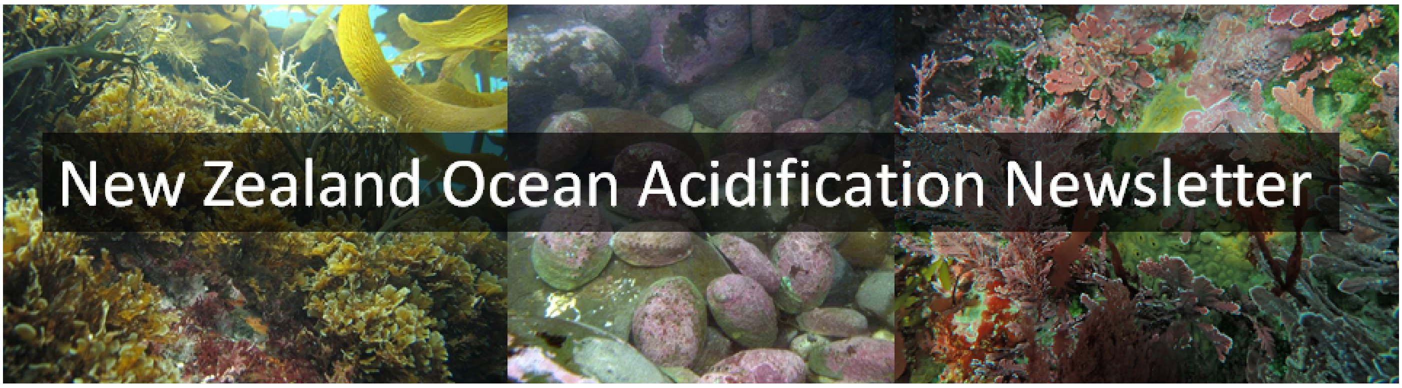
#69– November 2020 (http://nzoac.nz/)



Local News

14th annual New Zealand Ocean Acidification Conference – Dunedin Feb 11th to 12th 2021

Registration is now open for the 14th annual NZOAC Conference: *Ocean Acidification in a Decade of Ocean Science*. The conference will be held in Dunedin, New Zealand on 11 and 12 February 2021.

Please be aware of the following deadlines:

- 11 December: abstract submission
- 25 January: sign-up for the conference dinner and pre-dinner event
- 1 February: conference registration
- 1 February: registration for the early career pre-conference workshop (Experimental Design for Multiple Driver Research)

Please use the following form to register for the conference:

https://docs.google.com/forms/d/e/1FAIpQLSdvkX29N7JjSTzKCMRYLBz9pCP7JkFj8RoftyYzk_uc32vLvw/viewform

The abstract template is attached to this email, but can also be downloaded from the form.

Contact Habibeh Hashemi (hasha142@student.otago.ac.nz) if you have questions about the event, registration or the Google form.

Kind regards,

The organising committee (Christopher Cornwall, Grace Cowley, Kim Currie, Habibeh Hashemi, Linn Hoffmann, Christina McGraw)

Global news:

New Seacarb version available:

The R package seacarb calculates parameters of the seawater carbonate system and includes functions useful for ocean acidification research. It has just been updated to v3.2.14. It is recommended to use this version rather than any of the earlier ones. The new or updated functions are listed below; the seacarb ChangeLog provides more details:

Update: all functions using K1 and K2 now provide 3 additional formulations to calculate these constants: Millero et al. (2002), Papadimitriou et al. (2018) and Sulpis et al. (2020). This is particularly useful for polar waters. Also added are the formulations of Mojica Prieto et al. (2002). Thanks to Olivier Sulpis for his assistance.

