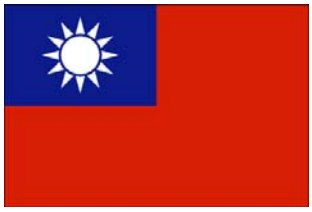
臺澳紐三邊
海洋生物、多樣性及生態研討會

TW-AU-NZ Conference
Marine Biology, Biodiversity and Ecosystem



國立臺灣海洋大學 海洋生物科技及環境生態中心
行政院國家科學委員會

民國 100 年 06 月 20~21 日

National Taiwan Ocean University
Center of Excellence for Marine Bioenvironment and Biotechnology
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目錄(Contents)

臺澳紐三邊海洋生物、多樣性及生態研討會議程表

TW-AU-NZ Conference, "Marine Biology, Biodiversity and Ecosystem"

日期：2011年06月20日(星期一) 地點:國立台灣海洋大學 (NTOU) 行政大樓 第一演講廳

場次	時　間		主　　題
	08:30-08:50		**報到Registration**
	08:50-09:30		**貴賓致詞 Welcome ceremony and Opening remarks** 國立臺灣海洋大學李國添校長（Prof. K. T. Lee, NTOU President） 澳大利亞商工辦事處柯未名代表(Ms. Alice Cawte, Representative, Australian Commerce and Industry Office) AIMS Chief Executive Officer Dr. Ian R. Poiner 紐西蘭辦事處代表 (Miss Felicity Bloor, Deputy Director, New Zealand Commerce and Industry Office) 行政院國家科學委員會張清風副主委（Prof. C. F. Chang, Deputy Minister, NSC）
	09:30-09:40		**團體照相 Group picture**
Session 1: Marine environment and ecosystem in the ocean and coral reefs			
	主持人 Chairman		高家俊博士（Dr. C. C. Kao)/謝志豪博士（Dr. C.H. Hsieh）
1	09:40-10:10		Dr. Ian Poiner (Australian Institute of Marine Science, Australia) AIMS – Australia's tropical marine research agency
2	10:10-10:40		Dr. Scott Bainbridge (Australian Institute of Marine Science, Australia) Sensor Networks - working towards smart monitoring of environmental systems
3	10:40-11:10		龔國慶博士 (Dr.G. C. Gong, National Taiwan Ocean University, Keelung, Taiwan) Yangtze River floods enhance coastal ocean phytoplankton biomass and potential fish production
	11:10-11:30		**中場休息 Coffee break**
4	11:30-12:00		Dr. Richard Brinkman (Australian Institute of Marine Science, Australia) Operational oceanography - an enabling science for marine ecosystem management
5	12:00-12:30		夏復國博士 (Dr. F. K. Shiah, Academia Sinica, Taipei, Taiwan) Characterizing the pelagic system of Dong-Sha atoll of the South China Sea
	12:30-13:30		**午餐 Lunch**
	主持人 Chairman		宋克義博士（Dr. K. Y. Soong)/樊同雲博士（Dr. T. Y. Fan）
6	13:30-14:00		林慧玲博士 (Dr. H. L. Lin, National Sun Yat-Sen University, Kaohsiung, Taiwan) The succession and stable isotopes in modern planktonic foraminifera: records from sediment Ttaps and plankton tows
Session 2: Coral studies in biology, reproduction, genetics, evolution and speciation			
7	14:00-14:30		Dr. David Bourne (Australian Institute of Marine Science, Australia) Corals and their associated microbiota: Implications for health, bleaching and disease
8	14:30-15:00		陳啟祥博士（Dr. C. S. Chen, National Museum of Marine Biology and Aquarium, Pingtung, Taiwan) Lipid bodies in coral–dinoflagellate endosymbiosis: proteomic and ultrastructural studies
9	15:00-15:30		陳昭倫博士(Dr. C. A. Chen, Academia Sinica, Taipei, Taiwan) Impact of environmental change on corals and coral reefs: patterns and processes in Taiwan coral reefs
	15:30-15:50		**中場休息 Coffee break**
Session 3: Physiological variations of corals and their associated organisms and their responses to extreme environments			
	主持人 Chairman		劉秀美博士(Dr. S. M. Liu)/程一駿博士(Dr. I. J. Cheng)
10	15:50-16:20		Dr. Ken Anthony (Australian Institute of Marine Science, Australia) Ocean acidification – a growing threat to marine calcification
11	16:20-16:50		Dr. Sven Uthicke (Australian Institute of Marine Science, Australia) Coral reefs at volcanic CO_2 seeps in Papua New Guinea as a natural proxy to study effects of long-term exposure to ocean acidification
12	16:50-17:20		戴昌鳳博士 (Dr. C. F. Dai, National Taiwan University, Taipei, Taiwan) Dynamics of marginal coral communities and the ecology of symbiotic copepods on hard corals
13	17:20-17:50		黃將修博士(Dr. J. S. Hwang, National Taiwan Ocean University, Keelung, Taiwan) The effects of hydrothermal vent on the corals, crabs and copepods in Turtle Island
	18:20~		**晚餐 Dinner**

臺澳紐三邊海洋生物、多樣性及生態研討會議程表

TW-AU-NZ Conference, "Marine Biology, Biodiversity and Ecosystem"

日期：2011年06月21日(星期二) 地點:國立台灣海洋大學 (NTOU) 行政大樓 第一演講廳

場次	時　間		主　　題
	08:40-09:00		**報到Registration**
Session 4: Marine environment、 biodiversity and natural products			
	主持人Chairman		周宏農博士(Dr. H. N. Chou)/蔣國平博士(Dr. K. P. Chiang)
14	09:00-09:30		Dr. David Mead (Australian Institute of Marine Science, Queensland, Australia) Experimental capability – simulating tropical marine environments
15	09:30-10:00		Dr. John Montgomery (Marine Science School of Biological, University of Auckland, New Zealand) Marine science at the University of Auckland: a south pacific perspective
16	10:00-10:30		陳義雄博士 (Dr. I. S. Chen, National Taiwan Ocean University, Keelung, Taiwan) Biodiversity and phylogeny of marine and amphidromous gobioid fishes in West Pacific
	10:30-10:50		**中場休息 Coffee break**
17	10:50-11:20		陳天任博士 (Dr. T. Y. Chan, National Taiwan Ocean University, Keelung, Taiwan) Slipper lobster diversity and phylogeney
18	11:20-11:50		Dr. Lyndon Llewellyn (Australian Institute of Marine Science, Australia) Field diagnostics and sensing for marine and seafood toxins
	11:50-13:00		**午餐 Lunch**
	主持人 Chairman		李澤民博士(Dr. T. M. Lee)/許濤博士(Dr. T. Hsu)
19	13:00-13:30		林綉美博士 (Dr. S. M. Lin, National Taiwan Ocean University, Keelung, Taiwan) Diversity, molecular phylogeny and biogeography of the marine red algae from the western pacific ocean with an emphasis on the species from Taiwan
20	13:30-14:00		沈雅敬博士 (Dr. Y. C. Shen, National Taiwan University, Taipei, Taiwan) Biodiversity, chemistry and medical application of marine invertebrates
21	14:00-14:30		宋秉鈞博士 (Dr. P. J. Sung, National Museum for Marine Biology and Aquarium, Pingtung, Taiwan) Bioactive natural products from the cultured-type octocorals
22	14:30-15:00		黃登福博士 (Dr. D. F. Hwang,National Taiwan Ocean University, Keelung, Taiwan) Biodiversity of marine toxins in gastropods
	15:00-15:20		**中場休息 Coffee break**
Session 5: Fisheries and Aquaculture			
	主持人 Chairman		沈士新博士(Dr. S. S. Sheen)/曾萬年博士(Dr. W. N. Tzeng)
23	15:20-15:50		Dr. Brain Paterson (Department of Employment, Economic Development and Innovation, Queensland, Australia) Footprints in the sea- towards a new sustainability benchmark for giant tiger shrimp farming in Australia
24	15:50-16:20		Dr. Rob Murdoch (National Institute of Water and Atmospheric Research, New Zealand) Marine science at NIWA: from the subtropics to the Antarctic
25	16:20-16:50		李明安博士 (Dr. M. A. Lee, National Taiwan Ocean University Keelung, Taiwan) Influence of climate change on fishery ecology around Taiwan
26	16:50-17:20		廖一久院士/陳瑤湖博士 (Dr. I. C. Liao/ Dr. Y. H. Chien,National Taiwan Ocean University, Keelung, Taiwan) Overview of Taiwan and Australia bilateral fora on aquaculture and fishery management
	主持人 Chairman		龔國慶中心主任 (Dr.G. C. Gong, NTOU) / Dr. Ian R. Poiner (CEO, AIMS)
	17:20-18:00		綜合討論及結論（**Final Discussion, all Section Chairmen and Speakers**)
	18:20~		**晚餐 Dinner 基隆港海產樓(All Section Chairmen and Speakers)**

Opening remarks

Deputy Minister CHANG of National Science Council, Academician Professor LIAO, AIMS CEO Professor Poiner, Representative MS Cawte (柯未名代表), Deputy Director Miss Bloor, Distinguished Guests, Ladies and Gentlemen :

It is my great honor and pleasure to participate in and deliver the opening address for the Taiwan-Australia-New Zealand Conference of "Marine Biology, Biodiversity and Ecosystem". Here I would like to warmly welcome the distinguished scholars from Australia, New Zealand and Taiwan. Our university is famous for education and research in marine science and technology in Taiwan and overseas. We have 6 colleges such as College of Life Sciences, College of Ocean Science and Resource, College of Maritime Science and Management, College of Engineering, College of Electrical Engineering and Computer Science, and College of Engineering, and College of Humanities and Social Sciences. The research on "marine biology and ecosystem" is one of the most famous academic achievements in our university. Therefore, we have established "Center for Excellence of Marine Bioenvironment and Biotechnology" since August of 2006. The main purpose of this center is to develop and coordinate the research in marine studies and fishery life science. I truly appreciated the center. They organized this important conference and invited so many outstanding scientists and professors.

I believe that your attendance could motivate the research activities in Taiwan and further develop collaborative research programs between you and my university in the near future. Finally, I wish you all a successful and fruitful meeting, and a pleasant stay at the campus and Taiwan. Thank you.

Professor Kuo-Tien LEE
President
National Taiwan Ocean University

Opening remarks

Distinguished guests, President LEE (NTOU), Academician Professor LIAO, AIMS CEO Professor Poiner, Representative MS Cawte (柯未名代表), Deputy Director Miss Bloor, Distinguished Guests, Ladies and Gentlemen :

It is indeed my great pleasure to participate to this Taiwan-Australia-New Zealand tri-countries Conference “Marine Biology, Biodiversity and Ecosystem”. This conference is under the support of MOU between NSC (Taiwan) and AIMS (Australia). Actually I was one of the people to initiate this mutual collaboration between NSC and AIMS 2 years ago. I am especially very pleased to see this conference came true because I have been asked by NSC to organize this conference since last year and I did work very hard for this.

It is well known that National Taiwan Ocean University (NTOU) plays a very important role in marine biology, fishery, marine science and technology in my country. The main theme of this conference, “Marine Biology and Ecosystem”, is one of the important research areas of life sciences in both basic and applied aspects. These areas are also important for global environmental change. The topics cover from molecular biology to organisms and ecology including 5 themes related to marine biology and ecology. This conference brought distinguished guests from Australia and New Zealand together with Taiwanese scientists and students. Australia, New Zealand and Taiwan all recognize the importance and also share common interest in marine areas. I believe that this conference is an excellent opportunity to exchange knowledge and ideas. It is also an opportunity to build friendship and collaboration.

On behalf of the National Science Council, I welcome all distinguished guests from abroad and local participants to attend this interesting conference. I sincerely wish that this conference will be very successfully and would contribute the academic collaboration in the field of marine science.

Professor Ching-Fong CHANG
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專題演講 (State-of-the Art Lecture)

AIMS – Australia's Tropical Marine Research Agency

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Australia is largely a marine nation with ocean territories more than 1.8 times its continental landmass. The Australian Exclusive Economic Zone is the third largest in the world with valuable marine resources and iconic ecosystems such as the Great Barrier Reef, Ningaloo Reef, the Kimberley Coast and the oceanic shoals of the Timor Sea. Marine –based industries already contribute almost $44 billion per annum (AIMS Index of Marine Industry, 2008-09) to the national economy and are projected to grow, especially in tropical Australia. This is a greater contribution to the Australian economy than the agricultural sector and between 2001-02 and 2008-09 the sector's value has increased by around 80%. Despite this, our ocean territories are under-explored and our coasts and oceans are vulnerable to climate change (e.g. increasing temperatures and ocean acidification). Marine research (of which tropical marine research is a subset) is critical to improving understanding of the ocean environment and ecosystems and to provide the knowledge necessary for Australia to fully explore and pursue the sustainable development, use and protection of its ocean resources, including in regional and northern Australia.

