International Symposium

Climate Change Effects on Fish and Fisheries:

Forecasting Impacts, Assessing Ecosystem Responses, and Evaluating Management Strategies

April 25 – 29, 2010
Sendai, Japan

Table of Contents

Abstracts for oral presentations are sorted first by session 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 welcome you to the beautiful city of Sendai for the International Symposium on "*Climate Change Effects on Fish and Fisheries: Forecasting Impacts, Assessing Ecosystem Responses, and Evaluating Management Strategies*".

The Symposium is providing an opportunity for scientists and policymakers to discuss the potential impacts of climate change on marine ecosystems and our uses of these ecosystems, and to consider strategies that society can take to be prepared for anticipated impacts on fish and fisheries. Response to this event has exceeded our expectations, with more than 350 abstracts submitted by scientists from over 40 countries. The Symposium is arranged around ten theme sessions, with six workshops preceding the meeting. These sessions and workshops encompass a broad range of topics that will provide a global perspective on climate change and the future of the World's fisheries.

This event is the culmination of the planning and preparation of many individuals and organizations. It was made possible by your participation, by the hard work of the local organizers and professionals at the PICES and ICES Secretariats, and by the generous financial support from our sponsors. Without the funds that these organizations entrusted to us, it would have been impossible to achieve our aim of convening a symposium of global scope. We also extend our sincere thanks to all session and workshop convenors, and members of the ICES/PICES Working Group on *Forecasting Climate Change Impacts on Fish and Shellfish* (WGFCCIFS) for their efforts and valuable advice that resulted in an exciting scientific program.

During this week, you will have the opportunity to immerse yourself in the issues, challenges and science of climate change and its influence on marine ecosystems. We anticipate that history will remember this Symposium and its key results as a turning point in addressing the consequences and implications of climate change on fish and fisheries.

We hope our meeting in Sendai will be productive, intellectually rewarding, and we look forward to hearing your ideas and including them in a Symposium proceedings. Enjoy the Symposium!

Anne B. Hollowed, Manuel Barange, Shin-ichi Ito, Suam Kim and Harald Loeng
Symposium convenors

Organizers and Sponsors

Symposium Convenors

Anne Hollowed (Alaska Fisheries Science Center, NMFS/NOAA, USA)
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The Japanese Society of Fisheries Science (JSFS)
The Oceanography Society of Japan (JOS)

Symposium Timetable

Sunday, April 25					
09:00 17:30	**Workshop W1** (*Room 7, 3F*) 13:00 **Workshop W6** (*Room 7, 3F*)	**Workshop W2** (*Room 2, 1F*)	**Workshop W3** (*Room 6, 3F*)	**Workshop W4** (*Room 1, 1F*)	**Workshop W5** (*Room 4, 2F*)
Monday, April 26					
OPENING SESSION (*Tachibana Hall, 2F*)					
08:30	Welcome address on behalf of Symposium convenors				
08:40	Welcome address on behalf of the host country				
08:50	Notes from the Local Organizing Committee				
08:55 10:40	**Day 1 Plenary Session** (*Tachibana Hall, 2F*)				
11:00 13:00	**Theme Session P1-D1** (*Tachibana Hall, 2F*)			**Theme Session P2** (*Hagi Hall, 2F*)	
14:30 18:30	**Theme Session P1-D1** (*Tachibana Hall, 2F*)			**Theme Session A2** (*Hagi Hall, 2F*)	
19:30 21:30	**Welcome Reception** (*Ballroom of Sendai Excel Hotel Tokyu*)				
Tuesday, April 27					
09:00 13:20	**Theme Session B1** (*Tachibana Hall, 2F*)			**Theme Session A2** (*Hagi Hall, 2F*)	
14:30 18:30	**Theme Session B1** (*Tachibana Hall, 2F*)			**Theme Session A1** (*Hagi Hall, 2F*)	
18:30 20:30	**Poster Session** (*Sakura Hall, 2F*)				
Wednesday, April 28					
09:00 13:15	**Theme Session C1** (*Tachibana Hall, 2F*)			**Theme Session B2** (*Hagi Hall, 2F*)	
14:30 18:30	**Theme Session C2** (*Tachibana Hall, 2F*)			**Theme Session D2** (*Hagi Hall, 2F*)	
18:30 20:30	**Poster Session** (*Sakura Hall, 2F*)				
Thursday, April 29					
09:00 12:00	**Day 4 Plenary Session P3** (*Tachibana Hall, 2F*)				
CLOSING SESSION (*Tachibana Hall, 2F*)					
12:00	Outcomes from the Symposium by Dr. Steven Murawski				
12:20	Comments from the audience				
12:40	Best Presentations Awards				
12:50 13:00	Closing remarks by Symposium convenors				

All Sessions and Workshops will be held at the Sendai International Center.

List of Sessions and Workshops

P1-D1	Forecasting impacts: From climate to fish
P2	Forecasting impacts: From fish to markets
P3	Sustainable strategies in a warming climate
A1	Downscaling variables from global models
A2	Species-specific responses: Changes in growth, reproductive success, mortality, spatial distribution, and adaptation
B1	Assessing ecosystem responses: Impacts on community structure, biodiversity, energy flow and carrying capacity
B2	Comparing responses to climate variability among nearshore, shelf and oceanic regions
C1	Impacts on fisheries and coastal communities
C2	Evaluating human responses, management strategies and economic implications
D2	Contemporary and next generation climate and oceanographic models, technical advances and new approaches
GP	General Poster Session
W1	Reducing global and national vulnerability to climate change in the fisheries sectors: Policy perspectives post Copenhagen
W2	Potential impacts of ocean acidification on marine ecosystems and fisheries
W3	Coupled climate-to-fish-to-fishers models for understanding mechanisms underlying low frequency fluctuations in small pelagic fish and projecting its future
W4	Salmon workshop on climate change
W5	Networking across global marine “hotspots”
W6	Examining the linkages between physics and fish: How do zooplankton and krill data sets improve our understanding of the impacts of climate change on fisheries?

Notes for Guidance

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 Sakura Room from 12:00 on April 27. Two evening poster sessions (with appetizers and drinks) will be held from 18:30-20:30 on April 27 and 28, when poster presenters are expected to be available to answer questions. Posters must be removed at the end of the poster session on the evening of April 28.

Internet access

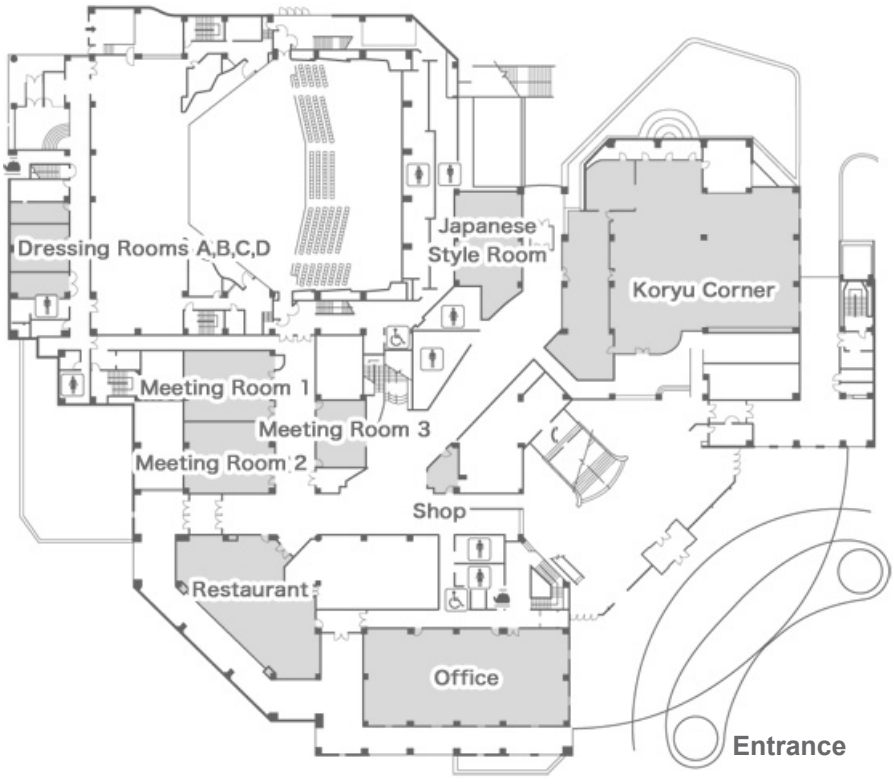
Internet access via wireless LAN will be available at the Sendai International Center. A few desktop computers will also be available for participants.

Social activities

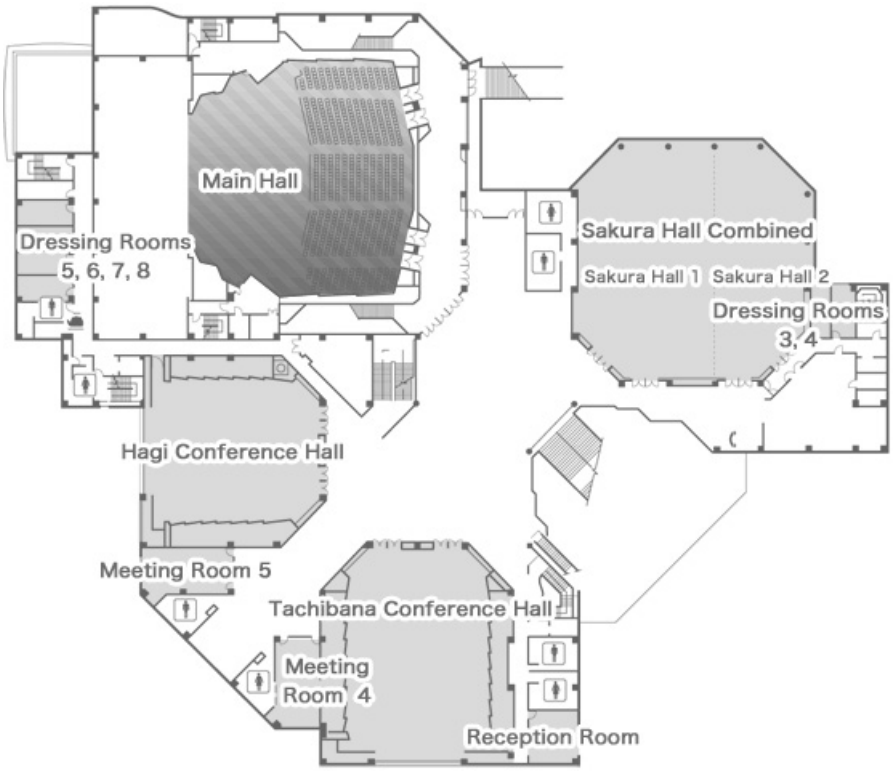
The Welcome Reception for all participants will be held on April 26 from 19:30-21:30 at the Ballroom of Sendai Excel Hotel Tokyu.

Sendai International Center Floor Plan

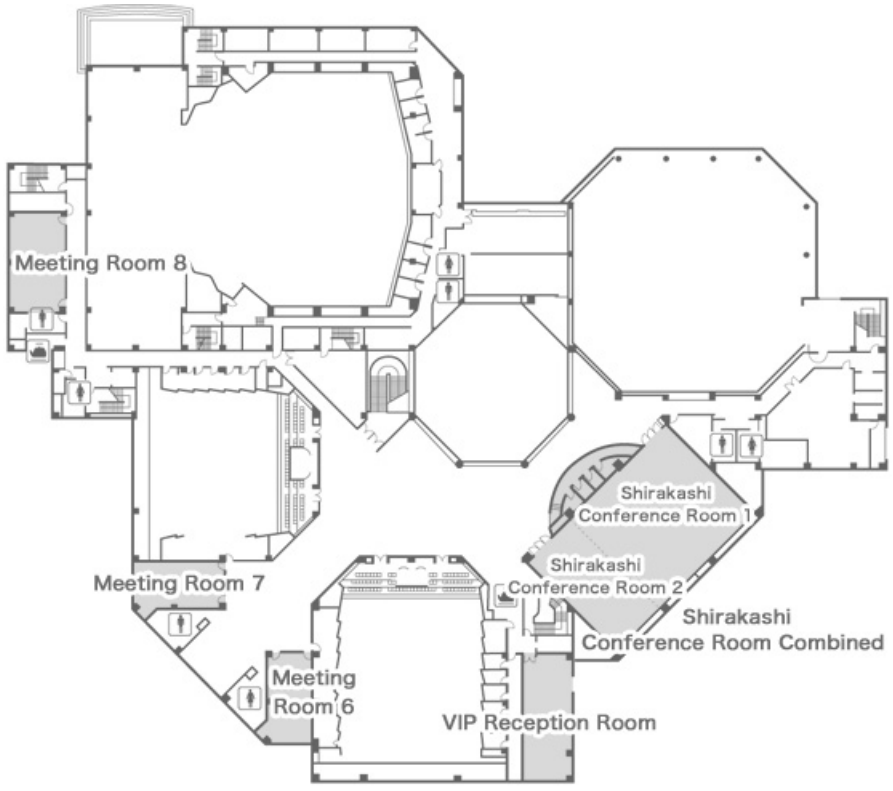
First Floor (1F)



Second Floor (2F)



Third Floor (3F)



Schedules

Day 1 Plenary

Monday, April 26 (8:55-10:40)

8:55	**Kevin E. Trenberth** The Earth's climate system: Variability and change (Plenary-6063)
9:25	**Akihiko Yatsu** Effects of climate change on marine ecosystems around Japan: Implications for sustainable fisheries (Plenary-6127)
9:50	**Ussif Rashid Sumaila and William L. Cheung** Cost of adapting global marine fisheries to climate change (Plenary-6029)
10:15	**Edward H. Allison** Climate change in perspective: The global drivers of change in fisheries (Plenary-6413)
10:40	***Coffee/Tea Break***
11:00	Session ends

P1-D1 Forecasting impacts: From climate to fish

Co-Convenors:
Kenneth Drinkwater (Institute of Marine Research, Norway)
Harald Loeng (Institute of Marine Research, Norway)
Yasuhiro Yamanaka (Hokkaido University, Japan)
Franz J. Mueter (School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, USA)
Carl O'Brien (Centre for Environment, Fisheries and Aquaculture Science, UK)

This session will focus on the impacts of future climate change on the physical oceanography, biogeochemistry, and food webs of the world oceans. This includes contributions on appropriate methods for determining impact projections and estimating levels of uncertainty as well as actual development of ecosystem scenarios. Presentations will address downscaling from global models and the problems involved to produce regional future climate and physical oceanographic scenarios, scenarios of climate-induced changes in nutrient dynamics and other biogeochemical processes, changes in ecosystem community structure and function from phytoplankton and zooplankton through to fish populations, including changes in production and distribution and their influence upon biodiversity.

