PREFACE

We give thanks to God Almighty that our 2nd Marine Resilience and Sustainable Development International Symposium (MARSAVE 2020) Proceedings are now published in the IOP Conference Series: Earth and Environmental Science (EES).

The seas which sustain life on our blue planet are experiencing increasingly complex and severe pressures. To achieve sustainable development goals in a marine context, we need to address threats and strengthen resilience. Science has a key role to play, informing policy and management, exploring solutions and catalysing change. The 2nd Marine Resilience and Sustainable Development International Symposium - MARSAVE 2020 – brought together people from a wide range of scientific disciplines and origins. Our speakers and participants came from many countries across all continents, as well as from a wide range of backgrounds.

Due to the Covid-19 pandemic, MARSAVE 2020 was held on-line using the Zoom platform on 10th October 2020. Despite challenges related to the pandemic, the participants were able to share their knowledge, experience and research, and to expand their networks to address crucial issues in the context of the MARSAVE 2020 theme: "Strengthening Marine Resilience for Sustainable Development Goals".

MARSAVE 2020 was opened by the Vice Rector IV of Universitas Hasanuddin (Prof. dr. Muh. Nasrump Massi, Ph.D), representing the Rector Prof. Dr. Dwia Aries Tina Pulubuhu, M.A. During the two plenary sessions we were privileged to hear from keynote speakers Dr. Peter Mous of The Nature Conservancy and Dr. Susan Wells of IUCN WCPA-Marine, followed by ten other eminent scientists and practitioners from around the world. A series of parallel sessions focused on topics including Marine Biodiversity, Biology and Ecology, Biotechnology, Climate, Conservation, Ecosystems Approach to Fisheries Management (EAFM), Fisheries, Mariculture, Maritime Technology, Marine Policy, Modelling, Pollution, and Socio-Ecological Approaches. The plenary and parallel presenters came from and/or represented institutions based in Australia, Belgium, Canada, China (Hong Kong), Germany, India, Malaysia, the Netherlands, South Africa, the USA and the UK, as well as Indonesia as the host country.

We thank all the authors who have contributed to these MARSAVE 2020 proceedings, which will contribute to the body of publicly available scientific knowledge, as well as the achievement of individual, institutional, and national publication targets. We are particularly delighted to see the work of young scientists, both undergraduate and postgraduate students, as well as many experienced researchers.

Last but not least, we take this opportunity to say a big thank you to our sponsors: the South Sulawesi Provincial Government, the Association of Indonesian Fisheries Graduates, and the Indonesian Aquaculture Association. A warm thank you also to all the MARSAVE 2020 team whose hard work and enthusiasm made the event and these proceedings possible and to all who contributed or took part in any capacity.

Thank you and may Almighty God bless us all and our endeavours, keep us safe and inspire us to emerge stronger from the challenges we all face, in particular the global pandemic and climate emergency.

MARSAVE 2020 Organising Committee Chair,

Dr. Nadiarti Nurdin, M.Sc.
**MARSAVE 2020 AND THE COVID-19 PANDEMIC**

From its inception in 2017, the Centre of Excellence for Marine Resilience and Sustainable Development (MarSave CoE) committed to a role in the dissemination of knowledge, the sharing of relevant experience and the building of partnerships. The holding of an international conference at two-yearly intervals, is a foundational remit and a primary pillar of the MarSave CoE strategy. The 1st MARSAVE Marine Resilience and Sustainable Development International Symposium (MARSAVE 2018) was held on 6th and 7th August 2018 at the Gambara Hotel, Makassar. Retaining the theme “Strengthening Marine Resilience for Sustainable Development Goals”, the 2nd Marine Resilience and Sustainable Development International Symposium (MARSAVE 2020) was originally planned as a classical in-person event, comprising plenary and parallel presentation and discussion sessions over two days (10th-11th August 2020) as well as social events such as welcoming and gala dinners and side-events such as workshops and field trips.

As the program was being finalised in December 2019 and early 2020, rumours of a mysterious disease in Wuhan, China evolved to become increasingly disturbing news of a possible and then declared global pandemic. During the early months of 2020 the prognostics, in Indonesia at least, were generally much more positive than the reality we have faced since then, with few people anticipating severe travel restrictions situation lasting to the end of 2020 and beyond. Nonetheless, as the situation worldwide in general and in Indonesia in general deteriorated, it became increasingly clear that both international and domestic travel might be difficult or impossible in August 2020. As “work from home” became the norm where possible, and gatherings were forbidden or strongly discouraged and limited by Covid-19 protocols, we were faced with decisions on whether or not to hold MARSAVE 2020, and if so, when and in what form.

