2nd International Symposium

Effects of Climate Change on the World's Oceans

May 13 – 20, 2012
Yeosu, Korea

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Abstracts for oral presentations are sorted first by date and then by presentation time. Abstracts for posters are sorted by session and then by paper ID number. Presenter name is in bold-face type and underlined. Some abstracts in this collection are not edited and are printed in the condition they were received.

Welcome

We are honored to welcome you to the Second International Symposium on "*Effects of Climate Change on the World's Oceans*" that intends to become a major and regular event for the oceanography and climate change scientific communities. In May 2008, we met in Gijón (Spain), and this time the Symposium takes place in Yeosu, Korea where the International Exposition Yeosu Korea 2012 on the Living Ocean and Coast (Expo-2012) is being held. No other venue could be more appropriate.

Expo-2012 is calling for good practices in a sustainable ocean and coasts, and this reminds us that good practices and greening the economy must be scientifically and politically driven. In fact, the debate on climate change relies heavily on science, and this science has to be adequately transmitted to policy makers. While the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (2007) lacked specificity on the impacts of climate change on ocean ecosystems, the emerging Fifth Assessment Report (2014) will have two chapters dedicated to marine ecosystems. This is a great opportunity for researchers, but put an immense responsibility on them, and requires impartial, objective and excellent science. The issues related to climate change are moving up the political agenda, but we are still far from achieving a global commitment to reduce the emissions of greenhouse gases. The debate on climate change needs input from science as one of the essential elements, and symposia like this one are crucial to consolidate and share our understanding and knowledge.

This symposium aims to review recent achievements in climate change research in ocean and marine ecosystems, and to identify future requirements and steps. Our speakers include key players in different facets of this large and complex issue, and they represent views from academia to policy covering a variety of temporal and spatial scales and geographical locations.

We would like to thank the Secretariats of the convening organizations PICES, IOC and ICES, and especially the Local Organizing Committee for their efforts that ranged from trivial preparations to fundraising for this event. They have worked hard to ensure that all arrangements for the large number of theme sessions and workshops will run smoothly at the Symposium, This Symposium gathers together more than 350 participants from approximately 40 countries, and confirms the breadth, richness and vitality of scientific interests of the Asian community which is represented by about 150 experts.

We want to thank all the institutions for the trust they placed in us when we asked for support for this symposium. Without their commitment and decisive support, our aims would have been impossible to achieve. Our sincere thanks and congratulations must also go to the Scientific Steering Committee for their work in mobilizing a wide representation of scientific teams attending the meeting.

Not only will this Symposium give us an opportunity to discuss our ongoing research, progress and plans, it will also give us a chance to deliberate on the institutional challenges that we face in our various responsibilities and capacities. We are sure that all of you will have a scientifically productive meeting and that you will also enjoy the Expo and the social events, sights, foods, and hospitality of Korea.

Luis Valdés, Alexander Bychkov, Adolf Kellermann, Suam Kim, Hiroaki Saito and Svein Sundby

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Symposium Organizers

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Pukyong National University, Republic of Korea)

Hiroaki Saito (PICES)
Fisheries Research Agency, Japan)

Svein Sundby (ICES)
Institute of Marine Research, Norway)

Luis Valdés (IOC-UNESCO)
IOC Ocean Science Section, United Nations

Symposium Coordinators

Alexander Bychkov (PICES)
Adolf Kellermann (ICES)
Luis Valdés (IOC-UNESCO)

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Primary International Sponsors

ICES
International Council for the Exploration of the Sea

IOC
Intergovernmental Oceanographic Commission of UNESCO

PICES
North Pacific Marine Science Organization

Symposium Local Organizers

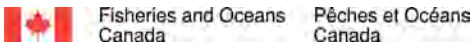
KOC
Korea Oceanographic Commission

KORDI
Korea Ocean Research and Development Institute

Co-sponsoring Organizations

Expo-2012 Yeosu Korea

MLTM
Ministry of Land, Transport and Maritime Affairs



Fisheries and Oceans Canada

EAST-1
Korean East Asian Seas Time Series Research Project

FAO
Food and Agriculture Organization of the United Nations

GOOS
Global Ocean Observing System

IMAS
Institute for Marine and Antarctic Studies, Australia

IMBER
Integrated Marine Biogeochemical Ecosystem Research

IPHC
International Pacific Halibut Commission

KMA
Korea Meteorological Administration

NASA
National Aeronautics and Space Administration

NFRDI
National Fisheries Research and Development Institute, Korea

NOAA
U.S. National Oceanographic and Atmospheric Administration

NPAFC
North Pacific Anadromous Fish Commission

NPRB
North Pacific Research Board

Seoul National University OCCAPA (Ocean Climate Change: Analysis, Projection, Adaptation) project

PKNU
Pukyong National University

PNU
Pusan National University

SCOR
Scientific Committee on Oceanic Research

UNEP
United Nations Environment Programme

WCRP
World Climate Research Programme

Yeosu City

Notes for Guidance

Registration

The registration desk will be located at the Expo Promotion Center (p. XVII) from May 12 (p.m.) to May 20.

Location for the Sessions and Workshops

All sessions and workshops will be convened at the Expo Hall (#13, p. XVI). The Theater (p. XIV) will be used for opening and closing ceremonies and for all plenary sessions. The Conference Rooms C1, C2, B1 and B2 (pp. XIV-XV) will be used for parallel sessions/workshops.

W2 (May 13 only) will be held at the Notos Room of the MVL Hotel (#25, p. XVII).

Presentations

In order to allow the sessions to run smoothly, and in fairness to other speakers, all presentations are expected to adhere strictly to the time allocated. All authors should designate at least 3 minutes for questions.

Authors can download their presentations straight to the computers where the session/workshop will be held.

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

If complications occur due to incompatibilities between PCs and Macs, Macintosh owners may use their own computers to make presentations.

Posters

Posters will be on display in the Conference Rooms C3 and C4 (p. XIV) during the entire Symposium, from May 14-20. Two evening poster sessions (with appetizers and drinks) will be held from 18:30-20:30 on May 16 and May 17, when poster presenters are expected to be available to answer questions.

Social activities

All participants are invited to attend the Welcome Reception to be held from 18:30-21:00, on May 15, in the Ballroom of the Korea Pavilion (#5, p. XVI), and the Symposium Dinner to be held from 19:00-22:00, on May 18, in the Ballroom of the MVL Hotel (#25, p. XVII).

For the Convention Center floor maps and building locations please refer to pp. XIV-XVII.

Symposium Timetable

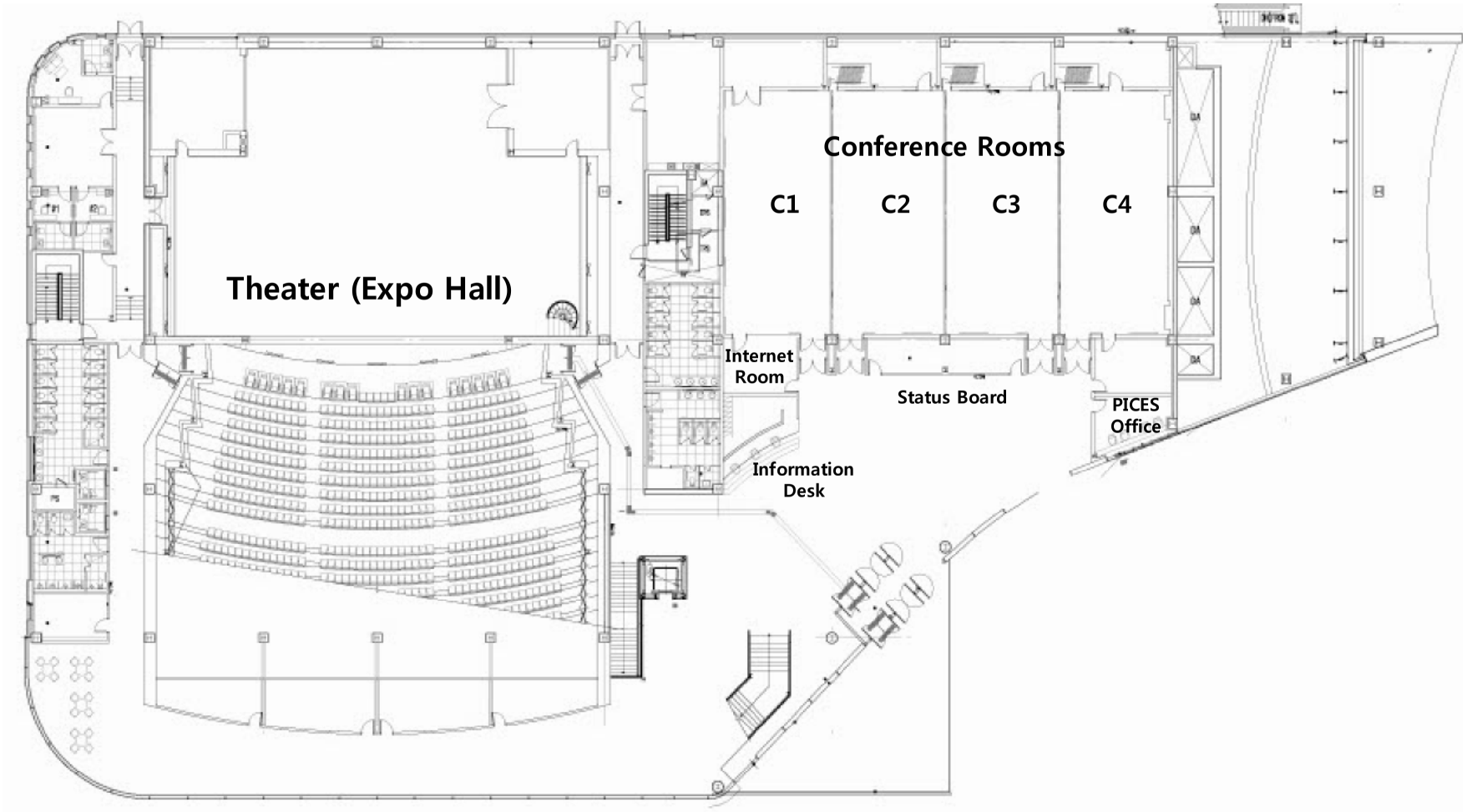
Sunday, May 13				
09:00 17:30	W2 Workshop (day 1)			
Monday, May 14				
09:00	W2 Workshop (day 2)	W3 Workshop	W4 Workshop	W5 Workshop
12:30	Lunch			
14:00	W2 Workshop	W3 Workshop	W4 Workshop	
Tuesday, May 15				
10:00	**Opening Ceremony**			
10:45	**Day 1 Plenary Session** Kenneth Drinkwater (S1) Ann Bucklin (S5) Núria Marbà (S7)			
12:30	Lunch			
14:00 18:00	Session 1 (day 1)	Session 5	Session 7	
18:30 21:00	**Welcome Reception**			
Wednesday, May 16				
09:00 10:40	**Day 2 Plenary Session** Anthony Charles (General Plenary) Manuel Barange (S4) Pedro Monteiro (S2)			
11:00	Session 1 (day 2)	Session 4 (day 1)	Session 2	
12:30	Lunch			
14:00	Session 1	Session 4	Session 2	
18:30 20:30	**Poster Session / Reception**			
Thursday, May 17				
09:00 10:40	**Day 3 Plenary Session** Peter Brewer (General Plenary) Lothar Stramma (S8) Takafumi Hirata (S3)			
11:00	Session 3 (day 1)	Session 4 (day 2)	Session 8	
12:30	Lunch			
14:00	Session 3	Session 4	Session 8	
18:30 20:30	**Poster Session / Reception**			
Friday, May 18				
09:00 10:40	**Day 4 Plenary Session** Ichiro Yasuda (General Plenary) Kyung-Ryul Kim (General Plenary) Jeffrey Dambacher (S9)			
11:00	Session 3 (day 2)	Session 4 (day 3)	Session 9	
13:00	Free afternoon / Sightseeing	(14:00-18:00) CCME Meeting	(14:00-18:00) Workshop 1	
19:00 22:00	**Symposium Dinner**			

Saturday, May 19			
09:00 10:40	**Day 5 Plenary Session** Peter Lemke (General Plenary) Hugh Possingham (S6) Benjamin McNeil (S10)		
11:00	Session 10	Session 4 (day 4)	Session 6
13:00	Lunch		
14:30	**Closing Plenary Session** Keith Alverson and Martin Visbeck (General Plenary) Corinne Le Quere (summary)		
15:40 16:30	**Closing Ceremony**		
Sunday, May 20			
09:30	Workshop 6	Workshop 7	
12:30	Lunch		
14:00 17:30	Workshop 6	Workshop 7	

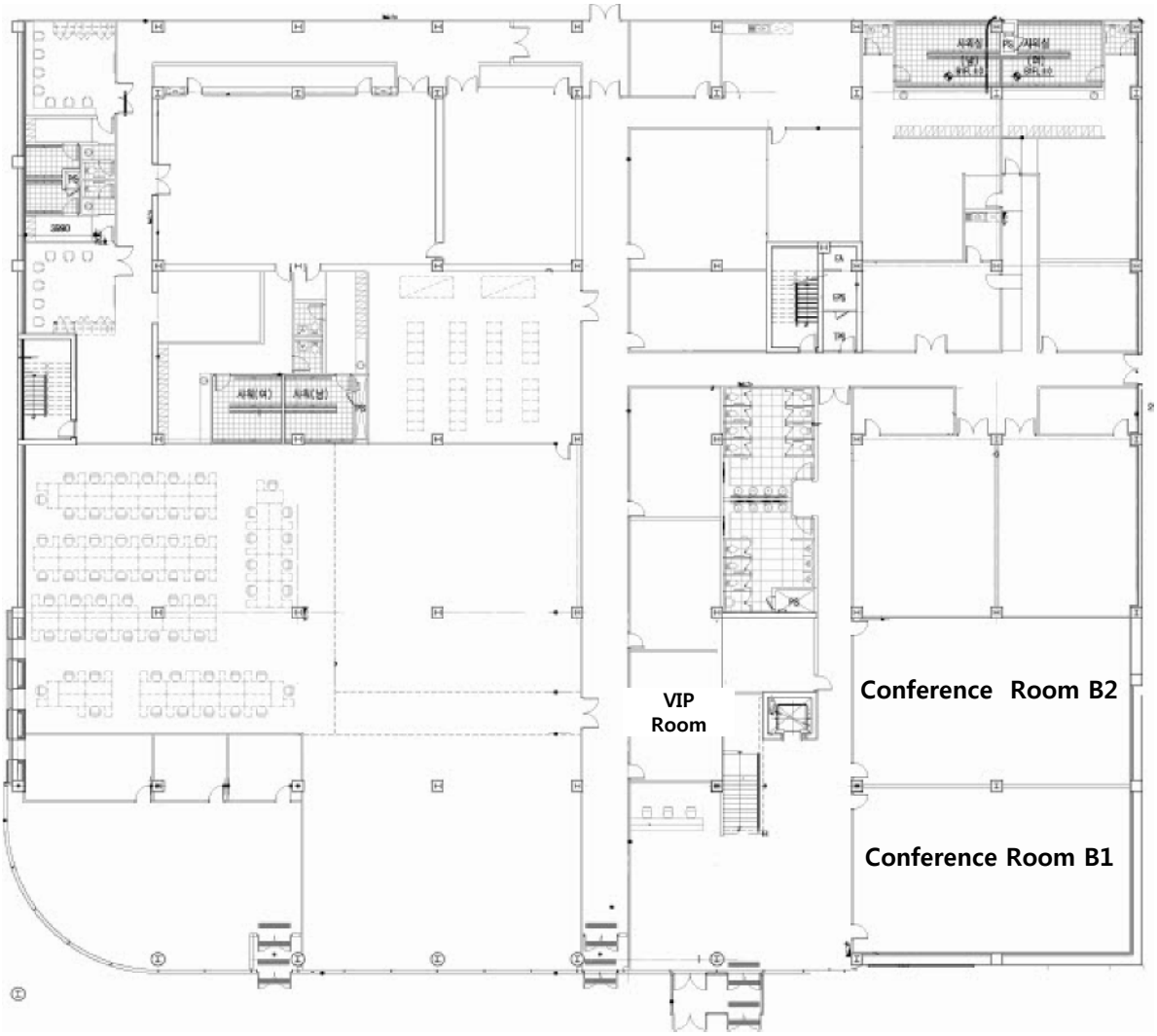
List of Sessions and Workshops

S1	Climate variability versus anthropogenic impacts; analysing their separate and combined effects on long-term physical, biogeochemical and ecological patterns
S2	Systematic, sustained and integrated global ocean observations
S3	Projections of climate change impacts on marine ecosystems and their uncertainty
S4	Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities
S5	From genes to ecosystems: Genetic and physiological responses to climate change
S6	Marine spatial planning and risk management in the context of climate change: The living ocean and coast under changing climate
S7	Coastal and low-lying areas
S8	Trend and impacts of de-oxygenation in oceanic and coastal ecosystems
S9	Marine tipping points in the earth system
S10	Changes in the marine carbon cycle
W1	Ocean observation: Strategic framework
W2	Climate change projections for marine ecosystems: Best practice, limitations and interpretation
W3	Coastal Blue Carbon: Mitigation opportunities and vulnerability to change
W4	Effects of climate change on advective fluxes in high latitude regions
W5	Public perception of climate change
W6	Climate change and range shifts in the ocean: Detection, prediction and adaptation
W7	Beyond dispersion: integrating individual-based models for bioenergetics and behavior with biophysical transport models to predict influences of climate change on recruitment processes in marine species
GP	General Poster Session
CCME	Joint ICES/PICES Expert Group on Climate Change Effects on Marine Ecosystems

