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5TH WORLD CONFERENCE ON MARINE BIODIVERSITY

Understanding the current state and importance of biodiversity in the marine environment

PeerJ Life & Environment

A *PeerJ Life & Environment* Conference Collection in association with the World Conference on Marine Biodiversity

PeerJ Life & Environment

5th World Conference on Marine Biodiversity

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5th World Conference on Marine Biodiversity

Collection Introduction

The 5th World Conference on Marine Biodiversity Collection - published in the *PeerJ Life & Environment journal* - collates research presented at the most recent edition of the WCMB series, which was held virtually by the University of Auckland, New Zealand.

The WCMB series first started in 2008, and has become a major focal assembly for sharing research outcomes, management and policy issues, as well as discussions on the role of biodiversity in sustaining ocean ecosystems. This meeting brings together scientists, practitioners, and policy makers to discuss and advance our understanding of the importance and current state of biodiversity in the marine environment.

The 5th edition of the WCMB saw over 400 delegates from 45 countries attend the 3-day conference.

At initial launch, this Conference Collection is formed of five published articles: the discovery of extensive fields of cyanobacteria-like mats that threaten coral health off Rapa Nui (Easter Island); a study into the distribution of 71,108 amphipods from 355 species across the Icelandic seabed; a model to predict the distribution of sponge and coral species in unexplored seamounts off South America; an investigation into a marine national park which is important for the dispersal and connectivity of coral reef-dwelling species in the South China Sea; and research into the biodiversity of Cumaceans in Nordic Seas.

Additional articles are still under consideration at PeerJ Life & Environment and will be added to this collection upon their publication.

Visit the 5th World Conference on Marine Biodiversity Collection homepage here

5th World Conference on Marine Biodiversity
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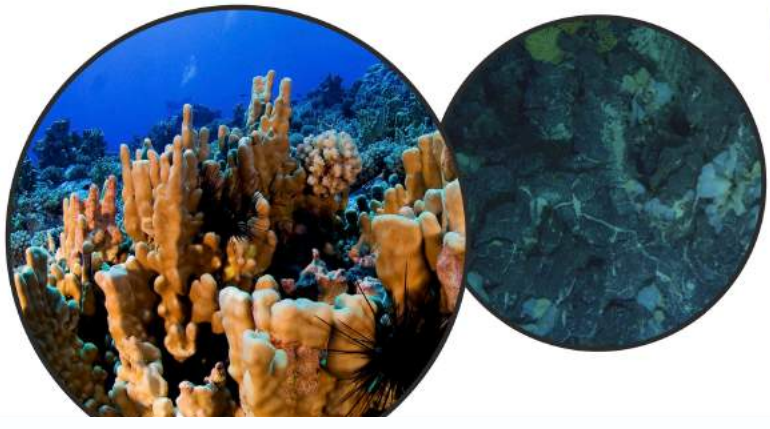
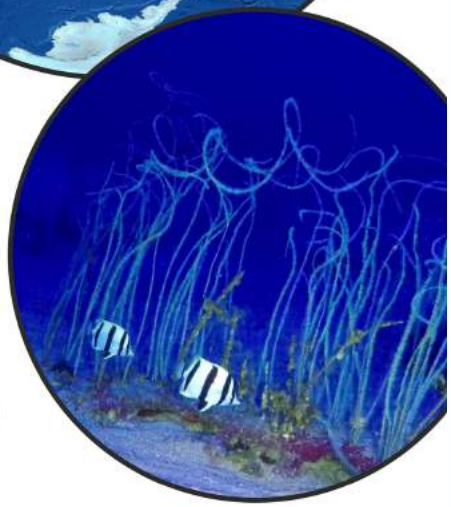
Guiding high seas conservation efforts by modelling coral and sponge habitat

SEAMOUNT RIDGES WITH RICH AND DIVERSE MARINE LIFE

The **Salas y Gómez and Nazca ridges are two seamount chains** off the coast of South America. The ridges contain more than **110 seamounts**, with summit depths ranging between over 3,000 meters to just a few meters below the surface.

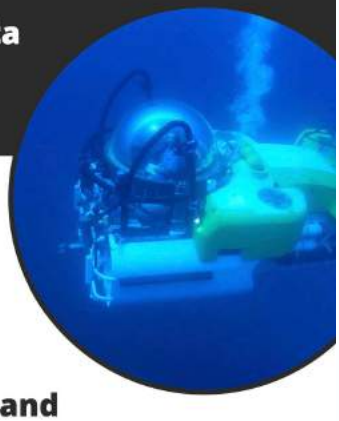
The ridges support an exceptionally rich diversity of marine life, inluding whales, corals and many other ecologically important species. The region also has the highest level of endemism found in any marine environment. For many groups of organisms, nearly half of the species that live there are not found anywhere else on Earth.