We decided against a cancellation, with the interest already shown by prospective speakers and participants reinforcing our resolve to implement this core component of the MarSave CoE mission in 2020. After an assessment of the options open to us, we considered that it was too risky to hope for a return to “normal” travel conditions later in the year. We decided to alter the format to a fully on-line event – at least for participants – although some in-person activity would be necessary for the organisers. In order to allow for the necessary adjustments, MARSAVE 2020 was postponed by two months to 10th October 2020. We also decided not to hold side events and to change the timeframe from two days to one day, with morning and evening plenary sessions to accommodate speakers from a range of time zones around the world.

When we took this decision, we were blissfully unaware of the many challenges we would face in holding our first major virtual event. However, thankfully we were able to overcome these challenges, learning by doing. For this we have to thank the wonderful support from colleagues at Unhas, as well as our community of (plenary and parallel) speakers and participants, and the generous donors who supported MARSAVE 2020 despite pandemic-related limitations. We set up social media accounts on Facebook and Instagram and used several Whatsapp groups for coordinating participants and publication management. These media were vital for logistics and communication as well as meaningful interaction before, during and after the events. While this was our first major virtual event, we anticipate building on the skills developed and the links made to hold virtual and hybrid events not only while the pandemic situation lasts but also in a “new normal” future. We have realised that such formats can increase inclusiveness and reduce the ecological footprint of the exchanges and networking essential for the advance of the scientific basis for and implementation of resilient and sustainable development in all marine-related fields. In this context, we are already planning for MARSAVE 2022.

The original MARSAVE 2020 goals included the initiation and expansion of networking and partnerships for research and action, as well as the socialisation of the research and concepts presented and discussed at the Symposium through publication in the scientific literature. The former goal was achieved, including several new partnerships arising from interactions during MARSAVE 2020. These proceedings are the main output related to the second goal. We hope that the manuscripts contained in this volume will be of value and contribute to advancing marine resilience and sustainable development in Indonesia and around the world, thus contributing to the SDG targets. We welcome feedback and cordially invite you to MARSAVE 2022.

**MARSAVE 2020 Organising Committee Chair**

Dr. Nadiarti Nurdin, M.Sc.

**MARSAVE CoE Chairman**

Prof. Dr. Ir. Jamaluddin Jompa, M.Sc.
The 2nd Marine Resilience and Sustainable Development International Symposium (MARSAVE 2020) was held on 10th October 2020. The ZOOM platform was used, with a 500 person capacity and YouTube livestreaming for the plenary sessions and 6 break-out rooms for the parallel sessions. Most components of the event were live, although some presentations were pre-recorded.

**MARSAVE 2020 Timetable**

| Time          | Description                                                                                                                                 |
|---------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| 07:00 – 08.30 | Registration                                                                                                                                  |
| 08:30 – 08:45 | Cultural entertainment, Opening Prayers and National Anthem                                                                               |
| 08:45 – 08:55 | Committee Chair Report: Dr. Nadiarti Nurdin, M.Sc.                                                                                           |
| 08:55 – 09:15 | Welcoming Speech: Prof. dr. Muh. Nasrum Massi, PhD – Vice Rector IV of Universitas Hasanuddin                                             |
| 09:15 – 09:45 | Keynote Speaker 1: Dr. Peter J. Mous – The Nature Conservancy Indonesia                                                                   |
| 09:45 – 11:15 | Plenary Session 1: 1. Dr. Sebastian Thomas 2. Dr. Shaili Johri 3. Laurence J. McCook, PhD. 4. Dr. Maarten de Brauwer 5. Dr. Naomi Gardiner |
| 11:15 – 11:30 | BREAK 1 – Poster Session                                                                                                                   |
| 11:30 – 12:30 | Parallel Session 1: 5 papers per room                                                                                                       |
| 12:30 – 13:45 | BREAK 2 – Poster Session                                                                                                                   |
| 12:45 – 14:00 | Arranging meeting rooms                                                                                                                    |
| 14:00 – 16:00 | Parallel Session 2: 9 papers per room                                                                                                       |
| 16:00 – 16:20 | BREAK 3 – Poster Session                                                                                                                    |
| 16:20 – 17:20 | Parallel Session 3: 5 papers per room                                                                                                       |
| 17:20 – 19:00 | BREAK 4 – Determination of Award Winners                                                                                                    |
| 19:00 – 19:30 | Keynote Speaker 2: Dr. Sue Wells – IUCN Green List Standards Committee                                                                     |
| 19:30 – 20:45 | Plenary Session 2: 1. Dr. Iain C. Neish 2. Prof. Dr. Ir. Jamaluddin Jompa, M.Sc. 3. Dr. Theresa Dabruzzi 4. Dr. Dominik Kneer 5. Prof. Dr. Marc Kochzius |
| 20:45 – 21:00 | Closing Remarks: Dean of the Faculty of Marine Sciences and Fisheries Dr. St. Aisjah Farhum, M.Si.                                            |

The time allocated to the keynote speakers for each of the two plenary sessions was 30 minutes, with 20 minutes each for a further ten eminent plenary speakers. The 110 parallel speakers were given 10 minute time slots, and advised to allow approximately 3 minutes for discussion. Questions could be posed orally.
through the raising hand feature and activation of the microphone of the person asking the question or through the chat feature in zoom, with questions read by the moderator. The speakers had the option to respond live, write responses in the chat feature, or respond later (e.g. through email or using other contact information provided). There were a total of 15 poster presentations, mostly by student presenters, which were presented as a rolling slideshow during the breaks. All participants had the opportunity to vote for their preferred posters. After the official closing ceremony, the zoom room remained live for a lively virtual informal social session, conducted orally and through the chat function.

