13: FUTURE Workshop
Common ecosystem reference points

Convenors:
Jennifer Boldt (Canada) *corresponding,* Vladimir Kulik (Russia), Elliott Hazen (USA), Xiujuan Shan(China), Mary Hunsicker (USA), Jongseong Ryu (Korea)

Invited Speaker:
Kirstin Holsman (NOAA Alaska Fisheries Research Center, Seattle, USA)

WG-36 on "Common Ecosystem Reference Points across PICES Member Countries" is addressing PICES FUTURE Science Program's research theme question: "How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?" Strong nonlinearities in marine ecosystems indicate the existence of thresholds beyond which small changes in pressure variables can cause large responses in other ecosystem components. Better knowledge of where 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 ecosystems from shifting into undesirable states. The purpose of this workshop is to finalize WG 36 TOR-4: "Determine shapes or functional forms of driver - response relationships from available datasets, and to quantify thresholds to identify potential ecosystem reference points". WG 36 convened a workshop at PICES-2018 for which members built a GitHub repository. This GitHub repository includes R code for single pressure GAMs, dynamic factor analyses (DFA), and gradient forest approaches. Participants from each PICES member nation ran the R code on a California Current dataset, and then expanded analyses to country-specific indicators. The working group will meet intersessionally in 2019 to advance progress on TOR-4, and to be more prepared to complete the full set of objectives of the WG at the hands-on practical workshop proposed for PICES-2019. The practical workshop is for WG 36 members and other interested participants to (1) compare results of the threshold quantification analyses, (2) refine the analyses based on group feedback, (3) examine model diagnostics , (4) complete additional analyses using gradient forest and DFA approaches, (5) identify next steps, and (6) document the analyses completed and the R code used.

W14: BIO Workshop
New frontiers: The application of molecular approaches in marine ecology and fisheries science

Convenors:
Brian Hunt (Canada) *corresponding*, Kristi Miller (Canada), Junya Hirai (Japan)

Invited Speakers:
Hitoshi Araki (Faculty of Agriculture, Hokkaido University, Japan)
Ryan Kelly (School of Marine and Environmental Affairs, University of Washington, USA)

Molecular ecology has developed rapidly over the last decade, opening up possibilities for a wide range of applications in marine and fisheries science. This workshop will focus on two aspects of molecular ecology that have the potential to significantly advance the current state of our knowledge: (1) Environmental (e)DNA – all organisms release genetic material into the environment as they move through it. The ability to detect this free DNA in water samples is revolutionizing our ability to determine species occurrence, with applications in biodiversity monitoring, invasive species tracking and community ecology; and (2) Food web ecology – traditional methods of diet analysis involving microscopy having been essential to characterizing the diets of all levels of the marine food web. They allow quantification of dietary contributions and digestion state, however, they are time consuming and are not suitable for identifying heavily digested or fragile prey, and challenging to apply to smaller organisms (e.g., zooplankton) hindering our ability to resolve the diets and trophic connection of lower trophic levels. Molecular approaches provide a means to assess entire dietary content for all organism types and size classes. We are seeking applicants to this workshop who are conducting research in the fields of eDNA and trophic ecology. We invite contributions on diverse taxonomic groups and from diverse ecosystems, covering topics including invasive species, community ecology, organism diets, and biodiversity monitoring. As a developing field, we invite contributions on method development, new applications, and calibration studies (e.g., eDNA trawl catch comparisons). We will discuss the current status and future trends of molecular approaches in the fields of eDNA and trophic ecology. Through this workshop we aim to connect researchers applying molecular approaches in the North Pacific, to facilitate international collaborations and coordinated development in the North Pacific region.

W15 Workshop
Application of machine learning to ecosystem change issues in the North Pacific

Convenors:
Charles Hannah (Canada) *corresponding,* Cisco Werner (USA), Hiroyasu Hasumi (Japan), Michael St. John (Denmark)

Invited Speaker:
Debra P.C. Peters (USDA Agricultural Research Service, NM, USA)

The two tools typically used for understanding and predicting ecosystem change are 1) dynamical models that simulate the important processes, and 2) statistical models that exploit straightforward relationships observed between parameters of interest. Outside of marine science, the newly dominant approach to finding important relationships between parameters in large data sets and predicting future behavior is a family of techniques that go by the names machine learning, artificial intelligence, and neural networks. While easy to use programming tools are available, machine learning techniques are not widely used in marine science. However, given their growing importance in finance, automotive industry, advertising, and now potentially earthquake prediction, it is time to investigate the potential for their application to the goals of PICES FUTURE Science Program. The goal of this workshop is to find researchers interested in pursuing the applications of machine learning to ecosystem change issues in the North Pacific and to develop a work plan. Participation will be sought from as wide a community as possible. The outcome of the workshop should be a proposal for a PICES Study Group. Another possible outcome is a joint ICES/PICES Working group.

W16: FIS Workshop
Developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean

Co-sponsors:
North Pacific Anadromous Fish Commission (NPAFC)
North Pacific Fisheries Commission (NPFC)

Convenors:
Mark Saunders (NPAFC) c*orresponding,* Hal Batchelder (PICES), Dick Beamish (DFO, Emeritus), Ed Farley (NMFS/NOAA), Suam Kim (Pukyong National University, Korea), Chrys Neville (DFO), Evgeny Pakhomov (UBC, Canada), Shigehiko Urawa (Japan), Laurie Weitkamp (NMFS/NOAA), Alex Zavolokin (NPFC)

Invited Speakers:
Alexey Somov (VNIRO-TINRO, Vladivostok, Russia)
Kjell Rong Utne (Institute of Marine Research, Bergen, Norway)
Laurie Weitkamp (Conservation Biology Division, NWFSC, USA)

The high-seas pelagic ecosystems of the North Pacific support five species of Pacific salmon and Steelhead trout as well as associated species including saury and North Pacific Armorhead. Communities and resource managers around the Pacific rim are challenged to understand and forecast the impacts of an increasingly uncertain climate on the distribution and productivity of these culturally and economically important fishes. New knowledge is required to determine how climate uncertainty is affecting distribution and productivity across scales from coastal to high seas and how human intervention with hatchery production impacts the structure of North Pacific ecosystems in relation to carrying capacity. The NPAFC along with NGO's, government, academic and private partners as part the International Year of the Salmon, have initiated a high seas expedition with scientists from around the Pacific rim in winter 2019. This expedition will begin to address gaps in our knowledge through survey work of salmon, plankton, and physical conditions in the central Gulf of Alaska. The intention is that this effort will lead to a program of coordinated integrated surveys across the entire North Pacific that will allow us to test hypotheses related to mechanisms affecting salmon productivity and to provide timely forecasts and advice. A workshop is proposed to convene salmon/fish specialists, oceanographers, climatologists and resource managers to review the progress made during the March 2019 survey and recommend the core elements of a pan-Pacific high seas ecosystem research survey program that would be implemented through 2022 to assess the ocean/climate mechanisms affecting salmon distribution and productivity. A PICES Scientific report will document the proceedings including review of 2019 findings, requirements for future monitoring surveys and approaches to integrating data for salmon and ocean observations across multiple platforms as well as approaches to outreach/engagement to managers and other audiences. Popular articles will be published in the PICES press and posted to the IYS website.

W17: BIO Workshop
Scoping an IEA of the Northern Bering-Chukchi Seas LME

Convenors:
Libby Logerwell (USA, FIS) *corresponding,* Kirstin Holsman (USA, NOAA IEA Program), Raychelle Daniel (USA, Pew Trusts), Yutaka Watanuki (Japan)

Invited Speaker: Albert Simon

Preparing an Integrated Ecosystem Assessment for the Northern Bering-Chukchi Seas Large Marine Ecosystem (LME) is necessary to provide scientific advice on issues such as the prospect for future fisheries in the Arctic, vulnerability to increased shipping activities, impacts of oil and gas development, and consequences of climate change. The potential impacts of climate change on Arctic marine mammals and seabirds, many of which provide subsistence resources for local and indigenous communities is also a growing concern. A workshop focusing on scoping an IEA of the Northern Bering-Chukchi Seas LME has been proposed to:

1. Review recent research, activities and priorities related to an IEA of Arctic Ecosystems
2. Review the scientific interest, data availability and overall feasibility of conducting such an IEA for the Northern Bering-Chukchi Sea region
3. Assess the opportunities to partner with other organizations to address the issues identified above
4. If the above activities demonstrate the feasibility of conducting an IEA of the NBS-Chukchi Seas LME, then Terms of Reference for a Study Group or possibly a Working Group would be developed for PICES consideration.

The purpose of the workshop proposed will be to assemble experts in the Northern Bering-Chukchi Sea LME and also in Integrated Ecosystem Assessment in other systems (such as ICES areas (e.g. Barents Sea, Norwegian Sea), the SE Bering Sea and the California Current). The experts will review the interest, data availability and overall feasibility of conducting an IEA in the proposed ecosystems. We invite contributions on ecosystem surveys and research activities in the Northern Bering-Chukchi Seas LME. We also invite contributions on IEA in other ecosystems, lessons learned and best practices. The result of the workshop will be a report and a recommendation regarding the feasibility of conducting an IEA in the proposed area and suggestions for Terms of Reference for a PICES Working Group (possibly joint with ICES and the Joint EA-EG led by PAME) to conduct the IEA.

W19: MEQ Workshop
The impacts of mariculture to coastal ecosystems

Convenors:
Zengjie Jiang (China) *corresponding,* Xianshi Jin (China), Michael Graham (USA), Kristi Miller (Canada), In-Kwon Jang (Korea), Mi Young Cho (Korea), Igor Sukhin (Russia)

Invited Speaker:
Qingli Zhang (Yellow Sea Fisheries Research Institute, China)

Mariculture, especially large-scale mariculture, is an important factor affecting coastal ecosystems. In PICES Scientific Report No. 44, a previous PICES expert group (Working Group 24 on Environmental Interactions on Marine Aquaculture) provided analyses and overviews of the following: (1) Environmental Interactions of Marine Aquaculture, (2) Marine Aquaculture Legislative Frameworks and Environmental Interactions Research and (3) Pathogens of Aquatic Animals: Detection, Diagnosis and Risks of Interactions Between Wild and Farmed Population. While this was an important contribution and a sound basis on which to proceed, there is much more research needed to characterize the effects of pathogenic and harmful organisms derived from or associated with mariculture on coastal marine ecosystems, consistent with FUTURE Research Theme 3. The Study Group will leverage the international expertise within PICES and partner organizations to "identify the impacts in coastal ecosystems that arise from regional- and large-scale mariculture". The rather cautious "Study Group leading to a Working Group" approach was selected in response to previous challenges and recommendations from Working Group 24, specifically: i) any future marine aquaculture-related PICES expert group should be more narrowly focused to not only allow for more directed work, but also to increase the likelihood of experts from all PICES member countries being able to participate and contribute, and ii) it is clear that active participation from all PICES member countries is key to realizing a complete analysis of sustainable marine aquaculture issues. Goals of the workshop are to (1) review recent research, activities and priorities related to the effects of pathogenic and harmful organisms derived from mariculture on coastal marine ecosystems in PICES nations, (2) assess the opportunities to partner with other organizations to address the issues identified above, and (3) prepare Terms of Reference for a Working Group to address the issues identified. Where appropriate, the workshop discussions might identify opportunities for future PICES expert groups to address issues related to the impacts of aquaculture that have not been previously explored.

W18: MEQ Workshop
GlobalHAB: Evaluating, reducing and mitigating the cost of harmful algal blooms: A compendium of case studies

Co-sponsors:
SCOR, ISSHA, NOWPAP, Greig Seafood Ltd., IOC UNESCO, GlobalHAB, AXA XL insurance

Convenors:
Vera L. Trainer (USA) *corresponding,* Keith Davidson (ICES, WGHABD), Kazumi Wakita (Japan)

Invited Speakers:
Leif Anderson (NOAA, USA), Alejandro Clément (Chile), Keith Davidson (SAMS, Scotland), Dan Holland (NOAA, USA), Sunny Jardine (UW, USA), Di Jin (WHOI, USA), Jorge Mardones (Chile), Charles Trick (Canada)

Over the last 2 decades, several reports have compiled what is known about the economic effects of harmful algal blooms. However, both the type and amount of available data are limited, and these reports largely have been compiled by marine scientists rather than economic experts. Most coastal states have neither conducted economic analyses of HABs nor collected data that can be used to generate reliable quantitative estimates of net economic losses and economic impacts. Proposals submitted to NOAA for economic impact studies demonstrate this lack of coordination; they are strong either in the HAB science or economic assessments, but not both.

We propose a 2.5 day international workshop to bring together international experts on economics and the science of harmful algal blooms to develop a best practices manual for the study of economic impacts of HABs. The proposed workshop structure is:

Day 1 (1/2 day): Net impacts and cost analysis of U.S. west coast HAB. Here we will focus on the U.S west coast example from a massive 2015 *Pseudo-nitzschia* bloom. Specific area of focus includes costs to commercial fishery, recreational fishery and market analysis/responses. The presentations and following discussion will include impacts on shellfish, including recreational, commercial, and subsistence. Questions that will be discussed include: How do you value these fisheries? What is the difference between value and economic impacts? What are the job losses, consumer impacts on harvesters and market responses, and halo effect? What is the cost of the delay of crab fishery (what did they end up catching vs. what did they catch)? Once the loss is described, an economic impact model can be used for quantification. *The discussion will be focused on types of economic assessment that will guide our discussions of worldwide examples on day 2.*

Day 2 (full day): Net impacts, costs, coastal resilience to HABs worldwide. Worldwide examples of wild fisheries, recreational fisheries and aquaculture losses. We will begin with presentations of 4 additional examples of HABs globally to include losses to aquaculture, wild fisheries, recreational fisheries, and human well-being. These presentations will be followed by breakout group discussions. As a group we will discuss potential economic cost analysis methods that could be used. This will include discussion of social science impacts and how to assess impacts on health (including mental health), well-being, resilience of coastal communities (non-financial impacts). *The discussions will be focused on specific areas of economic assessment agreed upon in the morning plenaries.*

Day 3 (full day): Strategies for mitigation. Breakout groups will discuss value of information from better or more refined forecasts and best practices for economic assessment, including economic costs and net economic losses. In particular, we will discuss approaches for assessing the value of the forecasts versus the cost of monitoring. Can contingency planning reduce loss? How do we open areas more quickly, how do we make closures shorter, and what is the value of information from better forecasts? What is the cost benefit analysis of monitoring programs? What actions can be implemented in the future? What is the value of information? How much do you spend on monitoring? For insurance purposes, how is cost of HABs reduced?

Wrap up and writing assignments.

The output of this workshop will be a compendium of examples describing economic approaches used to estimate the costs of HABs and their mitigation, focusing on establishing connections between HAB scientists and economists. A shorter version of the compendium may be prepared for submission to a journal. In addition, the workshop will (1) propose priorities for research and effective management in the future, (2) develop partnerships between economists and HAB researchers to develop transdisciplinary projects, and (3) attract resources to the field.