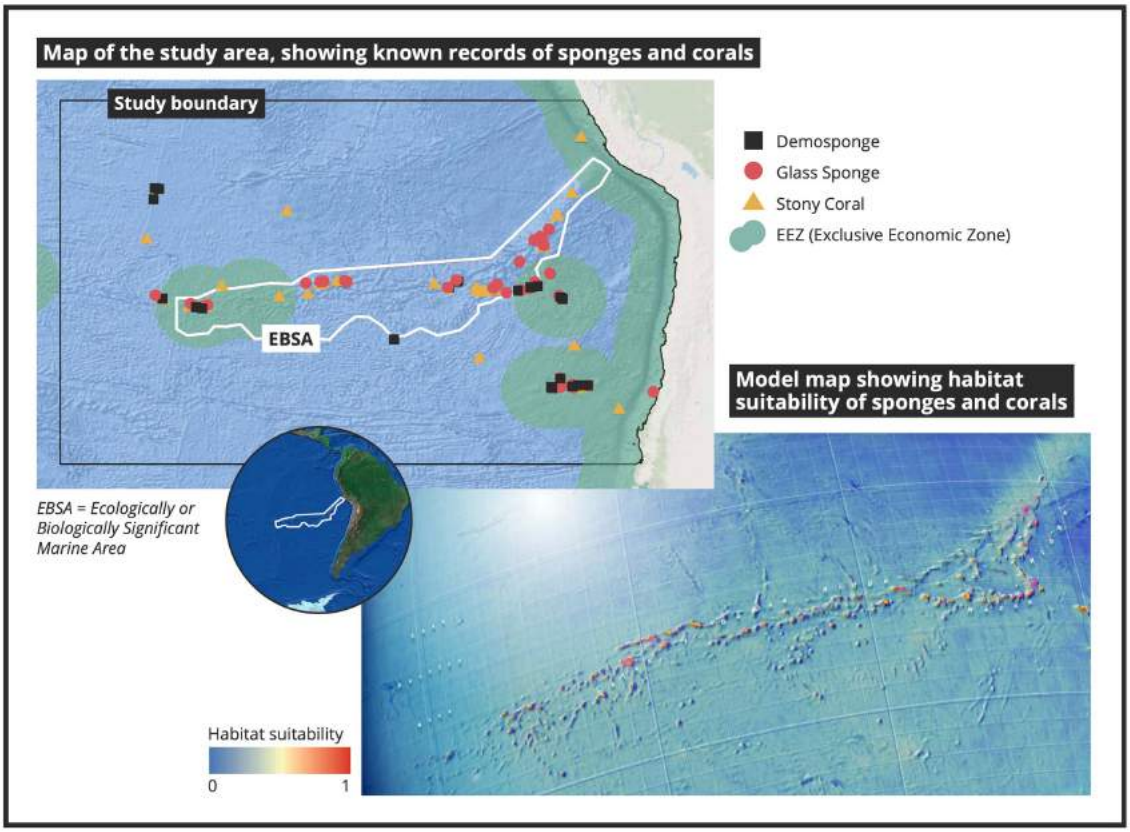
PROTECTING THE PRISTINE SEAMOUNTS

Despite some historical fishing in the region, the seamounts are relatively pristine. They are an excellent conservation opportunity to protect a global biodiversity hotspot before it is degraded. One **obstacle for effective protection is the scarcity of observational data from the region's deeper waters.**



MODELING DEEP-WATER CORAL AND SPONGE HABITAT

As a first step in mapping biodiversity along the ridges, we created **models that predict the distribution of sponges and corals**. These organisms create complex structures where diverse marine life is able to flourish.



Our models predict that the seamounts along both ridges contain highly suitable habitats for sponges and corals. This suggests that the ridges offer widespread suitable habitat for diverse marine life.

Our results strongly suggest that we must act quickly to protect these fragile habitats before they are damaged by human activities.

PeerJ

The modeled distribution of corals and sponges surrounding the Salas y Gómez and Nazca ridges with implications for high seas conservation

Samuel Georgian[1], Lance Morgan[1] and Daniel Wagner[2]