In the Australian national innovation system, the Australian Institute of Marine Science (AIMS) (www.aims.gov.au) is Australia's tropical marine research agency and works to generate and transfer knowledge to support the sustainable use and protection of the marine environment through innovative, world class research. AIMS' role is to conduct mission-driven, strategic research to provide a national capacity in research on Australia's tropical marine ecosystems.

AIMS targets problems of national and international significance and develops its research program in consultation with users. To deliver its research program, AIMS has adopted a strong collaborative approach to build critical mass (skills, shared knowledge and infrastructure) and to maximise its capacity for effective research to improve understanding of complex ecosystems. In planning its research, AIMS directs its effort to where it can have impact, and this includes linking to complementary national and international research where there is mutual capacity (i.e. a clear value proposition for both parties and for end users). The strong linkages developed with complementary research organisations, and government, industry and other end-users ensures a strong focus for its research, coordinated effort and clear pathway for the future.

Keywords: Tropical, Marine Nation, Research Program, Sustainable Development

Sensor Networks - working towards smart monitoring of environmental systems

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Wireless Sensor Networks present new opportunities for monitoring coastal marine systems through the delivery of real time data, adaptive sampling capacity, the ability to process data, such as images and video, on the node itself, and through being able to implement new ways of accessing and delivering data. Sensor networks have been deployed on coral reefs in Kenting National Park in southern Taiwan through the National Center for High-Performance Computing (NCHC) as well as on the Great Barrier Reef in Australia through AIMS, under the umbrella of the Coral Reef Environmental Observatory Network (CREON) community group.

The work done by both groups highlights the application of sensor networks to coastal systems, including coral reefs, and the role that real time monitoring plays in helping to conserve and protect these critical resources, not only in Australia and Taiwan, but in the larger East-Asia region. The CREON vision is to deploy cost effective monitoring stations across coral reefs through East-Asia to track issues such as coral bleaching, ocean acidification, the effect of oceanic processes on coastal systems and the impact of cyclones and monsoon events. This vision will require the development of the next generation of cost effective controllers, sensors and communication systems. In parallel is the need for data assimilation systems, linked to modeling and visualization software, to transform the avalanche of data into new information and knowledge products. Finally there is a need to link the data into the science being undertaken as well as to explore ways of delivering new outcomes through emerging paradigms such as social networking and the 'Internet of Things'.

Globally coral reefs are under threat from a range of stressors. New approaches, such as sensor networks, have a role in increasing our understanding of how changing conditions are impacting these systems and what this means for their long-term future. Both nations have deployed sensor networks to monitor their coral reefs; the challenge is to take the work done and move it forward at a scientific level, at a technical level, and also at a geographic level, so increasing our capacity to monitor and conserve our critical coastal marine resources.

Keyword: coral reefs, wireless sensor networks, coastal observatories, CREON

Yangtze River Floods Enhance Coastal Ocean Phytoplankton Biomass and Potential Fish Production

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The occurrence of extreme weather conditions appears on the rise under current climate change conditions, resulting in more frequent and severe floods. The devastating floods in southern China in 2010 and eastern Australia 2010-2011, serve as a solemn testimony to that notion. Accompanying the excess runoffs, elevated amount of terrigenous materials, including nutrients for microalgae, are discharged to the coastal ocean. However, how these floods and the materials they carry affect the coastal ocean ecosystem is still poorly understood. Yangtze River (aka Changjiang), which is the largest river in the Eurasian continent, flows eastward and empties into the East China Sea. Since the early twentieth century, serious overflows of the Changjiang have occurred four times. During the two most recent ones in July 1998 and 2010, we found total primary production in the East China Sea reaching $147x10^3$ tons carbon per day, which may support fisheries catch as high as $410x10^3$ tons per month, about triple the amount during non-flooding periods based on direct field oceanographic observations. As the frequencies of floods increase world wide as a result of climate change, the flood-induced biological production could be a silver lining to the hydrological hazards and human and property losses inflicted by excessive precipitations.

Keyword: Yangtze River, Floods, East China Sea, Primary production, Fish production

Operational oceanography - an enabling science for marine ecosystem management

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Operational Oceanography describes the systematic and routine observation of the ocean and continental shelf seas, and the dissemination of observational data and derived products in near real-time, including short term ocean forecasts produced by numerical ocean models. A number projects at AIMS are delivering on our vision for operational system to provide 3-dimensional information on ocean conditions on the Great Barrier Reef (GBR) in near-real-time. A collaborative project lead by AIMS has developed an operational numerical model that simulates ocean currents, temperature and salinity within and adjacent to the GBR at a scale and resolution never before achieved. In parallel, monitoring programs provide observations of ocean conditions with spatial coverage and temporal resolution suitable for integration with large scale model results: Ocean gliders and satellite tracked drifters provide highly detailed description of the internal bio-physical structure of the oceanic conditions impinging on the GBR shelf, and map in exquisite detail, the complexity of currents that control the transport of waterborne material; A vast array of temperature loggers is recording, over annual timescales, the patterns in water temperature that bathe the reefs of the GBR; Oceanographic moorings provide observation of ocean current and temperature structure at strategic locations along the shelf and shelf-edge; Near-shore monitoring programs are capturing the strong seasonal cycle and large inter-annual variability of inshore water quality; AIMS ships equipped with automated underway observational packages, map surface temperature, salinity, turbidity and chlorophyll as they transit the length and breadth of the GBR. These data provide an unprecedented overview of the current state of the GBR, delivering information in near real-time on how the reef is impacted by both natural and anthropogenic events, and providing information necessary to underpinned impact response activities.

Keywords: oceanography, operational oceanography, marine ecosystem management

Characterizing the pelagic system of Dong-Sha atoll of the South China Sea

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Coral reef ecosystems are characterized with high biodiversity and primary productivity. In Taiwan, the ecological studies of the benthic system have received much more attention than that of the pelagic system till recently. A full understanding of the reef ecosystems can't be achieved without knowing the ecology of the pelagic system, and vice versa. The major purpose of this study was to investigate the tempo-spatial variations of physical, chemical and biological properties within the water-column inside Dong-Sha atoll. Seasonal (May, Jul, Sep of 2010 and Feb of 2011) sampling of more than 13 environmental factors was performed at the 26 stations deployed inside the Atoll. The results are summarized below. **(1). Physical hydrography:** the cold and nutrient-laden deep-waters outside the Atoll might penetrate into the system at the east side via internal wave processes, which served as one of the important sources of "new" nutrient. Water residence time within the Atoll was about one month. **(2). Chemical hydrography:** More than 80% of our N/P ratio data were greater than the Redfield ratio of 16, indicating phosphate limitation occurred in most areas and seasons. This was confirmed by the results of the bioassay analysis. **(3). Plankton structure and activity:** Phytoplankton was dominated by Bacillariophyte, Cryptophyte, Chlorophyte and Cyanophyte. Zooplankton was dominant by calanoida (34%), shrimp larva (32%) and crab zoea (32%). Biomass and production of phytoplankton and bacteria, as well as DOC concentrations were significantly higher than those recorded in the surrounding sea. **(4). Microbial loop:** Bacterial production and primary production were decoupled in most seasons. **(5). System trophic status:** The ratios of primary production to community respiration approached 1 except February, which had an average of 2.65±3.68. In conclusion, the Dong-Atoll is surrounded by oligo-trophic seawater, however, most of our measurements were high, similar to those recorded in meso-trophic environment. It is deduced that the Atoll itself and the organisms living inside are acting as a nutrient trap, taking up the inorganic nutrients imported from outside. These nutrients are then transformed and recycled within the atoll but had lower possibility of flowing outside (export) due to the semi-enclosed topography. The heterogeneous distribution of chemical and biological measurements could be ascribed to the weak physical circulation inside the atoll. In the perspective of climatic changes, This Atoll seems to be an ideal observatory in detecting global warming and ocean acidification.

Keywords： Atoll, South China Sea, Biogeochemistry, Nutrient limitation, Trophic status.

The Succession and Stable Isotopes in Modern Planktonic Foraminifera: Records from Sediment Traps and Plankton Tows

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This study reports on the stable isotopic composition of modern planktonic foraminifera tests collected from plankton tows and sediment trap moorings in the northern South China Sea, as well as the succession of planktonic foraminifera from the sediment trap moorings deployed at the continental slope off Southwest Taiwan. Four common and widely distributed tropical/subtropical planktonic foraminifer species, including *Globigerinoides ruber* (white variety), *Globigerinoides sacculifer* (without sac), *Neogloboquadrina dutertrei* and *Pulleniatina obliquiloculata,* were analyzed for $\delta^{18}O$ and $\delta^{13}C$ within narrow shell size ranges and compared with the concurrent sea surface temperature (SST) and wind stress. Results show that foraminiferal $\delta^{18}O$ is primarily influenced by seawater temperature, while $\delta^{13}C$ is affected by surface water nutrients, which in this region can be discerned from wind stress data. For foraminifer tests collected by sediment trap, the $\delta^{18}O$ of the shallow dwelling *G. ruber* shows the largest amplitude variation (*ca*. 1.6 ‰) among the four species. In contrast, the $\delta^{13}C$ of *P. obliquiloculata* shows relatively constant values throughout the study period. A pattern of enriched $\delta^{18}O$ values, associated with marked $\delta^{13}C$ depletion, is common to three species collected between late October and late December 2004. This distinct isotopic signal corresponds to a decrease in SST and increase in wind stress, indicating the onset of prevailing northeast winds during the winter season. The succession of planktonic foraminifera was observed based on the sediment trap moorings with 3-day collecting duration at the continental slope. In general, variation of shell abundance (#/g; number of specimens per gram of original bulk sample) shows a pattern that seems to be related to the lunar cycle: shell abundance increases from low values at new moon and reaches its maximum before full moon. The faunal assemblages were dominated by *Globigerinella aequilateralis, G. sacculifer*, *Globorotalia menardii*, *G. ruber*, *N. dutertrei*, and *P. obliquiloculata*; these six species constituting 30–80% of all foraminiferal shells found in sediment trap.

Keyword: foraminifera, isotopic composition, sediment trap

Corals and their associated microbiota: Implications for health, bleaching and disease

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Global warming and increased sea surface temperatures present a major challenge to the health of the world's coral reefs, particularly in light of evidence that bleaching and disease outbreaks have contributed to significant loss of both key reef organisms and coral cover. Studies have demonstrated that corals shape their microbial partners, creating complex holobiont associations thought to be vital in maintaining coral health. This presentation will provide an overview of the research currently being undertaken investigating coral bacterial communities and their implication for the health of corals, highlighting some of the challenges, pitfalls and successes along the road.

What factors structure coral microbial associations remain a mystery? Cycling of sulfur and nitrogen compounds are being investigated as driving many of these coral microbial associations and having important consequences for coral health and the subsequent resilience of coral reefs. For example, diazotrophic bacteria appear specific to coral species with the two most abundant groups of diazotrophic bacteria found in three different coral species closely related to species belonging to the Rhizobia, a group of diazotrophic bacteria that can only accomplish nitrogen fixation after establishing symbiosis in the roots of host plants. In addition an extensive overlap was observed between bacterial species associated with corals and species implicated in the degradation of dimethylsulfoniopropionate (DMSP) to dimethylsulfide (DMS), two key compounds in the global sulfur cycle. Interestingly, when exploring publically available metagenome datasets, genes implicated in DMSP metabolism are abundant in the viral component of coral-reef-derived metagenomes, indicating that viruses can act as reservoirs for such genes.

Shifts in coral associated microbiota are indicators and implicated in contributing to reduced coral fitness. During a natural bleaching event on the Great Barrier Reef, the normal microbial community shifted with increases in temperature and colony bleaching correlated with distinct changes in the microbial community. A metagenomic approach was adapted to investigate how bleaching affected the microbial functional component of the holobiont during this natural bleaching event. Vibrios have been implicated in a number of coral diseases including bleaching, often as a response to compromised health and changing environmental parameters. The role of virulence factors in the onset of coral disease is currently one area of active study to provide insights into the molecular mechanisms of bacterial infection in coral and the risk that increasing sea surface temperatures will enhance pathogen virulence.

A quantitative PCR (qPCR)-based *V. coralliilyticus* detection assay has been was successfully developed and validated when targeting the pathogen within the complex coral holobiont. Such an assay represents a novel approach to coral disease diagnosis and provides a useful tool to allow coral pathogen detection, pathogen load monitoring, and identification of pathogen sources, vectors, and reservoirs.

