

4th International Symposium

# THE EFFECTS OF CLIMATE CHANGE ON THE WORLD'S OCEANS

# Program



June 4-8, 2018  
Washington, DC, USA

 @eccwo

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#ECCWO18

Advancing  
Understanding  
and Responses  
to Changing Oceans

[pices.int/climateandoceanssymposium2018](http://pices.int/climateandoceanssymposium2018)

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For convenience, the listings of presentations (oral and posters) in this "Program" only include the presenter's name. Please refer to the "Book of Abstracts" (on-line) for the full list of co-authors.

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## Symposium Organizers

### Symposium Convenors

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Jason Link (NOAA), NOAA Fisheries, USA

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Vivian Piel (ICES)

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Salvatore Arico (UNESCO-IOC)

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Mary-Louise Timmermans (Yale Department of Geology and Geophysics, USA)

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## Welcome

*It is our great pleasure to welcome you to Washington DC and the 4<sup>th</sup> International Symposium on the Effects of Climate Change on the World's Oceans (ECCWO).* This important meeting will bring together more than 600 of the world's current and next-generation experts to share information, build understanding and advance responses to climate impacts on oceans and the many people, businesses and communities that depend on them.

*The ECCWO Symposium series was launched in 2008 by the International Council for the Exploration of the Sea (ICES), the North Pacific Marine Science Organization (PICES), and the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) to address the urgent need for information on changing oceans.* All three of the prior Symposia (Spain 2008, Korea 2012 and Brazil 2015) have played a key role in advancing our understanding of the causes, consequences and responses to the effects of climate change on oceans.

*This 4<sup>th</sup> ECCWO Symposium comes at a key juncture in understanding and responding to climate impacts on ocean systems.* National and international assessments confirm that the Earth's climate and oceans are rapidly changing, the impacts are already evident in some regions and more impacts are expected with continued changes in the planet's climate system. There is much at stake. Changing oceans are expected to have significant impacts on a wide range of issues from food security, national security and international relations, to the resilience of peoples, communities and economies. Future efforts will utilize the products, outcomes and lessons emerging from this Symposium.

*We hope this Symposium provides an inspiring venue for increasing understanding and responses to changing oceans.* The demand for information is high, and the opportunities to advance the science are many. Please take advantage of the Symposium Workshops, Sessions and other events to network with colleagues from around the world and help advance the international science collaboration needed to address these issues.

*We thank the Symposium organizers (ICES, PICES, IOC-UNESCO, the Food and Agriculture Organization (FAO), US National Oceanic and Atmospheric Administration (NOAA)) for their vision, dedication and hard work that made this meeting a reality.* We also thank the many other sponsors for their outstanding support for this important gathering.

*Thank you for being an important part of this Symposium.* We wish you all the best at ECCWO 2018!

*Manuel Barange, Véronique Garçon, Shin-ichi Ito, Jason Link  
Convenors, ECCWO 2018*

## Notes for Guidance

The Symposium will be held from June 4-8, 2018, at The Washington Hilton, Washington, DC, USA, with Workshops on June 2 and 3, preceding the main Symposium.

### Registration

The registration desk will be located in the Terrace Foyer and available from 8:00–18:00, June 1-7, 2018.

### Presentations

In order to allow the sessions to run smoothly, and in fairness to other speakers, please note that all presentations are expected to adhere strictly to the time allocated. All presenters should designate at least 5 minutes for questions. Authors should upload their presentations (the day before, preferably, or the morning/lunch of their presentation day) directly to the computers in the rooms where the sessions/workshops will be held.

**Important:** Please rename your files - session/wsh-time-name.ppt (e.g. **S01-0900-Smith.ppt**, **W10-1530-Kim.ppt**).

After the Symposium PICES Secretariat will contact each presenter for permission to post their talk on the Symposium website (extra slides removed, file converted to pdf format).

### Posters

Posters will be on display at the Washington Hilton Hotel (Columbia West and International Terrace) from 18:30-21:30 of June 6. Poster presenters are expected to be available at their posters for 90 min. (19:00-20:30) to answer questions during this Poster Session/Reception. Your poster numbers are at the end of this program (e.g. **S2-P6**). Look for your session and poster number on the board.

### Internet access

Wireless internet access will be available to all participants.

### Social activities

#### Symposium Welcome Reception

*June 4 (18:30-20:30)*

*The Washington Hilton (Heights Courtyard – Lobby Level)*

Welcome reception for all Symposium attendees.

#### Norway-COMPASS Reception

*June 5 (18:30-21:00)*

*The Washington Hilton (Columbia West)*

Join us for a special reception highlighting the Nanson Legacy Initiative and the importance of science communication.

#### Poster Session / Reception

*June 6 (18:30-21:30)*

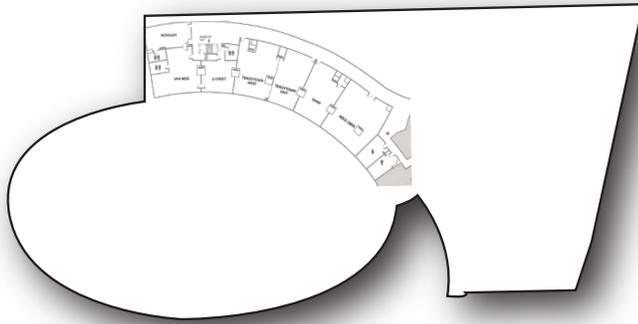
*The Washington Hilton (Columbia West and International Terrace)*

Join your colleagues at this special Poster Session and Reception. Check out the great poster displays and chat with presenters while sipping a beverage and nibbling on snacks.

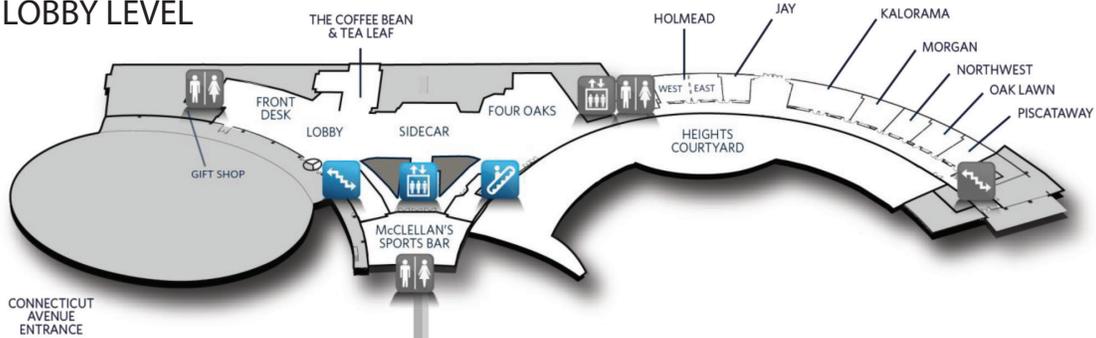
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# FLOOR PLAN WASHINGTON HILTON

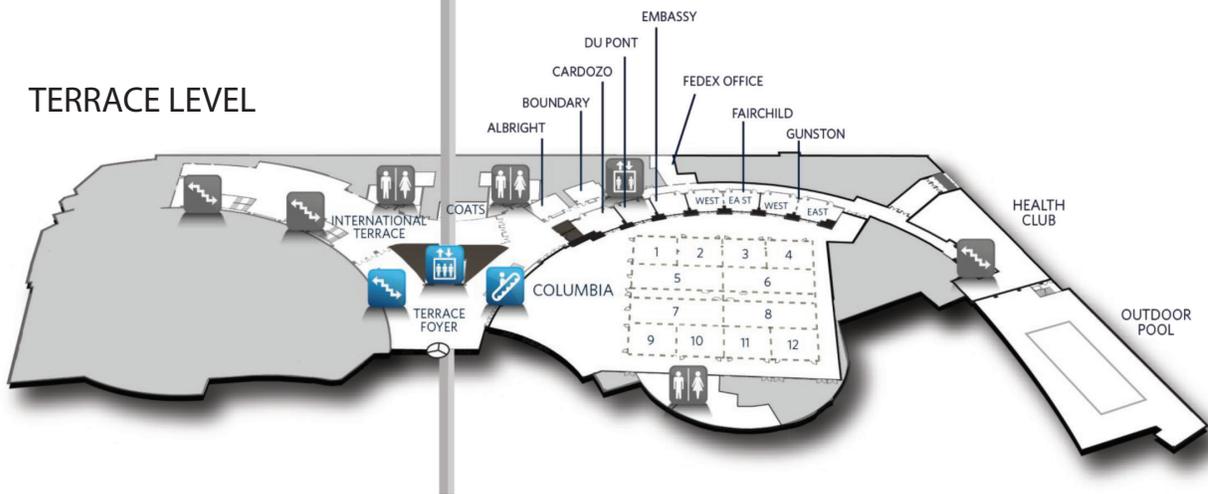
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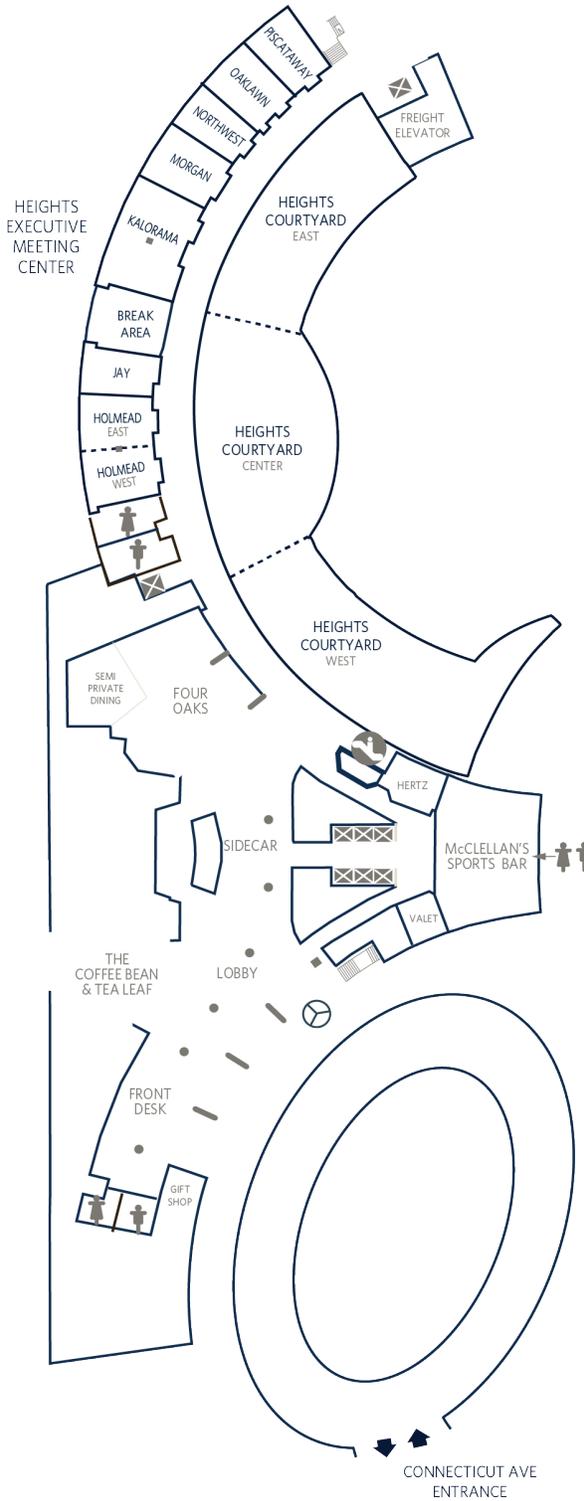
## LOBBY LEVEL



## TERRACE LEVEL

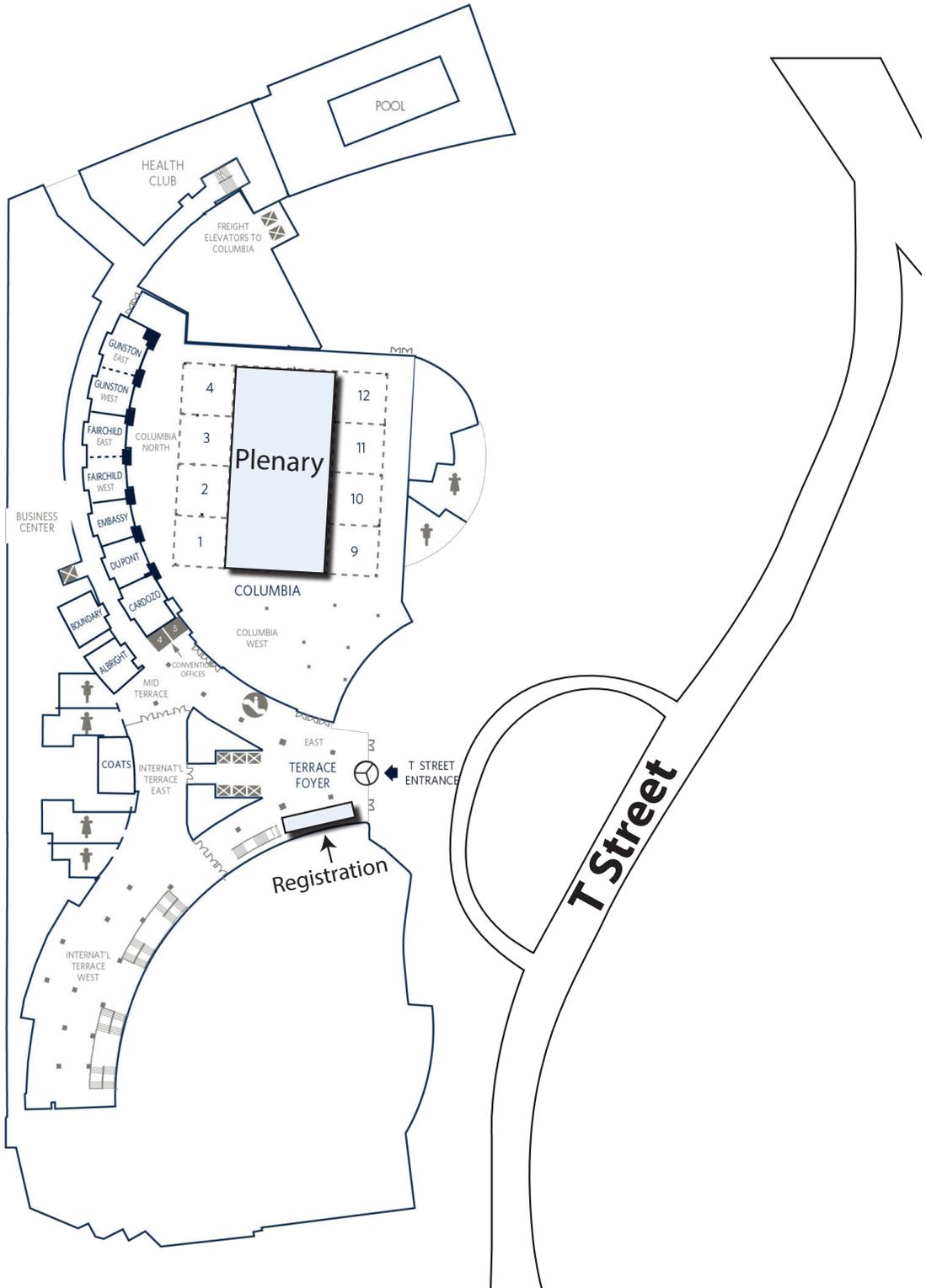


# LOBBY LEVEL WASHINGTON HILTON



# TERRACE LEVEL WASHINGTON HILTON

FLOOR PLAN



# FIRST FLOOR MEETING SPACE WASHINGTON HILTON



## Program At-A-Glance (June 2-3: Workshops)

Workshops will run 0900-1800, with 1.0-1.5 h for lunch and 20-min morning and afternoon coffee breaks

### Saturday, 2 June

Room	<i>Columbia 1</i>	<i>Columbia 2</i>	<i>Columbia 9</i>	<i>Columbia 4</i>	<i>Columbia 3</i>	<i>Columbia 11</i>
0900-1230	W1		W11 (closed)	W9	W6	SCOR WG 155 EBUS (closed)
1330-1800		W2 (1300-1800)				

### Sunday, 3 June

Room	<i>Columbia 1</i>	<i>Columbia 2</i>	<i>Columbia 9</i>	<i>Columbia 4</i>	<i>Columbia 3</i>	<i>Columbia 11</i>	<i>Columbia 10</i>	<i>Columbia 12</i>
0900-1230	W3		W11 (open)	W7	W5	SCOR WG 155 EBUS (closed)	W10	W8
1330-1800		W4 (1300-1800)						

### Saturday, 9 June

Room	<i>Tenleytown E+W</i>
0900-1230	WK-PESTLE
1330-1800	

### Workshops:

- W1 Communicating and responding to climate change
- W2 Advances in Earth System Models (ESMs) for marine applications
- W3 Exploring potential ocean-based solutions to climate change impacts on marine biodiversity and ecosystem services
- W4 Climate change adaptation of fisheries and aquaculture: examples of field projects supporting countries and communities
- W5 Climate Change and Fishing Communities: Interactions with Environmental Conservation, Sustainable Livelihoods and Food Security
- W6 Utilizing bioenergetics measurements and modeling to evaluate climate change effects on marine species and ecosystems
- W7 What do seabirds reveal about the effects of climate change on the World's Oceans?
- W8 Connecting climate, ocean and ecosystem observation – Ocean observation futures
- W9 Vulnerability of Low Elevated Coastal Zones (LECZ) to SLR in changing oceans
- W10 Intercomparison of fisheries and marine ecosystem models
- W11 PICES Working Group 36 (CERP) on Common Ecosystem Reference Points across PICES Member Countries workshop: "Quantifying thresholds in driver-response relationships to identify reference points"

## Program At-A-Glance (June 4-8: Sessions and Events)

TIME	Monday, 4 June			
08:30	<b>Opening Welcome [Columbia 5-8]</b>			
08:45	<b>RDML Timothy Gallaudet (Keynote)</b> Assistant Secretary of Commerce for Oceans and Atmosphere and Acting Under Secretary of Commerce for Oceans and Atmosphere, USA			
09:05	<b>Philippe Cousteau (Keynote)</b> Filmmaker, Explorer, Advocate, CA, USA			
09:55	<b>Musical Performance</b>			
10:05	<b>Science Panel: Oceans in a Changing Climate</b>			
11:00	<b>Preview of Days Sessions (S5, S6, S8, S9, S12, S16)</b>			
11:15	<b>COFFEE</b>			
<b>Room ==&gt;</b>	<i>Columbia 1&amp;2</i>	<i>Columbia 3&amp;4</i>	<i>Columbia 9&amp;10</i>	<i>Columbia 11&amp;12</i>
11:35	<b>S5</b>	<b>S16</b>	<b>S9</b>	<b>S6</b>
12:45	<b>LUNCH</b>			
<b>Room Columbia 5-8</b>	<b>Oh the Places You'll Go: Lessons for Early Career Professionals (TOWN HALL EVENT sponsored by Women's Aquatic Network)</b>			
14:00	S5 Continues	S16 Continues	S9 Continues	S6 Continues
16:20	<b>COFFEE</b>	<b>COFFEE; S16 Ends (16:00)</b>	<b>COFFEE</b>	<b>COFFEE; S6 Ends</b>
16:40	S5 Continues	<b>S8 (Day 1) (16:20)</b>	S9 Continues	<b>S12 (Day 1)</b>
18:20	S5 Ends	S8 (Day 1) Ends	S9 Ends	S12 (Day 1) Ends
18:30 20:30	<b>WELCOME RECEPTION</b> <i>The Washington Hilton (Heights Courtyard – Lobby Level)</i>			

TIME	Tuesday, 5 June			
08:30	<b>Announcements/Preview Sessions (S1, S3, S12, S13) [Columbia 5-8]</b>			
08:50	<b>IOC - Ocean Decade (Vladimir Ryabinin, Executive Secretary, IOC-UNESCO)</b>			
09:05	<b>David Allen Hutchins (S13 Plenary)</b>			
09:35	<b>Eric Galbraith (S12 Plenary)</b>			
10:05	<b>Naomi Harada (3 Plenary)</b>			
10:35	<b>COFFEE</b>			
<b>Room ==&gt;</b>	<i>Columbia 1&amp;2</i>	<i>Columbia 3&amp;4</i>	<i>Columbia 9&amp;10</i>	<i>Columbia 11&amp;12</i>
11:00	<b>S13</b>	<b>S12 (Day 2)</b>	<b>S3</b>	<b>S1 (Day 1)</b>
13:10	<b>LUNCH</b>			
<b>Room Columbia 5-8</b>	<b>Communicating Science about the Effects of Climate Change on the World's Oceans (COMPASS TOWN HALL EVENT)</b>			
14:20	S13 Continues	S12 Continues	S3 Continues	S1 Continues
16:20	<b>COFFEE</b>	<b>COFFEE</b>	<b>COFFEE</b>	<b>COFFEE</b>
16:40	S13 Continues	S12 Continues	S3 Continues	S1 Continues
18:20	S13 Ends	S12 Ends	S3 Ends	S1 (Day 1) Ends
18:30 21:00	<b>NORWAY-COMPASS HOSTED EVENING RECEPTION</b> <i>The Washington Hilton (Columbia West)</i>			

TIME	Wednesday, 6 June			
08:30	Announcements/Preview Sessions (S4, S10, S14, S15) [Columbia 5-8]			
08:50	Merle Sowman (S14 Plenary)			
09:20	Prateep Kumar Nayak (S15 Plenary)			
09:50	Gretta Pecl (S10 Plenary)			
10:20	Dimitri Gutierrez (S4 Plenary)			
10:50	COFFEE			
Room ==>	<i>Columbia 1&amp;2</i>	<i>Columbia 3&amp;4</i>	<i>Columbia 9&amp;10</i>	<i>Columbia 11&amp;12</i>
11:10	S14 (Day 1)	S15	S10	S4
12:40	LUNCH			
Room <i>Columbia 5-8</i>	Benchmarks for Ecosystem Assessment: Indicators and Guidelines for Practical Ecosystem-Based Fishery Management (TOWN HALL EVENT sponsored by Lenfest Ocean Program and CSIRO)			
14:00	S14 Continues	S15 Continues	S10 Continues	S4 Continues
16:00	COFFEE			
16:20	S14 Continues	S15 Continues	S10 Continues	S4 Continues
18:20	S14 (Day 1) Ends	S15 Ends	S10 Ends	S4 Ends
18:30	POSTER SESSION / RECEPTION (all posters will be on display) <i>The Washington Hilton (Columbia West and International Terrace)</i>			

TIME	Thursday, 7 June			
08:30	Announcements/Preview Sessions (S2, S7, S11, S17) [Columbia 5-8]			
08:50	Andreas Oschlies (S7 Plenary)			
09:20	Iddya Karunasagar (S17 Plenary)			
09:50	Lisa Goddard (S2 Plenary)			
10:20	Steve Widdicombe (S11 Plenary)			
10:50	COFFEE			
Room ==>	<i>Columbia 1&amp;2</i>	<i>Columbia 3&amp;4</i>	<i>Columbia 9&amp;10</i>	<i>Columbia 11&amp;12</i>
11:10	S7	S17	S2	S11 (Day 1)
12:40	LUNCH			
Room <i>Columbia 5-8</i>	Ocean assessment in the Sixth Assessment Cycle of the Intergovernmental Panel on Climate Change (IPCC TOWN HALL EVENT)			
14:00	S7 Continues	S17 Continues	S2 Continues	S11 Continues
16:00	COFFEE	COFFEE	COFFEE	COFFEE
16:20	S7 Continues	S17 Continues	S2 Continues	S11 Continues
17:40		S17 Ends		
18:20	S7 Ends		S2 Ends	S11 (Day 1) Ends