Jean-Pierre Gattuso, Jean-Marie Epitalon, Heloise Lavigne and James Orr (2020). seacarb: Seawater Carbonate Chemistry. R package version 3.2.14. https://CRAN.R-project.org/package=seacarb

Jobs:

Coral Reef Postdoc

Location: Mote Marine Laboratory – Elizabeth Moore International Center for Coral Reef Research and Restoration (IC2R3), Summerland Key, Florida
Primary Function: The Coral Resilience Postdoctoral Researcher will primarily be responsible for overseeing the integration of resilience into Mote's coral restoration pipeline, including conducting research on resilient traits, potential tradeoffs, and managing the thoughtful implementation of resilient traits into restoration practices.
Primary Duties:

- Assist in managing Mote's coral resilience research efforts, specifically focused on quantifying heat tolerance, resilience to ocean acidification and resistance to disease of Mote's restoration corals.
- Mentor Staff Biologist(s) on-site conducting day-to-day resilience research activities within Mote's
- Climate and Ocean Acidification Simulator system.
- Be a leader in Mote's coral research efforts by providing guidance, perspective and initiative for transformative research applications to keep Mote within the forefront of coral reef research and restoration science
- Oversee Mote's coral resilience testing activities at IC2R3 and communicate findings to Mote's coral restoration programs to facilitate the integration of knowledge
- Represent Mote's Coral Health and Disease Program within workshops, partner meetings, and collaborative initiatives.
- Oversee data management of the coral resilience research deliverables and additional related research projects within the scope of funded grants
- Conduct data analyses, create reports and publish peer-reviewed articles on Mote's coral resilience science
- Lead efforts to collate and manage phenotypic data into Mote's trait database
- Liaise with partners and local managers associated with integrating resilience within coral restoration including, but not limited to, the Florida Keys National Marine Sanctuary and Florida Fish and Wildlife.
- Write grants for additional financial support that further Mote's coral reef research efforts Additional duties, as assigned, related to the daily operation of a full-service marine laboratory, including outreach and education activities as needed.

Minimum Qualifications or Requirements:

- PhD degree in the marine or biological sciences from an accredited college or university. Ability to obtain a valid Florida driver's license.
- Ability to obtain AAUS dive certification
- Ability to be an adaptable and collegial member of team, self-motivated and complete assigned tasks in a timely manner.

Required Knowledge, Skills, and Abilities:

- Experience with conducting 'resiliency' research on Caribbean corals.
- Some experience in coral restoration activities a benefit, but not required
- Experience in quantifying coral physiological traits
- Ability to conduct extensive statistical applications to large data sets
- Strong independent writing skills
- Publication history appropriate for Postdoctoral Scientist level position.
- Ability to secure funding through competitive grants or philanthropic sources

- Ability to identify Florida stony corals.
- Ability to work outdoors, for long hours, in a tropical climate.
- Lift heavy objects or equipment up to 50 lbs required.
- Normal hours are 8-hour workdays M-F; however, weekend and evening hours may be required at times.

Interested applicants should submit as a single electronic file, 1) a cover letter, 2) resume, and 3) the names and contact information for three references, before 5 pm November 16, 2020, to HumanResources(at)mote.org. Alternatively, a single package of all requested elements may be submitted to Mote Marine Laboratory, Attn: Human Resources, 1600 Ken Thompson Parkway, Sarasota, FL 34236. Anticipated start date: January 2021

More information.

Staff Chemist:

The Ocean Acidification Program at Mote Marine Laboratory seeks a staff chemist with a minimum 2 years of experience in analytical chemistry including experimental seawater ocean acidification facilities and focus in carbonate chemistry. This position will be permanently located in Summerland Key, Florida at the Elizabeth Moore International Center for Coral Reef Research and Restoration (IC2R3). General duties to be performed include working with research-focused outdoor raceways and the CAOS (Climate and Acidification Ocean Simulator) at IC2R3. This includes sample collection, monitoring and analysis of total seawater alkalinity, dissolved inorganic carbon, spectrophotometric pH, and other water quality parameters. The staff chemist performs statistical data analyses to process carbonate chemistry data and disseminating that information to users of the CAOS system. Tasks also include maintaining the dry ocean acidification (OA) laboratory, maintaining the dry chemistry laboratory, keeping track of and ordering all supplies and materials, keeping all OA-related work organized, instrument maintenance, data entry, working with visiting scientists, some coral husbandry, and some field work. The staff chemist will be responsible for managing and mentoring student interns year round. This position might longer days and weekend work. Travel to the main lab in Sarasota, Florida is possible. Must be able to lift up to 40 lbs. and must be able to work in a hot/outdoor environment.