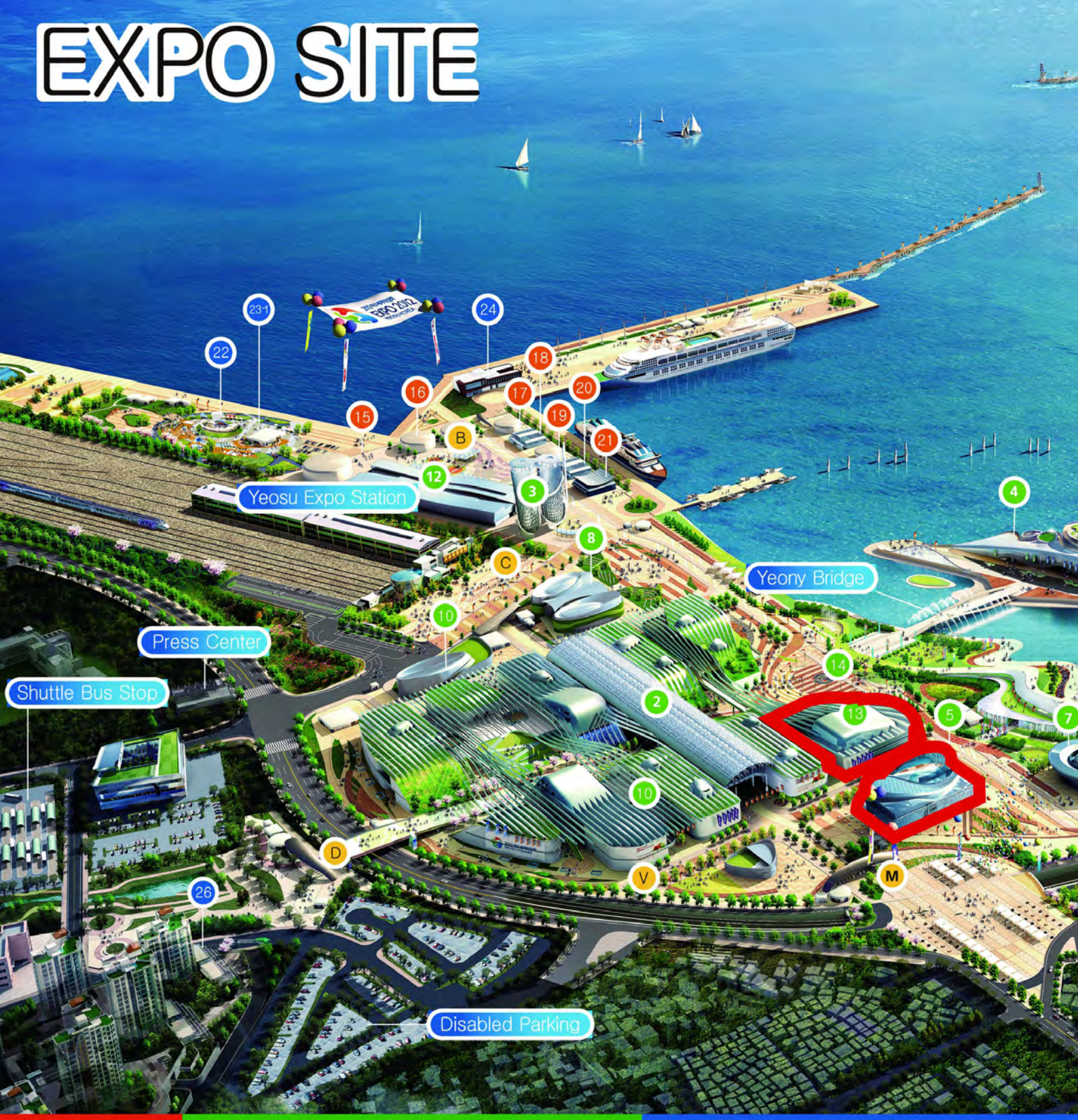
First Floor of the Expo Hall



Basement of the Expo Hall



EXPO SITE


Yeosu Expo Station
Yeony Bridge
Press Center
Shuttle Bus Stop
Disabled Parking


The Big-O


Expo Digital Gallery(EDG)


Theme Pavilion

1 The Big-O
2 Expo Digital Gallery (EDG)
3 Sky Tower
4 Theme Pavilion
5 Korea Pavilion
6 Marine Life Pavilion (Aquarium)
7 Climate & Environment Pavilion
8 Marine Civilization & City Pavilion
9 Marine Industry & Technology Pavilion
10 International Pavilion
11 Local Governments Pavilion
12 International Organizations Pavilion, BIE Pavilion, Korea Shipping & Ports Pavilion, DSME Marine Robot Pavilion
13 Expo Hall (Convention Center)
14 Expo Plaza
15 Hyundai Motor Group Pavilion
16 SAMSUNG Pavilion
17 SK Telecom Pavilion
18 LG Pavilion
19 GS Caltex Energy Field
20 LOTTE Pavilion
21 POSCO Pavilion
22 Energy Park
23 Fisheries Experience Zone (Coastal)
23-1 Fisheries Experience Zone (Deep Sea)
24 Ferry / Cruise Terminal
25 Yeosu MVL Hotel
26 Expo Town
M Main Gate
A Gate 1 (Odong-do Is.)
B Gate 2 (Cruise Terminal)
C Gate 3 (KTX Station)
D Gate 4 (Expo Town)
V VIP Gate
P Promotion Center

Schedules
Oral Presentations

Sunday, May 13 - W2

Workshop 2 (W2) - Day 1

Climate change projections for marine ecosystems: Best practice, limitations and interpretations

Co-Convenors:
Enrique Curchitser (Rutgers University, USA)
Icarus Allen (Plymouth Marine Laboratory, UK)

Invited Speakers:
William Cheung (Fisheries Centre, UBC, Canada)
Villy Christensen (University of British Columbia, Canada)
Jason Holt (National Oceanographic Centre, UK)
Charles Stock (Geophysical Fluid Dynamics Laboratory, USA)

This 2-day workshop aims to assemble scientists interested in making and interpreting projections of ecosystem responses to future climate change. The goal is to describe different approaches to modeling the impacts of climate variability on marine ecosystems, their ability to support sustainable harvesting and to highlight the strengths and limitations of the different approaches. We seek models that address both global and regional ecosystems and are particularly interested in presentations covering a range of models from statistical to mechanistic approaches including mass-balance (ECOPATH), size-based, minimalist, individual-based (IBMs) and end-to-end (E2E) models. Emphasis will be placed on models that examine trophic interactions as well as approaches that link biogeochemical processes with higher trophic level production. Presentations that discuss advantages and limitations of particular approaches and discuss the quantification of uncertainty in climate forced simulations are encouraged.

Sunday, May 13, Day 1 (9:00-17:00)

09:00	***Introduction by Convenors***
09:10	**Villy Christensen** Nereus: Predicting the Future Ocean (W2-7989), Invited
09:50	**Jason Holt, James Harle, Sarah Wakelin, Momme Butenschön, Yuri Artioli, Icarus Allen, Jason Lowe and Jonathan Tinker** Exploring the drivers of climate change impacts on shelf and coastal marine ecosystems: Consequences for downscaling experiment design (W2-8126), Invited
10:30	***Coffee/Tea Break***
11:00	**Charles A. Stock, Michael A. Alexander, Nicholas A. Bond, Keith Brander, William W.L. Cheung, Enrique N. Curchitser, Thomas L. Delworth, John P. Dunne, Stephen M. Griffies, Melissa A. Haltuch, Jonathan A. Hare, Anne B. Hollowed, Patrick Lehodey, Simon A. Levin, Jason S. Link, Kenneth A. Rose, Ryan R. Rykaczewski, Jorge L. Sarmiento, Ronald J. Stouffer, Franklin B. Schwing, Gabriel A. Vecchi and Francisco E. Werner** On the use of IPCC-class models to assess the impact of climate on living marine resources (W2-8141), Invited
11:40	**William W.L. Cheung, Jose Fernandes, Thomas L. Frölicher, Jorge L. Sarmiento, U. Rashid Sumaila and Daniel P. Pauly** Modelling large scale effects of global change on marine ecosystems and fisheries (W2-8243), Invited
12:20	***Lunch***

14:00	**Corinna Schrum, Bjørn Ådlandsvik, Richard Bellerby, Ute Daewel, Trond Kristensen and Dhanya Pushpadas** Dynamic downscaling to marine ecosystems (W2-8293)
14:30	**Fei Chai, Yi Xu, Kenneth A. Rose and Francisco P. Chavez** Modeling Peru upwelling ecosystem dynamics: From physics to anchovy (W2-8046)
15:00	**Enrique N. Curchitser, Kenneth A. Rose, Kate Hedstrom, Jerome Fiechter, Miguel Bernal, Shin-ichi Ito, Alan Haynie and Francisco E. Werner** Development of a climate-to-fish-to-fishers model: Implementation in the Eastern Pacific sardine and anchovy system (W2-8315)
15:30	***Coffee/Tea Break***
16:00	Discussion
17:00	Workshop Ends

Monday, May 14 - W2

Workshop 2 (W2) - Day 2

Climate change projections for marine ecosystems: Best practice, limitations and interpretations

Co-Convenors:
Enrique Curchitser (Rutgers University, USA)
Icarus Allen (Plymouth Marine Laboratory, UK)

Invited Speakers:
William Cheung (Fisheries Centre, UBC, Canada)
Villy Christensen (University of British Columbia, Canada)
Jason Holt (National Oceanographic Centre, UK)
Charles Stock (Geophysical Fluid Dynamics Laboratory, USA)

This 2-day workshop aims to assemble scientists interested in making and interpreting projections of ecosystem responses to future climate change. The goal is to describe different approaches to modeling the impacts of climate variability on marine ecosystems, their ability to support sustainable harvesting and to highlight the strengths and limitations of the different approaches. We seek models that address both global and regional ecosystems and are particularly interested in presentations covering a range of models from statistical to mechanistic approaches including mass-balance (ECOPATH), size-based, minimalist, individual-based (IBMs) and end-to-end (E2E) models. Emphasis will be placed on models that examine trophic interactions as well as approaches that link biogeochemical processes with higher trophic level production. Presentations that discuss advantages and limitations of particular approaches and discuss the quantification of uncertainty in climate forced simulations are encouraged.

Monday, May 14, Day 2 (9:00-17:30)

09:00	Discussion
10:30	***Coffee/Tea Break***
11:00	Discussion
12:30	***Lunch***
14:00	Discussion
15:30	***Coffee/Tea Break***
16:00	Discussion
17:30	Workshop Ends

Monday, May 14 - W3

Workshop 3 (W3)

Coastal Blue Carbon: Mitigation opportunities and vulnerability to change

Co-Convenors:
Ik Kyo Chung (PNU, Korea)
Gabriel Grimsditch (UNEP)
Jerker Tamelander (UNEP)

Invited Speaker:
Núria Marbà (Mediterranean Institute for Advanced Studies, CSIC-UIB, Spain)

Blue Carbon is a relatively recent concept in finding nature-based solutions to climate change. It recognizes the role that coastal ecosystems can play in climate change mitigation as well as adaptation, as these ecosystems (in particular mangroves, intertidal marshes, seaweed beds and seagrass beds) hold vast CO_2 reservoirs. In fact, the rates of carbon sequestration and storage in coastal ecosystems are comparable to and often higher than those rates in carbon-rich terrestrial ecosystems such as tropical rainforests or peatlands. Given the recent heightened interest in coastal Blue Carbon, the science surrounding the concept is advancing rapidly; especially concerning our understanding of how coastal ecosystems sequester and store carbon, where the 'hotspots' for coastal Blue Carbon are, how rapidly the ecosystems are being lost or modified because of anthropogenic disturbances and climatic changes, and the releases of carbon that follow ecosystem loss of modification. Although our understanding of these crucial questions is improving, there are still large gaps in our knowledge and our scientific understanding of these processes and how to manage them.

The objectives of this 1-day workshop are to: a) synthesize the current status of scientific knowledge of the role that coastal ecosystems play in climate change mitigation, and to identify how this knowledge can support management strategies and policy decisions; b) identify the major gaps in knowledge concerning coastal Blue Carbon that still need to be addressed; c) analyze the major threats to coastal Blue Carbon and how different damaging anthropogenic practices as well as climate change are responsible for causing greenhouse gas emissions from these ecosystems, as well as eroding the various ecosystem services provided; d) provide Blue Carbon science-based policy recommendations for the management of coastal carbon sinks; e) raise awareness of successful coastal Blue Carbon case studies around the world; and f) explore possibilities for Blue Carbon policy, science and pilot projects in the region of East Asia and set out a plan of action for Blue Carbon in the region of East Asia.

The outcomes of the workshop are expected to be: (1) a white paper/workshop report, providing a synthesis of current status of scientific knowledge on coastal Blue Carbon, identification of major gaps in knowledge, successful Blue Carbon case studies, and management strategies that protect and enhance these carbon stocks, including an analysis of threats and damaging activities to coastal Blue Carbon and how they are responsible for greenhouse gas emissions; and (2) a plan of action for Blue Carbon in the region of East Asia, outlining research needs, policy gaps and possible pilot projects.

Monday, May 14 (9:00-17:30)

09:00 ***Introduction by Convenors***

09:10 **Carlos M. Duarte and Núria Marbà**
Vegetated coastal habitats as intense carbon sinks: Understanding and using Blue Carbon strategies (W3-8052), Invited

09:50 **Gabriel Grimsditch**
The UNEP Blue Carbon Initiative (W3-8311)

10:10 **Stephen Crooks**
Predicting the response of coastal marshes and mangroves to sea level rise and human impacts: State of science and information needs (W3-8316)

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

11:00 **Gail L. Chmura and Dante Torio**
Assessing the permanence of Blue Carbon sinks with rising sea levels (W3-8318)

11:20 **Gabriel Grimsditch, Gordon Ajonina and James Kairo**
Mangroves and carbon in West and Central Africa (W3-8320)

11:40 **Guanghui (George) Lin, Hui Chen, Weizhi Lu, Shengchang Yang, Hao Wu, Q. Li and Dai Jia**
Effects of tidal regimes, mariculture and restoration on carbon pools and fluxes in subtropical mangrove ecosystems of China: Implications for blue carbon managements (W3-8322)

12:00 **Ik Kyo Chung, Jung Hyun Oak, Kwang Seok Park, Jong Ahm Shin, Jong Gyu Kim and Jin Ae Lee**
Kelp forest/seaweed bed as mitigation and adaptation measure: Korean project overview (W3-8160)

12:20 Questions

12:30 ***Lunch***

14:00 Round Table Panel Discussion

15:00 Open Discussion

15:30 ***Coffee/Tea Break***

16:00 Open Discussion

17:30 Workshop Ends

Monday, May 14 - W4

Workshop 4 (W4)

Effects of climate change on advective fluxes in high latitude regions

Co-Convenors:
Ken Drinkwater (Institute of marine Research, Norway)
George Hunt (University of Washington, USA)
Eugene Murphy (British Antarctic Survey, UK)
Jinping Zhao (Ocean University of China, PR China)

This 1-day workshop, sponsored by ESSAS (Ecosystem Studies of Subarctic Seas) and ICED (Integrating Climate and Ecosystem Dynamics in the Southern Ocean), will briefly review the advection of water masses within and between polar and sub-polar regions and their driving mechanisms. It will also review the role of advection on the ecology of these high latitude regions, including heat and nutrient fluxes as well as the advection of flora and fauna. The major objective of the workshop, however, is to develop likely scenarios of these advective fluxes under climate change. Comparative studies of the responses in the Arctic and Antarctic regions are also of interest. To achieve these objectives we plan to bring together atmospheric scientists, climatologists, biogeochemists, physical and biological oceanographers, ecologists, and fisheries scientists who will use a combination of conceptual, statistical and numerical models studies. The workshop will also receive input from the ESSAS-sponsored Theme Session on "Arctic-Subarctic Interaction" to be held at the Ocean Sciences Meeting in Salt Lake City in February 2012 and the ICED Sentinel meeting on "Southern Ocean Ecosystem Change and Future Projections" to be held in Hobart in early May 2012. The workshop consists of a few focused invited talks with significant discussion time to address the main topic, the expected future high latitude circulation patterns and their ecological effects.

