THE SASAKAWA PEACE FOUNDATION

THE OCEAN POLICY RESEARCH INSTITUTE

International Symposium on Ocean Acidification

-Dialogues between scientists and stakeholders-

Sunday 28th October, 2018

Ocean Policy Research Institute, The Sasakawa Peace Foundation

Cooperation by :PICES, IOCCP-GOOS

THE SASAKAWA PEACE FOUNDATION
THE OCEAN POLICY RESEARCH INSTITUTE

International Symposium on Ocean Acidification
-Dialogues between scientists and stakeholders-

With the development of scientific research in recent years, the issue of ocean warming and acidification has been attracting attention internationally from the perspective of policymaking. Especially with regards to the 17 Sustainable Development Goals (SDGs) in the 2030 Agenda for Sustainable Development, Target 14.3 of Goal 14 mentions the need to "Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels," establishing the importance of addressing the issues, and highlighting the need for specific adaptation measures.

In response to these issues, the Ocean Policy Research Institute of the Sasakawa Peace Foundation will host the "International Symposium on Ocean Acidification -Dialogues between scientists and stakeholders-". The symposium will aim to share knowledge of current situations on ocean warming and acidification, consider adaptation measures needed in future including enhancement and networking of monitoring methods, and conduct discussions on policy in the field of ocean science.

■Date : 10:00-17:00, Oct 28, 2018 (Registration begins at 09:30)

■Venue : Sasakawa Peace Foundation Bldg. 11F / International Conference Hall
1-15-16 Toranomon, Minato-ku, Tokyo

■Organizer : Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF)
Cooperation by :PICES, IOCCP-GOOS

■Registration : https://www.spf.org/opri/news/article_25103.html

■Program (Simultaneous interpretation Japanese/English, Free of Charge)

Session1:Towards the establishment of a monitoring network (10:00-13:00)
10:00-11:00 Keynotes Dr. Richard A. Feely (NOAA-PMEL, US) Dr. Masao Ishii (MRI-JMA, Japan) 11:00-13:00 Panel Discussion Dr. Tsuneo Ono (FRA, Japan) Dr. Jim Christian (DFO, Canada) Dr. Naomi Harada (JAMSTEC, Japan) Dr. Kim Currie (NIWA, New Zealand) Dr. Maciej Telszewski (IOCCP-GOOS)
Lunch(provided by organizer)
Session2 : Dialogues between scientists and stakeholders
14:00-15:00 Keynotes Dr. Jason Hall-Spencer (Univ. of Plymouth, UK) Mr. Toru Kumatani(Cabinet Office, Japan) 15:00-17:00 Panel Discussion Dr. Silvana Birchenough (CEFAS, UK) Dr. Masahiko Fujii (Hokkaido Univ., Japan) Mr. Tomohiko Tsunoda (OPRI-SPF, Japan) Mr. Masato Nobutoki(EX Research Inst., Japan) Dr. Tsuneo Ono (FRA, Japan)

Session1:

Towards the establishment of a monitoring network

AM Keynote speech -1 Dr. Richard A. Feely

Dr Richard A Feely
(National Oceanic and Atmospheric Administration - Pacific Marine Environmental Laboratory, USA)

Dr. Richard A. Feely is a NOAA Senior Fellow at the NOAA Pacific Marine Environmental Laboratory in Seattle WA. He also holds an affiliate full professor faculty position at the University of Washington School of Oceanography. His major research areas are carbon cycling in the oceans and ocean acidification processes. He received a B.A. in chemistry from the University of St. Thomas, in St Paul, Minnesota in 1969. He then went onto Texas A&M University where he received both a M.S. degree in 1971 and a Ph.D. degree in 1974. Both of his post-graduate degrees were in chemical oceanography. He is the past co-chair of the U.S. CLIVAR/CO_2 Repeat Hydrography Program. He is also a member of the International Ocean Carbon Coordination Project (IOCCP) Scientific Steering Group, the U.S. Interagency Working Group on Ocean Acidification and the Washington State Blue Ribbon Panel on Ocean Acidification. Dr. Feely has authored more than 300 refereed research publications, and received more than 30 awards (including Department of Commerce Gold Award in 2006 and Heinz Environmental Award in 2010) for his extraordinary efforts in identifying ocean acidity as an existing major challenge to the health of the ocean's food web. Logging more than 1,000 days at sea on over 50 scientific expeditions, Feely has played a leading role in examining the extent and impact of ocean acidification in open-ocean and coastal waters.