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ABSTRACT

The Salas y Gómez and Nazca ridges are two adjacent seamount chains off the west coast of South America that collectively contain more than 110 seamounts. The ridges support an exceptionally rich diversity of benthic and pelagic communities, with the highest level of endemism found in any marine environment. Despite some historical fishing in the region, the seamounts are relatively pristine and represent an excellent conservation opportunity to protect a global biodiversity hotspot before it is degraded. One obstacle to effective spatial management of the ridges is the scarcity of direct observations in deeper waters throughout the region and an accompanying understanding of the distribution of key taxa. Species distribution models are increasingly used tools to quantify the distributions of species in data-poor environments. Here, we focused on modeling the distribution of demosponges, glass sponges, and stony corals, three foundation taxa that support large assemblages of associated fauna through the creation of complex habitat structures. Models were constructed at a 1 km^2 resolution using presence and pseudoabsence data, dissolved oxygen, nitrate, phosphate, silicate, aragonite saturation state, and several measures of seafloor topography. Highly suitable habitat for each taxa was predicted to occur throughout the Salas y Gómez and Nazca ridges, with the most suitable habitat occurring in small patches on large terrain features such as seamounts, guyots, ridges, and escarpments. Determining the spatial distribution of these three taxa is a critical first step towards supporting the improved spatial management of the region. While the total area of highly suitable habitat was small, our results showed that nearly all of the seamounts in this region provide suitable habitats for deep-water corals and sponges and should therefore be protected from exploitation using the best available conservation measures.

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Additional Information and Declarations can be found on page 24

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Keywords Cold-water corals, Sponge, Deep sea, Species distribution modeling, Habitat suitability, Conservation, Areas beyond national jurisdiction

INTRODUCTION

The Salas y Gómez and Nazca ridges are two adjacent seamount chains stretching more than 2,900 km off the coasts of Peru and Chile (Fig. 1) (reviewed in *Wagner et al., 2021*).

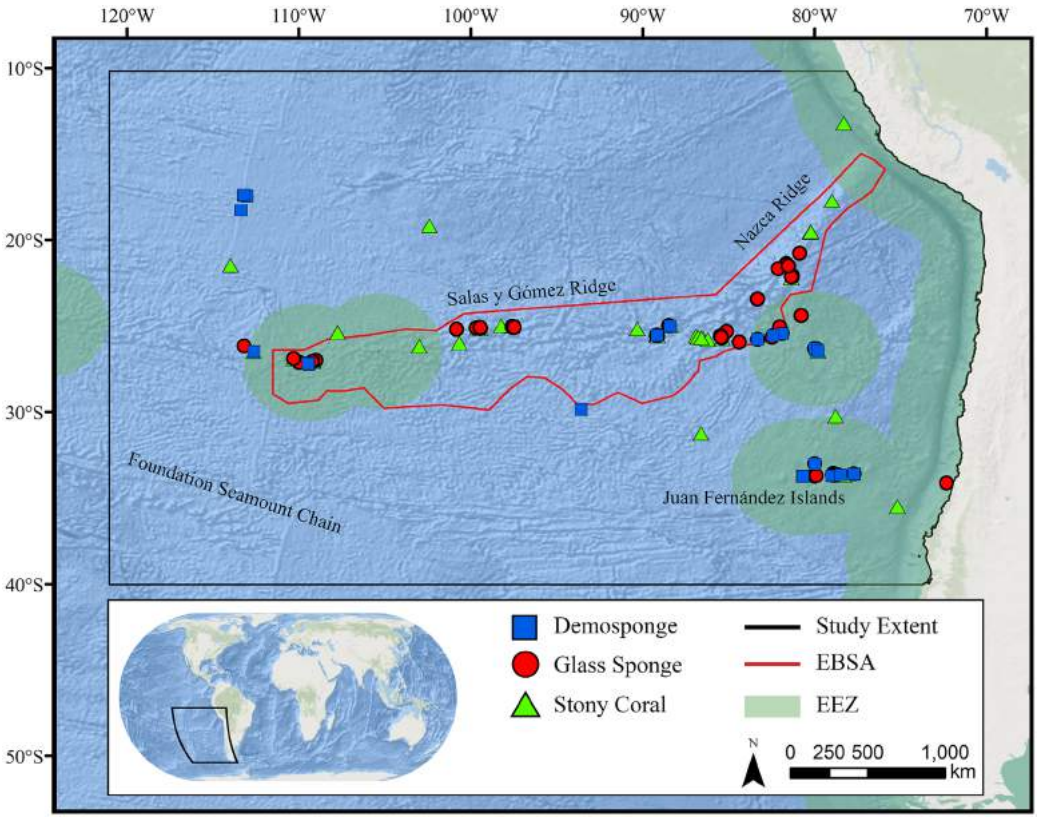

Figure 1 **Map of the study area.** The map shows the modeling extent, distribution of occurrence records for demosponges, glass sponges, and stony corals, national exclusive economic zones (EEZs), and Ecologically or Biologically Significant Marine Area (EBSA) designation.
Full-size DOI: 10.7717/peerj.11972/fig-1