The primary outcomes of the workshop aim to be: (1) a paper on the future physical, chemical and biological fluxes in high latitude regions under climate change; (2) identification of the gaps in our knowledge about these advective processes and development of recommendations for future research to address these gaps; and (3) discussions on the formation of a Working Group under IMBER (Integrated Marine Biogeochemistry and Ecosystem Research) to compare the structure and function of sub-polar and polar ecosystems for the Arctic and Antarctic.

Monday, May 14 (9:00-17:30)

09:00	***Introduction by Convenors***
09:10	**Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao** Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-a)
09:30	**Eileen E. Hofmann, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao** Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-b)
09:50	**Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao** Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-c)
10:10	**Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao** Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-d)
10:30	***Coffee/Tea Break***

11:00 **Eileen E. Hofmann, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-e)

11:20 **Sei-Ichi Saitoh, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-f)

Toru Hirawake, Katsuhito Shinmyo, Shintaro Takao, Amane Fujiwara and Sei-Ichi Saitoh
Interannual changes in primary productivity and sea surface temperature in the polar oceans (W4-8248)

11:55 **Carin Ashjian, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-g)

Rosamma Stephen, P. Jasmine and N.V. Madhu
Copepods in Austral summer in Sub-Antarctic region of western Indian Ocean: A synthesis of 1964 and 2004 observations (W4-8146)

12:30 ***Lunch***

13:30 **Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-h)

13:50 **William Cheung, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-i)

14:10 **Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-j)

14:30 **Nina Karnovsky, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-k)

15:30 ***Coffee/Tea Break***

15:50 **Carin Ashjian, Eugene Murphy, Kenneth F. Drinkwater, George Hunt Jr., Eugene Murphy and Jinping Zhao**
Climate change and its impacts: Comparisons between the polar and subpolar regions of the Arctic and Antarctic (W4-8119-i)

16:30 Discussion

17:30 Workshop Ends

Monday, May 14 - W5

Workshop 5 (W5)

Public perception of climate change

Co-Convenors:
Dohoon Kim (National Fisheries Research & Development Institute, Korea)
Katja Philippart (Royal NIOZ, The Netherlands)

Invited Speakers:
Paul Buckley (Centre for Environment, Fisheries and Aquaculture Science (CEFAS), UK)
Mitsutaku Makino (Fisheries Research Agency, Japan)

Despite extensive research programs including considerable outreach efforts focusing specifically on climate change in the marine environment, very little of this research has reached public consciousness, and the level of public awareness of such issues is still relatively low. The reasons for this limited uptake are unclear, and in particular it is not known whether the lack of public awareness is primarily a consequence of limited media attention in marine science or climate change issues, whether it reflects limited efforts by the research community (or funding agencies) to communicate or publicize their results, or whether it reflects a general lack of understanding among the public of scientific and technical issues.

During this 0.5-day workshop, we will explore the effectiveness of different approaches for promoting the climate change messages to a wider audience. We will discuss trends and developments in the scope of outreach activities, for example the recent inclusion of social networking websites (*e.g.*, Facebook and Twitter), among the arsenal of tools used by research projects. Most importantly, we will address the ways in which scientific information on the effects of climate change on the world's oceans could be presented in such a way as to create engagement, in addition to merely to increase public knowledge.

The outcome of the workshop is expected to be a compilation of recommendations with regard to outreach programs and communicating with the public, stakeholders and policy makers, ranging from suggestions of particular tools and techniques that have proven useful or effective elsewhere, to recommendations regarding project strategy, planning and cost-effectiveness (taking into account the regional variation in possibilities and limitations of outreach). Based on the outcomes of the workshop, we will submit a joint manuscript to the special issue of the ICES Journal of Marine Science.

Monday, May 14 (9:00-12:30)

09:00	***Introduction by Convenors***
09:10	**Paul J. Buckley and John K. Pinnegar** Outcomes of the first pan-European poll on public perception of marine climate change impacts (W5-8138), Invited
09:40	**Tae-Goun Kim and Daniel R. Petrolia** Public perceptions of wetland restoration benefits in Louisiana (W5-8064)
10:10	***Coffee/Tea Break***
10:40	**Mitsutaku Makino** Outreach and adaptation strategy for climate change; Japanese examples (W5-8181), Invited
11:10	Round table discussion on effectiveness of different approaches for promoting the climate change messages to a wider audience

12:10 Wrap up by Convenors:
- First compilation of recommendations
- Road book for joint publication

12:30 Workshop Ends

Tuesday, May 15 - Plenary

Plenary Session

10:00	Opening Ceremony
10:45	**Kenneth F. Drinkwater** Ecosystem responses to climate variability and anthropogenic-induced changes (S1 Plenary-8118)
11:20	**Ann Bucklin, Ebru Unal and Paola G. Batta-Lona** From transcriptomes to bugs: Using 'omics to understand climate responses of marine zooplankton (S5 Plenary-7988)
11:55	**Carlos M. Duarte and Núria Marbà** The potential of coastal ecosystems to help mitigate climate change impacts (S7 Plenary-8004)
12:30	Plenary Session Ends

Tuesday, May 15 - S1

Session 1 (S1), Day 1

Climate variability versus anthropogenic impacts; analysing their separate and combined effects on long-term physical, biogeochemical and ecological patterns

Co-Convenors:
Sanae Chiba (JAMSTEC, Japan)
Nicholas A. Bond (JISAO, University of Washington, USA)

Invited Speakers:
Nathan Bindoff (University of Tasmania, Australia)
Shin-ichi Uye (Hiroshima University, Japan)

There is a strong scientific consensus that human-induced global warming is occurring, with this signal having been detected even into the deep ocean. The effects of climate change are not restricted to just temperature, but also have been observed in water properties such as pH and oxygen concentrations. The world's oceans will continue to be influenced by natural variability over a range of temporal and spatial scales, which can obscure anthropogenic effects. The confounding effects of intrinsic fluctuations in the physical forcing can be especially challenging to sort out for marine ecosystems, due to the complexity of the interactions controlling the biogeochemistry of the ocean. But that challenge needs to be met in order to be able to predict probable shifts and trends in the structure and function of marine ecosystems, and to carry out effective mitigation. This session consists of papers on topics related to disentangling natural variability from anthropogenic climate change with respect to marine ecosystems. We expect papers featuring a variety of approaches, and lively discussions of their relative merits and limitations.

Tuesday, May 15, Day 1 (14:00-18:05)

14:00	***Introduction by Convenors***
14:05	**Shin-ichi Uye** Jellyfish blooms as consequences of human perturbed environment and ecosystems (S1-7975), Invited
14:35	**Sanae Chiba, Tomoko Yoshiki, Kosei Sasaoka, Hiroya Sugisaki, Tsuneo Ono and Sonia Batten** Lower trophic level linkage and cool-warm cycle based on the North Pacific CPR survey 2001-2009: An implication for the future warming ocean (S1-8225)
14:55	**Antonio Bode, M. Teresa Álvarez-Ossorio, A. Miranda and Manuel Ruiz-Villarreal** Shifts between gelatinous and crustacean plankton in a coastal upwelling region (S1-7963)
15:15	**Ting-Chun Kuo, Janet Nye, Franz J. Mueter, Nicholas K. Dulvy and Chih-hao Hsieh** Environmental sensitivity of latitudinal shifts in marine fishes depends on latitude and fishing effects (S1-7982)
15:35	**Dave Checkley, Julie Jones, Shoshiro Minobe, Yoshioki Oozeki, Ryan R. Rykaczewski, Carl D. van der Lingen, Nadine Moroff and Anja Kreiner** Long-term fluctuations of sardine populations in relation to dominant modes of high-latitude climate variability (S1-8254)
15:55	***Coffee/Tea Break***

16:20 **Roksana Jahan and Joong Ki Choi**
Estuarine phytoplankton responses to climate change: Gyeonggi Bay long-term surveys (S1-7970)

16:40 **Christian Möllmann, Justus van Beusekom, Rabea Diekmann, Jens Floeter and Axel Temming**
Climate and anthropogenic effects on structure and functioning of the North Sea ecosystem (S1-8145)

17:00 **Stefano Ciavatta, Claudia Halsband-Lenk, Claire Widdicombe, Steve Coombs, Davis Sims and Tim Smyth**
Impact of climate events on trophic dynamics in coastal ecosystems (S1-8142)

17:20 **Jonne Kotta, Velda Lauringson and Arno Põllumäe**
Effects of eutrophication and climate change on the benthic and pelagic environments in the brackish Baltic Sea: What are their consequences to the water quality assessment? (S1-8037)

17:40 **Aiko Tachibana, Hideaki Nomura and Takashi Ishimaru**
Long-term variation of the copepod community structure in Tokyo Bay, Japan (S1-8252)

18:00 Discussion

18:05 Session ends

Tuesday, May 15 - S5

Session 5 (S5)

From genes to ecosystems: Genetic and physiological responses to climate change

Co-Convenors:
Julie Hall (National Institute of Water and Atmospheric Research, New Zealand)
Coleen Moloney (University of Cape Town, South Africa)

Invited Speaker:
Carl van der Lingen (Department of Agriculture, Forestry and Fisheries, South Africa)

Individual organisms experience the effects of climate change directly. Their responses are governed by genotype, phenotype, physiology and behaviour. The responses by individuals ultimately influence the impacts of climate change on individuals, populations, communities and ecosystems. This session aims to understand and explore the rich variety of genetic and physiological responses to climate change, and to assess the progress we have made in predicting the presence, extent and persistence of the impacts of these responses at the level of the ecosystem.

Tuesday, May 15 (14:00-18:05)

14:00	***Introduction by Convenors***
14:05	**Carl D. van der Lingen and Coleen L. Moloney** From ecosystems to genes: Climate change effects on Benguela sardine (S5-8006), Invited
14:35	**Jennifer Sunday, Amanda E. Bates and Nicholas K. Dulvy** Marine species' latitudinal distributions conform better to their thermal tolerance than terrestrial species: Implications for range shifts (S5-8240)
14:55	**Sam Dupont and Mike Thorndyke** Ocean acidification – The quest for unifying principles (S5-8031)
15:15	**Thomas Wernberg** Latitude and aptitude: The influence of climatic stress on the distribution, performance and function of seaweeds (S5-8297)
15:35	**Alexandra H. Campbell, Ezequiel M. Marzinelli, Tamsin A. Peters, Rebecca Neumann and Peter D. Steinberg** Climate-mediated diseases affecting habitat-forming seaweeds: Complex environmental effects on hosts and pathogens (S5-8214)
15:55	***Coffee/Tea Break***
16:20	**Rui Yin, Kyoung-Seon Lee, Guining Wang, Haruko Kurihara and Atsushi Ishimatsu** Climate changes (ocean acidification and warming) may impact the reproduction of the sea urchin *Hemicentrotus pulcherrimus* (S5-7999)
16:40	**Maarten Boersma, Arne M. Malzahn, Stefanie Schnell and Katherina L. Schoo** Food web effects of ocean acidification: Why is an increase in CO_2 availability important? (S5-8287)
17:00	**Atsushi Ishimatsu, Awantha Dissanayake, So Kawaguchi, Robert King, Haruko Kurihara, Akio Ishida and Masahide Wakita** Antarctic krill in a high CO_2 Southern Ocean: Potential impacts on early development and adult growth (S5-7998)

17:20 **Piero Calosi, Sedercor Melatunan, Simon Rundle and Steve Widdicombe**
Latitudinal variation in the vulnerability to elevated temperature and CO_2 in a marine gastropod (S5-8309)

17:40 **Amanda E. Bates, Simon Morley, Koh Siang Tan and Chien-Houng Lai**
Behaviour, thermal safety margins, environmental variability, and species-specific vulnerability to climate change (S5-8236)

18:00 Discussion

18:05 Session ends

Tuesday, May 15 - S7

Session 7 (S7)

Coastal and low-lying areas

Co-Convenors:
Iñigo Losada (University of Cantabria, Spain)
Poh Poh Wong (University of Adelaide, Australia)

Invited Speaker:
Poh Poh Wong (University of Adelaide, Australia)

Scientific evidence has been presented during the last decades that the coasts and low-lying areas, especially deltas, are experiencing the adverse consequences of the hazards related to climate change. Saltmarshes, coral reefs, mangroves and other relevant ecosystems are and will be suffering degradation affecting seriously their sustainability and the services they provide. Besides, coastal human settlements are highly vulnerable to climate change, especially to extreme events. The combination of sea level rise with the alteration of sea surface temperature, storm surges, waves, run-off/precipitation and acidification are some of the relevant elements to be considered. Besides, external stressors mostly originated by increasing human-pressure such as land-use, hydrological changes in catchments, groundwater extraction or reduced sediment supply exacerbate the impact of climate change. Erosion, flooding, saltwater intrusion, ecosystem deterioration and migration or increasing valuable human assets at risk are some of the immediate impacts requiring further research and immediate action. Contributions to this session may help to clarify and quantify the drivers of climate change impacts in coastal areas, from the evidence to projections as well as those considering the impacts and adaptation options for natural and human coastal systems.

Tuesday, May 15 (14:00-17:45)

14:00	***Introduction by Convenors***
14:05	**Poh Poh Wong** Large-scale modular mangrove planting – Adaptation to sea-level rise (S7-8228), Invited
14:35	**Andy Steven, Russ Babcock, Geoff Carlin, Nagur Cherukeru, Phillip Ford, Felipe Gusmao, Gary Fry and Kadija Oubelkheir** Biogeochemical properties and ecological consequences of the 2011 floods in Moreton Bay, Queensland (S7-8253)
14:55	**Guize Liu, Jingfeng Fan and Kuishuang Shao** The impact of climate changes on coastal wetland ecosystem (S7-8015)
15:15	**Shailendra Mandal, Kamini Sinha and Manoj Kumar** Effects of climate change on Indian Oceans: Concepts, approaches and applications of Integrated Coastal Zone Management in planning and management of Indian coastal zone of India (S7-8282)
15:35	**So-Min Cheong** Coastal adaptation (S7-8221)
15:55	***Coffee/Tea Break***
16:20	**Michael Dagg and Brian Roberts** Marsh derived DOC and CO_2 production in the coastal ocean of the northern Gulf of Mexico (S7-7960)

16:40 **Sergey Aleksandrov**
Impact of climate change on algae blooms and eutrophication in the lagoon ecosystems of the Baltic Sea (S7-8063)

17:00 **Evangeline Magdaong, Hiroya Yamano and Masahiko Fujii**
Development of a large-scale, long-term coral cover database in the Philippines (S7-8217)

17:20 **Guillem Chust, Aitor Albaina, Aizkorri Aranburu, Ángel Borja, Onno E. Diekmann, Andone Estonba, Javier Franco, Joxe M. Garmendia, Mikel Iriondo, Fernando Rendo, J. Germán Rodríguez, Otsanda Ruiz-Larrañaga, Iñigo Muxika and Mireia Valle**
Estuarine connectivity: Assessing species vulnerability to global change (S7-7985)

17:40 Discussion

17:45 Session ends

Wednesday, May 16 - Plenary

Plenary Session

09:00 **Anthony Charles**
Social, economic and governance impacts of climate change on fisheries
(General Plenary-8011)

09:35 **Manuel Barange, Gorka Merino, Icarus Allen, Jason Holt, James Harle, Simon Jennings, Julia Blanchard and Eddie Allison**
Quantifying the impacts of climate change on marine shelf ecosystems and their resources: Feeding the world in 2050 (S4 Plenary-8127)

10:10 **Pedro M.S. Monteiro and Christopher Sabine**
Global Ocean Carbon Observations: Decadal challenges in addressing and understanding global climate and ocean ecosystem change (S2 Plenary-8312)

10:45 Plenary Session Ends

Wednesday, May 16 - S1

Session 1 (S1), Day 2

Climate variability versus anthropogenic impacts; analysing their separate and combined effects on long-term physical, biogeochemical and ecological patterns

Co-Convenors:
Sanae Chiba (JAMSTEC, Japan)
Nicholas A. Bond (JISAO, University of Washington, USA)

Invited Speakers:
Nathan Bindoff (University of Tasmania, Australia)
Shin-ichi Uye (Hiroshima University, Japan)

There is a strong scientific consensus that human-induced global warming is occurring, with this signal having been detected even into the deep ocean. The effects of climate change are not restricted to just temperature, but also have been observed in water properties such as pH and oxygen concentrations. The world's oceans will continue to be influenced by natural variability over a range of temporal and spatial scales, which can obscure anthropogenic effects. The confounding effects of intrinsic fluctuations in the physical forcing can be especially challenging to sort out for marine ecosystems, due to the complexity of the interactions controlling the biogeochemistry of the ocean. But that challenge needs to be met in order to be able to predict probable shifts and trends in the structure and function of marine ecosystems, and to carry out effective mitigation. This session consists of papers on topics related to disentangling natural variability from anthropogenic climate change with respect to marine ecosystems. We expect papers featuring a variety of approaches, and lively discussions of their relative merits and limitations.