AM Keynote speech -1 Dr. Richard A. Feely

Ocean Acidification: A Global Problem with Local Impacts

Carbon dioxide (CO_2) is one of the most important "green-house" gases in the atmosphere affecting the radiative heat balance of the earth. As a direct result of the industrial and agricultural activities of humans over the past two centuries, atmospheric CO_2 concentrations have increased by about 100 ppm. The atmospheric concentration of CO_2 is now higher than experienced on Earth for at least the last 800,000 years, and is expected to continue to rise, leading to significant temperature increases in the atmosphere and oceans by the end of this century. The global oceans are the largest natural long-term reservoir for this excess heat and CO_2, absorbing approximately 85% of the heat and 30% of the anthropogenic carbon released into the atmosphere since the beginning of the industrial era. Recent studies have demonstrated that both the temperature increases and the increased concentrations of CO_2 in the oceans are causing significant changes in marine ecosystems. Many marine organisms are already affected by these anthropogenic stresses, including impacts due to ocean acidification. Dr. Feely will discuss the present and future implications of increased CO_2 levels on the health of our ocean ecosystems and related ocean-based economies.

AM Keynote speech -2 Dr. Masao Ishii

Dr. Masao Ishii
(Meteorological Research Institute of Japan Meteorological Agency)

Masao is a senior scientist in the Meteorological Research Institute (MRI) of Japan Meteorological Agency (JMA) where his managerial role is as a Director of Oceanography and Geochemistry Research Department, which has a long history of ocean carbon cycle studies. Masao has developed automated instruments for seawater CO2 system measurements and is studying ocean carbon cycle and biogeochemistry based on shipboard observations. Masao with his research group runs an oceanographic and marine meteorological observation network, collects data on national to global scales, and develops data information products for the benefit of management, decision and policy makers. His main regions of interest are the western North Pacific and the western equatorial Pacific, with occasional detour to the Southern Ocean and the Arctic.

Masao has served as IOCCP SSG member for the past 6 years (2011-2016) in which role he heavily influenced the processes related to projects such as SOCAT (Pacific Group), GLODAP, GO-SHIP (Executive Group), RECCAP (chapter leader) and other. He has been an active member of the PICES Section on Carbon and Climate since 2008, and IMBER SSC member for 2015-2017. He is now leading IOCCP as a co-Chair and also contributing to IPCC AR6 as one of the Lead Authors of WGI.

AM Keynote speech -2 Dr. Masao Ishii

Trends of acidification in the open ocean around Japanese Islands

Over the past 35 years since early 1980s, Japan Meteorological Agency has been making the measurements of CO_2 in the atmosphere and in the ocean in the western North Pacific, while developing high-performance instruments for these measurements. The result of the sustained long-term measurements demonstrates that the ocean acidification is also occurring significantly here in the western North Pacific around Japanese Islands. Trends of the ocean acidification differ among subtropical, tropical and subarctic regions reflecting the difference in the circulation, biogeochemistry and biological activities. In the surface layer of the subtropics to the south of Japan, the increase in CO_2 thereby ocean acidification is accelerating with the acceleration of the atmospheric CO_2 increase.

AM Moderator Dr. Tsuneo Ono

Dr. Tsuneo Ono
(Fisheries Research and Education Agency, Japan)

Born in 1968. Ph.D. (Fisheries Sciences). Worked with Frontier Research System for Global Change as research scientist, and moved to Fisheries Research and Education Agency. Now Chief Scientist of Fisheries Oceanography Group, National Research Institute for Far Seas Fisheries in Japan Fisheries Research and Education Agency. Member of PICES Section for Carbon and Climate (co-chair).

Research Interests

*Temporal variation of physical/chemical ocean environment both by natural and by anthropogenic forcings, such as PDO and/or global warming
*Response of oceanic lower trophic ecosystems to such ocean environmental changes
*Carbon and nutrient cycles within North Pacific ocean

AM Moderator Dr. Tsuneo Ono

How minutely do we need to monitor coastal pH variation?

There has been a significant progress of ocean-acidification monitoring in open ocean. But we need to assess risk of ocean acidification in coastal waters as well as open waters, as most of commercially important calcifiers lives there. Coastal waters generally have large temporal variation in pH, and some coastal organisms responds not to diurnal-average pH but diurnal minimum of that [e.g., Onitsuka et al., 2018]. This means that we need to monitor coastal pH with enough resolution to solve its diurnal variation to correctly assess their risk on OA. Spacial variation of pH are also large in coastal waters, and previous our analysis indicate that we need to monitor coastal pH with the special resolution of less than 10 km to correctly assess pH variation of Japanese coastal waters. Such high spacio-temporal resolution of pH monitoring cannot be deployed worldwide, and hence we need to develop some techniques to parametarize coastal pH variability as well as direct high-res pH monitoring at several model coastal stations.

