Japan-Australia Marine Science Workshop

Overview

Dates: 11-12 July 2013

Workshop Venue: Mita Conference Hall, Tokyo, Japan

2-1-8 Mita, Minato-ku, Tokyo 108-0073

Co-hosts: The Ministry of Education, Culture, Sports, Science and Technology (MEXT)

The Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE)

Co-chairs: Dr Yoshihisa Shirayama, Executive Director, JAMSTEC

Professor John Gunn, CEO, AIMS

Working Title: Japan-Australia Marine Science Workshop - Understanding Global Change Impacts and Opportunities in Tropical and Subtropical Marine Ecosystems

Themes: (1) What are the biogeochemical processes that influence ocean acidification and the impacts of acidification on biodiversity?

(2) What do we understand about the limits to the adaptability of tropical and sub-tropical marine ecosystems to climate change?

(3) What new technologies are required to better explore and routinely observe tropical and sub-tropical marine systems?

Desired Outcomes: To enhance the relationship between Japan and Australia in marine science.

Timetable:

Day 1

Time	Item	
09:30-10:00	Opening Remarks	Dr Shirayama, JAMSTEC, and Professor Gunn, AIMS Mr Yuichi Inoue, Director, Ocean and Earth Division, Research and Development Bureau, MEXT Mr. Yoshiaki Takahashi

		Director, International Science Cooperation Division, Disarmament, Non-Proliferation and Science Department, MOFA Ms Karen Sandercock (Education & Science), Counsellor, Australian Embassy, Tokyo Professor Mitsuo Uematsu, the University of Tokyo/President of the Oceanographic Society of Japan Dr Bruce Mapstone, Chief, CSIRO Marine and Atmospheric Research (CMAR)
10:00-10:30	Keynote Address: Theme 1 (1)	Dr Haruko Kurihara, University of the Ryukyus
10:30-11:00	Keynote Address: Theme 1 (2)	Professor Philip Boyd, Institute for Marina and Antarctic Studies, University of Tasmania
11:00-11:15	Break	
11:15-11:45	Keynote Address: Theme 2 (1)	Dr Yoshihisa Shirayama, JAMSTEC
11:45-12:15	Keynote Address: Theme 2 (2)	Dr Ken Anthony, Australian Institute of Marine Science
12:20-13:20	Lunch Break	
13:20-13:50	Keynote Address: Theme 3(1)	Professor Toshio Suga, Tohoku University
13:50-14:20	Keynote Address: Theme 3 (2)	Associate Professor Stefan Williams, The University of Sydney
14:20-14:45	Break	
14:45-16:45	Breakout sessions in theme groupings 4 speakers from each side x 10 mins each) Discussions	Session co-chairs: <u>Theme 1</u> Dr Haruko Kurihara, University of the Ryukyus Dr Bruce Mapstone, CSIRO/CMAR

		Theme 2 Dr Yoshihisa Shirayama, JAMSTEC Dr Jamie Oliver, AIMS Theme 3 Professor Toshio Suga, Tohoku University Professor John Gunn, AIMS
17:00	Closing Remarks for Day 1	Dr Shirayama and Professor Gunn

Day 2

Time	Item	
09:40-09:45	Opening Remarks for Day 2	Dr Shirayama and Professor Gunn
09:45-11:50	Continuation of Breakout sessions in theme groupings (1)	Themed session co-chairs
11:50-12:50	Lunch Break	
12:50-13:50	Continuation of Breakout sessions in theme groupings (2)	Themed session co-chairs
13:50-14:15	Break	
14:15-17:00	Wrap-up session - Reports from each themed session - development of work program	Dr Shirayama and Professor Gunn
17:00-17:10	Closing Remarks	Dr Shirayama and Professor Gunn Mr Yuzuru Kimura , Director for Deep-Sea Exploration, Ocean and Earth Division, Research and Development Bureau, MEXT Ms Karen Sandercock, Counsellor (Education & Science), Australian

		Embassy, Tokyo

Japan-Australia Marine Science Workshop

11 and 12 July 2013, Tokyo

Participant Information and Abstract

Core Members
Australia

Name	**Dr Bruce Mapstone (Theme 1 Session Co-Chair)**
Position	Chief
Organization	CSIRO Marine and Atmospheric Research
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Short biography	Dr Bruce Mapstone took up his appointment as the Chief of CSIRO Marine and Atmospheric Research in November 2009. Research capability under Dr Mapstone's direction include: earth, atmospheric and ocean observation and modelling, climate variability and change, fisheries and aquaculture and marine biology, ecology and biogeochemistry. He has a track record of providing research and development (R&D) leadership and executive management across Australia over the last 20 years. Dr Mapstone gained his Doctor of Philosophy from the University of Sydney, Australia, after which he spent 15 years leading research in tropical marine ecology, fisheries and sustainable ocean industries from Townsville, Queensland, Australia. He moved to Tasmania in 2003 to become Chief Executive of the Antarctic Climate & Ecosystems Cooperative Research Centre until 2008. He led The Centre for Australian Weather and Climate Research (CAWCR), a partnership between CSIRO and the Bureau of Meteorology, from November 2008 to November 2009. Dr Mapstone has a strong interest in delivering research outputs to stakeholders beyond traditional research peer communities. He has chaired and served on several advisory committees to Australian and State government agencies, mainly related to fisheries management, the Great Barrier Reef, and national Regional Marine Planning.
Themed Session	**Theme 1**

Name	**Professor Philip Boyd**
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Short biography	Philip Boyd was educated in the UK, and his postdoctoral research straddled the international Joint Global Ocean Flux Study (JGOFS) in North Pacific, North Atlantic and Southern Ocean waters. His current research themes include environmental controls on open ocean phytoplankton, the drivers of the biological pump, and biogeochemical iron cycle. These themes have led him to focus on better understanding how a changing ocean will influence phytoplankton dynamics. He is a lead author on the IPCC WG2 Ocean systems chapter, and in 2014 will co-chair the first Gordon Research Conference on the effects of global change on ocean biota.
Themed Session	**Theme 1**
Presentation title (Keynote speech)	**Exploring the ramifications of Ocean Acidification in the context of global environmental change and ocean biogeochemistry**
Abstract	More than a decade of research into Ocean Acidification has enabled ocean scientists to evaluate both how acidification is driven by a range of ocean processes, and how in turn it influences ocean biota. Recently, the consequences of ocean acidification have been appraised more broadly. This appraisal includes the influence of acidification on other biogeochemical processes, and the biological consequences of the interplay of acidification with other changing oceanic properties. This more holistic approach reveals a complex series of both biogeochemical and biological feedbacks. For example, acidification can alter the bioavailability of trace metals. Biological feedbacks of ocean acidification include its interaction with ocean warming that can result in synergistic or antagonistic effects on the biota. Such feedbacks present challenges for the interpretation of ocean survey or time-series observations, and also for the design of environmental manipulation experiments on ocean biota. In this presentation I will explore the nature of these challenges and how addressing them can help us better understand controls on, and the impact of, acidification in a rapidly changing ocean.

Name	**Dr Richard Matear**
Position	Senior Research Scientist
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Short biography	Dr. Matear is an internationally recognized scientists pursuing research in earth system modelling and ocean acidification. Dr. Matear is involved in both national and international working groups on ocean acidification and his research expertise spans both fundamental advances in earth system modelling and ocean acidification, as well as applying his scientific understanding to investigate the future consequences on marine ecosystems, biodiversity and climate change.
Themed Session	**Theme 1**
Presentation title	**Australian research on the Ocean Acidification impacts from the global to local scale**
Co-Authors	Richard Matear, Andrew Lenton, Bronte Tilbrook and Matheu Mongin CSIRO Marine and Atmospheric Research
Abstract	For the oceans, rising oceanic CO2 causes seawater pH and saturation state of calcium carbonate to decline. These chemical changes to the ocean environment have the potential to modify marine ecosystems composition and dynamics. Further, ocean acidification impacts do not occur in isolation, but will occur with ocean warming, de-oxygenation and increased stratification, and these changes might significantly modulate future impacts. In this presentation, I will give a brief overview of ocean acidification impacts, future projections of ocean acidification, and the potential synergy with other future environmental changes. I will then review some of the Australian Ocean Acidification research effort, which will span work from the global to regional to local scale. Finally, I end the presentation we some comment on key issues that need to be addressed in future research effort.