Wednesday, May 16, Day 2 (11:00-16:45)

11:00	***Introduction by Convenors***
11:05	**Nathaniel L. Bindoff, Paul Halloran, Oliver Andrews, Corinne Le Quéré, Catia Domingues and Helen E. Phillips** Are the observed pattern changes of ocean heat, salinity and oxygen man made? (S1-8209), Invited
11:35	**Nicholas A. Bond, Muyin Wang and Phyllis J. Stabeno** Which climate change signals in the North Pacific are liable to emerge sooner and stronger? (S1-7991)
11:55	**Olga Trusenkova** Regional patterns of interannual sea level variability: Case of the Japan/East Sea (S1-7954)
12:15	**Svetlana P. Shkorba, Vladimir I. Ponomarev, Elena V. Dmitrieva and Lubov N. Kuimova** Long wave of interdecadal oscillation in moderate latitude of the Asian Pacific (S1-8014)
12:35	***Lunch***
14:00	**Joji Ishizaka, Yongjiu Xu, Hisashi Yamaguchi and Eko Siswanto** Influence of Changjiang discharge, resuspension of sediment and eutrophication to chlorophyll variability in the Yellow Sea and East China Sea: Results from new satellite data set (S1-8045)

14:20 **Yun Ho Kang, Se-Jong Ju, Kyoung-Soon Shin, Sang-Duk Choi, Kyeong-Ho Han and Ho-Seop Yoon**
Simulating ecosystem response to climate change, thermal waste discharge and reclamation in a highly industrialized bay (S1-8034)

14:40 **Jong-Yeon Park, Jong-Seong Kug and Young-Gyu Park**
Bio-physical interaction in the tropical Pacific (S1-8005)

15:00 **Alexander Demidov, Eugene Krayushkin, Nina Kalshnikova and Sergey Chereshnyuk**
Water mass structure in the South Atlantic and its decadal variability (S1-8036)

15:20 **James R. Christian**
Detection of anthropogenic influences on ocean biogeochemistry (S1-8295)

15:40 ***Coffee/Tea Break***

16:00* **Svetlana Pakhomova, Elena Vinogradova, Evgeny Yakushev, Andrey Zatsepin, Valery Chasovnikov and Oleg I. Podymov**
Presented by Evgeny Yakushev on behalf of Svetlana Pakhomova
Black Sea biogeochemical regime recent decades variability: The role of climatic and anthropogenic forcing (S1-8051)

16:20 **Fabricio V. Branco, Bruno Biazeto, Ricardo de Camargo, Ilana Wainer, Jose Edson, Daniel Moita, Bruno Ferrero, Pedro P. Lopes, Tiago Bomventi, Christiano Campos, Marcelo Andrioni and Andre L.T. Mendes**
South Atlantic wave climate under climate change impacts (S1-8230)

16:40 Discussion

16:45 Session ends

Wednesday, May 16 - S2

Session 2 (S2)

Systematic, sustained and integrated global ocean observations

Co-Convenors:
Keith Alverson (UNEP, Division of Environmental Policy Implementation)
Dong-Young Lee (Korea Ocean Research and Development Institute, Korea)

Invited Speakers:
Hee-Dong Jeong (National Fisheries Research and Development Institute, Korea)
Eric Lindstrom (National Aeronautics and Space Administration, USA)

Over the past two decades a sustained ocean observations for climate have evolved from a patchwork of research efforts to a sustained Global Ocean Observing System. A network of satellites and *in situ* platforms are monitoring essential climate variables in service of research needs and societal benefits. Reporting to the parties of the UN Framework Convention on Climate Change ensures the adequacy of the system for purposes largely associated with detection and attribution of anthropogenic climate change. This session seeks to build on these past successes, but with an eye to the future of sustained ocean monitoring. In particular, focusing on sustained ocean observations is required in support of climate change adaptation measures and biogeochemical variables. Prioritization and assessment of climate change adaptation measures will call for very different monitoring strategies than have been designed for detection and attribution. At the same time, monitoring non-climatic targets, including for example acidification, biodiversity changes and ecosystem shifts, will require that new variables are integrated with the existing system. The session is based on a broad range of presentations on ocean monitoring, including both past results and future strategies.

Wednesday, May 16 (11:00-18:15)

11:00	***Introduction by Convenors***
11:05	**Eric Lindstrom, John Gunn, Albert Fischer, Candyce Clark and Andrea McCurdy** *Presented by Andrea McCurdy and Candyce Clark on behalf of Eric Lindstrom* The framework for ocean observing: Best practices for the global observing system (S2-8279), Invited
11:35	**Sung Yong Kim, E.J. Terrill, B.D. Cornuelle, B. Jones, L. Washburn, M.A. Moline, J.D. Paduan, N. Garfield, J.L. Largier, G. Crawford and P.M. Kosro** Sustained observations of mesoscale and submesoscale surface circulation off the U.S. West Coast (S2-7935)
11:55	**William T. Peterson, Jay Peterson, Cheryl Morgan and Jennifer Fisher** Tracking ecosystem change in the northern California Current: A role for long term ship-board observations (S2-8180)
12:15	**Che Sun and Lin Zhang** Interannual variability of the Antarctic Circumpolar Current strength based on merged altimeter data (S2-8047)
12:35	***Lunch***
14:00	**Hee Dong Jeong, Sang Woo Kim, Yong Kyu Choi, Jeong Min Shim and Kee Young Kwon** Global ocean observing and monitoring activities: Focus on the North East Asian Region (S2-8299), Invited

14:30 **Toshihiko Nagai**
History and present situation of Japanese coastal wave and tsunami monitoring system (NOWPHAS) (S2-7997)

14:50 **Huaming Yu, Qingyang Song and Xueen Chen**
Analyses on the tidal characteristics of the China Sea from the satellite altimetry data (S2-8025)

15:10 **Jae-Hyoung Park, Kyung-Il Chang, Young-Tae Son, Hee-Mang Park, Ki-Wan Kim and Joo-Hyung Ryu**
A long-term coastal ocean buoy station in the East/Japan Sea: Past, present, future (S2-8067)

15:30 **Yu-Hwan Ahn, Joo-Hyung Ryu, Young-Je Park and Seongick Cho**
Geostationary Ocean Color Imager for the North East Asian waters: Overview and ocean application***s*** (S2-8083)

15:50 **J.S. Park, J.R. Li, J.Y. Jin, D.Y. Lee, K.S. Lee, S.G. Hyun and E. Hayte**
Integrated coastal monitoring system through combination of *in situ* monitoring, satellite remote sensing and 3-D numerical models (S2-8140)

16:10 ***Coffee/Tea Break***

16:30 **Igor Burago, Georgy Moiseenko, Olga Vasik and Igor Shevchenko**
Federating metadata collections on monitoring of the North Pacific (S2-7942)

16:50 **So Kawaguchi, Mitsuo Fukuchi, Andrew Constable and Anthony J. Press**
Assessment of climate change impacts on marine ecosystems in East Antarctica: Outcomes of a research collaboration between Australia and Japan (S2-8020)

17:10 **Rosamma Stephen and R. Radhika**
Decadal changes in pelagic copepod distribution in the EEZ -west coast of India (S2-8076)

17:30 **Marie-Fanny Racault, Trevor Platt, Shubha Sathyendranath, Ertugrul Agirbas and Victor Martinez Vicente**
Integration of ecological indicators with the global network of ocean observations (S2-8129)

17:50 **Sei-Ichi Saitoh, Toru Hirawake, I. Nyoman Radiarta, Tomonori Isada, Robinson Mugo, Fumihiro Takahashi, Ichiro Imai, Yasuhiro Sakurai, Michio J. Kishi, Masaaki Wada, Toshiyuki Awaji and Yoichi Ishikawa**
Development of integrated coastal fisheries information system for sustainable fisheries in southern Hokkaido, Japan (S2-8267)

18:10 Discussion

18:15 Session Ends

Wednesday, May 16 - S4

Session 4 (S4), Day 1

Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities

Co-Convenors:
Miguel Bernal (Instituto Español de Oceanografía, Spain)
Keith Criddle (University of Alaska Fairbanks, USA)
Anne Hollowed (Alaska Fisheries Science Center, NOAA-Fisheries, USA)

Invited Speaker:
Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan)

Climate change is likely to affect the biological components of marine ecosystem at various spatial and temporal scales, and will have different effects at species, population and ecosystem levels. This session covers climate-induced changes in the medium to high trophic levels of the marine ecosystem biological components, including fish, mammals, seabirds and humans. Changes in those communities expected to be analysed in the session include shifts in distribution of species, changes in fish reproduction and productivity, migratory routes, changes in the productivity of littoral habitat (*e.g.*, estuaries, marshes), changes in freshwater habitat for anadromous species, and loss in marine biodiversity. Mechanisms of individual, population and ecosystem – including humans - responses to climate change, such as marine populations acclimation and adaptation; resilience of fishery management systems; resilience of fishery dependent communities (including modern and subsistence-dependent economies) effects on management of transboundary stocks; interactions of climate and harvesting impacts on fish populations, will also be dealt with.

Wednesday, May 16, Day 1 (11:00-18:05)

11:00	***Introduction by Convenors***
11:05	**Shin-ichi Ito, Takeshi Okunishi and Mitsutaku Makino** Climate induced fluctuation of Japanese sardine, its influence on marine ecosystem and human being (S4-8265), Invited
11:35	**William J. Sydeman, Sarah Ann Thompson, J. Anthony Koslow, Ralf Goericke, Marisol Garcia-Reyes and Mark D. Ohman** Climate change impacts on the pelagic ecosystem off southern California: Comparisons of trends and variability within and between trophic levels (S4-8176)
11:50	**Elvira S. Poloczanska, Christopher J. Brown, William J. Sydeman, Wolfgang Kiessling, Pippa J. Moore, Keith Brander, John F. Bruno, Lauren Buckley, Michael T. Burrows, Carlos M. Duarte, Benjamin S. Halpern, Johnna Holding, Carrie V. Kappel, Mary I. O'Connor, John M. Pandolfi, Camille Parmesan, David S. Schoeman, Franklin B. Schwing, Sarah Ann Thompson and Anthony J. Richardson** Climate change imprint on marine life from long-term observations (S4-8306)
12:05	**Gennady Matishov, Denis Moiseev, Olga Lyubina, Aleksandr Zhichkin, Sergey Dzhenyuk, Oleg Karamushko and Elena Frolova** Climate and cyclic hydrobiological changes in the Barents Sea in the 20th and 21st centuries (S4-7968)
12:20	**Jürgen Alheit, Kenneth F. Drinkwater and Janet Nye** Impact of Atlantic Multi-decadal Oscillation on marine ecosystems (S4-8147)
12:35	***Lunch***
14:00	**Camilla S. Landa** Geographical distribution and abundance of North East Arctic (NEA) haddock (Melanogrammus aeglefinus) in a changing climate (S4-8207)

14:15 **George Hunt Jr., Harald Loeng, Anne B. Hollowed, Franz J. Mueter and Kenneth F. Drinkwater**
To migrate or not? When may we expect groundfish species to move poleward? (S4-7949)

14:30 **Phyllis J. Stabeno, Ed Farley, Nancy Kachel, Sue Moore, Calvin Mordy, Jeffrey M. Napp, James E. Overland, Alexei I. Pinchuk and Michael F. Sigler**
Climate-mediated processes on the northern and southern shelves of the eastern Bering Sea and some implications for the ecosystem (S4-8135)

14:45 **Vicky W.Y. Lam, William W.L. Cheung and U. Rashid Sumaila**
Climate change, ocean acidification and the fish and fisheries of the Arctic (S4-8233)

15:00 **Oleg Titov**
Water exchange in the southern Barents Sea: Indirect integral characteristics and impact on the abundance of NEA cod (S4-7996)

15:15 **Paul D. Spencer, Nicholas A. Bond, Anne B. Hollowed and Franz J. Mueter**
Projected spatial distributions for eastern Bering Sea arrowtooth flounder under simulated climate scenarios, with implications for predation (S4-8060)

15:30* **Andrea Piñones, Eileen E. Hofmann, Kendra L. Daly, Michael S. Dinniman and John M. Klinck**
Presented by Eileen E. Hofmann on behalf of Andrea Piñones
Effects of circulation and climate change on early life stages of Antarctic krill (S4-8153)

15:45 **Daniel P. Costa**
Cancelled The potential effects of climate change on southern ocean top predators (S4-8305)

16:00 ***Coffee/Tea Break***

16:20 **Robinson Mugo, Sei-Ichi Saitoh, Akira Nihira, Tadaaki Kuroyama, Shuhei Masuda, Toshiyuki Awaji, Takahiro Toyoda, Hiromichi Igarashi and Yoichi Ishikawa**
Potential impact of global warming on skipjack tuna (*Katsuwonus pelamis*) habitat in the western North Pacific (S4-8269)

16:35 **Jeffrey J. Polovina, Phoebe Woodworth, Julia Blanchard and John P. Dunne**
Use of a size-based ecosystem model driven by a climate model to project the consequences of climate change on fish abundance and catches in the North Pacific Ocean (S4-7958)

16:50 **Nan-Jay Su, Chi-Lu Sun, André E. Punt and Su-Zan Yeh**
Potential impacts of climate change on the habitat of striped marlin (*Kajikia audax*) in the North Pacific Ocean (S4-8017)

17:05 **Jung Jin Kim, Cheol-Ho Kim, Hong Sik Min, Chan Joo Jang, William T. Stockhousen and Suam Kim**
Predicted ecological characteristics of common squid (*Todarodes pacificus*) larvae inferred by various climate models under IPCC SRES A1B Scenarios (S4-8257)

17:20 **Yongjun Tian, Kazuya Nashida and Hideo Sakaji**
Synchrony in the abundance trends of spear squid *Loligo bleekeri* in the Japan Sea and Pacific Ocean with special reference to the latitudinal differences in response to the climate regime shift (S4-7956)

17:35 **David Costalago and Isabel Palomera**
Vulnerability of small pelagic fish populations in non-upwelling areas under climate change (S4-7986)

17:50 **Priscilla Licandro, Delphine Nicolas, Sébastien Rochette and Mark Dickey-Collas**
Linking the impact environmental changes on clupeoid fish through the zooplankton: The example of North Sea herring (S4-8027)

18:05 Session Ends

Thursday, May 17 - Plenary

Plenary Session

09:00 **Peter G. Brewer**
Deep-Sea gas exchange rates: The diffusive boundary layer link between fish, changing chemistry and climate (General Plenary-7946)

09:35 **Lothar Stramma**
On the expansion of oxygen minimum zones, trends in dissolved oxygen and its impact on the tropical Pacific Ocean (S8 Plenary-7959)

10:10 **Yasuhiro Yamanaka and Takafumi Hirata**
Developing marine ecosystem model to improve future projection (S3 Plenary)

10:45 Plenary Session Ends

Thursday, May 17 - S3

Session 3 (S3), Day 1

Projections of climate change impacts on marine ecosystems and their uncertainty

Co-Convenors:
Kyung-Il Chang (Seoul National University, Korea)
Corinna Schrum (University of Bergen, Norway)

Invited Speakers:
Noel Keenlyside (Geophysical Institute, University of Bergen, Norway)
Markus Meier (Sveriges Meteorologiska och Hydrologiska Institut, Sweden)
Ryan Rykaczewski (Princeton University, USA)

Within the last decades increasing scientific evidence indicates that climate change is occurring and impacting the functioning and structuring of regional marine ecosystems on various scales in various ways. Politicians and environmental and fisheries managers increasingly demand answers from scientist to assess regional impacts and future changes and risks for regional marine ecosystems and marine resources. Consequently, scientific efforts have been undertaken recently to develop tools and dynamically consistent methods to assess the regional climate change impacts to the marine ecosystems. These projections typically build on future climate change scenarios from Global Climate Models (GCMs) and involve model chains with modelling tools for various regional parts of the marine ecosystems, such as coupled physical-biological models for the lower trophic levels, IBMs (individual based models) for fish larvae, multi-species or end-to-end models. Such projections involve a number of practical and conceptual challenges and are subject to uncertainties that arise from the baseline global climate projections and downstream modelling tools.

This session consists of papers on various aspects related to climate change projections for global and regional marine physical, biogeochemical and ecological systems, such as contributions related to: (i) projected changes, risks and potential chances, (ii) various downscaling methods (bias corrections, delta change) and their impacts on dynamic consistency of the projections and (iii) uncertainties in projections and error propagation through the model chain. We are seeking a lively and open discussion about potentials and limitations of climate change projections and downscaling to marine ecosystems.