In addition to the 125 oral and poster presenters, 2 keynote and 10 invited plenary speakers, a further 92 registered non-presenting participants attended via the Zoom application, together with non-presenting committee members and assistants. The total number of YouTube livestreaming participants is hard to measure, but seems to have exceeded 300. The invited and registered participants came from Australia (3), Belgium (2), Germany (1), Hong Kong (1), India (1), Japan (1), Malaysia (1), Netherlands (1), South Africa (1), Nigeria (1), UK (3), USA (4), with the remainder from across Indonesia. In terms of institutional affiliations, the participants came from academia, research institutions, government agencies, non-government agencies and the private sector, while from a gender perspective 51% of registered and invited attendees were female and 49% were male.

**MARSAVE 2020 MULTIMEDIA LINKS**

The 2nd Marine Resilience and Sustainable Development International Symposium (MARSAVE 2020), held on 10th October 2020, was a lively and interactive virtual event. The plenary video presentation prepared for MARSAVE 2020 by Iain Neish can be viewed at https://youtu.be/uRxCGRRa1vY.

One of the lessons learned from this event was the desirability of breaking up the recordings into shorter sessions rather than attempting to record the whole day and evening as one film. Unfortunately the system ran out of memory and part of the evening session was not recorded. However, recording of the event is being edited and we plan to make selected highlights available, with a link from the MARSAVE 2020 website: http://fikpunhas.marsave.org/.

Screenshots taken by participants during the event, along with their brief testimonies or comments on the scenes they chose to share with the MARSAVE community, can be seen on the MARSAVE 2020 website: http://fikpunhas.marsave.org/. Information on 3rd MARSAVE 2022 will also be posted later in 2021 on this site.
PROFILE OF MARSAVE 2020 KEYNOTE SPEAKERS

Peter J. Mous
The Nature Conservancy's Indonesia Fisheries Conservation

Title: A data-driven, community-friendly approach to regulation of fishing effort, illustrated by the Indonesia fishery on deepwater snappers

Biography

Dr Peter J. Mous holds a PhD. in fisheries management from Wageningen University in The Netherlands. He has been living and working in Indonesia since 1998. Peter is currently leading a team of 40 Indonesian and international experts who implement The Nature Conservancy's Indonesia Fisheries Conservation Program. The Fisheries Conservation Program works together with fishing companies, fishing communities, and government agencies to safeguard Indonesia's archipelagic biodiversity and to sustain its fisheries. Peter is a practical scientist with a keen interest in the coastal communities (humans and other animals) of tropical seas and oceans. Peter is an Associate Professor at the University of Rhode Island.

Sue Wells
IUCN Green List Standards Committee/WCPA MPA Management Effectiveness Task Force

Title: The IUCN Green List: the global standard for protected and conserved areas

Biography

Dr. Sue Wells has been involved in marine and coastal conservation throughout her career, and has worked for a range of international organizations, NGOs and governments. She has particular expertise in marine protected areas and coral reefs in several countries, especially in the Western Indian Ocean where she worked with IUCN and the UK where she was involved with the designation of England’s Marine Conservation Zones. She co-ordinates the IUCN WCPA MPA Management Effectiveness Task Force and is a member of the Green List Standard Committee. Sue explained the IUCN Green List and it’s relevance for Indonesia, as marine protected areas (MPAs) will only be successful if sites are well governed, soundly designed, effectively managed and deliver positive outcomes for marine biodiversity and all those dependent on ocean resources. Evaluation of protected area performance is now recognised an essential aspect of improving management, and a range of assessment tools are being used. Many countries, including those in the Coral Triangle Region, are institutionalising management effectiveness assessments as a core part of protected area operations.
MARSAVE 2020 PLENARY PRESENTATION ABSTRACTS

SESSION I

1. Sebastian Thomas: Cultures of ocean governance: Historical approaches, future scenarios, and implications for sustainable development