TIME	Friday, 8 June			
08:30	Announcements/Publication Plans and Target Dates [ <i>Columbia 5-8</i> ]			
08:50	Severino G. Salmo III (S18 Plenary)			
09:20	Alistair Hobday (S1 Plenary)			
09:50	Fan Wang (S8 Plenary)			
10:20	COFFEE			
Room ==>	<i>Columbia 1&amp;2</i>	<i>Columbia 3&amp;4</i>	<i>Columbia 9&amp;10</i>	<i>Columbia 11&amp;12</i>
10:40	S8 (Day 2)	S1 (Day 2)	S14 (Day 2)	S11 (Day 2)
12:20	LUNCH			
13:40	S8 Continues	S1 Continues	S14 Continues	S11 Continues
15:00	S8 Ends	S1 Ends	S14 Ends	S11 Ends
15:00	COFFEE			
15:20	Plenary Closing Ceremony [ <i>Columbia 5-8</i> ]			
17:00	END OF SYMPOSIUM			

### Sessions:

- S1 Ocean extremes and their impact on marine ecosystems
- S2 From prediction to projection: the role of seasonal to decadal forecasts in a changing climate
- S3 Carbon uptake, ocean acidification, and ecosystems and human impacts
- S4 Deoxygenation in Global Ocean and Coastal Waters in Relation to Climate Change
- S5 Climate change impacts on high latitude systems on multiple scales in space and time
- S6 The deep ocean under climate change
- S7 Eastern Boundary upwelling systems: diversity, coupled dynamics and sensitivity to climate change
- S8 Understanding the impact of Abrupt Ocean Warming and Continental Scale Connections on marine productivity and food security via Western Boundary Currents
- S9 Drifting into the Anthropocene: How will pelagic marine ecosystems be affected and what are the biogeochemical and lower trophic consequences
- S10 Management and conservation of species on the move
- S11 Benthic and pelagic system responses in a changing ocean: From genes to ecosystem level functioning
- S12 Scenarios and models to explore the future of marine coupled human-natural systems under climate change
- S13 Multiple stressors at multiple scales: ecosystem based management in the face of changing ocean conditions
- S14 Vulnerability and adaptation of marine socio-ecological systems to climate change
- S15 Fisheries and aquaculture in the face of climate change: Current actions, identified solutions and opportunities in support of sustainable livelihoods and food security
- S16 Climate, oceans and security
- S17 Effects of climate change on ocean ecosystem health: Projecting occurrences of harmful algal blooms and disease outbreaks and assessment of the risk to ecosystem functioning, aquaculture, fisheries and human health
- S18 POSTER Session only: Coastal ecosystem and their blue carbon science, conservation and policy progress



## Sessions and Workshops Descriptions

### ***Session 1: Ocean extremes and their impact on marine ecosystems***

#### **Convenors:**

Thomas Froelicher (*Corresponding*) (University of Bern, Switzerland)

Gabriel Reygondeau (Institute for the Oceans and Fisheries, The University of British Columbia, Canada)

Emanuele Di Lorenzo (Georgia Institute of Technology, GA, USA)

Extreme climate and weather events shape the structure of biological systems and affect the biogeochemical functions and services they provide for society in a fundamental manner. There is overwhelming evidence that the frequency, duration, intensity and timing of extreme events on land are changing under global warming, increasing the risk of severe, pervasive and in some cases irreversible impacts on natural and socio-economic systems. In contrast we know very little about how extreme events in the ocean, especially those associated with warming, acidification, deoxygenation and nutrient stress, will unfold in time and space. In addition, our understating of the impact of ocean extreme events on marine organisms and ecosystem services is very poor. This session seeks current knowledge as well as new and evolving insights into modeling and observational efforts that advance our understanding of the regional and global short-term and long-term changes in marine extreme events (heat waves, hypoxia, acidification, nutrient stress) and how these events impact marine organisms, biodiversity and ecosystem services.

### ***Session 2: From prediction to projection: the role of seasonal to decadal forecasts in a changing climate***

#### **Convenors:**

Mark R. Payne (*Corresponding*) (DTU-Aqua, Technical University of Denmark Copenhagen, Denmark)

Erica Ombres (NOAA OAR Ocean Acidification Program, USA)

Mike Jacox (University of California Santa Cruz, Institute of Marine Sciences, NOAA Southwest Fisheries Science Center, USA)

Masami Nonaka (Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Yokohama, Japan)

Research examining the future impacts of environmental change and variability on ocean ecosystems has historically been focused on making projections on multi-decadal to centennial time scales. Nevertheless, recent years have seen the emergence of the first generation of marine ecosystem predictions working on shorter timescales (i.e. seasonal, annual and decadal scales). These forecasts are tailored to the tactical decision-making timescales of individuals, businesses, sectors or governments and inform strategies for coping with and adapting to climate change and variability. They also form a natural continuum with projections on the climatic timescale: many of the techniques used are similar, and testing predictability in the short-term builds confidence in our ability to project in the long-term. In this session, we welcome contributions on a broad range of potential future impacts on ocean ecosystems, including (but not limited to) ocean warming, circulation changes, acidification, eutrophication, hypoxia, and ecosystem structure or function. We seek research that addresses prediction of these ecosystem impacts as well as its relationship to long-term projections; relevant topics include 1) mechanisms that generate predictability in ocean ecosystems, 2) methods for statistically and/or mechanistically forecasting physical and/or biological variables, 3) case studies of existing biological forecast systems, 4) requirements for forecasts - including end-user needs - and assessment of forecast value, and 5) uses of forecasts within a climate-change adaptation context. Contributions that link the time-scales of prediction and projection and highlight examples of what one field can learn from the other are particularly encouraged.

**Session 3: Carbon uptake, ocean acidification, and ecosystems and human impacts****Convenors:**Masahiko Fujii (*Corresponding*) (Hokkaido University, Japan)

Tsuneo Ono (Japan Fisheries Research and Education Agency)

Libby Jewett (NOAA)

Galen A. McKinley (Columbia University/Lamont Doherty Earth Observatory)

Nianzhi Jiao (Xiamen University)

By absorbing significant quantities of CO<sub>2</sub>, the ocean provides a critical climate regulation service. At the same time, carbon uptake is altering marine biogeochemistry, food web and ecosystem properties. Other drivers of large-scale degradation of the marine environment have been widely reported, specifically temperature-driven coral bleaching and hypoxia. Yet, there exist significant uncertainties. The long-term ability of the ocean to absorb carbon and thus to modulate climate is a critical question of utmost relevance to international climate negotiations. Uncertainties with respect to impacts on marine ecosystems and human society hinders the effective management of ocean resources.

In this session, we will explore a range of physical, biogeochemical, and sociological interactions that impact the ocean CO<sub>2</sub> sink, rates of acidification, and ecosystem impacts. Presentations will characterize the physical and biogeochemical processes driving current and projected future CO<sub>2</sub> uptake, variability, and long-term trends. Advanced methods both for observing CO<sub>2</sub> uptake, and for modeling its variability and change will be discussed. Contributions are also welcome from observational, experimental, modeling and socio-economic studies on ocean acidification, hypoxia, biological carbon sequestration and related ecosystem dynamics with various spatio-temporal scales, from local to global and from short to long-term. Linkages between these processes with potential development of international observing and modeling networks, vulnerability assessments, management strategies and integrative studies are particularly welcome.

**Session 4: Deoxygenation in global ocean and coastal waters in relation to climate change****Convenors:**Denis Gilbert (*Corresponding*) (Pelagic and Ecosystem Science Branch, Maurice-Lamontagne Institute, Fisheries and Oceans Canada, Québec, Canada)

Nancy N. Rabalais (Department of Oceanography and Coastal Sciences, Louisiana State University, USA)

Deoxygenation in the open ocean, upwelling systems, oxygen minimum zones, and coastal waters is expected to accelerate over the next decades in response to warming-induced reduction in O<sub>2</sub> solubility and increased ocean stratification that would diminish ventilation of marine waters. In addition, multiple stressors from eutrophication worsen oxygen depletion in coastal waters where hypoxia and harmful algal blooms (including those that are toxin producers) is now a prevalent and worsening situation. Observations indicate that the global ocean oxygen inventory has already decreased by 2% over the past five decades, and the volume occupied by oxygen minimum zones (OMZ) quadrupled over the same time period. Many questions are raised for open ocean and coastal waters. Do the spatial and temporal patterns of observed oxygen changes match projections from climate change models? Do large-scale patterns of atmospheric and oceanic variability such as ENSO (El-Niño Southern Oscillation), the Pacific Decadal Oscillation, the North Atlantic Oscillation or the Southern Annular Mode prevent us from detecting multi-decadal oxygen trends with confidence because of a signal to noise ratio that still remains too low? Should we expect that coastal waters, because of their adjoining landscapes and oceanscapes, will be variably affected by warming? Changes in temperature, winds and currents will alter physical processes. Biological process rates should increase up to some point where other limiting factors may intervene. Climate-driven changes in landscape use, particularly agriculture, will occur along with changes in precipitation, weather patterns, freshwater discharge and nutrient loads, all drivers of physical structure and biological production that can cause changes in dissolved oxygen concentrations in the lower water column. How does global warming affect the ocean's density stratification, vertical mixing rates, deep convection, and ventilation processes in the main thermocline? What are the expected impacts of deoxygenation on various trophic levels, on biogeochemical cycles, on fisheries and on ecosystem functions and services? How can studies of paleo-indicators shed light on what we may expect in the future?

In this session we are seeking contributions that will help address the physics and biogeochemistry of deoxygenation – from continental shelves to the deep ocean – from various angles: causes, impacts, monitoring and modeling. We welcome presentations that include long-term observations that help conceptualize the intricacies of how inter-related biological and physical processes drive oxygen changes.

### ***Session 5: Climate change impacts on high latitude systems on multiple scales in space and time***

#### **Convenors:**

Will Perrie (*Corresponding*) (Bedford Institute of Oceanography, DFO, Canada)

Vincent Saba (NOAA National Marine Fisheries Service, Princeton NJ, USA)

This session focuses on climate impacts on high latitude systems and northern and southern polar regions at both regional (e.g., Bering Sea, Beaufort Sea, Barents Sea, Labrador Sea) and broader spatial scales (e.g., Arctic Ocean and the Southern Ocean). We seek papers that evaluate climate impacts at time scales ranging from seasonal, decadal, to multi-decadal. Included topics might be: (a) Seasonal time scales, for example, estimates of September ice conditions and links to preceding winter and early spring atmosphere or ocean conditions; (b) The impacts of climate change on high latitude and Arctic or Southern Ocean storms and their impacts and feedbacks on the upper ocean; (c) The role of inertial gravity waves, mesoscale and sub-mesoscale eddies and related processes on mixed layer depths, vertical mixing, and on the ice edge etc; (d) Estimates of climate and climate change on longer time scales, up to the next several decades, e.g. following IPCC scenarios; and (e) Climate impacts on high latitude ecosystems and ecosystem services (i.e. fisheries).

### ***Session 6: The deep ocean under climate change***

#### **Convenors:**

Nadine Le Bris (*Corresponding*) (University Pierre and Marie Curie, France)

Andrew Sweetman (The Lyell Centre, Heriot-Watt University, UK)

Covering over half of the planet, and comprising 95% its habitable volume, the deep ocean (>200 m) is critical to any analysis of the role of the ocean in climate mitigation and adaptation. Beyond its capacity to absorb excess heat, the deep ocean has a predominant role in sequestering carbon and removing it from the atmosphere. The deep sea hosts a broad range of pelagic and benthic ecosystems, which provide services that are vitally important to the entire ocean and biosphere, ranging from nutrient cycling to habitat provision, including greenhouse-gas regulation, support to biodiversity (including genetic diversity), food supply and energy production.

Today, significant changes in the environmental properties of the ocean realm in terms of water column oxygenation, temperature, pH and food supply, with concomitant impacts on deep-sea ecosystems are being recorded at great depth. Recent projections suggest that abyssal (3000–6000 m) ocean temperatures could increase by 1°C over the next 84 years, while abyssal seafloor habitats under areas of deep-water formation may experience reductions in water column oxygen concentrations by as much as 0.03 mL L<sup>-1</sup> by 2100. Bathyal depths (200–3000 m) worldwide are predicted to undergo the most significant reductions in pH in all oceans by the year 2100 (0.3 to 0.4 pH units). O<sub>2</sub> concentrations may also decline in the bathyal NE Pacific and Southern Oceans, with losses up to 3.7% or more, especially at intermediate depths. Another important environmental parameter, the flux of particulate organic matter to the seafloor, is likely to decline significantly in most oceans, most notably in the abyssal and bathyal Indian Ocean where it is predicted to decrease by 40–55% by the end of the century.

However, how these changes will affect deep-sea ecosystem (both benthic and pelagic) functions and the ecosystem services the deep sea provided are just starting to be inventoried. There are, in particular, still large gaps in our knowledge of deep hydrology, hydrography, pelagic and seafloor ecology that must be filled to anticipate how these

changes may impair ecosystems at depth and potential feedbacks to surface waters. The growing imprint of human activities at great depths, including contaminant accumulation, overfishing, and disturbances from seafloor extractive activities, further justifies the need for a better understanding of how direct impacts will interact with climate stressors. New knowledge is critical to improve predictions and assess societal impacts, and requires the expansion of deep-water observing programs with experimental capacities, to support the design of marine protected areas encompassing vulnerable regions in deep waters, and to inform environmental management of industrial activities and development of new policies addressing deep national and international waters. There is also an unprecedented need to integrate the deep ocean into ocean science and policy. New international regulations (e.g. for mining) and treaties (e.g. for biodiversity), environmental management, and spatial planning also must incorporate climate change impacts on deep ocean-processes.

In this session, we invite presentations that describe how climate stressors may alter deep-ocean ecosystems, as well as their combination with other occurring anthropogenic stressors (e.g., fishing, mineral mining), and what the possible societal implications may be. Current initiatives and observing programs, scientific and policy advances and technological developments that will contribute to this effort are also welcome.

### ***Session 7: Eastern Boundary upwelling systems: Diversity, coupled dynamics and sensitivity to climate change***

#### **Convenors:**

Ivonne Montes (*Corresponding*) (Instituto Geofísico del Perú)

Ryan Rykaczewski (Department of Biological Sciences and Marine Science Program, University of South Carolina, USA)

The Eastern Boundary Upwelling Systems (EBUS) are the most productive areas of the world's oceans, supporting large populations of commercially important fish species. The basic forcing mechanisms are similar across the different EBUS. However, owing to differences in the relative strengths of potential stressors, a unified understanding regarding the sensitivity of individual EBUS to climate change remains elusive. In this session, we focus on the different physical mechanisms occurring over different time scales (i.e., intradaily, intraseasonal, interannual, decadal, multidecadal) and their implications for water-column properties, biogeochemical cycles, biodiversity/ecosystem structure and functioning, and the regional climate. We seek to identify the key feedback processes in EBUS, appreciate the similarities across systems, and understand the differences. We also intend to identify critical knowledge gaps that limit our current understanding of physical and ecological responses to natural and anthropogenic climate forcing in EBUS.

### ***Session 8: Understanding the impact of abrupt ocean warming and continental scale connections on marine productivity and food security via Western Boundary currents***

#### **Convenors:**

Ellen Mccray (*Corresponding*) (NOAA / NESDIS / NCEI)

Avijit Gangopadhyay (UMassD / SMAST)

Hassan Moustahfid (FAO, UN)

John Quinlan (NOAA / NMFS / SEFSC)

Living marine resources and the coastal communities that depend on them are shifting in response to rapid physical and environmental changes. How are these changes being monitored and measured when connected on large scales by boundary currents and differing management regimes? Recent physical oceanographic studies have shown that changes in the intensity and position of several western boundary currents have already been observed. Specifically, the Kuroshio and Agulhas Currents have shifted their paths poleward. The consequences of such changes for ecosystems, and especially for marine productivity and fisheries, are beginning to emerge. The impact of Arctic meltwater and the North Atlantic Oscillation on the Atlantic Meridional Overturning

Circulation and the Gulf Stream have been observed over a few decades now. These changes may be related to disappearing cod and other species from the western north Atlantic and introduction of some new species in the North Atlantic. Similar regime shifts in the productivity of several small pelagic fish species also have severe implications on food security and malnutrition of coastal communities, particularly in West Africa. This session will examine the physical and biological changes measured and documented in western boundary current regimes (e.g., Loop Current / Gulf Stream, Kuroshio, Brazil, East Australian, and Agulhas Currents), with special emphasis on how these changes impact species range shifts, phenology, species interactions, resource management planning and adaptation, as well as the food security and social fabric of coastal communities.

We welcome larger community participation from ocean, climate and fisheries scientists to present advances in (i) understanding physical and biological linkages (ii) boundary current variabilities and trends under climate change and/or (iii) the impact of recent changes in western boundary currents on marine life, productivity, fisheries and food security.

Additional emphasis will be placed on the examination of oceanic and estuarine ‘hotspots’ in these systems, and any evidence for specific areas that can provide environmental refugia for living marine resources.

***Session 9: Drifting into the Anthropocene: How will pelagic marine ecosystems be affected and what are the biogeochemical and lower trophic consequences***

**Convenors:**

Todd D. O’Brien (*Corresponding*) (NOAA Fisheries, USA)

Angelica Peña (Institute of Ocean Sciences, Canada)

Climate-related changes in the physical and chemical oceanic environment impact the biological and biogeochemical components of marine ecosystems. These impacts take effect at a variety of spatial and temporal scales, and at varying magnitudes, and often differ greatly between geographic regions and realms (e.g., polar vs. equatorial, shelf vs. open ocean). Ultimately, these changes can greatly alter the productivity, biodiversity, and resilience of the marine ecosystems that depend on them.

Since the first ECCWO in 2008, numerous studies have documented changes in ocean acidification, deoxygenation and carbon cycling, planktonic biodiversity and biogeographic range, and the phenology and strength of seasonal events (e.g., spring blooms, onset and strength of stratification, extent and presence of sea ice). Have these instances and impacts changed in magnitude, severity, or geographic extent since 2008, and are new impacts and side-effects now being uncovered?

This session will look at observed and predicted causes and impacts of climate-related changes within pelagic marine lower trophic levels (e.g., microbes, plankton, larval fish) and biogeochemical components (e.g., carbon, oxygen and nutrient cycling), including studies using systematic and sustained ocean observations and modeling.

**Session 10: Management and conservation of species on the move****Convenors:**Charles Stock (*Corresponding*) (USA)

Shin-ichi Ito (Japan)

Thomas Therriault (Canada)

Wendy Morrison (USA)

Samantha Twiname (Australia)

Most fisheries and marine conservation efforts have been managed under the assumption that species distributions are static or fluctuate around historical averages. Sustained scientific surveys and new technologies, however, have revealed persistent climate-driven movements. In some areas, this has resulted in movements across management jurisdictions. Such movements are projected to continue under global warming, creating difficult questions for managers trying to balance coastal economic interests and conservation goals. For example, do past observed shifts reflect future responses? How will the invasion of new species impact resident populations? How will shifted species adapt to new environments? When should new fisheries be established? When is a historically productive fishery extirpated? Should protected areas be relocated? How should historical quotas be adjusted for range shifts? This session welcomes ecosystem, policy and economic research aimed at answering such questions and developing management and conservation strategies that are resilient to movement. Contributions can span research addressing novel observations of and mechanisms underlying movement, modeling historical and projecting future movements and their ecosystem consequences, and incorporation of movement into management and conservation decisions.

**Session 11: Benthic and pelagic system responses in a changing ocean: From genes to ecosystem level functioning****Convenors:**Mahasweta Saha (*Corresponding*) (Helmholtz Center for Ocean Research - Kiel (GEOMAR), Germany)

Stacy Krueger Hadfield (University of Alabama at Birmingham, USA)

Uli Sommer (Helmholtz Center for Ocean Research - Kiel (GEOMAR), Germany)

The rapid climate change we are experiencing today poses a major threat to Earth's biodiversity and ecosystem functioning. Ongoing global change is expected to shift the average levels of pCO<sub>2</sub>, temperature, pH or oxygen by regionally-variable amounts and also to increase the occurrence and intensity of transient extreme events causing species extinction and range shifts with economic impacts. It has recently been suggested that increased variation, rather than changes in mean values, may represent the greater threat to species survival, stressing the need to experimentally study the effects of both environmental variations and extreme events on ecosystems and their functioning. Along with overfishing and deoxygenation at local scales, biological invasions form one of the principal components of global change. Disease occurrence (pathogens, parasites) among hosts including algae, corals and sponges can substantially increase with ocean warming. This session invites contributions from marine biologists and ecologists to bring diverse expertise and new perspectives to a subject of global significance. We encourage submissions from field, laboratory, and mesocosm studies that offer new insights into the functioning of benthic and pelagic ecosystems at the genetic, population, community and ecosystem scale under biotic and abiotic stressors.

***Session 12: Scenarios and models to explore the future of marine coupled human-natural systems under climate change***

**Convenors:**

William W.L. Cheung (*Corresponding*) (Institute for the Oceans and Fisheries, The University of British Columbia, Canada)

Lisa Crozier (Northwest Fisheries Science Centre, NOAA, USA)

Desiree Tommasi (Southwest Fisheries Science Centre, NOAA, USA)

Oai Li Chen (Institute for the Oceans and Fisheries, The University of British Columbia, Canada)

The oceans consist of coupled human and natural systems. Responses of marine ecosystems to climate change are thus shaped by human-natural interactions. For example, climate change effects on the biogeochemical properties of the oceans and foodwebs set ecological constraints on fish production. Economically, seafood demand from the growing population, evolving consumption patterns and costs of seafood production determine the viability of fisheries and aquaculture. Socially, available technology, historical development, political stability and regulatory policies also limit the extent of fisheries and mariculture development. Developing scenarios and models for the oceans that incorporate interactions between human and natural components are essential for understanding the dynamics of these coupled systems and informing climate mitigation and adaptation choices. This session invites oral or poster presentations that contribute to understanding the interactions between human and natural marine systems under climate change. Specific topics of the submissions may include, but are not limited to, scenarios e.g., shared socioeconomic pathways for marine systems or sectors; models that integrate different dimensions of human-natural systems e.g., biophysical, economic, social, political dimensions; management strategy evaluations e.g., stakeholder-driven simulation processes that incorporate biological, fishery, and management sub-models to compare the effectiveness of alternative regulatory policies while accounting for uncertainty in different sources, including climate effects; testing, comparison, exploration and integration of multiple modelling approaches; and empirical and mechanistic exploration of the dynamics of coupled human-natural systems. Studies from different marine systems, sectors and spatial scales are welcome. A special issue of a journal for this session may be organized.

***Session 13: Multiple stressors at multiple scales: Ecosystem based management in the face of changing ocean conditions***

**Convenors:**

Carol Robinson (*Corresponding*) (University of East Anglia, UK)

Isaac Kaplan (NOAA North West Fisheries Science Center, USA)

Franklin Schwing (Office of Science and Technology, NOAA Fisheries, USA)

Philip Boyd (University of Tasmania, Australia)

Saskia Otto (Hamburg University, Germany)

The marine realm is experiencing unprecedented changes resulting from the complex interactions between multiple stressors and drivers over multiple time and space scales and which, in turn, affect the human communities that rely on the ocean's services and resources. Ocean warming, acidification, changing circulation, and deoxygenation are all expected to shift both the productivity and distribution of marine species, and therefore their availability to human communities that depend upon them.