Five case studies:

1. U.S. West Coast *Pseudo-nitzschia* (Leads: Sunny Jardin Stephanny Moore)
2. Aquaculture in Europe (Lead: Keith Davidson)
3. *Cochlodinium polykridoides* effects on wild and aquacultured fish in Asia (Lead: Weol Ae Lim)
4. Chile *Pseudochattonella* impacts on aquacultured fish and *Alexandrium* impacts on shellfish (Leads: Alejandro Clément, Jorge Mardonez)
5. Ciguatoxin impacts on wild fisheries (Lead: Charles Trick)

Case Study Presentations (30 min):

Indicative content:

1. Describe your HAB or HABs and the impact it had that had economic consequences (e.g. lost harvests and revenues, recreational fishery closures, beach closures, etc.), including where, when and how often it occurs
2. Describe the types of economic analysis that have been done or are planned
3. Discuss the types of data and models that are available to support economic analysis of your specific case. Examples include:
    - HAB monitoring data and related area closure records
    - Ex-vessel or farmgate prices (price at first landing) and quantities for affected commercial fisheries or aquaculture
    - Variables that impact the production of the affected seafood products and not the demand for those products (e.g. weather variables)
    - Economic impact models or Computable General Equilibrium (CGE) models calibrated for the region impacted
    - Wholesale or retail price and quantity information for species affected by HAB event
    - Estimates of recreational harvest trips for affected species and for substitute recreational activities
    - Estimates of the costs of recreational activities (harvest costs, travel costs, opportunity costs)
    - Costs of monitoring and forecast programs
    - A count of local media reports on HAB events
4. Gaps/limitations of data
5. What could be been done differently if HAB early warning was possible?
6. What are the policy drivers in your region?
7. How have health risks and other impacts of the HAB been communicated to the public? Is media coverage positive or negative? Have actual risks been clearly communicated or are the risks to the public unclear?
8. Provide a relevant publication (maximum 2) on your HAB specifically related to its economic impact

Session/Workshop Schedules at a Glance

(*) Identifies an Early Career Scientist

W10 [Oak Bay-1]

PICES/ICES collaborative research initiative: Toward regional to global measurements and comparisons of zooplankton production using existing data sets

Convenors: Toru Kobari (Japan), Akash Sastri (Canada), Lidia Yebra (Spain)

09:00 09:10	*Introduction by Convenors*
09:10 09:50	**Shin-ichi Uye (Invited)** Zooplankton production in temperate coastal waters: from individual to community level
09:50 10:10	**Pei-Chi Ho*** Prey stoichiometry, primary production, and plankton composition influence production of marine zooplankton
10:10 10:30	**John F. Dower** What have we learned from 13 years of chitobiase-based measurements of crustacean zooplankton productivity along Canada's west coast?
10:30 11:00	**Coffee/Tea Break**
11:00 11:20	**Shin-ichi Uye** Seasonal population dynamics, biomass, production, and feeding of the chaetognath *Aidanosagitta crassa* in a temperate eutrophic inlet
11:20 11:40	**Hui Liu** A simulation model for estimating the growth and production of jellyfish (*Aurelia aurita*)
11:40 12:00	**Akash Sastri** Chitobiase-based estimates of developing biomass, growth rate, biomass production rate for a synchronous cohort of *Pseudodiaptomus inopinus* in culture
12:00 14:00	**Lunch**
14:00 14:20	**Kazuaki Tadokoro** Application of the physiological model to the existing data sets for estimating zooplankton production rates
14:20 14:40	**Karyn Suchy** Biomass production rates of copepod communities along the West Coast of Vancouver Island and in the Strait of Georgia, BC, Canada: An application of multiple empirical growth rate models

W11 [Esquimalt]

PICES/NPFC collaborative research: The influence of environmental changes on the potential for species distribution shifts and population dynamics of Pacific saury (cosponsored by NPFC)

Convenors: Chris Rooper (Canada), Vladimir Kulik (Russia), Eddy Kennedy (Canada), Yong Chen (USA), Chih-hao Hsieh (Chinese Taipei), Kazuhiro Oshima (Japan)

09:00 09:10	*Introduction by Convenors*
09:10 09:50	**Kazuhiro Oshima (Invited)** Results of stock assessment on Pacific saury by the NPFC
	Topic 1: *Overview of environmental changes in areas that overlap Pacific Saury distribution and identification of periods with different environmental conditions that could influence the abundance of saury*
09:50 10:30	**Chuanxiang Hua* (Invited)** Aggregation habitat variation of Pacific saury and its influence factors based on HSI model
10:30 11:00	**Coffee/Tea Break**
11:00 11:20	**Taiki Fuji** Habitat of Pacific saury *Cololabis saira* is affected by the distributional change of other small pelagic fishes in the North Pacific
11:20 11:40	**Vladimir Kulik** The impact of water temperature on the Pacific saury catch distribution
11:40 12:00	Discussion
12:00 14:00	**Lunch**
	Topic 2: *Projections and uncertainties in habitat suitability for saury*
14:00 14:40	**Bai Li* (Invited)** Estimating spatial non-stationary environmental effects on the distribution of Pacific saury in the Northwest Pacific Ocean

W14 [Saanich-1]

New frontiers: The application of molecular approaches in marine ecology and fisheries science

Convenors: Brian Hunt (Canada), Kristi Miller (Canada), Junya Hirai (Japan)

09:00 09:10	*Introduction by Convenors*
09:10 09:50	**Ryan Kelly (Invited)** Using environmental DNA (eDNA) to track changes in species and ecosystems
09:50 10:30	**Hitoshi Araki (Invited)** Environmental DNA for fish monitoring in the wild
10:30 11:00	**Coffee/Tea Break**
11:00 11:20	**Joanna Strzelecki** Evaluation of infauna community structure through microscopy and eDNA
11:20 11:40	**Matthew Lemay** A census of coastal biodiversity through DNA Barcodes
11:40 12:00	**Kristina M. Miller** Multi-species quantitation with eDNA – is it possible?
12:00 14:00	**Lunch**
14:00 14:20	**Caterina R. Giner*** Assessing the seasonality of the planktonic protists in the Northern Strait of Georgia, British Columbia (Canada)
14:20 14:40	**Colleen Kellogg** Microbial diversity along a land-sea continuum in coastal British Columbia: Using microbial source tracking to resolve the terrestrial influence on coastal ecosystems

W17 [Saanich-2]

Scoping an IEA of the Northern Bering-Chukchi Seas LME

Convenors: Libby Logerwell (USA), Kirstin Holsman (USA), Raychelle Daniel (USA), Yutaka Watanuki (Japan)

09:00 09:10	*Introduction by Convenors*
	Poster Presentations (5 min each) **Kathy Kuletz** Pacific Arctic seabird communities in a time of change **Matthew Baker** Applying NPRB Arctic IERP (2016-2019) research to inform an IEA in the Northern Bering Sea and Chukchi Sea **George A. Whitehouse** Sensitivity of Alaska marine food webs to mortality-based perturbations **Matthew Asplin** Synoptic meteorological controls on declining seasonal sea ice in the Bering and Chukchi Seas
10:30 11:00	**Coffee/Tea Break**
11:00 12:00	Discussion
12:00 14:00	**Lunch**
14:00 16:00	Discussion (continued)

(*) Identifies an Early Career Scientist

W10 [Oak Bay-1]

PICES/ICES collaborative research initiative: Toward regional to global measurements and comparisons of zooplankton production using existing data sets

Convenors: Toru Kobari (Japan), Akash Sastri (Canada), Lidia Yebra (Spain)

14:40 15:00	**Lidia Yebra** A global collaboration for the worldwide mapping of marine zooplankton biomass and production
15:00 15:30	Poster Presentations
15:30 16:00	**Group Discussion** **Group A**: Collaborative activities for zooplankton production measurements and methodologies with the ICES Working Group on Zooplankton Ecology (Dr. Yebra) **Group B**: Comparative researches of zooplankton production using zooplankton time-series or data-sets among the PICES nations (Dr. Sastri) **Group C**: Further approaches to make a breakthrough for zooplankton production measurements in the field (Dr. Liu)
16:00 16:30	**Coffee/Tea Break**
16:30 18:00	**Group Discussion** (continues) and wrap up
18:00	**Workshop 10 Ends**

W11 [Esquimalt]

PICES/NPFC collaborative research: The influence of environmental changes on the potential for species distribution shifts and population dynamics of Pacific saury (cosponsored by NPFC)

Convenors: Chris Rooper (Canada), Vladimir Kulik (Russia), Eddy Kennedy (Canada), Yong Chen (USA), Chih-hao Hsieh (Chinese Taipei), Kazuhiro Oshima (Japan)

14:40 15:00	**Chih-hao Hsieh** Ensemble forecasting of spatial distribution of Pacific Saury (*Cololabis saira*) in the Northwestern Pacific Ocean
15:00 15:20	**Midori Hashimoto** Pattern transition of age-specific distribution for Pacific saury *Cololabis saira* in the Northwestern Pacific Ocean
15:20 15:40	**Shin-Ichiro Nakayama** Property of Pacific saury recruitment in the North Pacific Ocean
15:40 16:00	**Kirill Kivva (for Andrey Krovnin)** The climate impact on Pacific saury (*Cololabis saira*) stock dynamics
16:00 16:30	**Coffee/Tea Break**
16:30 16:50	**Yang Liu (CANCELLED)** **Yong Chen (REPLACEMENT)** Incorporating changes in environmental conditions in fish stock assessment
16:50 17:45	**Discussion** of mechanisms for further research on interaction of ecosystem and saury and consequences for estimating abundance
17:45 18:00	Summary and Discussion
18:00	**Workshop 11 Ends**

W14 [Saanich-1]

New frontiers: The application of molecular approaches in marine ecology and fisheries science

Convenors: Brian Hunt (Canada), Kristi Miller (Canada), Junya Hirai (Japan)

14:40 15:00	**Svetlana Esenkulova** Metabarcoding, qPCR, and microscopy identification of taxa associated with harmful algal blooms
15:00 15:20	**Junya Hirai*** Metabarcoding diet analysis for revealing predator-prey relationships during the spawning period of Japanese sardine and Pacific round herring in Tosa Bay
15:20 15:40	**Jacqueline L. Maud*** Marine food webs: what can metabarcoding tell us about the true trophic pathways of the dominant mesozooplankton of the Strait of Georgia
15:40 16:00	**Fanyu Zhou*** Possible prey of three species of euphausiids in the North Pacific Ocean inferred from DNA metabarcoding
16:00 16:30	**Coffee/Tea Break**
16:30 16:50	**Strahan Tucker** Diet segregation of Northwest Pacific pinniped communities; Application of novel high-throughput DNA techniques to scat
16:50 17:10	**Jennifer Sunday** Tracking seawater eDNA in British Columbia coastal waters
17:10 17:25	Poster Presentations
17:25 18:00	Summary and Discussion
18:00	**Workshop 14 Ends**

W17 [Saanich-2]

Scoping an IEA of the Northern Bering-Chukchi Seas LME

Convenors: Libby Logerwell (USA), Kirstin Holsman (USA), Raychelle Daniel (USA), Yutaka Watanuki (Japan)

	Discussion (continued)
16:00 16:30	**Coffee/Tea Break**
16:30 18:00	Discussion (continued)
18:00	**Workshop 17 Ends**

Thursday, October 17

(*) Identifies an Early Career Scientist

W7 [Saanich-1]

PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)

Convenors: Sei-Ichi Saitoh (Japan), Hyoung-Chul Shin (Korea), Guangshui Na (China), Lisa Eisner (USA), Gordon Kruse (USA)

09:00 09:10	*Introduction by Convenors*
09:10 09:40	**Elena Eriksen (Invited)** WGIBAR activities and development integrated ecosystem assessments for the Barents Sea with prospect for connecting WGICA activities
09:40 10:00	**Hiromichi Ueno** Pacific water in the northeastern Chukchi Sea
10:00 10:20	**Lisa Eisner** Variations in spring and summer phytoplankton communities across water mass gradients in the Chukchi Sea
10:20 10:40	**Yuri Fukai*** Spatial changes of phytoplankton community in the northern Bering Sea during summers of 2017 and 2018
10:40 11:00	**Coffee/Tea Break**
11:00 11:20	**Yoshiyuki Abe*** Spatial and inter-annual changes in zooplankton community structure in the western Arctic Ocean during summers of 2008−2017
11:20 11:40	**Sei-Ichi Saitoh** Multiple facets of marine biodiversity in the Pacific Arctic under future climate
11:40 12:30	Discussion
12:30	**End of Workshop 7** **Lunch**

W8 [Esquimalt]

Synthesis of bioacoustics programs for monitoring zooplankton and fisheries in the North Pacific

Convenors: Lu Guan (Canada), Mei Sato (Canada), Hidekatsu Yamazaki (Japan), Hyoung Sul La (Korea)

09:00 09:10	*Introduction by Convenors*
09:10 09:40	**Stephane Gauthier (Invited)** Bottom-moored echosounders to monitor the migration dynamics of fish populations
09:40 10:10	**Kouichi Sawada (Invited)** Development of monitoring techniques for zooplankton using multi-frequency profilers-moored in Yamada bay, Tohoku, Japan
10:10 10:30	**Wooseok Oh** Vertical Distribution and density of Antarctic silverfish (*Pleuragramma antarcticum*) in the Ross Sea, Antarctic using Multi-frequency
10:30 10:50	**Coffee/Tea Break**
10:50 11:10	**Yanhui Zhu*** Assessment of fishery resources around Set-net using acoustic methods for sustainable fishery
11:10 11:30	**Inwoo Han** Estimating the species identification and abundance of Antarctic Krill (*Euphausia superba*) Using 2-frequency difference method
11:30 11:50	**Hyoung Sul La** Zooplankton Acoustic Surveys of Korea Polar Research Institute in the Polar Oceans
11:50 12:10	**Steve Pearce** Bio-acoustic monitoring with the Acoustic Zooplankton Fish Profiler
12:10 12:30	Discussion
12:30 14:00	**Lunch**

W9 [Oak Bay-2]

Monitoring non-indigenous species in PICES member countries: Towards best practices

Convenors: Thomas Therriault (Canada), Hiroshi Kawai (Japan), Jeanette Davis (USA)

09:00 09:10	*Introduction by Convenors*
09:10 09:50	**Emily Grason (Invited)** Community science to capture the leading edge of an invasion: European green crab on Washington State's inland shorelines
09:50 10:10	**Alexandra C.D. Davis*** Developing spatially explicit tools to minimize costs and maximize benefits of marine invasive species control
10:10 10:30	**Claudio DiBacco** Development of an aquatic invasive species monitoring program: past, present and next steps
10:30 10:50	**Coffee/Tea Break**
10:50 11:10	**Thomas W. Therriault** A collaborative science-based approach to non-indigenous species monitoring on British Columbia's North Coast
11:10 12:30	**Discussion** Strengths and weaknesses of various NIS monitoring approaches
12:30 14:00	**Lunch**

W13 [View Royal]

Common ecosystem reference points

Convenors: Jennifer Boldt (Canada), Vladimir Kulik (Russia), Elliott Hazen (USA), Xiujuan Shan(China), Mary Hunsicker (USA), Jongseong Ryu (Korea)

09:00 09:15	*Introduction by Convenors* .
09:15 09:40	Overview of WG TORs, accomplishments, workshop goals
09:40 10:15	**Kirstin Holsman (Invited)** Beyond singular driver-response tipping points and thresholds, recent examples and emerging approaches
10:15 10:40	**Kirstin Holsman** Discussion and demonstration of new tools
10:40 11:00	**Coffee/Tea Break**
11:00 11:35	**Kirstin Holsman** Discussion and demonstration of new tools (*continued*)
11:35 12:00	**Mary Hunsicker** Summary of ICES working group
	This part of the Session is closed to WG-36 members ONLY
12:00 12:30	Overview of status of regional analyses (WG36 members)
12:30 14:00	**Lunch**

W15 [Saanich-2] Part-1

Application of machine learning to ecosystem change issues in the North Pacific

Convenors: Charles Hannah (Canada), Cisco Werner (USA), Hiroyasu Hasumi (Japan), Michael St. John (Denmark)

09:00 09:40	*Introduction by Convenors*
09:40 10:40	**Debra P.C. Peters (Invited)** AI and machine learning to improve understanding and prediction of complex ecosystem dynamics
10:40 11:00	**Coffee/Tea Break**
11:00 11:30	**Michael St. John** **(CANCELLED)** Can we predict the emergent properties of marine systems? Machine learning as way forward
11:30 12:30	Discussion
12:30 14:00	**Lunch**

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W18 [Saanich-1] Part-1 *Economic effects of HABs: Recommended practices* **Convenors:** Vera L. Trainer (USA), Keith Davidson (ICES, WGHABD), Kazumi Wakita (Japan)	
14:00 14:30	*Introductions, Welcome, and Goals for Workshop* (Vera Trainer)
14:30 15:00	Plenary: Overview of HAB impacts on fisheries, forecasts, and value of information (Di Jin)
15:00 15:30	Plenary: Glossary of Economic Terms (Sunny Jardin)
15:30 16:00	**U.S. west coast studies** Costs to commercial fisheries (Dan Holland)
16:00 16:30	**Coffee/Tea Break**
16:30 17:00	**U.S. west coast studies (Continues)** Costs to recreational fisheries (Leif Anderson)
17:00 17:30	**Case Study 1**: U.S. West Coast *Pseudo-nitzschia* - market analysis and responses (Sunny Jardin)
17:30 18:00	Discussion and Summary
18:00	**Workshop18, Part-1 Ends**