Keywords: Coral Holobiont, Bacteria, Nitrogen Fixation, DMSP, Environmental Stres

Lipid bodies in coral–dinoflagellate endosymbiosis: proteomic and ultrastructural studies

Chii-Shiarng Chen[1, 2, 3]

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Gastrodermal lipid bodies (LBs) are organelles involved in the regulation of the mutualistic endosymbiosis between reef-building corals and their dinoflagellate endosymbionts (genus *Symbiodinium*). As their molecular composition remains poorly defined, we herein describe the first gastrodermal LB proteome and examine *in situ* morphology of LBs in order to provide insight into their structure and function. After tissue separation of the tentacles of the stony coral *Euphyllia glabrescens*, buoyant LBs of the gastroderm encompassing a variety of sizes (0.5-4 m in diameter) were isolated after two cycles of subcellular fractionation via stepwise sucrose gradient ultracentrifugation and detergent washing. The purity of the isolated LBs was demonstrated by their high degree of lipid enrichment and well as absence of contaminating proteins of the host cell and *Symbiodinium*. LB-associated proteins were then purified, subjected to SDS-PAGE, and identified by MS using an LC-nano-ESI-MS/MS. A total of 42 proteins were identified within 8 functional groups, including metabolism, intracellular trafficking, the stress response/molecular modification and development. Ultrastructural analyses of LBs *in situ* showed that they exhibit defined morphological characteristics, including a high electron density resulting from a distinct lipid composition from that of the lipid droplets of mammalian cells. Coral LBs were also characterized by the presence of numerous electron-transparent inclusions of unknown origin and composition. Both proteomic and ultrastructural observations seem to suggest that both *Symbiodinium* and host organelles, such as the ER, are involved in LB biogenesis.

Keywords: bleaching, cnidarian, lipid droplets, *Symbiodinium*, symbiont.

Impact of environmental change on corals and coral reefs: patterns and processes in Taiwan coral reefs

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Corals and coral reefs worldwide are suffering from the threats of environmental changes. These threats include overfishing, pollution, and habitat destruction, and synergetic by the global impacts, such as extreme seawater temperature and ocean acidification. Understanding how corals respond to these complicated disturbances and predicting the scenarios of how coral reefs act as a functional ecosystem to serve the needs for future human society are the key concerns of research in the coming decades.

Taiwan, situated above the coral triangle and below the sub-tropical reefs of Japan is an ideal place to study the effect of climate change along the latitudinal gradient from the tropical Philippines to high-latitude Japan. In this study, we review (1) the biogeographic and ecological characteristics of corals and coral reefs in Taiwan; (2) the resistance of corals and their symbionts impacted by human activities, including overfishing, a 25-year thermal pollution from the outflow of a nuclear power plant, and a chilling event caused by extremely low seawater temperature in 2008; and (3) current research effort on the domestic and international collaborations of Biodiversity Research Centre, Academia Sinica (BRCAS) to understand the pattern and process of impact and potential resistance of Taiwanese corals and coral reefs to the future environmental changes. These efforts include:

(1)Understanding the potential response of coral reefs to climate change: using Kuroshio Triangle as a model system(BRCAS/Kochi, Japan) ;

(2)Response to stressors across the climate zone (BRCAS/PMBC/TJU/NMMBA);

(3)Census of coral reefs: Autonomous Reef Monitoring Structure (ARMS) (BRCAS/AIMS/ Smithsonian Museum);

(4)Drilling the heat under the coral heads (BRCAS/ UQ).

Keywords: coral reefs, corals, environmental changes, extreme seawater temperature, ocean acidification, local stressors, Tropical of Cancer, Kuroshio Current

Ocean acidification – a growing threat to marine calcification

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Global carbon emissions lead to an increase in the concentrations of greenhouse gasses in the Earth's atmospheric – predominantly carbon dioxide (CO_2). For the marine system, one of the consequences of carbon emissions is ocean acidification, which is a direct chemical consequence of increased CO_2 uptake by the ocean surface globally. Ocean acidification affects the ability of marine calcifying organisms to build exoskeletons. One marine ecosystem particularly sensitive to acidification is coral reefs, whose foundations are built on limestone and who depend on high rates of calcification for their ecological function. In this talk, I present a series of studies conducted at the Australian Institute of Marine Science with collaborating institutions aiming to provide new insight into the ecological consequences of ocean acidification for the World's coral reefs. First, I present results from laboratory studies demonstrating the physiological and biological responses to ocean acidification under different carbon emission scenarios. Models based on these studies predict that reefs will shift from net calcification to net dissolution by the second half of this century. Secondly, I present results of recent field studies in naturally acidified environments, which provide insight into the types of coral reefs expected under anthropogenic ocean acidification. Thirdly, I present new data indicating that some reefs are able to modify the carbon chemistry of their seawater, thereby providing opportunities for marine-park planning and the establishment of refugia for ocean acidification. Lastly, I discuss the ocean acidification consequences for ecosystems in combination with the consequences for socio-economic systems in developing countries, where the goods and services provided by coral reefs support the livelihood of many millions of people. I propose a framework in which mitigation of local-scale disturbances, such as reduced overfishing and degraded water quality, can buy coral reefs time while global carbon emissions can be stabilized and reduced.

Keyword: carbon dioxide, ocean acidification, coral reefs, vulnerability

Coral reefs at volcanic CO_2 seeps in Papua New Guinea as a natural proxy to study effects of long-term exposure to ocean acidification

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To date the consequences of long-term exposure of marine ecosystems to ocean acidification remain poorly understood. Here we report on the properties of coral reefs acclimatized to elevated seawater CO_2 at three cool and shallow volcanic CO_2 seeps in Papua New Guinea, reducing seawater pH by up to 0.5 units. The study shows that coral cover can remain high at high pCO_2. However species richness, the cover of corals contributing to structural complexity, and coral recruitment significantly declined with increasing pCO_2. Massive *Porites* increased in cover despite low recruitment and doubled density of macrobioeroders. Calcification rates of massive *Porites* were low at both high and low pCO_2 sites. In surface sediments, carbonate concentration and the densities of foraminifera, calcareous spicules, *Halimeda* segments and small gastropods were low, and on seagrass blades, densities of foraminifera and calcareous epiphytes were nearly zero at high pCO_2. Seagrasses had high above- and below-ground biomass only at high pCO_2, suggesting release from CO_2 limitation. The seeps are a natural laboratory to improve predictions about likely effects of ocean acidification for the future of coral reefs. The study shows that exposure to elevated pCO_2 reduces the diversity and resilience of in Indo-Pacific coral reefs.

Keyword: ocean acidification, calcification, long term effects

Dynamics of a marginal coral community and the ecology of symbiotic copepods on hard corals

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Coral communities in Taiwan are highly diverse including those with active reef-building activities in southern Taiwan and non-reefal coral communities in northern Taiwan. The dynamics of non-reefal or marginal coral communities is of increasing concern since they may serve as refuges for tropical reef organisms under the impacts of climate change. We monitored the changes of a marginal coral community in Yenliao Bay in northeastern Taiwan from 2003 to 2011. The results showed that the dynamics of this coral community are mainly due to occasional typhoon disturbances. During the major typhoon disturbance in 2005, coral species with different morphologies varied greatly in partial and whole colony mortality. Foliaceous and encrusting species suffered higher mortality, while massive faviids suffered lower mortality during typhoon disturbances. In addition, the coral community showed substantial resilience after typhoon disturbances.

The infection of parasites on corals is also of particular interest since it is closely related to the health condition of coral reef ecosystems. Parasitic copepods are a group of diverse and widespread crustaceans that live in close association with corals in Indo-Pacific Ocean. In the past five years, we have found 37 species of copepods including 1 new genus, 4 new species, 23 new records, and 9 possible new species from corals collected at various localities in Taiwan. Among them, the Xarifiidae including 21 species of endoparasitic copepods was the most abundant group. The infection of xarifiids was related to zooxanthellae density of host corals and the mean density of xarifiids was higher in bleaching corals than those in healthy and severely bleached corals. Histological and microscopic studies demonstrated that xarifiid copepods would retain zooxanthellae in their guts for photosynthesis, and this photosymbiotic relationship might benefit the survival of copepods. Further studies on species diversity, infection process and influences of parasitic copepods on corals will provide valuable information for the conservation of coral reefs.

The effects of hydrothermal vent on the corals, crabs and copepods in Turtle Island

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Zooplankton diversity, abundance and distribution patterns were studied above shallow water hydrothermal vents (HVs) at Turtle Island, off the northeast coast of Taiwan. These HVs provide a unique opportunity for the study of community and population effects of HV effluents with ecophysiological and behavioral investigations that are otherwise restricted to studies in the deep sea. We investigated how physical transport processes and ecotoxicological tolerance to HV fluids affect life history parameters and behavior of plankton at vent sites. The present study provides evidence for a bottle-neck situation for plankton above vent sites. Holoplankton was generally deadly affected by the vent plumes. Intoxicated plankton settled on the seabed and provided food for resident macrofauna – but considerable portions were advectively transported by currents. Copepods from HV sites were maintained, some cultivated, and subsequently used for ecotoxicological testing in the laboratory. Tolerance to HV plume fluids was shown to be species-, gender- and stage-specific, that caused shifts of population-structure and communities within assemblages above and away from vent sites. Toxicity experiments showed that life cycle stages of the hypoplanktonic calanoid *Pseudocyclops* sp. in accordance with other species were particularly sensitive to HV effluents when younger, with highest mortalities in the group of naupliar stages and the lowest mortalities at later copepodids. HV effluents showed effects on the swimming behavior of holo- and meroplankton in the laboratory, as well as during mesocosm experiments in the field as analyzed by UW video-recording and subsequent lab-track analysis.

Breeding strategies of hydrothermal vent biota are of central interest for the "supply-side" ecology and evolution at vent sites. We have recently uncovered a new nursery habitat for the vent crab, *Xenograpsus testudinatus* (Decapoda, Brachyura) at a shallow hydrothermal vent site that extends from the deep-sea Okinawa Trench, off the northeastern coast of Taiwan. Megalopa and early juvenile crab stages were found abundantly in a fissured habitat: sulfur aggregates around the chimneys of the vent system. The present underwater visual observations at hydrothermal vent systems at depths of around 20 metres indicate that sulfur rock aggregates are a primary nursery habitat for early benthic crab stages. They provide shelter from physical and biotic disturbance. This finding may explain why hydrothermal

vents from the shallows to the deep sea provide suitable habitats for crabs to become astoundingly flourishing and dominant in all hydrothermal vent systems. Recently studies also indicated that the hydrothermal vent waters affected the distribution of most coral species in the surrounding waters of Turtle Island.

Key words: hydrothermal vents, planktonic copepods, vent crabs, Turtle Island, Taiwan, Ecological impacts

Experimental capability – simulating tropical marine environments

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The Australian Institute of Marine Science (AIMS) is an internationally renowned, world leader in the science underpinning sustainable development, conservation and management of tropical marine environments. The main research facility is located at Cape Ferguson, 50km from Townsville, with facilities also in Perth, WA and Darwin, NT. The Tropical Marine Research Facilities Project is a new A$65 million Australian Government initiative to expand marine science infrastructure capability at AIMS. This includes A$35 million to construct a new research aquarium facility design to simulate tropical oceanic and coastal environments.

The Australian Tropical Oceans Simulator will build significant national infrastructure to support cutting edge research in support of Australia's marine industries and management of its tropical marine ecosystems. This includes research into the ecosystem impact of a changing climate such as how systems will respond to ocean acidification and ocean warming and research to develop management options to mitigate impacts. The new facility will support experimental work by providing the unique ability to control parameters such as temperature, pH, salinity and contaminants in large volumes of seawater. This experimental capability will significantly reduce the timeframes required to evaluate future climate scenarios and therefore increase the likelihood of timely and effective intervention options to protect Australia's coral reefs and other marine ecosystems. The facility will be co-located with the AIMS Centre for Marine Microbiology and Genetics creating a world leading facility attracting national and international research collaborations.

The project aims to combine modern industrial process controls technology with aquarium and experimental knowledge to create a state of the art facility. It will provide researchers with the ability to undertake experiments ranging from sophisticate large multi factorials though to long run experiments in medium scale tanks and flumes based on aquarium systems that allow biological process and symbiotic relationships to establish. The facility will include the ability to spawn captive corals out of season thereby providing researchers with several opportunities each year to undertake research focused around the reproductive cycle of corals.

The design phase is nearing completion with construction commencing in September 2011 with commission of the facility in early 2013.

Keywords: Tropical, Research Aquarium, Ocean Simulation, Capability Development, Collaboration

Marine Science at the University of Auckland: a South Pacific Perspective

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The University of Auckland has a strong interdisciplinary marine science program. The hub for our program is the Leigh Marine Laboratory situated 100km north of Auckland on the east coast. The Laboratory, and its research vessel provides access to a wide range of temperate environments, and the laboratory itself is situated on one of the world's first no-take marine reserves. The Reserve has formed a significant focus for our ecological research, but recent initiatives have extended this emphasis into the Hauraki Gulf which has a marine park status and a high biodiversity with, for example, over a quarter of the world's cetaceans and a third of the world's seabird species reported from the Gulf. A research strategy is being developed to define the key ecosystems services of the Gulf, and their response trajectories to current and likely stressors. In the medium term, predictive power will develop from linking bottom-up hydrodynamic models of nutrient and sediment movement, to fisheries level and ecosystems models.

A number of specific research programs have been built around the Gulf strategy, including: ecosystems services and recruitment cross-subsidy from marine reserves; seabird population biology and high resolution tracking; population biology and acoustic remote sensing of resident cetacean species; reef noise and passive acoustic orientation of larval fish and crustacea; reef ecology, productivity flows and sediment impacts; and sustainable aquaculture.