Monday, April 26 (11:00-18:30)

11:00	**James E. Overland, Andrew Bakun, Jürgen Alheit, James Hurrell, David Mackas and Arthur Miller (*presented by Nicholas Bond*)** Match/mismatch of fish population changes to climate events (P1-D1-6045)
11:15	**Chan Joo Jang and Sinjae Yoo** Change in the North Pacific mixed layer depth and its impact on primary production in a warming world (P1-D1-6315)
11:30	**William L. Cheung, John P. Dunne, Jorge Sarmiento and Daniel Pauly** Integrating eco-physiology and plankton dynamics into projected global changes in marine biodiversity and maximum catch potential under climate change (P1-D1-6105)
11:45	**Teruhisa Komatsu, Masahiro Fukuda, Atsuko Mikami, Yutaka Kokubu, Shizuha Mizuno, Hideaki Tanoue and Michio Kawamiya** Possible change in distribution of seaweed, *Sargassum horneri*, in East Asia under A2 scenario of global warming and its impact on fishes (P1-D1-6089)
12:00	**Stewart Frusher, Gretta Pecl, Caleb Gardner, Marcus Haward, Alistair J. Hobday, Sarah Jennings, Melissa Nursey-Bray, André E. Punt, Hilary Revill and Ingrid van Putten** Fisheries and ecosystems in a changing climate: A case study on the Tasmanian east coast lobster fishery (P1-D1-6313)
12:15	**George L. Hunt, Jr., Lisa B. Eisner, Edward W. Farley, Jamal H. Moss, Jeffrey M. Napp and Phyllis J. Stabeno** The oscillating control hypothesis: Reassessment in view of new information from the eastern Bering Sea (P1-D1-6036)
12:30 (*Cancelled*)	**Martin Huret, Pierre Petitgas and Caroline Struski (*Cancelled*)** The response of fish populations to climate change forecasted by integrating a sequence of models over different life stages: Anchovy in the Bay of Biscay (P1-D1-6364)
12:30	**Roy Mendelssohn (presented by Frank Shwing)** State-space analysis of ocean and atmospheric data for use in forecasting ecological impacts of climate change (P1-D1-6387)
12:45	***Lunch***

14:30 **Myron A. Peck, Patricia Reglero, Motomitsu Takahashi and Ignacio A. Catalán**
Life cycle ecophysiology of small pelagic fish: Environmental thresholds and climate-driven changes in populations (P1-D1-6292)

14:45 (*Cancelled*) **Dawit Yemane, Nandipha M. Twatwa and Janet C. Coetzee**
Performance of multiple approaches in modelling small pelagic fish distribution: Predictive ability in the light of climate change (P1-D1-6141)

14:45 **Jonathan A. Hare, Mark J. Wuenschel and Matthew E. Kimball**
Larval dispersal, overwinter mortality, and climate change: Forecasting range shifts of a sub-tropical fish species in a western boundary current system (P1-D1-6195)

15:00 **Pierre Fréon, David M. Checkley, Jr. and Francisco E. Werner**
Climate change and small pelagic fish: A review and recommendations (P1-D1-6308)

15:15 **Solfrid Sætre Hjøllo, Geir Huse, Morten D. Skogen and Einar Svendsen**
Modeling secondary production in the Norwegian Sea with a fully coupled physical-primary-secondary production model system (P1-D1-6349)

15:30 **Shin-ichi Ito, Takeshi Okunishi, Michio J. Kishi and Muyin Wang**
Potential impact of climate change on Pacific saury (P1-D1-6266)

15:45 **Kenneth A. Rose, Enrique N. Curchitser, Kate Hedström, Jerome Fiechter, Miguel Bernal, Shin-ichi Ito, Salvador Lluch-Cota, Bernard A. Megrey, Christopher A. Edwards, David M. Checkley, Jr., Alec MacCall, Tony Koslow, Sam McClatchie, Kenneth L. Denman and Francisco E. Werner**
Development of a climate-to-fish-to-fishers model: Proof-of-principle using long-term population dynamics of anchovies and sardines in the California Current (P1-D1-6106)

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

16:20 **Randall M. Peterman (Invited)**
Uncertainties about climatic change and Pacific salmon: Risk assessment, risk communication, and risk management (P1-D1-6052)

16:45 **Anna Gardmark, Stefan Neuenfeldt, Martin Lindegren, Thorsten Blenckner, Eero Aro, Outi Heikinheimo, Bärbel Müller-Karulis, Susa Niiranen, Maciej Tomczak, Anieke van Leeuwen, Anders Wikström and Christian Möllmann**
Biological ensemble modelling of climate impacts – Improving fisheries science and management by accounting for uncertainty (P1-D1-6301)

17:00 **Franz J. Mueter, Nicholas A. Bond, Anne B. Hollowed, Carol Ladd and Enrique N. Curchitser**
Future recruitment of Bering Sea walleye pollock. Part I: Retrospective patterns and uncertainty (P1-D1-6214)

17:15 **Nicholas A. Bond, Franz J. Mueter, Anne B. Hollowed, Carol Ladd and Muyin Wang**
Future recruitment of Bering Sea walleye pollock. Part II: Ranges in key environmental parameters from global climate model forecasts (P1-D1-6068)

17:30 **Hiroshi Yoshinari, Tomonori Azumaya, Tetsuichiro Funamoto, Akira Kusaka, Orio Yamamura and Akira Nishimura**
Numerical simulations of spatio-temporal distribution of juvenile walleye pollock around Hidaka Bay (P1-D1-6183)

17:45 **Jon Brodziak, Kevin Piner and Dean Courtney**
Modeling recruitment responses of striped marlin (*Tetrapturus audax*) and swordfish (*Xiphias gladius*) to environmental variability in the North Pacific (P1-D1-6396)

18:00 **Kerim Aydin, Nicholas A. Bond, Enrique N. Curchitser, Georgina A. Gibson, Kate Hedström, Albert J. Hermann and Ivonne Ortiz**
Integrating data, fieldwork, and models into an ecosystem-level forecasting synthesis: The modeling challenge of the Bering Ecosystem Study/Bering Sea Integrated Research Program (BEST-BSIERP) (P1-D1-6215)

18:15 **Julia L. Blanchard, Nicholas K. Dulvy, Robert Holmes, Manuel Barange and Simon Jennings**
Potential climate change impacts on fish production from 20 large marine ecosystems around the world (P1-D1-6275)

18:30 Session ends

Posters

P1-D1-5977 **Nkemasong Samuel Acha and Thomas Tazoche Njang**
The ramification of climate change on aquaculture production in Cameroon

P1-D1-6024 (*Cancelled*) **Hao Wei, Yuheng Wang, Liang Zhao and Michio J. Kishi (*Cancelled*)**
A study of climate impacts on anchovy population dynamics in the Yellow Sea by individual-based model

P1-D1-6074 (*Cancelled*) **Andrei S. Krovnin, Boris Kotenev, Mikhail Bondarenko and Anatoly Morozov (*Cancelled*)**
Factors determining dynamics of highly variable fish stocks and possibilities of its long-range forecasting (taking Northeast Arctic cod as an example)

P1-D1-6075 (*Cancelled*) **Andrei S. Krovnin, Nataliya Klovach and George Moury (*Cancelled*)**
The climatic causes of recent rise of Asian salmon catches and its prospects

P1-D1-6076 **Tatyana V. Belonenko and Aleksey V. Koldunov**
The North-Atlantic Oscillation and biotical cycles within the Azores region

P1-D1-6102 **Camille Albouy, François Le Loc'h, Jean M. Culioli and David Mouillot**
Global warming effects on a Mediterranean ecosystem: A trophic modeling approach on the Bonifacio Straits Natural Reserve (Corsica, France)

P1-D1-6103 **Dmitry K. Staritsyn**
Current divergences and enhanced biological production zones in the Japan Sea according to satellite observations

P1-D1-6114 (*Cancelled*) **M. Aaron MacNeil (*Cancelled*)**
Ignorant academic or a sage fool? Using prior beliefs to forecast climate effects on reef fish communities

P1-D1-6126 **Andrey A. Smirnov, Alexey V. Vakatov and Alexander L. Figurkin**
Changes of increase growth rates and fecundity of the Gizhiga-Kamchatka herring (*Clupea pallasii* Valenciennes, 1847), living in a northeast part of Sea of Okhotsk in connection with fluctuations of a water temperature benthic layer around their wintering grounds

P1-D1-6151 **Alistair J. Hobday, Jason R. Hartog, Richard Matear, Claire M. Spillman and Oscar Alves**
Predicting tuna habitat for spatial fisheries management using electronic tags and ocean models

P1-D1-6176 **Mega Laksmini Syamsuddin, Sei-ichi Saitoh, Samsul Bachri and Agung Budi Harto**
Regional climate change impacts on bigeye tuna (*Thunnus obesus*) catch in the Indonesian Seas

P1-D1-6184 **Ichiro Yasuda, Satoshi Osafune, Shunsuke Konda, Sachihiko Itoh and Hiroyasu Hasumi**
18.6-year period moon-tidal cycle in ocean/climate and its impact on climate/ecosystem predictability

P1-D1-6189 **Chih-Chieh Hsu, Chih-Wei Chang, Chia-Hui Wang, Yuan-Mou Chang, Chen-Feng You and Wann-Nian Tzeng**
The fluctuations of solar activity on catch data of mullet and eel

P1-D1-6195 **Jonathan A. Hare, Mark J. Wuenschel and Matthew E. Kimball**
Larval dispersal, overwinter mortality, and climate change: Forecasting range shifts of a sub-tropical fish species in a western boundary current system

P1-D1-6199 **Joe Scutt Phillips, Graham M. Pilling, Lisa J. Readdy, John K. Pinnegar and Nicholas K. Dulvy**
Do we know the potential impacts of global climate change on fishing nations?

P1-D1-6208 **Trond Kristiansen and Kenneth Drinkwater**
Analyzing warm and cold climate phases to understand differences in survival and connectivity of larval cod: Possible implications for climate change

P1-D1-6221 **Thomas Wilderbuer, Nicholas A. Bond and William Stockhausen**
An example of estimating future Bering Sea northern rock sole productivity from statistical downscaled IPCC models and its effect on management

P1-D1-6263 **Shengyun Yang and Qiulin Zhou**
The impact of climate change on the fishery ecosystems in the Taiwan Strait and their responses

P1-D1-6272 (*Cancelled*) **Arnaud Bertrand, Michael Ballón and Alexis Chaigneau (*Cancelled*)**
Acoustic observation of living organisms reveals the oxygen minimum zone

P1-D1-6283 **Marc Hufnagl, Myron A. Peck, Mark Dickey-Collas, Richard D.M. Nash and Thomas Pohlmann**
Climate-driven, bottom-up control of North Sea herring recruitment

P1-D1-6289 **Yumiko Yara, Masahiko Fujii, Yasuhiro Yamanaka, Naosuke Okada, Hiroya Yamano and Kazuhiro Oshima**
Projected effects of global warming on corals in seas close to Japan

P1-D1-6354 (*Cancelled*) **Miguel Ñiquen, Marilou Bouchon and Milena Arias-Schreiber (*Cancelled*)**
Extreme climatic events and the dynamics of the Peruvian small pelagic fish environment

P1-D1-6380 **Sukyung Kang, Jae Bong Lee, Anne B. Hollowed, Nicholas A. Bond and Suam Kim**
The impact of climate changes on the distribution and abundance of mackerel in the northwestern Pacific

P1-D1-6383 **Franklin B. Schwing, Roy Mendelssohn and Steven J. Bograd**
An assessment of regime shifts in North Pacific ecosystems

P1-D1-6389 **Francisco Beltran, Bruno Sanso, Ricardo Lemos and Roy Mendelssohn**
Indices of temporal variability in North Pacific SST from IPCC model future climate scenarios: A hierarchical Bayesian analysis

P2 Forecasting impacts: From fish to markets

Co-Convenors:
Manuel Barange (GLOBEC International Project Office)
Jacquelynne King (Pacific Biological Station, DFO, Canada)
Ian Perry (Pacific Biological Station, DFO, Canada)

Climate change direct impacts on marine populations will alter the provision of food from our oceans to our markets. At the same time, the on-going process of economic globalization will modify or exacerbate the vulnerability of fish production systems to climate change at global, regional and local level. Policy and management agencies will require scientific advice on the potential impacts that climate change (and its associated economic developments) will have on the availability of fish populations to fisheries, markets and consumers. This session will focus on (1) forecasting changes in marine population dynamics as they relate to fisheries (*e.g.*, impacts on catchability or maximum sustainable yield), to processing and market demands (*e.g.*, changes in size-at-age), to market forces (*e.g.*, changes in price and trade) and to food security (*e.g.*, collective vulnerability analysis); (2) quantifying the uncertainty of these forecasts in risk assessment frameworks useful to resource managers; and (3) exploring the interactivity between the ecosystem and market dynamics.

Monday, April 26 (11:00-13:00)

11:00	**Gorka Merino, Manuel Barange, Christian Mullon, Robert Holmes, Julia L. Blanchard and Lynda Rodwell** Global environmental change scenarios for the world's small pelagic fisheries and global fishmeal and oil markets (P2-6119)
11:15	**Gakushi Ishimura, Samuel Herrick and Ussif Rashid Sumaila** Can there be stable, cooperative exploitation of a transboundary fish stock under climate variability? A game analysis on the Pacific sardine fishery in the California Current (P2-6290)
11:30	**Timothy Pickering, Ben Ponia, Cathy Hair, Paul Southgate, Elvira S. Poloczanska, Luc Della Patrona, Antoine Teitelbaum, C.V. Mohan and Michael Phillips** Vulnerability of aquaculture to climate change in the Pacific (P2-6398)
11:45	**Alan Haynie and Lisa Pfeiffer** Modeling fleet behavior in the Bering Sea pollock fishery under climate change (P2-6359)
12:00	**Marie-Caroline Badjeck and Tania Mendo Aguilar Wosnitza** Scenarios for the future: Drivers of change in the Peruvian fisheries sector (P2-6367)
12:15	**Ana Norman-López and Sean Pascoe** The effect of climate change on fishing behaviour in the Eastern Tuna and Billfish Fishery (P2-6071)
12:30	**Ussif Rashid Sumaila, William L. Cheung and Vicky W.Y. Lam** Impact of climate change on marine resources food security and local economies in West African countries (P2-6230)
12:45	**Maria A. Gasalla, R. Pincinato and I. Belkin** Ocean proxies for seafood market variability in the South Brazil Bight (P2-6386)
13:00	Session ends

Day 4 Plenary P3

Sustainable strategies in a warming climate

Co-Convenors:
Anne B. Hollowed (Alaska Fisheries Science Center, NMFS/NOAA, USA)
Michael J. Schirripa (Southeast Fisheries Science Center, NMFS/NOAA, USA)

Many nations have adopted a goal of building sustainable fisheries. Traditionally, this goal has been pursued through the adoption of precautionary harvest policies that are based on the expected productivity of the stock in a future environmental state. However, these harvest policies seldom explicitly consider how possible future climate change may modify critical aspects of the productivity of the stock. At the single species level, climate change could significantly influence the carrying capacity, the reproductive potential, as well as the spatial distribution of the stock. At the multi-species level, climate change may alter the abundance of competitors and predators of species targeted for fishing. Societal changes in the consumption of fish and policies regarding marine ranching and aquaculture may also change the economic factors governing fisheries. This session is intended to explore the future of fish and fisheries under a changing climate. The focus will be on examples of management strategies that could be applied to sustain fisheries under a changing climate and techniques for assessing and forecasting the performance of harvest policies under changing climate. This session is also open to new and novel modeling techniques designed to take into account an uncertain future and/or non-equilibrium conditions in fish, fishing fleets, management, and the marketing of seafood products. This could range from how future fishing vessels may be outfitted to best adapt to a changing climate to how traditional management benchmarks and concepts (maximum sustainable yield, minimum stock size threshold, *etc.*) could be modified or updated to take climate change into account. Inventive ways to circumvent or adapt to the forecasted impacts of climate change and the uncertainty surrounding it are also of interest.