W8 [Esquimalt] *Synthesis of bioacoustics programs for monitoring zooplankton and fisheries in the North Pacific* **Convenors**: Lu Guan (Canada), Mei Sato (Canada), Hidekatsu Yamazaki (Japan), Hyoung Sul La (Korea)	
14:00 14:20	**Lu Guan*** Long-term bio-acoustics monitoring of zooplankton dynamics in Saanich Inlet (British Columbia, Canada)
14:20 14:40	**Mei Sato** "Seeing" prey provides insights into the decline of southern resident killer whales
14:40 15:00	**Rhonda Reidy** Mapping prey fields of foraging humpback whales in British Columbia, Canada
15:00 15:20	**Abigail McCarthy** Spatial distribution of fin (*Balaenoptera physalus*) and humpback (*Megaptera novaeangliae*) whales in relation to environment and acoustically measured prey distribution
15:20 15:40	**Kyounghoon Lee** Correlation analysis between fish and zooplankton in cold water mass using acoustic survey
15:40 16:00	**Wu-Jung Lee** Interoperating ocean sonar data of heterogeneous sources using echopype
16:00 16:20	**Coffee/Tea Break**
16:20 16:40	**Jeff Dorman** Spatial organization and abundance indicators of Euphausiids across the California Current Ecosystem
16:40 18:00	Discussion
18:00	**Workshop 8 Ends**

W9 [Oak Bay-2] *Monitoring non-indigenous species in PICES member countries: Towards best practices* **Convenors**: Thomas Therriault (Canada), Hiroshi Kawai (Japan), Jeanette Davis (USA)	
14:00 16:00	**Discussion** Identification of possible NIS monitoring tools to be employed within PICES member countries
16:00	**Workshop 9 Ends**

W13 [View Royal] *Common ecosystem reference points* **Convenors**: Jennifer Boldt (Canada), Vladimir Kulik (Russia), Elliott Hazen (USA), Xiujuan Shan(China), Mary Hunsicker (USA), Jongseong Ryu (Korea)	
14:00 15:30	Overview of status of regional analyses (WG36 members) (*continued*)
15:30 16:00	Review of analytical goals and tools and working session to advance analyses
16:00 16:20	**Coffee/Tea Break**
16:20 18:00	Working session to advance analyses (WG36 members)
18:00	**Workshop 13 Ends**

W15 [Saanich-2] Part-1 *Application of machine learning to ecosystem change issues in the North Pacific* **Convenors**: Charles Hannah (Canada), Cisco Werner (USA), Hiroyasu Hasumi (Japan), Michael St. John (Denmark)	
14:00 14:20	**Barbara Muhling** Using machine learning techniques to estimate pelagic species distributions under novel environmental conditions in the California Current system
14:20 14:40	**Alexandra Branzan Albu** Computer vision-based detection of schools of herring from acoustic backscatter time series
14:40 15:30	Discussion
15:30 15:45	**Yi Xu** What will influence Chilko Lake sockeye salmon as climate changes?
15:45 16:00	**Caihong Fu** A machine learning approach to evaluating the impacts of multiple stressors on biotic indices at multiple trophic levels
16:00 16:20	**Coffee/Tea Break**
16:20 16:40	**Moritz Schmid** Application of machine learning to automated image analysis
16:40 17:30	Discussion
17:30	**Workshop 15, Part-1 Ends**

Friday, October 18

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W2 [Oak Bay-1]

Integrating biological research, fisheries science and management of Pacific halibut and other widely distributed fish species across the North Pacific in the face of climate and environmental variability

Convenors: Josep Planas, (IPHC), Gordon Kruse (USA), Chris Rooper (Canada), Roman Novikov (Russia), Naoki Tojo (Japan)

09:00 09:10	*Introduction by Convenors*
09:10 09:35	**David Wilson (Invited)** The International Pacific Halibut Commission: approaching 100 years of science-based fishery management decision making
09:35 09:55	**Allan Hicks** Accounting for temporal variability in productivity and dynamic reference points in tactical and strategic decision-making
09:55 10:15	**Roman Novikov** Features of the Pacific halibut fishery in the western part of the North Pacific Ocean
10:15 10:35	**Ian Stewart** Fully subscribed: Evaluating yield trade-offs among sectors utilizing the Pacific halibut resource
10:35 11:00	**Tea/Coffee Break**
11:00 11:25	**Mark Lomeli (Invited)** Reducing Pacific halibut bycatch in groundfish bottom trawl fisheries: A review of trawl modifications
11:25 11:45	**Geoffrey M. Mayhew*** Model-based discard mortality rates of Pacific halibut from covariates in the North Pacific trawl fishery
11:45 12:05	**Sarah Webster** Alaska's approach to estimating recreational discard mortality of Pacific halibut

W4 [Oak Bay-2]

Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: past and future of CREAMS (Circulation Research of East Asian Marginal Seas)

Convenors: SungHyun Nam (Korea), Fei Yu (China), Joji Ishizaka (Japan), Yuri I. Zuenko (Russia)

09:00 09:10	*Introduction by Convenors*
09:10 09:35	**Kuh Kim (Invited)** History of PAMS, CREAMS-I and II (JES) with important findings in 1981-2005
09:35 09:55	**Vyacheslav Lobanov** Toward CREAMS 3.0: recent achievements of collaborative studies in the northern Asian marginal seas and future challenges for sustainable development of the region
09:55 10:15	**Jing Zhang** Material exchanges between land and the open ocean - A framework for cooperative studies in the western North Pacific Marginal Seas (WESTPAC WG06)
10:15 10:35	**Takafumi Yoshida** NOWPAP activities and cooperation with PICES
10:35 11:05	**Tea/Coffee Break**
11:05 11:25	**Olga Novikova** **CANCELLED** Influence of external environmental factors on dynamics of the number of cod and saffron cod of the eastern part of the Sea of Okhotsk
11:25 11:45	**Xinzheng Li** Long-term variations of macrobenthic communities from the Yellow Sea and East China Sea, under the climate change
11:45 12:05	**Ji Hyun Kim*** Long-term variations in nutrient concentrations in the upper layer of the East/Japan Sea

W5 [Esquimalt]

Celebrating two decades of North Pacific CPR sampling, and future directions

Convenors: Sonia Batten (Canada), Sanae Chiba (Japan), Bill Sydeman (USA)

09:00 09:10	*Introduction by Convenors*
09:10 09:25	**Sonia Batten** Background and evolution of the North Pacific CPR Survey
09:25 09:40	**William Sydeman** A review of studies using the data to understand upper trophic level dynamics
09:40 09:55	**Sanae Chiba** A review of studies using the western Pacific CPR survey data
09:55 10:35	**Pierre Helaouet (Invited)** 60 years of plankton community in the northern North Atlantic Ocean
10:35 11:05	**Tea/Coffee Break**
11:05 11:25	**Brian Hunt** Defining isoscapes in the Northeast Pacific as an index of ocean productivity
11:25 11:45	**Brian Allan Hoover*** Interannual variation in regional zooplankton community structure in the eastern North Pacific
11:45 12:05	**Clare Ostle*** Extending the North Pacific CPR Survey pole-ward into the Arctic and potential future investigations

W12 [Colwood]

Potential food competition between top predators and fisheries in the North Pacific

Convenors: Yutaka Watanuki (Japan), William Sydeman (USA), Elizabeth A. Logerwell (USA), Andrew Trites (Canada)

09:00 09:10	*Introduction by Convenors*
09:10 09:35	**Elizabeth Logerwell** **(for Susanne McDermott) (Invited)** Steller sea lions and Atka mackerel in the Aleutian Islands; abundance and spatial patterns in fish distributions - A tale of scale
09:35 09:55	**Ivonne Ortiz** Northern fur seals and competing pollock fish predators in the eastern Bering Sea: variability in prey size availability and spatial overlap
09:55 10:15	**Andrew Trites** Evaluating competition between marine mammals and fisheries: a case study of the southern resident killer whales
10:15 10:35	**Abigail McCarthy** Spatial distribution of fin (*Balaenoptera physalus*) and humpback (*Megaptera novaeangliae*) whales in relation to environment and acoustically measured prey distribution
10:35 11:05	**Tea/Coffee Break**
11:05 11:25	**Yutaka Watanuki** Potential competition between fish and seabirds: A case study in the Bering Sea
11:25 11:45	**Caihong Fu** Assessing food competition between marine mammals and fisheries off western Canada over the past six decades
11:45 12:30	Discussion **Workshop 12 Ends**

W15 [Saanich-2] Part-2

Application of machine learning to ecosystem change issues in the North Pacific

Convenors: Charles Hannah (Canada), Cisco Werner (USA), Hiroyasu Hasumi (Japan), Michael St. John (Denmark)

09:00 09:45	Disussion
09:45 10:15	**William L. Michaels** Where is machine learning going in the marine world
10:15 10:35	**Di Wan** Exploratory machine learning applications in oceanography
10:35 11:05	**Tea/Coffee Break**
11:05 11:25	**Prospero C. Naval, Jr.** **(CANCELLED)** A semi-automated method for measuring reef fish population density and biomass from stereo-video footage
11:25 13:00	Decision Time **Workshop 15 Ends**

W18 [Saanich-1] Part-2

Economic effects of HABs: Recommended practices

Convenors: Vera L. Trainer (USA), Keith Davidson (ICES, WGHABD), Kazumi Wakita (Japan)

09:00 09:30	**Case Study 2**: Aquaculture in Europe (Keith Davidson)
09:30 10:00	**Case Study 3**: *Cochlodinium polykrikoides* effects on wild and aquacultured fish in Asia (Weol Ae Lim)
10:00 10:30	**Case Study 4**: *Pseudo-chattonella* impacts on aquacultured fish and *Alexandrium* impacts on shellfish (Jorge Mardonez and Alejandro Clément)
10:30 11:00	**Tea/Coffee Break**
11:00 11:30	**Case Study 5:** Ciguatoxin impacts on wild fisheries (Charles Trick)
11:30 12:05	Grieg Seafood: HAB financial impact and risk

Friday, October 18 (*continued*)

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W2 [Oak Bay-1]	
12:05 12:25	**Claude L Dykstra** Improving discard mortality rate estimates of Pacific halibut (*Hippoglossus stenolepis*) in the directed longline fishery
12:25 12:45	**Anita Kroska*** Controlled experiments to explore the use of a multi-tissue approach to characterizing stress in wild-caught Pacific halibut (*Hippoglossus stenolepis*)
12:45 14:00	**Lunch**
14:00 14:20	**Inigo Novales Flamarique** The visual system of flatfish: how retinal studies can help assess and reduce fisheries bycatch mortality
14:20 14:45	**Janet Duffy-Anderson (Invited)** Process and mechanistic studies of Pacific halibut early life stages can inform management strategy and decision making in the North Pacific
14:45 15:05	**Lauri Sadorus** Early life connectivity of Pacific halibut (*Hippoglossus stenolepis*) within and between the Bering Sea and Gulf of Alaska
15:05 15:25	**Timothy Loher** Movements of Pacific Halibut (*Hippoglossus stenolepis*) in the Bering Sea and Aleutian Islands: evidence of variance in relative connectivity and regional spawning dynamics
15:25 15:45	**Anthony Einfeldt*** **(CANCELLED)** Genomics of Atlantic halibut: Parallels and contrasts with Pacific halibut
15:45 16:05	**Cheryl L. Barnes*** Assessing the potential for competition between Pacific halibut and arrowtooth flounder in the Gulf of Alaska
16:05 16:25	**Coffee/Tea Break**
16:25 16:45	**Gordon H. Kruse** Environmental, ecological, and fishery effects on size-at-age of Pacific halibut
16:45 17:05	**Brian Ritchie** Exploring the role of diet in driving declining size-at-age in Pacific halibut in the Gulf of Alaska
17:05 17:35	Discussion
17:35 18:00	Poster Session **Workshop 2 Ends**

W4 [Oak Bay-2]	
12:05 12:25	**KyungJae Lee*** Statistical characteristics of East Sea (Japan Sea) mesoscale eddies detected, tracked, and grouped using satellite altimeter data from 1993 to 2017
12:25 12:45	**Jiwon Kang** Non-seasonal variability of the Kuroshio shelf intrusion and its associated changes in the ocean environment over the East China Sea during 1993-2017
12:45 14:25	**Lunch**
14:25 14:45	**Hojun Lee*** Observations on the cyclonic circulation semi-persistently formed in the northern East China Sea
14:45 15:05	**Min-Young Lee** The monthly wet depositional fluxes of organic matter in precipitation of Jeju Island
15:05 15:25	**Yong Xu** Spatial pattern of benthic macroinvertebrate communities and the relationship with environmental variables in the East China Sea shelf
15:25 15:45	**Guebuem Kim** Estimating the vertical fluxes of nutrients using Ra-228 as a tracer in the East/Japan Sea
15:45 16:05	**Kazuki Ogi*** Effects of strong turbulent mixing on phytoplankton around the Tokara strait
16:05 16:25	**Coffee/Tea Break**
16:25 16:45	**JiYun Shin*** Intraseasonal abyssal current variability of bottom-trapped topographic Rossby waves in southwestern East Sea (Japan Sea)
16:45 17:05	**Dongfeng Xu** Diel vertical migration of zooplankton and micronekton on the northern slope of the South China Sea observed by a moored ADCP
17:05 17:25	**Discussion**
17:25	**Workshop 4 Ends**

W5 [Esquimalt]	
12:05 12:45	Discussion on priorities for the future; for example expansion of the sampling, use of the data and samples for new studies and increasing output from the survey **Workshop 5 Ends**
12:45 14:25	**Lunch**

W3 [Esquimalt]
Let's play the GAME! (to achieve sustainable fisheries development in the PICES regions)
Convenors: Aoi Sugimoto (JFRA, Japan), Siri Hakala (NOAA, USA)

14:00 14:20	*Introduction by Convenors* ** Please be at the room from the beginning if you want to join the Game playing, for the sake of smooth operation*
14:20 14:45	**Instruction of the Game** **Yuuki Terada (Invited)** Let's play the fishing village revitalization game to achieve sustainable fisheries development in the PICES regions
14:45 15:05	**Game playing** ** To observe the Game playing, you can come to/go out the room anytime.*
15:05 16:05	**Feedback and Discussion** What should we achieve by the gamification method for the sustainable future of North Pacific?
16:05 16:25	**Workshop 3 Ends**

W18 [Saanich-1] Part-2	
12:05 12:30	Discussion
12:30 14:00	**Lunch**
14:00 16:00	4 Breakout groups (focus on specific questions)
16:00 16:30	**Coffee/Tea Break**
16:30 17:00	Breakout group discussions
17:00 18:00	Breakout group reports and goals for tomorrow's mitigation strategy topic **Workshop 18, Part-2 Ends** Happy Hour and Group Dinner

Saturday, October 19

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W1 [Sidney]

Learn to effectively communicate your science

Convenors: Jackie King (Canada), Manu Di Lorenzo (USA), Mitsutaku Makino (Japan), Matt Baker (USA)

W1 AGENDA MODIFIED

09:00 09:15	*Introduction by Convenors*
09:15 09:55	**Alison Morrow (Invited)** Be your own newsroom: How to make your science engaging
09:55 10:30	**Tutorial 1: Elevator Pitch** **Leads: Jackie King, Alison Morrow and Manu Di Lorenzo** "Use the 'Message Box' to get to the essence of your science message. Practice a pitch to recap shortly who you are and what you do. You need to be persuasive. Even though it's a short pitch, your 'Elevator Pitch' should be compelling enough to spark the listener's interest in your idea, organization, or background."
10:30 10:50	**Coffee/Tea Break**
10:50 11:10	**Let's hear the pitches!** "Volunteer to give your Elevator Pitch and get feedback."
11:10 12:30	**Tutorial 2: News/Blogs/Podcasts – Making your story news appealing** **Leads: Alison Morrow and Matt Baker** "Take your best science idea and write a short news piece that will engage a broader audience. Organize yourself to be ready with your own newsroom. We'll share our news pieces, and get feedback. We'll also use writing tips to develop an engaging blog post."
12:30 14:00	**Lunch**

W6 [Oak Bay-2]

Assessing marine ecosystem services: A comparative view across the North Pacific

Convenors: Daniel K. Lew (USA), Shang Chen (China)

09:00 09:10	*Introduction by Convenors*
09:10 09:50	**Chanda J. Littles* (Invited)** Coastal ecosystem services in the Temperate Northern Pacific: An emphasis on beneficiaries
09:50 10:30	**Peng Zhao*** Developing a system of environmental-economic accounting for oceans: A Chinese perspective
10:30 11:00	**Coffee/Tea Break**
11:00 11:30	**Shang Chen (CANCELLED)** Valuation of marine ecosystem services: misunderstandings and lessons **Gisele Magnusson (REPLACEMENT)** Ocean Accounts for Canada
11:30 12:00	Discussion
12:00 14:00	**Lunch**

W16 [Oak Bay-1] Part-1

PICES/NPAFC/NPFC collaborative research: Developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean

Convenors: Mark Saunders (NPAFC), Hal Batchelder (PICES), Dick Beamish (DFO Canada), Emeritus), Ed Farley (NMFS/NOAA), Suam Kim (Korea), Chrys Neville (DFO Canada), Evgeny Pakhomov (Canada), Shigehiko Urawa (Japan), Laurie Weitkamp (NMFS/NOAA), Alex Zavolokin (NPFC)

09:00 09:20	*Introduction by Convenors*
09:20 09:50	**Ed Farley** The challenges to understand how rapid climate warming impacts marine ecology of Pacific salmon
09:50 10:20	**Dick Beamish** 2019 Gulf of Alaska Expedition
10:20 10:40	Video of GOA Survey
10:40 11:00	**Coffee/Tea Break**
11:00 11:30	**Alexey A. Somov* (Invited)** Overview of methodology and high level results of Russian salmon research and comparison with obtained results in 2019 GoA salmon expedition.
11:30 12:00	**Evgeny Pakhomov and Laurie Weitkamp** Overview of preliminary findings during the February-March 2019 International Gulf of Alaska expedition
12:00 12:30	**Laurie Weitkamp (Invited)** Pacific salmon ecosystems on the high seas: Initial findings from the Winter 2019 Gulf of Alaska Expedition
12:30 13:45	**Lunch**

W18 [Saanich-1] Part-3

Economic effects of HABs: Recommended practices

Convenors: Vera L. Trainer (USA), Keith Davidson (ICES, WGHABD), Kazumi Wakita (Japan)

09:00 09:20	Mitigation strategies: wild fisheries (Dan Holland)
09:20 09:40	Mitigation strategies: Recreational fisheries (Leif Anderson)
09:40 10:00	Mitigation strategies: Aquaculture (Keith Davidson)
10:00 10:30	Mitigation strategies: shellfish (Di Jin)
10:30 11:00	**Coffee/Tea Break**
11:00 12:30	4 Breakout groups on Mitigation strategies (focus on specific questions)
12:30 14:00	**Lunch**

W19 [Esquimalt]

Impacts of mariculture on coastal ecosystems

Convenors: Zengjie Jiang (China), Xianshi Jin (China), Michael Graham (USA), Kristi Miller (Canada), In-Kwon Jang (Korea), Mi Young Cho (Korea), Igor Sukhin (Russia)

09:00 09:10	*Introduction by Convenors*
09:10 10:00	**Qingli Zhang (Invited)** Ecological risk of covert mortality nodavirus: from ponds to wild sea
10:00 10:30	**Morgan Black CANCELLED** Marine fish communities of First Nations' clam gardens
10:30 11:00	**Coffee/Tea Break**
11:00 11:30	**Michael Rust (Invited) -- Video** Overview of the ICES Aquaculture Steering group and 7 working groups in aquaculture
11:30 12:30	Discussion
12:30	**Workshop 19 Ends**

W1 [Sidney]

Learn to effectively communicate your science

Convenors: Jackie King (Canada), Manu Di Lorenzo (USA), Mitsutaku Makino (Japan), Matt Baker (USA)

14:00 15:00	**Cherisse Du Preez (Invited)** Communicating science through social media 101: the art of speaking nerdy **Tutorial 3: Developing a social media presence** **Lead: Cherisse Du Preez** "Develop or share a strategy for a twitter-style presence. Who is your audience? What is your unique message and narrative?"
15:00 16:00	**Tutorial 4: Elevator Pitch** **Lead: Manu Di Lorenzo** "Publish a clear and engaging science video quickly, and learn how to communicate your message directly. Participants will be grouped into small teams to produce a video. Laptops with video editing software will be available."
16:00 16:30	**Coffee/Tea Break**
16:30 18:00	**Let's Watch Our Videos!** "Finish producing our videos and show them off for feedback."
18:00	**Workshop 1 Ends**

W6 [Oak Bay-2]

Assessing marine ecosystem services: A comparative view across the North Pacific

Convenors: Daniel K. Lew (USA), Shang Chen (China)

Reporting on Progress and Challenges

14:00 16:00	Working Group project updates
16:00 16:20	**Coffee/Tea Break**
16:20 18:00	Working Group project updates (continued, if necessary) and open discussion
18:00	**Workshop 6 Ends**

W16 [Oak Bay-1] Part-1

PICES/NPAFC/NPFC collaborative research: Developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean

Physical and Biological Oceanography Panel

Results, hypotheses and recommendations for future research and methods
Panel: Gennady Kantakov (Russia), Anna Vazhova (Russia), Brian Hunt (Canada), Vishnu P.S. (Canada), Evgeny Pakhomov (Canada)

13:45 14:05	**Anna Vazhova*** Hydrochemical study in open part of the Gulf of Alaska in the winter 2019
14:05 14:25	**Vishnu P S** Winter dynamics of phytoplankton biomass in the Gulf of Alaska derived from Sentinel 3 Imagery
14:25 14:45	**Brian Hunt** Mega-swarm of northern sea nettles (*Chrysaora melanaster*) in the Gulf of Alaska in the winter of 2019
14:45 16:00	Discussion of findings in relation to conventional understanding of the GOA in winter and recommendations for future work/improvements
16:00 16:20	**Coffee/Tea Break**

Salmon and higher trophic levels panel

Results, links to physical and biological oceanography hypotheses and recommendations for future research and methods.
Panel: Svetlana Esenkulova (Canada), Albina Kanzeparova (Russia), Chrys Neville (Canada), Aleksei Somov (Russia), Shigehiko Urawa (Japan), Charlie Waters (USA), Laurie Weitkamp (USA), Ed Farley (USA), Kentaro Honda (Japan)

16:20 16:35	**Vladimir Radchenko** Pacific salmon abundance and biomass as estimated by trawl survey in the Gulf of Alaska in February-March 2019
16:35 16:50	**Chrys M. Neville and R.J. Beamish** Changes in our thinking of the ocean life of sockeye salmon
16:50 17:05	**Shigehiko Urawa** Origins and status of chum salmon caught in the Gulf of Alaska in the winter of 2019
17:05 17:20	**Kentaro Honda** Condition of Pacific salmon stocks in the summer Bering Sea
17:20 18:00	Discussion
18:00	**Workshop 16, Part-1 Ends**

W18 [Saanich-1] Part-3

Economic effects of HABs: Recommended practices

Convenors: Vera L. Trainer (USA), Keith Davidson (ICES, WGHABD), Kazumi Wakita (Japan)

14:00 16:00	Breakout group reports
16:00 16:20	**Coffee/Tea Break**
16:20 18:00	Outline of writing assignments, discussion of publications
18:00	**Workshop 18 Ends**

Sunday, October 20

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HAB-S Meeting	W16 [Oak Bay-1] Part-2	
Convenors: Mark L. Wells (USA), Vera Trainer (USA)	*PICES/NPAFC/NPFC collaborative research: Developing a collaborative, integrated ecosystem survey program to determine climate/ocean mechanisms affecting the productivity and distribution of salmon and associated pelagic fishes across the North Pacific Ocean*	
Canada Country Report (Nicky Haigh) **USA Country Report** (Vera Trainer) **China Country Report** (Hao Guo) **Japan Country Report** (Natsuko Nakayama) **Korea Country Report** (Weo-Ae Lim) **Russia Country Report** (Tatiana Orlova)	08:45 09:00	Welcome and Review of day 1 and introduction to day 2 by the convenor
	Salmon and higher trophic levels panel (continued from Day 1)	
	09:00 09:15	**Albina N. Kanzeparova*** Occurrence of non-salmonid species in the Northwestern Pacific Ocean and the Gulf of Alaska during the 2019 winter survey
	09:15 09:30	**Oleg N. Katugin** Distribution patterns of squid in the upper epipelagic Gulf of Alaska in winter 2019
	09:30 09:45	**Charles D. Waters** Winter energetic status of Pacific salmon in the Gulf of Alaska
	09:45 10:00	**Kristina Miller** Genomic science tools being implemented on samples from the first Gulf of Alaska expedition in 2019
	10:00 10:15	**Alexey Somov** Food habits of Pacific salmon in the North Pacific Ocean in winter 2019
	Special topics - Stock ID, Plastics, Tagging at Sea *Panel:* Chris Deeg (Canada), Evgeny Pakhomov (Canada), Brian Hunt (Canada), Kristi Miller (Canada)	
	10:15 10:30	**Christoph M. Deeg** At sea genetic stock identification of overwintering coho salmon in the Gulf of Alaska: Evaluation of nanopore sequencing for remote real-time deployment
	10:30 10:50	**Coffee/Tea Break**
	10:50 11:05	**Gennady Kantakov and Vladimir Radchenko** Spatial distribution and abundance of floating macro-and microplastics based on visual observations and neuston net survey in the Gulf of Alaska in February-March 2019
	11:05 11:20	**Vladimir Radchenko** Live fish trap for pelagic trawl and problems of its use for salmon revealed at the international Gulf of Alaska expedition in winter 2019

HAB-S Meeting (continues until 12:30)	W16 [Oak Bay-1] Part-2 (continued)	
Contributed Talks **Berhane Tesfai** Morphology, molecular phylogeny and toxicity potential of a new *Prorocentrum* species, *P. thailandensis*, (Dinophyceae, Prorocentrales) from Phuket Island, Thailand **Hao Guo** 2018 Red Tide in China **Bum Soo Park** New evidence for the role of oil-degrading bacteria in the formation of a *Prorocentrum* dinoflagellate bloom after an oil spill **Tatiana Orlova** 20 years of HABs monitoring on the east coast of Russia: Results and lessons **Seung Ho Baek** Why massive blooms of the fish-killing harmful dinoflagellate *Cochlodinium polykrikoides* did not occur along the Korean coastal water in 2016 **Jin Ho Kim** Field application and validity of a Red-tide Acoustic Sensing System (RASS) for monitoring and alerting of Harmful Algal Blooms (HABs) in Korean coastal waters **Young Kyun Lim** Succession phenomenon of two dinoflagellates *Cochlodinium polykrikoides* and *Alexandrium affine* in the southern sea of Korea in summer of 2017 **Anbiah Rajan** Influence of eutrophication on dinoflagellate cyst distribution in Abu Dhabi coastal waters and future aspects	11:20 12:30	Discussion (1) future priorities for stock ID, plastics, e-DNA, tagging (2) publication of findings
	12:30 14:00	**Lunch**
	Related Survey work in North Pacific Coastal regions *Eastern Pacific Panel*: Kym Jacobson (USA), Laurie Weitkamp (USA), Jackie King (Canada), Chrys Neville (Canada), Ed Farley (USA) *Western Pacific Panel*: Kentaro Honda (Japan), Vladimir Radchenko, Suam Kim (Korea)	
	14:00 14:15	**Kym Jacobson (for Richard Brodeur)** Juvenile salmon and ocean ecosystem studies in the Northern California Current
	14:15 14:30	**Chrys Neville** Annual surveys for juvenile Pacific salmon in the coastal waters of British Columbia
	14:30 14:45	**Kentaro Honda** How does sea-entry condition of juvenile chum salmon affect their subsequent survival/growth? A case study in eastern Hokkaido, Japan
	14:45 15:00	**Suam Kim** Chum salmon monitoring using electronic tags in Yeongok river of mid-eastern coast, Korea
	Planning for 2021/2021 Survey Design Panel *Panel:* Ed Farley (USA), Chrys Neville (Canada), Laurie Weitkamp, Shigehiko Urawa (Japan), Aleksei Somov (Russia)	
	15:00 15:15	**Kjell Rong Utne (Invited)** IESSNS – International ecosystem survey in the Northeast Atlantic
	15:15 15:30	**Aleksandr Zavolokin** Non-anadromous species in the Subarctic North Pacific
	15:30 15:45	**Brian K. Wells** Integrating salmon ocean research results into a management framework
	15:45 17:30	**Facilitated session:** (1) Survey design/hypothesis/methods and relevance to resource management – starting with short presentation on potential 5 vessel survey design (2) Approaches to data integration - presentation of contracted review of data integration – starting with short presentation on data integration review contract with Oceans Network Canada (3) Gear issues - net, horsepower, vessel comparisons etc. – discussion (4) Outreach and communications
	17:30 18:00	Summary and Closing Remarks
	18:00	**Workshop 16 Ends**

Monday, October 21 [Lecture Theater]

Session 1: Connecting science and communities in a changing North Pacific

Convenors: Hiroaki Saito (SB), Vera L. Trainer (SB), Se-Jong Ju (BIO), Xianshi Jin (FIS), Keith Criddle (HD), Guangshui Na (MEQ), Jennifer Boldt (MONITOR), Emanuele Di Lorenzo (POC), Joon-Soo Lee (TCODE), Steven Bograd (FUTURE), Sukyung Kang (FUTURE), Igor Shevchenko (Russia), Motomitsu Takahashi (Japan)

KeyNote

Connecting science to management, policy and people

Jackie **King** (Fisheries and Oceans Canada)

The cumulative impacts of human stressors on coastal ecosystems are increasingly exacerbated by climate change. As scientists, we are called upon to provide scientific evidence and advice to support sustainable resource and ecosystem management of coastal ecosystems. Yet public distrust of science is increasing, which creates a new challenges for us. I will highlight research programs on coastal human stressors that have actively made connections to coastal communities, resource managers and policy makers, and to the general public when designing, implementing or communicating scientific research. In doing so these programs build trust, relevance and accessibility for their science. The challenge to connect beyond our traditional science roles and relationships is a difficult one, and personal, but a challenge that each of us should attempt to undertake in some capacity.

Session 1: Connecting science and communities in a changing North Pacific

10:30	**Jackie King (Keynote)** Connecting science to management, policy and people
11:15	**Takeyoshi Nagai (Invited)** How the Kuroshio enriches the southern coast of Japan and its downstream regions
11:45	**Dohoon Kim (Invited)** Better understanding of socioeconomic impacts of climate change in fisheries
12:15	**Aoi Sugimoto*** Participatory scenario building to conserve Cultural Ecosystem Services: The possibilities and challenges from a case study in Japan
12:35	**Lunch**
14:00	**Sean C. Anderson (Invited)** An automated synopsis of the state of Pacific Canadian groundfish and climate impacts
14:30	**Laurie Weitkamp** The Winter 2019 Gulf of Alaska Expedition: Studying salmon ecosystems on the high seas
14:50	**Anne Hollowed** An assessment of climate change impacts on polar ecosystems
15:10	**Elliott Hazen** Top predators as climate and ecosystem sentinels
15:30	**Anna Milena Zivian (Invited)** Connecting science and communities under a changing climate: the role of boundary organizations
16:00	**Coffee/Tea Break**
16:20	**Peter Chandler** The North Pacific Ecosystem Status Report 2009-2015
16:40	**Fangli Qiao** The UN Decade of Ocean Science for Sustainable Development and PICES: For the perspective of a predicted ocean
17:00	**Patricia T. Angkiriwang*** Participatory system modelling to increase climate resilience of seafood availability in Tla'amin Nation
17:20	**Thomas A. Okey** The Local Environmental Observer Network for inclusive documentation and understanding of unusual environmental / ecological changes that matter to communities
17:40	**Mitsutaku Makino** Capacity building in Indonesian fishing communities using smartphone technology to monitor the environment and fisheries: The FishGIS project
18:00	**Session 1 Ends**

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Tuesday, October 22

Plenary Session

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09:00 **Naoki H. Kumagai (S5)**
09:30 Community shifts from macroalgae to corals under climate warming: Underlying processes and adaptation strategies

09:30 **Jun Nishioka (S10)**
10:00 Micro- and macro-nutrient supply from the marginal seas to the North Pacific Ocean and its changing

10:00 **Nicole Lovenduski (S15)**
10:30 Decadal predictions of ocean biogeochemistry in the North Pacific

10:30 **Coffee/Tea Break**
10:50

S2 [Lecture Theater]

Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions

Convenors: Jennifer Jackson (Canada), Tetjana Ross (Canada), Toshio Yamagata (Japan), Yun-Wei Dong (China), Emanuele di Lorenzo (USA)

10:50 11:00 *Introduction by Convenors*

11:00 11:30 **Eric Oliver (Invited)**
Historical and future projected changes in global marine heatwaves

11:30 11:50 **Michael Jacox**
Predicting the evolution of the 2014-16 California Current System marine heatwave from an ensemble of coupled global climate forecasts

11:50 12:10 **Jing-Jia Luo**
California Niño/Niña

12:10 12:30 **Jennifer L. Fisher (for Richard Brodeur)**
Effects of a prolonged marine heatwave on middle and upper-trophic level biota in the California Current