In addition to the areas above, the University of Auckland has active programs in: fish sensory ecology; herbivorous fishes; ocean acidification; fish ecophysiology; sea level and coastal geomorphology; marine chemistry; and Antarctic marine fishes and ecosystems.

As a program, we are developing our linkages with other New Zealand Universities, in particular Victoria University of Wellington and Otago University with whom we have a "joint platform for advance teaching and research in marine science". Recognizing New Zealand's interests into the South Pacific we are also keen to engage more with marine science in Oceania.

Keywords: program overview; Auckland; Hauraki Gulf; cetacean; seabirds; fish

Biodiversity and phylogeny of marine and amphidromous gobioid fishes in West Pacific.

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Gobioid fishes belong to the most speciose group of marine teleost fishes which have over 2100 species. The family Gobiidae is the largest fish family of them. Recent systematic revision for this group have revealed the largest genus would be *Eviota* which have been estimated over about 110 species and second one would be as *Trimma* about 85 species. Some genera of gobies adapted into deeper habitat around coral reef habitat of West Pacific which have been discovered recently and their phylogenetic position will be discussed herein.

Another very important members of gobioid fishes would be adapted well into the freshwater and estuarine habitat by their amphidromous or complete fluvial life histories. Among them, *Rhinogobius* would be the highest species diversity group around West Pacific region, the genus comprise over 90 valid species into three main life history including: fluvial, lacustrine, and amphidromous patterns. The molecular phylogenetic studies employing mtDNA genetic markers among them would be shown the highly endemicity in different islands of Far East region.

In order to realize the life history for their amphidromous pattern, DNA barcoding also been conducted for detecting larval gobioid fish diversity and recruitment pattern in Taiwanese rivers, our example shown the very useful to use the genetic marker to not only trace major community pattern of fish fauna but also detecting the real species diversity among them ascending fish community.

Slipper lobster diversity and phylogeney

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The slipper lobsters of the family Scyllaridae are a unique group of decapod crustaceans characterized by the strong modification of the antennal flagellum flattened to a plate and used for steering during the escape response. Some members even have the body extremely depressed for adapting to a sand burrowing or crevice hiding life-style. The distribution of slipper lobsters is essentially a world-wide warm-water pattern and with a vertical range from very shallow to more than 800 m deep. Many large or moderate large species are fished commercially but the highest diversity is amongst the smaller species. To date, 20 genera and 89 species of slipper lobsters distributed across four subfamilies (Arctidinae, Ibacinae, Scyllarinae, and Theninae) are known. We have collected nucleotide sequence data from regions of five different genes (16S, 18S, COI, 28S, H3) to estimate phylogenetic relationships among species from the Scyllaridae with a focus on the species rich subfamily Scyllarinae. We have included in our analyses at least one representative from all 20 genera in the Scyllaridae and 35 of the 52 species within the Scyllarinae. Our resulting phylogenetic estimate shows the subfamilies are monophyletic, except for Ibacinae, which has paraphyletic relationships among genera. Many of the genera recently erected within the Scyllarinae are non-monophyletic groups while the genera from all other subfamilies form significantly supported clades. We discuss the implications of this evolutionary history on the morphological evolution and ecological transitions (nearshore vs. offshore) within the slipper lobsters. Key morphological features diagnostic of the major clades of diversity within the Scyllaridae are partially identified and related to current taxonomy and classification.

Keywords: slipper lobsters, diversity, phylogeney, molecular genetics, taxonomy

Field diagnostics and sensing for marine and seafood toxins

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The saxitoxins are a globally distributed, naturally occurring seafood contaminant which can cause fatal neurotoxicity if ingested by humans and other animals. Saxitoxins occur in microalgae, benthic macroalgae, echinoderms, crustacea, fish and molluscs. They also move through the food chain as they are ingested and bioaccumulated. Less lethal than saxitoxin but causing more poisonings world-wide are the ciguatoxins which accumulate in fish and cause ciguatera, a seafood poisoning phenomenon restricted mostly to the tropics and sub-tropics. Numerous species that can harbor these toxins are commercially harvested or cultured and traded world-wide. This latter fact has resulted in ciguatera cases in Europe and Canada taking its impact beyond the tropics.

Both saxitoxins and ciguatoxins can have dramatic impacts upon seafood consumption and trade. They both experience the "halo" effect with poisoning events sullying the reputation of many species of seafood beyond the culprits and this poor reputation can last for many months, if not years. Seafood quality standards are being implemented globally and their enforcement is becoming increasingly rigorous with the saxitoxins and ciguatoxins now subject to these international regulations. Management of harvests, globalization of seafood trade and implementation of "rapid recall" protocols is increasing the demand for rapid on-site testing for seafood toxins at an increasing number of points along the seafood production chain. Changing climates and environmental conditions can also increase the future risks posed by these toxins to public health and the seafood industry.

Saxiphilins are a protein found in the circulatory fluid of an increasing number of vertebrates and invertebrates. It is a transferrin, proteins known more for their iron binding and sequestration properties. Animals found to date to possess saxiphilin include lizards, amphibians, fish, spiders, scorpions, insects, crabs, centipedes, molluscs and onycophorans, most of which do not harbour or bioaccumulate saxitoxins. Saxitoxins have only been found in the marine and freshwater environment, yet many terrestrial organisms possess this unusual saxitoxin binding protein in their blood, providing a mystery as to its biological role. To satisfy the increased demand for rapid toxin tests, saxiphilin has been used to develop rapid, microtitre plate assays for the saxitoxins, and a biosensor. This latter aspect was enabled by the biotinylation of saxitoxin creating a novel bifunctional analogue of these toxins. Many test samples contain a multitude of saxitoxin variants with very different potencies and understanding how toxin mixtures behave in these systems is also critical to their wider deployment. Each isoform of saxiphilin has a different pattern of sensitivity to the different saxitoxins and this is a potentially powerful property upon which to develop tests with a very broad coverage of all of the

saxitoxins. Achievements from developing saxiphilin-based methods can inform the more challenging task of developing easy-to-use ciguatoxin diagnostics, a need being driven by markets seeking more seafood imports and nations pursuing economic growth through seafood exports.

Keyword: saxitoxin, ciguatera, diagnostic, biosensor

Diversity, molecular phylogeny and Biogeography of the marine red algae from the western Pacific Ocean with an emphasis on the species from Taiwan

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The marine red algae in the western Pacific Ocean are composed of temperate, subtropical to tropical genera and families, i.e. Liagoraceae, Halymeniaceae, Gracilariaceae and Delesseriaceae. Some of the genera have a wide distribution from the Indian Ocean to subtropical Pacific Ocean. Taiwan, bisected by the tropic of Cancer, is considered both tropical and subtropical and is geologically a continental island. Oceanographic conditions around the island vary in topography, temperature and currents. Kuroshio Current, one the two main currents affecting Taiwan, brings water of high temperature and salinity up from the Philippines and the equatorial areas toward to Taiwan and Japan. The major branch runs northward to the east coast and a smaller branch veers west through Taiwan Strait. As a result, the seaweed flora in the southern coastlines comprises many tropical assemblages, which are seasonally different from the seaweed communities in the northern and northeastern Taiwan. There are about six hundred species of seaweeds from Taiwan recorded in the literature and the red algal flora, among the records, is particularly rich. The species diversity of the marine flora of Taiwan will be explored along with a discussion on the phylogenetic relationships and biogeography about some cosmopolitan red algae in the western Pacific Ocean.

Biodiversity, Chemistry and Medical Application of Marine Invertebrates

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Marine organisms are a fundamental part of Earth's environment and have been the focus of biodiversity and chemical studies for their ecological impact and economic value. Although pharmaceutical industry research into natural products has declined, studies on untapped marine resources, structure activity relationship, and manipulation of biosynthetic pathways for natural product drug discovery have been increased worldwide.

Marine invertebrates such as sponges and soft corals have proven to be good biological sources for new leads because they often develop a number of novel secondary metabolites as chemical weapons used for surviving. These novel natural products may be useful in medical applications. For example, a chemical investigation of *Ircinia formosana* has resulted in the isolation of eleven new cytotoxic C22-furanosesterterpenoids. In the search for bioactive substances from the Taiwanese marine soft corals, seventeen new xenicane-type diterpenoids, designated asterolaurins A-Q, were isolated from *Asterospicularia laurae*. Species of the genus *Cespitularia* produce various diterpenoids including cembrane, neodolabellane, cespitularane, and verticillane skeletons. Some of these compounds exhibited cytotoxic and immuno-modulatory activities.

To solve the limited source of marine natural products, we have aimed our part work on analog design and synthesis. Thus, a series of 1-substituted carbazolyl-1,2,3,4-tetrahydro- and carbazolyl-3,4-dihydro-β-carboline analogs have been synthesized and evaluated for antitumor activity against human tumor cells including KB, DLD, NCI-H661, Hepa, and HepG2/A2 cell lines. The SAR study revealed that there were correlation between carbon numbers of the side chain and biological activities. The molecular complex with DNA for 1-(9'-Ethyl-3'-carbazolyl) -3,4-dihydro-β-carboline was also proposed.

Keyword: sponges, soft corals, marine natural products, β-carboline analogs

Bioactive natural products from the cultured-type octocorals

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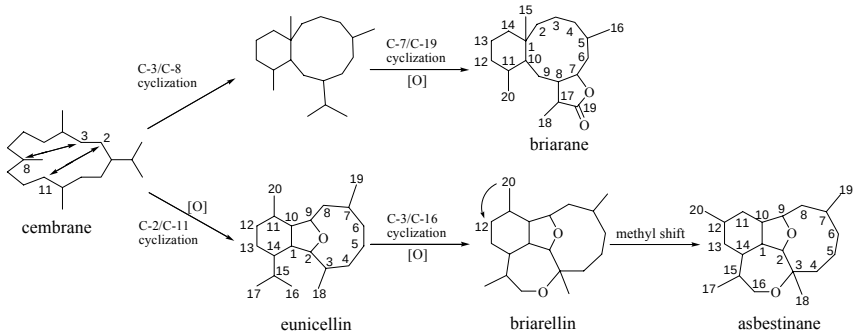
In the past forty years, a series of novel natural products are isolated from various marine organisms mainly from the cone snail, soft corals, sponges, sea squirts, and microorganisms. Marine natural product continue to attract the attentions of investigations because of the structural complexity and interesting bioactivities, such as anti-inflammatory, cytotoxicity, antiviral, immunomodulatory activity, insect control, biotoxin, and ichthyotoxicity. However, because of the complexity of marine natural products and many marine invertebrates, such as all the corals are claimed to be threatened species. We try to keep and culture these interesting specimens as the sources of potential natural products with our highly developed aquaculture technology to enhance in captivity mass production of materials needed for extraction of potential marine natural products which also protect the natural population and habists from over exploitation. In the Pingtung Campus, National Dong Hwa University University (National Museum of Marine Biology and Aquarium), a series of potential medical using octocorals, including the octocorals belonging to the genus *Briareum*, *Sarcophyton*, *Sinularia*, and *Klyxum* were cultured successfully. These octocorals were found to produce a lot of potential terpenoid analogues, such as cembranoid, briarane (3,8-cyclized cembranoid), and eunicellin-type (2,11-cyclized cembranoid) compounds, which could be leading compounds in medicinal using and these compounds are difficult to synthesize with chemical methods. A potential compound Exc-B was evaluated for its significant anti-inflammatory in the *in vivo* test.



Scheme 1. The proposed biosynthetic pathway among the cembrane, eunicellin, briarellin, asbestinane, and briarane carbon skeleton.

Keyword: octocoral, bioactive, natural product, terpenoid

Biodiversity of marine toxins in gastropods

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The oceans are essential to people as a food supply, for transportation, and as a recreation environment. Marine organisms in the oceans could offer us high value nutrition and also are good for the economy. But these uses can be spoiled by over fishing, pollution and the occurrence of marine toxin food poisoning cases. The marine toxins naturally occur in marine organisms, especially for puffer fish and gastropods. Gastropods are univalve snails. The body is usually asymmetrical in a spirally coiled shell. Typically there is a distinct head, with one to two pairs of tentacles, two eyes, and a large, flattened, fleshy foot. Gastropods may be either monoecious or dioecious, and are mostly oviparous. Paralytic gastropod poisoning incidents have frequently occurred in the world. In the outbreaks, the symptoms of victims exhibited quite different patterns depending on the specific outbreak and most of all showed parenthesis with rare fatal cases. The toxin identified was mainly tetrodotoxin (TTX), sometimes with minor paralytic shellfish poison (PSP) and other toxins. Toxic gastropods include Family Nassariidae, Naticidae, Olividae, Muricidae, Buccinidae, Ranellidae, Harpidae, Trochidae, Turbinidae, Burdidae, and Melongenidae. Toxins may distribute in the muscle and/or digestive gland, depending on the species. Toxin profiles are quite different in the same species when collected from different countries. The sources of toxins are from bacteria, dinoflagellate, or biosynthesis. The toxicities of gastropods are various depending on individual, area, species and season when the toxin is exogenous from the food chain. The physiological function of toxin in toxic gastropods acts as defensive and/or attacking agent. The more toxic gastropod has higher preference or palatability preference to TTX and/or PSP.