Thursday, April 29 (9:00-12:00)

9:00	***Introduction by Convenors***
9:05	**Chang Ik Zhang and Jae Bong Lee (Invited)** Impacts of climate changes and a pragmatic ecosystem-based approach for assessing and forecasting harvest policies under changing climate in Korea (P3-6212)
9:30	**Éva Plagányi, Scarla Weeks, Tim Skewes, Mark Gibbs, Elvira S. Poloczanska Ana Norman-López, Laura Blamey, Muri Soares and William Robinson (Invited)** Assessing the adequacy of current fisheries management under changing climate (P3-6073)
9:55	**Jennifer L. Nielsen, Gregory T. Ruggerone, Christian E. Zimmerman and Jamal H. Moss** Sustainable strategies in a warming climate: Salmon in the Arctic (P3-5996)
10:10	**Philippe Cury** Moving from fisheries oceanography towards ecosystem oceanography for building scenarios for marine ecosystems under anthropogenic and natural forcing in the XXI Century (P3-6395)
10:25	**James N. Ianelli** The challenges of developing fisheries stock assessment approaches, harvest control rules, and management strategies to satisfy and adapt to increasingly complex management objectives in a changing environment (P3-6391)
10:40	***Cofee/Tea Break***

11:00 **Gretta Pecl, Alistair J. Hobday, Stewart Frusher, Warwick Sauer and participants of Workshop 5**
Networking across global marine 'hotspots' (P3-6335)

11:15 **Anne B. Hollowed, Nicholas Bond,Alan Haynie, James N. Ianelli and Franz J. Mueter**
Scenario based models for predicting stakeholder responses to a changing climate: A case study for the Eastern Bering Sea (P3-6240)

11:30 **Yi-Jay Chang, Chi-Lu Sun, Yong Chen and Su-Zan Yeh**
Incorporating climate changes into population dynamic modelling: an individual-based modelling approach for the pronghorn spiny lobster (*Panulirus penicullatus*) in eastern Taiwan (P3-6316)

11:45 **Masahide Kaeriyama, Hyunju Seo and Michio J. Kishi**
Sustainable fisheries management of Pacific salmon in a warming climate (P3-6136)

12:00 Session ends

Posters

P3-6376 **Manuel Barange, J. Icarus Allen, Eddie Allison, Marie-Caroline Badjeck, Julia L. Blanchard, Ben Drakeford, Nicholas K. Dulvy, James Harle, Jason Holt, Robert Holmes, Simon Jennings, Gorka Merino, Graham M. Pilling and Lynda Rodwell**
QUEST_Fish: Estimating climate change impacts on global fish production and additional vulnerabilities to human societies

P3-6402 **Du Van Toan, Nguyen Van Tien, Vu Thanh Ca, Nguyen Hoang Anh, Nguyen Hai Anh, Vu Thi Hien and Tran The Anh**
Impact assessment of flooding inudation in the Vietnam coastal zone for marine ecosystems by CC and SLR

P3-6411 **Feng-Chen Chang and Shean-Ya Yeh (*Cancelled*)**
Albacore (*Thunnus alalunga*) distribution versus SST in the Indian Ocean based on 1982-2008 log reports of Taiwaneses longliners

P3-6414 **Michael J. Schirripa, Rebecca J. Allee, Russell H. Beard, Stephanie Oakes, Bonnie J. Ponwith, Rebecca Shuford and Roger J. Zimmerman**
An approach to an Integrated Ecosystem Assessment of the Gulf of Mexico

A1 Downscaling variables from global models

***Co-Convenors**:*
Michael Foreman (Institute of Ocean Sciences, DFO, Canada)
Jason Holt (Proudman Oceanographic Laboratory, UK)

Analyses and summaries recently presented in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) indicate that many of the dramatic changes observed in the circulation and physical characteristics of the oceans over the past century will continue in the future. As one of the major limitations of the global climate models that are used to estimate these future projections is their relatively coarse resolution, statistical or dynamical downscaling is often needed to provide sufficient spatial detail in the variables of interest. This session will address the downscaling of global climate model variables relevant to marine ecosystems, with emphasis on (1) downscaling techniques and/or their application to particular regions or variables, and (2) analysis of global climate model projections, or results from higher-resolution regional ocean, or coupled atmosphere-ocean models that are forced by, and take their boundary conditions from, global climate models.

Tuesday, April 27 (14:30-18:30)

14:30 ***Introduction by Convenors***

14:35 **Muyin Wang, James E. Overland and Nicholas A. Bond (Invited)**
Examples of using global climate models for regional marine ecosystem projection (A1-6050)

15:00 **J. Icarus Allen (Invited)**
Shelf seas ecosystems: Past, present and future states (A1-6062)

15:25 **Masao Kurogi, Hiroyasu Hasumi and Yukio Tanaka**
Kuroshio path variation studied by a nested-grid OGCM (A1-6342)

15:40 **Robert Holmes, James Harle, J. Icarus Allen, Jason Holt and Manuel Barange**
Predicting impacts of climate change on primary production in coastal-ocean regions (A1-6190)

15:55 **Jason Holt, James Harle, Rob Holmes and J. Icarus Allen**
Potential climate change impacts on contrasting shelf sea regions: Atmospheric and oceanic impacts *vs.* tidal and seasonal constraints (A1-6294)

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

16:30 **Enrique N. Curchitser, William Large, Kate Hedström and Jon Wolf**
Downscaling climate simulations in the North Pacific Ocean using a fully coupled multi-scale model (A1-6107)

16:45 **Hiroshi Kuroda, Takashi Setou, Manabu Shimizu and Kazuhiro Aoki**
Dynamical downscaling from the basin scale to submesoscale with a triply nested ocean model (A1-6293)

17:00 **Talgat R. Kilmatov and Elena V. Dmitrieva**
Climatic structural stability of the Kuroshio Extension jet and catastrophe theory (A1-6038)

17:15 **Albert J. Hermann, Kerim Aydin, Nicholas A. Bond, Wei Cheng, Enrique N. Curchitser, Georgina A. Gibson, Kate Hedström, Ivonne Ortiz, Muyin Wang and Phyllis J. Stabeno**
Simulated modes of biophysical variability on the Bering Sea shelf (A1-6375)

17:30 **Huaming Yu, Thomas Pohlmann, Xianwen Bao and Xueen Chen**
Tidal current effects on the simulation of ocean circulation by theoretical and numerical analyses (A1-6264)

17:45 **Alexandra V. Temnykh, Yuriy N. Tokarev and Viktor V. Melnikov**
The Black Sea zooplankton-climate connection: A multi-scale approach and new methods (A1-6017)

18:00 **Michael Foreman, Badal Pal, William Merryfield, Diane Masson and John Morrison**
Toward a regional climate model for the British Columbia continental shelf (A1-6069)

18:15 **Elena I. Ustinova**
Evaluation of potential limitations for statistical downscaling in the Far-Eastern Seas (A1-6393)

18:30 Session ends

Poster

A1-6347 **Anne D. Sandvik, Solfrid Sætre Hjøllo and Anne Britt Sandø**
Downscaling global climate predictions for the North Sea - A discussion about quality

A2 Species-specific responses: Changes in growth, reproductive success, mortality, spatial distribution, and adaptation

Co-Convenors:
Richard Beamish (Pacific Biological Station, DFO, Canada)
Myron Peck (Center for Marine and Climate Research, University of Hamburg, Germany)

Climate is now recognized as a major factor affecting the productivity of key species in world fisheries. The mechanisms that link climate to fish productivity need to be better understood to ensure that natural and greenhouse gas induced climate changes are incorporated into the management of fisheries. Population-level changes in commercially and ecologically important marine fish species may result from climate-driven changes in organismal-level vital rates (*e.g.*, changes in growth, reproductive success and mortality). Furthermore, expansion, contraction and/or shifts in the distribution of fish stocks will result from changes in suitable habitats (habitats that allow connectivity among life stages, life cycle closure and successful recruitment). The extent of climate-driven changes will be mediated by the capacity for individual species (or populations) to adapt to changes in important abiotic and biotic factors. Adaptations could include both changes in the phenology of important life history events (*e.g.*, migration, spawning) and/or physiological changes (*e.g.*, thermal reaction norms of key traits such as growth, increased tolerance to lowered pH/ocean acidification). This session provides a forum for presentations focusing on the response of key fish and fisheries species worldwide to climate change by: (1) documenting historical, long-term fluctuations in abundance and distribution, (2) discussing processes underlying current changes, and/or (3) projecting future impacts in light of adaptive capacity. Key fisheries species include those utilizing marine habitats during any portion of their life cycle and that are commercially or ecologically important marine resources.

Day 1, Monday, April 26 (14:30-18:30)

14:30 ***Introduction by Convenors***

14:35 **Hans-O. Pörtner (Invited)**
Oxygen- and capacity-limitation of thermal tolerance: A matrix for integrating climate-related stressor effects in marine ecosystems (A2-6085)

15:00 **Olav Sigurd Kjesbu, Jon Egil Skjæraasen, David Righton, Kathrine Michalsen, Christian Jørgensen, Anders Frugård Opdal and Peter R. Witthames**
Climate effects on maturation and spawning of Atlantic cod and implications for fisheries (A2-6099)

15:15 **So Kawaguchi, Haruko Kurihara, Robert King, Lillian Hale, Thomas Berli, James Robinson, Patti Virtue, Stephen Nicol and Atsushi Ishimatsu**
An experimental assessment of effects of raised pCO_2 on early-larval Antarctic krill (A2-6153)

15:30 **Jun Shoji, Masakazu Hori, Yasuhiro Kamimura, Ken-ichiro Mizuno and Shun-ichi Toshito**
Fish production in coastal habitats under global warming: Spatio-temporal variability in early growth of a dominant species, black rockfish, in seagrass beds (A2-6090)

15:45 **Frida Ben Rais Lasram, Francois Guilhaumon, Samuel Somot, Wilfried Thuiller and David Mouillot**
The Mediterranean Sea as a trap for endemic fishes facing climate change (A2-6020)

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

16:20 **John K. Pinnegar, Georg Engelhard, Julia L. Blanchard, Joe Scutt-Phillips and William L. Cheung (Invited)**
How has climate change impacted marine food-webs in the past, and how might we predict changes in the future? (A2-6362)

16:45 **Louis W. Botsford, Matthew D. Holland, Alan Hastings, Michael J. Fogarty, Francis Juanes and Hui-Yu Wang**
The effects of fish life histories on time scales of response to environmental change (A2-6109)

17:00 **Remment ter Hofstede and Adriaan D. Rijnsdorp**
Disentangling the effects of fisheries and climate change on fish communities (A2-6080)

17:15 **Manuel Hidalgo, Valerio Bartolino, Santiago Cerviño, Angélique Jadaud, Enric Massutí, Fran Saborido-Rey, Marina Santurtún and Nils Christian Stenseth**
Comparative study of fishing-induced juvenescence effects under different climatic and fishing harvesting scenarios (A2-6145)

17:30 **J. Marti Pujolar, D. Bevacqua, M. Andrello and L. Zane**
Bringing together molecular genetics and population dynamics modelling: Disentangling the influence of fisheries and climate variation in the endangered European eel (A2-6034)

17:45 **Yongjun Tian, Hideaki Kidokoro, Tatsuro Watanabe, Yosuke Igeta, Hideo Sakaji and Ken Watanabe**
Response of yellowtail *Seriola quinqueradiata* in the Japan Sea to sea water temperature over the last century and potential effect of global warming (A2-6115)

18:00 **Adriaan D. Rijnsdorp, Ralf van Hal, Marc Hufnagl, Richard D.M. Nash, Alexander Schroeder, Lorna R. Teal, Ingrid Tulp, Rob Witbaard, Doug Beare and Henk W. van der Veer**
Key mechanism determining the impact of climate change on the productivity and fisheries of North Sea plaice, *Pleuronectes platessa* L. (A2-6258)

18:15 **Michele Casini, Valerio Bartolino, Juan Carlos Molinero and Georgs Kornilovs**
Linking climate, trophic interactions and fisheries: Threshold dynamics drive herring (*Clupea harengus*) growth in the central Baltic Sea (A2-6345)

18:30 Session ends

Day 2, Tuesday, April 27 (9:00-13:20)

9:00 **Kuo-Wei Lan, Ming-An Lee and Hsueh-Jung Lu**
A study on yellowfin tuna (*Thunnus albacares*) stocks and fishing conditions in relation to oceanic environmental variation in the Atlantic Ocean (A2-6171)

9:15 **Nan-Jay Su, Chi-Lu Sun, André E. Punt and Su-Zan Yeh**
Impacts of climate change on the distribution of blue marlin (*Makaira nigricans*) as inferred from data for longline fisheries in the Pacific Ocean (A2-6295)

9:30 **Barbara Muhling, Sang-Ki Lee, Michael J. Schirripa, Walter Ingram and John Lamkin**
Predicting the effects of climate change on bluefin tuna (*Thunnus thynnus*) spawning habitat in the Gulf of Mexico (A2-6032)

9:45 **Melanie Abecassis, Patrick Lehodey, Inna Senina and Jeffrey J. Polovina**
Swordfish population dynamics in the Pacific Ocean (A2-6110)

10:00 **Yury I. Zuenko, Lydmila A. Chernoivanova, Alexander N. Vdovin and Elena I. Ustinova**
Climate change effect on the saffron cod *Eleginus gracilis* reproduction, stock, and fishery in the Japan Sea (A2-6227)

10:15 **Z. Teresa A'mar, André E. Punt and Grant G. Thompson**
Incorporating climate variability into the assessment of Gulf of Alaska Pacific cod (A2-6239)

10:30 **Rüdiger Voss, Hans-Harald Hinrichsen, Jörn O. Schmidt and Martin F. Quaas**
Spatially resolved impact of temperature change on recruitment of sprat and cod in the Baltic Sea – From observation to bio-economic modeling (A2-6202)

10:45 ***Coffee/Tea Break***

11:05 **Harald Loeng, Hjámar Hátún, Jens Christian Holst, Mark Payne and Aril Slotte**
The rise and the fall of the northern blue whiting stock (A2-6191)