12:30 12:50 **Meredith Elliott**
The 2014-16 North Pacific marine heatwave's impacts on the marine ecosystem in central California, USA

12:50 14:00 **Lunch**

S5 [Oak Bay-2] Part-1

Trends in ocean and coastal ecosystems and their services and its future

Convenors: Shin-ichi Ito (Japan), Angelica Peña (Canada), Kirstin Holsman (USA), Xiujuan Shan (China), Igor Yashayaev (Canada)

10:50 11:00 *Introduction by Convenors*

11:00 11:20 **Carol Ladd**
Interannual variability in stratification, nutrients, and water mass structure in the Chukchi Sea

11:20 11:40 **Matthew Baker and Kirill Kivva**
Shifts in the physical environment in the Pacific Arctic and implications for ecological timing and structure

11:40 12:00 **Colleen Kellogg**
Resolving drivers of microbial community variability in the Strait of Georgia over multiple time scales

12:00 12:20 **Wiley Evans**
Constraining along-coast surface seawater CO_2 system variability and changeability from an Alaskan ferry

12:20 14:00 **Lunch**

S13 [Saanich-1] Part-1

Implications of prey consumption by marine birds, mammals, and fish in the North Pacific

Convenors: Andrew Trites (Canada), Robert Suryan (USA), Tsutomu Tamura (Japan), Kirstin Holsman (USA)

10:50 11:00 *Introduction by Convenors*

11:00 11:20 **Cheryl L. Barnes***
Development of a predation index to assess spatiotemporal variation in consumption of Walleye Pollock in the Gulf of Alaska

11:20 11:40 **Matthew Savoca***
Rorqual ingestion estimates for the Eastern North Pacific based on direct measures of feeding rates and prey quality

11:40 12:00 **Hiroko Sasaki**
Spatial estimation of prey consumption by sei, Bryde's and common minke whales in the western North Pacific during the summers of 2008 – 2009: Density surface model approach

12:00 12:20 **Yoko Goto**
Daily food requirements of Steller sea lion, spotted seal and ribbon seal distributed along the coast of the Nemuro Strait, Hokkaido, Japan

12:20 **Session 13, Part-1 Ends**

S14 [Esquimalt]

Integrating economic and social objectives in marine resource management

Convenors: Keith Criddle (USA), Alan Haynie (USA), Mitsutaku Makino (Japan)

10:50 11:00 *Introduction by Convenors*

11:00 11:40 **Sean Pascoe (Invited)**
Integrating economic and social objectives in marine resource management: Australian experiences

11:40 12:00 **Charlotte Whitney***
(CANCELLED)
Using an open-access information platform and expert elicitation to prioritize management actions for salmon in the face of uncertainty

12:00 12:20 **Kiva Oken***
A bioeconomic simulation for understanding the roles of synchrony and permit access in driving revenue stability on the U.S. West Coast

12:20 14:00 **Lunch**

S15 [Oak Bay-1]

Advances in North Pacific marine ecosystem prediction

Convenors: Mike Jacox (USA), Fei Chai (China), Jinqiu Du (China), Shoshiro Minobe (Japan)

10:50 11:00 *Introduction by Convenors*

11:00 11:30 **Takeshi Doi (Invited)**
Seasonal-interannual prediction of sea surface height using an ocean-atmosphere dynamical model "SINTEX-F"

11:30 11:50 **Kelly Kearney**
Seasonal forecast skill for the Bering Sea cold pool

11:50 12:10 **Emily L. Norton***
The importance of environmental exposure history in forecasting Dungeness crab megalopae occurrence using J-SCOPE, a high-resolution model for the US Pacific Northwest

12:10 12:30 **Michael Malick***
Skill and uncertainty of environmentally driven forecasts of Pacific hake distribution

12:30 14:00 **Lunch**

	S2 [Lecture Theater]		S5 [Oak Bay-2] Part-1
	Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions **Convenors:** Jennifer Jackson (Canada), Tetjana Ross (Canada), Toshio Yamagata (Japan), Yun-Wei Dong (China), Emanuele di Lorenzo (USA)		*Trends in ocean and coastal ecosystems and their services and its future* **Convenors:** Shin-ichi Ito (Japan), Angelica Peña (Canada), Kirstin Holsman (USA), Xiujuan Shan (China), Igor Yashayaev (Canada)
14:00 14:20	**Sonia Batten (Invited)** Marine heat wave impacts on lower trophic levels in the northern Gulf of Alaska	14:00 14:20	**Phoebe Woodworth-Jefcoats*** The role of temperature in determining how marine fish will be differentially affected by climate change
14:20 14:40	**Brian Allan Hoover*** Influence of temperature and the 2014-2016 heat wave on regional zooplankton community structure in the eastern North Pacific	14:20 14:40	**Karyn Suchy*** Synchrony between phytoplankton and zooplankton phenology in the Strait of Georgia, Canada
14:40 15:00	**Mayumi Arimitsu*** Reduced energy transfer through forage fish disrupted marine food webs during the North Pacific marine heatwave	14:40 15:00	**Carol A. Stepien** Community species identities, diversity, and patterns across the Salish Sea: Metagenomic analyses of zooplankton and eDNA
15:00 15:20	**Antonietta Capotondi** Predicting physical drivers of marine ecosystems in the Northeast Pacific using a Linear Inverse Modeling approach	15:00 15:20	**Ian Perry** Drivers of interannual and decadal-scale variability in the lower trophic levels of the marine ecosystem off Vancouver Island, Canada
15:20 15:40	**John Piatt** Was an “ectothermic vise” responsible for the mass mortality and breeding failure of seabirds in Alaska following the NE Pacific marine heat wave of 2014-2016?	15:20 15:40	**Eric P. Bjorkstedt** Climate-related variability in assemblage and size- structure of euphausiids in coastal waters off northern California
15:40 16:00	**William J. Sydeman** Are marine heatwaves causing an increase in seabird breeding failure globally?	15:40 16:00	**Sheng-Yuan Teng*** Development of an ecosystem-based assessment approach for the northwestern Pacific mullet (*Mugil cephalus*) fishery
16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**
16:20 16:40	**Simone Alin (Invited)** Effects of the North Pacific marine heatwave and El Niño events of 2013–2016 on the biogeochemistry of the southern Salish Sea	16:20 16:40	**David McGowan*** Large multi-decadal space and time shifts in Pacific herring spawning in the Gulf of Alaska
16:40 17:00	**Timothy Green** Marine heatwave alters abundance, structure and virulence of *Vibrio* populations associated with the Pacific oyster resulting in a mass mortality event	16:40 17:00	**Jessica Garzke** Depressed condition and growth of juvenile sockeye salmon (*Oncorhynchus nerka*) during early migration

	S12 [Saanich-1] Part-1		S14 [Esquimalt]		S15 [Oak Bay-1]
	Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems **Convenors:** Hiromichi Ueno (Japan), Tetjana Ross (Canada), Olga O. Trusenkova (Russia)		*Integrating economic and social objectives in marine resource management* **Convenors:** Keith Criddle (USA), Alan Haynie (USA), Mitsutaku Makino (Japan)		*Advances in North Pacific marine ecosystem prediction* **Convenors:** Mike Jacox (USA), Fei Chai (China), Jinqiu Du (China), Shoshiro Minobe (Japan)
14:00 14:10	*Introduction by Convenors*	14:00 14:20	**Raphael K. Roman*** How fisheries portfolio diversification can enhance social-ecological resilience along the Sanriku Coast of Japan	14:00 14:20	**Toru Miyama** Marine heatwave of sea surface temperature of the Oyashio region in summer since 2010
14:10 14:40	**Jody M. Klymak (Invited)** Submesoscale observations in the Northeast Pacific	14:20 14:40	**Hiroaki Sugino*** Infrastructuring big data of multi-species fishery catch for agile-up fishery strategy	14:20 14:40	**Baolan Wu*** The impact of Atlantic Multi-Decadal Oscillation on the North Pacific subtropical mode water
14:40 15:00	**Tara Howatt*** Glider observations of downwelling processes and zooplankton distributions in Clayoquot Canyon	14:40 15:00	**Timothy Frawley*** Recent changes to the structure and function of the North Pacific albacore fishery	14:40 15:00	**Shuyang Ma*** Climate variability patterns and their ecological effects on ecosystems in the northwestern North Pacific
15:00 15:20	**Vadim Navrotsky** Interaction of multi-scale dynamic processes in the coastal ocean and their biological impacts	15:00 15:20	**Iwao Fujii*** Capacity building for the successful management of the high seas, with a focus on NGOs – in the context of the Pacific region	15:00 15:20	**Shoshiro Minobe** Basin-scale relations between marine ecosystem indices and physical environment in North Pacific
15:20 15:40	**Hui Liu** Impacts of the Loop Current associated mesoscale processes on zooplankton communities in the northern Gulf of Mexico	15:20 15:40	**Yu-San Han** Dispersal routes of Japanese glass eel in the East Asian continental shelf and its sustainable use	15:20 15:40	**Peter Kuriyama*** Applying empirical dynamic modelling to identify intraspecific spatial scales of dynamics and improve in-sample predictability in the CalCOFI ichthyoplankton survey
15:40 16:00	**Annalisa Bracco** Role of submesoscale circulations in vertical transport within and across the mixed-layer	15:40 16:00	**Meng Su** Marine fishery development and user rights management in Jimo (China)	15:40 16:00	**Albert J. Hermann** Expanding the biophysical ensemble: hybrid dynamical-statistical downscaling methods based on spatial/temporal scale
16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**
16:20 16:40	**Hiromichi Ueno** Eddy yield in the North Pacific	16:20 16:40	**Minje Choi*** Comparative analysis of stock assessment models for planning the effective fishery resource management: Analyzing potential yield of West sea, Republic of Korea	16:20 16:40	**Stephanie Brodie* (Invited)** Exploring the determinants of ecological predictability
16:40 17:00	**Hanna Na** Kuroshio variability and its relationship with mesoscale eddies in the southern East China Sea	16:40 17:00	Discussion **Session 14 Ends**	16:40 17:00	**Yongjun Tian** Regime shifts in the fish assemblages around Japan over the last century and their early warning signals

S2 [Lecture Theater]

Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions

Convenors: Jennifer Jackson (Canada), Tetjana Ross (Canada), Toshio Yamagata (Japan), Yun-Wei Dong (China), Emanuele di Lorenzo (USA)

17:00 17:20	**Charles Hannah** Characterizing marine heatwaves in British Columbia waters
17:20 17:40	**Jennifer Jackson** A tale of three fjords: A comparison of marine heatwave impacts on three British Columbia mainland coastal systems
17:40 18:00	Discussion of session and possible working group
18:00	**Session 2 Ends**

S5 [Oak Bay-2] Part-1

Trends in ocean and coastal ecosystems and their services and its future

Convenors: Shin-ichi Ito (Japan), Angelica Peña (Canada), Kirstin Holsman (USA), Xiujuan Shan (China), Igor Yashayaev (Canada)

17:00 17:20	**Caitlin Magel*** Quantifying the role of estuaries in Oregon Coast coho salmon production
17:20 17:40	**Cecilia O'Leary*** Spatiotemporal dynamics of groundfish availability to Eastern Bering Sea bottom trawl surveys and abundance estimate uncertainties
17:40 18:00	**Elizabeth M.J. Lee*** Big fishery, big data, and little crabs: Examining fine-scale genetic connectivity among Dungeness crab (*Cancer magister*) larval recruits in the California Current Ecosystem
18:00	**Session 5, Part-1 Ends**

S12 [Saanich-1] Part-1

Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems

Convenors: Hiromichi Ueno (Japan), Tetjana Ross (Canada), Olga O. Trusenkova (Russia)

17:00 17:20	**Xiaopei Lin** Meridional heat transport variability induced by mesoscale processes in the subpolar North Atlantic
17:20 17:40	**Andrey Andreev** Water dynamics in the western Bering Sea and its impact on chlorophyll concentration and chum salmon abundance
17:40 18:00	**Elena Ustinova** Impact of mesoscale variability in the Northwest Pacific on the saury, sardine and mackerels fishery in summer and autumn in recent years
18:00	**Session 12, Part-1 Ends**

S15 [Oak Bay-1]

Advances in North Pacific marine ecosystem prediction

Convenors: Mike Jacox (USA), Fei Chai (China), Jinqiu Du (China), Shoshiro Minobe (Japan)

17:00 17:20	**Caihong Fu (for Chuanbo Guo*)** Interactive effects of fishing, ocean acidification and ocean warming on a marine ecosystem off western Canada
17:20 17:40	**Megan Cimino*** Winter preconditioning, mesoscale variability and geomorphology influence the distribution and abundance of krill in the California Current System
17:40 18:00	**Jerome Fiechter** A downscaling approach to predict climate change effects on forage fish abundance and distribution in the California Current
18:00	**Andrey Krovnin** Prospects of long-range prediction of changes in fish stocks based on the large-scale climatic factors in the Northern Hemisphere
18:20	**Session 15 Ends**

Wednesday, October 23

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S4 [Esquimalt]

The impacts of marine transportation and their cumulative effects on coastal communities and ecosystems

Convenors: Cathryn Murray (Canada), Sarah Bailey (Canada), Hideaki Maki (Japan), Paula Doucette (Canada)

09:00 09:10	*Introduction by Convenors*
09:10 09:40	**Hideo Okamura and Hiroshi Kawai (Invited)** Ship antifouling biocides used in Japan and their environmental risk
09:40 10:00	**Josephine Iacarella*** Unwanted networks: vessel traffic heightens the risk of invasions in marine protected areas
10:00 10:20	**R. Cotton Rockwood** Ship strike management in priority regions of the U.S. West Coast: Effectiveness of past efforts and potential for new strategies
10:20 10:40	**Sarah Bobbe** Environmental impacts and mitigation of grey water discharges from ships
10:40 11:00	**Coffee/Tea Break**

S12 [Saanich-1] Part-2

Impacts of meso-/submeso- scale processes on heat/material transport and on marine ecosystems

Convenors: Hiromichi Ueno (Japan), Tetjana Ross (Canada), Olga O. Trusenkova (Russia)

09:00 09:20	**Réka Domokos** Spatiotemporal variability of two North Pacific fronts and their effects on micronekton
09:20 09:40	**Jianchao Li* (CANCELLED)** Yellow Sea Cold Water Mass multiple ocean process and their impacts on Pacific cod life history and Yellow Sea ecosystem
09:40 10:00	**Dongfeng Xu** Diel vertical migration of zooplankton and micronekton on the northern slope of the South China Sea observed by a moored ADCP
10:00 10:20	**Olga Trusenkova** Mesoscale and submesoscale dynamic structures off the Russian coast in the northwestern Japan/East Sea and their impact on chlorophyll-a concentration: Satellite imagery and moored profiler measurements
10:20 10:40	Discussion
10:40	**Session 12 Ends**

S10 [Oak Bay-2]

Linking changes in climate, nutrient distribution, phytoplankton ecology, and production of algal exudates in the North Pacific

Convenors: Andrew Ross (Canada), Sayaka Yasunaka (Japan)

08:50 09:00	*Introduction by Convenors*
09:00 09:20	**Qiufen Li** Long-term monitoring and assessing of the eco-environment health of sea area around Laoshan Mountainin in Qingdao, China
09:20 09:40	**Lisa Eisner** Variations in spring and summer phytoplankton communities across water mass gradients in the Chukchi Sea
09:40 10:00	**Justin A. Del Bel Belluz** High temporal resolution phytoplankton compositions and environmental drivers in the northern Salish Sea, British Columbia, Canada
10:00 10:20	**Andrew R.S. Ross** Evidence for the production of copper-complexing ligands by marine phytoplankton in the Canadian Arctic and subarctic NE Pacific
10:20 10:40	**Min-Young Lee* (CANCELLED)** The monthly wet depositional fluxes of organic matter in precipitation of Jeju Island **Baodong Wang (REPLACEMENT MOVED from MEQ-Paper)** Long-term changes of nutrient regimes and their ecological effects in Bohai Sea, China
10:40 11:00	**Coffee/Tea Break**

S11 [Oak Bay-1] Part-1

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)

09:00 09:10	Introduction by Convenors
09:10 09:40	**Stephani Zador (Invited)** Merging contextual ecosystem advice with single-species stock assessment to inform fisheries managers in times of extreme environmental changes
09:40 10:00	**Anne Hollowed** National Oceanic and Atmospheric Administration's Climate Fisheries Initiative: Long-term projections
10:00 10:20	**Szymon Surma*** Towards ecosystem-based management of Northeast Pacific herring fisheries
10:20 10:40	**Tatiana N. Dautova (CANCELLED)** Emperor Chain Research Project of the NSCMB FEB RAS – key animal groups in the vulnerable marine ecosystems and natural resources management in the Pacific High Seas
10:40 11:00	**Coffee/Tea Break**