Keywords: TTX, PSP, gastropod, marine toxins, ciguatoxin, tetramine

Footprints in the sea- towards a new sustainability benchmark for giant tiger shrimp farming in Australia.

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Australia's environmentally sustainable shrimp aquaculture industry has reached a critical juncture where its growth, and its economic sustainability, is in danger of becoming collateral damage in the broader struggle to curtail much more problematic agricultural and municipal inputs into Great Barrier Reef (GBR) waters. To weather tightening expectations as the full threat of climate change on the GBR crystallizes, the industry in Australia will probably have little choice but to lift the benchmark for what is considered "sustainable" in shrimp farming.

Economic sustainability of shrimp farming in Australia has of course long hinged upon maintaining competitiveness with imports. Companies here are already rolling out genetic-selection programs that enhance productivity while research focuses upon new technology for improved feeding and aeration efficiency and upon reduced reliance on fishmeal in feed manufacture. A study of energy use in shrimp farms is also under way. Companies here have grown in confidence and to them expansion is the obvious response to rising market demand also allowing them to squeeze the very last economies of scale out of farm and processing alike. But this strategy hinges upon perceptions and some misperceptions of the "environmental" sustainability of aquaculture. Growth of shrimp farming in Australia is constrained by a complex and often onerous regulatory approval process designed amongst other things to restrict discharge of nutrients into the waters of Australia's GBR. For shrimp farms to pursue increased economies of scale and therefore competitiveness without a net increase in nutrient discharge will require, for example, feeds with increased bioavailability; more sophisticated feed delivery systems which gauge standing crop and cut feed wastage; and enhanced nutrient conversion/capture systems. Closed-cycle operation of farms is already enforced by occasional power-failures or practiced for short periods – for example to avoid low salinity in monsoonal floods or anthropogenic contamination in surface water draining from agricultural land. Closed-cycle "biofloc"-based pond management regimes are increasingly being favoured as a farming system in its own right, for reasons of both improved production efficiency and reduced environmental impacts. Further work is needed here to refine these new methods of pond management. Some progress is also being made with polychaete-assisted biofiltration on farm but it is yet to be tested at a commercial scale. Other researchers in Australia are also revisiting seaweed production as a means of capturing both nutrients and also of course, carbon dioxide.

While work on measuring and reducing the nutrient footprint of shrimp aquaculture has begun

in Australia, work on the industry's carbon footprint is less advanced. While farms can continue to improve energy efficiency, investigate low-carbon or renewable energy, or indeed examine the scope for "blue carbon" capture within the farm, a better understanding is also required of the scope for nearby mangroves to sequester both nutrients and carbon at a time of rising sea level.

Keywords: nutrients, aquaculture feeds, energy, climate change

Marine science at NIWA: from the subtropics to the Antarctic

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The National Institute of Water and Atmospheric Research (NIWA) is New Zealand's major provider of atmospheric, freshwater and marine research and associate services. It employs over 700 staff and operates research vessels, a high performance supercomputer, a commercial scale aquaculture facility and national measurement networks for climate and water resources. NIWA's marine science activities aim to (i) increase economic growth through the sustainable management and use of marine resources, (ii) increase the resilience of New Zealand and South-West Pacific Islands to marine hazards, (iii) enhance the stewardship of New Zealand's marine ecosystems and biodiversity, and (iv), increase understanding of the Antarctic and Southern Ocean climate, cryosphere, and ecosystems.

New Zealand's Exclusive Economic Zone (EEZ) and Legal Continental Shelf cover 5.7 million square kilometers of ocean. This region has a complex seabed, including a 10,000 m deep trench, active undersea volcanism, over 800 seamounts and vast plateaus. New Zealand also crosses major ocean currents and water masses, from the subtropics in the north to the subantarctics to the south. This highly variable physical environment, along with New Zealand's long geological isolation, has resulted in a unique biodiversity. Surveys to date suggest that up to 10% of the global marine biodiversity can be found within the New Zealand EEZ. The region also supports significant fisheries, oil and gas, and mineral resources.

A summary will be provided of NIWA's marine research facilities and activities, not only around New Zealand, but also within South-West Pacific and Antarctic waters. It will include an overview of research on (i) the seabed structure and resources; (ii) ocean water masses, currents and climate (including air-sea exchange of gases and ocean acidification); (iii) marine biodiversity and biosecurity; (iv) coastal and open ocean productivity; (v) marine hazards and energy; (vi) fisheries surveys and stock assessment; and (vii), aquaculture, especially marine finfish.

Keyword: New Zealand, oceans, resources, climate, environment, aquaculture

Influence of climate change on fishery ecology around Taiwan

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The influences of climate change on the world ocean are characterized by rapid changes in marine environments as well as the consequent dynamic responses of marine organisms. These effects may include increase in sea surface temperature (SST), change in hydrological patterns, extreme oceanic events of rare occurrence, and decrease in populations of marine fishes. Most analyses in previous studies focused on pelagic fishes, however, a limited number of studies has discussed relationships between variation in fish abundance and climate change in coastal and regional waters.

The observed impacts of such change on coastal capture fisheries included species regime shift, ecosystem structure vulnerability, and displacement of fishing ground. As the inter-annual fluctuations of abundance in small pelagic fishes were much greater than those of larger size or longer life species, the structures of food (fish) pyramid in the coastal waters would be more significantly weakened. Studies of impacts of climate change on the seas around Taiwan have showed that abundance of most fishes was decreased, especially among species migrating with China Coastal Current, while the abundance of warm-water fish species was slightly increased. The short-, mid-, and long-term warmings may lead to 5-50% decrease of catch for winter migratory species, therefore, some rarer species may be in the danger of disappearance. Traditional fishery management measures were unable to handle the problem caused by climate change. More external precautionary and adaptive measures should be applied to reduce impact and risk.

In addition, an extreme case of cold water intrusion into the southern Taiwan Strait was well noted in February 2008. This intrusion dropped SST from 20.2 to 12.6ºC in 7 days with a fall of 7.6ºC and causing the death of more than 130 tons of resident, coral reef, and cage aquaculture fishes. To compare the fishing catch of the La Niña winter of 2008 with the average catch of 1998-2007, we found 50-80% decrease in the catch of pole and lines boot, gill net, and longline fisheries but 193% increase in set net fishery. It is suggested that the intrusion of cold current may also bring some schools of cold water and migratory species from the East China Sea to the southern Taiwan Strait. Another cold water intrusion occurred in the La Niña winter of 2011, however, the influence of cold water on the abundance of marine fishes was slighter in 2011 than in 2008. The wind field and model simulated sea current data of these two La Niña events were different from each other.

Key words*:* Climate change, La Niña, Taiwan, Fishery.

Overview of Taiwan and Australia Bilateral Fora on Aquaculture, Fisheries Resources and Management

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Formation of Taiwan and Australia Bilateral Fora on Aquaculture, Fisheries Resources and Management was based on the Scientific Cooperation Agreement between Taiwan National Science Council (NSC) and Australian Academy of Technological Science and Engineering (ATSE) signed in March of 1992. The Agreement promotes bilateral scientific cooperation and activity exchange. Forum I was held in Brisbane in 1996 in conjunction with the Second World Fisheries Congress. During the Forum besides scientific papers were presented from 18 delegates and directions and items of future scientific cooperation were identified, a consensus was reached to hold the Forum biannually in alternative country. Before Forum II, which was held in Taiwan Fishery Research Institute (TFRI) in Keelung in November of 1998, two Australian scientists came to Taiwan to conduct research on eel culture and marine fish reproduction under the NSC-ATSE Agreement and the consensus of Forum I. In Forum II, 37 papers were presented and later in 2001 published by TFRI in Proceedings. Forum III was organized by Queensland Department of Primary Industry and held in Bribie Island in June of 2001. Besides 19 papers were presented, 10 priority research topics and 11 commonly interested topics were identified. Forum IV was delayed and finally organized by and held in National Taiwan Ocean University in November of 2008. Total 36 papers presented and not only commonly interested research items but also corresponding contact persons were proposed. Forum V was planned to be held in Hobart, Tasmania in May of 2010 in conjunction with Annual Conference of Asian-Pacific Chapter of the World Aquaculture Society, however failed due to short of organizational and financial support. The overview of these fora can be relevant to the development of a regularly held multinational meeting.

紐澳講員個人資料
(Curriculum Vitae of Australia and New Zealand)

臺灣主持人及演講者聯絡資料
(General Information of Taiwanese chairmen and speakers)

Dr Ian Poiner

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Role
Chief Executive Officer (CEO) and Council Member. Dr Poiner's role is to provide strategic leadership and day-to-day management to maintain AIMS as one of the world's leading tropical marine science centres.

Background
Became Chief Executive Officer of AIMS in July, 2004. I have significant experience in strategic development and planning of science, both as a practising scientist and at the organisational level. This is reflected in my successful large-scale, multi-disciplinary research projects and the establishment of national and international research programmes to support the sustainable use, conservation and management of marine ecosystems. My scientific background is research into tropical fisheries and ecological systems, including those in Australia's northern Great Barrier Reef, Torres Strait and the Gulf of Carpentaria. I have also worked in Jamaica, Papua New Guinea and Southeast Asia. I currently serve on a number of national and international committees. In 2008, I was appointed a Fellow of the Australian Academy of Technological Sciences and Engineering (ATSE).

Education
1975-80: BSc Zoology, BSc Hons 1A Zoology, PhD Zoology, University of Queensland, Aust
1991: Research Leadership, Inst of Management, UNSW, Aust
2003: International Executive Program, INSEAD, France

Current Research Activities
Currently my main role is the strategic development and planning of science at the organisational, national and international level. My scientific expertise is in tropical marine ecology and fisheries including: understanding how marine systems are influenced by human activities, their environment and climate factors; tropical seagrass ecology; identifying and mitigating the environmental impacts of fishing; developing and evaluating fisheries and environmental management strategies including ecosystem level approaches; developing environmental standards for industries for incorporation into third party certification processes.

Expert Committees and Boards
Chair, International Scientific Steering Committee - Census of Marine Life (CoML)
Chair, Oceans Policy Science Advisory Group (OPSAG)
Board Member, Reef and Rainforest Research Centre Limited
Board Member, Western Australian Marine Science Institution (WAMSI)
Board Member, Integrated Marine Observing System (IMOS)
Board Member, TopLinks Pty Ltd
Member, Great Barrier Reef Foundation - International Scientific Advisory Committee.

Publications
Over 60 science and technical papers in refereed journals. The following are a selection of recent publications:

Pitcher CR, Burridge CY, Wassenberg T, Hill BJ and Poiner IR (2009) A large scale BACI experiment to test the effects of prawn trawling on seabed biota in a closed area of the Great Barrier Reef Marine Park, Australia. Fisheries Research 99: 168-183.

Burridge CY, Pitcher CR, Hill BJ, Wassenberg T,Poiner IR (2006) A comparison of demersal communities in an area closed to trawling with those in adjacent areas open to trawling: a study in the Great Barrier Reef Marine Park, Australia. Fisheries Research 79: 64-74.

Kaiser MJ, Collie JS, Hall SJ, Jennings S and Poiner IR (2002) Impacts of fishing gear on marine benthic habitats. pp. 197-218. In: Sinclair M and Valdimarsson G (eds) Responsible Fisheries in the Marine Ecosystem. FAO Rome.

Kaiser MJ, Collie JS, Hall SJ and Poiner IR (2002) Long-term habitat changes and their implications for future fisheries management. pp. 189-201. In: Wefer G, Mantoura RFC (eds) Marine Science Frontiers for Europe. Springer-Verlag.

Poiner IR (2001) Review of "Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic". US Department of Commerce, National Marine Fisheries Service, Miami Fla, SEFSC Contribution PRD-00/01-08. 328p.

Poiner IR, Blaber JM, Brewer DT, et al.(1999) Final Report on the Effects of Prawn Trawling in the Far Northern Section of the Great Barrier Reef: Final Report to Great Barrier Reef Marine Park Authority and Fisheries Research and Development Corporation on 1991-96 (Years 1-5) Research. CSIRO Marine Laboratories. (Vol 1 - Chapters 1 to 3, Vol 2 - Chapters 4 to 7). 850 p.

Dr Ken Anthony

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Role

Principal Research Scientist,
Research Team Leader – Climate Change and Ocean acidification

Background

My key interest and focus is coral reef ecology, which was born out of my passion for marine aquaria. In the absence of tropical coral reefs in my native country (Denmark), I studied costal marine ecology in Sweden for my BSc and MSc. I was then awarded a postgraduate fellowship from the Royal Swedish Academy to study the benthic marine ecology of the subarctic Sweden. In 1995, I moved to Australia to undertake a PhD in coral biology under Prof. Bette Willis. During my PhD work I developed an interest in understanding the links between physiology and population-level processes, a mechanistic approach I am now using to gain insight into the processes that drive ecosystem resilience. After the PhD, I enjoyed a year as a marine park manager at the Great Barrier Reef Marine Park Authority, which gave me valuable insight into the client side of marine conservation biology. In 2000, I was awarded an Australian Postdoctoral Research Fellowship, and in 2004 I took up the position as marine ecology lecturer at JCU. In 2006, I joined the Centre for Marine Studies at UQ in Brisbane as a Senior Research Fellow, leading a research team to investigate ocean acidification impacts on coral reef physiology and ecology. In May 2011 I took up the position as Research Team Leader of the Climate Change and Ocean Acidification group at AIMS.