Combined, the ridges contain more than 110 seamounts that were created between 2–27 million years ago by a geological hotspot located on the western edge of the Salas y Gómez Ridge (*Parin, Mironov & Nesis, 1997*; *Steinberger, 2002*). The limited exploration that has been accomplished along the ridges has revealed exceptionally high biodiversity as well as unusually high endemism, due in part to its isolation from South America by the Humboldt Current System and the Atacama Trench (*Parin, 1991*; *Comité Oceanográfico Nacional de Chile, 2017*). More than 40% of known fish and invertebrate species are endemic to the region, the highest level of marine endemism in the world (*Parin, Mironov & Nesis, 1997*; *Friedlander et al., 2016*). New species have frequently and recently been discovered on the ridges (*e.g.*, *Andrade, Hormazábal & Correa-Ramírez, 2014*; *Sellanes et al., 2019*; *Shepherd et al., 2020*; *Diaz-Diaz et al., 2020*), indicating that many new species remain to be discovered. The waters surrounding the Salas y Gómez and Nazca ridges provide important feeding grounds and migratory pathways for an array of important species, including billfish, sharks, sea turtles, seabirds and marine mammals (*Weichler et al., 2004*; *Shillinger et al., 2008*; *Yanez et al., 2009*; *Hucke-Gaete et al., 2014*; *CBD, 2017*; *Serratosa et al., 2020*). On the seamounts and neighboring island habitats, diverse benthic communities form around

shallow-water, mesophotic (*Easton et al., 2019*), and deep-water coral and sponge reefs (*Hubbard & Garcia, 2003*; *Easton et al., 2019*; *Friedlander et al., 2021*).

Deep-water corals and sponges are critical foundation species found in every ocean basin. The complex, three-dimensional habitat structures they produce support thousands of associated species including other invertebrates and commercially important fish (*Rogers, 1999*; *Costello et al., 2005*; *Cordes et al., 2008*; *Kenchington, Power & Koen-Alonso, 2013*). In addition to habitat creation, corals and sponges provide other critical ecosystem services including the alteration of local current regimes (*Dorschel et al., 2007*; *Mienis et al., 2009*), carbon cycling and long-term sequestration (*Oevelen et al., 2009*; *Kahn et al., 2015*), and nutrient cycling (*Wild et al., 2008*; *Tian et al., 2016*). Deep-water corals and sponges are also being increasingly used as avenues for research purposes ranging from biomedical research (*e.g.*, *Hill, 2003*; *Müller et al., 2004*) to reconstructing paleoclimate archives of climate change, pollution, and nutrients (*Smith et al., 2000*; *Williams et al., 2006*; *Cao et al., 2007*). The slow growth rates (*Prouty et al., 2011*), extreme longevity (*Roark et al., 2009*; *Fallon et al., 2010*), and life history strategies (*e.g.*, low recruitment; *Doughty, Quattrini & Cordes, 2014*) make these taxa extremely sensitive to anthropogenic disturbance, and the recovery of damaged communities may take many decades, centuries, or even longer (see *Ramirez-Llodra et al., 2011*; *Baco, Roark & Morgan, 2019*). Considering the extreme logistical difficulties and costs associated with restoration efforts in these remote habitats (*Van Dover et al., 2014*), improved conservation measures are urgently needed to protect these fragile ecosystems before long-term damage occurs.

Like most marine biodiversity hotspots, the Salas y Gómez and Nazca ridges are threatened by a variety of ongoing or imminent anthropogenic disturbances, including commercial fishing, marine debris and plastic pollution, seabed mining, and climate change (reviewed in *Wagner et al., 2021*). Despite these threats and the clear biological value of the ridges, protecting their sensitive benthic communities from anthropogenic disturbance is a complex challenge. Over 73% of the ridges are located in areas beyond national jurisdiction (ABNJ), commonly known as the high seas, where no one country has sole management responsibility and hence international cooperation is necessary. While the portions of the ridge located within the Chilean and Peruvian exclusive economic zones (EEZs) have several established marine protected areas (MPAs) (*MPAtlas, 2021*), the high seas portions of the ridges are more loosely regulated by intergovernmental agencies including the International Seabed Authority (ISA), the International Maritime Organization (IMO), the Inter-American Tropical Tuna Commission (IATTC), and the South Pacific Regional Fisheries Management Organisation (SPRFMO), which regulate seabed mining, shipping, and fishing, respectively. Despite ongoing United Nations negotiations to better protect vulnerable marine ecosystems (VMEs) on the high seas (*UNGA, 2007*; *Rogers & Gianni, 2010*), there is no legal mechanism to establish high seas MPAs that are applicable to all States or sectors. Industrial fishing occurs in an estimated 48% of ABNJ, with fisheries pushing into deeper waters each year as stocks deplete in shallower waters (*Visalli et al., 2020*). Commercial fishing in waters surrounding the Salas y Gómez and Nazca ridges has been relatively limited historically (*Wagner et al., 2021*), providing a unique opportunity to protect this diverse region before it is irrevocably

damaged. However, effecting strong protection in ABNJ is difficult due to the lack of clear legal mechanisms, competing interests, and lack of sufficient data in lesser-explored regions (*Gjerde et al., 2021*).