S13 [Lecture Theater] Part-2

Implications of prey consumption by marine birds, mammals, and fish in the North Pacific

Convenors: Andrew Trites (Canada), Robert Suryan (USA), Tsutomu Tamura (Japan), Kirstin Holsman (USA)

09:00 09:20	**Andrew Trites** Daily prey consumption by marine mammals is a function of their cost of living
09:20 09:40	**Szymon Surma*** Modeling the importance of prey quality to endothermic predators in the Northeast Pacific
09:40 10:00	**Jacob Weil** Variability in the energy density of prey and its consequences for growth in juvenile Chinook Salmon
10:00 10:30	**David Beauchamp (Invited)** Ontogenetic shifts in the trophic role and consumption demand by Chinook salmon and Pacific herring in Puget Sound
10:30 11:00	**Coffee/Tea Break**

S4 [Esquimalt]		S5 [Saanich-1] Part-2		S10 [Oak Bay-2]	
The impacts of marine transportation and their cumulative effects on coastal communities and ecosystems **Convenors:** Cathryn Murray (Canada), Sarah Bailey (Canada), Hideaki Maki (Japan), Paula Doucette (Canada)		*Trends in ocean and coastal ecosystems and their services and its future* **Convenors:** Shin-ichi Ito (Japan), Angelica Peña (Canada), Kirstin Holsman (USA), Xiujuan Shan (China), Igor Yashayaev (Canada)		*Linking changes in climate, nutrient distribution, phytoplankton ecology, and production of algal exudates in the North Pacific* **Convenors:** Andrew Ross (Canada), Sayaka Yasunaka (Japan)	
11:00 11:20	**Rachael D. Mueller** Influences of wind, sea state, and oil type on oil dispersion in the Salish Sea	11:00 11:20	**Irene Alabia*** Multiple facets of marine biodiversity in the Pacific Arctic under future climate	11:00 11:20	**Ruoyu Guo*** An algicidal bacteria secreted natural compound induces mortality in the marine phytoplankton
11:20 11:40	**Keliang Chen** Marine eco-damage assessment methods based on the eco-restoration cost in China	11:20 11:40	**Haruka Nishikawa*** Simulated primary production in the Kuroshio Extension under the influence of the global warming	11:20 11:40	**Svetlana Esenkulova** Linking harmful algal blooms and oceanographic conditions in the Strait of Georgia, Canada
11:40 12:00	**Jingmei Li** Research on the application level of marine ecosystem services economic valuation in decision-making in China	11:40 12:00	**Szymon Surma*** Reconstructing and projecting trends in a Northeast Pacific ecosystem	11:40 12:00	**Xinfeng Dai** The effect of temperature and salinity on growth rate and azaspiracid cell quotas in two strains of *Azadinium poporum* (Dinophyceae) from Puget Sound, Washington State
12:00 12:20	**Kuan-Mei Hsiung*** The variability of Japanese eel body larval length concerning the environmental factors of the migration route	12:00 12:20	**Samuel Akande*** Developing a Community-Based Resilience Assessment Model to extreme ocean-climate events	12:00 12:20	**Pengbin Wang*** Studies on *Prorocentrum* (Dinophyceae) in the coastal water of China
12:20 12:40	Discussion	12:20 12:40	**Po-Yuan Hsiao** The influences of climatic variability on the summertime environmental variations and ecosystem structures around the waters of Taiwan Bank	12:20 12:40	**Robert Jay Nerit Ramos (for Mengmeng Tong)** Light triggered the hemolytic toxin production of fish-killing Raphidophyte: *Heterosigma akashiwo*
12:40	**Session 4 Ends**	12:40 12:50	Discussion **Session 5 Ends**	12:40 13:00	**Chenfeng Hua*** **(CANCELLED)** Role of dissolved nitrate/ammonium and phosphate in isolates of *Mesodinium rubrum* and toxin-producing *Dinophysis acuminata*
				13:00	**Session 10 Ends**

S11 [Oak Bay-1] Part-1		S13 [Lecture Theater] Part-2	
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)		*Implications of prey consumption by marine birds, mammals, and fish in the North Pacific*	
11:00 11:20	**Isaac C. Kaplan** Fragile ecosystems, robust assessments? Performance testing stock assessments for the California Current and Nordic and Barents Seas under climate change	11:00 11:20	**Gemma Carroll*** Environmental drivers of variation in energy intake by Pacific bluefin tuna over 15 years
11:20 11:40	**Gloria S. Duran*** Spatiotemporal interannual variabilities of swordfish catch in relation to fronts and eddies in the northwestern Pacific	11:20 11:40	**Andrew Trites** Shifts in prey consumption by seals and sea lions in the North Pacific
11:40 12:00	**Phoebe Woodworth-Jefcoats** Ideas on how to incorporate EBFM into a pelagic longline tuna fishery	11:40 12:00	**Meredith Elliott (for Pete Warzybok)** Prey switching and consumption by seabirds in the central California Current upwelling ecosystem: Implications for forage fish management
12:00 12:20	**James A. Smith** An evaluation of dynamic and static spatial management in a swordfish fishery: Balancing economic and bycatch concerns	12:00 12:20	**Tsutomu Tamura** Estimation of prey consumption by marine mammals in the PICES regions - Update of Hunt et al. (2000)
12:20 12:40	**Yan-Lun Wu** Application of time series analysis to detect the effect of multi-scale climate indices on global yellowfin tuna population	12:20 12:40	**Caihong Fu** Assessing decadal changes in prey consumption by marine mammals and forecasting the impacts of marine mammals off western Canada
12:40 13:00	**Johanna Wren*** Network analysis in the Hawai'i-based longline fishery reveal spatiotemporal changes in network complexity and species association from 1995-2019	12:40 13:00	**Szymon Surma*** Marine mammal prey consumption and competition with fisheries in the Northeast Pacific
13:00	**Session 11, Part-1 Ends**	13:00	**Session 13 Ends**

Thursday, October 24

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Plenary Session

09:00 **Michael Foreman (S3)**
09:30 Challenges and progress in the development of a circulation model for the central west coast of Vancouver Island

09:30 **Saskia A. Otto (S6)**
10:00 How can we develop suitable indicators to inform management of ecosystems under multiple pressure?

10:00 **Stephanie Avery-Gomm (S7)**
10:30 Past progress and future opportunities: Seabirds as biological monitors of microplastic pollution in the Pacific

10:30 **Coffee/Tea Break**
10:50

S3 [Saanich-1]

Coastal ocean modelling in the North Pacific

Convenors: Laura Bianucci (Canada), Tarang Khangaonkar (USA), Chan Joo Jang (Korea), Susan Allen (Canada), Fei Chai (China), YouYu Lu (Canada)

10:50 11:00	*Introduction by Convenors*
11:00 11:20	**Yuehua Lin** Queen Charlotte Strait FVCOM modeling development
11:20 11:40	**Charles Hannah (for Youyu Lu)** Sea level and meso-scale eddy variations in the Northeast Pacific during 2007-2016 simulated with a high-resolution regional ocean model
11:40 12:00	**Pramod Thupaki** Modelling the riverine coastal domain along the Central Coast of British Columbia, Canada
12:00 12:20	**Toru Miyama** Role of river inflows from the Kamchatka Peninsula in the Okhotsk Sea
12:20 14:00	**Lunch**

S6 [Lecture Theater]

Identifying thresholds and potential leading indicators of ecosystem change: The role of ecosystem indicators in ecosystem-based management

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

10:50 11:00	*Introduction by Convenors*
11:00 11:20	**Philina English*** Are Canadian Pacific groundfishes shifting their distribution in response to local climate velocities?
11:20 11:40	**Dan Liu*** Identifying drivers and their thresholds for piscivorous fishes in the exploited China Seas under climate change
11:40 12:00	**David Kimmel** Zooplankton abundance trends and patterns in the Shelikof Strait, western Gulf of Alaska 1990-2017
12:00 12:20	**Jason Link** Evidence for ecosystem overfishing in North Pacific marine ecosystems
12:20 14:00	**Lunch**

S7 [Saanich-2]

Environmental indicators of plastic pollution in the North Pacific

Convenors: Matthew Savoca (USA), Chengjsun Sun (China), Lev Neretin (NOWPAP)

10:50 11:00	*Introduction by Convenors*
11:00 11:30	**Daoji Li (Invited)** Main advances in marine microplastics research in China
11:30 11:50	**Won Joon Shim** Fast fragmentation rate of secondary nano- and microplastics from foamed polystyrene by sunlight exposure
11:50 12:10	**Nicolas Vanderzyl*** Microplastic accumulation patterns in sand at three Hawaiian beaches
12:10 12:30	**Peter Ross** Microplastic pathways into the ocean: Lessons learned from Vancouver, Canada
12:30 12:50	**Dorothy Horn*** Impacts of environmentally-relevant concentrations of polypropylene rope on Pacific mole crab (*Emerita analoga*) development and lifespan
12:50 14:20	**Lunch**

S8 [Esquimalt]

Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries

Convenors: Alan Haynie (USA), Libby Logerwell (USA), Shigeto Nishino (Japan)

10:50 11:00	*Introduction by Convenors*
11:00 11:30	**Phillip S. Levin (Invited)** Connecting science and communities through Integrated Ecosystem Assessments
11:30 11:50	**Elliott Hazen (for Chris Harvey)** A brief history of the California Current Integrated Ecosystem Assessment: How we got here, what we've learned, and where we're headed
11:50 12:10	**Takafumi Hirata** Potential vulnerability of the Arctic marine ecosystem due to environmental changes
12:10 12:30	**Kirstin Holsman (for Kerim Aydin)** The Bering Sea Fishery Ecosystem Plan as a guidance tool for ecosystem-based fishery management in Alaska
12:30 12:50	**Changan Xu** Implementation of "ecosystem-based management" for net cage farming in Sandu Bay Fujian China. An approach towards ecologically sustainable form of development
12:50 14:20	**Lunch**

S9 [Oak Bay-2]

Coastal Ocean Observing Systems, Essential Biological Variables and community-based monitoring

Convenors: Charles Hannah (Canada), Sung Yong Kim (Korea), Kim Juniper (Canada)

10:50 11:00	*Introduction by Convenors*
11:00 11:35	**Eric Peterson (Invited)** The Hakai Institute: Supporting community-based science in British Columbia with global frameworks for biological Essential Ocean Variables (EOVs)
11:35 11:50	**Sanae Chiba (Invited)** Essential Ocean Variables for biology and ecosystem to inform policy in the Decade of Ocean Science for Sustainable Development
11:50 12:10	**Erin Satterthwaite*** Developing a biological Global Ocean Observing System: Qualities, attributes, and readiness of existing biological Essential Ocean Variable networks
12:10 12:30	**Paul Covert and Spencer Taft** Incorporating multiple community perspectives in development of essential ocean variables for monitoring port ecosystems
12:30 12:50	**Andrew Margolin*** Compilation of essential ocean variables for British Columbia based on nine decades of observations from disparate databases: Biogeochemical regionalization, variability and trends
12:50 14:00	**Lunch**

S11 [Oak Bay-1] Part-2

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

11:00 11:20	**Desiree Tommasi** Integration of multiannual climate predictions in the estimation of stock status and rebuilding time frames for highly migratory species
11:20 11:40	**Melissa Karp*** Accounting for shifting distributions and changing productivity in U.S. marine fisheries management: challenges and recommendations
11:40 12:00	**Fan Zhang*** Regime shift and early warning signals of Atlantic cod and American plaice on Grand Bank off Newfoundland
12:00 12:20	**Kristin Marshall** A multi-model approach to better understanding the robustness of management of Pacific hake to environmental variability
12:20 12:40	**Elliott Hazen (for Heather Welch*)** Environmental indicators to reduce loggerhead turtle bycatch offshore of Southern California
12:40 14:00	**Lunch**

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S3 [Saanich-1]		S6 [Lecture Theater]		S7 [Saanich-2]	
Coastal ocean modelling in the North Pacific **Convenors:** Laura Bianucci (Canada), Tarang Khangaonkar (USA), Chan Joo Jang (Korea), Susan Allen (Canada), Fei Chai (China), YouYu Lu (Canada)		*Identifying thresholds and potential leading indicators of ecosystem change: The role of ecosystem indicators in ecosystem-based management* **Convenors:** Elliott Hazen (USA), Xiujuan Shan (China), Mary Hunsicker (USA), Jennifer Boldt (Canada)		*Environmental indicators of plastic pollution in the North Pacific* **Convenors:** Matthew Savoca (USA), Chengjsun Sun (China), Lev Neretin (NOWPAP)	
14:00 14:20	**Laura Bianucci** A coupled physical-biogeochemical FVCOM model for the Discovery Islands (BC, Canada)	14:00 14:20	**Lunch (cont.)** **Nina Bednaršek (CANCELLED)** Biological threshold application for forecasting future sustainability of estuarine calcifiers in the Salish Sea		**Lunch (cont.)**
14:20 14:40	**Angelica Peña** Modelling the interannual variability of biogeochemical conditions along the British Columbia coast	14:20 14:40	**Kelly S. Andrews** Ecological thresholds in forecast performance for key United States West Coast Chinook salmon stocks	14:20 14:40	**Kyle Van Houtan** The vertical distribution and biological transport of marine microplastics across the epipelagic and mesopelagic water column
14:40 15:00	**Amber Holdsworth** Projecting climate change for Canadian Northeast Pacific waters	14:40 15:00	**Mike Litzow** The changing physical and ecological meanings of North Pacific Ocean climate indices	14:40 15:00	**Rhiannon Moore*** Microplastics in pelagic food webs: initial insights from a study on microplastic contamination in the Beaufort Sea beluga whales and its prey
15:00 15:20	**Guimei Liu** Green macroalgae blooms and particle trajectories in the Yellow sea: A numerical experiment of lagrangian-particle-tracking coupled with biological processes	15:00 15:20	**Stephanie J. Green** Traits-based tools to account for the effect of shifting predator-prey interactions on the distributions of ocean species under climate change	15:00 15:20	**Jennifer Lynch** Sea turtles as indicators of plastic marine debris quantities and types in the Central Pacific
15:20 15:40	**Susan Allen** Using SalishSeaCast, a coupled bio-chem-physical model of the Salish Sea, to evaluate interannual variability in the Strait of Georgia	15:20 15:40	**Natasha Hardy*** Trait-based modeling for albacore tuna predator-prey interactions under climate change in the NE Pacific	15:20 15:40	**K David Hyrenbach** BIOPs: Towards seabird bioindicators of North Pacific plastic pollution
15:40 16:00	**Elise Olson** Salish Sea Model Ecosystem - Lower Trophic: Tidally driven nutrient supply to surface waters in the northern Strait of Georgia	15:40 16:00	**David Costalago** Dynamics of the planktonic food-web of the Strait of Georgia (northeast Pacific) and implications for zooplanktivorous fish	15:40 16:00	**Taewon Kim** The feeding preference for the color of plastic debris in the hawksbill turtle, *Eretmochelys imbricate*
16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**
16:20 16:40	**Yuanchao Wang*** Modelling the energy flow structures and interannual dynamics of Yangtze estuary and its adjacent waters in China	16:20 16:40	**Kym Jacobson** Characterizing spatial coherence of copepods as regional indicators in the Northern California Current	16:20 16:40	**Sang Hee Hong** Quantities and characteristics of plastic debris ingested by sea turtles in the Korean coastal waters
16:40 17:00	**Mercedes Pozo Buil*** Future changes of the coastal waters in the California Current System	16:40 17:00	Discussion **Session 6 Ends**	16:40 17:00	**Miran Kim** Microplastic ingestion by seabirds in South Korea