Abstract. Water covers more than two thirds of our planet’s surface, and the oceans represent more than 98 percent of the habitable biosphere. Across time and space human societies have understood the oceans in many different ways – as vast, alien, and mysterious; as an intertemperate yet infinite provider; as a resource frontier; as identity and home. Current scientific views highlight the importance of ocean ecosystem goods and services in the rapidly growing ‘blue economy’ – the sustainable use of ocean resources. As human civilization continues to grow and develop in this century of growing climate chaos, significant environmental change, and increasing political contest, the oceans are becoming the next great frontier for industrial progress and economic growth. Yet these new marine territories also present novel ontological challenges as well as commercial opportunities, and governance approaches will influence and determine environmental dynamics, political conflicts, and social justice outcomes. This paper reviews historical approaches to ocean governance through an analysis of treaties, conventions, and other relevant agreements, and offers an empirical identification of governance characteristics that can be categorised in ‘cultural’ terms. Future scenarios of development, political contest, and global change are considered in an integrated manner to identify potential challenges, conflicts, and opportunities arising from cultural features of marine territories in coming decades. The paper offers insights into how different governance approaches might affect cultural and biophysical ecosystem services in a climate-changed world, and is immediately relevant not only to SDGs 16 and 17 but also SDG 14 (Life below water) and SDGs 8 (Decent work and economic growth) and 9 (Industry, innovation, and infrastructure).

Biography
Dr Sebastian Thomas is a research scholar and subject expert in the fields of sustainability science, environmental policy, and critical geographies of climate change. His particular areas of interest are oceans and the blue economy, climate change mitigation policy and carbon markets, and energy transitions. He has extensive experience and significant expertise in applied interdisciplinary research, particularly in the Asia-Pacific region. His work integrates theories, methods, and tools from economic and human geography, political economy, sustainable development, ecological economics, and international relations. Sebastian is an Adjunct Professor at Curtin University, and previously a lecturer at the University of Melbourne and Senior Fellow with the Australia-Indonesia Centre. Sebastian has consulted to organisations including CSIRO, the Australian Department of Foreign Affairs and Trade, the Pacific Islands Development Forum, Sustainability Victoria, the Aboriginal Carbon Foundation, the UNDP, and others. He is an experienced and transformative educational leader and research academic, with strengths in interdisciplinary scholarship, research design, and postgraduate teaching and supervision. His unique expertise is integrating complex science, policy, and critical theoretical perspectives to support policy insights that contribute to real-world change and sustainable development.

2. Shaili Johri: Using genomics to trace illegal wildlife trade and conserve biodiversity

Abstract. Chondrichthyes (sharks, rays and chimaeras, referred to as ‘sharks’) are among the thirteen species groups identified as extremely vulnerable to illegal, unregulated and unreported fishing (IUU) practices. Overexploitation through indiscriminate fishing activities to meet the international demand for shark fins has led to a 90% decline in shark populations worldwide. Sharks as apex predators play a crucial role in top-down regulation and in maintaining healthy marine ecosystems. Loss of sharks is therefore detrimental to marine ecosystems and to ecosystem services provided. Thus, in order to protect remaining shark populations, and ensure the health of our oceans it is important that unsustainable fishing practices are regulated using the most efficient and comprehensive tools at hand. Current methods for IUU monitoring and detection, rely on fishing vessel monitoring and self or third party reporting of the point of origin and/or destination. These methods have so far proven inefficient as 25-30 % of seafood imported in the US, is
sourced by IUU. We addressed this lack of traceability in seafood imports by using genetic methods which rely on the species and stock populations of imported or domestically sourced seafoods. Shark samples are collected from free swimming sharks or from specimens found in fish markets. Genomic DNA is sequenced on-site by trained undergraduate and graduate students on the MinION. We sequenced four new chondrichthyan genomes including the Silky shark (*Carcharhinus falciformis*), Sharpnose guitarfish (*Glaucostegus granulatus*), and two manta rays (*Mobula japonica* and *Mobula tarapacana*). Ongoing genome assessments for population size and structure will allow determination of conservation status for these shark species. Genome comparisons across taxa will increase understanding of mechanisms which impart evolutionary resilience to this species group and also increase traceability of seafood.

Biography
Shaili Johri is a geneticist with a research focus in conservation genomics of wildlife populations. She completed her B.S. and M.S. in India and moved to the United States for her Ph.D in Genetics. She is currently a Research Fellow at the Biology Department, Stanford University, pursuing her post-doctorate at the Hopkins Marine Station, Stanford University in the field of conservation genomics. Shaili works at the intersection of marine conservation policy and interdisciplinary research. Her research career spans projects relating to conservation of tigers in western India, wolves in northwest USA, killer whales in the Pacific Northwest and now sharks and rays in the southwest US and India. Shaili’s role as a project lead involves developing genomic and metagenomic tools to assist with biodiversity assessments and population health monitoring of marine megafauna such as sharks. In parallel to her research, Shaili works in close collaboration with fishing communities to develop science based conservation policies through cross-sector collaborations, outreach and education. In addition to her research, Shaili engages in capacity building for genomic methods among wildlife research communities in the US and abroad. Email: shailij@stanford.edu

3. Laurence J. McCook: Upgrading conservation in S.E. Asian Marine Protected Areas: Adapting IUCN protocol for a Chinese MPA.