Species distribution models, also referred to as habitat suitability models, are important tools that help characterize the distribution and niche of taxa in data-poor regions. These models can be particularly useful for deep-water taxa on the high seas, where extremely limited surveys have occurred relative to shallow-water coastal areas (*Fujioka & Halpin, 2014*; *Ortuño Crespo et al., 2019*), and data availability is a considerable obstacle to improved conservation management and scientific advancement (*Vierod, Guinotte & Davies, 2014*; *Wagner et al., 2020*). Species distribution models statistically couple the known distribution of species with relevant environmental parameters to predict niche and distribution in unsurveyed geographic regions or under varying environmental conditions (*Guisan & Zimmermann, 2000*; *Miller, 2010*). Quantifying the biogeographic distribution of ecologically important or threatened species is critical for designing and implementing management plans, shaping future research and exploration efforts, and assessing past, present, and future anthropogenic impacts. Increasingly, species distribution models are being developed specifically to inform marine conservation and management (*e.g.*, *Rowden et al., 2017*; *Georgian, Anderson & Rowden, 2019*) or to predict responses to recent anthropogenic disturbances (*e.g.*, *Georgian et al., 2020*). Models have been successfully developed for a large variety of benthic taxa, including global models for stony corals (*Davies & Guinotte, 2011*), black corals (*Yesson et al., 2017*), octocorals (*Yesson et al., 2012*), and gorgonian corals (*Tong et al., 2013*), as well as large-scale regional sponge models (*e.g.*, *Knudby, Kenchington & Murillo, 2013*; *Chu et al., 2019*). Given their status as foundation species, and the frequent classification of these taxa as indicators of VMEs, which SPRFMO and other fishery management organizations are mandated with identifying and protecting (*e.g.*, *Penney, Parker & Brown, 2009*), it is critical to quantify their distribution.

An improved understanding of the spatial distribution of key taxa throughout the Salas y Gómez and Nazca ridges is necessary for the evidence-based conservation of the region. The suitability modeling in this study will inform ongoing efforts to identify and prioritize key conservation targets along the ridges (see *Wagner et al., 2021*), reinforcing the increasingly clear need to protect sensitive benthic fauna in the region from further exploitation and disturbance from anthropogenic sources. In addition to conservation planning, these models will also support future expedition planning, and will improve our understanding of the niche of cold-water corals and sponges throughout the region.

MATERIALS & METHODS

Study area

The study area encompassed a large region (15,991,101 km^2) of the southeast Pacific Ocean centered on the Salas y Gómez and Nazca ridges off the coasts of Peru and Chile (Fig. 1). This area contains 755 seamounts and guyots covering a total area of 561,452 km^2 (3.5% of the total area; geomorphology data from *Harris et al., 2014*). The region includes

an area that has been recognized as an Ecologically or Biologically Significant Marine Area (EBSA) by the Conference of the Parties to the Convention of Biological Diversity (*CBD, 2014*). The EBSA extends around the ridges (Fig. 1) and includes roughly 285 seamounts and guyots covering a total area of 294,225 km^2 (17.2% of the EBSA area). The region is bounded on the eastern side by the Atacama Trench, which along with the Humboldt Current System isolates the ridges from South America (*Von Dassow & Collado-Fabbri, 2014*). The Nazca Ridge is comprised primarily of a large plateau, while the Salas y Gómez Ridge is mostly comprised of a series of smaller seamounts, escarpments, and ridge features (Fig. S21). Seamounts and features farther east along the ridges are progressively older and deeper (*Rodrigo, Díaz & González-Fernández, 2014*). Closer to the South American coast, a series of deep-water canyons extends into the Atacama Trench, while farther offshore the terrain is dominated by a series of large spreading ridges as well as smaller seamounts, ridges, and escarpments. The study area is primarily categorized as abyssal, with the Atacama Trench extending into hadal environments and small areas along the coasts, islands, and shallower seamounts extending upwards onto the slope and shelf (Fig. S22).