Requirements:

- BS required, M.S preferred. Preferably with a chemistry or ocean acidification background.
- Knowledge of coral reef ecosystems
- Working knowledge of carbonate chemistry processes and instrumentation.
- Familiar with standard computer software (Excel, Word, etc.), data handling applications such as R and database management
- U.S. citizenship or foreign citizen's U.S. work permit appropriate for the work is required

Special Qualifications:

- Knowledge of ocean acidification, CO2Sys or CO2Calc, and monitoring equipment
- Previous laboratory and experimental systems experience, especially with carbonate chemistry instruments
- Familiar with marine organism experimental testing equipment (pH monitoring probes, temperature probes, tanks, pumps, filters, heaters, etc.)
- Strong troubleshooting and problem solving skills
- Ability to work autonomously
- Very organized with great attention to detail
- Willing to work with groups from other institutions
- Ability to move, live and work in a remote location (Florida Keys)
- Open water SCUBA, AAUS Scuba preferred
- Boat handling skills, US Coast Guard OUPV/Six-pack Captain's License preferred

Interested applicants should submit as a single electronic file, 1) a cover letter, 2) resume, and 3) the names and contact information for three references, before 5pm December 1, 2020 to HumanResources(at)mote.org. Alternatively, a single package of all requested elements may be submitted to Mote Marine Laboratory, Attn: Human Resources, 1600 Ken Thompson Parkway, Sarasota, FL 34236.

All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, protected veteran status or other protected category. Mote participates in E-Verify.

More information.

Selection of recent papers

Diffusive boundary layers and ocean acidification: implications for sea urchin settlement and growth. Chemical changes in the diffusive boundary layer (DBL) generated by photosynthesising macroalgae are expected to play an important role in modulating the effects of ocean acidification (OA), but little is known about the effects on early life stages of marine invertebrates in modified DBLs. Larvae that settle to macroalgal surfaces and remain within the DBL will experience pH conditions markedly different from the bulk seawater. We investigated the interactive effects of seawater pH and DBL thickness on settlement and early post-settlement growth of the sea urchin *Pseudechinus huttoni*, testing whether coralline-algal DBLs act as an environmental buffer to OA. DBL thickness and pH levels (estimated from well-established relationships with oxygen concentration) above the crustose coralline algal surfaces varied with light availability (with photosynthesis increasing pH to as high as pH 9.0 and respiration reducing pH to as low as pH 7.4 under light and dark conditions, respectively), independent of bulk seawater pH (7.5, 7.7, and 8.1). Settlement success of *P. huttoni* increased over time for all treatments, irrespective of estimated pH in the DBL. Juvenile test growth was similar in all DBL manipulations, showing resilience to variable and low seawater pH. Spine development, however, displayed greater variance with spine growth being negatively affected by reduced seawater pH in the DBL only in the dark treatments. Scanning electron microscopy revealed no observable differences in structural integrity or morphology of the sea urchin spines among pH treatments. Our results suggest that early juvenile stages of *P. huttoni* are well adapted to variable pH regimes in the DBL of macroalgae across a range of bulk seawater pH treatments.

Houlihan E. P., Espinel-Velasco N., Cornwall C. E., Pilditch C. A. & Lamare M. D., in press. Diffusive boundary layers and ocean acidification: implications for sea urchin settlement and growth. *Frontiers in Marine Science.* Article.