Thursday, May 17, Day 1 (11:00-18:05)

11:00 ***Introduction by Convenors***

11:05 **Ryan R. Rykaczewski, John P. Dunne, Charles A. Stock, James R. Watson and Jorge L. Sarmiento**
Connectivity between basin-scale and local processes influences regional ecosystem responses to increases in upper-ocean stratification (S3-8159), Invited

11:35 **Jason Holt, Momme Butenschön, Sarah Wakelin, Yuri Artioli, Icarus Allen, James Harle, Jason Lowe and Jonathan Tinker**
Climate change impacts on shelf and coastal marine ecosystems: Contrasting ocean-shelf exchange, stratification, and temperature effects on the northwest European shelf (S3-8272)

11:55 **Dhanya Pushpadas, Corinna Schrum and Ute Daewel**
Climate change impacts on the North and Baltic Sea ecosystems: An assessment based on IPCC AR4 and AR5 models (S3-8162)

12:15 **Corinna Schrum, Bjørn Ådlandsvik, Richard Bellerby, Ute Daewel, Trond Kristensen and Dhanya Pushpadas**
Dynamic downscaling to marine ecosystems (S3-8292)

12:35 ***Lunch***

14:00 **Noel Keenlyside**
Near-term climate prediction: New opportunities and challenges (S3-8124), Invited

14:30 **Charles A. Stock, John P. Dunne and Jasmin John**
Augmenting earth system models to capture global-scale energy flows through the planktonic food web to fish (S3-8157)

14:50 **Yang-Ki Cho, Gwang-Ho Seo, Byoung-Ju Choi and Kwang-Yul Kim**
Development of a regional ocean climate model for the northwest Pacific marginal seas (S3-8245)

15:10 **Ute Daewel, Corinna Schrum and Dhanya Pushpadas**
Impact of climate changes on North Sea Atlantic cod (*Gadus morhua*) larval survival: A modeling study (S3-8131)

15:30 **Enrique N. Curchitser, Kenneth A. Rose, Kate Hedstrom, Jerome Fiechter, Miguel Bernal, Shin-ichi Ito, Alan Haynie and Francisco E. Werner**
Development of a climate-to-fish-to-fishers model: Implementation in the eastern Pacific Sardine and Anchovy system (S3-8314)

15:50 ***Coffee/Tea Break***

16:10 **H.E. Markus Meier, Helén C. Andersson, Kari Eilola, Bo G. Gustafsson, Ivan Kuznetsov, Bärbel Müller-Karulis, Thomas Neuman and Oleg P. Savchuk**
Hypoxia in future climates: A model ensemble study for the Baltic Sea (S3-8001), Invited

16:40 **Manal M. Sabrah and Azza A. El-Ganainy**
Relationship between coral reef degradation and overexploitation of coral reef fishes in El-Tur region, Egyptian Red Sea coast (S3-8264)

17:00 **Jose Fernandes, William Cheung, Simon Jennings and Alastair Grant**
Projecting distribution changes in marine fishes and invertebrates by integrating trophic interactions (S3-7944)

17:20 **Pavel A. Salyuk and Oleg A. Bukin**
Interactions between regional climate-forming factors and phytoplankton communities in the north-western Pacific (S3-8111)

17:40 **Hyunwoo Lee, Ki-Tae Park, Kitack Lee, Hae Jin Jeong and Yeong Du Yoo**
Prey-dependent retention of dimethylsulfoniopropionate by mixotrophic dinoflagellates (S3-8117)

18:00 Discussion

18:05 Session Ends

Thursday, May 17 - S4

Session 4 (S4), Day 2

Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities

Co-Convenors:
Miguel Bernal (Instituto Español de Oceanografía, Spain)
Keith Criddle (University of Alaska Fairbanks, USA)
Anne Hollowed (Alaska Fisheries Science Center, NOAA-Fisheries, USA)

Invited Speaker:
Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan)

Climate change is likely to affect the biological components of marine ecosystem at various spatial and temporal scales, and will have different effects at species, population and ecosystem levels. This session covers climate-induced changes in the medium to high trophic levels of the marine ecosystem biological components, including fish, mammals, seabirds and humans. Changes in those communities expected to be analysed in the session include shifts in distribution of species, changes in fish reproduction and productivity, migratory routes, changes in the productivity of littoral habitat (*e.g.*, estuaries, marshes), changes in freshwater habitat for anadromous species, and loss in marine biodiversity. Mechanisms of individual, population and ecosystem – including humans - responses to climate change, such as marine populations acclimation and adaptation; resilience of fishery management systems; resilience of fishery dependent communities (including modern and subsistence-dependent economies) effects on management of transboundary stocks; interactions of climate and harvesting impacts on fish populations, will also be dealt with.

Thursday, May 17, Day 2 (11:00-18:15)

11:00	***Introduction by Convenors***
11:05	**William W.L. Cheung, Jorge L. Sarmiento, John P. Dunne, Thomas L. Frölicher, Vicky W.Y. Lam, M.L. Deng Palomares, Reg Watson and Daniel P. Pauly** Shrinking of fishes exacerbates impacts of global ocean changes on marine ecosystems (S4-8242)
11:20	**Adriana Vergés, Fiona Tomas, Emma Cebrian, Zafer Kizilkaya, Enric Sala and Enric Ballesteros** Invasion of tropical herbivores into a temperate system results in devastating phase-shift mediated by the loss of canopy algae (S4-7990)
11:35	**Dawit Yemane, Toufiek Samaai and Steve P. Kirkman** Assessing changes in distribution and range size of demersal fish species in the Benguela Current Large Marine Ecosystem in relation to long-term change in the environment (S4-8055)
11:50	**Arno Põllumäe and Lennart Lennuk** Is the abundance of invasive cladoceran *Cercopagis pengoi* controlled by blooms of moon jelly *Aurelia aurita* in northern Baltic Sea? (S4-8032)
12:05	**Malin L. Pinsky, Michael Fogarty, Boris Worm, Jorge L. Sarmiento and Simon A. Levin** How predictable are species distribution shifts? Testing ecological hypotheses against four decades of observations (S4-8071)
12:20	***Lunch***
14:00	**Sukgeun Jung and Ilsu Choi** Latitudinal shifts in catch distribution of fisheries species in Korean waters during the past 30 years in relation to climate change (S4-8224)

14:15 **Warren Potts and Warwick H.H. Sauer**
Transboundary climate induced distributional changes in an important recreational west African fish species – consequences and adaptation (S4-7957)

14:30 **Steve P. Kirkman, Dawit Yemane, John Kathena, Sam Mafwila, Sylvia N'siangango, Toufiek Samaai and Larvika Singh**
Identifying and characterizing of demersal biodiversity hotspots in the Benguela Current large marine ecosystem: Its relevance in the light of global changes (S4-8088)

14:45 **Dan Smale, Thomas Wernberg, Tim Langlois and Gary Kendrick**
Impact of a 'marine heat wave' on seaweed, coral and fish assemblages in a global biodiversity hotspot (S4-7995)

15:00 **John K. Pinnegar, Will J.F. Le Quesne and Silvana N.R. Birchenough**
Ocean acidification and the possible loss of echinoderms: How will commercial fish and fisheries be affected? (S4-8058)

15:15 **Daniel Small, Piero Calosi, John Spicer, Dominic Boothroyd and Steve Widdicombe**
Synergistic impacts of climate change drivers on the developmental ecophysiology, growth and survival of the European lobster, *Homarus gammarus* (S4-8310)

15:30 **C. Tracy Shaw, Leah R. Feinberg and William T. Peterson**
Effects of climate variability on the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* in the coastal upwelling zone off the Oregon Coast, USA (S4-8178)

15:45 ***Coffee/Tea Break***

16:00 **Alan Haynie and Lisa Pfeiffer**
Climate change and fisher behavior in the Bering Sea pollock trawl and Pacific cod longline fisheries (S4-8231)

16:15 **Anthony Charles**
Climate change impacts and adaptation in the real world of coastal communities (S4-8074)

16:30 **Kuo-Wei Lan and Ming-An Lee**
Effects of climate variability on the distribution and fishing conditions of yellowfin tuna (*Thunnus albacares*) in the Indian Ocean (S4-8022)

16:45 **Renae C. Tobin, Ann Penny, Andrew J. Tobin, Stephen Sutton and Nadine Marshall**
Stop, change or move: Practical adaptation of commercial fishers to spatial changes in fish abundance due to extreme weather events (S4-7977)

17:00 **Edward JK. Patterson**
Climate change impacts on coastal resources and dependent livelihood in Tamil Nadu, Southeastern India (S4-7947)

17:15 **Sibananda Senapati and Vijaya Gupta**
Dying fisheries in a changing environment: A study on livelihood strategies of fishery communities in Mumbai (S4-8189)

17:30 **Caroline Brown and Nicole M. Braem**
Observations of climate change and subsistence harvests in Emmonak, Alaska (S4-8168)

17:45 **SM Sharifuzzaman**
The effect of climate change on shrimp aquaculture, Bangladesh (S4-8134)

18:00 **Francisca George, Dominic O. Odulate and Adekunle Idowu**
Climate change effects and adaptation strategies in a Nigerian coastal agro-ecological zone (S4-7969)

18:15 Session Ends

Thursday, May 17 - S8

Session 8 (S8)

Trend and impacts of de-oxygenation in oceanic and coastal ecosystems

Co-Convenors:
Frank Whitney (Canada)
Evgeniy Yakushev (Norwegian Institute for Water Research, Norway/Russia)

Invited Speakers:
Steven Bograd (Southwest Fisheries Science Center, NOAA-Fisheries, USA)
Felix Janssen (Max-Planck Institute for Marine Microbiology, Germany)

Modifications to ocean circulation due to global warming are being observed broadly throughout our oceans. Surface warming of our planet reduces oxygen solubility in seawater, increases mixed layer buoyancy and reduces ice formation in important ventilation areas. All of these processes lead to a reduction in oxygen transport to the interior waters of major ocean basins and coastal seas. As a transition zone between the continents and the ocean, coastal waters are natural susceptibility to oxygen-deficiency and anoxia due to both the input of low density coastal water and topographic restrictions which can increase the residence time of bottom waters.

Oxygen depletion inevitably leads to biological impacts ranging from altered microbial activity (*e.g.*, enhanced de-nitrification, N_2O production or sulfate reduction) to whole community displacements (loss of fisheries, invasions of displaced species into new habitat) which are poorly understood. As well, oxygen losses in the interior ocean are accompanied by increased acidity as carbon dioxide levels rise. These two trends may have synergistic impacts on biota. Contributions across these diverse topics, as well as on expansions of coastal dead zones caused by non-climate related change, are included in this session.

Thursday, May 17 (11:00-18:00)

11:00	***Introduction by Convenors***
11:05	**Felix Janssen, Christoph Waldmann, Antje Boetius and the HYPOX project team** Oxygen observation activities within the FP7 EU-project HYPOX: A step towards hypoxia monitoring in a rapidly changing world (S8-8094), Invited
11:35	**Evgeniy Yakushev** Oxygen depletion events in the European Seas: Observations and modelling (S8-8043)
11:55	**Oleg I. Podymov** Recent decadal changes of the northeastern Black Sea anoxic boundary position and interannual nutrient dynamics (S8-8167)
12:15	**Pavel Tishchenko, Vyacheslav B. Lobanov, Tatyana Mikhajlik, Pavel Semkin, Alexander Sergeev, Petr Tishchenko and Vladimir Zvalinsky** *Presented by Vyacheslav Lobanov on behalf of Pavel Tishchenko* Seasonal hypoxia of Amurskiy Bay (Japan/East Sea) (S8-8084)
12:35	***Lunch***
14:00	**Young Jae Ro, Baek Jin Kim, Kwang Young Jung and Kwang Soon Park** Two case studies for hypoxia in Korean coastal waters (S8-8193)
14:20	**Meng Xia** The effect of climate change on a Gulf estuary plume and its hypoxia variation (S8-7927)

14:40 **Dmitry D. Kaplunenko, Vyacheslav B. Lobanov, Pavel Tishchenko and Maria A. Shvetsova**
Vertical structure of dissolved oxygen and nitrate *in situ* profiles in the North-East Asian Marginal Seas (S8-8246)

15:00 **Jinhui Wang and Yanqin Wu**
The historical status and impacts of hypoxia in Changjiang estuary (S8-8044)

15:20 **K. Allison Smith, John P. Dunne, Brendan R. Carter, and Jorge L. Sarmiento**
Predicting future habitat changes above oxygen minimum zones (S8-8175)

15:40 ***Coffee/Tea Break***

16:00 **Frank A. Whitney, Steven J. Bograd and Tsuneo Ono**
Implications of subsurface nutrient increases in the subarctic Pacific Ocean (S8-8010), Invited

16:30 **Frank A. Whitney, Vaughn Barrie, Kim Conway and Bill Crawford**
Oxygen sinks and sources along the coast of British Columbia, Canada (S8-7974)

16:50 **John A. Barth, Stephen D. Pierce and Francis Chan**
Hypoxia over the continental shelf in the Northeast Pacific ocean (S8-8069)

17:10 **J. Anthony Koslow, Peter Davison, Ana Lara-Lopez, Amanda Netburn and Noelle Bowlin**
The influence of declining oxygen concentrations and mesopelagic fish biomass on ecosystem structure and carbon export in the California Current (S8-8173)

17:30 **Anand Gnanadesikan, Daniele Bianchi, Irina Marinov, Jaime Palter and Marie-Aude Pradal**
Understanding the connection between ocean circulation and open-ocean oxygen levels (S8-8218)

17:50 Discussion

18:00 Session Ends

Friday, May 18 - Plenary

Plenary Session

9:00	**Ichiro Yasuda** Interactions between fisheries production, planktonic ecosystems, physical oceanographic processes and climate change (General Plenary-8072)
9:35	**Kyung-Ryul Kim** Recent Advances in studies for East Sea (Sea of Japan), a miniature test ocean for global changes (General Plenary-8307)
10:10	**Jeffrey M. Dambacher** The role of positive feedback in structuring alternative ecosystem states (S9 Plenary-7966)
10:45	Plenary Session Ends

Friday, May 18 - S3

Session 3 (S3), Day 2

Projections of climate change impacts on marine ecosystems and their uncertainty

Co-Convenors:
Kyung-Il Chang (Seoul National University, Korea)
Corinna Schrum (University of Bergen, Norway)

Invited Speakers:
Noel Keenlyside (Geophysical Institute, University of Bergen, Norway)
Markus Meier (Sveriges Meteorologiska och Hydrologiska Institut, Sweden)
Ryan Rykaczewski (Princeton University, USA)

Within the last decades increasing scientific evidence indicates that climate change is occurring and impacting the functioning and structuring of regional marine ecosystems on various scales in various ways. Politicians and environmental and fisheries managers increasingly demand answers from scientist to assess regional impacts and future changes and risks for regional marine ecosystems and marine resources. Consequently, scientific efforts have been undertaken recently to develop tools and dynamically consistent methods to assess the regional climate change impacts to the marine ecosystems. These projections typically build on future climate change scenarios from Global Climate Models (GCMs) and involve model chains with modelling tools for various regional parts of the marine ecosystems, such as coupled physical-biological models for the lower trophic levels, IBMs (individual based models) for fish larvae, multi-species or end-to-end models. Such projections involve a number of practical and conceptual challenges and are subject to uncertainties that arise from the baseline global climate projections and downstream modelling tools.

This session consists of papers on various aspects related to climate change projections for global and regional marine physical, biogeochemical and ecological systems, such as contributions related to: (i) projected changes, risks and potential chances, (ii) various downscaling methods (bias corrections, delta change) and their impacts on dynamic consistency of the projections and (iii) uncertainties in projections and error propagation through the model chain. We are seeking a lively and open discussion about potentials and limitations of climate change projections and downscaling to marine ecosystems.