Occurrence records

Geo-referenced coral and sponge records were obtained from the Ocean Biodiversity Information System (*OBIS, 2020*), the NOAA Deep-Sea Coral and Sponge Database (*NOAA, 2020*), and records from recent expeditions to the area (J. Sellanes and E. Easton, 2020, unpublished data). All records were obtained as presence-only records, with duplicate records removed prior to analysis. The bulk of records were focused on the Salas y Gómez and Nazca ridges, with another cluster of records in the neighboring Juan Fernández Islands region. We chose to focus on three higher taxonomic groupings that are often key foundation species on seamounts: stony corals (Order: Scleractinia, $n = 233$), demosponges (Class: Demospongiae, $n = 275$), and glass sponges (Class: Hexactinellida, $n = 134$) (Tables S3–S5).

Pseudoabsence records

Species distribution models are ideally constructed using either presence-absence or abundance datasets (*Winship et al., 2020*). However, obtaining high-quality, true absence data is often difficult or impossible in remote environments, and particularly for deeper-water species. Even when absences are recorded, they may reflect the lack of systematic observations throughout the entire study area rather than true absence (particularly given the narrow field of view of most submersibles or towed camera arrays and similar issues with other sampling techniques such as tows or dredges). Inferring suitable habitat from absence data may also be misleading due to dispersal limitation, biotic interactions, or historical disturbances (*e.g., Hirzel et al., 2002*). Researchers are increasingly developing methods that account for the lack of true absence data by using sophisticated methods to produce better-than-random pseudoabsence or background data (*e.g., Iturbide et al., 2015*).

Related Content

Navigating paths through science as early career researchers: A WCMB panel discussion

Navigating the winding, complicated, uncertain path through science can be stressful even for seasoned scientists, and often completely overwhelming for early career researchers. A useful method to provide a roadmap for this path is to learn from those who have walked it before you. With this in mind, we hosted a panel at the 5th World Conference on Marine Biodiversity with Maria Dornelas, Graham Edgar, Madeleine van Oppen, and Moriaki Yasuhara to discuss their paths through marine science and offer advice to early career researchers. Here, we share the stories, recommendations, and advice they conveyed to the audience during the panel.

Trevyn Toone, Elin Thomas, Georgia Sarafidou, and Ariadna Nocera

Members of the WCMB Early Career Committee

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Prof Madeleine van Oppen

Dr Maria Dornelas

Dr Moriaki Yasuhara

Prof Graham Edgar

The adage that one's journey through life is never straight was exemplified by our panellists' routes from their doctorates to their current positions. Dr. Edgar was quick to volunteer that he has never had a permanent job, rather bouncing between fellowships and contract positions. This path was not without its downsides including a lack of job security; however, he enjoys the freedom it allows to shift between different interesting ideas. Dr. Dornelas's career has also followed a winding path including a series of postdocs, a child, and multiple moves before her position at the University of St. Andrews. Dr. Yasuhara moved to the U.S. from Japan as a postdoc before moving back to East Asia to take up his current position in Hong Kong. This multi-national journey was shared by Dr. van Oppen who moved between the Netherlands, England, and Australia for various opportunities before ultimately negotiating her current Australian position.

Science is a marathon not a sprint, and it is vital to focus on your successes and future rather than drowning in negative feedback.

For early career researchers just starting on their path through science, our panellists emphasized the importance of learning skills outside your comfort zone. For example, seeking colleagues within your lab who can help teach new techniques or connecting with someone outside the lab who can bring in new ideas.

Looking to the future, we asked our panellists how they stay positive in a field like conservation and marine biodiversity where trends can often be negative. The responses ranged from the metaphysical ("the Great Barrier Reef did not exist 2 million years ago and will not exist in 2 million years") to the eminently practical ("go for a walk"). Overall, however, the panellists agreed that passion for the environment and the world around us can motivate any researcher to look past the negatives and embrace the future.

Finally, we offered each of our panellists the opportunity to provide one final piece of advice to early career researchers. Dr. van Oppen recommended studying statistics and developing the quantitative skills that are necessary for wrangling the large data sets that have come to define conservation science, while Dr. Moriaki advised having a strong skin and not worrying about rejection. Dr. Edgar recommended broadening horizons and generalizing results to larger audiences. Dr. Dornelas, on the other hand, was succinct: "be curious, and be stubborn".

******

Our paths through life and through science are circuitous, but hopefully the thoughts and words of our panellists will be inspiring and helpful to early career researchers. We want to offer our sincerest thanks to WCMB for organizing and allowing us to host this event and, of course, to the four wonderful panellists for sharing their time and thoughts.

PeerJ Blog

Navigating Early Careers as Women in Marine Science: A WCMB panel discussion

Every scientist transitions through the initial phases of their career as an early career researcher. It is a challenging career phase, marked by numerous transitions, short term contracts and a lot of uncertainty. In addition, navigating this phase as women in marine science can bring extra challenges of its own. To provide guidance and advice, the brilliant Dr. Suchana Apple Chavanich, Dr. Lisa Levin, Dr. Patricia Miloslavich, and Dr. Amanda Bates accepted our invitation to be panellists in a forum specifically for female early career researchers at the 5th World Conference of Marine Biodiversity. During an online panel discussion with over seventy participants, they answered moderator and audience questions relating to women's early careers in science. The four accomplished panellists shared their own experiences and thoughts on the early career process.