S8 [Esquimalt]		S9 [Oak Bay-2]		S11 [Oak Bay-1] Part-2	
Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries **Convenors:** Alan Haynie (USA), Libby Logerwell (USA), Shigeto Nishino (Japan)		*Coastal Ocean Observing Systems, Essential Biological Variables and community-based monitoring* **Convenors:** Charles Hannah (Canada), Sung Yong Kim (Korea), Kim Juniper (Canada)		*Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century*	
	Lunch (cont.)	14:00 14:20	**Sei-Ichi Saitoh** Development of information service for set net fisheries using satellite and numerical data	14:00 14:20	**Briana Abrahms*** The only constant is change: Incorporating socioecological variability into protected species management
14:20 14:40	**Mariska Weijerman*** Evaluating management strategies for ecosystem services in a Hawaiian Islands coral reef IEA	14:20 14:40	**Isobel Pearsall** Experience in developing and operating a marine Citizen Science Program in the Strait of Georgia, Canada	14:20 14:40	**Johanna Wren* (for Donald R. Kobayashi)** Assessing the vulnerability of marine life to climate change in the Pacific Islands region
14:40 15:00	**Robert Wildermuth*** A Bayesian decision network model for ecosystem-based management of the Georges Bank social-ecological system	14:40 15:00	**Lynn Lee** Establishing a long-term marine monitoring program for Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage Site	14:40 15:00	**Carrie Holt** Incorporating climate, oceanographic and ecological change considerations into population assessments in Canada: A review and recommendations
15:00 15:20	**Marisol García-Reyes** Cloud computing of key NASA oceanographic data: Implications for automating aspects of ecosystem status reports	15:00 15:20	**Rebecca Goldman Martone** Community-based monitoring to support cumulative effects assessment in coastal BC	15:00 15:20	**James T. Thorson** Measuring the impact of oceanographic indices on species distribution shifts: The spatially varying effect of cold-pool extent in the eastern Bering Sea
15:20 15:40	**Gordon Kruse** Developing a placed-based participatory IEA framework for coastal communities in the Gulf of Alaska	15:20 15:40	**Jacklyn Barrs and Haley Tomlin** Identifying forage fish beach spawning habitat in British Columbia - "To Conserve and Protect"	15:20 15:40	**Yumeng Pang*** Environmental effects on reproductive traits in cold/warm-water squids: implications on catch fluctuation
15:40 16:00	**Kelly S. Andrews** Human activities - developing indicators that can translate costs and benefits across the human dimension and ecological domains of the socio-ecological system	15:40 16:00	**John A. Barth** Using an underwater glider to detect acoustically-tagged green sturgeon	15:40 16:00	**Xiutang Yuan** Impact of seawater acidification and warming on the early development of the sea cucumber *Apostichopus japonicus* (Selenka) (Echinodermata: Holothuroidea)
16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**	16:00 16:20	**Coffee/Tea Break**
16:20 16:40	Discussion	16:20 16:40	**Xavier Mouy** Identifying fish sounds of British Columbia with an autonomous audio and video array	16:20 16:40	**Brian K. Wells** Environmental determinants of spatiotemporal variability in salmon forage and its direct and indirect effects on salmon recruitment
16:40	**Session 8 Ends**	16:40 17:00	**Xavier Mouy (Francis Juanes)** Estimation of the biodiversity of fish and invertebrates using video and acoustics	16:40 17:00	**Barbara Muhling** Shifting distributions of fisheries for juvenile albacore in the eastern North Pacific

S3 [Saanich-1]

Coastal ocean modelling in the North Pacific

Convenors: Laura Bianucci (Canada), Tarang Khangaonkar (USA), Chan Joo Jang (Korea), Susan Allen (Canada), Fei Chai (China), YouYu Lu (Canada)

17:00 17:20	**Darren J. Pilcher*** Importance of simulating coastal biogeochemical processes for projections of ocean acidification on the Bering Sea shelf
17:20 17:40	**Dan Wang** The value of the greenhouse gas monitoring system for climate change in the China Sea
17:40 18:00	Discussion
18:00	**Session 3 Ends**

S7 [Saanich-2]

Environmental indicators of plastic pollution in the North Pacific

Convenors: Matthew Savoca (USA), Chengjsun Sun (China), Lev Neretin (NOWPAP)

17:00 17:20	**Yutaka Watanuki** Ingestion of plastics by seabirds and its potential effects
17:20 17:40	**Peter Murphy** AMAP's Microplastics and Marine Litter Expert Group
17:40 18:00	Discussion
18:00	**Session 7 Ends**

S9 [Oak Bay-2]

Coastal Ocean Observing Systems, Essential Biological Variables and community-based monitoring

Convenors: Charles Hannah (Canada), Sung Yong Kim (Korea), Kim Juniper (Canada)

17:00 17:20	**Daisuke Hasegawa** Development and observational examples of measuring vertical turbulent nitrate flux using sensors
17:20 17:40	**William M Fairchild*** High-resolution carbonate dynamics of Netarts Bay, OR from 2014-2019
17:40 18:00	**Burke Hales** Tracer relationships in surface waters of coastal waters from the Gulf of Alaska, Bering and Chukchi Seas
18:00 18:10	Discussion **Session 9 Ends**

S11 [Oak Bay-1] Part-2

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

17:00 17:20	**Desiree Tommasi** **(for Kisei Tanaka*)** Prospects for environmental prediction of annual fishery range expansion and contraction: a case study in the Northwest Atlantic
17:20 17:40	**Tatiana V. Kozlova** Dynamics of Pink Salmon (*Oncorhynchusgorbuscha*) abundance in the Tatar Strait rivers (Sea of Japan)
17:40 18:00	Discussion
18:00	**Session 11 Ends**

Friday, October 25

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	BIO-P Contributed Paper Session [Saanich-1] **Convenors:** Se-Jong Ju (Korea), Akash Sastri (Canada)		FIS-P Contributed Paper Session [Oak Bay-1] **Convenors:** Xianshi Jin (China), Jackie King (Canada)
09:00 09:10	*Introduction by Convenors*	09:00 09:10	*Introduction by Convenors*
09:10 09:30	**Pei-Chi Ho*** Body size, light intensity and nutrient supply determine plankton stoichiometry in mixotrophic plankton food webs	09:10 09:30	**Ryan Rykaczewski** Revisiting Lasker's stable ocean hypothesis: The influence of wind events on larval fish mortality in the southern California Current Ecosystem
09:30 09:50	**Siyu Jiang*** Comparison of phytoplankton growth and mortality in oligotrophic subtropical North Pacific and Eastern Indian Ocean	09:30 09:50	**Yuki Takemuro*** Impacts of environmental changes on ichthyoplankton assemblages in the northern Bering Sea
09:50 10:10	**M. James McLaughlin** An investigation of the biophysical oceanography in coastal waters of north-western Australia and photo-physiological response of phytoplankton to tidal mixing	09:50 10:10	**Lingbo Li** Distributional changes of NE Pacific groundfish owe more to ontogeny than to temperature change
10:10 10:30	**Samantha Zeman*** Copepod community dynamics across a shelf and oceanic gradient in the northeast Pacific from 1998-2016	10:10 10:30	**Peng Sun** Environmental variables effects on the early growth of largehead hairtail (*Trichiurus japonicus*) in China Seas
10:30 10:50	**Coffee/Tea Break**	10:30 10:50	**Coffee/Tea Break**
10:50 11:10	**C. Tracy Shaw** Population dynamics of the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera*, with notes on *Thysanoessa inspinata*, off of Newport, Oregon, USA	10:50 11:10	**Hyunjoo Lee*** Estimation of the potential fisheries production in the Korean waters based on ecosystem approach
11:10 11:30	**Jennifer L. Fisher** Comparison of condition metrics and lipid content between *Euphausia pacifica* and *Thysanoessa spinifera* in the northern California Current, USA	11:10 11:30	**Olga Novikova CANCELLED** Influence of external environmental factors on the dynamics of the number of cod and saffron cod of the Eastern part of the sea of Okhotsk
11:30 11:50	**Iria Giménez*** Developing a mechanistic understanding of ocean acidification sensitivity in marine bivalves: Experimentally decoupling pH and saturation state and reproducing natural variability	11:30 11:50	**Olga Zikunova** State of chinook salmon *Oncorhynchus tschawytscha* (Walbaum) stock in Kamchatka territory
11:50 12:10	**Julie E. Keister** Climate controls on zooplankton composition and ocean-estuary exchange in the Strait of Juan de Fuca, USA	11:50 12:10	**Yuliya Kuzmenko (CANCELLED)** High resolution Sockeye salmon (*Oncorynchus nerka*) early marine growth a response to environmental conditions
12:10 12:30	**Minna Hiltunen** The quality of juvenile salmon prey during early marine residence in Puget Sound, WA, USA	12:10 12:30	Discussion
12:30 12:50	**Liyuan Zhao CANCELLED** Cloning and characterization of the insulin and glucagon genes in short-beaked common dolphin (*Delphinus delphis*), and analysis of its islet architecture	12:30	**FIS-Paper Session Ends**
12:50	Discussion **BIO-Paper Session Ends**		

	MEQ-P Contributed Paper Session [Saanich-2] **Convenors:** Guangshui Na (China), Andrew Ross (Canada)		POC-P Contributed Paper Session [Esquimalt] **Convenors:** Emanuele Di Lorenzo (USA), Yury I. Zuenko (Russia)
09:00 09:10	*Introduction by Convenors*	09:00 09:10	*Introduction by Convenors*
09:10 09:30	**Baodong Wang (MOVED to S10, 10:20)** Long-term changes of nutrient regimes and their ecological effects in Bohai Sea, China	09:10 09:30	**Marisol Garcia Reyes (for Kathleen Dohan)** Dynamic biogeography of the subarctic North Pacific
09:30 09:50	**Amy Uhrin** Marine debris as bycatch: Using fishery observer data to estimate trends over time in the North Pacific Subtropical Convergence zone	09:30 09:50	**Jiwon Kang*** Non-seasonal variability of the Kuroshio shelf intrusion and its associated changes in the ocean environment over the East China Sea during 1993-2017
09:50 10:10	**Moemi Okamoto** Occurrences of microplastics in surface water of Bisunumati and Bagmati Rivers, and on the roads in Kathmandu city, Nepal	09:50 10:10	**Hiromichi Ueno** Global distribution and interannual variation of winter halocline
10:10 10:30	Discussion **MEQ-Paper Session Ends**	10:10 10:30	**Sheng Chen*** Impact of surface waves on wind stress under low to moderate wind conditions
10:30 10:50	**Coffee/Tea Break**	10:30 10:50	**Coffee/Tea Break**
		10:50 11:10	**Siyu Chen*** Effects of the non-breaking surface wave induced vertical mixing on winter mixed layer depth in subtropical regions
		11:10 11:30	**Emanuele Di Lorenzo** The 2019 Alaskan Heatwave and recent changes in North Pacific climate
		11:30 11:50	**Yajuan Song** An evaluation of the short-term prediction skill of FIO-ESM in the North Pacific
		11:50 12:10	**Miaki Muramatsu*** Pacific water in the northeastern Chukchi Sea
		12:10 12:30	Discussion
		12:30	**POC-Paper Session Ends**

POSTER SESSION
October 24

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Poster presenters are expected to be available near their poster to answer questions during the Thursday (October 24) evening poster session (18:00-21:00), for at least one hour 19:00-20:00

S1: Connecting science and communities in a changing North Pacific

S1-P1 **Kitack Lee**
Increasing input of anthropogenic nitrogen drives the East China and Yellow Seas to phosphorus limitation

S1-P2 **Jennifer Boldt**
Spatio-temporal models provide new insights on the biotic and abiotic drivers shaping Pacific Herring (*Clupea pallasi*) distribution

S1-P3 (cancelled) **Eric Hertz***
Reduced portfolios in salmon populations in British Columbia

S1-P4 (cancelled) **Sean C. Simmons**
Recruiting anglers across Canada to build a nation-wide fisheries monitoring program that helps researchers fill their data gaps

S2: Marine heatwaves in the North Pacific: Predictions and impacts in coastal regions

S2-P1 **Matthew Baker**
The Blob and its impacts on marine ecology in the Salish Sea

S2-P2 **Tetjana Ross**
How unusual were ocean temperatures in the Northeast Pacific during 2014-2018?

S2-P3 **Hayley V. Dosser***
Sharp reduction in nutrient concentrations in deep British Columbian strait linked to marine heatwave

S2-P4 **Hakase Hayashida***
Regional case studies on marine heatwaves and their impacts on primary production

S2-P5 **Julie E. Keister**
Unexpected changes in zooplankton biomass and juvenile salmon growth during the 2015-2016 warm anomalies, Puget Sound, WA, USA

S2-P6 **Malcolm Cowan***
Influence of *Vibrio* spp., temperature, reproductive development, and stocking density on Pacific oyster (*Crassostrea gigas*) summer mortality in Baynes Sound, British Columbia

S2-P7 **Sofia Darmaraki**
Mediterranean marine heatwaves: Physical drivers and future evolution

S3: Coastal ocean modelling in the North Pacific

S3-P1 **Byungmoon Park**
Methods for predicting short-term surface sea temperature and the forecasting service in Republic of Korea

S3-P2 (cancelled) **Hyoun-Woo Kang**
Numerical experiments on the summer distributions of water properties and nutrients in the East China Sea

S3-P3 **Minkyoung Bang***
Effects of ocean warming on potential habitat distribution of Japanese anchovy (*Engraulis japonica*) in the seas around Korea: A maximum entropy approach

S4: The impacts of marine transportation and their cumulative effects on coastal communities and ecosystems

S4-P1 **Yohei Shimasaki**
Effects of TBT on sinking rate and physiological parameters of marine planktonic diatom, *Thalassiosira pseudonana*

S5: Trends in ocean and coastal ecosystems and their services and its future

S5-P1 (cancelled) **Jilong Chen**
Sea level variations in the East China Sea from merged altimetry data

S5-P2 (cancelled) **Yongwen Gao**
Carbon isotopic composition of clam shells along the Washington coast and the effects of ocean acidification

S5-P3 **Rebecca Schijns***
What has Canada caught, and how much is left? Combining catch reconstructions in three oceans with current biomass estimates

S5-P4 **Changan Xu**
Valuation of mangrove ecosystem along the coastal of Beihai in China which receives heavy anthropogenic disturbances

S5-P5 **Wiley Evans**
Constraining along-coast surface seawater CO_2 system variability and changeability from an Alaskan ferry

S5-P6 **Taewon Kim**
Effect of ocean freshening and acidification on intertidal amphipods and limpets of Antarctica

S5-P7 **Shin-ichi Ito**
Declining catch of Japanese sandeels

S5-P8 **Anna Vazhova (for Denis Kurnosov)***
The relationship between lake and marine forms of Pacific herring *Clupea pallasii* based on the polymorphism of the mtDNA control region and microsatellite loci.

S5-P9 **Albert J. Hermann**
Multi-decadal projections of biophysical conditions in the Bering Sea

S5-P10 **Qingshan Luan**
Long-term variations on temperate phytoplankton communities in the Bohai and Yellow Seas, China

S6: Identifying thresholds and potential leading indicators of ecosystem change: The role of ecosystem indicators in ecosystem-based management

S6-P1 **Kedong Yin**
Using phytoplankton community index to assess water quality improvement in Hong Kong

S7: Environmental indicators of plastic pollution in the North Pacific

S7-P1 **June-Woo Park**
Introduction of convergence cluster for human and environmental safety research of (nano)microplastics in Korea

S7-P2 **Zuhao Zhu***
Review of microplastic pollutions in captured and cultured seafood in China

S7-P3 **Amir H. Parizi***
Microplastic pollution in the Vancouver urban watershed: the role of Combined Sewer Overflows (CSOs)

S7-P4 **Mathew J. Watkins***
Tackling microfiber pollution at source: An evaluation of washing-machine lint filters

S8: Creating more effective Integrated Ecosystem Assessments (IEAs) in PICES countries

S8-P1 **Naomi Harada**
Sea ice reduction in the Arctic Ocean: its impact on biogeochemical cycles

S8-P2 (cancelled) **Ferdenant A. Mkrtchyan**
Indicator of biocomplexity in assessing the state of environment

S9: Coastal Ocean Observing Systems, Essential Biological Variables, and community-based monitoring

S9-P1 **Young-Sug Kim**
Statistical analysis of seasonal water pollutants affecting phytoplankton proliferation on the South Korean coasts

S9-P2 **Anri Kabe***
Estimation of temperature of seaweed bed vegetation boundary in the Bungo Channel of the Western Seto Inland Sea using satellite SST

S9-P3 **Patrick Pata***
Sensitivity analysis on zooplankton bioregionalization of British Columbia

S9-P4 **Sei-Ichi Saitoh**
Coastal monitoring using Ocean Observation Camera (OOC) on micro satellite RISESAT

S9-P5 **Shion Takemura**
Developing a community-based coastal environmental monitoring system in Indonesia using smartphone app

S9-P6 (cancelled) **Di Wan**
Preparing for a data intensive integrated oceanographic future

S9-P7 **Laura Sánchez-Velasco**
Larval fish habitats and deoxygenation in the northern limit of the oxygen minimum zone off Mexico

S10: Linking changes in climate, nutrient distribution, phytoplankton ecology, and production of algal exudates in the North Pacific

S10-P1 **Kuo Wang***
Barrier effect of the Pearl River estuarine plume on wind-induced coastal upwelling of nutrients

S10-P2 **Sayaka Yasunaka**
Spatio-temporal variability of surface water pCO_2 and nutrients in the tropical Pacific from 1981 to 2015

S10-P3 (cancelled) **Min-Bo Luo**
Horizontal distribution and dominant species of phytoplankton in the Shengsi Sea area of East China Sea

S10-P4 **Mariia Shulgina***
Long-term trend of the diatom *Thalassiosira nordenskioeldii* population dynamics from the northwestern Sea of Japan

S10-P5 (cancelled) **Sonia Munir***
Biogenic silica cycle of planktonic Radiolarian in Western Pacific Ocean

S10-P6 **Tamisha Yazzie***
Optimizing the PCR clean-up method for 18S amplicons generated from phytoplankton samples collected in Bellingham Bay

S10-P7 (cancelled) **Zuhao Zhu (for Jie Chen)***
Transparent exopolymer particle (TEP) production and aggregation by a marine plankton diatom (*Thalassiosira weissflogii*) at different growth rates

S10-P8 **Takafumi Hirata**
Relationships between the cell size and the primary production for diatoms, haptophytes and cyanobacteria in Japanese waters

S11: Incorporating ecosystem variability and climate change into fisheries management: Progress and challenges for EBFM in the 21st century

S11-P1 **David Costalago**
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?