AM Panel -1 Dr. James R. Christian

Dr. James R. Christian
(Fisheries and Oceans Canada, Institute of Ocean Sciences, Sidney, BC, Canada
Canadian Centre for Climate Modelling and Analysis, Victoria, BC, Canada)

Dr. James Christian is a Research Scientist with Fisheries and Oceans Canada and an adjunct faculty member in the School of Earth and Ocean Sciences at the University of Victoria. He is the principal developer of ocean biogeochemistry models at the Canadian Centre for Climate Modelling and Analysis. He is the author of numerous publications on the effects of climate variability and climate change on the Pacific Ocean and its ecosystems. He has been North American co-chair of the PICES Section on Carbon and Climate since its inception in 2005.

AM Panel -1 Dr. James R. Christian

The PICES synthesis of North Pacific Ocean acidification and deoxygenation

James R. Christian and Tsuneo Ono

The North Pacific is one of the most vulnerable regions for ocean acidification and deoxygenation. Members of the PICES Section on Carbon and Climate have been working for several years to produce a synthesis and assessment report of the state of North Pacific ocean acidification and deoxygenation. This document is scheduled to be released in early 2019 and is intended to be an accessible summary of the state of the science, targeted to scientifically literate people who are not oceanographers or geochemists. Our intention is that it will be broadly read by fisheries scientists, fisheries managers, and ecologists or marine biologists who are interested in impacts on particular species or ecosystems.

AM Panel -2 Dr. Kim Currie

Dr. Kim Currie
(The National Institute of Water and Atmospheric Research, New Zealand)

Kim is a scientist with NIWA in New Zealand, with a focus on marine carbon chemistry. As part of the Ocean-Atmosphere Interactions group, she is responsible for surface ocean carbon programmes including the Munida Time Series, a long-running transect of ocean carbon measurements off the coast of New Zealand, and the open ocean carbon sink quantification project, using the RV Tangaroa . She is a part of a multi-disciplinary team working on coastal ocean acidification in New Zealand, and has recently set up a coastal ocean acidification observing network. Kim works at the collaborative Research Centre for Oceanography, located at the University of Otago, and was part of the team that was awarded the Prime Minister's Science Prize in 2011. Kim is one of the leaders of the Surface Ocean CO2 Atlas project, which means that she is involved in all global activities related to utilizing the surface ocean carbon data and knows the needs and challenges of that community first hand.

AM Panel -2 Dr. Kim Currie

SETTING UP A COASTAL OCEAN ACIDIFICATION OBSERVING NETWORK IN NEW ZEALAND

Kim Currie[1], Judith Murdoch[2], and Andrew Marriner[1]
([1]NIWA, New Zealand, [2]University of Otago, New Zealand)

The pH of the coastal waters around New Zealand varies on different spatial and temporal scales due to different drivers in different locations, however until recently there was little baseline data against which to measure any future change. Long –term monitoring of ocean carbon chemistry in the surface waters of the SW Pacific Ocean near New Zealand (the Munida time series) has shown that the pH_T decreased at a rate of 0.0013 pH units per year for the period 1998-2012. We have set up a coastal ocean acidification observing network (NZOA-ON) consisting of 14 sites around the country, in partnership with aquaculture industry representatives, regional councils, conservation and other institutes. The observing network consists of fortnightly bottle samples for DIC and alkalinity analyses, plus SeaFET pH sensors collecting data every 30 minutes at some sites. The data is publicly available via a web portal, and will be included in the next New Zealand 'Our Marine Environment' report. NZOA-ON is part of GOA-ON, the Global Ocean Acidification Observing Network.

Bates, N.R., et al. Oceanography 27 (1), 126-141.

AM Panel -3 Dr. Naomi Harada

Dr. Naomi Harada
(Research and Development Center for Global Change (RCGC), Japan Agency for Marin-Earth Science and Technology (JAMSTEC))

Naomi Harada is Deputy Director of RCGC and is also leading the Marine Ecosystem Dynamics Research Group of RCGC, and Arctic Marine Ecosystem Research Unit of Institute of Arctic Climate and Environmental Research.