Abstract. Globally, coral reefs and related tropical marine ecosystems are places of spectacular beauty and enormous value, ecologically, socially, culturally and economically. However, they are declining, from both local pressures and global climate change impacts. This can be seen in such vastly different contexts as Australia’s Great Barrier Reef, the Indonesian Coral Triangle, and the coastal reefs of heavily populated Hainan and Guangdong in China. These changes have dire consequences, for the food security, culture and economy of the millions of people who depend on the ecosystem services these ecosystems provide. There is an urgent, critical need for major and ongoing improvements in management and conservation of these ecosystems, especially in the face of climate change. Adaptive management, including rigorous and robust assessment of management effectiveness, provides a cyclical basis for upgrading management to meet these challenges. We are adapting/developing and applying world’s best practice “DIPSR” assessment frameworks to China’s tropical South China Sea coast, beginning with a test case at Sanya Bay, Hainan, in a collaboration with government management agencies and scientists. In China, as elsewhere, it can be difficult to implement timely and effective changes. However, the current, Chinese national (13th) Five Year Plan includes several important “ecocivilisation” policies that provide potentially powerful legal instruments for dramatic improvements in marine management. These include explicit emphasis on environmental management, marine protection, improved water management, poverty alleviation and the Rule of Law. Successful implementation would not only benefit China enormously, but provide international benefits and leadership.

Biography
Prof. Laurence McCook works in science-based management and conservation of marine ecosystems, especially coral reefs. Recently appointed Head of Oceans Conservation for World-Wide Fund for Nature (WWF) Hong Kong, he previously held a “President’s International Visiting Professorial Fellowship” from the Chinese Academy of Sciences, at the South China Sea Institute of Oceanology (SCSIO) in Guangzhou, China. He is also a Partner Investigator in the ARC Centre of Excellence for Coral Reef Studies at James
Cook University in Australia, adjunct Associate Professor at the University of Queensland, Australia, and Visiting Professor at Hasanuddin University in Makassar, Indonesia. Laurence has a Ph.D. from Dalhousie University, in Canada, and more than 30 years’ experience, including coral reefs in Australia, Indonesia and the “Coral Triangle”, the Pacific and Caribbean, as well as temperate ecosystems. He has worked with government, academic research, non-government and industry sectors, and international bodies such as the United Nations. He has more than 70 peer-reviewed, scientific publications, with >9,000 citations. Laurence was previously Senior Advisor to the Marine Program of Conservation International in Indonesia and from 2003 to 2014 worked for the Great Barrier Reef Marine Park Authority, focused on the scientific basis of management, including assessing management effectiveness. Before that, he spent 12 years at the Australian Institute of Marine Science, researching the ecology of coral reef resilience and degradation, the effects of water pollution, climate change and over-fishing. In 2005, Laurence was awarded a Pew Fellowship in Marine Conservation, which focused on enhancing the resilience of coral reefs and marine protected areas to climate change. Laurence’s work in China aims to strengthen management of coral reefs and tropical marine habitats generally. He is particularly interested in using natural capital and ecosystem service accounting to redress the mistaken perception that human development comes at the cost of nature conservation.

4. Maarten De Brauwer: A sea of change: Future methods in marine ecosystem monitoring

Abstract. Effective management of marine ecosystems is one of the biggest challenges in the Anthropocene. A sustainable blue economy has the potential to provide societal benefits ranging from food provisioning, to tourism, resource extraction, and cultural significance. Unfortunately, our current use of the ocean is far from sustainable and has led to collapsing fish stocks, rapidly degrading habitats, and a global pollution crisis. A crucial bottleneck in successful management is efficient and accurate monitoring of marine ecosystem health. The last two decades have seen a rapid development of new monitoring techniques beyond traditional visual surveys or reliance on fisheries catch data. In this talk I will explore the development of environmental DNA (eDNA) monitoring, a method that is rapidly gaining in popularity and seems to offer unbounded possibilities to monitor the marine environment. I will discuss the many practical applications that are already possible today, but also critically analyse the challenges and weaknesses of using eDNA for marine monitoring. Finally, I explore how this method might revolutionise the future of marine ecosystem monitoring.