Friday, May 18, Day 2 (11:00-13:05)

11:00	***Introduction by Convenors***
11:05	**Cody Szuwalski and André E. Punt** Reaching management goals under a changing climate: A management strategy evaluation of snow crab (*Chionoecetes opilio*) fishery in the eastern Bering Sea (S3-7945)
11:25	**Yun Ho Kang, Se-Jong Ju, Kyoung-Soon Shin, Young-Gyu Park, Sang-Duk Choi, Kyeong-Ho Han and Ho-Seop Yoon** Predicting climate change-induced fishery shrink through bottom-up control around the southern waters of Korea by using a flow trophic model (S3-8033)
11:45	**James R. Watson, Charles A. Stock, Ryan R. Rykaczewski and Jorge L. Sarmiento** Quantifying the distribution and dynamics of forage fish by using a size-based ecosystem model (S3-8158)

12:05 **Tomohiro Yasuda, Yusuke Tanaka, Junichi Ninomiya, Sota Nakajo, Nobuhito Mori and Hajime Mase**
Hindcast and historical assessment of Cyclone Tomas and climate change impact analysis on tropical cyclones in the South Pacific (S3-8259)

12:25 **Yang Liu, Sei-Ichi Saitoh, I. Nyoman Radiarta and Toru Hirawake**
Impact of climate change on the development of marine aquaculture: A case study on the Japanese scallop in Dalian, China, using satellite remote sensing and Geographic Information Systems-based models (S3-8132)

12:45 **Tore Johannessen and Tron Frede Tingstad**
Do phytoplankton, bacteria, and heterotrophic nanoflagellates gain competitive advantages by sacrificing parts of their clonal populations in favour of receiving resources for continuous growth? (S3-7984)

13:05 Session Ends

Friday, May 18 - S4

Session 4 (S4), Day 3

Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities

Co-Convenors:
Miguel Bernal (Instituto Español de Oceanografía, Spain)
Keith Criddle (University of Alaska Fairbanks, USA)
Anne Hollowed (Alaska Fisheries Science Center, NOAA-Fisheries, USA)

Invited Speaker:
Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan)

Climate change is likely to affect the biological components of marine ecosystem at various spatial and temporal scales, and will have different effects at species, population and ecosystem levels. This session covers climate-induced changes in the medium to high trophic levels of the marine ecosystem biological components, including fish, mammals, seabirds and humans. Changes in those communities expected to be analysed in the session include shifts in distribution of species, changes in fish reproduction and productivity, migratory routes, changes in the productivity of littoral habitat (*e.g.*, estuaries, marshes), changes in freshwater habitat for anadromous species, and loss in marine biodiversity. Mechanisms of individual, population and ecosystem – including humans - responses to climate change, such as marine populations acclimation and adaptation; resilience of fishery management systems; resilience of fishery dependent communities (including modern and subsistence-dependent economies) effects on management of transboundary stocks; interactions of climate and harvesting impacts on fish populations, will also be dealt with.

Friday, May 18, Day 3 (11:00-12:45)

11:00	***Introduction by Convenors***
11:05*	**Akihiko Yatsu, Sanae Chiba, Yasuhiro Yamanaka, Shin-ichi Ito, Yugo Shimizu, Masahide Kaeriyama and Yoshiro Watanabe** *Presented by Shin-ichi Ito on behalf of Akihiko Yatsu* Climate forcing and the Kuroshio/Oyashio ecosystem (S4-7980)
11:20	**Myron A. Peck, Marc Hufnagl, Klaus Huebert, Markus Kreus and Johannes Pätsch** Will climate-driven warming uncouple marine food webs? Projections from biophysical, size-based modeling (S4-8150)
11:35	**Jong Hee Lee, Jae Bong Lee, Chang Ik Zhang and Suam Kim** Ecosystem-based risk assessing the Korean major fisheries under climate change (S4-8100)
11:50	**Mbog Dieudonné Marius** Impacts of climate change on waterbirds, mammals, fish and fishermen in coastal systems: The case of mangroves, coral reefs and coastal lagoons in the sub-region of the Congo Basin in Central Africa (S4-8232)
12:05	**Ivonne Ortiz, Kerim Aydin and Al Hermann** *Presented by Nicholas Bond on behalf of Ivonne Ortiz* From climate to fisheries: Performance of a 40-year hindcast for the Eastern Bering Sea (S4-8009)
12:20	**Jennifer Howard and Roger Griffis** Impacts of climate change on U.S. oceans and marine resources: Technical input to the 2013 U.S. National Climate Assessment (S4-8049)
12:35	Session Summary
12:45	Session Ends

Friday, May 18 - S9

Session 9 (S9)

Marine tipping points in the earth system

Co-Convenors:
Gretta Pecl (University of Tasmania, Australia)
Martin Visbeck (IFM-GEOMAR, Germany)

Invited Speakers:
Mike Litzow (University of Tasmania, Australia)
Jacob Schewe (Potsdam Institute for Climate Impact Research, Germany)

The ocean plays a central role in the regional and global climate system. Its circulation, temperature and salinity patterns, nutrient distributions and chemical composition are mainly influenced by changes in the atmosphere and fluxes from the land. This ocean state provides the basis for the marine ecosystem, which itself has several complex interdependencies. From complex system theory we know that many systems tend to respond in an almost linear fashion to changes in the forcing. However, at some point a critical value can be reached, and the system responds with a dramatic switch-like behavior into a new stable state, having passed a critical tipping point. Evidence for tipping points in nature is often generated only after the consequences of a major shift become obvious. Predicting the existence and effects of tipping points on ocean state or ecosystem function are major, and likely increasing, challenges for both scientists and resource managers. This session aims to provide an overview of some of the known tipping points in the marine system and invites contributions to elaborate on our mechanistic understanding of these or provide evidence or a strong theoretical basis for new tipping points. Disciplines to be covered range from ocean circulation dynamics, sea ice formation, de-oxygenation, through to dramatic shifts in ecosystem structure and function, and beyond.

Friday, May 18 (11:00-13:05)

11:00	***Introduction by Convenors***
11:05	**Jacob Schewe and Anders Levermann** Rapid transitions in the horizontal ocean circulation (S9-8188), Invited
11:35	**Michael A. Litzow, Franz J. Mueter and Dan Urban** Rising variance as a leading indicator of tipping points in marine ecosystems: A test using Alaskan crustacean data (S9-8113), Invited
12:00	**Elena I. Ustinova and Yury D. Sorokin** Tipping points: Shifts in climatic variables or their relationships? Examples for the Far-Eastern Seas (S9-8184)
12:15	**Christian Möllmann, Justus van Beusekom, Rabea Diekmann, Jens Floeter and Axel Temming** Multi-level oscillating trophodynamic control causes regime shifts in large marine ecosystem (S9-8149)
12:30	**Hongjun Li, Qing Yang and Jingfeng Fan** Long-term responses of zooplankton in northern Yellow Sea of China: Implications of climate change (S9-7994)
12:45	**Hans-Juergen Hirche, Michael Karcher and Ksenia N. Kosobokova** The future of Arctic zooplankton: Interplay between advection, life history traits and trophodynamics (S9-8271)

13:00 **Yury Zuenko**
Resonance effect of spawning match with spring bloom for some fish species in the Japan/East Sea (S9-8073)

13:05 Session Ends

Friday, May 18 - W1

Workshop 1 (W1)

Ocean observation: Strategic framework

Co-Convenors:
David Checkley (Scripps Institution of Oceanography, USA)
Candyce Clark (Climate Project Office, NOAA, USA)

The ocean observation workshop is to address the new multidisciplinary requirements (both climate and non-climate) being placed on the marine observing community. The primary objective of the workshop is to begin consideration of the approaches needed to move these new multidisciplinary and diverse observing requirements forward into the next decade. Particular attention will be to follow up on the discussions at the symposium theme session on "Systematic, sustained and integrated global ocean observations" that are directed at how to integrate new biogeochemical, biodiversity and ecosystem shifts observations into a sustained observing system integrated with established monitoring systems. The Framework for Ocean Observing document will serve as the foundation for these exchanges. A panel of several scientists with diverse expertise is selected to prepare short presentations and then lead the audience in discussion. An intense effort to incorporate early career scientists into the workshop is essential to ensure that a cadre of future observationalists is available.

Friday, May 18 (14:00-18:00)

14:00	***Introduction by Convenors David Checkley and Candyce Clark***
14:20	**Graham Hosie, Sonia Batten, Sanae Chiba and The GACS Board of Governance** Initiation of a Global Alliance of Continuous Plankton Recorder Surveys (GACS) (W1-8091)
14:35	Convening of Panel with remarks by other panel members (Eric Lindstrom, Pedro Monteiro, and Hee-Dong Jeong)
15:00	Discussion
16:00	***Coffee/Tea Break***
16:30	Reconvene
18:00	Workshop Ends

Saturday, May 19 - Plenary

Plenary Session

09:00 **Peter Lemke**
Climate change in high-latitude oceans (General Plenary-8286)

09:35 **Hugh P. Possingham, Maria Beger, Alex Maufroy, Eddie Game, Matt Watts, Lissa Barr, Carissa Klein, Viv Tulloch, Azusa Makino, Hedley Grantham, Lucy Robinson, Christopher J. Brown, Kerrie Wilson, Eve McDonald-Madden, Eric Treml, Stuart Kininmonth and Takuya Iwamura**
Marine spatial planning and risk management in the context of climate change (S6 Plenary-8239)

10:10 **Benjamin McNeil**
Nature *vs* Nurture: The importance of understanding the oceans natural carbon cycle in the context of anthropogenic change (S10 Plenary-8319)

10:45 Break

Saturday, May 19 - S4

Session 4 (S4), Day 4

Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities

Co-Convenors:
Miguel Bernal (Instituto Español de Oceanografía, Spain)
Keith Criddle (University of Alaska Fairbanks, USA)
Anne Hollowed (Alaska Fisheries Science Center, NOAA-Fisheries, USA)

Invited Speaker:
Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan)

Climate change is likely to affect the biological components of marine ecosystem at various spatial and temporal scales, and will have different effects at species, population and ecosystem levels. This session covers climate-induced changes in the medium to high trophic levels of the marine ecosystem biological components, including fish, mammals, seabirds and humans. Changes in those communities expected to be analysed in the session include shifts in distribution of species, changes in fish reproduction and productivity, migratory routes, changes in the productivity of littoral habitat (*e.g.*, estuaries, marshes), changes in freshwater habitat for anadromous species, and loss in marine biodiversity. Mechanisms of individual, population and ecosystem – including humans - responses to climate change, such as marine populations acclimation and adaptation; resilience of fishery management systems; resilience of fishery dependent communities (including modern and subsistence-dependent economies) effects on management of transboundary stocks; interactions of climate and harvesting impacts on fish populations, will also be dealt with.

Saturday, May 19, Day 4 (11:00-13:05)

11:00 ***Introduction by Convenors***

11:05 **Susa Niiranen, Johanna Yletyinen, Maciej T. Tomczak, Olle Hjerne and Thorsten Blenckner**
Could fishery management be used to mitigate the climate change effects on marine ecosystem function? (S4-8089)

11:20 **Melissa A. Haltuch, Nicholas A. Bond, Ian J. Stewart and Michael J. Schirippa**
Projecting U.S. west coast sablefish recruitment under global climate change scenarios (S4-8223)

11:35 **Jörn O. Schmidt, Massimiliano Cardinale, Piotr Margonski, Martin Quaas, Valerio Bartolino and Rüdiger Voss**
Optimal harvest of Baltic Sea herring under environmental change (S4-8285)

11:50 **Yi-Jay Chang, Chi-Lu Sun, Yong Chen and Su-Zan Yeh**
Modelling of the effects of climate change on population dynamics of the Taitung spiny lobster, *Panulirus penicillatus*, fishery (S4-8039)

12:05 **Z. Teresa A'mar and Martin W. Dorn**
Management strategy evaluation for the Gulf of Alaska walleye pollock (*Theragra chalcogramma*) fishery: How persistent are the environmental-recruitment links? (S4-8062)

12:20 **Huijie Xue, Stephen Cousins, Lewis S. Incze, Richard Wahle and Andrew C. Thomas**
Connectivity of Lobster Populations in the Gulf of Maine (S4-7973)

12:35 **Anne B. Hollowed, Enrique N. Curchitser and Charles A. Stock**
Modeling fish and shellfish responses to climate change: Trade-offs in model complexity (S4-8144)

12:50 Session Summary

13:05 Session Ends

Saturday, May 19 - S6

Session 6 (S6)

Marine spatial planning and risk management in the context of climate change: The living ocean and coast under changing climate

Co-Convenors:
Adriaan Rijnsdorp (IMARES, The Netherlands)
Christian Möllmann (University of Hamburg, Germany)

Invited Speaker:
John K. Pinnegar (Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory, UK)

Climate change will impact marine ecosystems and their habitats in various ways. Effects will include changed distribution and productivity of marine organisms, connectivity and adaptability of populations as well as overall biodiversity. The different climate-induced changes will have implications for the spatial management of our living resources and marine ecosystems. Especially migratory fish stocks move between management units leading to conflicts between resource users. Hence their dynamics will become more uncertain under climate change, and conservation objectives have to be re-defined or adapted. This session aims to discuss how climate change may affect the human activities on the sea and explore how society can adapt its policies and uses of the marine ecosystem.

Saturday, May 19 (11:00-13:05)

11:00	***Introduction by Convenors***
11:05	**John K. Pinnegar, Stephen R. Dye and Miranda Jones** Marine Protected Areas (MPAs) and climate change – Will the organisms we are trying to protect, still be there in 100 years time? (S6-8057), Invited
11:35	**Gretta T. Pecl, Jemina Stuart-Smith, Dianne Bray, Karen Edyvane, Stewart D. Frusher, Gary Jackson, Natalie Moltschaniwskyj, Melissa Nursey-Bray, Keith Rowling and Peter Walsh** Redmap: An online database and mapping resource for observational marine species data – Marine monitoring, community engagement and collaborative research effort (S6-8120)
11:55	**Thomas A. Okey, Hussein Alidina and Selina Agbayani** A preliminary climate change vulnerability assessment of Canada's Pacific Marine Ecosystems (S6-8301)
12:15	**See-Whan Kang and Ki-Cheon Jun** An overview of impacts and adaptation measures of climate change on seaports (S6-8250)
12:35	**Felipe Briceño, Stewart D. Frusher, Caleb Gardner, Rafael León, Sean R. Tracey, Jeffrey M. Dambacher and Gretta T. Pecl** Exploring the effect of environment and fishing pressure on a key prey/predator interaction: Signals from an 'early warning' fishery within a global hotspot region (S6-8080)
12:55	**David Vousden, Magnus Ngoile and Warwick H.H. Sauer** Building a regional alliance for sustainable science and governance in the Western Indian Ocean large marine ecosystems (S6-7964)
13:15	Session ends

Saturday, May 19 - S10

Session 10 (S10)

Changes in the marine carbon cycle

Co-Convenors:
James Christian (Department of Fisheries and Oceans, Canada)
Kitack Lee (POSTECH, Korea)

Invited Speaker:
Dr. Masao Ishii (Meteorological Research Institute, Japan)

The carbon cycle is the primary mechanism by which ocean processes determine future atmospheric CO_2 concentration and associated climate changes. Ocean acidification affects all marine biota and future ocean carbon fluxes and ocean-atmosphere CO_2 exchange. This session includes presentations on the ocean carbon cycle, its interactions with the biogeochemical cycles of nitrogen and other nutrient elements, and ocean acidification. Processes of interest are ocean-atmosphere exchange, fluxes across the pycnocline, interactions of CO_2 with the carbon cycle that determine the future course of ocean acidification and ocean CO_2 concentration, and acidification impacts on biota.

Saturday, May 19 (11:00-14:00)

11:00	***Introduction by Convenors***
11:05	**Masao Ishii, Takashi Midorikawa, Daisuke Sasano, Naohiro Kosugi, Toshiya Nakano and Hisayuki Y. Inoue** An overview of the ocean CO_2 increase in the western North Pacific subtropical and tropical zones (S10-8179), Invited
11:35	**Pedro M.S. Monteiro and Christopher Sabine** Global Ocean Carbon Observations: Decadal challenges in addressing and understanding global climate and ocean ecosystem change (S10-8312)
11:55	**Samar Khatiwala, Toste Tanhua, Christopher Sabine and Richard A. Feely** Ocean acidification over the industrial era constrained from tracer observations (S10-8177)
12:15	**Jae-Yeon Kim, Dong-Jin Kang, Tongsup Lee and Kyung-Ryul Kim** Decadal trend of carbon dioxide and ocean acidification in the surface water of the Ulleung Basin, the East/Japan Sea (S10-8098)
12:35	**Naoki Yoshie, Naoki Fujii, Xinyu Guo, Tomohiro Komorita and Atsuhiko Isobe** Nutrient and phytoplankton responses to the intrusion of oceanic warm water in the western Seto Inland Sea, Japan (S10-8097)
12:55	**Kyung-Su Kim JeongHee Shim and Suam Kim** Effect of elevated carbon dioxide in seawater on the early life history of olive flounder, *Paralichthys olivaceus* (S10-8206)
13:15	**Olubunmi Ayoola Nubi** Influence of equatorial upwelling on biological productivity in the eastern equatorial Atlantic (S10-7965)
13:35	**Tae-Wook Kim, Raymond G. Najjar and Kitack Lee** Enhanced phytoplankton production in the US east coast due to precipitation containing nitrate (S10-8104)
13:55	Discussion
14:00	Session Ends

Saturday, May 19 - Closing

Closing Plenary Session

14:30	**Keith Alverson and Martin Visbeck** Climate change: Mitigation and adaptation policy (General Plenary-8186)
15:05	**Corinne Le Quere** Summary
15:40	Closing Plenary Session Ends

Sunday, May 20 - W6

Workshop 6 (W6)

Climate change and range shifts in the ocean: Detection, prediction and adaptation

Co-Convenors:
Amanda Bates (University of Tasmania, Australia)
Gretta Pecl (University of Tasmania, Australia)
Stewart Frusher (University of Tasmania, Australia)
Alistair Hobday (CSIRO Marine and Atmospheric Research, Australia)
Warwick Sauer (Rhodes University, South Africa)
David Vousden (UNDP GEF Agulhas and Somali Currents Large Marine Ecosystems Project, South Africa)
Thomas Wernberg (University of Western Australia, Australia)

Invited Speakers:
Alistair Hobday (CSIRO Marine and Atmospheric Research, Australia)
Warwick Sauer (Rhodes University, South Africa)
Thomas Wernberg (University of Western Australia, Australia)

Climate change driven changes in the phenology, distribution and abundance of marine species are being reported around the globe. Distributional changes are the most commonly reported, sometimes involving shifts of 100's of km. Changes in exploited species may subsequently affect the utilization of marine resources, with ramifications that range from fishers' profitability and livelihoods to food security, poverty and social cohesion. Despite this importance, there are currently limitations to the detection and prediction of range shifts. Overcoming these is critical for policy adaptation to manage shifting marine resources in order to enhance food security.