The reduction of sea ice in the Arctic Ocean, which has progressed more rapidly than previously predicted, could exacerbate several environmental stresses, including ocean warming, acidification, and stratification. In terms of ocean acidification, subarctic area in the western North Pacific has also been serious state, namely unexpected progress of unsaturation degree in the sub-surface depth not only for aragonite but also calcite. How do marine organisms in polar and subarctic regions respond to ocean acidification? In order to find answer this open question, she has led the Japanese domestic project entitled “Plankton in polar regions-toward an understanding of their characteristics” focusing on planktic marine calcifiers, which constitute the base of the food chain. The aims of the research are to understand 1) the influence of ocean acidification on calcifiers; 2) the warming-associated changes of the biomasses of major and minor species; and 3) the specific functions of plankton that live in the Arctic (http://www.jamstec.go.jp/res/ress/haradan/e/). She is serving co-chair of science steering committee of Ecosystem Studies of Sub-Arctic and Arctic Seas (ESSAS), which is the regional program of Integrated Marine Biogeochemistry and Ecosystem Research (IMBeR), executive committee of OceanSITES, president of Paleosciences Society in Japan and vice president of The Geochemical Society of Japan.

AM Panel -3 Dr. Naomi Harada

Studies on ocean acidification in the western North Pacific and Arctic Ocean

Naomi Harada, Katsunori Kimoto, Jonaotaro Onodera, Masahide Wakita, Tetsuichi Fujiki (JAMSTEC)

Ocean acidification (OA) has become environmental stressor in pelagic ocean. According to Wakita et al., (2017, JGR Oceans 122, doi:10.1002/2017JC013002), annual mean $pH^{in\ situ}{}_{T}$ at St. K2 (47°N, 160°E) in the western North Pacific reduced significantly during 1999-2015 at a rate of 0.0025 $year^{-1}$. The reduction rate of $pH^{in\ situ}{}_{T}$ at St. K2 also indicated the seasonal change, namely slow down (0.0008 $year^{-1}$) during the winter season than that of annual mean rate. This would relate with a reduced rate of increases of dissolved inorganic carbon, and an increase of total alkalinity in winter associated with the weakening of calcification by marine calcifier. In addition to pH, saturation degree is also important index for organisms. In the Arctic Ocean, undersaturation area for aragonite has recently expanded in the Canada Basin as consequences of the accelerated sea ice melting (Yamamoto-Kawai et al., 2009, Science 326, doi:101126/science.1174190). Marine calcifiers such as pteropods, foraminifera and bivalves can be thought to be most vulnerable organisms against OA. In order to understand the response marine calcifiers in sub-arctic and polar regions on OA, a time series sediment trap mooring system has been deployed at St. K2 and St. NAP (75°N, 162°W) in the western Arctic Ocean. We have also developed the micro X-ray computer tomography technique (MXCT) to evaluate the impact of ocean acidification on calcifiers measuring the carbonate density of organisms. In this presentation, I show the latest activities on pelagic OA studies promoted in JAMSTEC including development of MXCT and comparison of time-series data between *in situ* pH and carbonate density of foraminifera from St. K2 and pteropods from St. NAP.

AM Panel -4 Dr. Maciej Telzewski

Dr. Maciej Telszewski
(International Ocean Carbon Coordination Project, Institute of Oceanology of Polish Academy of Sciences, Sopot, Poland - Global Ocean Observing System)

Maciej has been with the IOCCP since the beginning of 2011, first as a Deputy Director and starting October 2012 as a Director. Prior to taking on international research management Maciej worked in the UK, France and Japan with his research evolving around marine carbon cycling and surface ocean - lower atmosphere carbon fluxes. Alongside conducting field campaigns he developed strong expertize in basin-wide to global mapping of investigated parameters using neural statistics, self-organizing maps and other computational methods.

AM Panel -4 Dr. Maciej Telzewski

Requirements-driven global ocean observing system for Ocean Acidification

Maciej Telszewski[1], Masao Ishii[2], Kim Currie[3], Artur Palacz[1] and Albert Fischer[4]
([1]IOCCP-GOOS, [2]JMA-MRI, [3]NIWA / University of Otago Research Centre for Oceanography, Dunedin, New Zealand, [4]GOOS, IOC-UNESCO, Paris, France)

Ocean carbon and biogeochemistry observations aimed at quantifying the adverse impacts of currently observed variability on the ecosystem are conducted at national, regional and global levels. These measurements enable the understanding and quantification of processes such as ocean acidification, ocean deoxygenation, eutrophication, air-sea fluxes and remineralization.
The International Ocean Carbon Coordination Project (IOCCP), in collaboration with other international bodies such as GOA-ON leads the biogeochemistry community towards a harmonized and integrated strategy for the multi-disciplinary Global Ocean Observing System (GOOS) aimed at delivering essential ocean information to the society. These efforts entail reconciling the operational service-oriented and research-oriented elements of the value chain starting from ocean observations, developing information products, informing assessments, model forecasts and future projections thus supporting knowledge-based management and informed policy-making.
IOCCP is responsible for capturing and development of requirements for sustained observations. This process has been captured in GOOS Essential Ocean Variables (EOVs) and associated specification sheets. Aspects such as spatio-temporal scales of related phenomena, ranges of signal variability, geographical distribution and intensity of associated processes and more are combined with first-hand description of our current observing capacity as well updated status of data and information product delivery chains, allowing for multi-factoral gap analysis.
In this report we would like to update the stakeholders on the status of coordination of ocean observations with respect to Inorganic Carbon EOV, taking into account a complex myriad of spatio-temporal scales of the distinct biogeochemical phenomena of interest and the ever-growing array of corresponding observing elements.