Emilee D. Benjamin, Erin Satterthwaite, Priscila M. Salloum, Jasmin M. Schuster

Members of the WCMB Early Career Committee

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Dr. Suchana Apple Chavanich

Dr. Lisa Levin

Dr. Patricia Miloslavich

Dr. Amanda Bates

What was your path from early career researcher to the permanent academic position you now hold?

The panellists shared their journey from their PhDs to their current position, which included overcoming challenges like moving to different places and failed job applications. Dr. Bates said she wanted to travel the world, so had some breaks from academia, but she always ended up returning to science. Dr. Miloslavich did not have such gaps, but moved to a number of different countries for postdocs and research, while raising her three children with her husband. Dr. Levin changed to a slightly different field, from zoology to oceanography, after working as a consultant and realizing she was much happier in science. From their

answers, it was clear that it can be hard to make decisions such as coming in and out of academia, moving places and changing fields, but the answers of all panellists echoed the essence of what has really driven them through their journeys: a passion for science.

How have you balanced life with your career?

Women in particular face a lot of pressure to balance life and career, and women scientists are no exception. The panellists agreed that it is hard to balance having enough time for your kids, spouse, students, and research, but Dr. Levin emphasized that it is important to not be hard on yourself and to understand that you are doing the best you can. Dr. Miloslavich added that having a supportive partner is important, but that Moms are priceless when it comes to childcare. She acknowledged that when your children are young it can be difficult to balance your life and your career, but she also said that, “It isn’t going to be easy, but it can be done.” Dr. Bates added that it is important to know yourself and to put energy into what is important for you, so you can enjoy those things.

What would be important on a CV for getting a postdoc?

A central piece of advice from panellists was to be open to opportunities and work in a collaborative way. The panellists suggested that building relationships, being open to opportunities, and making sure to work in a connected, networked way is essential. Dr. Bates also suggested that you often can’t predict what someone is looking for by the job description. She encouraged recent grads to explore many career options in different sectors.

Do you have any advice for people that are trying to move from the postdoc loop to a permanent position?

The panellists highlighted the importance of multidimensionality in this context. Dr. Levin advised accepting opportunities that give you new skills, especially if you have multiple choices available to you; choose the ones that add something new to your skillset. She added that, “After all, a range of skills could lead to your dream job.”

In times where you felt it was hard to be a woman in academia what kept you going?

It can be hard being a woman working among male colleagues, and Dr. Chavanich agrees with that. But she said that she was inspired by Sylvia Earle, and that having role models, as well as using whatever support from resources available in your institution can help. Dr. Levin said that there was not much institutional support when she was an early career researcher, and that women used to sacrifice everything, including family, for their careers. However, she had a close group of female friends that supported each other. Thus, regardless of where support is coming from, it is key to face those hard moments, and reach out for support - nobody should feel alone.

Any last-minute words of advice, specifically for women in science?

The session closed with some final words by Dr. Miloslavich who said: “Your body is strong now and you have the ability to do things that you won't be able to do in 20 years; enjoy your life, do sports, dance, read, go hiking, take time for yourself and keep your body young in spirit as long as you can.”

PeerJ Awards Winners at the 5th World Conference on Marine Biodiversity

The PeerJ Awards program aims to support students and early career researchers by highlighting their work, as well as bringing continued awareness to the benefits that open access has in keeping science open and available to all.

PeerJ sponsored four Early Career Researchers awards at the 5th WCMB – two for presentations and two for posters – the winners of each receiving a free publication in any PeerJ journal (subject to peer review).

Yi-Yang (Alex) Chen PhD candidate at the Australian National University, Australia

Can you tell us a bit about yourself and your research interests?

I'm originally from Taiwan, now doing my PhD with Dr. Rebecca Fox and Dr. Michael Jennions at the Australian National University. I'm interested in the feeding preferences of reef fishes, and how much production they can access from epifaunal invertebrates in tropical seascapes.

Can you briefly explain the research you presented at the WCMB conference?

I've presented one chapter of my PhD thesis which was about the secondary production from macroalgae-associated epifaunal invertebrates. I've found that epifaunal production was positively correlated to macroalgal canopy size, and can be affected by predatory fish biomass and sea temperature. I've also found that epifaunal production was sensitive to environmental disturbances. Understanding how epifaunal production response to changing habitats can help us model the consequences of marine warming events.