11:20 **Eduardo Martins, Scott Hinch, David Patterson, Merran Hague, Steven Cooke, Kristina Miller, Michael Lapointe, Karl English and Anthony Farrell**
Effects of river temperature and climate warming on stock-specific survival of adult migrating Fraser River sockeye salmon (*Oncorhynchus nerka*) (A2-6028)

11:35 **Hyunju Seo, Masa-aki Fukuwaka and Masahide Kaeriyama**
Long-term fluctuations in somatic growth, survival, and population dynamics of Hokkaido chum salmon, *Oncorhynchus keta*, linking to climate changes (A2-6179)

11:50 **Juan L. Valero, Steven R. Hare and Bruce M. Leaman**
Investigating the roles of climate, density-dependence and fishing on long-term and large-scale changes in recruitment, growth, maturity and distribution of Pacific halibut (A2-6173)

12:05 **Yasunori Sakurai, A.L. Rosa and J. Yamamoto**
Past, present and future of Japanese common squid, *Todarodes pacificus* (Cephalopoda: Ommastrephidae) (A2-6156)

12:20 **Jacob F. Schweigert, Jennifer Boldt, Linnea Flostrand, Peter Olesiuk, Sherri Dressel and Ryan Watanabe**
Differing response of herring stocks to ecosystem forcing in the California and Gulf of Alaska Current systems (A2-6250)

12:35 **Akinori Takasuka, Sam McClatchie, Ed Weber, Yoshioki Oozeki, Takahiko Kameda, Yuichi Hirota and Hiroshi Okamura**
Responses of anchovy and sardine spawning to physical and biological factors in the Kuroshio and California Current systems: Interspecific and intersystem comparison (A2-6338)

12:50 **Janet A. Nye, Jason S. Link and Jonathan A. Hare**
Climate-induced changes in distribution of Northwest Atlantic fish and invertebrates: Implications for management (A2-6196)

13:05 **Benjamin Planque, Edwige Bellier, Frida Ben Rais Lasram and Christophe Loots**
Now you see me, now you don't: Uncertainties in projecting future spatial distribution of marine populations (A2-6019)

13:20 Session ends

Posters

A2-6022 **Alexander M. Kaev (presented by A. Velikanov)**
Possible inner causes for correcting "climatic" trends in pink salmon

A2-6030 **Claudio Castillo-Jordán, Luis A. Cubillos and Eduardo Navarro**
Inter-cohort growth rate changes of common sardine (*Strangomera bentincki*) and their relationship with environmental conditions off central southern Chile

A2-6033 **Melissa A. Haltuch, Carrie Holt, André E. Punt and M. Elizabeth Clarke**
Patterns and processes underlying Pacific hake (*Merluccius productus*) migrations: Progress on developing forecast tools to predict distribution and density

A2-6041 **Mei-Yu Chang and Audrey J. Geffen**
Classifying the spatial structure of different spawning populations of commercially important Atlantic and Mediterranean Sea by otolith elemental composition

A2-6058 **Valerio Bartolino, Piotr Margonski, Massimiliano Cardinale, Martin Lindegren, Hans Linderholm, Hakan Wennhage and Michele Casini**
Herring recruitment in the Baltic Sea: From observations to projections

A2-6059 (*Cancelled*) **Guimei Liu, Song Sun and Hui Wang (*Cancelled*)**
Modelling the demography of *Calanus sinicus* in the Yellow Sea Cold Water Mass

A2-6060 **Elizabeth Atwood, John K. Horne, Janet T. Duffy-Anderson and Carol Ladd**
Association of larval fish abundance with mesoscale eddies in the Gulf of Alaska

A2-6070 (*Cancelled*) **Nandipha M. Twatwa, Dawit Yemane and Janet C. Coetzee (*Cancelled*)**
Pattern of habitat preference by three small pelagic species in the southern Benguela during high and low biomass periods

A2-6077 **Alexander Arkhipkin and Vladimir Laptikhovsky**
Environmental changes caused recent increase in abundance of rock cod, *Patagonotothen ramsayi* in the Southwest Atlantic

A2-6082 **Matthew T. Wilson, Kathy Mier and Annette Dougherty**
The first annulus of otoliths: A tool for studying intra-annual growth among walleye pollock (*Theragra chalcogramma*)

A2-6083 **Kathryn Hughes, Mark P. Johnson and Leonie Dransfeld**
Warming seas and the migration of Atlantic mackerel

A2-6092 **Jennifer M. Donelson, Philip L. Munday and Mark I. McCormick**
Thermal acclimation by a coral reef fish

A2-6094 **Yasuo Itoh, Yukihiko Watanabe, Yukio Nakamura, Shuji Tsuchida, Hideaki Kinoshita, Takumi Setoguma and Yasushi Minowa**
Comparison of swimming performance at various acclimation temperatures for teleosts inhabiting Japanese coastal waters

A2-6097 **Shan Gao, Hui Wang and Liu Guimei**
Spatial and temporal variability of chlorophyll *a* and their responses to marine environments in the South China Sea

A2-6111 (*Cancelled*) **Claudio Gatica, Claudio Castillo-Jordán, Sebastian Vasquez and Rubén Alarcón (*Cancelled*)**
Population structure changes on size and age composition on Chilean hake (*Merluccius gayi gayi*) and their association with environmental conditions

A2-6112 **Strahan Tucker, Marc Trudel, David W. Welch, John R. Candy, John F.T. Morris, Mary E. Thiess, Colin Wallace and Terry D. Beacham**
Annual trends in seasonal stock- and life-history-specific ocean migration of juvenile Chinook salmon *Oncorhynchus tshawytscha*: An application of genetic identification techniques

A2-6120 **Masao Miura, Toshiro Fujisawa, Hiroshi Yamada and Takeya Hara**
Behavioral response of Japanese amberjack, *Seriola quinqueradiata*, to sea water temperature rise caused by thermal effluent

A2-6139 **Svetlana A. Murzina, Stig Falk-Petersen, Jørgen Berge and Nina N. Nemova**
Seasonal lipid and fatty acids dynamics in *Leptoclinus maculatus* larvae from Svalbard waters in relation to abiotic and biotic factors

A2-6142 (*Cancelled*)
N.M. Twatwa, Dawit Yemane and Janet C. Coetzee (*Cancelled*)
Modeling the distribution and abundance of pelagic fish species as a function of environmental variables

A2-6160
Haruka Nishikawa, Ichiro Yasuda, Sachihiko Itoh, Hideharu Sasaki and Yoshikazu Sasai
Environmental impacts on long-term variation in recruitment success of Japanese sardine

A2-6161
Rubén Rodríguez-Sánchez, Carl van der Lingen, Marlene Manzano, Larry Hutchings and Héctor Villalobos
Comparing the influence of oceanographic fronts on interannual changes in the distribution and relative abundance of sardine in the California and Southern Benguela Current systems

A2-6187
Jung Jin Kim and Suam Kim
Relationship between environmental variability and distribution of common squid (*Todarodes pacificus*) paralarvae in the northern East China Sea

A2-6200
Ana Moreira, Paulo Fonseca, Cristina Silva, Aida Campos, Maria de Fátima Borges and Miguel Santos
Are crustacean landings from Portuguese waters driven by environment variables?

A2-6217
Omar I. Abdul-Aziz and Nathan J. Mantua
Climate change impacts on the ocean distributions of Pacific salmon

A2-6224
Bernard A. Megrey, Kenneth A. Rose, Jacob F. Schweigert, Douglas Hay, Francisco E. Werner, Yasuhiro Yamanaka and Shin-ichi Ito
Geographic variation in Pacific herring growth and population responses to regime shifts in the North Pacific basin

A2-6246
Christos D. Maravelias and Alex Tidd
Northern *vs.* southern European Seas: Investigating spatio-temporal patterns of *Mullus surmuletus* distribution in relation to environmental changes

A2-6251
Sukgeun Jung
Recruitment and migration of Pacific cod (*Gadus macrocephalus*) to southern Korean coastal waters in relation to variations in the bottom cold waters originating from the Japan/East Sea

A2-6254
Motomitsu Takahashi, Yoshiro Watanabe, Akihiko Yatsu and Hiroshi Nishida
Contrasting responses in larval and juvenile growth rates of anchovy and sardine to a climate-ocean regime shift: Implications for their population dynamics

A2-6255
Akiko Takano, Hidekatsu Yamazaki, Osamu Honda, Kotaro Yokawa and Hiroshi Shono
An investigation of the relationship between bigeye tuna (*Thunnus obesus*) catch and three dimensional thermal structures

A2-6260
Cheryl A. Morgan, William T. Peterson, Joseph P. Fisher and Jesse F. Lamb
Effects of climate variability on the distribution, abundance and habitat usage of juvenile salmonids in the coastal waters of the northern California Current

A2-6270
Yuu Katsukawa, Yoshiro Watanabe, Hiroshi Okamura, Tatsuya Suzuki and Hisashi Nakategawa
Changes in the life history traits of Japanese anchovy and sardine

A2-6280
Jörn O. Schmidt and Rüdiger Voss
The rise and fall of snake pipefish (*Entelurus aequoreus* L.) off North Scotland

A2-6314 (*Cancelled*)
Caleb Gardner and Stewart Frusher (*Cancelled*)
Warming influences productivity of lobster stocks in SE Australia

A2-6317 **Andrew Tobin, Audrey Schlaff, Besse Krause, David W. Welch, Tony Ayling, Hugh Sweatman, Paul Marshall, Brigid Kerrigan and Jeff Maynard**
Contrasting ecological responses of two commercially important finfish to severe tropical cyclones: A sullen serranid and a lively lethrinid

A2-6319 **Haruko Kurihara, Yuji Hiratsuka, Takamasa Asai, Atsushi Ishimatsu, Laura Parker and Pauline Ross**
Are geographically distinct populations similarly impacted by ocean acidification? (Oysters as a case study)

A2-6331 **Kinuyo Fukamichi, Yoshiro Watanabe, Isamu Mitani and Tomohiko Kawamura**
Metamorphosis is closely associated with condition factor in Japanese anchovy in the Pacific coast waters of central Japan

A2-6334 **Mika Suhara, Yoshiro Watanabe, Yuu Katsukawa, Yasuo Mori, Satoshi Katayama, Masayuki Yamamoto and Tomohiko Kawamura**
Comparative reproductive ecology of Japanese anchovy, *Engraulis japonicus*, in different current areas off Japan

A2-6343 **Chen-Te Tseng, Chi-Lu Sun, Su-Zan Yeh, Shih-Chin Chen and Wei-Cheng Su**
Influence of environmental factors on the distributions of Pacific saury in the northwestern Pacific Ocean

A2-6350 **Cecilie Kvamme, Geir Odd Johansen, Jan Erik Stiansen, Trond Westgard, Bjørn Adlandsvik and Sigrid Lind Johansen**
Ocean temperature, cod stock distribution and cod fisheries in the Barents Sea the last decades

A2-6377 **Stephani Zador and Kerim Aydin**
Patterns in a changing climate: Fine-scale analysis of arrowtooth flounder catch rates in the eastern Bering Sea reveals spatial trends in abundance and diet

B1 Assessing ecosystem responses: Impacts on community structure, biodiversity, energy flow and carrying capacity

Co-Convenors:
Thomas Okey (Pew Fellow / UVic / Bamfield Marine Station, Canada)
Akihiko Yatsu (Seikai National Fisheries Research Institute, FRA, Japan)

Assessing effects of climate change on marine ecosystems (*i.e.*, biological communities) is a major challenge, mainly because (1) future changes in physical forcing, such as water temperature, will exceed historically observed values, and (2) biological responses or adaptations to these changes are highly uncertain, particularly over a long time period. Changes in geographic ranges, vertical distributions, phenologies, population structures, and productivities will differ among individual species thereby altering the connectivities and functions of ecosystem components, including predator-prey relationships and competition, species assembly, community structure, biodiversity, energy flow, and carrying capacity. This session will focus on retrospective analyses of changes in freshwater, coastal, and offshore ecosystems/communities, experimental studies on species interactions under climate-change-related conditions, and conceptual and numerical modelling of ecosystems relevant to climate change.

Tuesday, April 27 (9:00-18:30)

9:00 ***Introduction by Convenors***

9:05 **Jeffrey J. Polovina, John P. Dunne, Phoebe Woodworth and Evan A. Howell (Invited)**
Possible trends in North Pacific ecosystems over the 21st century based on output from a coupled climate, biogeochemical, and phytoplankton model (B1-6053)

9:30 **Hiroshi Sumata, Taketo Hashioka, Takeshi Okunishi, Masahito Shigemitsu, Maki N. Aita, Naoki Yoshie, Naosuke Okada, Takashi T. Sakamoto, Tatsuo Suzuki and Yasuhiro Yamanaka**
Effects of climate forcing on the North Pacific Ocean ecosystem simulated using an eddy-permitting marine ecosystem model (B1-6167)

9:45 **Jeffrey M. Napp, George L. Hunt, Jr., Lisa B. Eisner, Edward W. Farley, Phyllis J. Stabeno, Alex Andrews and Atsushi Yamaguchi**
The response of eastern Bering Sea zooplankton communities to climate fluctuations: Community structure, biodiversity, and energy flow to higher trophic levels (B1-6049)

10:00 **Hung-Yen Hsieh, Wen-Tseng Lo, Long-Jing Wu, Huang-Pin Chien, Deng-Cheng Liu and Wei-Cheng Su**
Larval fish assemblages in the waters around Taiwan, western North Pacific: A comparison between, during and after the northeasterly monsoon (B1-6168)

10:15 **Nadezhda L. Aseeva and Alexander L. Figurkin**
Changes of bottom ichthyocenosis structure on the shelf of west Kamchatka under changing environments in the last two decades (B1-6235)

10:30 **Rebecca G. Asch and David M. Checkley, Jr.**
Climate change leads to earlier seasonal occurrence of larval fishes in the southern California Current (B1-6216)

10:45 ***Coffee/Tea Break***

11:05 **William J. Sydeman, Bryan A. Black, Steven J. Bograd, Jeff Dorman, John C. Field, Kyra L. Mills, Stephen Ralston, T. Zack Powell, Jarrod A. Santora, Isaac D. Schroeder, Sarah Ann Thompson and Franklin B. Schwing**
Ocean climate change and phenology: Effects on trophic synchrony and consequences to fish and seabirds in the northern-central California Current (B1-6220)

11:20 **Takafumi Hirata, Robert Brewin and Nick Hardman-Mountford**
Global distribution of phytoplankton functional types estimated from satellite ocean colour (B1-6042)

11:35 (*Cancelled*) **Jacquelynne R. King, Vera N. Agostini, Gordon McFarlane, Christopher Harvey, Michael Foreman, James E. Overland and Kerim Aydin (*Cancelled*)**
Climate Forcing and Marine Ecosystems of the North Pacific (B1-6108)

11:50 **Gregory N. Nishihara and Ryuta Terada**
A preliminary study of the effects of a wave exposure gradient on the species richness of marine macrophytes along the eastern rim of the East China Sea (B1-6279)

12:05 **Sukgeun Jung, Young Shil Kang, Young-Sang Suh, Sukyung Kang and Yeong Gong**
Climate-driven shifts in marine fish communities indicated by commercial catch statistics from Korean coastal waters (B1-6253)