Session2:

Dialogues between scientists and stakeholders

PM Keynote speech -1 Dr. Jason Hall-Spencer

Dr. Jason Hall-Spencer
(Marine Biology and Ecology Research Centre, University of Plymouth, UK
Shimoda Marine Research Centrer, University of Tsukuba, Shimoda, Japan)

Jason Hall-Spencer is Professor of Marine Biology at the University of Plymouth in the UK and at the University of Tsukuba in Japan. He conducts applied research to provide policy makers with the scientific information needed to best manage the marine environment. This research ranges from deep-sea benthos, fisheries, aquaculture, marine protected areas, invasive species and seamounts. He is primarily a field-based marine scientist with a focus on ensuring marine research has impact beyond academia. This has included lasting protection for vulnerable marine ecosystems such as deep-sea coral reefs, maerl beds and flame-shell reefs. He is now working in Asia using natural analogues for ocean acidification, as well as mesocosm experiments, to help assess the risks of rising carbon dioxide levels on coastal habitats, jobs and well-being. His research group is also working on the efficacy of Ballast water treatment, on oyster physiology and on the effects of a lionfish invasion in the Mediterranean.

PM Keynote speech -1 Dr. Jason Hall-Spencer

Ecosystem effects of ocean acidification and warming in Japan – new scientific evidence for stakeholders

This talk will summarize advances that have been made using natural gradients in seawater carbon dioxide to assess the effects of multiple stressors (ocean acidification, eutrophication, warming, invasive species) on a wide range of marine life (e.g. algae, corals and fish). Experiments in areas where CO_2 seeps up through the seabed have shown profound effects of acidification on plankton and seaweeds, on larval settlement, biomineralization and on fish reproduction. This approach has revealed the ecological tipping points that drive shifts in coastal systems as CO_2 levels rise and was used as scientific evidence to inform the Paris Agreement 2016 negotiations on limiting green house gas emissions.

We face a startling reality: in 2017 around 50% of the Great Barrier Reef, and 75% of Japan's largest coral reef was killed due to greenhouse gas emissions. Shimoda Marine Research Centre is now leading collaborative international research to assess the likely ecosystem-level effects of ocean acidification and warming in Asia. At 300 ppm CO_2 we have found that calcareous organisms cover most of the intertidal and subtidal rocky substrata. These groups (e.g. coralline algae, barnacles and oysters) gradually decrease in abundance becoming rare and corroded at sites in seawater with 900 ppm. The patterns are the same as we found in the Mediterranean; Japanese seeps show which organisms are resilient to ocean acidification (e.g. many diatoms and seaweeds) and emphasise that rising CO_2 emissions must be reduced to avoid further major losses in the marine biodiversity of Japan. Our study sites are an effective communication tool to show how carbon dioxide can affect livelihoods and help inform the people that this will affect the most, like those who will need to adapt to changes in aquaculture, fisheries and coastal tourism.

In order to get the key regional messages of these finding out to stakeholders we propose a non-technical poster and a short publication tailoring key messages about OA to East Asian ecosystems, fisheries, and policy needs. Such a publication would promote understanding of challenges and opportunities, based on current scientific knowledge, among East Asian fishers, managers, and policy makers. This information would enable key fishing sectors to adapt to challenges and take advantage of upcoming opportunities. It would also provide a clear connection between OA impacts and East Asian society, to support policy decision-making around fishery and harvesting management, and explicitly link ecosystem changes to policy drivers such as the UN Sustainable Development Goals.

References

1. Agostini, S., Harvey. B.P., Wada, S., Kon, K., Milazzo,M., Inaba, I. Hall-Spencer, J.M. (2018) Ocean acidification drives community shifts towards simplified non-calcified habitats in a subtropical-temperate transition zone. *Scientific Reports* 8,11354.
2. Harvey, B.P., Agostini, S., Wada, S., Inaba, K., Hall-Spencer, J.M. (in press) Dissolution: the Achilles' Heel of the Triton shell in an acidifying ocean Frontiers in Marine Science doi: 10.3389/fmars.2018.00371
3. Hall-Spencer J.M. et al. (2008) Volcanic carbon dioxide vents reveal ecosystem effects of ocean acidification. *Nature* 454, 96-99.
4. Sunday J.M. et al. (2017) Ocean acidification can mediate biodiversity shifts by changing biogenic habitat. *Nature Climate Change* 7, 81-85.