Name	**Dr Rebecca Albright**
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Short biography	Rebecca received a Bachelor of Science from Duke University in 2003 and a Ph.D. from the Rosenstiel School of Marine and Atmospheric Science, University of Miami in 2011. She is currently a Super Science Fellow at the Australian Institute of Marine Science. The overarching goal of her research is to assess ecosystem response to changing environmental conditions. She has spent the last 8 years investigating the effects of ocean acidification on coral reef ecosystems. During this time, she has developed and led a variety of projects that address this central question at various scales ranging from single cells (gamete interactions and fertilization success) to individual organisms (perturbation experiments investigating the effects of ocean acidification on corals, calcareous algae, gorgonians, and sea urchins) and whole-reef processes (net ecosystem calcification and production). Currently, her research addresses two main questions: 1) how benthic carbon flux processes influence ocean acidification impacts on coral reefs; and 2) how ocean acidification will impact coral reproduction and recruitment.
Themed Session	**Theme 1**
Presentation title	**Dynamics of seawater carbonate chemistry, production, and calcification of a coral reef flat, Central Great Barrier Reef**
Co-Authors	Rebecca Albright, Chris Langdon, Ken Anthony Australian Institute of Marine Science
Abstract	Ocean acidification is projected to shift coral reefs from a state of net accretion to one of net dissolution this century. Presently, our ability to predict global-scale changes to coral reef calcification is limited by insufficient data relating seawater carbonate chemistry parameters to in situ rates of reef calcification. Here, we investigate natural trends in carbonate chemistry of the Davies Reef flat in the central Great Barrier Reef on diel and seasonal timescales and relate these trends to benthic carbon fluxes by quantifying net ecosystem calcification (nec) and net community production (ncp). Results show that seawater carbonate chemistry of the Davies Reef flat is highly variable over both diel and seasonal timescales. pH (total scale) ranged from 7.92 to 8.17, pCO_2 ranged from 272 to 542 µatm, and aragonite saturation state (Ωarag) ranged from 2.9 to 4.1. Diel cycles in carbonate chemistry were primarily driven by ncp. Net ecosystem calcification was positively correlated with Ωarag for both seasons.

Name	**Dr Bronte Tilbrook**
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Short biography	Dr. Bronte Tilbrook is a biogeochemist with CSIRO marine and Atmospheric Research. His research includes work on developing and utilising observing systems to track the uptake and storage of carbon, and the determination of acidification change in the ocean. He leads projects on the large scale carbonate chemistry of the Coral Sea and Great Barrier Reef, and the use of nested modeling and observations to estimate whole of reef metabolism and the response to acidification.
Themed Session	**Theme 1**
Presentation title	**Seawater carbonate chemistry and ocean acidification**
Co-Authors	Bronte Tilbrook[1,2], Yukihiro Nojiri[3], Andy Steven[4], Mathieu Mongin[1], Andrew Lenton[1,2], Richard Matear[1,2] [1]CSIRO Marine and Atmospheric Research, Hobart, Australia [2]Centre for Australian Weather and Climate Research, Hobart, Australia [3]National Institute for Environmental Studies, Tsukuba, Japan [4]CSIRO Land and Water, Brisbane, Australia
Abstract	Ocean acidification is considered a major threat to the health and sustainability of tropical reef ecosystems. Sustained observations of carbonate chemistry over a range of scales from reefs to ocean hydrographic sections have been made in the SW Pacific in order to establish baseline conditions for tracking acidification change. A major focus has been on the Great Barrier Reef (GBR). This research shows that as the water flows onto the GBR shelf from the Coral Sea, local processes of calcification/dissolution and production/respiration in the many reefs and coastal regions of the GBR significantly alter seawater carbonate chemistry. The changes are similar to the shifts in ocean acidification predicted over the next few decades due to ocean CO_2 uptake. The changes in carbonate chemistry indicate that many reefs of the GBR may already be exposed to marginal growing conditions with respect to seawater carbonate chemistry. However, the results are also consistent with a net calcification signal across the GBR, with no evidence of large-scale net dissolution of carbonates in sediments or reefs of the GBR at present. A shift to greater dissolution is expected as ocean acidification continues to alter the carbonate chemistry. The research is being used to develop an integrated modelling and sustained

	observational program to 1) establish ways to detect how the metabolism of the GBR is responding to ocean acidification, and 2) for diagnosing the complex feedback mechanisms in reefs that can alter water chemistry and influence the resilience of reefs to ocean acidification change.

Name	**Professor Maria Byrne**
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Short biography	Dr. Maria Byrne is the Professor of Marine and Developmental Biology at the University of Sydney, Australia. Maria obtained her bachelors degree from the National University of Ireland, Galway and her doctorate from the University of Victoria, Canada. As a marine biologist she has conduct her work at marine research laboratories around the world. This experience provided Maria with knowledge of patterns and trends in marine animal diversity and distribution and has guided her discovery of new species. Prof Byrne is expert in the biology and ecology of marine invertebrates especially echinoderms and molluscs. In comparative work she utilises the diversity of larval forms in closely related species as a model system to document mechanisms underlying evolution and speciation. Her research has involved a broad range of projects ranging from the Great Barrier Reef to Antarctica. Her current research investigates the effects of climate change on marine invertebrates to understand how these animals and their offspring fare in response to present day ad future ocean conditions.
Themed Session	**Theme 1**
Presentation title	**Understanding the adaptive capacity of tropical and subtropical invertebrates: the individual –vs- the independent approach to understanding potential for persistance in a changing ocean**
Co-Authors	Maria Byrne and Shawna Foo Schools of Medical and Biological Sciences, University of Sydney
Abstract	Concurrent ocean warming and acidification exerts deleterious effects on many marine invertebrates, although some species show potential for acclimation (phenotyic plasticity) or adaptation (genetic) to changing ocean conditions. Identifying potential 'winners' in the global change stakes requires an understanding of responses at both the individual and population levels. Most studies have employed orthogonal experimental designs – a powerful approach to understand mean species' responses. However, adaptation to changing climatic conditions will depend on heritable genetic variance for stress tolerance in populations and phenotyic plasticity may provide a temporal window for genetic change to occur. Thus, it is important to explore inter-individual variation. Investigations of marine invertebrate development to global

	change stressors show that the progeny of some parents do better than those of others. We used quantitative genetics (multiple dam-sire crosses) to determine variation in tolerance of sea urchin development to near-future (2100) ocean conditions. The interactive effects of warming (+2-4°C) and acidification (-0.3-0.5 pH units) were quantified across family lines. Significant genotype (sire) by environment interactions for both stressors indicated the presence of heritable variation in tolerance and the ability of fertilization, embryos and larvae to respond to changing environments. The influence of dam may be due to maternal provisioning (maternal genotype or environment) and/or embryo genotype. Positive genetic correlations indicated that genotypes that did well at lower pH also did well in higher temperatures. The presence of tolerant genotypes indicates the potential to adapt to concurrent warming and acidification, contributing to the resilience of sea urchins in a changing ocean.