Ecosystem-based management (EBM) is an integrated science-based approach to help evaluate trade-offs in resource uses and maintain healthy, productive, and resilient ecosystems and the services they provide. EBM recognizes the full array of ecosystem interactions and components, including humans, and because it is adaptive, EBM allows the dynamic nature of ecosystems to be managed in the face of multiple human and natural stressors. Integrated ecosystem assessments (IEAs) are a critical science-support element enabling EBM. IEAs synthesize biological, environmental, and socioeconomic information, define objectives, monitor the status of indicators related to those objectives, assess risk, test alternative management scenarios

and options, and measure performance relative to objectives. This holistic approach allows consideration of trust resources (e.g., protected species, fish stocks) and trade-offs across multiple human sectors such as shipping, fishing, and energy in the context of stressors such as warming and ocean acidification.

This session invites contributions from researchers investigating how interactions between climate-driven stressors such as warming, ice loss, ocean acidification, and deoxygenation and human driven stressors such as fishing, coastal development, and pollution, impact marine ecosystem structure and functioning at a range of scales, including the provision of ecosystem services. This includes analyses of the ecosystem consequences of multiple stressors on individual species and the importance of biodiversity in the resilience of ecosystems in the face of multiple drivers of change. Examples of integrated sectoral management such as ecosystem-based fisheries management (EBFM), an important step toward cross-sector EBM, are requested. Studies that project and predict future states by incorporating the estimated consequences of interacting multiple stressors at multiple scales on marine ecosystems and human societies, and those that describe how governments and partners are incorporating climate-related impacts into management and decision-making with the use of EBM tools, approaches, and case studies are also encouraged.

The session is aligned with the 2015-2026 science plan of the SCOR (Scientific Committee on Oceanic Research) and Future Earth sponsored Integrated Marine Biosphere Research (IMBeR) project and the SCOR working group 149 ‘Changing Ocean Biological Systems’.

#### ***Session 14: Vulnerability and adaptation of marine socio-ecological systems to climate change***

##### **Convenors:**

Jörn Schmidt (*Corresponding*) (Kiel Marine Science at Kiel University, Kiel, Germany)

Catarina Frazão Santos (MARE — Marine and Environmental Sciences Centre, Laboratório Marítimo da Guia, Faculdade de Ciências, Universidade de Lisboa, Cascais, Portugal)

Kathy Mills (Gulf of Maine Research Institute, Portland, USA)

The recent OECD report on the blue (ocean) economy identified it as being “essential to the welfare and prosperity of humankind” and “a key source of food, energy, minerals, health, leisure and transport upon which hundreds of millions of people depend.” With ocean economic activity poised to double by 2030, operations and management of existing and emerging industries will need to function effectively in a changing climate to ensure the sustainability of both socioeconomic development and ocean ecosystems.

Climate change is already profoundly affecting coastal communities, as well as ocean-based livelihoods and industries (e.g. fisheries, aquaculture) and related management systems, through a variety of impact pathways (e.g. sea level rise, ocean acidification, extreme events, species distribution shift). Adaptation approaches that have occurred in response to such climate-related impacts vary widely across topics and geographic regions. Similarly, planning for future resilience and adaptation has progressed differently across management bodies, communities, and industries.

Efforts to understand the impacts of climate change, and to plan for future adaptation strategies and management approaches, require a recognition and understanding of existing linkages and feedbacks between (and within) social and ecological factors. In this session, we seek contributions that address frameworks or case studies from around the world on sustainability in marine socio-ecological systems under a changing climate. In particular, we welcome contributions that advance the understanding and awareness of: (1) dimensions of vulnerability (e.g. physical, biological, human, financial) that affect adaptation and mitigation approaches; (2) tools and approaches for planning under climate change (e.g. trade-off analyses, evaluations of robustness of different management approaches, vulnerability assessments); and (3) climate adaptation efforts (both already implemented or planned). Contributions may span multiple social and institutional scales (e.g. individuals, communities, industries, management bodies). Examples related to marine spatial planning (MSP) and fisheries are of particular interest, but a wider range of topics is welcome to the session, specifically studies developed at a community scale (e.g. community-level adaptation to climate change in developing countries)

Besides oral contributions, we specifically invite the presentation of case studies as posters, with a short elevator pitch (max. 2 minutes) in the session. A concise session report with best practices and case studies will be produced.

***Session 15: Fisheries and aquaculture in the face of climate change: Current actions, identified solutions and opportunities in support of sustainable livelihoods and food security***

**Convenors:**

Lena Westlund (*Corresponding*) (FAO Fisheries and Aquaculture Department)

Hassan Moustahfid (FAO Fisheries and Aquaculture Department)

Anthony Charles (IUCN Fisheries Expert Group (IUCN-CEM-FEG) and the Community Conservation Research Network (CCRN))

Ratana Chuenpagdee (Memorial University of Newfoundland, Canada)

Cyrille Barnerias (Global Environment Facility (GEF))

Florence Poulain (FAO Fisheries and Aquaculture Department)

Michael Rust (Department of Commerce, National Oceanic and Atmospheric Administration (NOAA))

As climate change impacts are threatening marine and inland water ecosystems, fishers, fish farmers and coastal inhabitants will bear the full force of these impacts through less stable livelihoods, changes in the availability and quality of fish for food, and rising risks to their health, safety and homes.

This session will showcase current solutions and opportunities (good practices, tools and approaches) for how to respond to climate change and disaster risks in the fisheries and aquaculture sector. In particular, presentations on initiatives and adaptive strategies that use the Ecosystem Approaches to Fisheries and Aquaculture are welcomed as well as those that are concerned with the context of small-scale fishing and fish farming communities, including with reference to Chapter 9 on Disaster risks and climate change of the Voluntary Guidelines for securing sustainable small-scale fisheries in a context of food security and poverty eradication (the SSF Guidelines – FAO, 2015). In this spirit, the session will consider (i) holistic and integrated approaches to address disaster risks and climate change, (ii) the human rights based approach to development (on which the SSF Guidelines are based), (iii) policies, strategies and initiatives for adaptation, mitigation and resilience-building that are developed in full consultation with fishing and fish farming communities, including indigenous peoples and both men and women.

***Session 16: Climate, Oceans and Security***

**Convenors:**

Apurva Dave (*Corresponding*) (US Global Change Research Program, USA)

Alice Alpert (U.S. Department of State, USA)

The marine environment supports livelihoods and provides sustenance and essential services to communities, economies and nations around the world. As climate change affects ocean systems, augmenting and amplifying other environmental stresses, it also impacts human systems that rely on the oceans. While the socio-economic dimensions of these impacts have received more mainstream attention, a broad awareness of how ocean change could affect international governance, political and social stability, and military readiness, operations and strategy, is only recently emerging.

The purpose of this session is to explore how climate impacts on the oceans will, and in some cases already have, affect human, national and international security. We welcome submissions exploring a wide range of issues-including how climate impacts might challenge regional and global governance frameworks (for example, through loss of sea ice in the Arctic or shifts in fish stocks in the South China Sea), pose risks to military effectiveness (for example, through sea level rise around coastal infrastructure), or undercut investments in development (for example, through extreme events that disrupt societies and strain humanitarian assistance). We also welcome papers that examine strategically important regions in which multiple security issues overlap.

This session is intended to promote exchange across ocean science and security policy disciplines, and so a particularly important area of discussion will be the research needs for addressing security issues. The session will also identify gaps in our current knowledge and policy frameworks, and will advance understanding of both the vulnerability and resiliency of security- of the associated challenges and opportunities- arising from oceanic and climate change.

***Session 17: Effects of climate change on ocean ecosystem health: Projecting occurrences of harmful algal blooms and disease outbreaks and assessment of the risk to ecosystem functioning, aquaculture, fisheries and human health***

**Convenors:**

Elisa Berdalet (*Corresponding*) (Institut de Ciències del Mar -CSIC-, Barcelona, Spain)

Ryan Carnegie (Department of Aquatic Health Sciences, Virginia Institute of Marine Science, College of William & Mary, VA, USA)

Alexandra Campbell (Faculty of Science, Health, Education and Engineering, University of the Sunshine Coast, Australia)

Kedong Yin (School of Marine Sciences, Sun Yat-Sen (Zhongshan) University, Guangzhou, China)

Human and ocean health depends on the sustainable use of marine ecosystems, which host invaluable organisms biodiversity, supply food and support economic activities (fisheries, aquaculture, tourism, recreation). These benefits have always been threatened by natural phenomena such as harmful algal blooms (HABs) and pathogen diseases affecting marine life and ecosystems and producing toxins that are bioaccumulated and transferred through the food web up to humans. However, ongoing climate change and anthropogenic pressures can exacerbate these negative impacts by favoring geographic expansion of HAB organisms and increasing the frequency and intensity of their outbreaks, and by fostering pathogen diseases of marine resource species.

Designing effective strategies to protect human health, societal and marine environmental impacts of HABs and marine diseases requires among others, improving the fundamental knowledge of the mechanisms driving these events and consistent and long-term data series. In particular, there is a need to understand how changes in the main drivers of primary producers (surface water temperature and salinity, ocean stratification, wind and water circulation patterns, precipitation-linked nutrient inputs) combined with anthropogenic pressures on aquatic ecosystems (surface water acidification, alteration of natural habitats) could stimulate HAB occurrence and marine diseases in fisheries, aquaculture and marine life in general.

This session is aimed to summarize the existing understanding and gaps of knowledge about the future trends of the noxious events and their risks to aquaculture, fisheries and human and ecosystems health. The session has a transdisciplinary scope addressed to scientists, stakeholders, policymakers, and the public to find joint strategies to manage, mitigate and adapt to the impacts of these events in the future.

***Session 18: Coastal ecosystem and their blue carbon science, conservation and policy progress (Poster Session only)***

**Convenors:**

Jorge Ramos (*Corresponding*) (Conservation International)

Kirsten Isensee (IOC-UNESCO)

Dorothee Herr (IUCN)

Coastal and Marine Ecosystems (CMEs) - such as mangroves, tidal marshes, and seagrass meadows - mitigate the effects of climate change by sequestering carbon dioxide into the vegetation and their surrounding soil from the atmosphere and oceans. CMEs also sequester carbon (blue carbon) at significantly higher rates than terrestrial forests and store three to five times more carbon per equivalent area than tropical forests. Accounting for the blue carbon sequestered in coastal ecosystems and the emissions resulting from ecosystem conversion has the potential to be a significant tool in promoting and sustainably financing marine management and conservation. Recently, there has been a rapid expansion of such blue carbon focused policy and management programs and opportunities from local to global scales largely resulting from ongoing development of coastal carbon research and synthetic science. For example: 1) advances through the Verified Carbon Standard now facilitates coastal wetland restoration projects to access financing through voluntary carbon markets; 2) The 2013 Wetlands Supplement to the IPCC 2006 Guidelines for National Greenhouse Gas Inventories includes guidance for countries on integrating coastal blue carbon systems into their national GHG inventories; 3) a rapidly expanding portfolio and interest of coastal conservation and REDD+(Reducing Emissions from

Deforestation and Forest Degradation) projects globally focused in part on blue carbon; and 4) inclusion of coastal wetlands in countries national climate change commitments. A number of key scientific and technical issues related to carbon assessments and mapping, land use driven emissions, climate change and sea level rise impacts on coastal carbon budgets and carbon monitoring remain to be discussed. Here we describe recent blue carbon conservation and policy progress and the science research and tools that will be needed in the near future to support the protection and restoration of these ecosystems and with their climate change mitigation ecosystem service.

### ***Workshop 1: Communicating and responding to climate change***

#### **Convenors:**

Bryony Townhill, *Corresponding* (Cefas, UK)

Paul Buckley (Cefas, UK)

John Pinnegar (Cefas, UK)

This workshop focusses on the translation of research outputs into practicable actions that citizens and stakeholders can take to respond to climate change in the marine environment. If governments, industries, marine managers and members of the public are to take notice and put in place successful adaptation actions in the future, it is vital that the results of climate change research are effectively communicated to wider audiences outside of academia. Talks are welcome on initiatives that aim to bring together scientific information for a broad audience, to translate complex ideas and information into products that are useful to decision makers and practitioners. Also talks on the development of practical and applied approaches to risk assessment, adaptation implementation and building resilience of the marine environment and coastal communities.

### ***Workshop 2: Advances in Earth System Models (ESMs) for marine applications***

#### **Convenors:**

Jasmin John, *Corresponding* (NOAA/GFDL, USA)

Takashi Mochizuki (JAMSTEC, Japan)

Michael Alexander (NOAA/ESRL, USA)

Global climate and earth system projections contributed to the Coupled Model Intercomparison Project (CMIP) have been pivotal in building our understanding of the potential impacts of climate change on oceans, marine ecosystems, and marine resources. Progress, however, has also been hindered by numerous model limitations. These include coarse grid resolution and uncertainties in (or limited resolution of) climate and earth system dynamics. The upcoming sixth phase of CMIP seeks to advance global climate and earth systems models through an internationally coordinated set of experiments by incorporating both a standard set of idealized and historical simulations as well as a broad suite of Model Intercomparison Projects (MIPs), which will be of particular importance to the ocean science and marine ecosystem communities to advance understanding of ocean physics and biogeochemistry, and their role in climate processes, variability, future change, and impacts. The goal of this workshop is to share and exchange information on new and innovative ocean physical, biogeochemical, and ecological model developments and formulations incorporated into CMIP6 models and simulations and their relevance to marine applications. In particular, we invite submissions from colleagues across the international community describing CMIP6 model advances contributing to process understanding of climate and earth system change, variability, and predictability on broad timescales. Objectives of the workshop are to share the state-of-the-science in earth system model development between the earth system modeling and impacts communities, prioritize remaining modeling challenges to bridge understanding between these communities, and identify opportunities for synergistic collaborations.

***Workshop 3: Exploring potential ocean-based solutions to climate change impacts on marine biodiversity and ecosystem services***

**Convenors:**

William Cheung, *Corresponding* (Institute for the Oceans and Fisheries, The University of British Columbia, Canada)

Elizabeth McLeod (The Nature Conservancy, Arlington, USA)

Fiorenza Micheli (Hopkins Marine Station, Stanford University, USA)

Colette Wabnitz (Institute for the Oceans and Fisheries, The University of British Columbia, Canada)

Marine biodiversity and ecosystems are now at a crossroads and the world is demanding effective solutions to mitigate and adapt to climate change to maintain natural services provided by the ocean. Therefore, this workshop will focus on exploring and examining potential ocean-based solutions to “avoid the unmanageable” and to “manage the unavoidable” risks from climate change on marine biodiversity and ecosystem services. These potential solutions may include mitigation and adaptation measures, nature- or technology- based, as well as for local and global scales.

Specifically, the workshop aims to discuss about the potential effectiveness of proposed or implemented solution options to moderate climate impacts, challenges and opportunities for their implementation, their implications for sustainable development, as well as research and policy agenda to make progress in meeting these challenges. The workshop will be multi-disciplinary (from natural to social sciences) and welcome the participation from academics, practitioners (e.g., international, government or non-governmental organizations) and private sectors (e.g., fishing, aquaculture, tourism). The workshop will include short presentations and group discussions. Specific outcomes will include a manuscript that is based on the discussion and findings of the workshop, and a proposal for a working group to further discuss the research and policy agenda identified from this workshop.

***Workshop 4: Climate change adaptation of fisheries and aquaculture: Examples of field projects supporting countries and communities***

**Convenors:** Tarub Bahri, *Corresponding* (FAO), Tamber Himes-Cornell (FAO), Iris Monnereau (FAO)

The workshop will present a series of field projects led by the Food and Agriculture Organization and other partners to support countries and fisheries-dependent communities adapt to climate change. The presentations will address different angles linking physical environment to social, economic and institutional aspects of climate change adaptation in different regions of the world (Caribbean, Africa, Asia, Latin America and Europe). They will also describe relevant tools and measures that can support adaptation. The workshop will be the opportunity to provide details about field projects and gather scientific and methodological inputs from the participants. Eventually, the workshop is expected to contribute to a major understanding of both the enabling conditions of adaptation and its main challenges.

***Workshop 5: Climate change and fishing communities: Interactions with environmental conservation, sustainable livelihoods and food security***

**Convenors:**

Anthony Charles, *Corresponding* (Community Conservation Research Network & Senior Research Fellow, Saint Mary's University Canada)

Daniela Kalikoski (Strategic Programme on Rural Poverty Reduction, FAO of the UN Italy)

Jessica Sanders (Fisheries and Aquaculture Department, FAO of the UN Samoa)

Lena Westlund (Fisheries and Aquaculture Department, FAO)

This workshop examines how climate change both drives and exacerbates the multi-level imperatives of livelihood sustainability, food security and associated initiatives of community-based environmental conservation, within coastal fishing communities globally. Within that context, the workshop also explores the types of governmental and international programs and policies needed to effectively engage with and support small-scale fishery and

coastal community stewardship and security, in the face of climate change. These goals will be met by drawing on experiences of three major international bodies – the FAO, the IUCN and the Community Conservation Research Network – around climate change interactions with fisheries and coastal communities.

The first phase of the workshop will focus on the main theme: “Insights and Priorities for Linking Climate Change with Environmental Conservation, Sustainable Livelihoods and Food Security: A Fishing Communities Perspective”. The theme will be explored through scene-setting presentations (by the convenors), invited presentations (Islam and Rice) and contributed presentations, collectively drawing on a range of scientific, practice and policy perspectives, together with discussion sessions in which participants are invited to share ideas and practical experiences.

The second phase of the workshop, in the afternoon, will focus on the interactions of poverty and climate change in the context of coastal communities, coastal areas and Small Island Developing States (SIDS). A participatory process will be followed to generate ideas, insights and priority directions relating to the interaction of climate change with poverty. This will provide input into a current initiative of the Food and Agriculture Organization of the UN to explore desired pathways to make progress on linking poverty reduction and climate change responses. An initial presentation will set the scene for discussion of the topic, and then each participant will be invited to share their perspectives. The workshop will culminate in generating a set of recommendations for effective approaches to linking climate responses and poverty reduction.

### ***Workshop 6: Utilizing bioenergetics measurements and modeling to evaluate climate change effects on marine species and ecosystems***

#### **Convenors:**

Myron Peck, *Corresponding* (Center for Earth System Research and Sustainability (CEN), University of Hamburg, Germany)

Kirstin Holsman (NOAA NMFS Alaska Fisheries Science Center, USA)

Janet Nye (School of Marine and Atmospheric Sciences, Stony Brook University, USA)

Climate-driven changes in the mean, variance and interaction of key abiotic factors (e.g. water temperatures, extents of hypoxia, decreases in pH) will directly impact the distribution, fitness and abundance of species as well as alter energetic demands of consumers with reciprocal impacts on the food web. These effects are expected across all marine habitats and may be particularly pronounced at high latitudes. A physiological-based (cause-and-effect) understanding of the mechanisms underlying changes in the distribution, reproduction, and growth of fish is paramount for projecting the effects of climate change on these living marine resources as well as the knock-on (e.g. trophodynamic) effects at the community and ecosystem levels.

Advancements in bioenergetics-based modeling such as the inclusion of key physiological processes within individual-based, mass-balance, and ecosystem/food-web models, have provided a suite of tools for quantifying climate-driven changes in the distribution, abundance and productivity of fish stocks. For example, stage-specific and/or seasonal changes in the storage and allocation of food energy to growth and/or reproduction are depicted in dynamic energy budget models. These bioenergetics-based approaches can inform advice on the management of marine species and habitats under future climate change if outputs are deemed robust and can be incorporated within socio-economic models and management frameworks. The usefulness of these modelling tools depends, to a great extent, on structural assumptions and parameter estimates used to depict physiological and behavioural responses to changes in the mean, variance and interaction of key, abiotic factors and socio-economic drivers.

This workshop will include short presentations and discussion to (1) review state of knowledge on the effects of multi-stressor effects on vital rates (growth, feeding, survival, reproduction) of fish and the ability of bioenergetics-based models to capture observed patterns, (2) identify data requirements needed to better parameterize existing models for near-term forecasts and long-term projections (from single- to multi-species and ecosystem/end-to-end, and (3) discuss methods and case-studies for integrating the outputs gained from these bioenergetics-based models into biological ensembles and/or social-ecological system models and marine management frameworks. A review paper is planned on these topics.

**Workshop 7: What do seabirds reveal about the effects of climate change on the World's Oceans?**

**Convenors:**

William J. Sydeman, *Corresponding* (USA)

John F. Piatt (USA)

Yutaka Watanuki (Japan)

Joel Durant (Norway)

Robert Crawford/Lynne Shannon (South Africa)

Seabirds are the most conspicuous marine organisms living at the interface of the atmosphere and the ocean, and due to sustained public interest, have been extremely well-studied for multiple decades at many key locations around the world. The information base on seabirds is thus rich and comprehensive, with substantial longevity. Recent reviews and meta-analyses indicate complex — often unexpected — responses of seabirds to various manifestations of climate change. When combined with concurrently collected data on local food fish stocks and fisheries, these same datasets have provided strong insights into the functional and numerical relationships between climate change, meso-predators, and prey, and therefore provide unique benchmarks for global climate impacts assessments. In this workshop, we seek to compare marine bird response to climate change across marine ecosystems and biomes, from the tropics to the Arctic and Antarctic, develop a mechanistic understanding of these responses, with an emphasis on connections between climate change and the availability of seabird prey (forage fish and crustaceans), and educate informed laypeople (including managers and policy-makers) of recent observations of apparent marine bird responses to climatic factors globally, including unprecedented massive seabird die-offs in many parts of the world. We anticipate two primary scientific products from this effort: (a) publication of a multi-authored volume based on the workshop in a speciality journal (e.g., *Marine Ecology Progress Series* or *Global Change Biology*), and (b) a comprehensive synthesis summarizing the state of knowledge concerning seabirds and climate interactions globally designed for a high impact journal (*Science* or *Nature*).

**Workshop 8: Connecting climate, ocean and ecosystem observation – Ocean observation futures**

**Convenors:**

Jörn Schmidt, *Corresponding* (Kiel Marine Science at Kiel University, Kiel, Germany)

Sabrina Speich (Department of Geosciences, Ecole normale supérieure, Paris, France)

Fred Whoriskey (Department of Biology, University of Dalhousie, Halifax, Canada)

Daniele Iudicone (Stazione Zoologica Anton Dohrn, Naples, Italy)

John A. Barth (Marine Studies Initiative, Oregon State University, Corvallis, USA)

In the face of a changing ocean, we need to adjust our ocean observation systems to meet new needs. What do we need to know about the ocean-human system and what data do we need to collect to increase our knowledge and better manage its future development?

The workshop will bring together different ocean related observation communities to discuss the current capacities of each community, and how each foresees the future. Topics will include where we are in observing climate, ocean, eco- and human system related processes and variables, and how we are integrating across systems; what are climate, ocean, eco- and human system related objectives; what are major societal needs that the observing systems are addressing (e.g. ocean warming, changing dynamics, plastic litter, acidification, noise, overharvesting, biological observation); where do we need to adapt from where we are to achieve these goals; What are the major obstacles and what are the stepping-stones?

The workshop will address different levels of connectivity across technology levels, different disciplines, different temporal and spatial scales, different needs of stakeholders and the connectivity between national funding agencies and institutions.

It will not only address observational needs, but also the related research data infrastructure needs to connect data across all these levels including practical issues like standards and formats.

The product of the workshop will be a vision paper in a peer-reviewed journal and a one page summary for policy makers.

***Workshop 9: Vulnerability of Low Elevated Coastal Zones (LECZ) to SLR in changing oceans***

**Convenors:**

Tarek M. El-Geziry, *Corresponding* (National Institute of Oceanography & Fisheries (NIOF), Alexandria, Egypt)  
Sathaporn Monprapussorn (Department of Geography, Faculty of Social Sciences, Srinakharinwirot University, Bangkok, Thailand)

With a changing climate, sea level is also changing. The sea level rise issue is a critical issue, especially for the Low Elevated Coastal Zones (LECZ) worldwide. This workshop aims to focus on the impacts of the SLR on the LECZ, the vulnerability of these areas to the projected SLR rates, the related socioeconomic issues, in addition to the coastal risk factor and design.