PM Keynote speech -2 Mr. Toru Kumatani

Mr. Toru Kumatani
(Cabinet Counselor, National Ocean Policy Secretariat, the Cabinet Office, Japan)

Mr. Toru Kumatani is a Cabinet Counselor at the National Ocean Policy Secretariat of the Cabinet Office, responsible chiefly for environmental and fishery fields. Entering the Cabinet in April 2017, he has been involved in formulating the Third Basic Plan on Ocean Policy, which was approved on May 15th this year by Cabinet decision.
He graduated from Tokyo University of Fisheries (now Tokyo University of Marine Science and Technology) in 1982, entered the Ministry of Agriculture, Forestry and Fisheries, and has been engaged mainly in promoting policies concerning fisheries. Meanwhile, in addition to engaging in research and development as Director of the Marine Fisheries Research and Development Center of the Fisheries Research Agency, he was involved in promoting various fishery policies such as promoting and disseminating R & D and implementing resource management based on scientific evaluation, etc., at the Fisheries Agency.

PM Keynote speech -2 Mr. Toru Kumatani

The Third Basic Plan on Ocean Policy and Ocean Acidification

Measures on the ocean around Japan are being promoted in a comprehensive and systematic manner based on the Basic Act on Ocean Policy (Enacted in 2007) and the Basic Plan on Ocean Policy.
The Basic Plan is reviewed approximately every five years and the Third Basic Plan on Ocean Policy was approved in a Cabinet meeting in May 2018.
The Basic Plan stipulates “Maintenance and conservation of the marine environment” as its main measures, and includes “General Remarks” and a “Detailed Exposition” which the Japanese government should implement.
In order to conserve the irreplaceable marine environment, the Japanese government shall deal with various measures such as ocean acidification and respond to climate change under international frameworks (SDGs etc.).
It shall positively contribute to the conservation of the marine environment, taking into consideration the precautionary approach, based on the sustainable development of the ocean.
Also, it shall promote adaptive management, bearing in mind the fact that the state of the ocean always fluctuates and many scientifically unsolved problems remain concerning the oceans.
In order to understand global ocean change, the Japanese government will continue to participate in and contribute to the sharing of observation data, etc., to be carried out under international frameworks, and contribute to consensus formation based on scientific grounds.

PM Moderator Dr. Masahiko Fujii

Dr. Masahiko Fujii
(Faculty of Environmental Earth Science, Hokkaido University)

Masahiko Fujii is an Associate Professor of Faculty of Environmental Earth Science, Hokkaido University, Japan. His educational and research activities focus on sustainable use of marine ecosystem and developing a low-carbon society, especially by enhancing renewable energy in the society.

PM Moderator Dr. Masahiko Fujii

Anticipated impacts of ocean acidification on marine ecosystem and local societies in coastal Japan

Ocean acidification is anticipated to affect marine ecosystem services and human activities such as fisheries, aquaculture, tourism and recreation. However, extent of the impacts is expected to differ spatially. Thus ocean acidification may widen regional gaps of economic conditions and pose a social security threat in future by damaging specific local industries. Things might be further complicated because suitable habitats for the calcifiers, such as corals, scallops, oysters, pearls and shrimps, are projected to become sandwiched between migrating northern and southern limits regulated by ocean warming and acidification, respectively. Considering such backgrounds, this study aims to call for stakeholders' attention to the possible impacts of ocean acidification on local societies in Japan by sharing fundamental scientific knowledge through everyone's common interests: economic values.
Change in economic values of Japanese coral reefs was calculated by the product of changes in the area and health condition of coral reefs. The area was assumed to be regulated by annual maximum and minimum water temperature and minimum saturation state of aragonite (Ω_{arg}) (Yara et al., 2012; 2016). The health condition was assumed to be deteriorated by 15% per Ω_{arg} (Chan and Connolly, 2013; van Hooidonk et al., 2004). The change in economic values of Japanese fisheries and aquaculture was assumed to decrease by 10 through 40% per one pH unit of the water (Wootton et al., 2008).
Currently, calcifiers account for one-fifth of total fish catch in Japan (Ministry of Agriculture, Forestry and Fisheries, 2015). The annual economic values of tourism and fisheries profited by calcifiers in Japan were estimated to be 14,107 and 779-2,399 million USD, respectively (Cesar et al., 2003; Ministry of Environment, 2010). The economic values of Japanese coral reefs were projected to increase by mid-century because of expansion of coral reefs in response to ocean warming. However, the economic value will decrease dramatically in the latter half of the century, due to possible extinction of coral reefs caused coral bleaching and ocean acidification. As a result, the total loss of economic values of Japanese coral reefs in this century was estimated to be 22-67 billion USD for tourism and 5-6 billion USD for fisheries by the end of the century. Likewise, the total economic loss of Japanese fisheries by ocean acidification was estimated to be 15-37 billion USD by the end of the century. However, the impacts of ocean acidification are considered to be spatially different. For example, it is more concerned that the impacts on local industries are relatively prominent in such prefectures as Hiroshima, Okayama, Hokkaido, Fukui and Aichi where calcifiers currently account for the local fish catch by more than 30%.
It is obvious that global mitigation of ocean acidification such as reducing CO_2 emissions is essential to alleviate the impacts of ocean acidification. On the other hand, adaptive strategies would also be needed for aquaculture of calcifiers, which are very important for the local industries. Other strategies, namely protection and repair, are also needed to be applied locally. Such strategies will only be achieved after enlightenment and consensus building among various stakeholders relevant to ocean acidification, including citizens, policy makers and both natural and social scientists.