Name	**Dr Jamie Oliver (Theme 2 Session Co-Chair)**
Position	Research Director
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Short biography	Jamie has had a long association with coral reef research in Townsville. He undertook undergraduate and graduate studies at James Cook University from 1975 till 1983, completing an Honours degree and a PhD in coral growth and reproduction. He was one of the group of young researchers who jointly documented mass coral spawning on the Great Barrier Reef, a discovery that was awarded a Eureka Prize in 1992. Jamie continued working at JCU for several years as a research officer/fellow on the management of coral collecting and on remote sensing of coral spawning until taking a post-doctoral fellowship at AIMS to study coral spawning on high latitude reefs around Lord Howe Island. In 1991 Jamie moved into coral reef management at GBRMPA where he worked as the Monitoring Coordinator and ultimately the Director of Research and Information Support. During this time he took a year off to work at AIMS on the Long-Term Monitoring program where he edited the first LTMP report for the GBR. On returning to AIMS he conceived and oversaw the development of the first State of the Great Barrier Reef World Heritage Area report. After 26 years in Townsville Jamie shifted focus to address issues of food security and poverty alleviation, taking up a position with the WorldFish Center in Penang, Malaysia. There he was responsible for the expansion of a global coral reef information system, ReefBase, and played a major role in the International Coral Reef Action Network as chair of the Steering Committee. After nine years overseas Jamie was looking for new opportunities and was invited back to Australia to head up the Western Australian office of the Australian Institute of Marine Science where he immediately got caught up in the response to the major spill from the Montara oil well off NW Australia. Jamie returned back to Townsville in 2013 as the new Research Director. One of his roles is to represent AIMS on the AIMS@JCU Scientific Advisory Committee.
Themed Session	**Theme 2**

Name	**Dr Ken Anthony**
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Short biography	Dr. Ken Anthony's interest is ecosystem resilience and vulnerability, and management solutions for coral reefs under cumulative stressors in a rapidly changing world. Ken joined AIMS in May 2011 and now works with an excellent multidisciplinary program (A Healthy and Resilience GBR) of 40+ people spanning research areas from molecular biology to ecosystem modelling at the scale of the entire Great Barrier Reef. His Program is working towards solving critical issues for the GBR and the World Heritage Area, and towards communicating those solutions to managers, stakeholders and the public. Ken's main focus is science leadership and active collaborative research on high priority problems for coral reefs. Ken and his teams are collaborating with managers and stakeholders in identifying effective management "levers" for coral reefs in Australia and globally, and in the development of structured decision-making tools for reef conservation, management and policy practitioners.
Themed Session	**Theme 2**
Presentation title (Keynote speech)	**Cumulative impacts from local, regional and global-scale stressors on the Great Barrier Reef**
Abstract	Australia's Great Barrier Reef (GBR) has in the recent decades shown signs of vulnerability from a suite of stressors ranging from severe cyclones, coral bleaching events, crown-of-thorns starfish (COTS) and declining water quality. Successful management of the GBR into the future will require a deeper understanding of opportunities to influence environmental and societal drivers and pressures at local, regional, and global scales. Here I present a framework for understanding cumulative stressors on marine ecosystems, and for informing environmental decisions under complex scenarios. The framework builds on qualitative and probabilistic models developed with diverse groups of ecologists and stakeholders. I present examples of how cumulative stress scenarios of run-off from agricultural and coastal development activities, combined with business-as-usual climate change, represent risks to coral reefs and other ecosystem values. Environmental consequences of these scenarios depend on how the local and regional-scale stressors are managed in time and space, e.g. land use and coastal developments. Climate change represents the greatest

	long-term risk to the GBR as it has the largest (global) zone of influence. Reduced water quality related to agricultural land-use runoff has an intermediate zone of influence largely encompassing the 20-30km inshore band of the GBR. The proposed link between nutrient pulses during floods and the outbreaks of COTS imply that ecological consequences of nutrients runoff on the GBR could be as large as for climate change. While port developments represent high localised risk from dredging operations, their area of impact is relatively small depending on location and operation. Lastly, I present examples of how ecosystem modelling in combination with a structured decision-making process can inform multi-objective spatial planning decisions in complex social-ecological systems such as the GBR.

Name	**Dr Gretta Pecl**
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Short biography	**Dr Gretta Pecl** is a Fulbright Fellow and a Senior Research Fellow leading several projects within the Estuaries and Coasts Program at the Institute for Marine and Antarctic Studies. Her current research activity spans a range of topics including assessing population and fishery responses to climate change, developing and evaluating management adaptation options for fisheries, and on using citizen science approaches for ecological monitoring and engagement (e.g. www.REDMAP.org.au). She is one of several researchers building a virtual network connecting researchers from rapidly warming regions (Global Marine Hotspots Network) and the lead convenor of an international conference *Species on the move: detection, impacts, prediction and adaptation* planned for Hobart in February 2016
Themed Session	**Theme 2**
Presentation title	**Assessing species-specific responses to marine climate change in south-east Australia**
Co-Authors	Stewart Frusher[1,2], Amanda Bates[1], Felipe Briceño[1], Graham Edgar[1], Alistair Hobday[2,3], Eriko Hoshino[1,2], Martin Mazloff[1], Jorge Ramos[1], Lucy Robinson[1], Jemina Stuart-Smith[1], Rick Stuart-Smith[1], Jennifer Sunday[4] and Ingrid van Putten[3] [1] Institute for Marine and Antarctic Studies, University of Tasmania, Hobart, Tasmania, Australia 7001 [2] Australian Marine Adaptation Network [3] CSIRO Marine and Atmospheric Research, Climate Adaptation Flagship, Australia [4] Simon Fraser University, British Columbia, Canada
Abstract	Over the next century, marine ecosystems off the coast of south-eastern Australia are expected to exhibit some of the largest climate-driven changes in the Southern Hemisphere, impacting both fisheries and conservation management. Major distributional shifts have already been recorded for several dozen taxa. Even though shifts in species distributions are one of the major responses recorded here (and globally), the underlying mechanisms mediating such shifts are often unexplored, studies on marine range shifts tend to focus on individual species and rarely account for their broader impacts on ecosystem structure and functioning, and monitoring for species range-shifts at the necessary temporal and spatial scales is challenging. Here,

	we outline a multi-level approach for evaluating some of the distributional responses to climate change, stretching over biological scales from genetics and life history traits, through to single species and ecosystems. We briefly describe projects examining the mechanisms behind species shifts, changing species interaction strengths and impacts of range shifting species at the ecosystem level. Additionally, two IMAS-led approaches to addressing the monitoring challenge are outlined: Redmap (www.redmap.org.au), an Australia-wide online database and mapping resource that allows members of the public to submit geo-referenced observational data (including photographs) on marine species occurring outside their known distribution (i.e. species that may be undergoing range shifts), and Reef Life Survey (http://reeflifesurvey.com), a global monitoring network using trained divers in structured surveys resulting in high-quality data with broad taxonomic, spatial and temporal coverage.

Name	**Professor Philip Munday**
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Short biography	I have broad interests in the population, community and behavioural ecology of reef fishes. My research focuses on understanding and predicting the impacts that climate change will have on populations and communities of marine fishes, both directly through changes in the physical environment and indirectly through effects on coral reef habitat. Using a range of laboratory and field experiments I am investigating the effects of climate change on reef fish populations and testing their capacity for acclimation and adaptation to a rapidly changing environment. My research group are leaders in understanding and predicting the effects of ocean acidification on marine fishes.
Themed Session	**Theme 2**
Presentation title	**Transgenerational acclimation to climate change in marine fish**
Abstract	Understanding the capacity for organisms to acclimate to rapid environmental change is critical for making reliable predictions about the impacts of climate change. Many tropical species appear to be highly sensitive to global warming and ocean acidification and have limited within-generation capacity for acclimation to the stressors. However recent experiments with reef fish have demonstrated that some species have considerable potential for transgenerational thermal acclimation. Similar dramatic improvement in performance between generations has been observed in response to elevated CO2. In this talk I will prove a framework for understanding the various forms of acclimation that can occur in marine organisms and how they contribute to adaptive responses to climate change. I will describe the results of recent experimental studies on transgenerational acclimation in reef fishes and discuss the likely mechanisms underlying these effects. These studies indicate that transgenerational acclimation may be a powerful mechanism by which some species will be able to adjust to a changing climate and that short-term experiments risk underestimating the capacity of organisms to cope with environmental change.