Biography
Dr Maarten De Brauwer is a National Geographic Explorer, and a marine scientist. He got his PhD in Tropical Marine ecology from Curtin University, Australia. He currently works as a Research Fellow at the School of Biology, University of Leeds, where he is investigating human impacts on coral reefs in Southeast Asia, mostly in Indonesia. His work has tight links with scuba dive industry and the livelihoods of the people. His research focuses on rare and camouflaged species such as frogfishes and ghost pipefishes that are often found on volcanic sand. He investigates the abundance and distribution of these species and how they are affected by human impacts. He also looks into the value of these species to local communities and their importance to the development of tourism. At the moment he is testing new survey methods to make future research into cryptobenthic species easier. Email: M.DeBrauwer@leeds.ac.uk

5. Naomi M. Gardiner: Stability, certainty and family life in coral reef fish

Abstract. For people living on small islands and in coastal areas, healthy coral reefs provide land, protection from weather, food and income sources and many measures of social wellbeing. Coral restoration efforts, particularly in the Spermonde islands, are rebuilding the physical structure and stability of reef habitats. This talk explores the ecology & behaviour of coral reef fish, illustrating how a reef provides stable and predictable resources for fish life. I will introduce you to the cardinalfish family, one of the most abundant and diverse groups of reef fish. The way cardinalfish use coral habitats is surprisingly specific and their
locations on particular reefs may be highly constrained across generations. Herein we will explore the apparent importance of homes, neighborhoods and family relationships for fish’s lives. Coral restoration programs can be improved by measuring the behavioral response of various reef fish groups to different build and maintenance regimes. Coupling basic biological and ecological research with applications for management will help build and sustain stronger marine ecosystems for everyone.

**Biography**

Dr Gardiner is a marine biologist from James Cook University, Australia. She studies the behavior and ecology of coral reef fish, ecosystem health, and fisheries science. Her work provides important understanding on how marine ecosystems function which can then be used to identify potential ways to restore the health and productivity of our marine environments. To date, Dr Gardiner has been doing her field research work on reefs in Australia, Papua New Guinea and Indonesia. Email: Naomi.gardiner@jcu.edu.au, Twitter: @NaomiMGardiner

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**SESSION II**

1. Iain C. Neish: Adaptive phyconomy is a key to sustainable seaweed farming alliances in productive ecoscapes of Indonesia

**Abstract.** Phyconomy is the branch of applied phycology that comprises systems of art, science and technology applied to production systems that yield crops of algae. Through seaweeds, farmers turn seawater and sunshine into money. Adaptive marine phyconomy of tropical red seaweeds is an outstanding recent example of large-scale crop production that developed primarily from simple methods refined by farmers in the sea, but as of 2020 it is, arguably, much more art than science. Production ecoscape functions and market functions are inextricably intertwined. Every phyconomy action is influenced not only by energy and materials issues, but also by socio-economic transaction issues within business alliances. Ocean farming functions take place under conditions where environmental and socio-economic conditions are often uncertain, therefore adaptive approaches must be applied in a way that is not only resilient and sustainable, but is also ‘antifragile’ (in the sense of gaining strength from adversity; not merely surviving it). The present paper discusses how adaptive phyconomy art and science is being developed as a fundamental component of integrated coastal area management for sustainable marine ecoscape development.

**Biography**

Iain Neish is a Canadian phyconomist, marine biologist and businessman who has worked with seaweeds in aquaculture systems since 1965. He followed the lead of his father, Arthur C. Neish, who played a role in development of seaweed cultivation in Nova Scotia, Canada. Since 1977 most of Iain’s career involved seaweed farm development and factory installations in the Philippines, Malaysia and Indonesia. He has also worked in the Americas, Africa and India. More than 25 years of this work was conducted while Iain was working as consultant (then employee) of Marine Colloids (later FMC Corporation; then DuPont) until 1996. During that time, he was project manager for seaweed farm development and for construction of the world’s first factory that made semi-refined carrageenan (SRC) in Cebu City, Philippines. From 1996-2015 Iain undertook projects with various international organizations including IFC, GTZ, USAID, AusAID FAO, ILO and UNIDO and he also undertook seaweed-related projects with several private companies. He is currently engaged with innovative seaweed business ventures in Indonesia in his role as a director of PT Sea Six Energy Indonesia and Research and Development advisor to PT Sumber Tanaman Samudra. He is active in developing adaptive marine phyconomy for red seaweeds in tropical ecoscape villages. He lives with his Indonesian family in Bali and his field work is mainly around the Bali Sea.
2. Jamaluddin Jompa: Optimizing sustainably the full potential of marine mega biodiversity for Indonesian economic recovery during and after the Covid-19 Pandemic