Ocean warming "hotspots", or regions where ocean temperatures are rising most rapidly represent an opportunity to quickly advance our understanding of factors limiting detection of range shifts and to formulate predictions of future changes. We aim to develop of an inter-disciplinary team representing ocean "hotspots" from around the globe to identify knowledge gaps in the detection and prediction of range shifts at different temporal and spatial scales. Adaptation responses to the predicted changes should be robust to uncertainty in both detection and prediction, and shared experience is critical to minimize independent adaptation failures. We also target to identify and further develop effective mechanisms for translating scientific information into active management guidelines and policy for adaptive governance that can respond to ecosystem variation.

The main objective of this 1-day workshop is to lay the groundwork to develop contextually relevant response strategies to ensure sustainable resource use, management and food security by addressing the following three themes:

1. *Detection*: methods to quantify climate driven range extensions and contractions at different time scales;
2. *Prediction*: biological responses in ocean warming "hotspots" that can advance our understanding of likely changes both at hotspots and in a wider set of regions;
3. *Adaptation*: marine resource management, policy and governance responses to species range shifts for present and into the future, and at different spatial scales.

The main outcome of the workshop are expected to be: (1) a conceptual model of mechanisms, consequences and feedbacks involved in species range shifts, outlining critical links between detection, prediction and adaptation (this model will be developed into a publication for a high profile journal such as Nature Climate Change), (2) a workshop report, and (3) a summary article in PICES Press. The outputs from the workshop will be featured on Marine Hotspots website (www.marinehotspots.org).

Sunday, May 20 (09:00-17:30)

09:00	***Introduction by Convenors***
09:10	Participants introduction
09:20	**Thomas Wernberg, Amanda E. Bates, Gretta T. Pecl, Alistair Hobday and Dan Smale** Climate change and range shifts in the ocean, Theme 1: DetectionDetecting species distribution shifts with climate warming to inform adaptation (W6-8108), Invited
09:55	**Alistair Hobday, Gretta T. Pecl, Amanda E. Bates and Jennifer Sunday** Climate change and range shifts in the ocean, Theme 2: PredictionPredicting species' distribution shifts with climate warming: The role of monitoring and modelling in adaptation (W6-8109), Invited
10:30	***Coffee/Tea Break***
11:00	**Warwick H.H. Sauer, Stewart D. Frusher, David Vousden and Renae C. Tobin** Climate change and range shifts in the ocean, Theme 3: Adaptation to species distribution shifts with climate warming: Marine resource management, policy and governance responses for present and into the future (W6-8110), Invited
11:35	Workshop objectives and structure Break-out session 1
12:30	***Lunch***
14:00	Break-out session 2
15:30	***Coffee/Tea Break***
16:00	Full group discussion Action itemization
17:30	Workshop Ends

Sunday, May 20 - W7

Workshop 7 (W7)

Beyond dispersion: Integrating individual-based models for bioenergetics and behavior with biophysical transport models to predict influences of climate change on recruitment processes in marine species

Co-Convenors:
William T. Stockhausen (Alaska Fisheries Science Center, NOAA-Fisheries, USA)
Sukyung Kang (National Fisheries Research and Development Institute, Korea)
Carolina Parada (INPESCA, Chile)

Invited Speakers:
Shin-ichi Ito (Tohoku National Fisheries Research Institute, Japan)
Myron Peck (Institute for Hydrobiology and Fisheries Science, Hamburg, Germany)

Future climate change is expected to influence the abundance and distribution of marine fish species in complex ways, including changes in the local environmental characteristics and transport pathways experienced by early life stages that are typically pelagic, such as eggs and larvae. To date, numerous coupled biophysical models have been developed to study the influence of oceanographic transport patterns on dispersion of early life stages and recruitment variability in marine fish species. In many of these models, advective oceanographic processes are hypothesized to be the main determinant of recruitment variability; simulated individuals in the models are regarded primarily as passive particles or drifters and "success" is judged by the relative number of simulated particles that end up being advected to suitable juvenile nursery grounds. While these models represent an important step in our ability to understand and predict the effects of climate change on recruitment, they ignore important effects (temperature/salinity stress, food availability, etc.) on growth and survival associated with the environmental conditions encountered by the (simulated) individuals along their drift trajectories. While individual-based bioenergetic models can be used to address the impact of local environmental variation on the growth and survival of eggs and larvae, few bioenergetics models have been targeted toward early marine life stages, few coupled biophysical models incorporate bioenergetic considerations, and fewer still have been used to address the potential impact of climate change on marine species.

The objectives of this 1-day workshop are to: (1) stimulate the integration of bioenergetic considerations within coupled biophysical modes by bringing together researchers with expertise in bioenergetic models for early marine life stages and researchers with expertise in coupled biophysical models to facilitate cross-discipline communication; and (2) discuss state-of-the-art techniques and develop guidelines and "best practices" for incorporating individual-based bioenergetics models within existing or future coupled biophysical models to improve the biological realism associated with these latter models.

Anticipated products from the workshop include a workshop report and a white paper on best practices toward integrating bioenergetics considerations into individual-based coupled biophysical models.

Sunday, May 20 (09:00-17:30)

09:00	***Introduction by Convenors***
09:10	**Myron A. Peck, Klaus Huebert, Marc Hufnagl and Joel K. Llopiz** Integrating marine fish physiology, behaviour and physical constraints into early life stage biophysical IBMs: Recent advances and future challenges (W7-8148), Invited
09:40	**Shin-ichi Ito and Takeshi Okunishi** Beyond dispersion: How to model migration of Japanese sardine (*Sardinops melanostictus*) in the western North Pacific (W7-8266), Invited

10:10 **Carolina Parada, Javier Porobic and Sebastián I. Vásquez**
Understanding climate change through the coupling of bioenergetic and biophysical models: A review of the state-of the art, constraints and challenges (W7-8290)

10:40 ***Coffee/Tea Break***

11:10 **Jung Jin Kim, William T. Stockhousen, Yang-Ki Cho, Chang Sin Kim and Suam Kim**
Influence of ontogenetic vertical migration on transport processes of common squid (*Todarodes pacificus*) larvae in the East China Sea using a coupled behavioral-physical model (W7-8258)

11:40 **Sukgeun Jung, Ig-Chan Pang, Joon Ho Lee and Ilsu Choi**
Spatially-explicit, individual-based model for Pacific anchovy in Korean waters (W7-8035)

12:00 **Min-Jung Kim, Seok-Hyun Youn, Jin Yeong Kim and Chul-Woong Oh**
Diet of anchovy *Engraulis japonicus* in the southern coastal waters of Korea (W7-8256)

12:20 **Iskhaq Iskandar, Hideharu Sasaki, Yoshikazu Sasai, Yukio Masumoto and Keisuke Mizuno**
Eddy-induced chlorophyll bloom in the southeastern tropical Indian Ocean during Indian Ocean Dipole event (W7-8199)

12:40 ***Lunch***

14:00 **Sylvain Bonhommeau, Philippe Verley, Gwendoline Andres, Jean-Marc Fromentin, Anne Elise Nieblas and Christophe Lett**
Coupling a particle-tracking model (Ichthyop) and a bio-energetic model (Dynamic Energy Budget theory) to estimate Atlantic bluefin tuna larval survival in the Mediterranean Sea (W7-8185)

14:20 Questions and answers for presenters

15:30 ***Coffee/Tea Break***

16:00 Roundtable Discussion

17:30 Workshop Ends

Schedules
Poster Presentations

S1 Posters

Climate variability versus anthropogenic impacts; analysing their separate and combined effects on long-term physical, biogeochemical and ecological patterns

S1-P1 **Sommart Niemnil, Marc Naeije and Itthi Trisirisatayawong**
Sea surface height variability in the Gulf of Thailand and South China Sea using altimetry data

S1-P2 **Keun-Hyung Choi, Young-Bak Son and Hyung-Ku Kang**
Recent collapse of the copepods in the northern East China Sea: Effects of Three Gorges Dam?

S1-P3 **Vladimir I. Ponomarev, Elena V. Dmitrieva, Vera A. Petrova, Svetlana P. Shkorba, Lubov N. Kuimova and Pavel P. Sherstyankin**
Multiple scale climate variability in the Asian Pacific: Teleconnections and anthropogenic effect

S1-P4 **Viktoria Platonova**
Changes of extreme events in regional climate simulations for Russian Far East

S1-P5 **Sang Heon Lee, SeungHyun Son, Jae-Hyun Lim, Jae-Hoon Noh and Jae-Il Kwon**
Satellite observations of decadal changes in the Japan/East Sea phytoplankton chlorophyll-*a* concentration

S1-P6 **Roksana Jahan and Joong Ki Choi**
Interdecadal variations in phytoplankton communities associated with rapid regional climate change in the Gyeonggi Bay

S2 Posters

Systematic, sustained and integrated global ocean observations

S2-P1 **Qingyang Song and Huaming Yu**
Tidal information of Chinese Seas from altimetric data

S2-P2 **Artem Sarafanov, Anastasia Falina, Herlé Mercier, Alexey Sokov, Pascale Lherminier, Claire Gourcuff, Sergey Gladyshev, Fabienne Gaillard and Nathalie Daniault**
Present-day state of the gyre/overturning circulation at the northern periphery of the Atlantic Ocean: An estimate based on repeat hydrographic measurements and satellite altimetry data

S2-P3 **K. Maneesha and Y. Sadhuram**
Importance of stratification, upper ocean heat content and eddies in the genesis and intensification of storms over Bay of Bengal

S2-P4 **Nadezda M. Vakulskaya**
Analysis of spatio-temporal distributions of ice characteristics in the Bering Sea

S2-P5** *Moved to Oral* **Che Sun and Lin Zhang**
Interannual variability of the Antarctic Circumpolar Current strength based on merged altimeter data

S2-P6 *Cancelled* **Dmitry K. Staritsyn and Polina V. Lobanova**
Features of spatial and temporal sea level variability in the Japan and Okhotsk Seas based on satellite altimeter data

S2-P7 **Hak-Soo Lim, Chang S. Kim, Kwang-Soon Park and Insik Chun**
Operational oceanographic system for the coastal waters of Korea using ROMS

S2-P8 **Igor E. Stepochkin and Pavel A. Salyuk**
Estimation of phytoplankton communities' state from satellite ocean color scanners

S2-P9 **Hyoung Chul Shin, Hyoungsul La and Sung-Ho Kang**
Sea ice records and some limited ocean measurements from a small Antarctic coastal embayment; Trends and implications

S2-P10 **Roksana Jahan, Hyu Chang Choi, Young Seuk Park, Young Cheol Park, Ji Ho Seo and Joong Ki Choi**
Implementation of Self-Organizing Maps (SOM) to analyses of environmental parameters and phytoplankton biomass in a macrotidal estuary and artificial lake

S2-P11 **Oleg A. Bukin, Pavel A. Salyuk and Igor E. Stepochkin**
Reproduction efficiency of dissolved organic matter by phytoplankton cells as the indicator of climate changes influence on the phytoplankton communities' state

S2-P12 **Vladimir A. Krikun, Konstantin S. Kluger and Pavel A. Salyuk**
Analysis of the relationships between chlorophyll *a* and dissolved organic matter (DOM) concentrations depending on type of the DOM

S3 Posters

Projections of climate change impacts on marine ecosystems and their uncertainty

S3-P1 **Aleksey Bobrikov and Shmirko Konstantin**
The role of atmospheric aerosol in temperature field formation in the Primorsky region

S3-P2 **Oleg A. Bukin, Yuri N. Kulchin and Andrey N. Pavlov**
Complex investigation of basic climate-forcing factors in the northwest part of the Pacific Ocean

S3-P3 **Konstantin A. Shmirko and Oleg A. Bukin**
The impact of climate-forcing factors of the north-western Pacific on radiative budget

S3-P4 **Byung Ho Choi, Jin-Hee Yuk and Byung Il Min**
Effects of global warming on the oceanic systems of the northwest Pacific Ocean (S3-8195)

S3-P5 **Inkweon Bang and Kwang-Yul Kim**
Climate change in the northwest Pacific as seen in the SRES A1B simulations of AR4 models

S3-P6** *Moved to Oral* **Tomohiro Yasuda, Yusuke Tanaka, Junichi Ninomiya, Sota Nakajo, Nobuhito Mori and Hajime Mase**
Hindcast and historical assessment of Cyclone Tomas and climate change impact analysis on tropical cyclones in the South Pacific

S3-P7* **Mari S. Myksvoll, Anne D. Sandvik, Lars Asplin and Svein Sundby**
Presented by Svein Sundby on behalf of Mari S. Myksvoll
Impacts of variations in river runoff on coastal cod subpopulations

S3-P8 **Shiro Nishikawa, Yoichi Ishikawa, Shuhei Masuda, Hiromichi Igarashi, Yoshihisa Hiyoshi, Yuji Sasaki, Haruka Nishikawa, Takashi Mochizuki, Shigeki Hosoda, Kanako Sato and Toshiyuki Awaji**
Development of a global 4D-VAR data assimilation and forecast system focusing on climate variability in the North Pacific and use of Argo profiling data: Experiment of 2010–2011

S3-P9 **Sei-Ichi Saitoh, I. Nyoman Radiarta, Yang Liu and Toru Hirawake**
Potential impact of climate variability on Japanese scallop aquaculture in southern Hokkaido, Japan

S4 Posters

Climate change effects on living marine resources: From physics to fish, marine mammals, and seabirds, to fishermen and fishery-dependent communities

S4-P1 **Md. Kawser Ahmed and Shamima Sultana**
Impacts of climate change on the coastal fisheries resources of Bangladesh

S4-P2* **Andrés H. Arias, Carla V. Spetter, Rubén H. Freije and Jorge E. Marcovecchio**
30 years of oceanographic monitoring at the south Atlantic: Highlights of climate change

S4-P3 **Jabeur Chédia**
Role of sea surface temperature and rainfall in the fluctuation of production and abundance of the stock of the common octopus in the East of Tunisia

S4-P4 **S. Kalei Shotwell, Igor M. Belkin and Dana H. Hanselman**
In the path of the polar front: Extracting environmental time series from a large scale oceanographic feature with application to the Alaska sablefish stock assessment

S4-P5 **Wen-Tseng Lo, Hung-Yen Hsieh and Shwu-Feng Yu**
Comparison of siphonophore assemblages under the influence of two different monsoon seasons in the Taiwan Strait, western North Pacific

S4-P6 **Hideaki Kidokoro**
What was the major factor causing the change in the migration pattern of Japanese common squid *Todarodes pacificus* associated with the 1989 regime shift?