Name	**Dr Jodie Rummer**
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Short biography	Jodie is originally from the USA where she completed honours, BSc, and MSc degrees in Biology and Marine Biology before moving to Vancouver, Canada to commence a PhD at the University of British Columbia. Her PhD research investigated oxygen uptake and delivery mechanisms in fish during stress, but she has also done extensive research on buoyancy, exercise, and oxygen and temperature stress. After a post-doctoral fellowship in Hong Kong (2010-2011), she joined the ARC Centre of Excellence for Coral Reef studies at James Cook University as an ARC Super Science Fellow (2011-present). Dr. Rummer's areas of expertise are ecological and conservation physiology. She specifically investigates how fish perceive and mitigate environmental and anthropogenic stress by means of physiological and behavioural modifications, an important emerging area of study that is vital for effective management and conservation of marine and freshwater ecosystems.
Themed Session	**Theme 2**
Presentation title	**Metabolic performance in a warmer world, a case study on local adaptation in coral reef fishes**
Abstract	Equatorial populations of marine species could be most impacted by global warming because they may be adapted to the narrow temperature range of their local environment. For coral reef fishes, rising temperatures could have significant impacts on individual metabolic performance making life history processes more costly, thus ultimately affecting community structure, population demography and biogeographic distributions. Here, the metabolic performance of six coral reef fish species from northern Papua New Guinea (2.5°S; 150.5°E) was assessed over temperatures incorporating their existing thermal range (29-31°C) as well as projected increases in ocean surface temperatures of 2-3°C (33-34°C) by 2100. Results suggest one species is already living above its optimum temperature for metabolic performance (29°C), while the others appear to be close to their thermal optima (31°C). Furthermore, one species was unable to survive even short-term exposure to 34°C. Interestingly, populations of the same species but from higher latitudes along the Great Barrier Reef (14.5 and 23.5°S) appear to perform optimally at the same temperatures

	as equatorial populations (31°C), despite inhabiting slightly cooler but much wider annual temperature ranges (23-30 and 20-29°C). Equatorial reef fish populations are already living close to their thermal optima and may be more sensitive to ocean warming than higher-latitude populations. Even relatively small temperature increases (2-3°C) could result in population declines and the redistribution of equatorial populations to higher latitudes if adaptation cannot keep pace. Understanding the critical links between organism and environment will be key to developing effective strategies to conserve marine biodiversity in a changing climate.

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Short biography	Craig Johnson is a quantitative community ecologist and Director of the Marine & Antarctic Futures Centre in the Institute for Marine and Antarctic Studies (IMAS). He works on the space-time dynamics of marine systems, encompassing interactions among organisms spanning bacteria, phytoplankton, macroalgae, invertebrates and fishes. Most of his work has focused on temperate and tropical reefs, but recently has addressed ecological dynamics of the Southern Ocean. His research activity is equally divided between field work, largely focused on *in situ* experiments, and building computer models of marine system dynamics. His research is published in over 120 peer-reviewed publications including two edited books. Craig Johnson has chaired the Marine National Facility Steering Committee since 2004, and currently serves on the Steering Committee of the Australian National Data Service, and Science Advisory Committee of the Marine National Facility.
Themed Session	**Theme 2**
Presentation title	**Adapatability of habitat-forming species on nearshore shallow reefs to a changing environment**
Abstract	Shallow coastal reefs are important ecologically and economically, and are structured by important habitat-forming 'ecosystem engineer' species (e.g. corals and large seaweeds). The capacity of habitat-forming species to adapt to a changing physical environment is pivotal to the resilience and persistence stability of these systems. Work from tropical through temperate latitudes in eastern Australia indicates that adaptability of key habitat forming species can be strongly species-specific (e.g. among seaweeds) while other groups show relatively uniform, and poor, adaptability (e.g. corals). Additionally, habitat-forming species might adapt well to a changing physical environment but have low resistance and resilience to climate-driven changes in ecology as a result of range extension of other 'engineer' species. Importantly, reef systems are sufficiently accessible to obtain relevant data to build sophisticated models to examine alternative futures under different management practices. There is considerable scope for Japanese and Australian scientists to collaborate in developing ecosystem models of reef and other marine systems for management purposes.

Name	**Professor John Gunn (Co-Chair and Theme 3 Session Co-Chair)**
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Short biography	John Gunn is the Chief Executive Officer of AIMS. John has significant experience in leading development of strategy, scientific research and capability, and stakeholder engagement across a research portfolio encompassing marine ecology, fisheries, coastal systems, physical and chemical oceanography, atmospheric chemistry and climate science. John joined AIMS from the position of Chief Scientist of the Australian Antarctic Program, where he played a key role in developing the new Australian Antarctic Science Strategy Plan: 2011 – 2021. Prior to this, John was Deputy Chief of CSIRO's Marine and Atmospheric Research Division, the culmination of 29 year career with the Commonwealth Scientific and Industrial Research Organisation. John has held a number of important advisory and policy development roles through his membership of the Scientific Steering Committee for the Global Ocean Observing System, the Australian Academy of Science National Committee for Antarctic Research, the Antarctic Climate and Ecosystems Co - Operative Research Centre Board, the Oceans Policy Science Advisory Group (OPSAG), the Commonwealth Government's High Level Coordination Group on Climate Change Science, and Australia's Integrated Marine Observing System Board. Alongside his executive experience, John has an extensive academic record. Having graduated from James Cook University, Townsville in 1978 with a first class honours in marine biology, John has authored over 150 peer-review publications, book chapters, papers to international commissions and technical reports, and has presented at more than 100 conferences and symposia, in many instances as the keynote speaker. He has an international reputation in the fields of pelagic fish ecology and in the development of marine biological observing technology and systems. Having worked within and led a number of world-leading, multidisciplinary teams and programs, John is a passionate advocate for science, and in particular marine science, and its role in securing a prosperous and sustainable future for Australia. While addressing the needs and demands of a broad user community, he is determined to maintain and further enhance the scientific excellence for which AIMS has gained an enviable international reputation.
Themed Session	**Theme 3**

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Short biography	Stefan B. Williams is an Associate Professor and ARC Future Fellow at the University of Sydney's School of Aerospace, Mechanical and Mechatronic Engineering. He is a member of the Australian Centre for Field Robotics where he leads the Marine Robotics group. He is also the head of Australia's Integrated Marine Observing System Autonomous Underwater Vehicle Facility. His research interests include Simultaneous Localisation and Mapping in unstructured underwater environments using visual and acoustic sensing, autonomous navigation and control and classification and clustering of large volumes of data collected by robotic systems. He received his PhD from the University of Sydney in 2002 and completed a Bachelor of Applied Science in Systems Design Engineering at the University of Waterloo, Canada in 1997.
Themed Session	**Theme 3**
Presentation title (Keynote speech)	**Autonomous Underwater Vehicles for Environmental Survey**
Co-Authors	Stefan B. Williams, Oscar Pizarro, Mitch Bryson, Matthew Johnson-Roberson, Ariell Friedman, Daniel Steinberg and Donald Dansereau Australian Centre for Field Robotics, University of Sydney
Abstract	This talk will examine recent developments in marine imaging from Autonomous Underwater Vehicles (AUV), with a particular emphasis on novel imaging system design, visual navigation and mapping and clustering and classification of the resulting imagery. We provide a brief overview of Australia's Integrated Marine Observing System (IMOS) program that is facilitating the establishment of benthic reference sites around the country. These sites are revisited on an annual basis to monitor changes in marine habitats by exploiting developments in high resolution mapping using stereo imagery data collected by the AUV systems. We also briefly touch on recent challenges related to measuring change and transforming the resulting data into information suitable for the study of marine environments and examine how these tools and techniques are having an impact in a variety of application domains.