12:20 **Hiroya Sugisaki, Kiyotaka Hidaka, Tadafumi Ichikawa, Yutaka Hiroe, Yuichi Hirota, Kenji Morinaga, Manabu Shimizu, Takahisa Tokunaga, Mikiko Kuriyama, Tomowo Watanabe and Kaoru Nakata**
Interdisciplinary monitoring for the Kuroshio warm current ecosystem in relation to climate change (B1-6329)

12:35 **Hiroaki Saito, Shin-ichi Ito, Atsushi Kawabata, Mitsutaku Makino, Masami Nonaka, Takeshi Okunishi, Kazutaka Takahashi and Ichiro Yasuda**
Understanding and forecasting of fish species alternation in the Kuroshio-Oyashio ecosystem: The SUPRFISH programme (B1-6101)

12:50 ***Lunch***

14:30 **Elizabeth A. Fulton (Invited)**
Interesting times (B1-6044)

14:55 **Rosamma Stephen**
Decline in mackerel fishery along west coast of India and its relation to the diminishing density of an abundant upwelling copepod: A multi-decadal study (B1-6164)

15:10 **Sunil D. Ahirrao**
Effect of climate change on fish and fisheries of Marathwada region of Maharashtra state (India) (B1-6336)

15:25 **Stephen D. Simpson, Mark P. Johnson, David W. Sims, Pieter-Jan Schön, Julia L. Blanchard, Simon Jennings and Martin J. Genner**
Long-term climate-driven changes in UK marine fish communities (B1-6056)

15:40 **Remment ter Hofstede, Jan Geert Hiddink and Adriaan D. Rijnsdorp**
Global warming changes the species richness of marine fish in the eastern North Atlantic Ocean (B1-6078)

15:55 **Gabriel Reygondeau, Olivier Maury, Hervé Demarcq and Philippe Cury**
Changes in the environmental factors controlling the global biogeography of tuna and billfish communities (B1-6305)

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

16:30 **Charles A. Stock and John P. Dunne**
Modeling global patterns in the transfer of energy between primary producers and mesozooplankton in a global circulation model (B1-6366)

16:45 **Ryan R. Rykaczewski and John P. Dunne**
Comparison of the ecosystem response to climate change in the mid-latitude North Pacific and California Current ecosystems (B1-6363)

17:00 **Evan A. Howell, John P. Dunne and Jeffrey J. Polovina**
Modeling the central North Pacific ecosystem response to predicted climate variations and fishery management scenarios (B1-6061)

17:15 **William L. Cheung, Thomas A. Okey and Richard D. Brodeur**
Projecting future change in pelagic nekton communities along the west coast of North America (B1-6276)

17:30 **Matthew T. Wilson, Christina M. Jump and Andre Buchheister**
Ecology of small neritic fishes in the western Gulf of Alaska: Top-down mechanisms can moderate bottom-up forcing (B1-6081)

17:45 **Philip L. Munday, Danielle L. Dixson, Mark I. McCormick and Mark Meekan**
Ocean acidification threatens the replenishment of reef fish populations (B1-6130)

18:00 **Nicholas Graham, Pascale Chabanet, Richard Evans, Simon Jennings, Yves Letourneur, M. Aaron MacNeil, Tim McClanahan, Marcus Öhman, Nicholas Polunin and Charles Sheppard**
Extinction vulnerability of coral reef fishes in response to climate change and fisheries exploitation (B1-6095)

18:15 **Nam-Il Won, Tomohiko Kawamura, Hideki Takami, Hiroshi Hoshikawa and Yoshiro Watanabe**
Comparison of benthic community structure in natural habitats of abalone *Haliotis discus hannai* affected by different current systems (B1-6328)

18:30 Session ends

Posters

B1-6025 **Skip McKinnell and Enrique N. Curchitser**
Thermal refugia in the 21st century

B1-6046 **C. Tracy Shaw, Leah R. Feinberg and William T. Peterson**
Potential effects of climate change on the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* off Newport, OR, USA

B1-6067 **Toby D. Auth, Richard D. Brodeur, Heather L. Soulen, Lorenzo Ciannelli and William T. Peterson**
Long-term changes in fish larvae in the northern California Current in relation to climate variability

B1-6091 **Genta Takeda, Yoshinari Endo and Waka Sato-Okoshi**
Seasonal change in species composition of hydromedusae and the effect of environmental change in Onagawa Bay, northeastern Japan

B1-6100 **Kate E. Watermeyer, A. Jarre, L.J. Shannon and Larry Hutchings**
Ecosystem implications of the recent southward shift of key components in the southern Benguela

B1-6125 **Wen-Tseng Lo, Hung-Yen Hsieh, Dong-Chung Liu and Wei-Cheng Su**
Effect of water masses on larval fish distribution during the summer SW monsoon in Taiwanese waters, western North Pacific

B1-6170 **Tsuneo Ono, Kazuaki Tadokoro and the A-line Monitoring Team**
Ecosystem responses to ocean stratification and early-bloom occurrence in the future western subarctic North Pacific: A speculation from retrospective analyses

B1-6175 **Sachihiko Itoh, Ichiro Yasuda, Tohru Ikeya and Haruka Nishikawa**
Time series observations of chlorophyll fluorescence along the Kuroshio Extension by profiling floats

B1-6223 **Andrey Suntsov and Tony Koslow**
Long-term temporal trends in ichthyoplankton community composition in the southern California Current System

B1-6238 **Rubén J. Lara, Germán A. Kopprio, Carlos A. Strüssmann and Hugo Freije**
Uncertain future of fish populations in Argentinean coastal lakes: The impact of severe droughts and floods

B1-6274 **Sekharapilla Premjith**
Studies on the hydrobiology of the coconut husk retting grounds in the AVM Canal in Thoothoor region, southwest coast of India

B1-6333 **Yuji Okazaki and Kazuaki Tadokoro**
Early life history of *Euphausia pacifica* in the western North Pacific

B1-6382 **Juan Carlos Molinero, Michele Casini, Jakov Dulcic, Branka Grbec, Manuel Hidalgo, Lyudmila Kambourska, Andreas Lehman, Marcos Llope and Mira Morovic**
Climate and fishing pressure drive a non stationary behaviour in the long-term changes of pelagic food webs in European Shelf Seas

B1-6415 **Yu-Kai Chen, Yi-Jay Chang, Chi-Lu Sun, Chi-Lun Wu, Dong-Chung Liu and Wei-Cheng Su**
Identification of the relationship between environmental features and copepod abundances in the Kuroshio waters adjacent to eastern Taiwan using generalized additive models

B1-6425 (*New*) **Jacquelynne R. King, Vera N. Agostini, Gordon McFarlane, Christopher Harvey, Michael Foreman, James E. Overland and Kerim Aydin**
Climate Forcing and Marine Ecosystems of the North Pacific

B2 Comparing responses to climate variability among nearshore, shelf and oceanic regions

Co-Convenors:
Jürgen Alheit (Leibniz Institute for Baltic Sea Research, Germany)
Vladimir Radchenko (Sakhalin Research Institute of Fisheries and Oceanography, Russia)

Over the last two decades, convincing evidence has been collected that global and regional climate variability is a strong driving force of changes in marine ecosystems (and the fish and shell fish populations embedded in them). Climate drivers influence near-shore, shelf and oceanic regions. However, the same climate signal may be correlated with different responses of marine populations among these regions, due to the different mechanisms by which climate variability impacts these communities and the role of human activities in modifying these mechanisms, particularly in near-shore areas. Whereas the effect of climate variability has been intensely studied in single marine systems or on single species/species groups across different systems, comparisons of climatic influences on coastal and oceanic systems are generally lacking. As marine ecosystems are not amenable to experimental investigations with respect to climate effects, comparative analyses are the best way to enhance our knowledge on the response of ecosystems and their populations. Ecosystem regime shifts and teleconnection patterns in the reaction of distant marine ecosystems towards climate impacts are important phenomena which help us to better understand responses to climate variability. The goal of this session is to (1) discuss the interactions, ramifications, and potential connections between climate variability and marine ecosystems, and (2) demonstrate the impact of climate variability with a view to future climate change.

Wednesday, April 28 (9:00-13:15)

9:00	***Introduction by Convenors***
9:05	**Svein Sundby (Invited)** Changes in productivity of marine ecosystems from low to high latitudes under climate variability and change (B2-6213)
9:30	**Jae Bong Lee and Bernard A. Megrey** On the utility of self-organizing maps (SOM) and k-means clustering to characterize and compare low frequency spatial and temporal climate impacts on marine ecosystem productivity (B2-6225)
9:45	**Elvira S. Poloczanska, Keith Brander, Chris Brown, John Bruno, Lauren Buckley, Michael T. Burrows, Carlos Duarte, Pippa Moore, Mary O'Connor, John Pandolfi, Camille Parmesan, Maria Sanchez-Camacho, David Schoeman, William J. Sydeman and Anthony J. Richardson** Marine climate change impacts: Out of sight but not out of mind (B2-6278)
10:00	**Thomas A. Okey, Jameal F. Samhouri, Cameron H. Ainsworth, D. Shallin Busch and William L. Cheung** Potential impacts of climate change on Northeast Pacific marine ecosystems (B2-6261)
10:15	**Kenneth Drinkwater and the RECLAIM Team** Ecosystem response to future climate change in the Northeast Atlantic: Results from the RECLAIM Project (B2-6244)
10:30	**Susa Niiranen, Thorsten Blenckner and Reinette Biggs** Are general mechanisms found behind regime shifts across marine ecosystems? (B2-6188)
10:45	***Coffee/Tea Break***
11:05	**Nicholas K. Dulvy (Invited)** Housing crisis: Climate change-induced habitat loss impacts on temperate and tropical fishes (B2-6054)

11:30 **Lisa B. Eisner, Seth Danielson, Edward W. Farley, Jeanette Gann and Markus Janout**
Spatial and interannual variability in oceanography, plankton and forage fish in the Bering Sea: Results from U.S. BASIS surveys for 2002-2008 (B2-6043)

11:45 **Anatoliy Ya. Velikanov**
Climatic trends and long-term changes in species composition and abundance of pelagic fishes along the Sakhalin coast in the Japan Sea and the Okhotsk Sea (B2-6012)

12:00 **Miguel Ñiquen and Cecilia Peña**
Response of dominant species in coastal and oceanic regions of Peru (B2-6296)

12:15 **Jürgen Alheit**
The limits for forecasting fish population dynamics under changing climate scenarios: The example of small pelagic fishes (B2-6247)

12:30 **Konstantin Rogachev**
Thermal limits and coastal migration of chum salmon (*Oncorhynchus keta*) determined by submesoscale circulation (B2-6023)

12:45 **Hideaki Kidokoro, Norio Yamashita, Tsuneo Goto and Yongjun Tian**
Changes in the stock size and life history traits of Japanese common squid *Todarodes pacificus* in relation to climate changes, with special comparison between in the Kuroshio-Oyashio currents region and the Sea of Japan (B2-6228)

13:00 **Brian J. Rothschild**
Coupling between multi-decadal transients in fish stock abundance and anthropogenic forcing (B2-6397)

13:15 Session ends

Posters

B2-6006 **Vladimir B. Darnitskiy and Maxim A. Ishchenko**
Short-period variability of oceanologic conditions in the vicinity of the Pulkovskaya seamount (Part I)

B2-6007 **Vladimir B. Darnitskiy and Maxim A. Ishchenko**
Short-period variability of oceanologic conditions in the vicinity of the Pulkovskaya seamount (Part II)

B2-6072 **Olga Hernandez, Patrick Lehodey, Inna Senina, Arnaud Bertrand, Ramiro Castillo, Vincent Echevin and Philippe Gaspar**
Modelling anchovy population in the Humboldt upwelling system

B2-6088 **Svetlana Yu. Glebova**
Change in character of winter cyclonic activity over the Asian-Pacific region in 1996-2009 and its influence on a thermal regime of the Far East Seas

B2-6132 **Boris Prischepa, Oleg Titov and Yuri Lepesevich**
Climate change and prospects of fisheries in the Barents Sea and adjacent Arctic seas

B2-6137 **Jennifer Menkel and William T. Peterson**
Response of krill to climate change in the California current: Temporal and spatial variations in population “hotspots”

B2-6163 **Rubén Rodríguez-Sánchez, Héctor Villalobos and Sofía Ortega-García**
Spatial dynamics of small pelagic fish in the California Current system on the regime time-scale: Parallel processes in other species-ecosystems

B2-6186 **Kosei Komatsu, Arisa Yamawaki, Daisuke Ambe, Takahiko Kameda, Takashi Setou and Manabu Shimizu**
Impacts of mesoscale variations of water masses on larval survival processes of pelagic fishes around the Kuroshio based on an eddy resolving ocean ecosystem model

B2-6198 **Sean Lucey and Janet A. Nye**
Shifting species assemblages within the Northeast US Large Marine Ecosystem

B2-6248 **Jürgen Alheit and 12 co-authors**
Reaction of northern hemisphere ecosystems to the climate events in the late 1980s: A comparison of regime shifts and teleconnection patterns

B2-6271 (*Cancelled*) **Chun Li Liu and Dan Ling Tang (*Cancelled*)**
Distribution variation of phytoplankton effect by typhoon winds in the South China Sea

B2-6320 **Daisuke Ambe, Kosei Komatsu, Manabu Shimizu, Akira Okuno and Akinori Takasuka**
Environmental temperature impacts on the early survival process of larval Japanese sardine

B2-6373 **Jay O. Peterson and William T. Peterson**
Evidence of climate change in the northern California Current ecosystem and its impact on the distribution and community composition of zooplankton

B2-6392 **Takashige Sugimoto and Masato Niki**
Long-term variations in the catch of sergestid shrimp in Suruga Bay induced by variations in the Kuroshio path and climate regime shifts

C1 Impacts on fisheries and coastal communities

Co-Convenors:
Keith Brander (National Institute of Aquatic Resources, Technical University of Denmark, Denmark)
Suam Kim (Pukyong National University, Korea)

Climate change has had an impact on fisheries and coastal communities throughout history, due to environmentally driven fish stock fluctuations, changes in species distribution, extreme events and changes in sea-level. The survival of coastal communities depended on being able to cope with such changes, by altering their fishing practices or switching to alternative livelihoods. In many cases communities did not survive or suffered economic hardship and emigration. Although some adaptability can be expected in response to anthropogenic climate change, the new situation is different in a number of ways. The expected rate of change is rapid and in one direction; most fisheries are already under pressure from overfishing, habitat degradation and other sea and coastal uses; new pressures arise from sea-level rise and ocean acidification. This session will focus on forecasts of expected impacts of climate change on the coastal fish stocks and the communities that depend on them as well as strategies for survival under a changing climate.