***Workshop 10: Intercomparison of fisheries and marine ecosystem models***

**Convenors:**

Olivier Maury, *Corresponding* (IRD, France)  
Derek Tittensor (UNEP-WCMC, Dalhousie University, Canada)  
Heike Lotze (Dalhousie University, Canada)  
Eric Galbraith (Universitat Autònoma de Barcelona, Spain)  
Tyler Eddy (University of British Columbia, Canada)

The Fisheries and Marine Ecosystem Model Intercomparison Project (FISH-MIP) is a component of the Inter-Sectoral Impact Model Intercomparison Project (ISI-MIP). This workshop will gather ecosystem modelers contributing or interested to contribute to FISH-MIP. Contributing models will be presented in detail and a typology will be drawn, based on theoretical underpinnings and numerical implementations. The first round of projections will be discussed in light of model's characteristics. New developments as well as future analyses will be discussed, including the use of socio-economic scenarios (typically SSPs) for forcing fisheries models. A simulation protocol combining the use of RCPs and SSPs will be established.

***Workshop 11: PICES Working Group 36 (CERP) on Common Ecosystem Reference Points across PICES Member Countries workshop: "Quantifying thresholds in driver-response relationships to identify reference points"***

**June 3, Sunday (Day 2 is open to all Symposium participants)**

**Convenors:**

Mary Hunsicker, *Corresponding* (USA)  
Robert Blasiak (Sweden)  
Elliot Hazen (USA)  
Jennifer Boldt (Canada)  
Xiujuan Shan (China)

Marine ecosystems are influenced by dynamic atmospheric and oceanographic drivers and human activities. An open question is whether biological responses within the ecosystems are linear or nonlinear in relation to climatic forcing variables or the abundance of other species. Strong nonlinearities indicate the existence of thresholds beyond which small changes in a climatic variable or species abundance cause large responses in another ecosystem component. Thus, knowledge of where these thresholds exist is valuable for determining target or limit reference points to prevent ecosystem components from tipping into undesirable states.

The CERP: Common Ecosystem Reference Points across PICES Member Countries is working group (WG36) of PICES. During Day 1 of the workshop, the PICES working group members will review and make progress on Terms of Reference (TOR) (see WG-36 webpage), specifically identifying the focal ecosystems and indicators for our WG (TOR 2), the available data sets (TOR 2), the methods selected for identifying thresholds in the ecosystem indicators (TOR 3), and applying analyses to focal ecosystems and indicators (TOR 4).

Day 2 of the workshop is open to any ECCWO participants that wish to attend and contribute to (or learn more about) the topic of quantifying thresholds for identifying reference points. The goals of Day 2 are to 1) review and learn from similar efforts from other organizations such as ICES working groups and IndiSeas and 2) identify potential partnerships between PICES and other groups to advance the science of thresholds and leading indicators of ecosystem change

We encourage participation by other PICES, ICES, and IndiSeas members, as well as colleagues outside of these communities, who have expert knowledge of the ecological and human dimensions of North Pacific marine ecosystems and who have experience developing and implementing frameworks to quantify nonlinearities and thresholds in driver-response relationships.

***SCOR Working Group 155 (Eastern Boundary Upwelling Systems (EBUS): Diversity, Coupled Dynamics and Sensitivity to Climate Change) Workshop***

**June 2-3 (Closed Workshop)**

Co-Chairs: Ruben Escribano (Chile) and Ivonne Montes (Peru)

The focus of SCOR WG-155 will be on: 1) Assessing the trends and drivers of oceanographic, ecological and socio-economic properties in EBUE; 2) Assessing how well the current generation of coupled physical-biogeocological models can reproduce the mean and current trends; 3) Developing a common observational and modeling framework for upwelling systems that will yield improved predictions of climate and global change; 4) Developing a list of realistic governance actions for EBUE based on current trends and model forecasts 5) Promoting integrated international EBUE scientific cooperation through organizations such as IMBER, CLIVAR, SOLAS, GlobalHAB and PICES; 6) Developing capacity so that an integrated program of comparable observations and models can be promoted across EBUE. We propose a strong team with broad scientific expertise in observations, modeling and socio-economics, and with scientists from the four major coastal eastern boundary upwelling regions, i.e. California, Humboldt (Peru and Chile), Canary and Benguela. The team will review physical, biogeochemical, biological, fish and fisheries processes and trends, and their socio-economical impacts. Forecasts from global and higher resolution regional models will be analyzed. Potential effects on fisheries and other ecosystem services will be explored and a list of potential management strategies developed. The WG will develop a common observational and modeling framework for EBUE expected to yield improved predictions of climate and global change. It will promote an integrated international program to implement the observational and modeling framework developed by the WG. The results will be published in primary scientific and socio-economic journals, and technical reports.

## TOWN HALL and SPECIAL EVENTS (Room *Columbia 5-8*)

### Monday, June 4

#### Musical Performance

##### **Musical Reflection - Confluence**

*June 4 (09:55-10:05), Opening Plenary Session*

A *confluence* in nature is the coming together of two or more bodies of water. The ECCWO Symposium is a confluence of international scientists coming together to address the impacts of climate change on the world's oceans and the many people who depend on them. This composition reflects the power of confluences, with each member of the string quartet entering alone, lending their own unique voice to the music. As the piece progresses, the different voices interact and change as they learn to work together to create a grand climax. The piece ends on a quiet and hopeful note as we prepare to meet the challenges of climate change together.

Composer: Zachary Friedland

Zachary Friedland's symphonic band pieces have been performed and recorded by some of the finest ensembles on the eastern seaboard including The Metropolitan Wind Symphony, The Savannah River Wind Ensemble, and The American Band. Zach received a Bachelor's degree in music composition from the University of Rhode Island in 2013 and a Master's degree from the Bard College Longy School of Music in 2015. He is currently finishing a Doctorate in music composition at The Ohio State University. His musical themes include American music, folk music, and music that brings awareness to our relationship with nature.

Musicians: Anacostia String Quartet

Champions of music both new and old, the Anacostia String Quartet has performed at the Kennedy Center's Millennium Stage and is the 2018 Ensemble-in-Residence with the District New Music Coalition (DNMC). Through their collaboration with the DNMC, the quartet performs works of living composers representing a variety of musical styles in diverse venues across Washington, DC. The musicians are: Ryan Gregory and Myles Mocarsky, violins; Timothy MacDuff, viola; and Pecos Singer, Cello.

#### Science Panel - Opening Plenary Session

*June 4 (10:05-11:00)*

##### **Tell Me More: What people really want to know about oceans in a changing climate**

This panel of distinguished scientists and journalists help kick off the symposium with a fast-paced discussion of key conference topics in the form of a mock press conference. In brief introductory remarks, a panel of experts will highlight critical dimensions and intersections of the effects of climate change on our present and future oceans. Then, journalists from the New York Times, National Public Radio, Science, The Guardian and the news website Oceans Deeply will quiz the panelists to elicit what *their* audiences would want to know. As professional question-askers, they will cut to the chase: Why do warming oceans matter? What do policy makers and the public need to know? How might these changes affect *them*? This opening session is designed to stimulate fresh thinking, uncover connections, and catalyze conversations throughout the conference.

##### **Panelists:**

- Dr. Manuel Barange (FAO), Director, Fisheries and Aquaculture Policy and Resources Division
- Dr. Allistair Hobday, Senior Principal Research Scientist with CSIRO Oceans and Atmosphere
- Dr. Lynne Shannon, Senior researcher at the Marine Research (MA-RE) Institute, University of Cape Town
- Hon. Frances A. Ulmer, Chair, US Arctic Research Commission
- Dr. Cisco Werner, Chief Scientist, NOAA Fisheries

**Journalists:**

Cornelia Dean (New York Times)  
Christopher Joyce (National Public Radio)  
Alok Jha (UK, Wellcome Fellow, former Guardian and BBC reporter)  
Jessica Leber (Oceans Deeply)  
David Malakoff (Science)

**Facilitator:** Nancy Baron (COMPASS)

**Lunchtime Panel (Women’s Aquatic Network (WAN) Town Hall)**

**Oh the Places You’ll Go: Lessons for Early Career Professionals**

To foster the growth of the next generation of scientists, the Women’s Aquatic Network (WAN) will host a professional development event for early career men and women as part of the 4th International Symposium on The Effects of Climate Change in Our World Oceans. Through a moderated panel, attendees will learn about potential career paths in their field, hear lessons learned, and have an opportunity to connect with mentors and peers. Panelists will be leaders from the WAN community based in Washington DC and other areas.

**Agenda:**

0-20 min: Panel Introductions and Broad Q&A  
20-40 min: Q&A  
40-60 min: Networking between panelists, WAN mentors, and attendees

Contact: Jaya Ghosh

Women’s Aquatic Network <https://www.womensaquatic.org/>

**Symposium Welcome Reception**

*June 4 (18:30-20:30), The Washington Hilton (Heights Courtyard – Lobby Level)*

**Tuesday, June 5**

**Lunchtime Presentation and Interactive Workshop (COMPASS Town Hall)**

**Communicating Science about the Effects of Climate Change on the World’s Oceans**

Plenary: Stephen Posner (COMPASS)

This science communication workshop will help participants share what they do, what they know - and most importantly, why it matters - in clear, lively terms. Grounded in the latest research on science communication and policy engagement, this session is designed to help you find the relevance of your science for the audiences you most want to reach — policymakers, the public, media professionals and even other scientists.

COMPASS staff will introduce participants to The Message Box, a simple yet powerful tool for identifying and framing scientific messages for various audiences. There will be time to distill key science messages, practice communicating, and hone concrete skills with your peers.

This event will be designed and facilitated by COMPASS, a non-profit, non-advocacy organization that supports scientists to engage in the public discourse on the environment. Over nearly two decades, COMPASS has trained thousands of scientists and brokered relationships for scientists with their peers, journalists, and policymakers, helping them reach places like the front page of the New York Times, the halls of Congress, and the Executive Office of the President.

Contact: Stephen Posner  
COMPASS [www.COMPASSscicomm.org](http://www.COMPASSscicomm.org)

### **Norway-COMPASS Reception**

*June 5 (18:30-21:00), The Washington Hilton (Columbia West)*

Join us for a special reception highlighting the Nanson Legacy Initiative and the importance of science communication.

## **Wednesday, June 6**

### **Lunchtime Panel and Discussion (Lenfest Ocean Program Town Hall)**

#### **Benchmarks for ecosystem assessments: Input on Indicators for practical ecosystem-based fishery management**

This session is designed to share information and get input on the development and application of indicators in ecosystem-based fisheries management. Indicators are critical to effective ecosystem-based fisheries management but which indicators are most useful?

The Lenfest Ocean Program and the Commonwealth Scientific and Industrial Research Organization (CSIRO) are supporting a multi-regional project (Alaska, SE Australia, SW India, Chile) on development of practical indicators of ecosystem structure and function, along with guidelines for applying them in a variety of ecosystems and management contexts. Dr. Beth Fulton, Principal Senior Research Scientist, Commonwealth Scientific and Industrial Research Organization (CSIRO), and Charlotte Hudson, Director, Lenfest Ocean Program, will share information about the project and host a group discussion to get input on future directions and collaborations. In particular, feedback is needed on:

Recommendations on data sets and indicators of ecosystem structure and function;  
Barriers to developing indicators for a variety of ecosystems and management contexts;  
Experiences related to operationalizing EBFM from other regions; and  
Ideas on how indicators can facilitate adaptive EBFM frameworks in the face of environmental change.

Project sponsors:

Lenfest Ocean Program, Washington, DC  
Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia

Contact: Emily Knight, Lenfest Ocean Program  
<http://www.lenfestocean.org/>

**Poster Session / Reception**

*June 6 (18:30-21:30)*

*The Washington Hilton (Columbia West and International Terrace)*

Join your colleagues at this special Poster Session and Reception. Check out the great poster displays and chat with presenters while sipping a beverage and nibbling on snacks.

**Thursday, June 7**

**12.40-14.00 (IPCC Town Hall)**

**Ocean assessment in the Sixth Assessment Cycle of the Intergovernmental Panel on Climate Change**

In its Sixth Assessment Cycle (AR6), the Intergovernmental Panel on Climate Change is producing three Special Reports: Ocean and Cryosphere in a Changing Climate (SROCC), Global Warming of 1.5°C and Climate Change and Land as well as the main Working Group Assessment Reports. This session will start with an overview of IPCC and the AR6 reports focusing on Working Group II (Impacts, Adaptation, and Vulnerability) AR6 and SROCC. Much of this session will be devoted to open discussion \_with participants regarding SROCC and the Working Group II Assessment Report, including topics such as what literature does IPCC assess, how were authors selected and how does IPCC review process work, as well as ocean knowledge gaps highlighted in the AR5 report and emerging knowledge of climate change impacts and risks for ocean ecosystems and human communities.

Plenary: Hans Poertner (IPCC WGII Co-chair)

Panel discussion:

Hans Poertner IPCC WGII Co-chair, Ko Barrett IPCC Vice-chair, Anne Hollowed, William Cheung, Shin-Ichi Ito

Chairing

Elvira Poloczanska IPCC WGII TSU Head of Science

## Saturday, June 2

<b>Workshop 1: Communicating and responding to climate change (Room Columbia 1)</b>	
9:00	<b>Introduction by Convenors</b>
9:10	<b>Hazel Oxenford (Invited)</b> Communicating complex climate change impacts to regional stakeholders: The cases of <i>Sargassum</i> influxes to the Caribbean Sea and community-collaboration adaptation
9:50	<b>Paul Buckley</b> Communicating marine and coastal climate change impacts: Key findings and lessons learnt from the Pacific and Caribbean Regions
10:10	<b>Emily Nocito* (Student) CANCELLED</b> Analysis of United Nations voluntary commitments concerning marine protected areas and resilience
10:30	<i>Coffee/Tea Break</i>
11:00	<b>Lara Hansen</b> Developing a Fish Manager's Guide to climate change
11:20	<b>Mona Behl</b> A tale of two cities: How Sea Grant helped Tybee Island and St. Marys save money while saving lives
11:40	<b>John K. Pinnegar</b> Adapting to climate change: The UK Climate Change Risk Assessment (CCRA), National Adaptation Programme (NAP) and Adaptation Reporting Powers (ARP) – An integrated approach
12:00	<b>Paul Buckley</b> 10,000 voices on marine climate change in Europe: What does the public know...and really care about?
12:20	<b>Discussion</b>
12:40	<i>Lunch</i>

Workshop 9: Vulnerability of Low Elevated Coastal Zones (LE CZ) to SLR in changing oceans (Room Columbia 4)		Workshop 6: Utilizing bioenergetics measurements and modeling to evaluate climate change effects on marine species and ecosystems (Room Columbia 3)	
9:00	<i>Introduction by Convenors</i>	9:00	<i>Introduction by Convenors</i>
9:15	<b>Mohamed Abdel-Karim Aly Abdrabo (Invited)</b> <b>CANCELLED</b> The risk of inundation by sea level rise: The Nile Delta	9:10	<b>Kenneth Alan Rose (Invited)</b> Predicting marine ecosystem population and food web responses to environmental variation: Now is the time to merge bioenergetics and movement ecology
		9:45	<b>Shin-ichi Ito</b> Issues on elucidation of climate variability impacts on living marine resources and future perspectives
		10:00	<b>Myron Peck (for Ignacio Catalán)</b> Parametrizing climate-change responses of fished and cultured European aquatic species using experiments: A gap-analysis and meta-analytical perspective
		10:15	<b>Chenyng Guo* (Student)</b> Development of a growth-migration model and its application to evaluate environmental effects on growth and migration of Pacific chub mackerel <i>Scomber japonicus</i> in the Northwest Pacific
10:30	<i>Coffee/Tea Break</i>	10:30	<i>Coffee/Tea Break</i>
11:00	<b>Furqon Alfahmi</b> Potential increasing coastal inundation over Semarang city based on twelve years tide observations	11:00	<b>Morten Skogen</b> Climate change effects on growth, reproduction and distribution of Norwegian Spring Spawning Herring
		11:15	<b>Juan Bueno-Pardo</b> Sensitivity of anchovy population to environmental change in the Bay of Biscay using a bioenergetic model
11:30	<b>Mbachu Ikechuwku* (Student) CANCELLED</b> Assessing attitudinal response and perception of the threat of sea level rise: A case study of the coastal area of the Niger Delta	11:30	<b>Christine Stawitz</b> Forecasting the effects of ocean change on Alaskan snow crab ( <i>Chionoecetes opilio</i> ) using an individual-based bioenergetics model
		11:45	<b>Klaus Huebert</b> Population models for synthesis of climate effects on fish early life history stages
12:00	<b>John Marra</b> A scenario-based approach to assessing changes in coastal flood magnitude and frequency under a changing climate, with an exemplar application to ecosystem vulnerability assessment on the Island of Hawai'i	12:00	<b>Daniel van Denderen</b> Growth of teleost fish across marine regions and ecological lifestyles
		12:15	<b>Philipp Neubauer</b> Sizing the effects of temperature on fish: A general eco-physiological model to assess impacts from individuals to ecosystems
12:30	<i>Lunch</i>	12:30	<i>Lunch</i>

SAT June 2  
Wsh 1, 2, 6, 9

<b>Workshop 1: Communicating and responding to climate change (Room Columbia 1)</b>		<b>Workshop 2: Advances in Earth System Models (ESMs) for marine applications (Room Columbia 2)</b>	
14:00	<b>Discussion</b>	13:30	<b>Matthew Long (Invited)</b> Earth System Models and marine ecosystems in the context of climate variability and change
		14:30	<b>Michio Watanabe</b> Development of the marine ecosystem model OECO2 to be embedded into the Earth system model MIROC-ES2
		14:50	<b>Charles Stock</b> Ocean Ecosystem Dynamics in GFDL's CMIP6 Earth System Model GFDL-ESM4
		15:10	<b>Takashi Mochizuki</b> Multiyear climate prediction by using 4D-Var coupled data assimilation system
15:30	<b>W1 Ends</b>	15:30	<b>Coffee/Tea Break</b>
		16:00	<b>Alexis Bahl* (Student)</b> Impact of eddy mixing on the sensitivity of ocean biogeochemical cycling to doubled CO <sub>2</sub> within an earth system model
		16:20	<b>Nicole Lovenduski</b> Response of O <sub>2</sub> and pH to ENSO in the California Current System in a high resolution global climate model
		16:40	<b>Discussion</b>
		17:40	<b>W2 Ends</b>

<b>Workshop 9: Vulnerability of Low Elevated Coastal Zones (LECZ) to SLR in changing oceans (Room Columbia 4)</b>		<b>Workshop 6: Utilizing bioenergetics measurements and modeling to evaluate climate change effects on marine species and ecosystems (Room Columbia 3)</b>	
14:00	<b>Poster Presentation</b>	14:00	<b>Poster Presentation Discussion of talks / open points</b>
14:15	<b>Discussion</b>		
15:30	<i>Coffee/Tea Break</i>	15:30	<i>Coffee/Tea Break</i>
16:00	<b>Conclusions</b>	16:00	<b>Discussion/ outlining / Writing</b>
17:30	<b>W9 Ends</b>	17:30	<b>Wrap up and next steps</b>
		18:00	<b>W6 Ends</b>

## Sunday, June 3

### Workshop 3: Exploring potential ocean-based solutions to climate change impacts on marine biodiversity and ecosystem services (Room *Columbia 1*)

- 9:00     **Overview of workshop objectives**  
Discuss potential proposed or implemented actions to moderate climate impacts;  
Explore challenges and opportunities for their implementation;  
Explore the implications for sustainable ; Discuss research and policy priorities to address these challenges/development
- Workshop Outputs**  
Peer reviewed manuscript summarizing workshop findings;  
Research and policy priorities to inform research agenda/policy brief
- 9:10     *Introductions*
- 9:30     **Ling Cao (Invited)**  
Aquaculture in a changing climate: Lessons from China
- 10:00    **Chris Field**  
Set the stage – key risks/opportunities (IPCC)
- 10:15    **Alexandre Magnan**  
Assessment of solution space to address areas of key risk
- 10:30    **Alistair Hobday**  
Expanding current management interventions in the face of increasing climate impacts
- 10:45    *Coffee/Tea Break*
- 15-min speed talks**  
Assessment, development and implementation of ocean solutions in different sectors & countries
- 11:00    **Abdulwakil Saba**  
Impacts of climate change on mangrove biodiversity and sustainable livelihoods along Lagos Coast of West Africa
- 11:15    **Ibukun Jacob Adewumi\* (Student) CANCELLED**  
Using resilience assessment to understand the dynamics of marine socio-ecological systems in order to inform climate-change-smart marine spatial planning processes
- 11:30    **Malin Pinsky**  
Designing climate-smart ocean plans
- 11:45    **Katherine Mills**  
Eliciting and evaluating climate adaptation strategies for fisheries and fishing communities
- 12:00    *Lunch*
- 13:00    **Small breakout groups to discuss**  
Synergies/disconnects between cross-sector potential solutions to reduce climate impacts;  
Challenges and opportunities for implementation;  
Implications for sustainable development and ethical considerations

- 15:00 **Small group report back**
- 15:30 *Coffee/Tea Break*
- 15:45 **Break out groups**  
To identify key elements of policy/research agenda - for near term (1-3 yrs) and long-term (>10 yrs)
- 16:30 **Small group report back and group prioritization**
- 17:00 **Wrap up/next steps - Partnership opportunities with related initiatives**
- 18:00 **W3 Ends**

**Workshop 4: Climate change adaptation of fisheries and aquaculture: examples of field projects supporting countries and communities (Room Columbia 2)**

- 13:30 *Introduction*  
Tarub Bahri, FAO
- 13:35 **Edward Allison (Invited)**  
Building capacity to adapt to climate change in communities engaged in small-scale fishing and aquaculture
- 14:20 **Florence Poulain (FAO)**  
Addressing adaptation in fisheries and aquaculture
- 14:40 **Catarina Frazão Santos (University of Lisbon, Portugal)**  
The role of ocean planning in adapting to global climate change impacts
- 15:00 **Elena Gissi (Università Iuav di Venezia, Italy)**  
Addressing climate change-driven uncertainties in maritime spatial planning through Cumulative Effects Assessment
- 15:20 **Michaela Aschan (Arctic University of Norway, Norway)**  
Building knowledge and decision making frameworks for adaptation – Example of the ClimeFish Project
- 15:40 *Coffee/Tea Break*
- 16:00 **Merle Sowman (University of Cape Town, South Africa)**  
Community Vulnerability Assessments to Inform Adaptation Planning in the Benguela Region
- 16:20 **Thomas Nelson (Division of Fisheries, St Lucia & Iris Monnereau, FAO-CC4FISH Project)**  
Climate Change Adaptation in the Eastern Caribbean Fisheries Sector
- 16:40 **Mario Acevedo (Undersecretary for Fisheries)**  
Building resilience of fisheries and aquaculture in Chile
- 17:00 **Devendraraj Madhanagopal (Indian Institute of Technology, India)**  
Do the socioeconomic and institutional changes influence the perceptions and adaptation efforts to face climate change impacts? Critical analysis of narratives of the small-scale coastal fisherfolk in Tamil Nadu, India

- 17:20 **Samiya A. Selim (University of Liberal Arts Bangladesh)**  
Evidence of ecosystem-based adaptation to climate change in coastal Bangladesh
- 17:40 **Danya Kandarattil (M.E.S. Asmabi College, India)**
- 18:00 **Discussion on key messages and lessons learned**
- 18:20 **W4 Ends**

**Workshop 5: Climate Change and Fishing Communities: Interactions with Environmental Conservation, Sustainable Livelihoods and Food Security (Room *Columbia 3*)**

9:00 **Workshop Opening and Introductions**

**Introductory Presentations**

- 9:15 **Anthony Charles**  
A community focus: How local communities are dealing with climate change and environmental threats to build sustainable livelihoods and food security
- 9:30 **Daniela Kalikoski, Lena Westlund & Jessica Sanders**  
An FAO perspective on Climate Change and Small-Scale Fishing Communities from a Poverty and Food Security Lens

**Invited Presentations**

- 9:45 **Mohammad Mahmudul Islam (Invited)**  
Creating an enabling environment to support disaster risk reduction in the context of the Small-Scale Fisheries Guidelines. Lessons from Bangladesh
- 10:00 **Jake Rice (Invited)**  
Communities, climate change and adaptation strategies - Variability and viability
- 10:15 **Discussion Session #1**  
Topic: "Insights and Priorities for Linking Climate Change with Environmental Conservation, Sustainable Livelihoods and Food Security: A Fishing Communities Perspective". This session will invite workshop participants to contribute their analysis of the broad issues concerning interactions of climate change with livelihood sustainability, food security and environmental conservation, within coastal fishing communities around the world.
- 10:45 **Coffee/Tea Break**

**Oral Presentations**

- 11:00 **Maria Rebecca Alviar Campos**  
Indigenous fishers in the Philippines: Adaptation to climate change
- 11:15 **Sheku Sei**  
Assessment of Yawri Bay marine protected area vulnerability to climate change in Sierra Leone
- 11:30 **Devendraraj Madhanagopal\* (Student)**  
Factors influencing the climate change adaptation efforts: Discussions from the case of coastal Tamil Nadu, India
- 11:45 **Maria Gasalla**  
Social vulnerability to climate change of fishing communities across the South Brazil Bight
- 12:00 **Lunch**
- 13:30 **Discussion Session #2**  
Topic: “A Fishing Community Focus on Climate Change and Conservation Responses in Relation to Sustainable Livelihoods and Food Security”. This session will build on the experience presented in the morning by inviting workshop participants to contribute their own experiences with coastal fishing communities, focused on the interactions of climate change with livelihood sustainability, food security and environmental conservation.
- 14:30 **Workshop Phase 2: Interactions of Poverty and Climate Change**  
Phase 2 of the workshop will focus on a participatory process to generate ideas, insights and priority directions relating to the interaction of climate change with poverty. This will be discussed in the context of coastal communities, as well as Small Island Developing States (SIDS). The discussion will provide input into a process being carried out by the Food and Agriculture Organization of the United Nations to explore desired pathways to progress on linking poverty reduction and climate change responses, including development, humanitarian, disaster risk reduction and climate adaptation perspectives.