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Short biography	Dr. Emlyn Jones is a Research Scientist with the Coastal Environmental Modelling Team, located at the CSIRO Marine and Atmospheric Research labs in Hobart, Australia. His research interests are centered on combining marine models and observations using data assimilation techniques. He is particularly interested in using data assimilation tools to assist in improving observing systems and integrating non-standard observations to constrain model variables and parameters.
Themed Session	**Theme 3**
Presentation title	**Using data-assimilation tools to assist in observing system design**
Co-Authors	Emlyn M. Jones, Karen Wild-Allen, Jenny Skerratt and Mathieu Mongin CSIRO Marine and Atmospheric Research
Abstract	The term "data-assimilation" (DA) is often used to represent the quantitative use of observational data to constrain and reduce uncertainty in numerical model predictions through estimation off both state variables and parameters. There are many “tools” that can be extracted from a data-assimilation system that can assist in the interpretation of observations and also how observing systems can be modified or optimised. We present the following examples on how models and data assimilation tools can be used: • To investigate how representative various observations are of a surrounding region (i.e. the observational foot print). • What observations are required to constrain mechanistic models. • Where the greatest levels of uncertainty occur in model predictions. • Where to observe a particular process of interest. These examples are drawn from recent studies in temperature, sub-tropical and tropical coastal locations on the east coast of Australia.

Name	**Professor Saeid Nahavandi**
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Short biography	Saeid Nahavandi received a Ph.D. from Durham University, Durham, U.K. He is an Alfred Deakin Professor, Chair of Engineering, and the Director of the Center for Intelligent Systems Research at Deakin University, Australia. He has published over 450 papers in various international journals and conferences. His research interests include robotics and haptics and modeling of complex systems. He is the Co-Editor-in-Chief of the IEEE Systems Journal, an Editor (South Pacific Region) of the International Journal of Intelligent Automation and Soft Computing. He is a Fellow of Engineers Australia (FIEAust), the Institution of Engineering and Technology (FIET) and Senior member of IEEE (SMIEEE).
Themed Session	**Theme 3**
Presentation title	**Low-cost underwater robotics and sensing**
Abstract	This talk covers a range of technologies that have the potential to be used for various applications in marine systems. Firstly, design of a prototype low-cost underwater robotic system is described. Secondly, a fish like robot (biomimetic robot) that is haptically enabled for shallow waters and its functionality is demonstrated. The system comprised of a simulating carangiform tail, a barycentre adjustor, CCD cameras and various sensors. Challenges to overcome were for the systems to be rugged, reliable, waterproof and easy to maintain while through haptics to provide the remote sense of touch. Such systems have great potential to be used for underwater explorations where the sense of remote touch is a key factor. Finally, principal operations of the CISR haptically enabled universal motion simulator and it's use as a sea-vehicle motion simulator for training purposes is discussed.

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Short biography	David Battle earned the B.Eng and Ph.D degrees in electrical engineering from the Queensland University of Technology and the University of Sydney respectively. Between 2001 and 2003, he was a post-doctoral researcher at Scripps Institution of Oceanography on applications of environmental acoustics to problems involving geo-acoustic inversion from mobile platforms. From 2003 to 2006, he worked as a research scientist at MIT on some of the early applications of autonomous underwater vehicles to mine counter-measures and anti-submarine warfare. Following five years in commercial R&D with the Canon Corporation, he joined the Defence Science and Technology Organization in Sydney, where he now heads the Littoral Unmanned Systems Research Group.
Themed Session	**Theme 3**
Presentation title	**Dual-use Robotic Technologies for Ocean Surveillance**
Abstract	With recent advances in underwater robotics, several new options now exist for establishing a persistent, mobile and autonomous surveillance presence in the world's oceans. This talk will briefly highlight some new developments in defence technology that present interesting opportunities for dual-use as environmental monitoring platforms.

Name	**Mr Kyle Nelson**
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Short biography	Kyle Nelson received the B.Eng. (hons.) in Mechatronics and Robotics from Deakin University in 2009, where he attended as a Dean's Scholar and was a recipient of both the Alfred Deakin Medal and Vice-Chancellor's Prize. His PhD research focused on the image enhancement technique of super-resolution and combining this concept with ideas from the field of multi-view geometry to produce high-resolution images of 3-dimensional scenes. Currently a research fellow with the Centre for Intelligent Systems Research at Deakin University, Kyle is actively involved in robot-based motion simulation, computer vision and image processing research. Kyle has worked on a number of industry-linked robotics projects including the design and development of a vision-based measurement system for Boeing Research & Technology Australia.
Themed Session	**Theme 3**
Presentation title	**Multi-view Super-resolution and Vision-based Measurement in Underwater Environments**
Co-Authors	Kyle Nelson, Asim Bhatti, Hamid Abdi and Saeid Nahavandi Centre for Intelligent Systems Research, Deakin University
Abstract	Marine robotics and integrated vision systems can play an integral role in measuring and monitoring ocean acidification and indicators of climate change as well as enabling the exploration and observation of tropical and sub-tropical marine systems via unmanned surface vehicles, autonomous underwater vehicles or remotely operated vehicles. Dimly-lit, unstructured and rapidly changing underwater environments present a number of unique challenges and research opportunities in the field of machine vision. This presentation will discuss how two recent developments in computer vision research may be adapted and applied to the observation and analysis of marine ecosystems. Firstly, a vision-based geometric measurement system that may assist in the visual inspection and measurement of marine environments and underwater structures is investigated. Secondly, a novel multi-view super-resolution technique is presented, which could be employed to improve the spatial resolution, colour and quality of underwater imaging.

Japan

Name	**Dr Haruko Kurihara (Theme 1 Session Co-Chair)**
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Short biography	I' ve got my Ph.D in the field of Science at Kyoto University in 2004. After working as a post-doc for 4 years in Nagasaki University, I start to work as an assistant professor in the University of the Ryukyus from 2008. My specialty is marine biology, ecophysiology, marine ecology and am working more than 13 years in the field of ocean acidifications. After moving to Okinawa, I am principally focused on the effects of ocean acidification on the coral reef biology and ecosystems.
Themed Session	**Theme 1**
Presentation title (Keynote speech)	**Ocean acidification impacts on the tropical and subtropical marine organisms.**
Abstract	Coral reef is one of the most suspected ecosystems to be threatened by the climate change. However, we still do not have a clear picture of how and to what extent coral reef ecosystem will be affected by the ocean acidification (OA). Two recent CO2 vent studies demonstrated a dramatic loss of coral biodiversity, while they showed two different scenarios for the coral's community change (one dominated by massive corals and other by soft corals) under high CO2 condition (Fabricius et al. 2011, Inoue et al. 2013). Laboratory studies also revealed that the effect of CO2 to corals can be highly species specific, and while some corals are extremely vulnerable to CO2, some species are completely tolerant to high CO2 (Kurihara & Takahashi 2012 Coral Reefs, Inoue et al 2013 NCC). Activity of calcification related genes such as Ca-ATPase and energetic demand for maintaining internal pH might be a key for the mechanism underlying the difference of coral response to OA. Additionally, environmental factors such as light intensity, temperature or nutrient conditions possibly interact with coral sensitivity to OA. These results suggest that OA responses of coral reef organisms and ecosystems can be highly diverse. Further studies evaluating the effects of OA in both local and global scales are essential for predicting the OA impacts on tropical and subtropical marine ecosystem.

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Short biography	Major interest: Response of coral reefs to global changes through field survey and laboratory experiment: Role of coral reefs in global carbon cycles. Sea level rise and its impact to coral reefs and atoll islands. Bleaching and acidification of coral reefs. Sites: Ryukyu Islands, Tuvalu, Palau and western Pacific.
Themed Session	**Theme 1**
Presentation title	**Assessing Ocean Acidification in the Field of Coral Reefs**
Co-Authors	Hajime Kayanne[1], Shoji Yamamoto[1], Shihori Inoue[1], Haruko Kurihara[2] 1. The University of Tokyo, 2. University of the Ryukyus
Abstract	Growing number of laboratory experiments searching for effects of ocean acidification to various organisms has been and is being conducted. However laboratory experiments cannot only by themselves look into the actual ecosystem response in the future. Assessing ocean acidification in the actual field is necessary. One such field is a natural CO2 seep. We found that hard coral dominated community shifted to soft coral dominated one in an area with a higher CO2 level (831 µatm at low tide) in Iwotorishima Island (Inoue et al., 2013, Nature Climate Change, 3, 683-687). Both hard and soft corals are absent in the highest CO2 level (1465 µatm). The finding implies that reef community may shift from reef-building hard corals to non-reef-building soft corals under CO2 levels (550-970 µatm) projected by the end of this century. The other field where ocean acidification lies beneath the coral reef sediment, which pore water is saturated with CO2 released by respiration and dissolution of most soluble high magnesium calcite (Yamamoto et al. 2012, Biogeoscience, 9, 1441-1450). Field survey provide a ground-truth information for future ocean acidification, yet its environmental variables cannot be regulated. We need to fill a gap between field survey and laboratory experiment close to environmental conditions (Takahashi and Kurihara, 2013, Coral Reefs, 32, 305-314).