Education

1992: BSc, University of Copenhagen
1993: MSc, Uni Copenhagen
2000: PhD James Cook University

Current Research Activities

My current research focus is to develop a mechanistic and quantitative understanding of coral reef ecosystem resilience and vulnerability under environmental change. In particular, I am interested in tackling the problem of resilience and vulnerability under combinations of carbon emission scenarios and local-scale disturbances. This ambitious task is possible only through my collaboration with a large multi-disciplinary team at AIMS and with collaborators from multiple Australian and international institutions.

Publications

Over 50 science and technical papers in refereed journals. The following are a selection of recent publications:

Anthony KRN, Diaz-Pulido G, Maynard JA, Mumby PJ, Hoegh Guldberg O (2011) Ocean acidification and warming lower coral reef resilience. *Global Change Biology* 17: 1798-1808

Diaz-Pulido G, Gouezo M, Tilbrook B, Dove SI Anthony KRN (2011). High CO_2 enhances the competitive strength of seaweeds over corals. *Ecology Letters* 14: 156-162

Maynard JA, Anthony KRN, Afatta S, Hoegh-Guldberg O. (2010). Making models meaningful to coral reef managers in a developing nation: a case study of overfishing and rock anchoring in Indonesia. *Conservation Biology* 24: 1316-1326

Anthony KRN, Marshall PA (2009) Coral Reefs and Climate Change. In: Poloczanska ES, Hobday AJ, Richardson AJ (eds) A Marine Climate Change Impacts and Adaptation Report Card for Australia 2009

Anthony KRN, Kline DI, Diaz-Pulido G, Dove S, Hoegh-Guldberg O (2008) Ocean acidification causes bleaching and productivity loss in coral reef builders. *Proceedings of the National Academy of Science* 105:17442-17446

Weeks SJ, Anthony KRN, Bakun A., Feldman, GC, Hoegh-Guldberg O (2008). Improved predictions of coral bleaching using seasonal baselines and higher spatial resolution. *Limnology & Oceanography* 53: 1369-1375.

Anthony KRN, Kerswell A (2007) Coral mortality following extreme low tides and high solar radiation. *Marine Biology* 151:1623-1631

Mr Scott Bainbridge

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Role
Project Manager for the Great Barrier Reef Observing System (GBROOS) Project

Background
1985-1987: [AIMS] Experimental Scientist: Crowns of Thorns Starfish Project (data and field work)
1987-1989: [AIMS] Experimental Scientist: Remote Sensing of Reefs
1990-1993: [MMT Pty Ltd] Operations Manager, remote sensing and coastal mapping
1993-1997: [AIMS] Data Specialist: Long Term Monitoring Project
1997-2007: [AIMS] IT Manager
2000-2007: [AIMS] Manager, AIMS Data Centre
2007-Present: [AIMS] GBROOS Project Manager

Areas of interest and expertise include data, informatics, real time systems, sensor networks, coral reef climate change.

Education
1985: BSc (Marine Biology, Zoology & Botany), JCU
1995: Post Grad Dip in Management, Deakin University
1997: MBA in Technology Management, APESMA / Deakin University
2000: Microsoft MCSE

Current Research Activities
Project Manager for the GBROOS and Facility Leader of the Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS). Activities include design and deployment of reef based sensor networks, design of data systems and software to support real time environmental data, development of the next generation of sensor and data systems to support future environmental and biological monitoring and development of tools for users to use and integrate sensor data.

Expert Committees and Boards
Board Member, Australian Ocean Data Centre Joint Facility (AODC-JF)
Co-Chair, Coral Reef Ecological Observation Network (CREON)
Member, James Cook University Industry Advisory Panel

Publications
The following are a selection of recent publications:

Brainard RE, Bainbridge S, Brinkman R, Eakin CM, Field M, Gattuso J-P, Gledhill D, Gramer L, Hendee J, Hoeke RK, Holbrook SJ, Hoegh-Guldberg O, Lammers M, Manzello D, McManus M, Moffitt R, Monaco M, Morgan J, Obura D, Planes S, Schmitt RJ, Steinberg C, Sweatman H, Vetter OJ, Wong KB (2009) An International Network of Coral Reef Ecosystem Observing Systems (I-CREOS) OceanObs09 Ocean information for society: sustaining the benefits, realizing the potential, 21-25 September 2009, Venice Italy.

Bainbridge S, Feather G, Eggeling D. Application of senor networks to coral reef systems. In Proceedings of the 9th International Conference on Southern Hemisphere Meteorology and Oceanography (9ICSHMO), 2009.

Bainbridge S, Rehbein MA, Feather G, Eggeling D (2008) Sensor networks on the Great Barrier Reef - managing marine sensor data. pp. 19-25. In: Gries CG and Jones MB (eds) Proceedings of the Environmental Information Management Conference 2008. University of New Mexico.

Lough J, Bainbridge S, Berklemans R, Steinberg C. Physical monitoring of the Great Barrier Reef to understand ecological responses to climate change. In: You J, Henderson-Sellars A (eds) Climate Change Monitoring and Strategy. Accepted to Sydney University Press.

Bainbridge S. GBROOS - An Ocean Observing System for the Great Barrier Reef. Proceedings of the 11th International Coral reef Symposium, Ft. Lauderdale, Florida 7-11 July 2008.

Bainbridge S, Steinberg CR, Heron ML (2010) Integrating observations: an example from the Great Barrier Reef. Sea Technology 51: 33-38.

Dr Richard Brinkman

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Role

Lead Physical Oceanographer
Senior Research Scientist in physical oceanography and numerical modelling.

Background

I joined AIMS as a support scientist in 1995, following 3 years experience as a numerical hydrodynamic modeller for a coastal engineering consulting firm. Since becoming a Research Scientist in 1999, I have focused on understanding physical oceanographic processes relevant to coral reefs and tropical continental shelf environments at region to local scales.

I am currently the Lead Physical Oceanographer at AIMS, responsible for development and implementation of the scientific vision for physical oceanography, and the delivery of that vision through appropriate Research Team plans.

I currently lead Project 3 of WAMSI Node 2 and have strong collaborative links with the UWA Oceans Institute..

Education

2006: PhD Oceanography, School of Mathematics and Physics, James Cook University
1991: BSc Hons, Oceanography and Meteorology, Flinders University

Current Research Activities

My current research interests fall within the broad topics of coastal oceanography and physical-biological interactions on continental shelves. I am currently undertaking research on shelf dynamics; coupling of shelf and ocean circulation; sediment dynamics on tropical coasts; wave propagation over coral reefs and through coastal vegetation; and physical-biological interactions at regional and local scales. A unifying theme of my research is the development and application of validated models of hydrodynamic circulation and materials transport (sediment, larvae, pollutants) as part of multidisciplinary studies.

Expert Committees and Boards

Leader WAMSI Project 2.3
AIMS@JCU Program Leader "Coastal Processes and Modeling"

Publications

Over 30 science and technical papers in refereed journals. The following are a selection of recent publications:

Choukroun SM, Ridd P, Brinkman RM, McKinna L (2010) On the surface circulation in the Western Coral Sea and residence times in the Great Barrier Reef. Journal of Geophysical Research 115: C06013

Weeks S, Bakun A, Steinberg CR, Brinkman RM, Hoegh-Guldberg O (2010) The Capricorn Eddy: a prominent driver of the ecology and future of the southern Great Barrier Reef. Coral Reefs Alongi DM, McKinnon AD, Brinkman RM, Trott LA, Undu MC, Muawanah and Rachmansyah (2009) The fate of organic matter derived from small-scale fish cage aquaculture in coastal waters of Sulawesi and Sumatra, Indonesia. Aquaculture 295: 60-75.

Gilmour JP, Smith LD, Brinkman RM (2009) Biannual spawning, rapid larval development and evidence of self-seeding for scleractinian corals at an isolated system of reefs. Marine Biology 156: 1297-1309.

McKinnon AD, Trott LA, Talbot S, Brinkman RM, Alongi DM, Castine S, Patel FM (2008) Environmental Impacts of Sea Cage Aquaculture in a Queensland Context - Hinchinbrook Channel Case Study(SD576/06). Final Report. Australian Institute of Marine Science. 74 p.

Bannister R, Brinkman RM, Wolff CWW, Battershill CN, de Nys R (2007) The distribution and abundance of dictyoceratid sponges in relation to hydrodynamic features: identifying candidates and environmental conditions for sponge aquaculture. Marine and Freshwater Research 58: 624-633.

Andrefouet S, Ouillon S, Brinkman RM, Falter J, Douillet P, Wolk F, Smith R, Garen P, Martinez E, Laurent V, Lo C, Remoissenet G, Scourzic B, Gilbert A, Deleersnijder E, Steinberg CR, Choukroun SM, Buestel D (2006) Review of solutions for 3D hydrodynamic modelling applied to aquaculture in South Pacific atoll lagoons. Marine Pollution Bulletin 52: 1138-1155.

Meekan MG, Carleton JH, Steinberg CR, McKinnon AD, Brinkman RM, Doherty PJ, Halford AR, Talbot S, Mason L (2006) Turbulent mixing and mesoscale distributions of late stage larval fishes on the NW Shelf of Western Australia. Fisheries Oceanography 15: 44-59.

Brinkman RM, Wattayakorn G, Wolanski EJ, Spagnol SB and Marshall K (2005) Storm-driven erosion of fine sediment and its subsequent transport and trapping in fringing mangroves, Sawi Bay, Thailand. Journal of Coastal Research SI 42: 211-220.

Dr David Bourne

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Role
Research Scientist within the "Understanding Marine Microbes and Symbioses" Team at AIMS.
Currently Acting Research Team Leader

Background
My training and background is in Molecular Microbial Ecology. Since obtaining my PhD in 1997 which investigated microbial degradation of cyanobacterial toxins, I have applied these skills to a number of research topics during Postdoctoral stints, including terrestrial methanotroph ecology and marine microbiology at the University of Warwick (UK) and Bergen University (Norway) respectively. My time at AIMS has been spent across a number of projects including the investigation of marine microbes for drug discovery and the microbial dynamics in aquaculture (Rock Lobster) larval rearing systems. Recently, however, I have principally been focused on coral microbiology and coral disease.

Education
1997: PhD in Biotechnology, University of Queensland, Brisbane, QLD
1992: Bachelor of Applied Science in Biotechnology (First Class Honours), University of Queensland, Brisbane, QLD

Current Research Activities
I have established and managed a research theme within AIMS, focused primarily on the microbiology of corals and coral disease. This research is divided essentially into two areas, the first investigating the normal microbial communities associated with corals and their functional roles in maintaining coral fitness. The second research focus is to elucidate pathogens and mechanism of disease onset in corals and the implications this has on a stressed reef ecosystem in light of climate change being a major driver of coral reef degradation.

Expert Committees and Boards
Member of the AIMS@JCU 'Stress in tropical marine systems' program
Participant of the World Bank Global Environmental Fund's Coral Disease Working Group
AIMS representative on the CMMG Review Committee (funded through the Smart State Research Facilities Fund)

Publications
Over 60 science and technical papers in refereed journals. The following are a selection of recent publications:

Aeby GS, Bourne DG, Wilson B, Work TM (2011) Coral diversity and the severity of disease outbreaks: a cross-regional comparison of *Acropora* white syndrome in a species-rich region (American Samoa) with a species poor region (Northwestern Hawaiian Islands). Journal of Marine Biology in press, doi:10.1155/2011/490198.

Koenig JE, Bourne DG, Curtis B, Dlutek M, Stokes HW, Doolittle WF, Boucher Y (Online First) Coral-mucus-associated *Vibrio* integrons in the Great Barrier Reef: genomic hotspots for environmental adaptation. The ISME Journal 5: 962-972.

Littman R, Willis BL and Bourne DG (Online First) Metagenomic analysis of the coral holobiont during a natural bleaching event on the Great Barrier Reef. Environmental Microbiology Reports doi: 10.1111/j.1758-2229.2010.00234.x

Bourne DG, Muirhead A, Sato Y (2011) Changes in sulfate reducing bacterial populations during the onset of Black Band Disease. The ISME Journal 5: 559-564.

Ceh J, van Keulen M, Bourne DG (2011) Dynamics of coral-associated bacterial communities on Ningaloo Reef, Western Australia. FEMS Microbiology Ecology 75: 134-144.

Haapkylä J, Unsworth RKF, Flavell M, Bourne DG, Schaffelke B, Willis BL (2011) Seasonal rainfall and runoff promote coral disease on an inshore reef. PLoS ONE 6: e16893.