PM Panel -1 Dr. Silvana Birchenough

Dr Silvana N.R. Birchenough
(Centre for Environment Fisheries and Aquaculture Science(Cefas), UK
Chair of the ICES Ecosysmtems Processes and Dynamics Steering Gorup (EPDSG))

Dr Silvana Birchenough is a marine ecologist and scientific advisor to government departments (Defra and The Marine Management Organisation-MMO) on issues related to benthic ecology and the effects of human activities on the marine environment. She is the group manager for the Advice and Assessesmet, overseeing the work of 45 advisors and economists at Cefas. She has 18 years of experience in planning, conducting and managing ecological contracts. Her research portfolio focuses on studying long-term benthic changes resulting from climate change and the effects of ocean acidification on key commercial specis and habitats. She led the DEFRA funded project 'Placing ocean acidification into a wider fisheries context' (PLACID). She led the "Foresight of the sea report on ocean acidfication". She also led WP3: understanding changes to sediments and functions resulting from ocean acidification (funded under and the NERC/Defra/DECC). Silvana is also the Caribbean Science Lead for the Commonwealth Marine Economies Programme (CME) and she currently leads the project " vulnerability to fisheries and ocean acidification. "She chaired the ICES/PICES/AMAP ACIDUSE workshop to undertand the effects of ocean acidification on commercial species and end-users (WKACIDUSE) in 2016.

She is also the elected chair of the ICES 'Steering Group on Ecosystem Processes and Dynamics' (SSGEPD), overseeing the work of 20 ICES EGs. She also chairs the Benthic Ecology Working Group (BEWG). She is also a Fellow of the Winston Churchill Memorial Trust (WCMT) for work conducted with the Sediment Profile Imagery (SPI) for safeguarding marine environments. Recently, she has been awarded an OECD fellowship entitled: "Optimising science, technology and innovation for studying ocean acidification effects on commercial species" under Theme II: MANAGING RISKS IN A CONNECTED WORLD to conduct original research in Chile.

PM Panel -1 Dr. Silvana Birchenough

Translating ocean acidification into practical applications (to support aquaculture and food sustainability).

Aquaculture is a key activity to support development goals of food provision for the increasing global population. The rise of production has grown steadily over the past decades, surpassing the rate of global population growth and being an effective food production alternative. Aquaculture activities cover several species, including fish (66.6 million tons/yr), algae (23.8 tons/yr) and molluscs (15.1 tons/yr). This overall trend may account for 60% of seafood by 2030. Aquaculture production (~53%) now comes from the ocean's coasts and estuaries. As a large fraction of the world's population inhabits the coastal zones and these are highly exposed to anthropogenic impacts. However, one of the major changes affecting the oceans are due to the increase in CO_2 in the atmosphere over the past century. These increased atmospheric CO_2 concentrations are absorbed by the ocean, resulting in changes of the carbonate chemistry of the seawater (referred as *Ocean Acidification*). Commercial shellfish species, chiefly bivalves and crustaceans are exposed to these changes exhibiting different sensitivities. This work has synthesised all the available experimental OA evidence for shellfish commercial species. The information was then used to develop adaptation options for the aquaculture sector under OA effects. The potential adaptation options were then evaluated with a socio-ecological questionnaire. The respondents suggested that whilst OA could a threat there will be other more pressing co-stressors. Similarly, more issues associated with licensing, meeting market and demand as well as seed production could have more detrimental effects over the shorter time-scales for the industry sector.