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Short biography	Masao Ishii is a research scientist at the Meteorological Research Institute, JMA, and is now a member of Scientific Steering Group of International Ocean Carbon Coordination Project. His research interests focus on the marine carbon cycle and aim to understand the natural and anthropogenic changes in ocean carbon by observations. His latest activities include leading PACIFICA (PACIFic ocean Interior CArbon) data synthesis under the umbrella of PICES Section of Carbon and Climate, and leading international effort of documenting air-sea CO2 flux in the Pacific Ocean over the last two decade as a part of Global Carbon Project's RECCAP.
Themed Session	**Theme 1 and 3*** *Please refer to the page 39.
Presentation title	**Trend of ocean acidification in the western Pacific tropical and subtropical zones over the past decades**
Abstract	With three decades of CO2 system measurements, we demonstrate the occurrence of ocean acidification in surface waters of the western Pacific tropical zone and the western North Pacific subtropical zone. In the tropics (5°S - 5°N), partial pressure of CO2 in surface water has increased at a mean rate of +1.31 ±0.14 µatm yr-1, while no significant trend of change was determined for salinity-normalized total alkalinity. The results are indicative of the increase in salinity-normalized dissolved inorganic carbon (nDIC) at +0.77 ±0.14 µmol kg-1 yr-1, a lowering of pH at -0.0013±0.0001 yr-1 and a reduction of the saturation indices of the carbonate minerals aragonite (Ωarag) and calcite (Ωcalc) at -0.008±0.001 yr-1 and -0.012±0.001 yr-1, respectively. Similar trends of CO2 increase and ocean acidification have also been observed over the subtropical zone (5°N - 34°N) at 137°E. The trend of CO2 increase has also been observed since mid-1990s in the interior of the subtropical gyre at 137°E in the density classes above σθ >26.8 and in the Equatorial Undercurrent above σθ >25.5. These results of observation and ocean biogeochemistry / general circulation models suggest that the shallow meridional overturning circulations in the North and South Pacific are playing an important role for the uptake and storage of anthropogenic CO2 in the subtropical gyres and its transport into the equatorial Pacific and the Indian Ocean.

Name	**Dr Atsushi Suzuki**
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Short biography	Joined the Marine Geology Department, Geological Survey of Japan, Agency of Industrial Science and Technology in 1992. Obtained Doctor of Science (Tohoku University) in 1995. AIST. Visiting researcher at the Australian Institute of Marine Science in 1997-1998. Currently, leader of the Marine Geo-Environment Research Group, Geological Survey of Japan, AIST. Specialties are marine geology and biogeochemistry. Has been engaging in the researches for marine carbon cycle and paleoclimate reconstruction using coral skeleton. Currently engages in the research for marine acidification using the culture experiment method.
Themed Session	**Theme 1**
Presentation title	**Climate change influence on coral growth tested by culture experiments of subtropical Acropora species**
Co-Authors	Atsushi Suzuki[1], Chiharu Mori[2], Ryosuke Isono[3], Yusuke Watanabe[3], Masahiro Hayashi[3], Yuzo Yamamoto[3], Hiroya Yamano[4], Keiichi Nomura[5], Mayuri Inoue[2], Kozue Nishida[1], Hodaka Kawahata[2], Yukihiro Nojiri[4] 1.Geological Survey of Japan, AIST, 2.Atmosphere and Ocean Research Institute, The University of Tokyo,3.Marine Ecology Research Institute (MERI), 4.National Institute for Environmental Studies, [5]Kushimoto Marine Park
Abstract	Rising temperature of sea surface by global warming causes quick poleward range shift and/or expansion of some coral species around Japan (Yamano et al., 2011). Ocean acidification has been decreasing pH and saturation state of aragonite in seawater, which would cause negative impact on calcification in coral skeleton. However, the influences of climate changes on high-latitude corals distributed along mainland Japan have not yet been tested in detail. We focus on temperature Acropora species and conducted culture experiment in order to reveal the impacts of global warming and ocean acidification on coral growth. A series of culture experiments with 5 temperature settings (13, 17, 21, 25, 19 deg C) was conducted. Aragonite saturation state of seawater was manipulated by aeration and addition of carbon dioxide gas. Results of the experiments showed that all coral species were bleached and died at 13 deg C treatments, suggesting that low temperature of seawater during the winter

	season could be a limited factor of northern distribution of temperate corals. Suppression of coral growth according with the decreasing of aragonite saturation state was observed for at least one species, suggesting that ocean acidification could give negative influence on calcification of temperate corals.

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Themed Session	**Theme 1**
Presentation title	**Climate change and corals of Japan: evidence from the 20th century and projection for the 21st century**
Abstract	Climate change includes sea surface temperature (SST) warming and ocean acidification in the sea. Around Japan, ~1.5˚C rise in SSTs occurred in the 20th century. This allowed poleward range expansion of several species of corals in temperate areas of Japan (Yamano et al., 2011, GRL), while anomalously high SSTs caused severe bleaching in the subtropical areas. Although changes of corals in the past have been attributed to SST warming, ocean acidification in the future could have much greater effects on corals. Under the IPCC SRES A2 (business-as-usual-attitude assumption) scenario of CO2 emission, ocean acidification could limit poleward expansion of coral habitats, resulting in significant reduction of coral habitats in the 21st century (Yara et al., 2012, BIogeosciences). Understanding corals' responses and potential for adaptation to ocean acidification would be a key to project future status of corals.

Name	**Dr Yoshihisa Shirayama (Co-Chair and Theme 2 Session Co-Chair)**
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Short biography	Yoshihisa Shirayama is the Director of the Field Science Education and Research Center at Kyoto University in Japan. Prior to this position, he served as Director and Professor of Kyoto University's Seto Marine Biological Laboratory. Formerly, Dr. Shirayama was an Assistant and Associate Professor at the Ocean Research Institute at The University of Tokyo. Dr. Shirayama is involved in numerous scientific societies such as the Japanese Society for Systematic Zoology, the Japanese Association of Benthology, The Society of Nematologists, and the Oceanographic Society of Japan, among others. Since 1992, he has been a member of the Coastal Ocean Environment Assessment Committee to Japan's Ministry of Environment. He is also a member of JAMSTEC (Deep-sea Research Planning Committee) and UNESCO, C-GOOS Steering Committee. Dr. Shirayama has published over 80 papers, reviews, and other articles in both English and Japanese.
Themed Session	**Theme 2**
Presentation title (Keynote speech)	**Marine Ecosystem in the Changing Ocean**
Abstract	Marine Ecosystems are under many kinds of stress caused naturally and/or artificially. It is very clear that temperature of the ocean is increasing associated with the global climate change. The climate change may or may not be caused by increase of atmospheric CO2 concentration. The fluctuation of atmospheric CO2 concentration, however, certainly causes decrease of pH of the surface seawater. In addition, change of terrestrial environment e.g. change of the land use, increase of fertilizer usage, decrease of natural forest, construction of dams, change of river discharge pattern and so on, also changing the oceanic environment especially in the coastal region. The former environmental change is in the global scale, but the latter local. The connection to the human society is tighter in the latter case. Also, the time scale of the latter is shorter than the former. To conserve sound marine environment, both are equally important. However, the strategy to carry out scientific research is not the same among the global scale open ocean issue and local scale coastal issue. International research is essential in the

	former research, and there already are many activities, though these activities are not enough. On the other hand, international research activities regarding the impact of human activities on the coastal ecosystems are not very many. The environmental setting in Australia and Japan is similar, namely both are situated in the western Pacific Ocean, human societies are well developed, and these societies potentially will impact on the coastal ecosystem strongly. In combination of such human influence with stress of climate change, marine life is under severe condition. But it is very difficult to study ecosystem change in coastal region because the system is extremely complex. To overcome this difficulty, it would be great opportunity to tackle understanding the combined impacts of climate change and human activities on the coastal ecosystem comprehensively under collaboration of two nations.