Wednesday, April 28 (9:00-13:00)

9:00	***Introduction by Convenors***
9:05	**R. Ian Perry, Manuel Barange, Francisco E. Werner, Eileen Hofmann and Rosemary Ommer (Invited)** Adapting marine social-ecological systems to a world of change: Lessons from the GLOBEC experience (C1-6210)
9:30	**Sujan Saha** Postlarvae fishing, biodiversity and livelihoods under climate change: A case study on southwest coastal community in Bangladesh (C1-6310)
9:45	**Eva Papaioannou, Athanasios Vafeidis, Jörn O. Schmidt and Martin F. Quaas** Modeling the spatial distribution of coastal fisheries of the Baltic Sea using Geographic Information Systems (C1-6340)
10:00	**Ming-An Lee, Kuo-Wei Lan, Kuo-Ten Lee and Yi Chang** Satellite observation on the cold water intrusion related to the exceptional fishery disaster during the ENSO events in the Taiwan Strait (C1-6174)
10:15	**Audrey J. Geffen, Arild Folkvord, Hans Høie, Anne Karin Hufthammer, Carin Andersson, Kjell Nedreaas and Ulysses S. Ninemann (presented by Mei-Yu Chang)** High latitude climate variability and its implications for fish resources as revealed by fossil otoliths of cod (*Gadus morhua*) (C1-6201)
10:30	**Tatiana Krupnova, Yury I. Zuenko, Vladimir Matveev, Irina Tsypysheva and Vladimir Pavlyuchkov** Reconstruction of bottom phytocenoses on the coast of Primorye caused by climate change (C1-6233)
10:45	***Coffee/Tea Break***
11:05	**Kevern L. Cochrane, Tarub Bahri, Cassandra de Young and Doris Soto (Invited)** Evolution in an instant: Adaptation and resilience to climate change in fisheries (C1-6400)
11:30	**Akhmad Fauzi, Subandono Diposaptono and Suzy Anna** Socio-economic impacts of climate change on coastal communities: The case of the north coast of Java small-pelagic fisheries (C1-6124)

11:45 (*Cancelled*) **Janet C. Coetzee, Kobus Agenbag, Carl van der Lingen, Larry Hutchings, Jan van der Westhuizen, Awie Badenhorst and Mike Copeland (*Cancelled*)**
Impacts of changing weather patterns on the efficiency of South Africa's purse-seine fishery (C1-6351)

12:00 **Jong Hee Lee, Jae Bong Lee, Young Min Choi and Chang Ik Zhang**
Detecting decadal changes in marine environmental characteristics and fishery resources in Korean waters (C1-6166)

12:15 **Eider Andonegi, Jose Antonio Fernandes, Iñaki Quincoces, Xabier Irigoien, Daniel Howell and Gunnar Stefansson**
The potential use of a Gadget model to predict stock responses to climate change in combination with Bayesian networks: The case of the Bay of Biscay anchovy (C1-6236)

12:30 **Asuncion De Guzman, Cesaria Jimenez, Angelo Macario, Juliet Madula and Jayrald Santamnina**
Shifts in species abundance of sardine fisheries in southern Philippines: Early signs of vulnerability to climate change? (C1-6197)

12:45 **Nhung T.H. Nguyen and Hien T.H. Than**
Challenge and opportunity of climate change: Case studies in Vietnamese coastal communities (C1-6304)

13:00 Session ends

Posters

C1-5998 **Maria Rebecca A. Campos**
Assessment of adaptation responses of coastal communities in the Philippines to the impacts of climate change

C1-6040 (*Cancelled*) **Dmitry A. Galanin, V.A. Sergeenko and A.R. Repnikova (*Cancelled*)**
Status of short-spined sea urchin (*Strongylocentrotus intermedius*) colonies and kelp (*Laminaria japonica*) thicket along southwestern Sakhalin coast

C1-6116 **K.J. Thara, R. Sajeev and T. Pankajakshan**
Impacts of ENSO and IOD on summer monsoon rainfall and oil sardine fishery along the west coast of India

C1-6146 **Julius I. Agboola**
Loss of mangrove wetlands and implications for climate change, fisheries and food security in Lagos coastal lagoons shorelines (West Africa)

C1-6147 **Mark Prime, Ralf Bublitz, Bob Houghton and Magnus Johnson**
The effect of climate change upon the inshore fisheries of the United Kingdom

C1-6242 **Tomoaki Goto**
Trends of coastal fisheries in Iwate Prefecture, Pacific coast of northern Japan, with relation to the long-term oceanographic fluctuations

C1-6257 **Jin Koo Kim, Gi-Sik Min, Moon-Geun Yoon and Yeonghye Kim**
Mitochondrial and microsatellite DNA structure of the small yellow croaker, *Larimichthys polyactis* (Pisces: Sciaenidae) in the Yellow and East China Seas

C1-6265 **Melissa Nursey-Bray, Gretta Pecl, Stewart Frusher, Caleb Gardner, Marcus Haward, Alistair J. Hobday, Sarah Jennings, André E. Punt, Hilary Revill and Ingrid van Putten**
Contesting views or collaborative opportunity? Risk perception, science and fisheries management, Tasmania, Australia

C1-6284 **Suam Kim, Sangwook Yeh, Chung-Il Lee, Sukyung Kang, Hyunwoo Kang, Jin-Hee Yoon, Jung J. Kim and Sinjae Yoo**
Forecasting practice on the common squid (*Todarodes pacificus*) population responding climate/ oceanographic changes

C1-6309 **Jung Hwa Ryu, Jin Koo Kim and Dong Seon Kim**
Fluctuation on fish fauna in the east southern sea of Korea during 2006-2009

C1-6378 **Salvador Lluch-Cota, René Kachok and María Verónica Morales-Zárate**
Reasons for high vulnerability of coastal fishing communities of Baja California (Mexico) and potential adaptation strategies to climate change

C2 Evaluating human responses, management strategies and economic implications

Co-Convenors:
Kevern Cochrane (Fishery Resources Division, Food and Agriculture Organization)
Jake Rice (Ecosystem Science Directorate, DFO, Canada)

Humans depend on the oceans for many goods and services essential to their well-being. As terrestrial and marine ecosystems change in response to climate, these dependencies are expected to become even greater, particularly, but hardly exclusively, for food security. This session will focus on how society, at a range of scales from community to population, might adapt to the changes expected in the oceans, and in the goods and services on which they depend so that optimal benefits may be obtained without unacceptable increases in the risks to the systems. Contributions from social scientists, economists, and policy experts are welcomed, as well as from natural scientists interested in strategies for sustainable use of marine resources in the face of changing human needs as well as changing ocean conditions. Just a few decades in the future, societies and governments may face very difficult choices about the proper balance between provision of food security and conservation of marine biodiversity for an even bigger human population confronted with changing, possibly declining, aquatic and terrestrial food production. The proper balance between established uses of oceans and coastal regions and new uses, such as wind and tidal power, must also be faced. This session is intended to open an expert dialogue on these important questions, through a mixture of conceptual, analytical, and case-history presentations.

Wednesday, April 28 (14:30-18:30)

14:30	***Introduction by Convenors***
14:35	**Bonnie J. McCay (Invited)** Surfclam dramas and other stories about the human dimensions of climate change and fisheries (C2-6018)
15:00	**Serge M. Garcia, Andrew A. Rosenberg and Jake Rice** Food security, fisheries, and climate change (C2-6021)
15:15	**Gretta Pecl, Rebecca Brown, Peter Walsh, Stewart Frusher, Graham Edgar, Jeremy Lyle, Elvira S. Poloczanska and Rick Stuart-Smith** Citizen science as a research tool for monitoring ecological change in the marine environment (C2-6282)
15:30	**Renae C. Tobin and Stephen G. Sutton** Will diversity assist adaptability? A case study contrasting diverse and specialized fishing sectors in the Queensland Inshore Fishery, Australia (C2-6300)
15:45	**Ikutaro Shimizu, Tsutomu Ohnuki and Kunio Abe** Economic strategies for avoiding climate change effects on Japanese salmon fisheries (C2-6098)
16:00	***Coffee/Tea Break***
16:20	**Johann D. Bell (Invited)** Climate change, fisheries and aquaculture in the Pacific – Implications for food security, livelihoods and economic growth (C2-6185)
16:45	**Milena Arias-Schreiber, Miguel Ñiquen and Marilou Bouchon** Adapting to climate change – Lessons from the Peruvian anchovy fishery on how to cope with extreme climatic events and environmental variability (C2-6346)
17:00	**Satsuki Takahashi** In search of new sea legs: Women's roles in the survival of Japan's fishing industry (C2-6122)

17:15 **Henry P. Huntington, Alpina Begossi and Renato A.M. Silvano**
Traditional fisheries practices and adaptation to environmental change: Case studies from Alaska and Brazil (C2-6055)

17:30 **Renato A.M. Silvano, Henry P. Huntington and Alpina Begossi**
Fishers' local ecological knowledge about fish and climatic change (C2-6318)

17:45 **Friday J. Njaya**
The Lake Chilwa fishing household strategies in response to water level changes: Migration and conflicts (C2-6129)

18:00 **Pedcris M. Orencio and Masahiko Fujii**
Building community adaptability through ecosystem approach planning in the Province of Aurora, Philippines (C2-6159)

18:15 **Sahri Muhammad, Pudji Purwanti and Aida Sartimbul**
Household fishermen empowerment based on local community wisdom as a problem solver on fishermen poverty: Case study in Madura Strait, Indonesia (C2-6207)

18:30 Session ends

Posters

C2-6086 (*Cancelled*) **Siyanbola Adewumi Omitoyin, Tosan Fregene and Dontsop Paul (*Cancelled*)**
Impact of climate change on livelihood and food security of artisanal fisherfolks in Lagos State, Nigeria

C2-6140 **Francois Bastardie, J. Rasmus Nielsen, Bo Sølgaard Andersen and Ole Eigaard**
Modeling energy consumption efficiency of fisheries: What to gain by effort displacement? The case of Danish Skagerrat-Kattegat fisheries

C2-6155 **Michael D. Pido, Ruth Guzman, Maripaz L. Perez, Elvira Martija, Elen R. Basug and Len R. Garces**
The role of the academe in undertaking research and developing management strategies to address climate change impacts on fisheries: Some examples of initiatives of academic institutions in the Philippines

C2-6169 **Ingrid L. Holliday**
"Bringing it all together" – A multi-disciplined, collaborative approach to preparing fisheries and aquaculture for climate change in South Eastern Australia

C2-6172 **Felipe Hurtado-Ferro, Sachihiko Itoh and Kunio Shirakihara**
Could management react to a changing climate? The case of the Japanese small pelagic fishes

C2-6178 **I Nyoman Radiarta, Sei-ichi Saitoh and Toru Hirawake**
Potential impacts of climate change on Japanese scallop aquaculture: A case study in Funka Bay, Hokkaido, Japan

C2-6281 **Neil Holbrook, Gretta Pecl, Alistair J. Hobday and Stewart Frusher**
Australian National Climate Change Adaptation Research Network for Marine Biodiversity and Resources

D2 Contemporary and next generation climate and oceanographic models, technical advances and new approaches

Co-Convenors:
Jonathan Hare (Northeast Fisheries Science Center, NMFS/NOAA, USA)
Shin-ichi Ito (Tohoku National Fisheries Research Institute, FRA, Japan)

The projection of marine ecosystem response to future climate scenarios is needed to assess and implement marine ecosystem management. The marine ecosystem is part of the earth system, and prediction of ecosystem responses requires integrated knowledge from physical, chemical, and biological perspectives, as well as from marine, terrestrial and atmospheric perspectives. The earth system is complex with non-linear feedbacks (including biological to physical), regime shifts, and, in some cases, thresholds beyond which change is irreversible. Therefore, the uncertainties of climate and oceanographic models cause uncertainties of the projection of marine ecosystem response not only directly but also through complex feedback mechanisms. To reduce the uncertainties of the marine ecosystem projection, we must understand the mechanisms controlling climate systems and the linkages to marine ecosystems. Specific species responses to future ecosystem conditions are required by natural resource managers, and these require specific information (*e.g.*, environments in coastal area during the short spawning period) as well as information regarding change of the ecosystem as a whole (*e.g.*, total primary production, food-web dynamics). These issues are not part of climate modeling, but mechanistic links between the biological, physical, and chemical systems must be identified and incorporated into coupled population-ecosystem-climate models. Technical advances and new approaches are essential to achieve the goal of producing better projections of marine ecosystem response to future climate scenarios. This session will focus on climate and oceanographic models, including modeling of climate and ecosystem interaction, and technical advances and new approaches.

Wednesday, April 28 (14:30-18:30)

14:30 ***Introduction by Convenors***

14:35 **Michio Kawamiya (Invited)**
Global change projection for ocean biogeochemistry and ecosystem (D2-6117)

15:00 **Masami Nonaka, Bunmei Taguchi, Hideharu Sasaki and Hisashi Nakamura**
Decadal variability in the oceanic frontal zones in the western North Pacific Ocean in an eddy-resolving OGCM (D2-6325)

15:15 **Georgina A. Gibson, Kate Hedström, Enrique N. Curchitser and Albert J. Hermann** (D2-6209)
Simulating lower trophic level ecosystem dynamics in the Bering Sea

15:30 **Yasumasa Miyazawa, Xinyu Guo, Ruo Chao Zhang, Sergey M. Varlamov, Tomowo Watanabe, Takashi Setou and Daisuke Ambe**
Roles of the in-situ observations in the detection of the Kuroshio frontal variability south of Japan (D2-6324)

15:45 **Enrique N. Curchitser, Kate Hedström, William Large and Jon Wolf**
From a climate to a multi-scale earth system model: Technical issues and advances (D2-6357)

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

16:20 **Anand Gnanadesikan (Invited)**
Climate models and fisheries: Opportunities and challenges (D2-6123)

16:45 **Kosei Komatsu, Naoki Yoshie, Shin-ichi Ito, Takahiko Kameda, Tsuneo Ono, Kiyotaka Hidaka, Toru Hasegawa, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Takeshi Okunishi, Kazuaki Tadokoro, Hiroaki Saito and Yasuhiro Yamanaka**
Interannual variations of 3D structures of lower-trophic-level ecosystems in the western North Pacific using a new marine ecosystem model based on an eddy-resolving data-assimilative OGCM (D2-6323)

17:00 **Francisco E. Werner, Peter H. Wiebe and Jonathan A. Hare**
Developing a modeling framework for basin scale models of marine ecosystems (D2-6348)

17:15 **Michio J. Kishi, Shin-ichi Ito, Bernard A. Megrey, Kenneth A. Rose and Francisco E. Werner**
A review of the NEMURO.FISH model application to marine ecosystem investigations and its ability to evaluate responses of fish to future climate change (D2-6298)

17:30 **Scott Condie, Mark Hepburn, Jim Mansbridge and Phillip England**
A second generation online tool for exploring oceanographic connectivity (D2-6051)

17:45 **Ülo Suursaar, Markus Vetemaa and Tiit Kullas**
Climate change induced decadal variations in hydrodynamic conditions in the Estonian coastal waters and their possible influence on fish (D2-6131)

18:00 **William Peterson, Hongsheng Bi, Cheryl A. Morgan and Edmundo Casillas**
The Pacific Decadal Oscillation and marine food webs in the northern California Current: Variations in source waters which feed the California Current may be the mechanism which links climate change with ecosystem response (D2-6384)