Crothers-Stomps C, Høj L, Bourne DG, Hall M, Owens L (2010) Isolation of lytic bacteriophage against *Vibrio harveyi*. Journal of Applied Microbiology 108: 1744-1750.

Glas MS, Motti CA, Negri A, Sato Y, Froscio S, Humpage AR, Krock B, Cembella A, Bourne DG (2010) Cyanotoxins play no role in the etiology of coral black band disease outbreaks on Pelorus Island, Great Barrier Reef. FEMS Microbiology Ecology 73: 43-54.

Littman R, Bourne DG, Willis BL (2010) Responses of coral-associated bacterial communities to heat stress differ with *Symbiodinium* type on the same coral host. Molecular Ecology 19: 1978-1990.

Pollock FJ, Morris PJ, Willis BL and Bourne DG (2010) Detection and quantification of the coral pathogen *Vibrio coralliilyticus* by use of real-time PCR with TaqMan fluorescent probes. Applied and Environmental Microbiology 76: 5282-5286.

Sato Y, Willis B, Bourne D (2010) Successional changes in bacterial communities during the development of black band disease on *Montipora hispida*. The ISME Journal 4: 203-214.

Dr Sven Uthicke

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Role
Research Scientist in the Water Quality and Ecosystem Health Team studying the use of foraminifera and biofilms

Background
My current research activities include molecular and ecological research to develop indicators for changes in water quality. This work mainly focuses on benthic biofilms, and specifically foraminifera, diatoms and bacteria. This work combines field-based ecological techniques with state of the art molecular and other laboratory based methods. Most recently I have initialised studies on climate change and nutrient interactions to test the hypothesis that local management is important to ameliorate impacts of climate change on coral reefs.

I have strong expertise in experimental ecology, molecular ecology and population genetics. In previous studies I investigated genetic connectivity and ecological function of coral reef invertebrates (specifically echinoderms).

Education
1998: PhD in Biology, University of Hamburg, Germany
1994: Diplom in Biology, University of Hamburg, Germany

Current Research Activities
- Studying the effects of terrestrial runoff on reef biota
- Studying the effects of climate change on calcifying symbiont bearing organisms.

Expert Committees and Boards
Society Memberships
- Ecological Society of America
- International Coral Reefs Society
- Australian Coral Reef Society
- Australian Marine Science Association
- Associate Editor Marine Biology

Publications
Over 50 science and technical papers in refereed journals. The following are a selection of recent publications:

Byrne M, Rowe FWE, Uthicke S (2010) Molecular taxonomy, phylogeny and evolution in the family Stichopodidae (Aspidochirotida: Holothuroidea) based on COI and 16S mitochondrial DNA. Molecular Phylogenetics and Evolution 56: 1068-1081.

Uthicke S, Thompson AA, Schaffelke B (2010) Effectiveness of benthic foraminiferal and coral assemblages as water quality indicators on inshore reefs of the Great Barrier Reef, Australia. Coral Reefs 29: 209-225.

Uthicke S, Byrne M, Conand C (2010) Genetic barcoding of commercial Bêche-de-mer species (Echinodermata: Holothuroidea). Molecular Ecology Resources 10:634-646.

Uthicke S, Altenrath C (2010) Water column nutrients control growth and C:N ratios of symbiont-bearing benthic foraminifera on the Great Barrier Reef, Australia. Limnology and Oceanography 55: 1681-1696.

Wolkenhauer S-M, Uthicke S, Burridge CY, Skewess T, Pitcher CR (2010) The ecological role of *Holothuria scabra* (Echinodermata: Holothuroidea) within subtropical seagrass beds . Journal of the Marine Biological Association of the United Kingdom 90: 215-223.

Lee J, Uthicke S, Byrne M (2009) Asexual reproduction and observations of sexual reproduction in the aspidochirotid sea cucumber *Holothuria difficilis*. Invertebrate Reproduction and Development 53: 87-92.

Massin C, Uthicke S, Purcell S, Rowe FWE, Samyn Y (2009) Taxonomy of the heavily exploited Indo-Pacific sandfish complex (Echinodermata: Holothuriidae). Zoological Journal of the Linnean Society 155: 40-59.

Uthicke S, Schaffelke B, Byrne M (2009) A boom-bust phylum? Ecological and evolutionary consequences of density variations in echinoderms. Ecological Monographs 79: 3-24.

Uthicke S, Llewellyn LE, Eder F (2009) A fluorescent lectin assay to quantify Transparent Exopolymer Particles and Marine Snow on 96-well filtration plates. Limnology and Oceanography: Methods 7: 449-458.

Mr David Mead

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Role
General Manager, Australian Institute of Marine Science

Background
David is AIMS General Manager responsible for day to day operations of the Institute. In this role, he manages a broad spectrum of areas including: Health and Safety, Field and Ship Operations, Finance, Human Resources, Engineering Services, Supply and Property, Information Resources and Technology, Infrastructure Development and Legal and Commercial Services.

Prior to taking up this position, he worked as a senior manager at Snowy Hydro Limited for 14 years, a renewable energy generation and electricity retail company. He has extensive experience in business leadership along with the management of physical assets, capability and strategy planning, business development and a strong background in financial assessments. He also has a strong passion for application of the continuous improvement philosophy along with organisational cultural alignment & development. Prior to Snowy Hydro Limited he worked for several years as a research engineer developing mathematical models of rock fracturing under explosive loadings, creating numerical models of blasting and undertaking validation field trials with BHP at their research laboratories in Newcastle.

Education
2001: Masters of Business Technology
1994: Graduate Certificate Maintenance Management at Monash University
1990: Degree in Mechanical Engineering
1988: New Zealand Certificate in Mechanical Engineering

Current Research Activities
Heavily involved in developing external revenue opportunities and in the strategic planning of the Institute's research. David is also leading a major capability development project to develop the AIMS Tropical Oceans Simulator facility.

Awards
2000 Inaugural winner of the Steve Maxwell "Maintenance Leadership Award"
1998 Institute of Engineers "Maintenance Excellence Award"
1990 IPENZ for best final year university project in Mechanical Engineering
1983 Bay of Plenty Engineering Award

Dr Lyndon Llewellyn

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Role

Research Manager for AIMS, being responsible for research operations. Key roles include monitoring Institute research performance, research management systems, and oversight of major research infrastructure.

Background

Prior to joining AIMS, I was trained in marine biology (University of Queensland), protein biochemistry (University of New South Wales) and molecular pharmacology (Yale University). I developed, managed and grew scientific programs on marine toxins and marine natural product discovery, which included partners such as university academics, large and start-up biotechnology companies.

Education

1982 BSc (University of Queensland)
1988 PhD (University of Queensland)

Current Research Activities

- Marine pharmacology
- Chemical and biological analysis
- Database development and use

Expert Committees and Boards

Research Working Group, Queensland Government Marine Stinger Advisory Group Committee
Advisor - International Atomic Energy Agency - United Nations Development Project on seafood toxin testing technologies for Asia, Africa and South America.
AIMS@JCU Management Committee

Publications

Over 75 science and technical papers in refereed journals. The following are a selection of recent publications:

Doyle JR, Bowie JH, Jackway RJ, Llewellyn LE, Pukala TL, Apponyi MA and Booker GW (2009) Anuran host-defence peptides which inhibit the synthesis of nitric oxide by neuronal nitric oxide synthase. pp. 315-332. In: Bioactive Peptides. CRC Press.

Haines DS, Burnell JN, Doyle JR, Llewellyn LE, Motti CA, Tapiolas DM (2005) Translation of in vitro inhibition by marine natural products of the C4 acid cycle enzyme pyruvate, Pi dikinase to in vivo C4 plant tissue death. J Agric Food Chem 53: 3856-3862.

Llewellyn LE, Negri AP, Robertson A (2006) Paralytic shellfish toxins in tropical oceans. Toxin Reviews 25:159-196.

Llewellyn LE (2006) Saxitoxin, a toxic marine natural product that targets a multitude of receptors. Natural Prod Rep 23: 200-222.

Llewellyn LE (2006) The behavior of mixtures of paralytic shellfish toxins in competitive binding assays. Chem Res Toxicol 19:661-667.

Llewellyn LE (2007) Predictive toxinology: an initial foray using calculated molecular descriptors to describe toxicity using saxitoxins as a model. Toxicon 50:901-913.

Llewellyn LE (2009) Sodium channel inhibiting marine toxins. pp. 67-97. In: Fusetani N and Kem W (eds) Marine Toxins as Research Tools. Springer-Verlag.

Llewellyn LE (Online First) Revisiting the association between sea surface temperature and the epidemiology of fish poisoning in the South Pacific: Reassessing the link between ciguatera and climate change. Toxicon

Motti CA, Bourne DG, Burnell JN, Doyle JR, Haines DS, Liptrot CH, Llewellyn LE, Ludke S, Muirhead AN, Tapiolas DM (2007) Screening marine fungi for inhibitors of the C4 plant enzyme pyruvate phosphate dikinase: unguinol as a potential novel herbicide candidate. Appl Environ Microbiol 73: 1921-1927.

Mukherjee J, Webster NS, Llewellyn LE (2009) Purification and characterization of a collagenolytic enzyme from a pathogen of the Great Barrier Reef sponge, *Rhopaloeides odorabile*. PLoS ONE 4: e7177.

Robertson A, Negri AP, Burnell JN, Llewellyn LE (2006) Development and assessment of radioreceptor binding assays for the detection of saxitoxin binding proteins in biological extracts. Anal Biochem 356: 66-75.

Robillot C, Kineavy D, Burnell JN, Llewellyn LE (2009) Synthesis of bifunctional saxitoxin analogues by biotinylation. Toxicon 53: 460-465.

Uthicke S, Llewellyn LE, Eder F (2009) A fluorescent lectin assay to quantify transparent exopolymer particles and marine polysaccharides on 96-well filtration plates. Limnol Oceanogr (Methods) 7, 449-458

QUEENSLAND DEPARTMENT OF EMPLOYMENT, ECONOMIC DEVELOPMENT AND INNOVATION
CURRICULUM VITAE

Name: Dr Brian D. Paterson **Languages spoken:** English **Profession:** Principal Research Scientist Bribie Island Research Centre (BIRC)	**Educational qualifications: :** Bachelor Degree, Doctorate (PhD Zoology, University of Queensland) **Professional memberships:** Australian Marine Science Association

Specialist areas of expertise:

10 years experience in crustacean aquaculture research including reproduction, growth, moulting and behaviour

12 years experience in handling and transport of live seafood and physiological effects of handling on live crustaceans and finfish

8 years experience in the effects of feeds, harvesting and handling practices on product characteristics, particularly in aquaculture, with an emphasis on farmed southern bluefin tuna.

Recent projects :

- 2010- present. Australian Government Farm Ready Industry Grants Round 1 #251 Prawn farmers responding to Australia's Change Climate
- 2009- present Australian Seafood Cooperative Research Centre (CRC) 2009/756 Male fertility in *Penaeus monodon*
- 2009- present Australian Seafood CRC 2009/759 Towards All-female populations of *Penaeus monodon*
- 2005-2008 ACIAR FIS/2000/065 Low cost formulated diets for mud crab aquaculture

Employment and Professional Appointments:

2006 – present. Principal Research Scientist, Profitable Aquaculture Systems, Dept. of Employment, Economic Development and Innovation (formerly DPI&F)
2002 – 05 Senior Research Scientist (Crab Aquaculture), Profitable Aquaculture Systems, DPI&F
2001 - 02 Seconded to Fisheries & Aquaculture, Acting Principal Fisheries Biologist, DPI
1997 - 01 Senior Physiologist, Seafood Research, Centre for Food Technology, DPI
1989 - 97 Physiologist, Seafood Research, Centre for Food Technology, DPI

Recent peer-reviewed publications:

Wall, D., Paterson, B., Mohan, R., 2009. Behaviour of juvenile mud crabs *Scylla serrata* in aquaculture: response to odours of moulting or injured crabs. Applied Animal Behaviour Science 121, 63-73.

Uhlmann, S.S., Broadhurst, M.K., Paterson, B.D., Mayer, D.G., Butcher, P., Brand, C.P., 2009. Mortality and blood loss by blue swimmer crabs, *Portunus pelagicus*, after simulated capture and discarding from gillnets. ICES Journal of Marine Science 66, 455-461.

Truong, P.H., Anderson, A.J., Mather, P.B., Paterson, B.D., Richardson, N.A., 2009. Apparent digestibility of selected feed ingredients in diets formulated for the sub-adult mud crab, *Scylla paramamosain*, in Vietnam. Aquaculture Research 40, 322-328.

Nicholson, S., Mann, D., Fotedar, R., Paterson, B., 2008. The effects of holding space on growth and survival of individually reared three-spot crab (*Portunus sanguinolentus*). Aquacultural Engineering 39, 30-36.

Møller, H., Lee, S.Y., Paterson, B., Mann, D., 2008. Cannibalism contributes significantly to the diet of cultured sand crabs, *Portunus pelagicus* (L.): a dual stable isotope study. Journal of Experimental Marine Biology and Ecology 361, 75-82.