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Short biography	I graduated Department of Fisheries, the University of Tokyo in 1972, and was granted PhD from the same university in 1982 on taxonomy and ecology of toxic microalgae. I worked at Kitasato university located in Sanriku, Iwate for 1975-1982, and then at the University of Tokyo for 1983-2012. I retired from Asian Natural Environment Science Center of the University in March 2013, and keep working at the same university for development biological oceanography, especially on biology, ecology and chemistry of harmful microalgae.
Themed Session	**Theme 2**
Presentation title	**Increase of microalgal blooms in tropical and sub-tropical coastal area and its implication for changing environment**
Abstract	Microalgal blooms, unusual proliferation of certain photosynthetic protista, increases its magnitude in tropical and sub-tropical coastal areas in the western Pacific. Often they cause mass mortality of culture and wild fish, and also make useful bio-resources (fish and shellfish) unedible by their toxins. In the last 2-3 decades frequency, geographical size and duration of blooms looks increasing, although data of the occurrence is quite sporadic. If there is no harmful consequences, blooms are considered as just normal events in ecosystem, and therefore no record is kept. Harmful events associating with mass mortality of marine organisms and/or people poisoning are recorded. But even though scientists in the Western Pacific notice that microalgal blooms are increasing. There are several possible explanations to this change, but it is impossible to find and define level of contribution of each cause. Microalgae are transferred to new areas by maritime and fisheries activities. Eutrophication which favors blooms of photosynthetic organisms is accelerated by utilization of coastal marine areas for aquaculture and terrestrial areas for tourism and crop farming. Excess of fertilizers distributed for crops runs in coastal waters and cause algal blooms. Climate change causes shift of succession of microalgal species, and consequent invasion to new areas. Increase of scientific researches and scientists reveals new events in the region such as ciguatera and amnesic toxin contamination in marine organisms. It is worthy to generate a new collaborative study scheme between Japan and

	Australia, if possible with inviting scientists from tropical Asian countries, to observe the changing marine ecosystem and its driving forces. We have already good basis and capacity for generating international collaborative research in the wide western Pacific region.

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Short biography	1988:Ph. D (Agricultural Science), Tohoku University, Japan 1994:Visiting Scientist, University of Alberta, Canada 2005:Professor, Faculty of Biological Engineering, Ishinomaki Senshu University 2005-2006: Visiting Professor, Murdoch University, WA, Australia 2010: Professor, Graduate School of Environmental Science, Toho University 2013 President, The Malacological Society of Japan
Themed Session	**Theme 2**
Presentation title	**Characteristics of shell microstructure of pelagic and benthic mollusks from Antarctic waters, and global warming**
Co-Authors	Kenji Okoshi[1] and Waka Sato-Okoshi[2] 1. Department of Environmental Science, Graduate School of Science, Toho University, 2. Laboratory of Aquatic Ecology, Graduate School of Agricultural Science, Tohoku University
Abstract	In Southern Oceans, pteropod Limacina helicina antarctica forma antarctica occurs as one of the most abundant zooplankton and it is notable for its function as key mesozooplankton species. Pteropod species show large patch biomass and its high grazing rates roles as a significant contributor in carbon export fluxes. Laternula elliptica is widely distributed in Antarctic shallow coastal waters and known as one of the endemic and dominant benthic bivalve. Fundamental studies on shell structure are necessary as a prelude to applied research directed at tackling the anticipated effects of increased greenhouse gas emissions and ocean acidification. We examined the shell microstructure of the Antarctic species, Limacina helicina antarctica forma antarctica and Laternula elliptica and discuss the shell characteristics of the mollusc species inhabiting Antarctic waters from the point of adaptation to the cold seawaters and from the point of global warming.

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Short biography	I have been researching about the impact of changes in oceanographic conditions on the fisheries stocks (e.g. stock size, distribution range, fishing season) since 1993. Main target species is Japanese common squid, which is one of the most important cephalopod species for Japanese fisheries.

Themed Session	**Theme 2**
Presentation title	**Adaptation of squid fisheries to the impact of climate changes in the Sea of Japan**

Abstract	The Sea of Japan is one of the most rapidly warming in the world ocean. Based on the data from Japan Meteorological Agency, the SST increased by 1.6oC over the last 100 years in the Sea of Japan, which was the highest rate of increase in the waters around Japan. It has been shown that climate change has a large impact on the distribution and abundance of fisheries stocks in the world ocean. Therefore we need to adapt and mitigate the impact of climate change on the fisheries, which is inferred to be more extreme by global warming. In this report, it was summarized that the impact of climate change on the distribution and stock size of Japanese common squid Todarodes pacificus in the Sea of Japan and the adaptation of squid fisheries to these changes. Distribution range of Japanese common squid shifted to northward by the positive anomalies of water temperature conditions in summer and autumn in the recent years. This change caused shift in main fishing grounds and changing their target species from Japanese common squid into sub-tropical species (e.g. Swordtip squid Uroteuthis edulis) in the south-western part of the Sea of Japan.

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Themed Session	**Theme 2**
Presentation title	**Large-scale climate influence on biogeography and biodiversity of in the Pacific.**
Abstract	We have been conducting long-term ecosystem change studies in the western North Pacific by retrospective analysis of plankton time-series, such as Odate Collection data sets. We found large scale climatic variations, which are indicated by PDO and NPGO signals, significantly influenced plankton phenology and biogeography through seasonal mixed-layer process and oceanic currents dynamics, respectively. As climate-induced shift of plankton biogeography have been observed worldwide for recent decades, there is an increasing demand on global scale synthesis of its causes, mechanisms, and consequences in terms of biodiversity conservation and regional fisheries. Continuous Plankton Recorder (CPR) Survey is conventionally the best effective method to detect the zooplankton biogeography and its temporal variation. We participated in Global Alliance of CPR Survey (GACS), which was established in 2011 aiming at further enhancement of ecosystem monitoring effort for global synthesis of ecosystem change. Here I would like to discuss the future possibility in setting a new CPR meridional transect between Japan and Australia based on the close collaboration with GACS activities with particular focus on the latitudinal shift of zooplankton community.

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Themed Session	**Theme 3**
Presentation title (Keynote speech)	**How to develop/utilize new technologies for observing marine systems: lessons and inspirations from Argo**
Abstract	Understanding marine systems and their changes inherently requires multidisciplinary observations with diverse accuracy, time/space resolutions and coverage, depending on issues to be addressed. Comprehensive discussions on how to realize those observations have been carried out during the OceanObs'09 Conference and its follow-up activities. One of widely accepted views from those discussions is that national and/or regional activities, with some level of international coordination, are where actual implementation takes place and essential in realizing an integrated global ocean observing system. Japan-Australia collaboration to develop and utilize new technologies for observing marine systems would be beneficial not only to the two countries but also to the international community. Aiming to facilitate discussion seeking effective collaboration, Argo is taken as an example to show how new technologies have been used and how further development has been encouraged. Argo succeeded in putting the new technology, a profiling float, into the global ocean; the necessary ingredients of Argo include appropriate cost-effective technology, a clear statement of requirement, commercial partnerships, etc. Argo's success has been stimulating its expansion. Bio-Argo/Biogeochemical-Argo is one of such efforts, encouraging development of new sensors. Emerging idea of new coastal observing system using a profiling float

	requires renovation of technology adequate for coastal areas. The strong complementary relationship of Argo with the satellite altimeter mission points to the importance of similar relationship between Bio-Argo/BGC-Argo and relevant satellite missions. Further suggested is the usefulness of the combination of ocean glider technology and wide swath altimeter missions planned to be launched by 2019.