S11-P2 (cancelled) **Sarah Z. Rosengard***
Co-variability between Fraser River sockeye productivity and satellite-derived chlorophyll-a concentrations near Kodiak Island

S11-P3 **Mikale Milne**
Traditional Intertidal Species Regression Study

S12: Impacts of meso-/submeso-scale processes on heat/material transport and on marine ecosystems

S12-P1 **Yoshikazu Sasai**
Impact of ocean physics on marine ecosystems in the Kuroshio and Kuroshio Extension regions: A high-resolution coupled physical-biological model study

S12-P2 (cancelled) **Annalisa Bracco**
The role of submesoscale circulations in the population connectivity of deep-sea corals

S12-P3 **Isao Fujita**
Regional differences in the impact of mesoscale eddies on Chlorophyll in the North Pacific

S13: Implications of prey consumption by marine birds, mammals, and fish in the North Pacific

S13-P1 **Brian Hunt**
A marine salmon diet database for the North Pacific

S13-P2 **Sarah Ann Thompson**
Effects of ocean climate on forage fish condition in the Gulf of Alaska

S14: Integrating economic and social objectives in marine resource management

S14-P1 (cancelled) **Ching-Hsien Ho***
Impact and adaptation of coastal fisheries under climate change - a case study of set-net fishery in Taiwan

S14-P2 **Minje Choi***
Bioeconomic analysis of small yellow croaker in the Republic of Korea.

S15: Advances in North Pacific marine ecosystem prediction

S15-P1 **Masami Nonaka**
Potential predictability of interannual-to-decadal variability in eddy activity in the Kuroshio Extension

Biological Oceanography Committee contributed paper session

BIO-P1 **Minji Lee***
Seasonal dynamics of phytoplankton community using microscopic and Chemotax pigment analysis in Seomjin River Estuary, Korea

BIO-P2 **Hyunjin Yoon***
Feeding ecology of chaetognaths in the Yellow Sea and the East Sea inferred from gut content and fatty acid analyses

BIO-P3 **JunSu Kang**
Zooming in microbiome dynamics for short and intensive observation (replace) during *Akashiwo sanguinea* (Dinophyta) blooms

BIO-P4 **Hyun-Jung Kim**
Analysis of planktonic bivalve larvae focusing on *Anadara kagoshimensis* and *Tegillarca granosa* and using metagenomics next-generation sequencing in the Boseong coastal waters, South Korea

BIO-P5 **Joon Sang Park and Seung Won Jung**
Description of new vessel hull fouling diatom *Olifantiella* (Naviculales, Bacillariophyceae) from the northwest temperate Pacific region

BIO-P6 **Yuichiro Yamada**
The utilization of cold-water zooplankton as prey for chum salmon fry (*Oncorhynchus keta*) in Yamada Bay, Iwate, Pacific coast of northern Japan

BIO-P7 **Akiyuki Kenmochi***
Population dynamics of marine cladocerans in the offshore area in Suruga Bay, Japan

BIO-P8 **Colleen Harpold**
Basin-shelf connectivity of the zooplankton community in Bering Canyon, Alaska USA

BIO-P9 **Kiyotaka Hidaka**
Plankton production in spring around the Izu Ridge, south of Honshu, Japan

BIO-P10 **Jun Nishikawa**
Life history and food-habit of a lophogastrid *Gnathophausia longispina* in Suruga Bay, Japan

BIO-P11 **Yumiko Obayashi**
Responses of bacterial communities and extracellular enzyme activities to addition of protein or free amino acids in the subtropical and subarctic North Pacific

BIO-P12 **Joon Sang Park**
Response of the ubiquitous pelagic diatom *Fragilaripsis doliolus* to manganese nodule exposure

BIO-P13 **Anna S. Vazhova***
Oceanological, hydrochemical and micronecton investigations in the upper epipelagic zone of the northeastern Pacific Ocean in march 2019

Fisheries Science Committee contributed paper session

FIS-P1 **Mikhail Stepanenko**
Interannual diversity Bering Sea pollock spatial distribution due to ocean warming in continental shelves of the Bering and southern Chukchi Seas

FIS-P3 (cancelled) **Zuozhi Chen**
Age and growth of *Ceratoscopelus warmingii* (Myctophidae) in the South China Sea

FIS-P4 **Jennifer Boldt for (Hilari Dennis-Bohm*)**
Whole body energy density of juvenile Pacific Herring (*Clupea pallasii*) in the Strait of Georgia in the fall of 2012-2018

FIS-P5 **Steve Lindley**
Impact of a marine heat wave on Pacific salmon habitat

FIS-P6 **Kei Nakaya***
Early life history of Japanese horse mackerel *Trachurus japonicus* in the north Satsunan area, southern Japan

FIS-P7 **Kei Nakaya***
Seasonal occurrence pattern of leptocephali in the north Satsunan area, southern Japan

FIS-P8 **Hiromichi Igarashi**
Potential habitat of skipjack tuna in the western North Pacific using HIMAWARI satellite data

FIS-P9 **Svetlana Ovsyannikova**
Interalnual features of Walleye pollock distribution off the southern Kuril Islands

FIS-P10 (cancelled) **Zhimeng Zhuang**
Construction and application of the Chinese Fishery DNA Barcoding System

FIS-P11 **Jin Gao**
Spatio-temporal modelling of size distributions with incomplete survey data in a flat fish

FIS-P12 (cancelled) **Ekaterina S. Voronova***
Forecasting chum salmon progenies on the North-East of Kamchatka with the method of juvenile salmon trawl surveying

FIS-P13 **Lingbo Li**
Reconstructing salmon runs to support sustainable fisheries management

FIS-P14 **Christopher N. Rooper**
Predicting spatially explicit growth potential and contribution to recruitment for Pacific Ocean perch in the Gulf of Alaska

Marine Environmental Quality Committee contributed paper session

MEQ-P1 **Cathryn Wood***
Perfluorinated environmental contaminant concentrations in sea turtle blood and eggs from Hawaii to Saipan

MEQ-P2 **Daisuke Ambe**
Monitoring for radiocesium in sea-sediment around off Fukushima

Physical Oceanography and Climate Committee contributed paper session

POC-P1 **Donghyeon Yu**
Short-term forecasting for Korean coastal sea surface temperature and monitoring its levels based on Machine-Learning algorithms

POC-P2 **Jae-Hun Park**
Prediction of SST fronts using a recurrent neural network (RNN) in the South Sea of Korea

POC-P3 **Sabine Mecking**
(cancelled) Linking North Pacific ventilation changes with surface outcrop variations

General Poster Session

GP-P1 **Xuejuan Ren**
Influence of El Niño events on wintertime North Pacific atmospheric river, water vapor transport and precipitation

GP-P2 **Jocelyn Nelson**
Vulnerability of marine ecosystems to stressors

GP-P3 **Chunjiang Guan**
Jellyfish blooms in coastal waters nearby thermal discharges of nuclear power plant

GP-P4 **Ye Ji Lee***
Population structure of *Ampithoe valida* (Amphipoda) in Cheongsapo, Busan of South Korea

GP-P5 **Kyeong Ok Kim**
Development of a multi-target tissue approach for the prediction of non-uniform accumulation of radioactivity in fish

GP-P6 **Byung-Chan Song***
Submarine Groundwater Discharge (SGD) and coastal biogeochemistry in Jeju Island by typhoon

GP-P7 **Jin-Wook Song***
Spatio-temporal variations of Dissolved Organic Matter (DOM) in coastal water of Jeju Island

GP-P8 **Ho-kyun Kim**
Persistency in the DMSLs of sea level in the Coast of Korea

GP-P9 **Shirley Leung***
Separation of Pacific skipjack and bigeye tuna fishing grounds using public domain catch data

GP-P10 **Matthew Lemay**
Subtidal biodiversity on the central coast of British Columbia

GP-P11 (cancelled) **Mackenzie Woods***
The impact of boat noise on aggression and territoriality of the plainfin midshipman fish, *Porichthys notatus*

GP-P12 **Juhyun Yi***
Forecasting the demand of extruded pellet feed in Korea

GP-P13 **Emily Warren***
Optimizing sea urchin gonad enhancement with newly-designed formulated feeds and assessing benthic impacts of commercial-scale sea urchin farming to ensure environmental sustainability.

GP-P14 **Cole B. Brookson***
A traits-based approach to predict predator-prey uncoupling under climate change scenarios

GP-P15 (cancelled) **Naoki Tojo (for Takaaki Mori*)**
Sustainable fishing and farming strategy of Milkfish (*Chanos chanos*) under the influence of climate change in coastal communities in Indonesia

GP-P16 (cancelled) **Naoki Tojo (for Keitaroh Tao*)**
Sustainable production and household model with Mangrove forest and appropriate development assistances

GP-P17 **Naoki Tojo (for Shohei Sasabe*)**
A retrospective study on spatio-temporal dynamics of pacific herring (*Clupea pallasii*) spawning groups in East Bering Sea

GP-P18 **Bryn Fedje**
Transecting the Riverine Coastal Domain – observations of oceanographic properties on British Columbia's central coast from an estuary to the open ocean

GP-P19 **Yulia Stochkute**
Influence of Northern Pacific centres of atmospheric action on thermal regime of north-western coast of the Bering Sea

GP-P20 (cancelled) **Nianzhi Jiao**
Ocean Negative Carbon Emissions (ONCE)

W2: Integrating biological research, fisheries science and management of Pacific halibut and other widely distributed fish species across the North Pacific in the face of climate and environmental variability

W2-P1 **Timothy Loher (for Lorenz Hauser)**
Genetic population structure of Pacific halibut: Progress to date

W2-P2 **Teresa Fish***
Pacific halibut (*Hippoglossus stenolepis*) maturity status explored via histology and macroscopic maturity staging methods

W2-P3 **Anna Simeon***
Genetic sex identification of Pacific Halibut (*Hippoglossus stenolepis*) commercial landings

W2-P4 **Josep Planas**
Identification of molecular growth signatures in skeletal muscle of juvenile Pacific halibut (*Hippoglossus stenolepis*) for monitoring growth patterns in wild fish

W2-P5 **Lauri Sadorus**
A decade of coastwide environmental monitoring on the annual IPHC fishery-independent setline survey and practical applications of the data in a spatio-temporal assessment model

W2-P6 **Dana Rudy***
Can we reconstruct the growth history of the Pacific halibut (*Hippoglossus stenolepis*) population by otolith increment analysis?

W2-P7 **Joan Forsberg**
Re-ageing of archived otoliths from the 1920s to the 1990s at the International Pacific Halibut Commission

W2-P8 **Roman N. Novikov**
First records of killer whales (*Orcinus orca*) depredation on Greenland turbot (*Reinhardtius hippoglossoides*) and Pacific halibut (*Hippoglossus stenolepis*) fisheries in Western Bering Sea.

W4: Circulation, biogeochemistry, ecosystem, and fisheries of the western North Pacific marginal seas: Past and future of CREAMS (Circulation Research of East Asian Marginal Seas)

W4-P1 **Koki Mukai***
Effect of environmental factors on bloom formation of the toxic dinoflagellate *Alexandrium catenella* in Kariya Bay of northern Kyushu in Japan

W5: Celebrating two decades of North Pacific CPR sampling, and future directions

W5-P1 **Yutaka Fukai***
Seasonal abundance, population structure, and diel changes in abundance of five large dominant copepods evaluated by CPR samples collected in the western subarctic Pacific

W7: PICES contribution to Central Arctic Ocean (CAO) ecosystem assessment (Third)

W7-P1 **Rebecca Schijns***
What has Canada caught, and how much is left? Combining catch reconstructions in three oceans with current biomass estimates

W7-P2 **Yutaka Fukai***
Temporal changes of zooplankton community and population structure in the northern Bering Sea from June to September in 2017

W7-P3 **Yutaka Fukai***
Yearly comparison on abundance, horizontal, and vertical distribution of epipelagic ctenophores and scyphomedusae in the northern Bering Sea in summer of 2017 and 2018: Quantification by underwater video imaging analysis

W8: Synthesis of bioacoustics programs for monitoring zooplankton and fisheries in the North Pacific

W8-P1 (cancelled) **Andrew Majewski**
Detecting wind-driven transport of planktonic biomass using a moored acoustic instrument

W8-P2 **Kenji Minami**
Acoustic reflection intensity of *Sargassum horneri*

W9: Monitoring non-indigenous species in PICES member countries: Towards best practices

W9-P1 **Kyoungsoon Shin**
Preliminary study on risk assessment of in-water cleaning method to remove the ship's hull fouling organisms.

W10: PICES/ICES collaborative research initiative: Toward regional to global measurements and comparisons of zooplankton production using existing data sets

W10-P1 **Takeru Kanayama***
Trophic sources and feeding impacts of microzooplankton on phytoplankton community in the Kuroshio

W10-P2 **Fukutaro Karu***
Energy sources and feeding impacts of mesozooplankton community in the Kuroshio

W10-P3 **Megu Iwazono (and Toru Kobari)***
Evaluation of protein synthetases activity as a proxy for zooplankton biomass and production rate using cultured copepod population, *Pseudodiaptomus inopinus*

W14: New frontiers: The application of molecular approaches in marine ecology and fisheries science

W14-P1 **Hui Zhang**
Seasonal fish assemblage structure based on environmental DNA in the Yangtze Estuary as a primary study

W14-P2 **Shufang Liu**
DNA barcoding: A potential tool for fishery biodiversity conservation

W17: Scoping an IEA of the Northern Bering-Chukchi Seas LME

W17-P1 **Kathy Kuletz**
Pacific Arctic seabird communities in a time of change

W17-P2 **Matthew Baker**
Applying NPRB Arctic IERP (2016-2019) research to inform an IEA in the Northern Bering Sea and Chukchi Sea

W17-P3 **George A. Whitehouse**
Sensitivity of Alaska marine food webs to mortality-based perturbations

W17-P4 **Matthew Asplin**
Synoptic meteorological controls on declining seasonal sea ice in the Bering and Chukchi Seas

W18: GlobalHAB: Evaluating, reducing and mitigating the cost of harmful algal blooms: A compendium of case studies

W18-P1 **Bum Soo Park**
Dynamics of *Amoebophrya* parasites during recurrent blooms of the ichthyotoxic dinoflagellate *Cochlodinium polykrikoides* in Korean coastal waters

W18-P2 **Elisa Berdalet**
CoCliME: Investigating the socio-economic impacts of HABs through co-development with stakeholders in European marine coastal areas

Upcoming Events

PICES-2020, October
Qingdao China
www.pices.int

MSEAS-2020
Marine Socio-Ecological Systems--Managing for sustainable use of the Earth's marine and coastal systems
May 25-29, 2020
Yokohama, Japan
https://meetings.pices.int/meetings/international/2020/MSEAS/Background

ICES-PICES Small Pelagic Fish Symposium
Venue and Dates to be determined
Tentatively 2021

7th Zooplankton Production Symposium
Venue and Dates to be determined
Tentatively either 2021 or 2022

Effects of Climate Change on the World's Oceans (ECCWO-5)
Tentatively May 2023
Bergen, Norway

Prepared by the PICES Secretariat
www.pices.int