Abstract. Most countries, including Indonesia, are experiencing economic recessions due to the Covid-19 pandemic. Some economic sectors, however, are still surviving and even growing, especially in the marine and fisheries sectors. Can the marine and fisheries sector contribute to Indonesian economic recovery given its well-known potential, productivity and mega biodiversity? The strategic geographic position of the Indonesian Archipelago, connecting the Pacific and Indian Oceans, facilitates marine processes to host the most diverse and largest tropical marine resources of the world. That incredible richness of biodiversity has been considered as the last treasure trove for future food security and potential for economic development. National investments in the utilization and management of marine biodiversity needs to be optimized such as for food security, science eco-tourism development, bioprospecting for drug discovery and energy, and deep-sea exploration. During the Covid-19 pandemic, although the fisheries sector was initially affected mainly due to logistical problems, this sector now seems to be relatively stable. However, due to rapid global economic development and technology over the last decade, coral reefs, mangroves, and other coastal resources in Indonesia have been severely degraded due to various factors such as overfishing, destructive fishing, mining, mangrove deforestation, sedimentation, pollution, and newly emerging serious concerns related to climate change and ocean acidification. Therefore, it is crucial to develop a balance between protecting the richness of our mega-biodiversity and at the same time improve our science and management strategy to optimize their economic potential sustainably.

Biography
Jamaluddin Jompa is a marine ecologist with considerable research experience on coral reef biology, marine biology, coral reef bio-prospecting and coral reef ecology and coastal management with many international publications and books produced in collaboration with international researchers and organisations. He accomplished his master degree at McMaster University (Canada) and doctoral degree at James Cook University (Australia). A Professor in Marine Science and Fisheries, Hasanuddin University, Makassar, Indonesia, he currently serves as the Dean of the Graduate School of Hasanuddin University, and the Chairman of the Center of Excellence for Marine Resilience and Sustainable Development. During his career, Jamaluddin Jompa has served a number of strategic positions, such as: Director of Research and Development Center for Marine, Coastal and Small Islands of Hasanuddin University, Chairman of Scientific Advisory Group for National Coordinating Committee of CTI (Coral Triangle Initiative), Board Member of Coral Triangle Center (CTC), Member of National Commission on Fisheries Stock Assessment, Ministry of Marine Affairs and Fisheries, Republic of Indonesia. In 2015, he was selected as the President of Indonesian Young Academy of Science (ALMI) and he was recently appointed a fellow of the Indonesian Academy of Sciences. He also holds title as a Pew Fellow for Marine Conservation under Project 2019, granted by The Pew Charitable Trust. Email: j.jompa@unhas.ac.id

3. Theresa Dabruzzi: Some like it hot: Evaluating temperature tolerance limits and quantifying the thermal niche

Abstract. The goal of this research is to examine temperature limitations and quantify the thermal niche of keystone, top-predator, and forage fish species from shallow rocky outcroppings, seagrass meadows, and mangrove habitats on and around Hoga Island, Southeast Sulawesi. These studies produce and refine predictive ecological and physiological models: thermal tolerance polygons. Thermal tolerance polygons are a tool used to quantify an animal’s thermal niche. This technique was initiated by Fry in 1947 and has changed the way in which we evaluate temperature utilization of ectotherms. Most fish are by definition, ideal ectotherms incapable of maintaining body temperatures other than that of the water they inhabit. As such, these species are particularly vulnerable to changing climatic conditions which are currently increasing in duration and intensity in the tropical western Pacific. Thermally sensitive species can be used as indicators of ecosystem responses to ongoing or predicted abiotic change, thereby playing an important role in building sound conservation practices that preserve vulnerable habitats, such as the Wakatobi Marine National Park. As there are relatively few thermal niche polygons in the literature, these data enable us to build an empirical
thermal ecology database. Having a compilation of thermal data allows for comparisons between populations living in different locations across the globe as well as different species living in the same habitat. These data have the potential to predict population shifts as a result of climate change in protected areas such as the Wakatobi Marine National Park.

Biography
Currently based in the Department of Biology, Saint Anselm College, Manchester, UK, Theresa obtained her Ph.D. on Animal Biology at the University of California, Davis. Her research focuses on whole organismal ecological physiology (how animals are adapted to their environment). She is especially interested in the adaptations of animals living in extreme environments. This would include habitats that experience large variation in environmental parameters, such as the intertidal, mangrove areas, and shallow reefs. She spend the summers in the Wakatobi National Park, Southeast Sulawesi, Indonesia working with animals across taxa, including cephalopods, crustaceans, elasmobranchs, teleosts, amphibians, and reptiles. Her experiments examine physiological adaptations across different animal groups so that we have a better understanding of the breadth and depth of animal adaptations. Her research also enables us to demonstrate how animals living in a single extreme habitat adapt differently to similar environmental stresses. Email: TDabruzzi@anselm.edu

4. Dominik Kneer: Late Holocene (0–6 ka) sea-level changes in the Makassar Strait, Indonesia

Abstract. The Spermonde Archipelago, off the coast of southwest Sulawesi, consists of more than 100 small islands and hundreds of shallow-water reef areas. Most of the islands are bordered by coral reefs that grew in the past in response to paleo relative sea-level changes. Remnants of these reefs are preserved today in the form of fossil microatolls. In this study, we report the elevation, age, and paleo relative sea-level estimates derived from fossil microatolls surveyed in five islands of the Spermonde Archipelago. We describe 24 new sea-level index points, and we compare our dataset with both previously published proxies and with relative sea-level predictions from a set of 54 glacial isostatic adjustment (GIA) models, using different assumptions on both ice melting histories and mantle structure and viscosity. We use our new data and models to discuss Late Holocene (0–6 ka) relative sea-level changes in our study area and their implications in terms of modern relative sea-level estimates in the broader South and Southeast Asia region.