S4-P7 **Chang Ik Zhang, Jong Hee Lee, Anne B. Hollowed, Chan Joo Jang and Jae Bong Lee**
An IFRAME approach for estimating exploitable biomass of fish stocks changing climate

S4-P8 **Yeong Gong and Young Sang Suh**
Climate change and fluctuations of pelagic fish populations in the Far-East region

S4-P9* **Alexander V. Zavolokin**
Presented by Elena I. Ustinova on behalf of Alexander V. Zavolokin
Variations in abundance, body size, age, and growth of chum salmon in relation to climate changes and density-dependent interactions

S4-P10 **Hyunju Seo, Sukyung Kang, Yu-xue Qin, Kohei Matsuda and Masahide Kaeriyama**
Long-term variation in the relative abundance and body size of Pacific Salmon, *Oncorhynchus* species

S4-P11 **Dawit Yemane, Janet Coetzee, Carl D. van der Lingen and Nandipha Twatwa**
Modelling the distribution of small pelagic fish species in the Southern Benguela using remotely-sensed data

S4-P12 **Dawit Yemane, Nandipha Twatwa and Janet Coetzee**
The performance of multiple species distribution models in replicating the distribution of small pelagic fish in the Southern Benguela

S4-P13 **Juan P. Zwolinski and David A. Demer**
Fish story repeats itself

S4-P14 **Grace Aroella-Jarvie and Thomas A. Okey**
Expert survey of climate change and marine life: Gulf of California to the Beaufort Sea

S4-P15 **Ming-An Lee, Pei-Yuan Wang, Mu-Tun Tzeng, Yi Chang and Kuo-Wei Lan**
Effects of long-term environment variability on the gray mullet (*Mugil cephalus* L.) abundance in the Taiwan Strait

S4-P16 **Nina Karnovsky, Zachary Brown, Jorg Welcker, Ann Harding, Wojciech Walkusz, Slawomir Kwasniewski, David Grémillet and Alexander Kitaysky**
Arctic auks, advection and oscillations: The impact of climate change on planktivores of the Greenland Sea

S4-P17 **Steve P. Kirkman, Dawit Yemane, W. Herman Oosthuizen, Mike A. Meÿer, Deon Kotze, H. Skrypzeck, F. Vaz Velho and L.G. Underhill**
Going the wrong way? Changes in distribution of the cape fur seal *arctocephalus pusillus pusillus* (southern Africa, 1972-2009)

S4-P18 **Jae Bong Lee, Young Shil Kang, Peter-John Hulson, Chang Ik Zhang, Dong Woo Lee, Yang Jae Im and Hee Yong Kim**
Climate forcing and the Yellow Sea/East China Sea ecosystem

S4-P19 **Chen-Te Tseng, Chi-Lu Sun, Su-Zan Yeh, Shih-Chin Chen, Don-Chung Liu and Wei-Cheng Su**
Influence of oceanographic variability on the spatio-temporal distributions of Pacific saury (*Cololabis saira*)

S4-P20 **Suchana Chavanich, Voranop Viyakarn and Daiki Nomura**
Effect of climate change on feeding preference of Antarctic fish

S4-P21 **Yi-Jay Chang, Chi-Lu Sun, Yong Chen, Su-Zan Yeh and Gerard Dinardo**
Modelling the impacts of environmental variation on the habitat of swordfish, *Xiphias gladius*, in the North Atlantic Ocean

S4-P22 **John G. Ramirez, Gina M. Puentes and Francisco J. Reyes**
A link between the phase-shift Niño-Niña phenomenon and faunistic composition of small scale fisheries in the Colombian Caribbean

S4-P23 **Caroline Brown, Nicole M. Braem, Catherine Moncrieff and Lauren Sill**
Natural indicators and climate change in Emmonak, Alaska

S4-P24 **Nam-Il Won, Kawamura Tomohiko, Hideki Takami and Yoshiro Watanabe**
Climate effects on marine benthic organisms: A case study of an abalone *Haliotis discus hannai* on the Pacific coast of northern Japan

S4-P25 **Andhika Prima Prasetyo, Zhaohui Yin, Hanggar Prasetyo Kadarisman, Setiya Tri Haryuni and Puput Fitri Rachmawati**
Time-lag and EOF analysis for study of environment impact to Purse Seine fisheries in Java Sea

S4-P26 **Haruka Nishikawa, Toshiyuki Awaji, Yoichi Ishikawa, Masafumi Kamachi, Hiromichi Igarashi, Shuhei Masuda, Toshimasa Doi, Shiro Nishikawa, Yoshihisa Hiyoshi, Yuji Sasaki, Takashi Mochizuki, Hiroshi Ishizaki, Yoshikazu Sasai, Hideharu Sasaki, Mitsuo Sakai, Yoshiki Kato and Shin-ichi Sato**
Impact of environmental variability in the Kuroshio Extension on neon flying squid stock

S4-P27 **Heeyong Kim, Dae Hyun Kim and Hak Jin Hwang**
Effect of Siberian High and global warming on the catch fluctuation of pacific cod, *Gadus macrocephalus*, in the Yellow Sea

S4-P28 **Liviu-Daniel Galatchi**
Impacts of climate change on the Black Sea marine and coastal environment

S4-P29 *Cancelled* **Daniel P. Costa, Patrick W. Robinson, Daniel E. Crocker, Louis A. Huckstadt, Samantha E. Simmons, Chandra Goetsch, Kimberly T. Goetz, Jennifer Maresh and Sarah H. Peterson**
Foraging behavior of a widely ranging meso-pelagic top predator, the northern elephant seal

S4-P30 *Cancelled* **Chandra Goetsch, Patrick W. Robinson, Sarah H. Peterson, Greg A. Breed, Sara M. Maxwell, Melinda A. Fowler, Nicole M. Teutschel, Samantha E. Simmons, Daniel E. Crocker and Daniel P. Costa**
The changing face of El Niño: The influence of a strong central pacific El Niño on the foraging behavior of northern elephant seals

S5 Posters

From genes to ecosystems: Genetic and physiological responses to climate change

S5-P1 **Ying Cui, Ying Wu and Jing Zhang**
Trophic strategy of biota in a tropical estuarine ecosystem indicated by fatty acid composition

S5-P2 **Guo Ying Du, Yuxiang Mao and Ik Kyo Chung**
Responses of intertidal microphytobenthos community to environmental factors

S5-P3 **YoonSeok Choi, PyoungJoong Kim, KwangJae Park, JaeHee Song, SangOk Chung, SangPil Yoon and KyoungHo An**
The effect of geochemical characteristics and climate change on the growth of cultured clams at Taean tidal flat on the west coast of Korea

S5-P4 **Jee Eun Lee, Sang-Rae Lee, Jung Hyun Oak, Jin Ae Lee and Ik Kyo Chung**
Dynamic feature of eukaryotic plankton biodiversity in the Nakdong River system, Korea

S5-P5 **Ju-Hyoung Kim, Eun Ju Kang, Kwang Young Kim and Kitack Lee**
Impact of ocean acidification on five species of macroalgae

S5-P6 **David I. Kline, Lida Teneva, Kenneth Schneider, Thomas Miard, Aaron Chai, Malcolm Marker, Jack Silverman, Ken Caldeira, Brad Opdyke, Rob Dunbar, B. Greg Mitchell, Sophie Dove and Ove Hoegh-Guldberg**
A 6-month *in situ* ocean acidification experiment at Heron Island

S5-P7 **Ah-Ra Ko, Se-Jong Ju, Moonkoo Kim, Seok-Gwan Choi and Kyung-Hoon Shin**
Developing a biochemical index to track physiological adaptations of cetaceans to environmental changes

S5-P8 **Se-Joo Kim and Se-Jong Ju**
Gene expression of cytochrome P450 in *Euplotes crassus* (Ciliophora, Hypotrichida) under conditions of ocean acidification: Lab trial

S5-P9 **Jennifer Sunday, Amanda E. Bates and Nicholas K. Dulvy**
Marine species' latitudinal distributions conform better to their thermal tolerance than terrestrial species: Implications for range shifts

S5-P10 **Jin Yeong Kim, HaeYoung Moon Lee, Mun-Seong Choi and Sungchul C. Bai**
Evaluation of fatty acids as trophic indicators for the anchovy population in the southern coastal waters of Korea

S6 Posters

Marine spatial planning and risk management in the context of climate change: The living ocean and coast under changing climate

S6-P1 **Alexandra Temnykh, Victor Melnikov, Yuriy Tokarev and Mikhail Silakov**
State of plankton community of the Zernov's Phyllophora Field (Black Sea) in 2010-2011

S6-P2 **Vaughan Ituk**
Cancelled Responses to climate change: Past, present, and future

S6-P3* **Vitaly I. Sychev and Dmitri A. Petrenko**
Presented by Dmitri A. Petrenko on behalf of Vitaly I. Sychev
Spaceborne investigation of the long-term variations of primary productivity and sea ice conditions in the Arctic Basin

S7 Posters

Coastal and low-lying areas

S7-P1 **Md. Kawser Ahmed and Shamima Sultana**
Adaptation strategies in coping with the impacts of global climate change on the coastal environment and resources of Bangladesh

S7-P2* **Hyun-Min Eom, KiRyong Kang, Sang Boom Ryoo and Yong Hee Lee**
Co-Authors are not participating in the Symposium
A numerical simulation of storm surge and coastal inundation under the future climate condition

S7-P3* **Maksim Gulin, Kateryna Ivanova, Vitaly Timofeev and Mikhail Kovalenko**
Presented by Kateryna Ivanova on behalf of Maksim Gulin
Black Sea hot-spot environments and ecosystems: Future of deltas and riverbeds flooded by sea

S8 Posters

Trend and impacts of de-oxygenation in oceanic and coastal ecosystems

S8-P1* **Svetlana Pakhomova, Evgeny Yakushev, Hans Fredrik Veiteberg Braaten, Jens Skei and Kai Sørenson**
Presented by Evgeny Yakushev on behalf of Svetlana Pakhomova
Oxygen intrusions into anoxic fjords: Positive and negative effects

S8-P2** *Moved to Oral* **Pavel Tishchenko, Vyacheslav B. Lobanov, Tatyana Mikhajlik, Pavel Semkin, Alexander Sergeev, Petr Tishchenko and Vladimir Zvalinsky**
Presented by Vyacheslav Lobanov on behalf of Pavel Tishchenko
Seasonal hypoxia of Amurskiy Bay (Japan/East Sea)

S8-P3 **Daisuke Sasano, Masao Ishii, Takashi Midorikawa, Yusuke Takatani, Toshiya Nakano, Takayuki Tokieda and Hitomi Kamiya**
Oxygen decrease in the western Pacific along 165°E

S8-P4 **Mi Jin Kim, Se-Jong Ju, Chan Min Yoo and Jung-Ho Hyun**
Understanding the role of bacteria in the oxygen minimum zone (OMZ) in the carbon cycle

S8-P5 **Kateryna Ivanova, Maksim Gulin and Vitaly Timofeev**
Black Sea Holocene gas seeps as hot-spot environments with opposing natural properties: Zoobenthos high-activity and strong hypoxia coupled by H_2S contamination

S9 Posters

Marine tipping points in the earth system

S9-P1 **Marcos Llope, Thorsten Blenckner, Christian Möllmann, Michele Casini and Nils Chr. Stenseth**
The Baltic Sea regime shift, can it flip back?

S9-P2 **Olga Trusenkova and Dmitry D. Kaplunenko**
East-west regime shifts in the Japan/East Sea

S9-P3 **Dawit Yemane, Yohannes Itembu, Steve P. Kirkman, Bjorn Axelsen and Toufiek Samaai**
Investigation of common temporal trends in the major demersal fish populations in the Benguela Current Large Marine Ecosystem, 1985-2010

S9-P4 **Jin-Soo Kim, Kwang-Yul Kim and Sang-Wook Yeh**
El Niño change associated with subsurface ocean in greenhouse gas forcing scenarios

S10 Posters

Changes in the marine carbon cycle

S10-P1 **Dmitri A. Petrenko, E. Zabolotskih, D. Pozdnyakov and Vitaly I. Sychev**
Quantitative estimation of an annual inorganic carbon production in the Arctic Ocean by coccolithophore during 1998-2010 from synergistic remote sensing data

S10-P2* **Pavel Tishchenko, Galina Pavlova and Elena Shkirnikova**
Presented by Vyacheslav Lobanov on behalf of Pavel Tishchenko
Total alkalinity and calcium of the Japan/East Sea

S10-P3 **L.K. Sahu, S. Lal and S. Venkataramani**
Change in oceanic emissions of light alkenes due to monsoon circulations over northern Indian Ocean

S10-P4 **Yeon Jee Suh, Sangmin Hyun and Chan Hong Park**
Preliminary study on sedimentary organic matter variations in the East/Japan Sea

S10-P5 **Sangmin Hyun and Irino Tomohisa**
Paleoclimate and paleoceanographic variations based on foraminiferal isotope study in shelf sediment of the East/Japan Sea, Korea

General Session (GP) Posters

GP-P1 **Vladimir V. Plotnikov and Evgeniy M. Semenova**
Change of seasonal rhythms of ice processes by the Peter the Great Bay (Japan Sea) in the second half of the 20th - beginning of the 21st centuries

GP-P2 **Victoriia Saklakova and Pavel A. Salyuk**
Influence of Asian dust storms on the state of phytoplankton communities

GP-P3 **Keunyong Kim, Byung Ju Gong, Ju-Hyoung Kim and Kwang Young Kim**
The fate of floating macroalgal bloom in Yellow Sea during late July of 2011

GP-P4 **Olga Skaberda, Lubov Vasilevskaya and Viktoria Platonova**
Investigation of interactions between temperature and precipitation on Kamchatka Peninsula

GP-P5 **Mª Luz Fernández de Puelles, Laura Vicente and Valle Macias**
Cancelled Summer and winter zooplankton abundance and biodiversity in two oligotrophic areas of the Central Western Mediterranean Sea

GP-P6 **Dominic O. Odulate, Waheed O. Abdul and Yemi Akegbejo-Samsons**
Influence of ocean water quality on diversity of marine fauna resources in the Gulf of Guinea, off Ogun State Southwest Nigeria

GP-P7 **Gyung-Soo Park**
Preliminary plans of marine biodome for the studies of climate change and ecosystem management in Korea

GP-P8 **Alexander Turra, Ângelo F. Bernardino, A. Cecília Z. Amaral, Flavio A.S. Berchez, Joel C. Creed, Margareth S. Copertino, Ricardo Coutinho and Yara Schaeffer-Novelli**
Evaluating the effect of climate changes on marine biodiversity: The ReBentos (Network for Monitoring Coastal Benthic Habitats) initiative in Brazil

GP-P9* **Talgat R. Kilmatov**
The model of catastrophe theory to apply to the possible climatic trends

GP-P10 **Irina A. Golik and Pavel A. Salyuk**
Analysis of tropical cyclones influence on phytoplankton communities in the North-western Pacific in 2002-2011 on the basis of satellite ocean color data

GP-P11 **Gwang-Ho Seo, Yang-Ki Cho and Byoung-Ju Choi**
Seasonal and inter-annual variation of volume and heat transport in the Northwest Pacific marginal seas based on high resolution regional reanalysis

GP-P12 **Mi Hee Chung, Seok-Hyun Youn and Minjung Kim**
Temporal and spatial variation of phytoplankton communities in the Nakdong River, estuary and coastal areas

GP-P13* **Hyun-Ki Hong, Hyun-Sil Kang, Hee-Do Jeung, Hee-Jung Lee, Arumi Park and Kwang-Sik Choi**
Effect of air exposure on hemocyte parameters of abalone *Sulculus diversicolor supertexta* from Jeju Island, Republic of Korea

GP-P14* **Hyun-Sil Kang, Jee-Yeon Lee, Hyun-Ki Hong, Young-Ok Kim and Kwang-Sik Choi**
Molecular diagnostics of the ovarian parasite *Marteilioides chungmuensis* in wild Pacific oysters *Crassostrea gigas* on the south coast of Korea

GP-P15* **Mostafizur Rahman Mondol, Hyun-Ki Hong, Areumi Park, Heung-Sik Park, Won Joon Shim and Kwang-Sik Choi**
Impacts of *Hebei Spirit* oil spill on wild Pacific oyster, *Crassostrea gigas*, two years after the accident in Taean, Korea

W2 Posters

Climate change projections for marine ecosystems: Best practice, limitations and interpretations

W2-P1 **Alexey V. Golikov, Rushan M. Sabirov, Pavel A. Lubin and Lis L. Jørgensen**
Changes in Structure of Teuthocenosis (Cephalopoda) of the Arctic due to climatic changes of the last decades

W6 Posters

Climate change and range shifts in the ocean: Detection, prediction and adaptation

W6-P1 **Alexandra H. Campbell, Ezequiel M. Marzinelli, Tamsin A. Peters, Rebecca Neumann and Peter D. Steinberg**
Climate-mediated diseases affecting habitat-forming seaweeds: Complex environmental effects on hosts and pathogens

W6-P2 **Sukgeun Jung and Ilsu Choi**
Latitudinal shifts in catch distribution of fisheries species in Korean waters during the past 30 years in relation to climate change

W6-P3 **John K. Pinnegar, Georg H. Engelhard and Tina Kerby**
Range shifts in the North Sea: Why is life so complicated?

W6-P4 **Hans-Juergen Hirche, Michael Karcher and Ksenia N. Kosobokova**
The future of Arctic zooplankton: Interplay between advection, life history traits and trophodynamics

W6-P5 **Corinne Pomerleau, Gesche Winkler, Akash R. Sastri, R. John Nelson, Svein Vagle, Véronique Lesage and Steven H. Ferguson**
Spatial patterns in zooplankton communities across the eastern Canadian sub-Arctic and Arctic waters: Insights from stable carbon (δ13C) and nitrogen (δ15N) isotope ratios

W6-P6 **Edmo J.D. Campos**
Changes in the South Atlantic-Indian Ocean super-gyre due to poleward shift of the southern hemisphere westerlies

W6-P7 **Paul R. Lyon**
Risk-based approach to manage the impacts of climate change on Canada's aquatic resources

W6-P8 **Amina H. Khan, ElisabethLevac and Gail L. Chmura**
Potential impact of global warming on ranges of commercial fish species in the Northwest Atlantic