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Short biography	Daisuke Sasano is a research scientist at the Meteorological Research Institute, JMA. His research interests focus mainly on long-term variability of dissolved oxygen (DO) in the high frequency repeat section along 165ºE and in the Oyashio region for the past decades.
Themed Session	**Theme 3**
Presentation title	**Toward the future expansion of the ocean biogeochemistry observing network**
Co-Authors	Masao Ishii and Daisuke Sasano Oceanography and Geochemistry Research Department, Meteorological Research Institute, Japan Meteorological Agency
Abstract	Ocean acidification due to the ocean's uptake about 1/4 of CO2 released by fossil fuel combustion and land-use changes is threatening marine ecosystems and so the huge number of people who depend heavily on fishing and other marine resources and services. In some portions of the western Pacific subtropics and tropics, trend of ocean acidification superposed on the seasonal, interannual, and decadal variability of ocean biogeochemistry has already been observed. In the interior of the North Pacific, decadal variability and long-term trend of decrease in dissolved oxygen, likely being associated with climate change and enhancing the ocean acidification, has also been observed. Absolutely critical to monitoring and process-understanding of the change in the ocean biogeochemistry will be future expansion of the ocean biogeochemistry observing network. A central priority in expanding the network should be filling data gaps in the coastal zones and in the southern hemisphere as well as those in seasonal variability. This will benefit greatly from the implementation and operation of autonomous platforms such as moorings, profiling floats, and underwater gliders mounted with the emerging technology of sensors for oxygen, CO2 and other biogeochemical parameters. However, the autonomous platforms will certainly require coordinated efforts with the accurate measurements and calibration that are provided only by hydrographic measurements from research on oceanographic cruises. These data should be properly quality-controlled and synthesized, as being done in the PACIFICA (PACIFic ocean Interior CArbon) data synthesis for carbon and its related biogeochemical parameters in the Pacific Ocean.

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Themed Session	**Theme 3**
Presentation title	**Studies of Ocean Ecosystem using Satellites, New Platforms and Models**
Co-Authors	Joji Ishizaka[1] and Naoki Yoshie[2.] 1. Hydrosheric Atmospheric Research Center, Nagoya University 2. Division of Coastal Oceanography, Center for Marine Environmental Studies, Ehime University
Abstract	Ocean color remote sensing changed the view of ocean by biological oceanographers because of the frequent observations of the synoptic large coverage of phytoplankton distribution on the global and regional ocean. After the experimental sensor, CZCS launched by NASA, operated 1978-1986, National Space Development Agency of Japan (NASDA; present Japan Aerospace Exploration and Agency; JAXA), launched OCTS which was the first of the ocean color time series from 1997 to present with sensors from different countries, such as SeaWiFS, MODIS, GLI, MERIS, VIIRS, etc. Combined with various information from other satellite sensors, it helps to understand the anthropogcnic changes as well as natural variation of the ocean ecosystem. JAXA is now planning to launch Second Generation-Global Imager (S-GLI) on Global Change Observation Mission-Climate 1 (GCOM-C1) in 2016, which can observe global ocean with 250m resolution. The sensor is expected to supply ocean color, chlorophyll-a, primary production, phytoplankton functional type, and to be a good tool for observation of global ocean, especially coastal area. Satellite information supply synoptic large coverage of ocean surface; however, it is difficult to obtain information from below the surface. It is now expected to use biological and chemical sensors on the newly developed observation platforms, such as ARGO floats and ocean gliders. Combination of those data sets with satellite data

	sets supply nearly 4-dimensional synoptic data sets of biological parameters. The information is extremely important to improve ecosystem models which can be used to understand and to predict the future of the earth. Japan and Australia are both located at the western boundary of the Pacific Ocean, and similarities and differences are expected in the oceans around the countries. It is beneficial for both countries to work together to understand the ocean ecosystems.

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Short biography	I have been studying the marine ecosystem and the biogeochemical cycle using both the field observation and the numerical modeling. Now, I am focusing on the ecosystem and nutrient dynamics in the Seto Inland Sea which is the typical semi-enclosed coastal sea in Japan. Our widespread and highly-frequent field observation in the Seto Inland Sea captures these dynamics, and our ecosystem model simulates them realistically. I am trying to elucidate the mechanisms of the coastal ecosystem response to the various environmental changes such as the global warming or human activities.
Themed Session	**Theme 3**
Presentation title	**Studies of Ocean Ecosystem using Satellites, New Platforms and Models**
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Abstract	Please refer to the page 40.

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Themed Session	**Theme 3**
Presentation title	**Biogeochemical observation system to understand the relationships between physical processes and biogeochemical environments**
Abstract	The distribution of biogeochemical properties and its temporal changes are strongly affected by ocean circulation. To know them, it is important to observe physical and chemiccal properties at the same time and design the observation system taking into account for spatial and temporal scales of phenomena. To monitor the long term changes, we need improvement of spatial coverage with development autonomous observations with biogeochemical sensors (ex. profiling floats) as well as the highest accurate observations with reliable standards as WOCE revisit cruises. To investigate the relationships between physical and biocemical processes especially for the meso scale phenomena, we can suggest the combination with spatially intense

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Short biography	Research Associate of Nat'l Fisheries University (1990-1994) Associate professor of Kyushu University (1994-2008) (Guest investigator of WHOI (2005)) Professor of Ehime University (2008-present) My major is physical oceanography and coastal oceanography; dynamics of continental-shelf circulation, with a focus on observational and numerical studies of the Tsushima Current, Kuroshio, and ocean circulation in coastal waters.
Themed Session	**Theme 3**
Presentation title	**A proposal for advancing coastal ocean sciences by using a novel observation network around Japan Islands**
Co-Authors	Atsuhiko Isobe[1] and Naoki Hirose[2] 1. Center for Marine Environmental Studies, Ehime Univ, 2. Research Institute for Applied Mechanics, Kyushu Univ.
Abstract	The Oceanographic Society of Japan has proposed a research project to advance the coastal oceanography by establishing new observational networks in conjunction with a high-resolution (~100 m) ocean reanalysis dataset specialized for coastal-ocean phenomena such as oceanic fronts, frontal eddies, kyucho events, and so forth. The network includes high-frequency ocean radars which surround the entire Japan Islands, and includes launching a new satellite which monitors SSHs with high resolution in time and space. Of particular interest for the oceanographic community is the development of a profiling float (like Argo) available for coastal waters. Compact, durable, and affordable floats will be designed to repeatedly observe vertical profiles of temperature and salinity in shallow waters, and to send the observed data to our offices via a satellite. In the above our dream, dozens of the floats are deployed to coastal waters around Japan Islands, and provide us with spatio-temporal variations of 3D temperature and salinity structures, which will dramatically increase the accuracy of the coastal ocean reanalyses product through the data assimilation.

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Themed Session	**Theme 3**
Presentation title	**A proposal for advancing coastal ocean sciences by using a novel observation network around Japan Islands**
Co-Authors	Atsuhiko Isobe[1] and Naoki Hirose[2] 1.Center for Marine Environmental Studies, Ehime Univ, 2. Research Institute for Applied Mechanics, Kyushu Univ.
Abstract	Please refer to the page 44.

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Themed Session	**Theme 1**

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Themed Session	**Theme 2**

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Themed Session	**Theme 3**

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	Previous work (at Macquarie University, Australia) has focused on taxonomy, biogeography and assemblage composition of deep-sea benthic foraminifera of the New Caledonia Basin, the southern Great Barrier Reef and foraminifera associated with natural hazards (tsunami and cyclone) from Australia.
Themed Session	**Theme 2**

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Themed Session	**Theme 3**

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Themed Session	**Theme 1**

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