Biography
Dominik was born and educated in Baden-Württemberg, Germany. He studied biology at the Free University in Berlin where he finished with the Diploma (MSc-equivalent) in 2006. He completed his PhD with the AWI (Alfred-Wegener-Institute for Polar and Marine Research) in 2013 and continued as a postdoctoral research fellow until 2016, spending much of his time in the field in Indonesia. His early research on the role burrowing shrimps play in seagrass meadow ecology has broadened to include further components of the tropical reef ecosystem such as mangrove forests and small islands, and how they react to anthropogenic influences like resource exploitation, coastal development and climate change. Over the years Dominik has supervised six international and six Indonesian Bachelor and Master students and helped them to collect data for their projects. He has experienced and mastered the challenges surrounding the realization of land and ship-based expeditions, importing equipment and exporting samples, as well as maintaining relations with the local stakeholders. Outside Indonesia he has experienced firsthand how coastal communities in countries as diverse as Thailand, China, Australia, Fiji, Morocco, the United States and Brazil, and many European countries manage their marine resources. In spite of the daunting challenges imposed by population and economic growth, resource overexploitation and conflicting priorities of local, regional and global stakeholders, Dominik remains convinced that a sustainable future is possible. He envisions a world where a reduction of poverty, an increased level of environmental awareness and global exchange of ideas has resulted in a truly sustainable management of our coastal resources.
5. Dr. Marc Kochzius: Genetic structure of coral reef and mangrove fauna in the Indo-West Pacific

**Abstract.** The Indo-West Pacific (IWP) is the largest and most diverse marine biogeographic region, stretching about two thirds around the world from the Red Sea and Western Indian Ocean (WIO) across Southeast Asia to the Central Pacific. The epicentre of marine biodiversity is the Coral Triangle (CT), which includes the eastern part of Southeast Asia, New Guinea and the Solomon Islands. The main biogeographic models trying to explain the evolutionary mechanisms that produce this megadiversity in the CT are: 1) centre of speciation, 2) centre of overlap, 3) centre of accumulation, and (4) centre of survival. During sea-level low stands of up to 130 m during the Pliocene and Pleistocene glacial periods, the exposed shelves in Southeast Asia and Australia formed the Indo-Pacific Barrier (IPB), which separated populations of the two ocean basins. A genetic differentiation of populations in the CT and adjacent areas across the IPB is evident for many marine taxa. The genetic differentiation across the IPB support the centre of overlap model, while fine scale genetic differentiations among populations in the CT and adjacent regions also indicate a centre of speciation. However, genetic studies also show strong differentiation of populations in peripheral regions of the IWP, such as the Red Sea, the WIO, as well as the Central Pacific. New species evolve in peripheral regions and are eventually exported towards the centre, providing support for the centre of accumulation model. It is obvious that not only one biogeographic model can explain the megadiversity in the hotspot of the CT, all three mechanisms are operating in concert. This is summarised in the biodiversity feedback model, in which the biodiversity centre exports species to peripheral regions, where these eventually evolve into new species due to isolation, which in turn can be exported back to the biodiversity centre.

**Biography**
Prof. Dr. Marc Kochzius has a focus on tropical marine ecology, including coral reefs and mangroves. Based in the Biology Department, Vrije Universiteit Brussel (VUB), Belgium, his main research topic is the connectivity of populations by pelagic early life history stages (eggs and larvae), which can potentially drift with ocean currents hundreds of kilometres. Since adults of most animals in these ecosystems are sedentary and do not migrate, dispersal by early life history stages is the only possibility to replenish exploited populations or to re-colonise disturbed habitats. Knowledge about these processes is important in the context of the design of marine protected area (MPA) networks and ecosystem resilience after natural or anthropogenic disturbance. Exchange among populations is investigated by using molecular genetic techniques (PCR, DNA sequencing, and microsatellites) and population genetic analysis. These genetic techniques can also aid species delineation (molecular systematics), species identification (DNA barcoding), and the reconstruction of evolutionary relationships (molecular phylogenetics). Another area of research is the multivariate analysis of community structures in comparison with environmental parameters. Natural and anthropogenic disturbances can have profound negative effects on the faunal community structure and function of marine ecosystems. Such studies can give insights into sometimes subtle responses of these communities to stressors. Email: marc.kochzius@vub.be