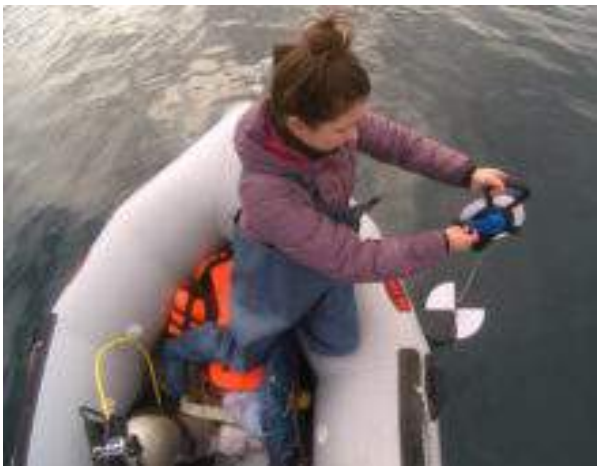
What first interested you in this field of research?

I was born and raised in Taiwan, a beautiful island surrounded by seas which is famous for its amazing marine biodiversity. I've been obsessed with marine animals since I was a child.

How did you find the virtual conference experience?

I'm still trying to get used to this new trend. Missing the chance of attending the conference and meeting outstanding people in person was quite frustrating. But I did find that this time I was able to watch all the talks I was interested in. I was also motivated by everybody's passion for marine research that can not be stopped by COVID-19.

Ariadna Nocera PhD candidate at the National University of Patagonia San Juan Bosco - CONICET, Argentina



Can you tell us a bit about yourself and your research interests?

I'm a marine biologist from Argentina who later specialized in biological oceanography in Canada. In 2018 I started my PhD focused on zooplankton dynamics in coastal marine ecosystems in northern Patagonia. I'm interested in how these organisms that are fundamental for marine food webs can change under future possible scenarios, but first it is important to update the baseline studies.

Can you briefly explain the research you presented at the WCMB conference?

I presented the most recent data from the Valdés Biosphere Reserve, corresponding to the composition and abundance of zooplankton in relation to environmental variables. This involved sampling at sea and the identification of hundreds of organisms under a stereo microscope.

What first interested you in this field of research?

I think I was always curious about how small organisms can have such a big influence on other larger organisms, and even on an entire marine ecosystem. I started the study through modeling and now looking more closely at their characteristics, morphologies and behavioral differences allow me to pose new questions that motivate even more my interest in these incredible organisms.

How did you find the virtual conference experience?

Even if there is still less interaction between researchers when compared to an in-person one, the virtual conference gave me the opportunity to participate at WCMB that otherwise would have been more difficult due to the distance and travel costs. It also allowed me to be part of the Early Career Researcher Committee, which organized two different panels during the conference, while interacting with young researchers from different countries. It was definitely a very positive experience and I recommend it!

Dr. Shang Yin Vanson Liu discusses the role Dongsha Atoll plays in connecting the coral reefs of the South China Sea

Can you tell us a bit about yourself?

Hi, I am Dr. Shang Yin Vanson Liu, currently an associate professor at the Department of Marine Biotechnology and Resources, National Sun Yat-sen University. I am a molecular ecologist and have an interest in marine biodiversity and the evolutionary processes of reef organisms.

Can you briefly explain the research you published in PeerJ?

Well, this study is an international collaboration of marine biologists and students from Taiwan, the United States, Sweden and Indonesia funded by NSC (National Science Council, US) and MOST (Ministry of Science and Technology, Taiwan) who were interested in understanding the role that Dongsha Atoll plays in connecting the coral reefs of the South China Sea (SCS). Dongsha Atoll, located 340 km southeast of Hong Kong and 850 km southwest of Taipei, with an area of about 600 km^2, is the largest and oldest atoll in the South China Sea.

In this study, by comparing DNA sequences obtained from 9 reef species collected at Dongsha atoll with sequences from nearby populations in a database compiled by DIPnet, we found that species with larvae that spend a relatively short duration in the plankton (< 40 days) tend to rely on Dongsha as a critical stepping-stone that connects SCS reefs which indicate its' importance in term of marine connectivity in the SCS.

Do you have any anecdotes about this research?

The data collecting of this study was done by a group of students from California State University, Monterey Bay and National Sun Yat-sen University under the supervision of Dr. Eric Crandall and I. It was fun to see how this joint project impacts their career and with interesting findings and fruitful results. The field trip led by scientists from three nations in 2017 to the Dongsha atoll was also amazing, Dongsha Atoll Research Station (DARS) is equipped with well-established facilities and equipment that we need for sampling with SCUBA (https://dongsha-mr.nsysu.edu.tw/) around the atoll and the diversity and coral coverage was stunning.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