18:15 **Maria A. Gasalla, O. Sato and P.S. Polito**
An application of the ethno-oceanographic framework to study global change issues off the South Brazil Bight with remote-sensing data (D2-6388)

18:30 Session ends

Posters

D2-6093 (*Cancelled*) **Hui Wang, Guimei Liu, Fei Chai, Xingyu Song and Shan Gao (*Cancelled*)**
Climate change and the ecosystem response in the South China Sea: Observations and numerical investigations

D2-6104 **Aleksey V. Koldunov**
Variability of the biotic material flow divergence patterns of the Azores

D2-6177 **Taketo Hashioka, Takashi T. Sakamoto, Hiroshi Sumata, Takeshi Okunishi, Masahito Shigemitsu, Maki N. Aita, Naoki Yoshie, Naosuke Okada, Akio Ishida and Yasuhiro Yamanaka**
Potential impact of global warming on North Pacific spring blooms projected by an eddy-permitting 3-D ocean ecosystem model

D2-6192 **Tatsuro Watanabe, Katsumi Takayama, Hideyuki Kawamura and Iori Tanaka**
One dimensional ecosystem model in the northern Japan Sea based on an operational ocean forecast system

D2-6256 **Naoki Yoshie, Kosei Komatsu, Shin-ichi Ito, Takahiko Kameda, Tsuneo Ono, Kiyotaka Hidaka, Toru Hasegawa, Akira Kuwata, Miwa Nakamachi, Yuji Okazaki, Takeshi Okunishi, Kazuaki Tadokoro, Hiroaki Saito and Yasuhiro Yamanaka**
Dynamics of lower-trophic-level ecosystems in the western North Pacific simulated by a high resolution 3D ecosystem model

D2-6277 **Takeshi Okunishi, Shin-ichi Ito, Naoki Yoshie, Taketo Hashioka, Hiroshi Sumata and Yasuhiro Yamanaka**
The impact of density-dependent processes on geographical distribution of Japanese sardine (*Sardinops melanostictus*)

D2-6322 **Hiroaki Tatebe, Masayoshi Ishii, Masahide Kimoto, Takashi T. Sakamoto, Yoshiki Komuro and Takashi Mochizuki**
Interannual to decadal modulations of high frequency eddies in the Kuroshio-Oyashio confluence zone in a high-resolution CGCM with ocean data assimilation

D2-6337 **Takashi T. Sakamoto, Yoshiki Komuro, Masayoshi Ishii, Hiroaki Tatebe, Akira Hasegawa, Hideo Shiogama, Takahiro Toyoda, Masato Mori, Seita Emori, Hiroyasu Hasumi and Masahide Kimoto**
MIROC4.0 – A high-resolution AOGCM for the near-term climate prediction

GP General Poster Session

GP-5783 **Vladimir B. Darnitskiy and Maxim A. Ishchenko**
Kuroshio System – The quasi-cyclic dynamics and the bifurcation from the source to the Shatskikiy hills

GP-6084 **Chiara Papetti, Mario La Mesa, Jennifer Rock, Esteban Barrera-Oro, Tomaso Patarnello and Lorenzo Zane**
Contrasting pattern of genetic differentiation between two Antarctic Channinchthyidae fish species at the West Antarctic Peninsula

GP-6134 **Minoru Tomiyama and Teruhisa Komatsu**
The influence of seawater temperature on sandeel stock in Ise Bay

GP-6193 **Eleuterio Yáñez and María Angela Barbieri**
Climate change and fisheries in Chile

GP-6204 **Aida Sartimbul, Hideaki Nakata and Erfan Rohadi**
Chlorophyll *a* concentration dynamics due climate change and its possible impact on pelagic fishes at Java and Bali, Indonesia: Case study in 2006

GP-6205 **Oky Rosita Tanjung, Aida Sartimbul and Anthon Efani**
The implication of oceanographic and meteorological factors on algae blooming events and possible impact on the *Sardinella lemuru* fishery along the coast of Bali, Indonesia

GP-6206 **Sary Rahmawati, Aida Sartimbul and Daduk Setyohadi**
Biological aspects and population dynamics of mud crab (*Scylla serrata*) in the mangrove area of Curah Sawo, Probolinggo, Indonesia

GP-6326 **Chia-Hui Wang and Hui-Lun Chen**
Biological studies of the oval squid *Sepioteuthis lessoniana* population in northern Taiwan

GP-6327 (*Cancelled*) **Kazumi Sakuramoto, Satomi Shimoyama and Naoki Suzuki (*Cancelled*)**
Forecasting models in the recruitment of Japanese sardine, *Sardinops melanostictus*, in the northwestern Pacific, incorporating environmental conditions and evaluations of management effects

GP-6332 **Naoki Suzuki and Kazumi Sakuramoto**
Effect of measurement errors on model selection in analyses of the stock–recruitment relationship

GP-6369 **Luis A. Cubillos, Leonardo R. Castro and Gabriel Claramunt**
Fishery-induced changes on the reproductive cycle of two small pelagic fish off central Chile

GP-6410 **Dmitry D. Kaplunenko, Vyacheslav B. Lobanov, Alexander Yu. Lazaryuk, Pavel Ya. Tishchenko and Vladimir A. Zvalinsky**
Measurements of NO_3 saturation in the Japan Sea by *in situ* and hydrochemical methods

GP-6412 (*Cancelled*) **Jingfeng Fan, Gengchen Han, Chuanlin Huo, Xinzhen Lin and Chunjiang Guan (*Cancelled*)**
Response of zooplankton and phytoplankton to climate change in China

W1 Reducing global and national vulnerability to climate change in the fisheries sectors: Policy perspectives post Copenhagen

Co-Convenors:
Cassandra de Young (Food and Agriculture Organization)
Eddie Allison (WorldFish Center, Malaysia on behalf of the Global Partnership on Climate, Fisheries and Aquaculture (PaCFA))

The challenges of climate change are a top priority for world leaders. About 520 million people—8% of the world's population—depend on fisheries and aquaculture as a source of protein, income, or family stability, many of them from vulnerable communities in tropical and low-lying areas and Small Island Developing States. The countries that are most vulnerable to climate change impacts on their fisheries are among the world's poorest, whose inhabitants are twice as dependent upon fish for food as those of other nations, with 27% of dietary protein derived from fish compared with 13% elsewhere (Allison *et al.* 2009).

The Global Partnership on Climate, Fisheries and Aquaculture (PaCFA) was created in 2009 to encourage states to include aquatic ecosystems, fisheries and aquaculture issues when formulating action to combat climate change, particularly in the build up to the UN Framework Convention on Climate Change (UNFCC) COP15 meeting in Copenhagen, December 2009. PaCFA recognizes that many governmental, non-governmental and civil society organizations have become actively engaged in the search for improved knowledge of the likely impacts of climate change on fisheries and aquaculture (Cochrane *et al. 2009*) and providing assistance to countries and communities to develop policies and strategies for adaptation and development of resilience to likely changes. However, these actions tend to take place in isolation from each other with a minimum of communication, sharing of experiences and cooperation. The role of PaCFA is to increase the effectiveness of these actions through increased collaboration, complementing mandates and capabilities of each organization and maximising the effectiveness of joint efforts.

The objectives of this workshop are to (1) present the goals and strategy of PaCFA; (2) inform participants about the COP15 decisions regarding adaptation and mitigation actions relevant to the reduction of vulnerability to climate change impacts on fisheries, aquaculture and marine ecosystems – including built-in mechanisms to do so within the UNFCCC; (3) consider the responses of individual agencies and institutions to COP-15 and any adaptation and mitigation efforts in response to climate changes; (4) discuss how the PaCFA can assist national and multinational agencies reduce the vulnerability of countries and regions to climate change impacts on fisheries and marine ecosystems, with particular emphasis on LDC and small island states; (5) identify the critical gaps in the science underpinning climate impacts on fish production systems and marine and coastal ecosystems and on potential adaptation.

This workshop will discuss and prepare a Plan of Action in pursue of these objectives. A policy note on next steps and needs to develop the objectives of PaCFA will be considered. The workshop may also produce a paper for the Symposium volume summarizing the current state of policy decisions regarding adaptation and mitigation actions relevant to the reduction of vulnerability to impacts of climate change on fisheries and marine ecosystems, and an analysis of the quality of the science base (including social sciences) that underpins these decisions.

Sunday, April 25 (9:00-12:30)

9:00	***Introduction by Convenors***
9:10	Discussion
10:30	***Coffee/Tea Break***
10:50	Discussion
12:30	Workshop ends

Posters

W1-6368 **Jose M.P. Silva, Miguel J.A. Lopes and Ana R.P. Quintas (*Cancelled*)**
Marine ecosystem reestablishment − Seawater electrolyse with carbon capture

W1-6403 **Hasan M. Abdullah and Yoshio Awaya**
Monitoring the impact of climate change on inland water bodies and fisheries by remote sensing and GIS technique a case study of Chalan beel (Bangladesh)

W2 Potential impacts of ocean acidification on marine ecosystems and fisheries

Co-Convenors:
Kenneth L. Denman (Canadian Centre for Climate Modelling and Analysis; DFO, Canada)
Yukihiro Nojiri (National Institute for Environmental Studies, Japan)
Hans Pörtner (Alfred-Wegener Institute, Germany)

The global ocean is being acidified as carbon dioxide from fossil fuel emissions enters its surface waters. The magnitude of this increase is directly related to the amount of carbon dioxide added, and more certain than many other changes related to climate change. Predicting the impacts of increasing acidification on marine ecosystems and fisheries is difficult due to the lack of knowledge of the ability of individual species and functional groups to adapt to increasing acidification, especially in combination with related effects associated with climate change such as increasing temperature, declining dissolved oxygen (Brewer and Peltzer, 2009), and stratification. Hence, potential effects cannot yet be represented in models of marine ecosystems. Potential impacts on commercial fisheries are significant: an analysis of 2007 US 'at vessel' fisheries value indicates 73% of the value is associated with calcium carbonate organisms and their direct predators (Cooley and Doney, 2009).

This workshop will discuss manipulation experiments and observations on the effects of high acidity (low pH) caused by elevated carbon dioxide on organisms at all trophic levels of fisheries foodwebs, modelling approaches to predict the impact of continuing increases in atmospheric carbon dioxide, effects on marine biodiversity, and economic and social impacts on marine fisheries.

It is expected that the workshop will produce a white paper on these research directions and a summary article in PICES Press.

Sunday, April 25 (9:00-15:45)

9:00	***Introduction by Convenors***
9:05	**Kenneth L. Denman, James Christian, Nadja Steiner and Warren Lee** Acidification of the global ocean: Observational evidence and projections to 2100 with the Canadian Earth System Model (CanESM) (W2-6370)
9:20	**Masako Nakamura, Shun Ohki, Atsushi Suzuki and Kazuhiko Sakai** Metabolism and metamorphosis of coral larvae in acidified seawater (W2-6149)
9:35	**Lailah G. Lartey-Antwi and Andreas J. Andersson** Effects of ocean acidification on the growth of the flat-tree oyster, *Isognomon alatus* (Gmelin, 1791) (W2-6259)
9:50	**Ryota Suwa and Yoshihisa Shirayama** Effects of diurnal pCO_2 fluctuation on sea urchin larvae: A preliminary report (W2-6361)
10:05	**Haruko Kurihara** Overview of the impacts of ocean acidification on the early development of fishes and shellfishes (W2-6303)
10:20	***Coffee/Tea Break***
10:40	**Awantha Dissanayake, Atsushi Ishimatsu, Haruko Kurihara and So Kawaguchi** Climate change impacts (ocean acidification and temperature) on the metabolic scope and activity of nektonic organisms: A crustacean example (W2-6311)
10:55	**Kehinde Salau** Mathematical approach to modeling the effects of ocean acidification on the pteropod and pink salmon population (W2-6243)

11:10 **Atsushi Ishimatsu, Atsuko Fukuda and Haruko Kurihara**
Effects of CO_2-driven ocean acidification and warming on early development of fish (W2-6291)

11:25 **Philip L. Munday, Monica Gagliano, Simon Thorrold, Jennifer M. Donelson and Danielle L. Dixson**
Ocean acidification does not affect the early life history development of a tropical marine fish (W2-6128)

11:40 **David M. Checkley, Jr.**
Effects of elevated pCO_2 on fish otoliths – Results, inference, and experimental design (W2-6390)

11:55 Short Introduction Posters (3 min. each)

12:30 ***Lunch***

14:00 Poster viewing session (60 min)

15:00 Closing Discussion

15:45 Workshop ends

Posters

W2-6065 **Steven S. Rumrill, Alicia R. Helms and Adam S. DeMarzo**
Variability in pH values and the potential influence of ocean acidification on oysters and other shellfish in Pacific Northwest estuaries

W2-6237 **Koji Sugie, Hisashi Endo, Koji Suzuki and Takeshi Yoshimura**
Increase in the Si:N drawdown ratio of the Bering Sea phytoplankton community under high CO_2 and iron-limited conditions

W2-6249 **Hideki Takami, Ryo Kimura, Tsuneo Ono, Toshihiro Onitsuka and Yukihiro Nojiri**
Effects of ocean acidification on the early developmental stages of Ezo abalone *Haliotis discus hannai*

W2-6287 **Jun Kita**
Impact of a high-CO_2 environment on Japanese Ivory-shell, *Babylonia japonica*

W2-6288 **Umme Salma and Hyun Woo Kim**
Effects of CO_2 induction on development of Brine Shrimp (*Artemia franciscana*)

W2-6344 **Bo Kwang Kim and Hyun Woo Kim**
Molecular technique analysis of effect of ocean acidfication on brine shrimp

W2-6422 **Will Le Quesne and John K. Pinnegar**
Physiology to Fisheries: Starting steps and future approaches

W3 Coupled climate-to-fish-to-fishers models for understanding mechanisms underlying low frequency fluctuations in small pelagic fish and projecting its future

Co-Convenors:
Salvador Lluch-Cota (Centro de Investigaciones Biologicas del Noroeste (CIBNOR), Mexico)
Enrique N. Curchitser (Institute for Marine and Coastal Sciences, Rutgers University, USA)
Shin-ichi Ito (Tohoku National Fisheries Research Institute, FRA, Japan)

The low-frequency variability of small pelagic fish abundance is one of the most emblematic and best-documented cases of fish population fluctuations not explained wholly by fishing effort. Over the last 25 years, diverse observations have been integrated into several hypotheses; however, due to limited-duration time series, hypothesis testing has proven extremely difficult with the available statistical and empirical tools. As a result, the mechanistic basis for how the physics, biogeochemistry, and biology interact to result in the various patterns of synchronous variability across widely separated systems remains unknown. Identification of these mechanisms is necessary in order to explore projections and to build scenarios of the amplitude and timing of stock fluctuations, and their responses to human interactions (fisheries) and climate change. The workshop aims to bring and compare state-of-the-art modeling tools and discuss on expertise to tackle this important scientific and environmental problem.