**Introductory Presentation****Anthony Charles (Saint Mary’s University) and Daniela Kalikoski (Food and Agriculture Organization of the UN)**

Nexus of Poverty and Climate Change in the Context of Coastal Communities and Small Island Developing States (SIDS)

- 14:50 **Discussion Session #3**  
Each participant will be invited to share their perspectives. Small group discussions will take place as appropriate. The goal will be to generate recommendations for effective approaches to linking climate responses and poverty reduction.
- 15:30 **Coffee/Tea Break**
- 16:00 **Discussion continues**
- 17:30 **W5 Ends**

**Workshop 7: What do seabirds reveal about the effects of climate change on the World's Oceans?  
(Room Columbia 4)**

- 9:00     **Convenors**  
          Opening remarks, goals of workshop, etc.
- 9:20     **Richard Sherley (Invited)**  
          Direct and indirect impacts of climate change on seabirds in the Benguela Ecosystem
- 10:00    **Kate Searle (Invited)**  
          North Sea seabirds: Responses to fisheries and changing climate
- 10:40    **Coffee/Tea Break**
- 11:10    **Stephanie Jenouvrier (Invited)**  
          Demographic models and IPCC climate projections predict the decline of an emperor penguin population
- 11:50    **Claire Saraux (Invited)**  
          Functional responses of marine birds to local and global changes in climate and prey availability
- 12:30    **Lunch**
- 14:00    Reconvene for planning review and meta-analytical papers
- 15:30    **Coffee/Tea Break**
- 16:00    Planning review... continues
- 18:00    **W7 Ends**

**Workshop 8: Connecting climate, ocean and ecosystem observation – Ocean observation futures  
(Room Columbia 12)**

- 8:30 **Introduction by Convenors**
- 9:00 **Jörn Schmidt**  
Short Introduction/Tour around the table
- 9:30 **Douglas Wallace (Invited)**  
Multidisciplinary Ocean Time Series: For researcher aggregation and the generation of surprises and knowledge
- 10:00 **Patricia Miloslavich (Invited)**  
Implementation of biological Essential Ocean Variables in the global observing system
- 10:30 **Coffee/Tea Break**
- 11:00 **Matthew B. Sullivan (Cont-1)**  
Tara Oceans: Eco-systems biology at the planetary scale
- 11:15 **Tim Boyer (Cont-3)**  
The World Ocean Database – Conjoining research observations and observing systems across disciplines, across time
- 11:30 **Varis Ransibrahmanakul (poster) CANCELLED**  
The Great Lakes: A Visual Description Of The Changes In Weather Patterns From 1979 To 2002, And Water Quality From 2002 To 2015
- 11:40 **José E. Martinelli Filho (poster)**  
Widespread microplastic distribution at a microtidal Amazon sandy beach.
- 11:50 Short wrap up of talks and drafting the afternoon session
- 12:30 **Lunch**
- 14:00 World Cafe OR break out groups
- 15:30 **Coffee/Tea Break**
- 16:00 **Rapporteurs**  
Reporting on World Cafe OR break out groups result
- 16:45 **Convenor**  
Final Discussion
- 17:30 **Convenor**  
Wrap up and discussion on further actions
- 18:00 **W8 Ends**

**Workshop 10: Intercomparison of fisheries and marine ecosystem models  
(Room Columbia 10)**

- 9:00 **Introduction by Convenors**
- 9:10 **Eric Galbraith (Invited)**  
FishMIP: A community effort to improve the realism and utility of fishery and marine ecosystem models
- 9:35 **Andrea Bryndum-Buchholz\* (Student)**  
Climate change impacts on fish biomass and associated ecosystem structure across ocean basins
- 9:55 **Olivier Maury**  
Projecting climate change & de-oxygenation impacts on global oceanic communities using NEMO-PISCES-APECOSM
- 10:15 **Colleen Petrik**  
The Princeton Ocean Ecosystem Model (POEM) v2.0: A size- and functional type-based model of global fisheries production and catch
- 10:30 **Coffee/Tea Break**
- 10:45 **Discussion**  
What have we learned about global ecosystem modelling and change from FishMIP thus far, and what are the big questions/problems/uncertainties we should consider tackling next?
- 11:10 **John Pinnegar (Invited)**  
Shared Socioeconomic Pathways (SSPs) for fisheries and aquaculture in Europe
- 11:55 **Discussion**  
Which scenarios for FishMIP, in an IPCC/IPBES context?
- 12:30 **Lunch**
- 13:30 **Cheryl Harrison**  
A predictive fisheries catch metric for CMIP6-OMIP Earth System models
- 13:50 **Hubert Du Pontavice, Didier Gascuel**  
EcoTroph, a tool for simulating unexploited biomass and productivity at the global scale from 1950 to 2100 (15 min + 5 min discussion)
- 14:10 **Ricardo Oliveros-Ramos**  
Projecting climate change impacts on regional marine ecosystems using OSMOSE
- 14:30 **Tyler Eddy**  
Fisheries and marine ecosystem projections under climate change from regional to global scales
- 14:50 **Beth Fulton (for Catherine Bulman)**  
Comparing climate forcing projections from global and local climate models in south-eastern Australia using an EwE model
- 15:10 **Discussion**  
Comparing regional models in FishMip

- 15:35 **Coffee/Tea Break**
- 15:50 **Discussion**  
How to make the most of the model inter-comparison: critical uncertainties, new experiments, regional testbeds
- 17:00 **Thibaut de la Chesnais**  
Poster Presentation: Role of cephalopods in ecosystem functioning and evolution
- 17:05 **W10 Ends**

**Workshop 11: Quantifying thresholds in driver-response relationships to identify reference points (Day 2) PICES Working Group 36 (CERP) workshop (Room Columbia 9)**

- 8:30 **Welcome, Introductions, W11 agenda / goals**
- 8:45 **Overview PICES WG 36: Common Ecosystem Reference Points (Mary Hunsicker, NOAA, USA)**
- 9:00 **Scott Large, Invited (NOAA, USA)**  
Quantifying critical points in ecological indicator responses to fishing and the environment
- 9:30 **Coffee/Tea Break**
- 9:45 **Related research from workshop participants and discussion**  
E.g. How have others approached selecting ecosystem indicators and identifying ecosystem-level thresholds and reference points? How are ecosystem-level reference points being used in management across different systems?
- I. Informal presentations (10 min overview + 5 min for questions)**  
Caihong Fu (DFO, Canada) and Yunne-Jai Shin (UMR Marbec, France; remote participation)  
Christian Möllmann and Saskia Otto (Univ. of Hamburg, Germany)  
Benjamin Planque and Gro van der Meeren (IMR, Norway)  
Kirstin Holsman (NOAA, USA)
- II. Group discussion**
- 12:00 **Group Lunch**  
(mull over ideas for collaboration) + GROUP PHOTO
- 13:30 Continue discussion, including generating ideas and identifying pathways for collaboration.
- 15:00 PICES WG 36 members wrap up (reports, planning for Japan workshop)
- 17:00 **W11 Ends**

**Monday, June 4**

- 8:30 **Opening Welcome**
- 8:45 **RDML Timothy Gallaudet (Keynote Speaker)**  
*(Assistant Secretary of Commerce for Oceans and Atmosphere and Acting Under Secretary of Commerce for Oceans and Atmosphere, USA)*
- 9:05 **Philippe Cousteau (Keynote Speaker)**  
*(Filmmaker, Explorer, Advocate, CA, USA)*
- 9:55 **Musical Reflection - Confluence**
- 10:05 **Science Panel: Oceans in a Changing Climate**
- 11:00 **Preview of Days Sessions (S5, S6, S8, S9, S12, S16)**
- 11:15 **Coffee/Tea Break**

Session 5 (Columbia 1&2)		Session 16 (Columbia 3&4)	
11:35	<b>Grace Saba (Invited)</b> Ecosystem response to Antarctic climate variability and change		<b>Frances Ulmer (Invited)</b> Geopolitical implications of Arctic warming
12:05	<b>Elizabeth Siddon</b> The interaction of climate conditions and spatial overlap structure condition and recruitment success of Walleye pollock in the eastern Bering Sea		<b>Lawson Brigham</b> Security at the top of the world: Arctic change and new governance
12:25	<b>Hugh Venables</b> Feedbacks between wintertime sea ice and summertime heat content and phytoplankton bloom strength in a 20-year Antarctic time series		<b>Diana Bull</b> National security implications from tipping events centered in Arctic waters
12:45	<b>Lunch</b>		<b>Lunch</b>
14:00	<b>Erik Mousing</b> Primary drivers of changes in productivity in a future warmer Barents Sea		<b>Todd Ringler</b> Connecting Earth system models to national security decision-making: Examples, opportunities and research needs
14:20	<b>Ken Drinkwater</b> Climate change impacts in the Northeast Atlantic transition zone between the Subarctic and Arctic		<b>Amrtatjuti Sereda</b> Extension of the ecosystem based management scale in the face of Climate Change: Cosmic perspective and need to respect the basic principle of peacekeeping
14:40	<b>Marcos Llope</b> Continuous and abrupt changes in the resilience of northeast Atlantic marine ecosystems		<b>Ifesinachi Marybenedette Okafor-Yarwood* (Student)</b> Fisheries, climate change and human insecurity in the Niger Delta area of Nigeria
15:00	<b>Raul Primicerio</b> Climate change impact on Barents Sea ecosystem functioning and vulnerability		<b>Esther Babson</b> Strained stability: Climate change and regional security in the Asia Pacific

### Concurrent Session Titles

Session 5: Climate change impacts on high latitude systems on multiple scales in space and time

Session 6: The deep ocean under climate change

Session 8 (Day 1): Understanding the impact of Abrupt Ocean Warming and Continental Scale Connections on marine productivity and food security via Western Boundary Currents

Session 9: Drifting into the Anthropocene: How will pelagic marine ecosystems be affected and what are the biogeochemical and lower trophic consequences

Session 12 (Day 1): Scenarios and models to explore the future of marine coupled human-natural systems under climate change

Session 16: Climate, oceans and security

Session 9 (Columbia 9&10)		Session 6 (Columbia 11&12)	
11:35	<b>Laura Lorenzoni (Invited)</b> Marine Ecological Time Series: What are they telling us about the ocean?	<b>Lisa Levin (Invited)</b> Climate-human-policy connections in deep-ocean ecosystems	
12:05	<b>Catherine Johnson</b> Zooplankton community changes on the Canadian northwest Atlantic continental shelves during recent warm years	<b>Carlos Dominguez-Carrió* (Student)</b> Utility of habitat suitability modelling tools for evaluating changes in VME distribution under future climate scenarios	
12:25	<b>Karen Wiltshire</b> Long term changes in the controlling factors of phytoplankton in the Southern North Sea	<b>Murray Roberts (Invited)</b> Deep-sea ecosystems in a changing ocean and the importance of basin-scale research for their long-term management and conservation	
12:45	<b>Lunch</b>	<b>Lunch (12:55)</b>	
14:00	<b>Joo-Eun Yoon* (Student)</b> Multi-decadal variability in coccolithophore abundance in the North Pacific Subtropical Gyre	<b>Andrew Yool</b> Future trends in seafloor community biomass in a global, body size-resolved model	
14:20	<b>Kym Jacobson</b> Variability in the copepod community structure, diversity, and biomass in the northeast Pacific (Newport, Oregon, USA) over the last 21 years	<b>William Cheung</b> Vulnerability of deep-sea fishes to climate change	
14:40	<b>Georg Engelhard</b> Lower trophic consequences with bottom-up effects: A decline in primary production in the North Sea over 25 years, associated with reductions in zooplankton and fish recruitment	<b>Marina Carreiro-Silva</b> Using a trait-based vulnerability assessment to estimate sensitivity and adaptive capacity of vulnerable marine ecosystems to climate change	
15:00	<b>Celeste López Abbate</b> Decadal changes in carbon budget of a SW Atlantic estuary: Coupling between a drop in phytoplankton biomass and the erosion of salt marshes	<b>Jianing Wang</b> Deep water flow in the channel between east and west Mariana basins	

Session 5 (Columbia 1&2)		Session 16 (Columbia 3&4)
15:20	<b>Mette Skern-Mauritzen</b> Diverse responses to warming in the Barents Sea	<b>Ayse Sezin Tokar</b> Building resilience of coastal communities to natural disasters
15:40	<b>Albert Hermann</b> Biophysical response of the Bering Sea to projected global climate of the 21st century	<b>Apurva Dave</b> Ocean research to improve climate system understanding and support national security decision-making
16:00	<b>Lisa Anne Libungan</b> Climate change effects on the linkages between environmental factors, zooplankton and pelagic fish in the Norwegian Sea	<i>End of Sesion 16</i> <i>Coffee/Tea Break</i>
		<b>Session 8, Day 1 (Columbia 3&amp;4)</b>
16:20	<i>Coffee/Tea Break</i>	<b>Lisa Hendrickson</b> Summary of an FAO workshop regarding the effects of climate variability and change on short-lived species and their forecasting with a focus on squid stocks and Boundary Currents
16:40	<b>Morten Skogen</b> Distribution of plankton and pelagic fish in a future climate	<b>Peng Sun</b> Climate change effects on the early recruitment of largehead hairtail ( <i>Trichiurus japonicus</i> ) in the East China Sea
17:00	<b>Mary Beth Decker</b> Biomass fluctuations of Eastern Bering Sea jellyfish: Recent trends and environmental drivers	<b>Shin-ichi Ito</b> Effects of climate change on growth and distribution of Japanese anchovy ( <i>Engraulis japonicus</i> ) larvae in the East China Sea
17:20	<b>Jan Sundet</b> Geographical distribution of the alien snow crab ( <i>Chionoecetes opilio</i> ) as a response to increased warming in the Barents Sea	<b>Shigang Liu* (Student)</b> Climate-induced variations in the sea surface temperature in subtropical Kuroshio waters and its effect on Pacific saury
17:40	<b>Duane Stevenson</b> Fish distributions and climate variation in the northern Bering Sea: A comparison of two bottom trawl surveys	<b>Yongjun Tian</b> Regime shifts in the fish assemblages around Japan over the last century and their early warning signals
18:00	<b>Anne Hollowed</b> A regional assessment of projected impacts of climate change on Arctic fish and fisheries under scenario, process, and structural uncertainty	<b>James Bisagni</b> Inter-annual variability of Gulf Stream warm-core ring/ continental shelf encounters and longfin squid ( <i>Doryteuthis pealeii</i> ) abundance fluctuations
18:20	<i>Session 5 Ends</i>	<i>Session 8, Day 1 Ends</i>

Session 9 (Columbia 9&10)		Session 6 (Columbia 11&12)	
15:20	<b>Patricija Mozetic</b> Linking long-term changes of pelagic microbial communities to fluctuations in climate and hydrological regime in a coastal ecosystem (Adriatic Sea)	<b>Nadine Le Bris</b> New seafloor <i>in situ</i> laboratories based on fixed and mobile robotic platforms to monitor indicators of deep-sea ecosystem functioning and address their vulnerability to industrial activities and climate change	
15:40	<b>Richard Rivkin</b> Anthropogenic effects on biogeochemical processes, carbon export and sequestration: Influence of bacteria-particle interactions on oceanic carbon cycling	<b>Bleuenn Guilloux</b> The deep ocean biodiversity under climate change: Integrative research and adaptive governance towards ocean and climate resilience	
16:00	<b>Cynthia Pilskaln</b> Natural and anthropogenic drivers of organic and inorganic carbon dynamics in the Gulf of Maine, USA	<b>Loreley Picourt</b> Measuring progress on ocean and climate initiatives: an action-oriented report	
16:20	<b>Coffee/Tea Break</b>	<b>End of Session 6 Coffee/Tea Break</b>	
		<b>Session 12, Day 1 (Columbia 11&amp;12)</b>	
16:40	<b>Tore Johannessen</b> Evidence of bifurcations (regime shift) in marine plankton communities in relation to increasing temperature, resulting in recruitment failure in fish	<b>Desiree Tommasi</b> Fisheries Management in an uncertain future: Using management strategy evaluation to assess robustness of harvest guidelines to changing North Pacific albacore tuna productivity and distribution	
17:00	<b>Frédéric Cyr</b> Decadal environmental changes in the Newfoundland and Labrador ecosystem	<b>Melanie Ang* (Student)</b> Impacts of climate change on Pacific North America's small-scale fisheries	
17:20	<b>Stéphane Plourde</b> Using optimal and realized habitat models to assess the underlying mechanisms of Calanus population responses to future climate change in the northwest Atlantic	<b>Jérôme Guiet</b> Bioenergetic influence on the historical development and decline of industrial fisheries, and implications for a warming ocean	
17:40	<b>Jessica Luo</b> Investigating plankton size-spectra dynamics using a global trait-based ecosystem model	<b>Eileen Hofmann</b> Factors affecting distribution of the Atlantic surfclam ( <i>Spisula solidissima</i> ), a continental shelf biomass dominant, during a period of climate change	
18:00	<b>Nicole Lovenduski</b> Coccolithophore growth and calcification in a changing ocean: Insights from Community Earth System Model simulations	<b>Steven Barbeaux</b> Climate impacts on ecosystem productivity and fisheries management: The 2014-2016 Gulf of Alaska marine heat wave and the cod crisis that followed	
18:20	<b>Session 9 Ends</b>	<b>Session 12, Day 1 Ends</b>	

**Tuesday, June 5**

- 8:30 Announcements/Preview Sessions (S1, S3, S12, S13) [Columbia 5-8]
- 8:50 IOC - Ocean Decade
- 9:05 **David Allen Hutchins (Plenary S13, University of Southern California, Los Angeles, CA, USA) CANCELLED**  
Interactions of global change with nutrient limitation of marine primary producers: How do we get from experimental bottles to whole ecosystem responses?  
**Sarah Cooley (Invited) REPLACEMENT (moved from 11:00)**  
How can we use imperfect knowledge to inform management of ecosystems facing multiple drivers?
- 9:35 **Eric Galbraith (Plenary S12, Universitat Autònoma de Barcelona, Spain)**  
Getting the big picture in focus: Assessing climate and human factors with global human-ecosystem models
- 10:05 **Naomi Harada (Plenary S3, Research and Development Center for Global Change (RCGC), Japan Agency for Marine-Earth Science and Technology (JAMSTEC))**  
Sentinel studies of ocean acidification in pelagic (the western North Pacific and Arctic Ocean) and Japanese coasts
- 10:35 *Coffee/Tea Break*

Session 13 (Columbia 1&2)		Session 12, Day 2 (Columbia 3&4)	
11:00	<b>Sarah Cooley (Invited) MOVED to PLENARY</b> How can we use imperfect knowledge to inform management of ecosystems facing multiple drivers?	<b>Kirstin Holsman (Invited)</b> Science for an uncertain future: evaluating climate impacts and management approaches using a coupled modeling framework	
11:30	<b>Camilla Sguotti* (Student)</b> Linear or non-linear? Understanding the effect of climate change on Atlantic cod recruitment	<b>Amanda Faig</b> Modeling the manager: Getting catch right to improve integrated climate-fisheries projections	
11:50	<b>Georg Engelhard</b> Multiple pressures at multiple time-scales: How climate change, fishing, nutrient inputs, and socio-political events shaped the sizes of plaice from 1902 to now	<b>Cody Szuwalski</b> The future of crab in the Bering Sea	
12:10	<b>Tin-Yu Lai* (Student)</b> The effects of climate on Baltic salmon: An application of Structural Equation Models	<b>Lisa Crozier</b> Salmon responses to climate change: From life-cycle models to a multi-model approach	
12:30	<b>Christian Möllmann</b> Multiple stressors cause alternative stable states in the Baltic ecosystem	<b>Cheryl Harrison</b> A predictive fisheries catch metric for CMIP6-OMIP Earth System models	
12:50	<b>Shuyang Ma* (Student)</b> Long-term variabilities in ecosystems structure of China Seas and the possible mechanisms of atmosphere-ocean-ecosystem process	<b>Momme Butenschön</b> The future status of trophic regimes of the global ocean	
13:10	<b>Lunch</b>		
14:20	<b>Phoebe Woodworth-Jefcoats</b> How do fishing and climate change interact to impact biomass available to future fisheries?	<b>Didier Gascuel</b> EcoTroph, a quasi-physical ecosystem model to analyze the global impact of climate change on marine food-webs	

**Concurrent Session Titles**

Session 1 (Day 1): Ocean extremes and their impact on marine ecosystems

Session 3: Carbon uptake, ocean acidification, and ecosystems and human impacts

Session 12 (Day 2): Scenarios and models to explore the future of marine coupled human-natural systems under climate change

Session 13: Multiple stressors at multiple scales: ecosystem based management in the face of changing ocean conditions