Paterson, B., Mann, D., Kelly, B., Barchiesi, M., 2007. Limb-loss in pond-reared blue swimmer crabs *Portunus pelagicus* (L.): effect on growth in an indoor shedding system. Aquaculture Research 38, 1569-1579.

CURRICULUM VITAE AND PUBLICATIONS
PART 1

1a. Personal details				
Full name	*Title* Prof	*First name* John	*Second name(s)* Charles	*Family name* Montgomery
Present position	Chair of Marine Science			
Organisation/Employer	University of Auckland			
Contact Address	School of Biological Sciences			
	University of Auckland			
	Private Bag 92019 Auckland Mail Centre Auckland		**Post code**	1142
Work telephone	09 3737599 ex 87208	**Mobile**		
Email	j.montgomery@auckland.ac.nz			

1b. Academic qualifications

1989 DSc, Biology, University of Bristol
1978 PhD, Biology, University of Bristol
1974 BSc(Hons), Zoology, University of Otago

1c. Professional positions held

1978 – present Academic Staff University of Auckland

1d. Present research/professional speciality

Sensory Ecology, Neuroethology

1e. Total years research experience	36 years

1f. Professional distinctions and memberships (including honours, prizes, scholarships, boards or governance roles, etc)

2007- Board of AntarcticaNZ
2002 Appointed Chair in Marine Science
1995-2001 Member of the NIWA Board
1998 Personal Chair in Biological Sciences
1994 Visiting Scholar, Parmly Hearing Institute, Loyola Univ Chicago
1990 Claude McCarthy Fellowship
1989 Elected to the Royal Society of New Zealand
DSc University of Bristol
1988 Fulbright Scholarship
1983 International Brain Research Organisation Fellowship
1974 Commonwealth Scholarship
1973 Medical Research Council Summer Studentship and Prize

1g. Total number of *peer reviewed* publications and patents	Journal articles	Books, book chapters, books edited	Conference proceedings	Patents
	126	27	78	

PART 2

2a. Research publications and dissemination

Peer-reviewed journal articles since 2004

Montgomery JC and Coombs SL (2011 in press) Lateral line neuroethology. In: Farrell AP., (ed.) Encyclopedia of Fish Physiology: From Genome to Environment, volume X, pp xx-xx San Diego: Academic Press.

Montgomery JC, Carter L. (2011) Marine Science in the past 25 years: Main findings and trends. In: The World Ocean in Globalization: Challenges and Responses. (eds) D. Vidas and P.J. Schei. The Fridtjof Nansen Institute Norway, Martinus Nijhoff - Brill.

Windsor SP, Norris S, Cameron SM, Mallinson GD, and **Montgomery JC** (2010) The flow fields involved in hydrodynamic imaging by blind Mexican cave fish (Astyanax fasciatus). Part I: open water and heading towards a wall. Journal of Experimental Biology 213: 3819-31.

Windsor SP, Norris S, Cameron SM, Mallinson GD, and **Montgomery JC** (2010) The flow fields involved in hydrodynamic imaging by blind Mexican cave fish (Astyanax fasciatus). Part II: gliding parallel to a wall. Journal of Experimental Biology 213: 3832-42.

Wellenreuther M, Michelle Brock M, **Montgomery JC**, and Clements KD (2010) Comparative morphology of the mechanosensory lateral line system in a clade of New Zealand triplefin fishes. Brain Behavior and Evolution 75:292-308.

Montgomery JC and David Bodznick D. (2010) Functional origins of the vertebrate cerebellum from a sensory processing antecedent. Current Zoology 56: 277-284**.**

Montgomery, J.C., Windsor, S., and Bassett, D. (2009) The behavior and physiology of mechanoreception : separating signal and noise. Integrative Zoology 4: 3-12

Radford CA, Stanley JA, Tindle CT, Montgomery JC and Jeffs AG (2010) Localised coastal habitats have distinct underwater sound signatures. Marine Ecology Progress Series 401: 21-29

Riding, T.A.C., Dennis, T.E., Stewart, C.L., Walker, M.M., and **Montgomery, J.C.** (2009) Tracking fish using 'buoy-based' GPS telemetry. Marine Ecology Progress Series 377: 255-262.

Lisney, T. J., Yopak, K. E., **Montgomery**, J. C and Collin S. P. (2009). Variation in Brain Organization and Cerebellar Foliation in Chondrichthyans: Batoids. Brain Behavior and Evolution 72: 262-282.

Radford C, Jeffs A, Tindle C, **Montgomery** JC (2008) Resonating sea urchin skeletons create coastal choruses. Marine Ecology Progress Series 362: 37-43.

Yopak, K. E. and **Montgomery**, J. C. (2008) Brain Organization and Specialization in Deep-Sea Chondrichthyans. Brain Behavior and Evolution 71: 287-304.

Le Port , A., Sipple, T. and Montgomery, J.C. (2008) Observations of mesoscale movements in the short-tail stingray, *Dasyatis brevicaudata* from New Zealand using a novel PSAT tag attachment method. Journal of Experimental Marine Biology and Ecology 359 110–117

Radford C, Jeffs A, Tindle C, **Montgomery** JC (2008) Temporal patterns in ambient sea noise at a shallow temperate reef. Oecologia 156: 921-929.

Windsor, S. P., Tan, D. and **Montgomery**, J. C. (2008) Swimming kinematics and hydrodynamic imaging in the blind Mexican cave fish (Astyanax fasciatus). Journal of Experimental Biology Journal of Experimental Biology 211: 2950-2959

Bassett, D, Jeffs AG , **Montgomery** JC (2008) Identification of predators using a

novel photographic tethering device. Marine and Freshwater Research 59: 1079–1083.

Yopak, K. E., Lisney, T. J., Collin S. P. and **Montgomery**, J. C. (2007). Variation in brain organization and cerebellar foliation in chondrichthyans: sharks and holocephalans. Brain Behavior and Evolution 69: 280-300.

Bassett. D., Carton, A.G.and **Montgomery**, J.C. (2007) Saltatory search in a lateral line predator. Journal of Fish Biology 70: 1148-1160

Radford, C,A., Jeffs, A.G. and **Montgomery**, J.C (2007). Directional Swimming Behavior by Five Species of Crab Postlarvae in Response to Reef Sound. Bulletin of Marine Science 80: 369-378

Ross P.M., Thrush, S.F. and **Montgomery**, J.C. (2007) Habitat complexity and predation risk determine juvenile snapper (Pagrus auratus) and goatfish (Upeneichthys lineatus) behaviour and distribution. Marine And Freshwater Research 58 : 1144-1151.

Bishop, A.S.D.H.,. Francis, M.P., Duffy, C. and **Montgomery**, J.C. (2006) Age, growth, maturity, longevity and natural mortality of the shortfin mako shark (*Isurus oxyrinchus*) in New Zealand waters. Marine and Freshwater Research 57: 134-154.

Montgomery J.C., Jeffs, A., Simpson, S.D., Meekan, M. And Tindle, C. (2006) Sound as an Orientation Cue for the Pelagic Larvae of Reef Fish and Decapod Crustaceans. Advances in Marine Biology 51: 143-196.

Bassett, D., Carton, A.G. and **Montgomery**, J.C. (2006) Flowing water decreases hydrodynamic signal detection in a fish with an epidermal lateral line-system. Marine and Freshwater Research 57: 611-617

Simpson, S.D., Meekan, M. **Montgomery**, J.C. Mccauley, R. and Jeffs, A. (2005) Homeward Sound Science 308: 221.

Jeffs, A.G., **Montgomery**, J.C. and Tindle, C. (2005) How do spiny lobster post-larvae find the coast? New Zealand Journal of Marine and Freshwater Research 39: 605-617

Radford, C,A., Jeffs, A.G., Tindle, C.T., Cole, R.G. and **Montgomery**, J.C. (2005) Bubbled waters: The noise generated by underwater breathing apparatus Marine and Freshwater Behaviour and Physiology; 38: 259–267.

Carton, A.G. **Montgomery,** J.C. (2004). A comparison of lateral line morphology of blue cod and torrentfish: two sandperches of the family Pinguipedidae. Environmental Biology of Fishes. 70: 123-131.

Tolimieri, N., Haine, O., Jeffs, A. Mccauley, R. and **Montgomery**, J.C. (2004) Directional orientation of pomocentrid larvae to ambient reef sound. Coral Reefs 23: 184-191.

Raethke, N., Macdiamid, A.B. and **Montgomery**, J.C. (2004) The role of olfaction during mating in the southern temperate spiny lobster *Jasus edwardsii*. Hormones & Behavior. 46: 2004. 311-318.

Peer reviewed books, book chapters, books edited since 2004

Montgomery, JC and Coombs SL. Lateral line neuroethology. Encyclopedia of Fish Physiology, from Genome to Environment, 1st Edition. (editor in chief AP. Farrell with senior editors JJ. Cech, JG Richards and ED Stevens) 2010 (in press).

Montgomery JC, Carter L. Marine Science in the past 25 years: Main findings and trends. In: The World Ocean in Globalization: Challenges for Marine Regions (ed) D. Vidas. The Fridtjof Nansen Institute Norway.

Montgomery JC, Windsor SP, and Bassett DK (2010) Vibration Perception:

Vertebrates. In: Breed M.D. and Moore J., (eds.) Encyclopedia of Animal Behavior, volume 3, pp. 491-497 Oxford: Academic Press.

Webb, J.F., **Montgomery**, J.C. and Mogodans, J (2008). Bioacoustics and the lateral line system of fishes. In: J.F. Webb, R.R. Fay and A.N. Popper (eds) Fish Bioacoustics. Springer-Verlag: New York. pp. 145-182.

Bodznick, D. and **Montgomery**, J.C. (2005) The Physiology of Low Frequency Electrosensory Systems. In: T.H. Bullock, C.D. Hopkins, A.N. Popper, and R.R. Fay (eds) Electroreception. Springer-Verlag, New York pp 132-153.

Coombs, S. and **Montgomery**, J.C. (2005) Comparing octavolateralis sensory systems: what can we learn. In: T.H. Bullock, C.D. Hopkins, A.N. Popper, and R.R. Fay (eds) Electroreception. Springer-Verlag, New York pp. 318-359.

Macdonald, J.M. and **Montgomery**, J.C. (2005) The Nervous System. In: The Physiology of Polar Fishes (A.P. Farrell and J.F. Steffensen eds.) Fish Physiology 22: 351-383

Refereed conference proceedings since 2004

Windsor, S; Mallinson, G; **Montgomery, J**. Hydrodynamic imaging by blind mexican cave fish (Astyanax Fasciatus) Comparative Biochemistry And Physiology A-Molecular & Integrative Physiology 150: S79-S79 2008

Windsor, SP; Mallinson, GD; **Montgomery, JC**. Hydrodynamic imaging by blind cave fish Integrative and Comparative Biology 46: E156-E156 2006

Bassett DK, **Montgomery JC** 2005 Ecological implications of different search strategies in nocturnal teleost predators. Integrative and Comparative Biology 45: 962-962

Other forms of dissemination (reports for clients, technical reports, popular press, etc)

Science communication – since 2008

2010 New Zealand Universities International PVCs at Leigh
National Geographic interview at Snell's Beach
Feb alumni and donor function at Leigh
RSNZ Media Centre Fisheries Briefing for Journalists
Probus Newmarket
Penrose Rotary Club

2009 Aorangi Club
Google Ocean Launch (ZB, National Radio, TV1, TV3, Prime)
Warkworth Rotary
School Careers Symposium at Tamaki
McLean's College, Careers Evening
Principal 's Forum University of Auckland, Marine Science
Mahurangi Senior School Prize Giving Guest Speech

2008 Devonport Library group,
Devonport Probus – Marine Science
Warkworth Tennis Club
Hibiscus Coast Probus
Takapuna Probus

Rob Murdoch – Biography

Rob has over 20 years of research experience in marine science, ranging from coastal waters to the Antarctic. Past research has included studies of plankton, ocean currents, fish, rocky reefs, black coral, marine reserves, mussel farming, seabirds on subantarctic islands, and drugs from marine animals. Much of his research has been sea based off research ships. In addition to research he has also been involved in a range of consultancy projects, ranging from offshore oil and gas development to resource consents for mussel farms. He joined the New Zealand Oceanographic Institute (now the National Institute for Water and Atmospheric Research, NIWA) as a research scientist in 1984, after completion of a PhD at the Portobello Marine Laboratory, University of Otago, Dunedin, New Zealand. Rob is currently the General Manager Research and a member of the NIWA Executive. He also oversees the management and operation of NIWA's three research vessels.

National Institute of Water and Atmospheric Research (NIWA)

NIWA is a Crown Research Institute, established in 1992. It operates as a stand-alone company with its own Board of Directors and Executive.

NIWA's mission is to conduct leading environmental science to enable the sustainable management of natural resources for New Zealand and the planet.

NIWA has working relationships with hundreds of organisations in New Zealand and overseas. Most of NIWA's revenue is from contestable research funding and commercial consultancy work.

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演講者 Speakers (Taiwan)

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