The workshop will likely produce a review paper on state-of-art models for coupled physical and biological (including higher trophic level) systems. It is also expected that papers presented at the workshop will be submitted for publication in the Symposium volume.

Sunday, April 25 (9:00-17:00)

9:00	***Introduction by Convenors***
9:30	**Ryan R. Rykaczewski** Changes in mesozooplankton size structure along a trophic gradient and implications for the growth of small pelagic fish (W3-6365)
9:55	**Wolfgang Fennel** A consistent nutrient to fish model for the Baltic Sea (W3-6027)
10:20	***Coffee/Tea Break***
10:40	**George Triantafyllou, Kostas Tsiaras, Stylianos Somarakis, Dimitris Politikos George Petihakis, Annika Pollani, Shin-ichi Ito and Bernard A. Megrey** Development and implementation of a 3D-IBM in the north Aegean Sea (eastern Mediterranean) that describes the full life cycle of anchovy (W3-6297)
11:05	**Shin-ichi Ito, Takeshi Okunishi, Michio J. Kishi and Muyin Wang** Potential impact of climate change on Pacific saury (W3-6267)
11:30	**Kate Hedström, Jerome Fiechter, Kenneth A. Rose, Enrique N. Curchitser, Miguel Bernal, Shin-ichi Ito and Bernard A. Megrey** Development of a climate-to-fish-to-fishers model: Data structures and domain decomposition (W3-6211)
11:55	**Kenneth A. Rose** Should climate-to-fish-to-fishers models be assembled from existing models? (W3-6401)
12:20	***Lunch***
14:00	Discussion
17:00	Workshop ends

W4 Salmon workshop on climate change

Co-Convenors:
James Irvine (Pacific Biological Station, DFO, Canada)
Masa-aki Fukuwaka (Hokkaido National Fisheries Research Institute, FRA, Japan)
Suam Kim (Pukyong National University, Korea)
Vladimir Radchenko (Sakhalin Research Institute of Fisheries and Oceanography, Russia)
Loh-Lee Low (Alaska Fisheries Science Center, NMFS/NOAA, USA)
Shigehiko Urawa (North Pacific Anadromous Fish Commission)

The North Pacific region is home to multiple species of salmonid fishes, including anadromous Pacific salmon that regularly migrate from freshwater to the sea and back. Salmon provide economic benefits in the form of subsistence, commercial, and recreational fisheries, and contribute to the cultural enrichment of the regions where they occur. Their ecological role is complex as they facilitate energy transfer directly and indirectly at multiple trophic levels in many ecosystems. Their ability to occupy habitats in fresh, salt, and brackish water has led to a remarkable diversity of life histories, but climate change threatens to alter their distribution and abundance.

Salmon are found most frequently in cooler regions of the Pacific Ocean. In recent years, commercial catches have been among the highest on record, with no indication of declines. For instance, 2007 catches exceeded 1 million tonnes, with pink and chum salmon constituting 51 and 31% of the catch by weight respectively. Yet coho, Chinook, and some sockeye salmon populations are declining in many areas.

This one-day workshop will examine scenarios for the future of Pacific salmon, based on climate projections from coupled ocean/climate or other models or from statistical projections of expected climate changes. The workshop will emphasize regional scales that are believed to be of particular importance. For example, global warming may enhance oceanic conditions for some species in some regions, while diminishing them for others. A good understanding of potential interactions between regional physical and biological processes is critical for accurate projections of such regional responses. The workshop will provide an opportunity to examine whether the responses of salmon populations to climate change will differ among regions, and what the mechanisms might be.

It is expected that papers presented at the workshop, as well as documentation from the panel discussion, will be submitted for publication in the Symposium volume.

Sunday, April 25 (9:00-17:30)

9:00	***Introduction by Convenors***
9:10	**James R. Irvine and Masa-aki Fukuwaka** Setting the stage for predicting climate change effects on Pacific salmon – How has salmon abundance varied during the last 85 years and why? (W4-6121)
9:30	**Masa-aki Fukuwaka, Toshiki Kaga and Tomonori Azumaya** Regional differences in climate factors controlling chum and pink salmon abundance (W4-6096)
9:50	**Masahide Kaeriyama, Michio J. Kishi and Hyunju Seo** Global warming and density-dependent effects on Hokkaido chum salmon (W4-6138)
10:10	**Ed V. Farley, Jr., Lisa B. Eisner, J. Murphy, R. Heintz and Alex Andrews** Implications of a warming eastern Bering Sea on western Alaska salmon (W4-6203)
10:30	***Coffee/Tea Break***
10:50	**Phillip R. Mundy and Dani F. Evenson** Phenolgy of high latitude chinook salmon populations (W4-6381)

11:10 **Thomas C. Wainwright and Laurie A. Weitkamp**
Climate effects and Oregon coast coho salmon: A multi-ecosystem approach (W4-6218)

11:30 **Thomas E. Reed, Robin S. Waples, Daniel E. Schindler, Eli Meir and Nathan J. Mantua**
Adaptation and persistence of Pacific salmon facing climate change: An individual-based modeling analysis (W4-6245)

11:50 **Randall M. Peterman, Peter B. Adams, Brigitte Dorner, Douglas L. Drake, Harold J. Geiger, Kendra Holt, Chris Jordan, David P. Larsen, Steven A. Leider, Richard H. Lincoln, Anthony R. Olsen, Charles K. Parken, Jeffrey D. Rodgers and Shaun Walbridge**
The Salmon Monitoring Advisor: A hierarchical web site to help design and implement salmon monitoring programs (W4-6087)

12:10 **Larry Wasserman**
Developing salmon management responses to climate impacts at the watershed scale (W4-6222)

12:30 ***Lunch***

13:30 Short Introduction Posters (10 min each)

14:30 **Discussion**
Forecasting impacts

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

16:00 **Discussion**
Long term research priorities

17:00 Wrap Up, publication plans

17:30 Workshop ends

Posters

W4-6048 **Cyril Piou and Etienne Prévost**
Atlantic salmon population dynamics under scenarios of climate change: An individual-based demogenetic approach

W4-6133 **Sergey Prusov, Boris Prischepa, Elena Samoylova and Svetlana Krylova**
Long-term changes in biological characteristics and abundance of Atlantic salmon juveniles and adults from important Kola Peninsula rivers (Russian Federation)

W4-6144 **Yasuyuki Miyakoshi, Mitsuhiro Nagata, Makoto Fujiwara and Sei-ichi Saitoh**
Effects of coastal seawater temperature on the return rate of hatchery-reared chum salmon in Hokkaido and recent shifts in coastal environmental conditions and release of juveniles

W4-6180 **Yukimasa Ishida, Hiroyasu Adachi, Isao Yagisawa, Kazuaki Tadokoro and Harold J. Geiger**
Archeological evidence implies that global warming will shift Japanese chum salmon distributions northward

W4-6268 **Gregory T. Ruggerone, Beverly A. Agler and Jennifer L. Nielsen**
Climate, growth, and population dynamics of western Alaska Chinook and coho salmon

W5 Networking across global marine "hotspots"

Co-Convenors:
Gretta Pecl (Tasmanian Aquaculture and Fisheries Institute, University of Tasmania, Australia)
Alistair J. Hobday (CSIRO Marine and Atmospheric Research, Australia)
Stewart Frusher (Tasmanian Aquaculture and Fisheries Institute, University of Tasmania, Australia)
Warwick Sauer (Rhodes University, South Africa)

Regional global warming 'hotspots', typified by above average ocean temperature increases, provide the potential for early warning and evidence of the response by natural resources to climate change. In theory, regions at the 'front-line' of climate change should also be leading the field in terms of assessing impacts and evaluating adaptation options. Networking and synthesising outcomes from across hotspots can facilitate accelerated learning and also indicate sensible pathways for maximising adaptation and minimising impacts for other global regions.

This workshop is designed to (1) highlight where global marine 'hotspots' occur now, and where they are projected to occur in the future; (2) summarize the information currently emerging on biological climate change impacts in these areas, and (3) discuss the potential for developing a global network of scientists, policy makers and managers working in marine hotspots.

Ecological monitoring of hotspots provides us with one of the first opportunities to detect the nature and pace of climate change induced impacts on our marine ecosystems, and also the first prospect for validating species or ecosystem model projections against reality. Fisheries provide significant social and economic benefits globally, and early warning of changes in resource quality and/or availability is required to minimize social tensions (*e.g.*, increased poverty and changes in resource allocation) and societal costs (*e.g.*, income redistribution and government restructuring). Prior knowledge of how and when resources may alter will also facilitate the development, application and evaluation of adaptation options for fisheries.

Participants providing or presenting a summary of impacts from any of the global hotspots will be asked to contribute to a multi-authored publication in a high-ranking international journal. Identification of biological change in these hotspots is the main workshop challenge; however, participants are also requested to identify publications or unpublished data showing long-term change in oceanographic or physical characteristics of the area (*e.g.*, SST, currents). Several potential proposals and funding sources for a global network of marine hotspots will be discussed.

Sunday, April 25 (9:00-17:30)

9:00	***Introduction by Convenors***
9:15	**Alistair J. Hobday and Gretta Pecl** Identification of global marine hotspots: Sentinels for change and vanguards for adaptation (W5-6152)
9:30	**Stewart Frusher, Gretta Pecl, Alistair J. Hobday, Craig Johnson and Zoe Doubleday** Climate driven changes in marine assemblages in SE Australia: A southern hemisphere 'hotspot' (W5-6312)
9:45	**Larry Hutchings, Carl van der Lingen, Chris Reason, Frank Shillington, Andy Cockcroft, Warren Potts, Romina Novo-Henriques, Paul Shaw and Warwick Sauer** The Benguela Current Large Marine Ecosystem (W5-6408)
10:00	**Graham Edgar and Stuart Banks** Catastrophic changes to inshore benthic communities following oceanographic warming events in the Galapagos archipelago (W5-6321)
10:15	**Franz J. Mueter** Biological responses to recent climate variability on the eastern Bering Sea shelf (W5-6307)

10:30	***Coffee/Tea Break***
11:00	**Thomas A. Okey, Alvaro Montenegro, Veronica Lo, Sabine Jessen and Hussein Alidina** Overview of climate change effects in British Columbia marine ecosystems (W5-6306)
11:15	**Nicholas K. Dulvy, Doug J. Beare, Julia L. Blanchard, Jan G. Hiddink, Simon Jennings, Brian J. MacKenzie and Allison L. Perry** Rapid ecological change in the Northeast Atlantic climate change hotspot (W5-6416)
11:30	**Nguyen Huu Ninh** Aquaculture and climate change in the coastal zone of Vietnam (W5-6341)
11:45	**Kuo-Tien Lee and Hsueh-Jung Lu** Impact of climate change on coastal fishery resources of Taiwan (W5-6406)
12:00	**Wang Hui** South China Sea
12:15	**Lucy Scott and Warwick Sauer** Vulnerability to ocean warming in the Mozambique channel region (W5-6407)
12:30	***Lunch***
14:00	**Yury I. Zuenko** The Japan Sea hotspot: Impacts of warming on bio-productivity and fisheries resources (W5-6404)
14:15	**José H. Muelbert** Oceanography and biological production off South Brazil and Urugay (W5-6405)
14:30	**George L. Hunt, Jr.** Hotspots in warming sub-arctic seas (W5-6037)
14:45	**Group Discussion** What practical functions could/should a Global Hotspots Network perform?
15:30	***Coffee/Tea Break***
16:00	**Group Discussion** Given these functions – How should we define a network?
16:30	**Group Discussion** Options to establish and develop a network – Potential frameworks and funders
17:00	**Group Discussion** Outline structure of synthesis paper, feedback and action items
17:30	Workshop ends

W6 Examining the linkages between physics and fish: How do zooplankton and krill data sets improve our understanding of the impacts of climate change on fisheries?

Co-Convenors:
William Peterson (Hatfield Marine Science Center, NMFS/NOAA, USA)
Kazuaki Tadokoro (Tohoku National Fisheries Research Institute, FRA, Japan)

This workshop will provide an opportunity for those keenly interested in "how data on zooplankton and krill can be used to better understand and forecast the impacts of climate change on fisheries" to discuss the topic in an informal workshop atmosphere. It is expected that the workshop will demonstrate explicitly how information on zooplankton and krill contribute to better understanding of linkages between physics and fish. Furthermore, the workshop will likely generate novel ideas that will add to the open discussions during the Symposium itself.

It is anticipated that the workshop will produce a white paper that summarizes ongoing research activities as well as publications which link climate change to fisheries through changes in the food web in a variety of ecosystems – coastal, oceanic, upwelling, Arctic, and Antarctic. This will be a foundation document that shows where we are now and where we want to be in the future. It would also produce a set of recommendations for how we might move forward in our quest to better understand the mechanisms that link physics and fish through food chain interactions. Such a white paper could be found acceptable for publication, after peer review, in the "Horizons" section of the *Journal of Plankton Research*.

Sunday, April 25 (13:00-17:30)

13:00 **William T. Peterson**
Overview of some physical mechanisms that link physical forcing with zooplankton and fisheries response in the North Pacific

13:20 **Ryan R. Rykaczewski**
Propagation of ecological anomalies from the western to eastern North Pacific in a global earth system model (W6-6420)

13:40 **William T. Peterson, Hongsheng Bi, Cheryl A. Morgan and Edmundo Casillas**
The Pacific Decadal Oscillation and marine food webs in the northern California Current: Variations in source waters which feed the California Current may be the mechanism which links climate change with ecosystem response (W6-6385)

14:00 **Jay O. Peterson and William T. Peterson**
Evidence of climate change in the northern California Current ecosystem and its impact on the distribution and community composition of zooplankton (W6-6374)

14:20 **C. Tracy Shaw, Leah R. Feinberg and William T. Peterson**
Potential effects of climate change on the euphausiids *Euphausia pacifica* and *Thysanoessa spinifera* off Newport, OR, USA (W6-6047)

14:40 **Leah R. Feinberg and William T. Peterson**
Impacts of wintertime upwelling and primary production on euphausiid phenology and the productivity of upper trophic levels in the northern California Current (W6-6372)

15:00 **Motomitsu Takahashi, David M. Checkley, Jr., Richard D. Brodeur and William T. Peterson**
Responses in growth rate of larval northern anchovy and Pacific sardine to anomalous upwelling in 2005 in the northern California Current (W6-6421)

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

15:50 **Kazuaki Tadokoro and Yuji Okazaki**
Overview of the zooplankton from viewpoint of food for fish resources in the western North Pacific (W6-6418)

16:10 **Mikiko Kuriyama, Hiroya Sugisaki, Yuichi Hirota, Tadafumi Ichikawa, Hiroshi Itoh and Hiroshi Horikawa**
Long-term variation in copepod community structure in the Kuroshio area, off southern Japan

16:30 **Toru Kobari, Kazuaki Tadokoro, Hiroya Sugisaki and Hiroshi Ito**
Response of large grazing copepods to climate-oceanographic changes in the western subarctic Pacific Ocean (W6-6419)

16:50 Discussion

17:30 Workshop ends