**TUES** June 5  
S 1, 3, 12, 13

<b>Session 3 (Columbia 9&amp;10)</b>		<b>Session 1, Day 1 (Columbia 11&amp;12)</b>	
11:00	<b>Nicole Lovenduski (Invited)</b> A change in the forecast: Ocean carbon uptake over the next decade	<b>Rebecca Asch (Invited)</b> Trophic mismatches between plankton blooms and fish spawning phenology as a function of climate extremes	
11:30	<b>Galen McKinley</b> Variability and trends in ocean carbon uptake: 1981-2016	<b>Julie E. Keister</b> Inland sea and coastal ocean zooplankton communities show contrasting responses to recent Northeast Pacific climate variability	
11:50	<b>Maciej Telszewski</b> Requirements-driven global ocean observing system for ocean acidification and deoxygenation	<b>Nathan Mantua</b> Time to expect the unexpected? Unprecedented warming and a chain of ecosystem impacts link altered forage fish distribution and crab fishery delays to a spike in whale entanglements along California’s central coast in 2015-2016	
12:10	<b>Darren Pilcher</b> Impact of local biogeochemical processes and climate variability on ocean acidification in the Bering Sea	<b>Richard Brodeur</b> Effects of a recent marine heat wave on forage taxa in the northern California Current: An unprecedented ecosystem shift in progress?	
12:30	<b>Marion Gehlen</b> Changing ocean acidity as a modulator of atmospheric biogeochemistry and climate	<b>Jan Newton</b> Understanding how extreme conditions and ocean acidification uniquely influence coastal upwelling zones: A case study from the Pacific Northwest U.S.	
12:50	<b>Nianzhi Jiao</b> Microbial carbon sequestration and ocean acidification and hypoxia	<b>Anne Hollowed (for Qiong Yang)</b> How “The Blob” affected groundfish distributions in the Gulf of Alaska	
13:10	<b>Lunch</b>		
14:20	<b>Libby Jewett</b> Making ocean acidification data accessible and useable for resource managers	<b>William Sydeman</b> Marine ecosystems and extreme events: A global analysis through the lens of seabirds	

Session 13 (Columbia 1&2)		Session 12, Day 2 (Columbia 3&4)	
14:40	<b>Javier Porobic* (Student)</b> Under pressure: Fisheries and climate change in a highly vulnerable marine ecosystem	<b>Vicky Wing Yee Lam</b> Projecting global fishing effort dynamics in the 21st century under climate change	
15:00	<b>Elliott Hazen (REPLACEMENT)</b> A dynamic ocean management approach to reduce bycatch in the California Drift Gillnet fishery <b>George Leonard (CANCELLED)</b> OSIRIS: A new analytical framework for evaluating compounding climate stressors in the ocean	<b>Oai Li Chen</b> Modeling the global marine capture fish market under climate change	
15:20	<b>Caihong Fu</b> Incorporating physical forcing in a marine ecosystem model for developing optimal fisheries management strategies	<b>William Cheung</b> Exploring future seafood sustainability under scenarios of climate change and socio-economic development	
15:40	<b>Isaac Kaplan</b> Projections of ocean acidification impacts on marine species and fisheries, for the California Current Integrated Ecosystem Assessment	<b>Gavin Fay</b> Development of robust management strategies for Northeast groundfish fisheries in a changing climate	
16:00	<b>K. Ortega-Cisneros</b> Using ecosystem models to evaluate how climate change influences ecological indicators' response to fishing effects in the southern Benguela system	<b>Bradley Franklin</b> Evaluating adaptation scenarios for fishing communities facing climate-driven species changes	
16:20	<i>Coffee/Tea Break</i>		
16:40	<b>Jonathan Reum</b> Scaling climate impacts from individual-level processes to populations and food webs using multispecies size spectrum models	<b>Arnault Le Bris</b> Climate vulnerability and resilience in the most valuable North American fishery	
17:00	<b>Leonie Färber* (Student)</b> Detecting catastrophic transitions – The case of North Atlantic herring	<b>Pablo Brosset</b> Forecasting herring productivity in the Gulf of St. Lawrence fishery: When the environment matters for management	
17:20	<b>Stefan Koenigstein</b> Impacts of ocean warming, acidification and fishing on marine food-web dynamics and human user groups in the Barents Sea region	<b>Lisa Kerr</b> Implications of environmentally-driven movement and productivity of Atlantic bluefin tuna	
17:40	<b>Erik Olsen</b> Ocean acidification explored using a suite of end-to-end ecosystem models covering ecosystems from the tropics to the arctic	<b>Ricardo Oliveros-Ramos</b> An intermediate complexity food web model to explore fisheries management scenarios under climate change	
18:00	<b>Jordan West</b> Adaptation design tool for ecosystem-based management: coral reef application	<b>E. Fulton or A. Hobday</b> The future of Australia's fisheries – A multi-model analysis	
18:20	<b>Session 13 Ends</b>	<b>Session 12 Ends</b>	

Session 3 (Columbia 9&10)		Session 1, Day 1 (Columbia 11&12)	
14:40	<b>Nathalie Hilmi and Peter Swarzenski</b> Bridging the gap between ocean acidification impacts and economic valuation “From Sciences to Solutions: Ocean acidification impacts on ecosystem services - Case studies on coral reefs”	<b>John Piatt</b> Extreme response of seabirds to extreme climate events in the NE Pacific	
15:00	<b>Richard Alan Feely</b> Anthropogenic carbon increases and biological impacts in the California Current Ecosystem	<b>Catarina Vinagre</b> Robustness of food web complex networks to heat-waves in tropical and temperate shallow waters	
15:20	<b>Martina Stiasny</b> Projecting the fate of fish stocks in a changing ocean - The future of Northeast Arctic cod under ocean acidification and warming	<b>Mahasweta Saha</b> Warmer doesn't mean weaker: Impact of heatwaves on foundation macrophyte species	
15:40	<b>Tomohiko Tsunoda</b> Dialogues between scientists and stakeholders on making ocean acidification a policy focus in Japan	<b>Russell Brainard</b> Ecological impacts of the extreme 2015-2016 El Niño in the central equatorial Pacific	
16:00	<b>Mary Chris Lagumen</b> Temporal variability of carbonate parameters in Guiguwanen Channel, Bolinao, Pangasinan	<b>Mary Hunsicker</b> Developing an index for early detection of abrupt change in northeast Pacific Ocean ecosystems	
16:20	<i>Coffee/Tea Break</i>		
16:40	<b>Bryony Townhill</b> Commercial shellfish and changing pH: Will fisheries be affected by projected changes or are species already adapted?	<b>Thomas Frölicher</b> Marine heat waves under global warming	
17:00	<b>Shubham Krishna</b> Model-based analyses of an ocean acidification mesocosm experiment	<b>Michael Alexander</b> Projected sea surface temperatures over the 21st century: Changes in the mean, variability and extremes for large marine ecosystem regions of Northern Oceans	
17:20	<b>Tiago Grilo</b> Transgenerational deleterious effects of ocean acidification on the reproductive success of a gammarid amphipod species	<b>Youngji Joh* (Student)</b> Increasing coupling between NPGO and PDO leads to prolonged marine heatwaves in the Northeast Pacific	
17:40	<b>Alexis Valauri-Orton</b> The Ocean Foundation's International Ocean Acidification Initiative: A cross-cutting program to build capacity of scientists and legislators to understand and address the complex impacts of ocean acidification	<b>Franklin Ormaza-González (REPLACEMENT)</b> “El Niño Costero” 2017 in Niño 1+2 or the Carnival Coastal Warming event? <b>Charlotte Laufkötter CANCELLED</b> Attribution of recent marine heat waves to anthropogenic climate change	
18:00	<b>Diane Lavoie</b> Projections of future oceanic biogeochemical conditions in the Gulf of St. Lawrence and on the Scotian Shelf using a coupled regional climate model	<b>Lester Kwiatkowski</b> Daily and seasonal ocean acidification extremes during the twenty-first century	
18:20	<b>Session 3 Ends</b>	<b>Session 1, Day 1 Ends</b>	

TUES June 5  
S 1, 3, 12, 13

## Wednesday, June 6

- 8:30 Announcements/Preview Sessions (S4, S10, S14, S15) [Columbia 5-8]
- 8:50 **Merle Sowman (Plenary S14, University of Cape Town (UCT), South Africa)**  
Community vulnerability assessments to inform coastal adaptation planning: Insights from Southern Africa
- 9:20 **Prateep Kumar Nayak (Plenary S15, University of Waterloo, ON, Canada)**  
Vulnerable yet viable: Fisheries and aquaculture amidst global change processes
- 9:50 **Gretta Pecl (Plenary S10, Institute for Marine and Antarctic Studies (IMAS), Centre for Marine Socioecology (CMS) Tasmania, Australia)**  
Addressing key questions for climate-driven species redistribution requires integration of ecology, conservation and social science
- 10:20 **Dimitri Gutierrez (Plenary S4, Peruvian Marine Research Institute (IMARPE))**  
Climate variability and ocean deoxygenation over continental margins associated to the Peru-Chile and other upwelling systems: Insights from proxy records
- 10:50 *Coffee/Tea Break*

Session 14, Day 1 (Columbia 1&2)		Session 15 (Columbia 3&4)
11:10	<b>Beth Fulton (Invited)</b> Living in a world of change – Juggling cumulative impacts and path dependency	<i>Introduction by Convenors</i> (11:10-11:30)
11:40	<b>Emanuele Bigagli</b> Humans at risk. Global spatial patterns of ocean ecosystems degradation and governance scales	<b>Abdelmalek Faraj (Invited)</b> (11:30-12:00) The blue belt initiative (BBI): Towards sustainable fisheries and aquaculture for building resilience to climate change
12:00	<b>Silvana Birchenough</b> Translating ocean acidification into practical applications to support aquaculture and food sustainability	<b>Devendraraj Madhanagopal* (Student)</b> Social adaptation strategies of marine fishers to respond to climate change: The case of ‘Tsunami’ affected fishing hamlets in Tamil Nadu, India
12:20	<b>Laura Falkenberg</b> Developing adaptation and management strategies for socio-ecological systems in an acidified ocean	<b>Samiya Selim</b> Evidence of ecosystem based adaptation to climate change in coastal Bangladesh
12:40	<i>Lunch</i>	
14:00	<b>Michaela Aschan</b> A pragmatic approach to developing climate adaptation plans for fisheries and aquaculture	<b>Dhanya Kandarattil</b> Effect of climate change on socio-economic conditions of fishermen – A tale from Kerala, India
14:20	<b>Catarina Frazão Santos</b> An index to assess the vulnerability of ocean planning and the Blue Economy to global climate change	<b>Johann Bell</b> Adaptations to maintain the contributions of small-scale fisheries to food security in the Pacific Islands

**Concurrent Session Titles**

Session 4: Deoxygenation in Global Ocean and Coastal Waters in Relation to Climate Change

Session 10: Management and conservation of species on the move

Session 14 (Day 1): Vulnerability and adaptation of marine socio-ecological systems to climate change

Session 15: Fisheries and aquaculture in the face of climate change: Current actions, identified solutions and opportunities in support of sustainable livelihoods and food security

Session 10 (Columbia 9&10)		Session 4 (Columbia 11&12)
11:10	<b>Jorge García Molinos (Invited)</b> Ocean currents and herbivory drive macroalgae-to-coral community shift under climate warming	<b>Lothar Stramma (Invited)</b> Large-scale ocean oxygen changes
11:40	<b>Adriana Vergés</b> Climate-mediated tropicalisation of temperate reefs: Should we care?	<b>Rui Rosa</b> Ocean deoxygenation overrides ocean warming and acidification impacts in marine biota
12:00	<b>Thomas Therriault</b> Characterizing and predicting Aquatic Invasive Species distributions: Reconciling large-scale model predictions with small-scale observations and incorporating climate change scenarios	<b>Natalya Gallo* (Student)</b> Implications of ocean deoxygenation for deep-sea demersal fish communities and fisheries
12:20	<b>Malin Pinsky (Invited)</b> Can we adapt to species on the move?	<b>Francisco Chavez (Invited)</b> Causes and impacts of ocean deoxygenation
12:40	<b>Lunch</b>	
14:00	<b>Irene Alabia</b> Projected distribution and diversity patterns of marine taxa in the Pacific Arctic under future climate	<b>Simone Alin</b> Synthesis of a decade of moored time-series observations of hypoxia and ocean acidification in the northern California Current Ecosystem
14:20	<b>Samantha Twiname</b> Mechanistic understanding of climate driven range shifts: Using thermal tolerances of rock lobster to predict future range shifts	<b>Jack Barth</b> Changes in coastal ocean hypoxia off Oregon as influenced by multiple, climate-sensitive drivers

**WED June 6**  
**S 4, 10, 14, 15**

Session 14, Day 1 (Columbia 1&2)		Session 15 (Columbia 3&4)
14:40	<b>Lauren Wenzel and Maria Brown</b> Building capacity to address climate impacts at marine protected areas	<b>Cody Szuwalski</b> Seafood security strategies in China
15:00	<b>Paul Buckley</b> Climate change impacts on marine species, communities and habitats: Implications for managing conservation features, marine protected areas and the wider implementation of marine biodiversity legislation	<b>Mariola Norte* (Student)</b> Adapt or lose: How to manage the socioeconomic impact of climate change in the Spanish aquaculture, the case of blue mussel
15:20	<b>Adrien Comte</b> Operationalizing ecological adaptive capacity: Assessing vulnerability, resilience, and action for coral reefs in French Polynesia under global environmental change	<b>Ethel Wilkerson</b> Strategies for diversifying Maine's softshell clam fishery in response to climate change
15:40	<b>Poster Presentations</b>	<b>Anne Hollowed</b> Climate variability and fisheries: Tools and information requirements
16:00	<i>Coffee/Tea Break</i>	
16:20	<b>Karen Hunter</b> Pacific Canadian fish stock climate change vulnerability assessment	<b>Melissa Karp</b> Accounting for shifting distributions and changing productivity in the development of scientific advice for fisheries management
16:40	<b>Elliott Hazen</b> Comparing climate vulnerability assessment of fish and shellfish resources across large marine ecosystems	<b>Merrick Burden</b> Climate-related impacts on fisheries management and governance in the Northeast Atlantic
17:00	<b>Robert Blasiak</b> Fuzzy logic approach for integrated assessment of vulnerability of marine fisheries	<b>Colette Wabnitz</b> Adapting to climate change in the Pacific Islands: Nutritional impacts of a change in pelagic fish consumption
17:20	<b>Elena Ojea</b> Ecological, socioeconomic and institutional resilience to shifting fish stocks	<b>Myron Peck</b> Risks and opportunities of climate change to European fisheries and aquaculture sectors: The CERES Program
17:40	<b>John Pinnegar</b> Assessing vulnerability and adaptive capacity in the fisheries sector of Dominica: Long-term climate change and catastrophic hurricanes	<b>Florence Poulain</b> Methods and tools for fisheries and aquaculture adaptation
18:00	<b>Jorge Ramos</b> Vulnerability of key Peruvian fishery species to Climate Change	<b>Discussion</b>
18:20	<b>S14, Day 1 Ends</b>	<b>S15 Ends</b>

Session 10 (Columbia 9&10)		Session 4 (Columbia 11&12)	
14:40	<b>Mitchell Roffer</b> Evaluating future fisheries management scenarios using combined downscaled climate, ocean circulation, and habitat suitability models	<b>Xiujun Wang</b> A pause in the decline of oxygen in the largest Oxygen Minimum Zone: A response to the recent global warming hiatus?	
15:00	<b>Robert Crawford</b> Famine in a time of plenty – A recent paradox in the Benguela upwelling system	<b>Olaf Duteil</b> Pacific Decadal Oscillation and recent oxygen decline in the eastern tropical Pacific Ocean	
15:20	<b>Richard Sherley</b> Metapopulation tracking juvenile penguins reveals an ecosystem-wide ecological trap	<b>Kalyani Devasena</b> Study of oxygen and nutrients in the Arabian Sea using model simulations and observations	
15:40	<b>Manuel Hidalgo</b> Reconciling ocean connectivity and hydroclimate with the management of transboundary metapopulations	<b>Andreas Oschlies</b> Reconciling systematic differences between observed and simulated ocean deoxygenation	
16:00	<i>Coffee/Tea Break</i>		
16:20	<b>Rebecca Selden</b> Vulnerability and adaptation of fishing communities to climate-driven species range shifts: Consequences for climate-ready management	<b>Hernan Garcia</b> High-quality dissolved oxygen baseline for ecosystem and variability studies	
16:40	<b>Juliano Palacios-Abrantes* (Student)</b> Current state and future scenarios for trans-boundary fisheries management in changing oceans of Canada and United States	<b>Eric Galbraith</b> Large oxygen decline on the northwest Atlantic Shelf from an ocean dynamical response to warming	
17:00	<b>Iratxe Rubio* (Student)</b> Institutional settings, climate change and the re-distribution of tropical tuna fisheries	<b>Rui Rosa</b> Climate-driven oceanic deoxygenation leads to an epipelagic shark ‘habitat trap’ more prone to overfishing	
17:20	<b>Dorothy Dick</b> Scenario planning as a tool in protected species management and conservation in a changing climate: An Atlantic salmon pilot	<b>Peter Swarzenski</b> Contribution of nuclear applications to study the effects of reduced oxygen in coastal environments	
17:40	<b>Tessa Francis</b> Fish on the move: Tools to support EBFM in facing challenges associated with species range shifts	<b>Ozeas Costa Jr.</b> Stream discharge and nutrient export from the Ohio River watershed under future climate change scenarios	
18:00	<b>Merrick Burden</b> Addressing the challenge of climate change and fisheries: A framework for implementing climate-appropriate fishery Management	<b>Isaac Irby</b> The competing impacts of climate change and nutrient reductions on dissolved oxygen in Chesapeake Bay	
18:20	<b>S10 Ends</b>	<b>S4 Ends</b>	

**WED June 6**  
**S 4, 10, 14, 15**

**Thursday, June 7**

- 8:30 Announcements/Preview Sessions (S2, S7, S11, S17) [Columbia 5-8]
- 8:50 **Andreas Oschlies (S7 Plenary, Marine Biogeochemical Modelling, GEOMAR and the University of Kiel, Germany)**  
Sensitivity of the Eastern Tropical South Pacific oxygen minimum zone to climate change
- 9:20 **Iddya Karunasagar (S17 Plenary, Nitte University, Mangalore, India)**  
Climate change, harmful algal blooms and health risks in one health context
- 9:50 **Lisa Goddard (S2 Plenary, International Research Institute for Climate and Society, Columbia University, USA)**  
Ten-years out: Navigating the information gap between El Niño and climate change
- 10:20 **Stephen Widdicombe (S11 Plenary, Marine Ecology and Biodiversity, Plymouth Marine Lab, UK)**  
How do we put all the pieces together to appreciate the bigger picture?
- 10:50 *Coffee/Tea Break*

Session 7 (Columbia 1&2)		Session 17 (Columbia 3&4)	
11:10	<b>Veronique Garçon (Invited)</b> Land-sea-atmosphere interactions exacerbating ocean deoxygenation	<b>Xuelei Zhang (Invited) CANCELLED</b> Recurrent green tides in the southern Yellow Sea: The process, drivers and way forward	
11:40	<b>Lucie Buttay* (Student)</b> Effect of environmental fluctuation amplitude on community temporal structure	<b>Jiansheng Huang* (Student)</b> Effects of meteorological factors on the temporal distribution of red tides in Tolo Harbour, Hong Kong	
12:00	<b>Folly Serge Tomety* (Student)</b> Coastal variability and change in the Benguela Upwelling system: Decadal trend analysis	<b>Janja France</b> Can we track climate related changes in the HAB species assemblage in a highly variable coastal sea (Gulf of Trieste, Adriatic Sea)?	
12:20	<b>Enrique Curchitser</b> Climate, anchovy and sardine in the California Current: A mechanistic understanding	<b>Eileen Bresnan</b> Regional changes in harmful algal events in the North Atlantic area over the last two decades documented using the HAEDAT database	
12:40	<i>Lunch</i>		
14:00	<b>Rodrigue Anicet Imbol Koungue* (Student)</b> Role of interannual Kelvin waves propagations in the equatorial Atlantic on the Angola Benguela Current System	<b>Raphael Kudela</b> GlobalHAB: International coordination to ascertain the effects of Climate Change on the occurrence of Harmful Algal Blooms	
14:20	<b>Nele Tim</b> Origin and pathways of the central water masses in the Benguela Upwelling system and the impact of the Agulhas leakage	<b>Elisa Berdalet</b> Solving harmful algal blooms problems by organizing bricks: <i>Ostreopsis</i> blooms as an example	

**Concurrent Session Titles**

Session 2: From prediction to projection: the role of seasonal to decadal forecasts in a changing climate

Session 7: Eastern Boundary upwelling systems: diversity, coupled dynamics and sensitivity to climate change

Session 11 (Day 1): Benthic and pelagic system responses in a changing ocean: From genes to ecosystem level functioning

Session 17: Effects of climate change on ocean ecosystem health: Projecting occurrences of harmful algal blooms and disease outbreaks and assessment of the risk to ecosystem functioning, aquaculture, fisheries and human health

<b>Session 2 (Columbia 9&amp;10)</b>		<b>Session 11, Day 1 (Columbia 11&amp;12)</b>
11:10	<b>Katherine Mills (Invited)</b> Understanding stakeholder decisions to guide forecasting efforts	<b>Ulrich Sommer (Invited)</b> The effects of climate change on the ocean's plankton
11:40	<b>Michael Jacox</b> Mechanisms driving seasonal forecast skill in the California Current System	<b>Scott Bennett</b> Contribution of local adaptation to vulnerability of marine biota to warming
12:00	<b>Mercedes Pozo Buil</b> Subsurface dynamics leading to decadal predictability in upwelling systems of the North Pacific	<b>Amrit Mishra* (Student) CANCELLED</b> Short term CO <sub>2</sub> enrichment increases carbon metabolism of air-exposed inter tidal seagrass communities  <b>Kathryn Morrissey* (Student) REPLACEMENT</b> Diving deeper into the algal holobiont: Exploring effects of environmental changes on bacterial diversity
12:20	<b>Antonietta Capotondi</b> Forecasting physical drivers of marine ecosystems in the California Current System using a Linear Inverse Modelling approach	<b>Olav Sigurd Kjesbu</b> Climate vulnerability of marine fish, response traits and mechanisms
12:40	<i>Lunch</i>	
14:00	<b>Takashi Mochizuki</b> Subdecadal modulation in the Pacific in 2000s	<b>Sara Mynott* (Student)</b> Camouflage under climate change: will marine species respond well to warming?
14:20	<b>Fernando Gonzalez Taboada</b> Subseasonal forecast of surface water conditions in Chesapeake Bay using a hybrid approach	<b>Gabriel Reygondeau</b> Effect of climate change on the distribution of global marine biodiversity