PM Panel -2 Mr. Tomohiko Tsunoda

Mr. Tomohiko Tsunoda
(Ocean Policy Research Institute of the Sasakawa Peace Foundation)

Mr. Tsunoda is a Senior Research Fellow at Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF) since 2015.
After finishing Master of Science at Center for Climate System Research, University of Tokyo, he joined Mitsubishi Research Institute (MRI) in 1998. He held positions as Senior Researcher, leaving in 2015.
During his career in MRI, he was engaged in many national projects on ocean policy such as developing a Marine Cadastre prototype system and supporting the formulation of the 2nd Basic Plan on Ocean Policy in Japan.

Though his studies were focused mainly on physical oceanography, his research interests also include ocean policy and science-based information sharing. He is in charge of ocean acidification program at OPRI-SPF.

PM Panel -2 Mr. Tomohiko Tsunoda

Dialogues between Scientists and Stakeholders on Making Ocean Acidification a Policy Focus in Japan

In 2015, OPRI-SPF led the launch of a 5-year program of research on ocean acidification(OA). Through this program, we aim to raise awareness on OA's threats to the oceans and develop policy recommendations in order to fill the gap in the recognition of ocean acidification among various stakeholders.
As part of this program, in collaboration with scientists in Japan, we submitted the following proposals in 2017 on ocean acidification issues for inclusion in Japan's next Basic Plan on Ocean Policy.

1: Promotion of understanding based on scientific knowledge and consideration of countermeasures
2: Increase international contributions
3: Promotion of emission reduction measures of carbon dioxide
4: Promotion of public awareness activities

Regarding the promotion of public awareness activities, we are also developing a website called "Marine Crisis Watch" and working with high school students to enhance monitoring in coastal areas.
In response to the proposals, we aim to discuss the measures necessary for mainstreaming the OA issue, especially focusing on their implementation within international frameworks including SDGs and the Paris Agreement.

PM Panel -3 Mr. Masato Nobutoki

Mr. Masato Nobutoki
(EX Research Institute Ltd.)

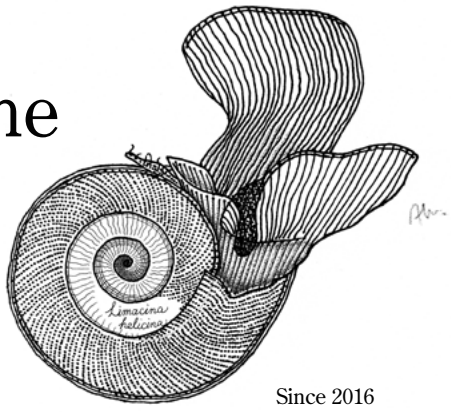
Director, Ex Research Institute Co., Ltd., Audit & Supervisory Board Member Tokyo Gas Co., Ltd. ,
Graduated from the University of Tokyo with urban engineering.
Mitsubishi Corporation (Information Industry, Development Construction, Finance)Vice General Manager
The Japan International Expo Association 2005 (Government Exhibition Project (Japan Pavilion and Government Hosted Event,Director of Planning & Event Management), University of Tokyo Graduate School Professor,
Yokohama City Urban Management Administration Urban Management Strategy Director in charge, Executive Director of Climate Change Policy Headquarter (Yokohama Smart City project, Future city project etc.).
Part-time lecturer at the University of Tokyo graduate school, visiting professor at Yokohama National University, visiting Kobe University Professor etc.

PM Panel -3 Mr. Masato Nobutoki

Yokohama Blue Carbon Project

As regards environmental policy, the coastal port city of Yokohama is the most advanced city in Japan. It was chosen by the Japanese government as the Environmental Model City (2008), The Next Generation Energy Social System Demonstration Experiment City (2010), the Environmental Future City (2011), and the SDGs Future City (2018). Since 2011, Yokohama City has been conducting a social experiment called the Yokohama Blue Carbon Project, which serves to counter climate change and includes a novel carbon offset campaign. Working with the private sector and experts in various fields in this project, Yokohama City is for the first time granting a ‘carbon offset credit’ for use in the Yokohama-City Triathlon Series, which incorporates a new, small economic system. Further, we are aiming to authorize blue carbon ecosystems as part of Japan’s Green House Gas inventory, continue research, spread education, connect with other countries and pursue the possibility of blue carbon applied projects.

Marine Crisis Watch



Since 2016

https://www.marinecrisiswatch.jp

[Contact]
Tomohiko TSUNODA
Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF)
E-mail : oceanpolicy@spf.or.jp, TEL: +81-3-5157-5237