**THURS June 7**  
**S 2, 7, 11, 17**

Session 7 (Columbia 1&2)		Session 17 (Columbia 3&4)
14:40	<b>Lynne Shannon</b> Using available fishery, ecological and environmental time series to examine temporal variability in the Southern Benguela ecosystem over the past four decades	<b>Alexandra Campbell</b> Which species traits predict susceptibility to disease in warming oceans? A systematic review of the literature from natural and aquaculture systems
15:00	<b>Isabel Porto da Silveira</b> Oceanic resolution controls differences between fast-SST-error-growth in CCSM4 simulations of the subtropical Southeastern Pacific	<b>Alba Serrat* (Student)</b> Applying a dynamic energy budget model to understand nematode parasite influence on the trade-offs between reproduction and energetic condition of fish
15:20	<b>Ivonne Montes</b> Dynamical relationship between the equatorial circulation and OMZ in the Eastern Tropical South Pacific between 1990 and 2008: a high-resolution modeling approach	<b>Barbara Muhling</b> Three species of Vibrio pathogen in the Chesapeake Bay under future climate change scenarios
15:40	<b>Vincent Saba (for Kristin Kleisner)</b> Evaluating the use of a high-resolution Earth System Model in the Humboldt Current ecosystem to understand regional large-scale climate variability	<b>Chamika W.A.S.* (Student)</b> Dynamics of the Vibrio abundance related to changes in benthic composition at Polhena reef, Southern Sri Lanka
16:00	<i>Coffee/Tea Break</i>	
16:20	<b>Manon Gévaudan</b> Changes in the Peruvian upwelling system under future climate scenarios	<b>Keliang Chen (CANCELLED)</b> Advancing the practice of marine eco-compensation in China: Knowledge synthesis from implementation
16:40	<b>Elizabeth Drenkard</b> Modeling climate change impacts on California Current System oceanography and fisheries	<b>Jonatha Giddens</b> The Pacific Islands Vulnerability Assessment (PIVA): Initial findings from expert panel workshop
17:00	<b>Steven Bograd</b> A water mass history of the Southern California Current System	<b>Ryan Carnegie</b> Managing marine aquaculture health in a changing world
17:20	<b>Raphael Dussin</b> Biogeochemical drivers of hypoxia in a coupled bio-physical model of the California Current Ecosystem	<b>Discussion</b>
17:40	<b>Angelica Peña</b> Interannual to decadal variability of biogeochemical conditions along the British Columbia continental shelf and slope	<b>S17 Ends</b>
18:00	<b>João Bettencourt</b> Physical and biogeochemical controls on dissolved oxygen in coastal upwelling systems	
18:20	<b>S7 Ends</b>	

Session 2 (Columbia 9&10)		Session 11, Day 1 (Columbia 11&12)
14:40	<b>Samantha Siedlecki</b> Seasonal forecasts of hypoxia and ocean acidification in Washington and Oregon waters	<b>Alyce Hancock* (Student)</b> Effect of ocean acidification on Antarctic marine bacterial, archaeal and eukaryotic communities
15:00	<b>Jong-Yeon Park</b> Seasonal to multi-annual marine biogeochemical prediction using GFDL's Earth System Model	<b>Ravi Maharaj* (Student)</b> The sensitivity of climate-induced shifts in the distribution of reef fish to the presence of reef habitat
15:20	<b>Jonathan Tinker</b> Exploring the potential for a North West European shelf seas ecosystem seasonal forecast	<b>Laurene Pecuchet</b> Structural and functional changes of multi-trophic communities in a large marine ecosystem
15:40	<b>Jason Hartog</b> Seasonal and decadal forecast development for a multi-species pelagic longline fishery	<b>Hubert Du Pontavice* (Student)</b> Temperature effects on the transfers of biomass in marine food webs
16:00	<i>Coffee/Tea Break</i>	
16:20	<b>Neda Trifonova</b> Predicting ecological responses to climate variability with a dynamic Bayesian network model	<b>Vincent Vallée* (Student)</b> The effects of climate change and the collapse of the shrimp fishery on fish communities' diversity and functions in a tropical context: The case of the continental shelf off French Guiana
16:40	<b>Mark Payne</b> Envisaging the future distribution of North Atlantic bluefin tuna across seasonal, decadal and centennial scales	<b>Florian Roth* (Student)</b> Local acidification caused by coral-algal phase shifts exacerbates the effects of global ocean acidification on tropical reefs
17:00	<b>Michael Malick</b> Seasonal forecasting of Pacific hake distribution in the California Current Ecosystem	<b>Catarina Santos* (Student)</b> Early perspective: A 3D approach to the effects of elevated CO <sub>2</sub> in the neuroanatomic development of an oviparous shark
17:20	<b>Gavin Fay</b> Incorporating recruitment-environment linkages into stock assessment models for Alaskan groundfish with application to population projections in a changing climate	<b>José Ricardo Paula* (Student)</b> Cognitive and neurobiological disruption of cleaning mutualisms under ocean acidification and warming
17:40	<b>James Thorson</b> Forecast skill for predicting distribution shifts: A retrospective experiment for marine fishes in the Eastern Bering Sea	<b>Will Ryan</b> Complex life cycles and complicated responses to change
18:00	<b>Noah Oppenheim</b> Forecasting fishery trends in a warming ocean: A modeling framework using early life stages of the American lobster	<b>Anna McLaskey* (Student)</b> Krill in a changing environment: Leveraging multiple approaches to understand a complex organism
18:20	<b>S2 Ends</b>	<b>S11, Day 1 Ends</b>

THURS June 7  
S 2, 7, 11, 17

**Friday, June 8**

- 8:30 Announcements/Publication Plans and Target Dates [Columbia 5-8]
- 8:50 **Severino G. Salmo III (Plenary S18, Department of Environmental Science, Ateneo de Manila University, Quezon City, Philippines; Visiting Foreign Researcher at the Tropical Biosphere Research Centre of the University of the Ryukyus, Okinawa, Japan)**  
Blue carbon ecosystems: Conservation and policy needs for an effective climate change adaptation and mitigation strategies
- 9:20 **Alistair Hobday (Plenary S1, CSIRO Oceans and Atmosphere, Hobart, Australia)**  
Ocean extremes: Marine heatwaves and marine ecosystems
- 9:50 **Fan Wang (Plenary S8, Institute of Oceanology, CAS, Qingdao, China)**  
Facing the future and sustainability through connecting the coastal and open oceans: Center for Ocean Mega-Science, Chinese Academy of Sciences
- 10:20 **Coffee/Tea Break**

Session 8, Day 2 (Columbia 1&2)		Session 1, Day 2 (Columbia 3&4)
10:40	<b>Glen Gawarkiewicz</b> Recent changes in shelfbreak exchange processes in the Middle Atlantic Bight	<b>Andrew Pershing</b> Increases in surprising ocean temperatures will challenge the limits of ecosystems and people to adapt
11:00	<b>Janet Nye</b> The influence of the Gulf Stream on Northwest Atlantic ecosystems	<b>Bayden Russell</b> Time matters: Longer heatwaves increase mortality of subtidal organisms at sub-lethal temperatures
11:20	<b>Vincent Saba</b> Using NOAA's high-resolution global climate model to assess climate change impacts in the Northwest Atlantic	<b>Jay Peterson</b> Effects of the recent anomalous warming on the lipid and fatty acid structure of zooplankton in the northeast Pacific (Newport, Oregon, USA)
11:40	<b>Michelle Staudinger</b> Climate-induced shifts in phenology: Case studies of fish, whales, and seabirds in the Gulf of Maine	<b>Louise Castro* (Student)</b> Ocean warming and marine heatwaves: Will these make temperate macroalgae increasingly vulnerable to tropical herbivores?
12:00	<b>Hassan Moustahfid (Invited)</b> The changing character of Western Boundary Currents with climate change and the implications for fisheries	<b>Mark Eakin</b> Global coral bleaching in the Anthropocene and a call for climate action
12:20	<b>Lunch (12:30)</b>	<b>Lunch</b>
13:40	<b>Haikun Xu</b> Evaluating the utility of the Gulf Stream Index for predicting recruitment of Southern New England-Mid Atlantic yellowtail flounder	<b>Gang Liu</b> Increase in global coral bleaching heat stress since 1982

**Concurrent Session Titles**

Session 1 (Day 2): Ocean extremes and their impact on marine ecosystems

Session 8 (Day 2): Understanding the impact of Abrupt Ocean Warming and Continental Scale Connections on marine productivity and food security via Western Boundary Currents

Session 11 (Day 2): Benthic and pelagic system responses in a changing ocean: From genes to ecosystem level functioning

Session 14 (Day 2): Vulnerability and adaptation of marine socio-ecological systems to climate change

Session 14, Day 2 (Columbia 9&10)		Session 11, Day 2 (Columbia 11&12)	
10:40	<b>Nigel Sainsbury* (Student)</b> Unravelling the effect of storms on commercial fish landings in UK waters	<b>Jay Minuti* (Student)</b> Resistance of subtidal reefs to change under future conditions: The role of benthic grazers	
11:00	<b>Eva Papaioannou</b> Not all those who wander are lost – Fishers communities’ responses to shifts in the distribution and abundance of fish resources	<b>Hailey Conrad* (Student)</b> Relative depth constraints on temperature-induced range shifts for continental shelf species	
11:20	<b>Lisa Colburn</b> Social and climate change vulnerability in fishing communities of the United States: An examination of shifting baselines	<b>Peng Lian* (Student)</b> Variability of the spatiotemporal distribution of yellowfin tuna and its response to environmental change in the eastern Pacific Ocean	
11:40	<b>Blair Greenan</b> Coastal index of vulnerability to climate change by economic zone (CIVEZ)	<b>Helen Gurney-Smith</b> The story so far: An in situ pairing of chemical oceanography and physiology	
12:00	<b>Alan Haynie</b> Adaptive fisheries management under changing environmental and economic conditions	<b>Christopher Chambers</b> Experimental methodologies optimized for examining multiple stressors, variable environments, and the scope of responses in early life-stages of marine fishes due to climate change	
12:20	<b>Lunch</b>		
13:40	<b>Stephanie Moore</b> Planning for future resilience of fishing communities to harmful algal blooms: What have we learned from the 2014-2016 northeast Pacific marine heatwave?	<b>Cátia Monteiro* (Student)</b> Is local adaptation driving the transcriptomics response to multiple stressors in the kelp <i>Saccharina latissima</i> ?	

**FRI June 8**  
**S 1, 8, 11, 14**

<b>Session 8, Day 2 (Columbia 1&amp;2)</b>		<b>Session 1, Day 2 (Columbia 3&amp;4)</b>
14:00	<b>John Quinlan</b> How might climate change impact fisheries management and marine protected areas?	<b>James Robinson</b> Productive instability of coral reef fisheries after a climate-driven regime shift
14:20	<b>Jonathan Hare</b> Fisheries in a changing world: examples from the Northeast U.S. Shelf	<b>Mary Elizabeth Livingston (REPLACEMENT)</b> New Zealand fisheries and climate change effects on the ocean: A wake up call  <b>Celina Scott-Buechler* (Student) (CANCELLED)</b> Regional scale coral bleaching is a new phenomenon in the Caribbean Lesser Antilles
14:40	<b>Discussion</b>	<b>Alistair Hobday (for Eric Oliver)</b> Historical and future projected changes in global marine heatwaves
15:00	<b>S8 Ends</b>	<b>S1 Ends</b>
15:00	<i>Coffee/Tea Break</i>	
15:20	<b>Plenary Closing Ceremony [Columbia 5-8]</b>	
17:00	<b>End of Symposium</b>	

Session 14, Day 2 (Columbia 9&10)		Session 11, Day 2 (Columbia 11&12)	
14:00	<p><b>Mark Payne (REPLACEMENT)</b> Marine climate-change's tropical blindspot</p> <p><b>Katherine Maltby* (Student) (CANCELLED)</b> Socio-ecological approaches to exploring climate change impacts: A case study of UK fisheries</p>	<p><b>Taewon Kim</b> Effects of temperature increase and oxygen decrease on behavior and physiology of marine benthic invertebrates</p>	
14:20	<p><b>Sarah Schumann</b> A stakeholder-led process to design climate resilience strategies for wild-harvest commercial fisheries in Rhode Island, USA</p>	<p><b>Marta Silva Pimentel</b> The impact of ocean warming and acidification on the physiology of the seahorse <i>Hippocampus reidi</i></p>	
14:40	<p><b>Lisa Pfeiffer</b> Effects of "The Blob" on profitability in the West Coast Pacific whiting fishery</p>	<p><b>Carolina Bastidas</b> Seasonality of fouling organisms in view of climate change and bioinvasions</p>	
15:00	<b>S14 Ends</b>	<b>S11 Ends</b>	
15:00	<i>Coffee/Tea Break</i>		
15:20	<b>Plenary Closing Ceremony [Columbia 5-8]</b>		
17:00	<b>End of Symposium</b>		

**POSTER SESSION and RECEPTION- June 6**  
**(Location: Columbia West & International Terrace)**

**Session 1: Ocean extremes and their impact on marine ecosystems**

- S1-P1 **Franklin Ormaza-González** (*will be also presented as a talk June 5, 17:40-18:00*)  
(P+O) “El Niño Costero” 2017 in Niño 1+2 or the Carnival Coastal Warming event?
- S1-P2 **Mary Elizabeth Livingston** (*will be also presented as a talk June 8, 14:20-14:40*)  
(P+O) New Zealand fisheries and climate change effects on the ocean: A wake up call
- S1-P3 **In-Seong Han**  
Extreme and abrupt changes of water temperature and their fisheries impacts in the East Asian Marginal Seas
- S1-P4 **Catarina Vinagre**  
Ecological traps in shallow coastal waters - Potential effect of heat-waves in tropical and temperate organisms
- S1-P5 **Catarina Vinagre**  
Integrated index of stress responses to a future marine heat wave in tropical intertidal organisms
- S1-P6 **Erick Geiger**  
Comparing NOAA Coral Reef Watch regional satellite monitoring and in-water observations to prepare for repeat coral bleaching events in a warming world
- S1-P7 **Francesco Rendina\*** (*Student*)  
Effects of elevated temperature as climate change stressor on physiological responses and survival of the coralline alga *Corallina officinalis*
- S1-P8 **Wei Cheng**  
Peek into the future: Extreme physical oceanographic condition in Alaskan Waters from CMIP5 simulations
- S1-P9 **Thomás Banha\*** (*Student*)  
Records of bleaching events in Brazilian reef communities
- S1-P10 **Cheryl S. Harrison**  
The effect of extreme cooling events on ocean ecosystems and biogeochemistry: fisheries implications

**Session 2: From prediction to projection: the role of seasonal to decadal forecasts in a changing climate**

- S2-P1 **Franklin Ormaza-González**  
Do sun spots influence the onset of ENSO and PDO events in the Pacific Ocean?
- S2-P2 **Meng Xia**  
The effect of climate change to the Chesapeake Bay Plume Dynamics
- S2-P3 **Yingying Zhao\*** (*Student*)  
The South Pacific Decadal Variability connections to basin-scale climate
- S2-P4 **Alistair Hobday**  
A framework for combining seasonal forecasts and climate projections to aid risk management for fisheries and aquaculture

- S2-P5      **Mark Payne**  
Lessons from the first generation of marine ecological forecast products
- S2-P6      **Xinyi Kang\* (Student)**  
Exchange dynamics at Maryland Coastal Bays under the effect of climate change
- S2-P7      **Susan Kay**  
Projections of marine ecosystem change in European seas in the 21st century
- S2-P8      **John Selvaraj**  
Projected sea surface temperature changes in the fishing areas of the Colombian Pacific under climate change scenarios
- S2-P9      **Jinyeong Kim**  
A wavelet approach to time series analysis for the anchovy recruitment and climate change in the southeastern waters of Korea
- S2-P10     **Desiree Tommasi**  
Multi-annual climate predictions for fisheries: An assessment of skill of sea surface temperature forecasts for Large Marine Ecosystems
- S2-P11     **Michael Alexander**  
More reliable coastal SST forecasts from the North American multimodel ensemble
- S2-P12     **Yoshikazu Sasai**  
Interannual variability of marine ecosystem in the Kuroshio Extension region
- S2-P13     **Albert Hermann**  
Downscaling global climate projections to the Bering Sea: a rapid hybrid dynamical-statistical method to generate a large regional ensemble
- S2-P14     **Masami Nonaka**  
Potential predictability of mesoscale eddy activities in the western boundary current regions in an ensemble eddy-resolving OGCM

**Session 3: Carbon uptake, ocean acidification, and ecosystems and human impacts**

- S3-P1      **Saravanakumar**  
Seasonal and Interannual variability of partial pressure of carbon dioxide (pCO<sub>2</sub>) and air-water CO<sub>2</sub> flux pattern along the southwest Bay of Bengal-Northern Indian Ocean region
- S3-P2      **Tsuneo Ono**  
Temporal variation of the saturation state of carbonate in intermediate waters of western North Pacific
- S3-P3      **Ortega-Cisneros**  
Potential impacts of ocean acidification on the southern Benguela food web
- S3-P4      **K. Gunasekaran\* (Student)**  
Elevated CO<sub>2</sub> effects on shell dissolution rates of two estuarine benthic foraminifera

- S3-P5      **Radwa Hossam Eldin Saad\* (Student)**  
The effect of ocean acidification on *Ulva lactuca* in relation to the associated bacteria metabolic interactions – A lab study
- S3-P6      **Alyce Hancock\* (Student)**  
Effect of ocean acidification on Antarctic marine organisms – A meta-analysis
- S3-P7      **Miho Ishizu**  
A marine carbon model coupled with an operational ocean model product for ocean acidification studies in the North Western Pacific
- S3-P8      **Robert Holmberg\* (Student)**  
Ocean acidification alters morphology of all otolith types in 3D, delays settlement in Clark’s anemonefish (*Amphiprion clarkii*)
- S3-P9      **Qinyu Liu\* (Student)**  
Influence of human activities on C:N ratio of riverine organic matter along the Pearl River in South China
- S3-P10     **Ferial Louanchi**  
Multi-decadal temperature, oxygen and pH trends in the upper layer of the Western Mediterranean Sea
- S3-P11     **Christine San Antonio\* (Student)**  
Examining the integrated effects of ocean acidification and warming on shell development, structural integrity, and incidence of epizootic shell disease in the juvenile American lobster, *Homarus americanus*
- S3-P12     **Silvana Birchenough**  
The economic impacts of ocean acidification on shellfish fisheries and aquaculture in the United Kingdom
- S3-P13     **Katsunori Kimoto**  
Morphology and habitat depth of planktic foraminifer in intermediate waters of western North Pacific: Implications of relationship to carbonate saturation states
- S3-P14     **Peter Swarzenski**  
Tackling diverse marine climate-change challenges: From nuclear-based techniques to policy
- S3-P15     **Merna Safwat\* (Student)**  
Ocean acidification impact on the grooved carpet shell clam (*Ruditapes decussatus*)
- S3-P16     **Richard Wahle (for Maura Niemisto\* Student)**  
Effects of high CO<sub>2</sub> and temperature on the physiology, behavior and development of American lobster larvae: comparing subpopulations across New England’s thermal gradient
- S3-P17     **Christopher Long**  
Effects of ocean acidification on snow crab larvae: Carryover effects from embryogenesis and oogenesis reduce direct effects on larval survival
- S3-P18     **Robert Foy**  
Ocean acidification does not affect embryo development, hatch success, or adult calcification in Bering Sea snow crab, *Chionoecetes opilio*

- S3-P19      **Fiona Tomas**  
Ocean acidification can release top down control on early life stages of a marine habitat-forming species
- S3-P20      **Carlos Barroso**  
Ocean acidification and warming induce mortality and shell loss in *Nassarius reticulatus* (L.) veligers jeopardizing the species survival
- S3-P21      **Agneta Fransson**  
Effects of sea-ice and biogeochemical processes and storms on under-ice water  $f\text{CO}_2$  from winter to spring in the high Arctic Ocean: Implications for sea-air  $\text{CO}_2$  fluxes

#### Session 4: Deoxygenation in Global Ocean and Coastal Waters in Relation to Climate Change

- S4-P1      **Pamela Hidalgo**  
Community structure and physiological responses of zooplankton in the upwelling system of the Eastern South Pacific: effect of the oxygen minimum zone
- S4-P2      **Fei Lan\* (Student)**  
The role of the SPM absorbed phosphorus in oxygen consumption in the Pearl River estuary
- S4-P3      **Denise Breitburg**  
The IOC-UNESCO Global Ocean Oxygen Network (GO2NE): Collaboration across disciplines and national boundaries to promote research and awareness of ocean oxygen decline

#### Session 5: Climate change impacts on high latitude systems on multiple scales in space and time

- S5-P1      **Elodie Salmon\* (Student)**  
Evaluation of iron sources and sea ice variability in the Ross sea and implications for the phytoplankton seasonal cycle
- S5-P2      **Linda Fernandez (for Brooks Kaiser)**  
Climate change impacts on Arctic marine resource productivity: Interlinking ecological, economic and institutional scenarios
- S5-P3      **Hwa Hyun Lee\* (Student)**  
Environmental variability and chum salmon production at the northwestern Pacific Ocean
- S5-P4      **Kaixing Dong\* (Student)**  
Climate effects on phytoplankton blooms in the Barents Sea
- S5-P5      **Emily Klein**  
Ecosystem outcomes of climate change and fishing impacts on krill, *Euphausia superba*, in the Scotia Sea, and their implications for management in a changing ocean
- S5-P6      **James Ianelli**  
(cancelled) Dynamic changes in two eastern Bering Sea groundfish stocks and relative impacts of temperature-dependent growth and their consequences for fisheries management
- S5-P7      **Suchana Chavanich**  
Potential changes in feeding behaviors and parasites of Antarctic fish on the East Ongul Island and King George Island, Antarctica

**Session 6: The deep ocean under climate change**

- S6-P1      **Liliana Espinosa-Leal\* (Student)**  
Diversity and distribution of hyperiid amphipods between Caldera – Isla de Pascua, Chile
- S6-P2      **Nadine Le Bris**  
Fluid and adaptive networks of fixed and mobile robotic platforms for the monitoring of deep-sea ecosystems

**Session 7: Eastern Boundary upwelling systems: diversity, coupled dynamics and sensitivity to climate change**

- S7-P1      **Jin Ma\* (Student)**  
Climate-driven latitudinal shift in fishing ground of jumbo flying squid (*Dosidicus gigas*) in the Southeast Pacific Ocean off Peru
- S7-P2      **Virginie Bornarel\* (Student)**  
Trophic amplification and attenuation of bottom-up perturbation on marine ecosystem in the Northeast Pacific under climate change
- S7-P3      **Ruben Escribano**  
The impact of the El Niño 2015-16 on the zooplankton community in Chilean Eastern Boundary Upwelling System
- S7-P4      **Joyce JL Ong**  
Global hotspots of synchronous marine populations
- S7-P5      **Nicole Lovenduski (for Riley Brady)**  
What controls the variability of CO<sub>2</sub> fluxes in Eastern Boundary Upwelling Systems?
- S7-P6      **Carlos Conejero\* (Student)**  
Mechanisms associated to the global warming-induced SST pattern in the South Eastern Pacific in the CESM-LE
- S7-P7      **Dimitri Gutierrez (for Espinoza-Morriberón Dante)**  
Modelling biogeochemical trends in the Peruvian Upwelling System: Remote vs local forcing
- S7-P8      **Dimitri Gutierrez (for Adolfo Chamorro)**  
Effect of climate change on upwelling-favorable winds in the Peruvian Upwelling System

**Session 8: Understanding the impact of Abrupt Ocean Warming and Continental Scale Connections on marine productivity and food security via Western Boundary Currents**

- S8-P1      **Carina Stefoni Böck**  
Potential impacts of climate change on physical processes and primary productivity in the Brazilian ocean warming hotspot
- S8-P2      **Caixia Gong\* (Student)**  
Effects of environmental variations on the abundance of western winter-spring cohort of *Ommastrephes bartramii* in the Northwest Pacific Ocean

- S8-P3      **Alexey Mishonov**  
Assessing the Northwest Atlantic 30-year climate change using 3-D visualization
- S8-P4      **Arielle Stela Nkwinkwa Njouodo\* (Student)**  
Atmospheric signature of the Agulhas Current

**Session 9: Drifting into the Anthropocene: How will pelagic marine ecosystems be affected and what are the biogeochemical and lower trophic consequences**

- S9-P1      **Todd OBrien**  
International efforts in plankton and ecosystems time series research
- S9-P2      **Dongxing Chen\* (Student)**  
Effects of typhoon events on chlorophyll and carbon fixation in different regions of the East China Sea
- S9-P3      **Roksana Jahan**  
Shifting pattern of phytoplankton species response to climate change and eutrophication in Gyeonggi Bay
- S9-P4      **Roksana Jahan**  
Temperature influences pennate diatom and flagellates in Gyeonggi Bay
- S9-P5      **Jasmin John**  
Assessing the legacy effects of climate change on the world's oceans utilizing reversibility scenarios
- S9-P6      **Shelby Brunner**  
Development of a global ocean biogeochemistry observing system
- S9-P7      **Charles A. Stock**  
Reconciling ocean productivity and fisheries catch in a changing climate

**Session 10: Management and conservation of species on the move**

- S10-P1      **Kate Searle**  
Climate and resource variation differentially affect intrinsic population processes to drive patterns of seabird population dynamics in UK coastal waters
- S10-P2      **Wei Yu**  
Climate-driven abundance and distribution variability of winter-spring cohort of neon flying squid *Ommastrephes bartramii* in the Northwest Pacific Ocean using habitat suitability modeling approach
- S10-P3      **Ismael Núñez-Riboni**  
Past and projected changes of the suitable thermal habitat of North Sea cod under climate change
- S10-P4      **Lisamarie Carrubba**  
Creating a climate science toolkit to inform management decisions for threatened and endangered species
- S10-P5      **Barbara Muhling**  
Out of tuna: Using metabolic models to estimate future accessibility of bluefin and yellowfin tunas to U.S. fisheries

- S10-P6      **Georg Engelhard**  
Squid on the move in a marine climate change ‘hotspot’ and why it matters to fisheries and society
- S10-P7      **Elena Ojea (for Xiaozhi Liu)**  
Management solutions for shifting trans-boundary fish stocks under fixed catch shares
- S10-P8      **Andrew Yool**  
Climatically-induced change in ocean circulation as a potential stressor of marine ecosystems
- S10-P9      **Thomas Miller**  
Winter is (not) coming: Changes to overwinter behavior of blue crab, *Callinectes sapidus*, in response to warming temperatures
- S10-P10     **Matthew Lettrich**  
A climate vulnerability assessment for marine mammals in the Northwest Atlantic, Gulf of Mexico, and Caribbean
- S10-P11     **Mark Payne**  
Understanding the past and predicting the future of the North-east Atlantic “Mackerel War”
- S10-P12     **Emily Moberg**  
Capital investment for optimal exploitation of renewable resource stocks in the age of global change biology
- S10-P13     **Shin-ichi Ito**  
Effects of climate change on growth and migration of Pacific saury (*Cololabis saira*) in the North Pacific
- S10-P14     **Inna Senina**  
Assessing the impact of climate change on marine top predator populations
- S10-P15     **Lingbo Li**  
Differences in groundfish distributional changes across NE Pacific shelf: Subregion, species, and life history
- S10-P16     **Gretta Pecl**  
How regional fishery bodies have responded to climate change
- S10-P17     **Jin Gao**  
Historical dynamics of the demersal fish community in the East and South China Seas
- S10-P18     **Yi Xu (or Caihong Fu)**  
Towards understanding changes in Pacific herring (*Clupea pallasii*) spawning distribution off the west coast of Canada over the past three decades

**Session 11: Benthic and pelagic system responses in a changing ocean: From genes to ecosystem level functioning**

- S11-P1      **Jun Shoji**  
Changes in fish community structures in seagrass beds along Pacific coast of northern Japan: Increase of species transported from southern waters
- S11-P2      **Carolina González\* (Student)**  
Effect of oceanographic change on the genetic diversity and phylogeography of a widely distributed copepod in the South Eastern Pacific

- S11-P3 **Tatyana Belan**  
(cancelled) Long-term changes of marine environment conditions in the north part of Amursky Bay (the Sea of Japan/ East Sea)
- S11-P4 **Kuo-Wei Lan**  
Effects of climate variability on catch rate of yellowfin tuna (*Thunnus albacares*) cohort in the Indian Ocean
- S11-P5 **Yongjun Tian (for Rui Wu)**  
Otolith microchemistry of Pacific cod in Yellow Sea reflects the annual and interannual variation of Yellow Sea Cold Water Mass
- S11-P6 **Ferial Louanchi**  
Multi-decadal evolution of Ichthyofauna in trawlable bottom of the Algerian coast (South Western Mediterranean Sea)
- S11-P7 **Kathryn Morrissey\* (Student)**  
(P+O) Diving deeper into the algal holobiont: Exploring effects of environmental changes on bacterial diversity
- S11-P8 **Michelle McClure (for Aimee A. Keller)**  
Return of the dead zone: severe hypoxia observed off Oregon and Washington during the 2017 West Coast Groundfish Bottom Trawl Survey
- S11-P9 **Sheng-Yuan Teng\* (Student)**  
The Possible Influence of Climatic Variation on the Catch of Grey Mullet (*Mugil cephalus L.*) in the Taiwan Strait
- S11-P10 **Regina Kolzenburg\* (Student)**  
Is *Corallina officinalis* (*Corallinales, Rhodophyta*) able to adapt to environmental conditions across its geographic distribution?
- S11-P11 **Alba Serrat\* (Student)**  
New insights into early oocyte dynamics and their links to environmental cues challenge assumed fecundity pattern and reproductive potential
- S11-P12 **Rui Rosa**  
Effects of ocean acidification on sharks
- S11-P13 **Aaron Honig\* (Student)**  
Exposure to elevated temperature reduces effects of acidification on inducible defenses in the blue mussel, *Mytilus edulis*, during predator crab exposure
- S11-P14 **Thomás Banha\* (Student)**  
Effects of multiple thermal stresses on chlorophyll-a content and size of *Cassiopea andromeda* (*Cnidaria: Scyphozoa*) and the role of heterotrophy and *Symbiodinium* concentration
- S11-P15 **Nina Bednarsek**  
Interactive effects of temperature and acidification on pteropods in the California Current Ecosystem during 2016 El-Niño

**Session 12: Scenarios and models to explore the future of marine coupled human-natural systems under climate change**

- S12-P1      **Travis Tai\* (Student)**  
Biophysical responses to ocean acidification and impacts on global fisheries
- S12-P2      **Marcos Llope**  
Natural and land-based human factors affect the abundance of anchovy in the Gulf of Cadiz (SW Spain)
- S12-P3      **Muhammed Oyinlola\* (Student)**  
Changes in fishmeal and fish oil supply under climate change
- S12-P4      **Leana Deriš\* (Student)**  
Effect of cod (*Gadus morhua*) predation on juvenile herring (*Clupea harengus*) in the Barents Sea
- S12-P5      **Taylor Clarke\* (Student)**  
Climate-induced shift in living marine resources of shrimp trawl and small-scale fisheries in the Tropical Eastern Pacific
- S12-P6      **Yi-Sin Lu**  
Potential analysis of climatic change impact on the fishing condition of tuna longline fisheries in the Pacific and Atlantic Oceans
- S12-P7      **Nan-Jay Su**  
Development of abundance index for sailfish based on data from the Taiwanese tuna longline fishery in the Atlantic Ocean
- S12-P8      **Paul Spencer**  
Projecting the abundance of eastern Bering Sea walleye pollock from a climate and trophically enhanced stock assessment model
- S12-P9      **Philip Underwood**  
Results from a fisheries configuration of the Madingley General Ecosystem Model
- S12-P10     **Sheng-Yuan Teng\* (Student)**  
Potential impacts of climate change on the *Mugil cephalus* habitat in the northwestern Pacific under future RCP emission scenarios
- S12-P11     **George Whitehouse**  
Modelling the interacting effects of climate change and fisheries management on the eastern Bering Sea food web
- S12-P12     **Michael Jacox**  
From physics to fisheries: A social-ecological management strategy evaluation for the California Current Large Marine Ecosystem
- S12-P13     **Maria Gasalla**  
Climate change effects on fisheries-dependent communities of coastal Brazil
- S12-P14     **Eleuterio Yáñez**  
Impacts of climate change on pelagic fishery resources in Chile

**Session 13: Multiple stressors at multiple scales: ecosystem based management in the face of changing ocean conditions**

- S13-P1 **Abigail McQuatters-Gollop**  
Developing pelagic biodiversity indicators for ecosystem-based management
- S13-P2 **Suinyuy Derick Ngoran (for Anthony Banyouko Ndah)\* (Student)**  
Response of phytoplankton functional groups to multiple simultaneous environmental stressors in the South China Sea
- S13-P3 **Shallin Busch**  
Sensitivity of California Current species to ocean acidification and climate change
- S13-P4 **Xochitl Cormon**  
How does scientific research support management of marine social-ecological systems prone to tipping points? A systematic review
- S13-P5 **Jason Holt**  
Competing physical processes mediating climatic impacts on shelf sea ecosystems around the world
- S13-P6 **Cátia Figueiredo\* (Student)**  
Lanthanum-exposure influences trace element accumulation, elimination, and oxidative stress in glass eels under a warming scenario
- S13-P7 **Tiago Grilo**  
Evidence of cue perception disruption in the European glass eel (*Anguilla anguilla*) migration under climate change
- S13-P8 **Sezgin Tunca\* (Student)**  
(cancelled) Game theory applications to Baltic Sea Multispecies and Multi-fleet fisheries under climate variability
- S13-P9 **Michael Johnson**  
Development of guidance for integrating climate change Information into NOAA Fisheries Habitat Conservation Division consultation processes in the U.S. Greater Atlantic Region
- S13-P10 **Seema Balwani**  
Approaches to utilizing indicators to improve understanding of climate change in the Pacific Islands
- S13-P11 **Caihong Fu**  
Ecosystem-level biological reference points under varying climate and ecosystem states
- S13-P12 **Elliott Hazen (will be presented as a talk June 5, 15:00-15:20)**  
(P->O) A dynamic ocean management approach to reduce bycatch in the California Drift Gillnet fishery
- S13-P13 **Lauren Rogers**  
Effects of climate and demographic change on spawn timing
- S13-P14 **Chen-Yi Tu\* (Student)**  
Fishing and temperature effects on the size structure of exploited fish stocks
- S13-P15 **Saskia Otto**  
Validating the performance of zooplankton as ecological state indicators - A European comparison

**Session 14: Vulnerability and adaptation of marine socio-ecological systems to climate change**

- S14-P1      **Changhua Weng**  
Socio-economic impacts of climate change on coastal fishing communities in the Eastern US:  
Risk assessment and visualization
- S14-P2      **Kelly Montenero**  
Dry Tortugas National Park: Developing a fishery dependent survey as an indicator of marine  
protected area success
- S14-P3      **Bryony Townhil**  
Climate change and marine recreational fishing in Europe: Potential benefits and challenges
- S14-P4      **Emily Farr**  
Local ecological knowledge in managed fisheries: A Maine case study
- S14-P5      **Katherine Mills**  
Social-ecological vulnerability of Northeast U. S. fishing communities to climate change
- S14-P6      **Jade Sainz\* (Student)**  
Spatial planning of marine aquaculture under climate variability and change: A case study for  
mussel, finfish and kelp farms in California
- S14-P7      **Jonathan Hare**  
Development of a vulnerability assessment for climate effects on the habitats of living marine  
resources
- S14-P8      **Ching-Hsien Ho**  
Analysis on the harm and potential risk of aquaculture in Taiwan under the extreme climate disaster
- S14-P9      **Anne Hayden**  
The role of governance in adaptation of fisheries to climate change
- S14-P10     **Mark Payne**  
(also talk) Marine climate-change's tropical blindspot
- S14-P11     **Xochitl Cormon**  
Climate changes and overfishing threats to Western Baltic cod fishery
- S14-P12     **Anna Varney (for Karma Norman)**  
U.S. West Coast fishing communities and climate vulnerability in an ecosystem-based management  
context
- S14-P13     **Mark Nelson**  
Status of fish stock climate vulnerability assessments in U.S. large marine ecosystems
- S14-P14     **Ellen Willis-Norton\* (Student)**  
Evaluating climate driven changes in spatial distributions and predator-prey overlap in the Alaskan  
groundfish fishery
- S14-P15     **Maria del Pilar Cornejo**  
Ecuador: Integrating Disaster Risk Reduction and Climate Change on the coastal zone

**Session 16: Climate, oceans and security**

- S16-P1      **Jayaraju, Nadimikeri**  
Impact of climate change on Indian monsoon: Implication to cyclones in Bay of Bengal
- S16-P2      **Diana Bull**  
Arctic coastal erosion: Development of a mechanistic model designed for coastal hazards evaluation

**Session 17: Effects of climate change on ocean ecosystem health: Projecting occurrences of harmful algal blooms and disease outbreaks and assessment of the risk to ecosystem functioning, aquaculture, fisheries and human health**

- S17-P1      **Gang Liu**  
Seasonal forecasting of coral disease outbreak risk

**Session 18: Coastal ecosystem and their blue carbon science, conservation and policy progress**

- S18-P1      **Sathaporn Monprapussorn**  
Land use and climate change impact on coastal ecosystem services in upper region of the Gulf of Thailand
- S18-P2      **Lauren Wenzel**  
IUCN's role in supporting ocean science and action for conservation in a changing climate
- S18-P3      **Robin Anderson**  
Anthropogenic blue carbon: Assessing the contribution of seaweed aquaculture for carbon uptake and storage
- S18-P4      **Miguel Dino Fortes**  
Coastal blue carbon stock in Southeast Asia: What does it mean to the region's climate change mitigation effort?
- S18-P5      **James R Holmquist**  
Coastal wetland blue carbon synthesis: Recent outcomes and future opportunities

**Workshop 3: Exploring potential ocean-based solutions to climate change impacts on marine biodiversity and ecosystem services**

- W3-P1      **Joel Kamdoum Ngueuko\* (Student)**  
Ocean governance in the Gulf of Guinea: Valuing planning as an ambitious path toward sustainable climate change solutions

**Workshop 6: Utilizing bioenergetics measurements and modeling to evaluate climate change effects on marine species and ecosystems**

- W6-P1      **David Deslauriers**  
Fish Bioenergetics 4.0: An R-Based Modeling Application

**Workshop 7: What do seabirds reveal about the effects of climate change on the World's Oceans?**

- W7-P1      **Anoop Das\* (Student)**  
What seabird communities can tell us on the effects of climate change - A case study

**Workshop 8: Connecting climate, ocean and ecosystem observation – Ocean observation futures**

- W8-P1      **Miguel Santos**  
OBSERVA.PT - Observations on board national commercial ships to support the conservation of marine biodiversity in the Portuguese Seas
- W8-P2      **Varis Ransibrahmanakul**  
(cancelled) The Great Lakes: A visual description of the changes in weather patterns from 1979 to 2002, and water quality from 2002 to 2015
- W8-P3      **José Martinelli Filho**  
Widespread microplastic distribution at a macrotidal Amazon sandy beach

**Workshop 9: Vulnerability of Low Elevated Coastal Zones (LECZ) to SLR in changing oceans**

- W9-P1      **Ozeas Costa**  
Impacts of sea-level rise on the Amazon Macrotidal Mangrove Coast
- W9-P2      **Marufa Ishaque**  
Sea level rise along the Bangladesh Coast

**Workshop 10: Intercomparison of fisheries and marine ecosystem models**

- W10-P1     **Thibaut de la Chesnais\* (Student)**  
Role of cephalopods in ecosystem functioning and evolution

## Upcoming Events

9-13 July 2018

Victoria, BC, Canada

**2018 PICES Summer School: Coastal Ocean Observatory Science**

<http://meetings.pices.int/meetings/summer-schools/2018/Victoria/scope>

16-20 September 2019

Honolulu, HI, USA

**2019 Ocean Observing Conference**

<http://www.oceanobs19.net/>

24-27 September 2018

Hamburg, Germany

**ICES Annual Science Conference**

[www.ices.dk/asc2018](http://www.ices.dk/asc2018)

9-12 October 2018

Reykjavik, Iceland

**ICES/UNECE Symposium on Management tools and standards in support of Sustainable Development Goal 14 "Life below water"**

[http://www.ices.dk/news-and-events/symposia/ICES\\_UNECE/Pages/default.aspx](http://www.ices.dk/news-and-events/symposia/ICES_UNECE/Pages/default.aspx)

22-26 October 2018

Bremerhaven, Germany

**Oceans Past VII**

<https://www.awi.de/forschung/besondere-gruppen/wissensplattform-erde-und-umwelt/opp7.html>

22-24 October 2018

Yokohama, Japan

**Practical Workshop: Production methodologies and measurements for in situ zooplankton**

<http://meetings.pices.int/publications/other/WG-37-ZooProd-wsh-phase1.pdf>

25 October – 4 November 2018

Yokohama, Japan

**PICES-2018 Annual Meeting: Toward integrated understanding of ecosystem variability in the North Pacific**

<http://meetings.pices.int/meetings/annual/2018/pices/scope>

5-7 November 2019

Tromsø, Norway

**Shellfish - Resources and Invaders of the North**

<http://www.ices.dk/news-and-events/symposia/shellfish/Pages/default.aspx>

12-14 June 2019

Bergen, Norway

**Johan Hjort symposium 2019**

website in progress

## NEARBY RESTAURANTS



### AMERICAN

**1) Circa**  
1601 Connecticut Ave., NW  
(202) 667-1601

**2) Front Page**  
1333 New Hampshire Ave., NW  
(202) 296-6500

**3) Kramerbooks and Café**  
1517 Connecticut Ave., NW  
(202) 387-1462

**4) Maddy's Bar and Grille**  
1726 Connecticut Ave., NW  
(202) 483-2266

**5) Nora's (Closed Sunday)**  
2132 Florida Ave., NW  
(202) 462-5143

### CHINESE

**6) Banana Leaves**  
2020 Florida Ave. NW  
(202) 986-1333

**7) City Lights of China**  
1731 Connecticut Ave., NW  
(202) 265-6688

### COFFEE HOUSE

**8) Bethesda Bagels**  
1718 Connecticut Ave., NW  
(202) 299-9399

**9) Cosi**  
1647 20th St., NW  
(202) 234-5837

**10) Dolcetta**  
1704 Connecticut Ave., NW  
(202) 299-9116

**11) Filter Coffeehouse & Espresso Bar**  
1726 20th St., NW  
(202) 234-5837

**12) Firehook Bakery & Coffeehouse**  
1909 Q St., NW  
(202) 588-9296

### COFFEE HOUSE (cont)

**13) Starbucks**  
1700 Connecticut Ave., NW  
(202) 232-6765

### FRENCH

**14) Bistro Bistro**  
1727 Connecticut Ave., NW  
(202) 328-1640

**15) Bistro du Coin**  
1738 Connecticut Ave., NW  
(202) 234-6969

### GREEK

**16) Mourayo**  
1732 Connecticut Ave., NW  
(202) 667-2100

**17) Zorba's Café**  
1612 20th St., NW  
(202) 483-8705

### ITALIAN

**18) Al Tiramisu**  
2014 P St., NW  
(202) 467-4466

**19) Buca Di Beppo**  
1825 Connecticut Ave., NW  
(202) 232-8466

**20) Café Odeon**  
1714 Connecticut Ave., NW  
(202) 328-6228

**21) Darlington House**  
1610 20th St., NW  
(202) 332-3722

**22) La Tomate**  
1701 Connecticut Ave., NW  
(202) 667-5505

**23) Sette**  
1666 Connecticut Ave., NW  
(202) 483-3070

### JAPANESE

**24) Raku**  
1900 Q St., NW  
(202) 265-7258

**25) Teatism**  
2009 R St., NW  
(202) 667-3827

### KOREAN

**26) Mandu**  
1805 18th St., NW  
(202) 588-1540

### MEXICAN

**27) Lauriol Plaza**  
1835 18th St., NW  
(202) 387-0035

**28) Alero**  
1724 Connecticut Ave., NW  
(202) 234-8100

### RUSSIAN

**29) Russia House**  
1800 Connecticut Ave., NW  
(202) 234-9433

### SEAFOOD

**30) Pesce**  
2002 P St., NW  
(202) 466-3474

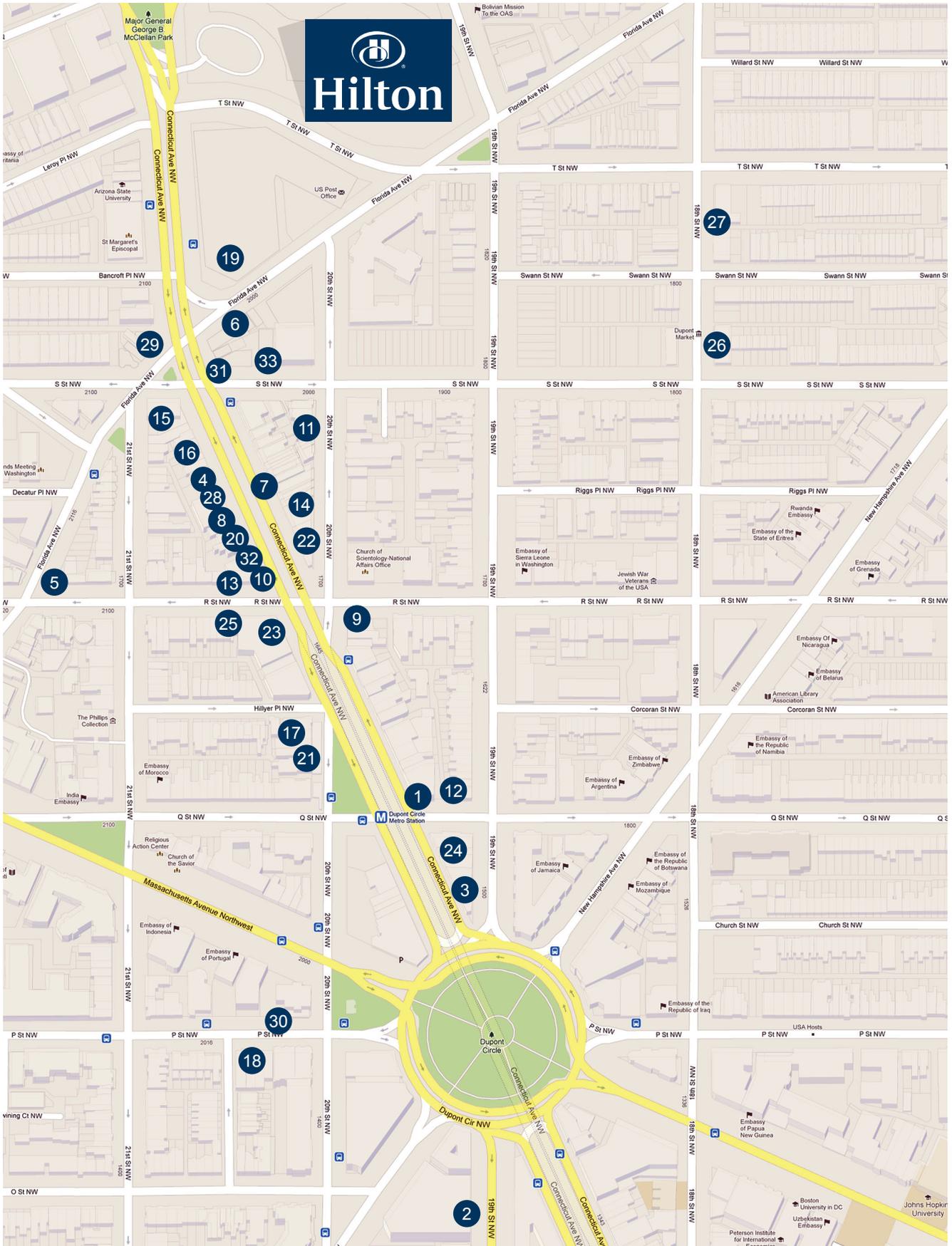
### STEAK

**31) Ruth's Chris Steakhouse**  
1801 Connecticut Ave., NW  
(202) 797-0033

### THAI

**32) Thai Chef**  
1712 Connecticut Ave., NW  
(202) 234-5698

**33) Thaiphon**  
2011 S St., NW  
(202) 667-3505



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