Ideas and perspectives: when ocean acidification experiments are not the same, reproducibility is not tested. Can experimental studies on the impacts of ocean acidification be trusted? That question was raised in early 2020 when a high-profile paper failed to corroborate previously-observed impacts of high CO_2 on the behavior of coral reef fish. New information on the methodologies used in the replicated studies now provides the explanation: the experimental conditions were substantially different. High sensitivity to test conditions is characteristic of ocean acidification research; such response variability shows that effects are complex, interacting with many other factors. Open-minded assessment of all research results, both negative and positive, remains the best way to develop process-based understanding of those responses. Whilst replication studies can provide valuable insights and challenges, they can unfortunately also be counter-productive to scientific advancement if carried out in a spirit of confrontation rather than collaboration.

Williamson P., Pörtner H.-O., Widdicombe S. & Gattuso J.-P., in review. Ideas and perspectives: when ocean acidification experiments are not the same, reproducibility is not tested. *Biogeosciences Discussions.* Article.

Resilience of the temperate coral *Oculina arbuscula* to ocean acidification extends to the physiological level. Both juvenile and adult life stages of the temperate scleractinian coral *Oculina arbuscula* are resilient to the effects of moderate ocean acidification (OA) in contrast to many tropical corals in which growth and calcification rates are suppressed. Here, potential mechanisms of resilience to OA related to photosynthetic physiology and inorganic carbon processing were studied in adult *O. arbuscula* colonies. After exposing colonies to ambient and elevated carbon dioxide (CO2) treatments for 7 weeks, photosynthetic performance was characterized using photosynthesis versus irradiance experiments, chlorophyll fluorescence kinetics, and algal pigment content. Inorganic carbon-processing capabilities were assessed by measurement of internal and external carbonic anhydrase activity of the coral host, internal carbonic anhydrase activity of symbiotic algae, and the reliance of photosynthesis on external carbonic anhydrase. Photosynthetic physiology was unaffected by OA ruling out the possibility that resilience was mediated by increased photosynthetic energy supply. Carbonic anhydrase activities were maintained at elevated CO2 suggesting no major rearrangements of the inorganic carbon-processing machinery, but this could be a sign of resilience since tropical corals often down-regulate carbonic anhydrases at high CO2. The general lack of effect of ocean acidification on these physiological traits suggests other characteristics, such as maintenance of calcifying fluid pH and ability to acquire energy from heterotrophy, may be more important for the resilience of *O. arbuscula* to OA.

Wang C., Arneson E. M., Gleason D. F. & Hopkinson B. M., in press. Resilience of the temperate coral *Oculina arbuscula* to ocean acidification extends to the physiological level. *Coral Reefs*. Article (subscription required).

Eat, breathe, repeat: physiological responses of the mussel *Mytilus galloprovincialis* to Diclofenac and ocean acidification Combined effects of the nonsteroidal anti-inflammatory drug diclofenac and lowered seawater pH were assessed on the physiological responses of the mussel *Mytilus galloprovincialis*. Bivalves were exposed for

1 week to natural pH (8.1) and two reduced pH values (pH −0.4 units and pH −0.7 units), as predicted under a climate change scenario. After the first week, exposure continued for additional 2 weeks, both in the absence and in the presence of environmentally relevant concentrations of diclofenac (0.05 and 0.5 μg/L). Clearance rate, respiration rate, and excretion rate were measured after 7 days of exposure to pH only and after 14 (T1) and 21 (T2) days of exposure to the various pH*diclofenac combinations. At all sampling times, pH significantly affected all the biological parameters considered, whereas diclofenac generally exhibited a significant influence only at T2. Overall, results demonstrated that the physiological performance of *M. galloprovincialis* was strongly influenced by the experimental conditions tested, in particular by the interaction between the two stressors after 21 days of exposure. Further studies are needed to assess the combined effects of climate changes and emerging contaminants on bivalve physiology during different life stages, especially reproduction.

Munari M., Matozzo V., Riedl V., Pastore P., Badocco D. & Marin M. G., 2020. Eat, breathe, repeat: physiological responses of the mussel *Mytilus galloprovincialis* to Diclofenac and ocean acidification. *Journal of Marine Science and Engineering* 8 (11): 907. doi: 10.3390/jmse8110907. Article.

Scaling up: predicting the impacts of climate change on seagrass ecosystems. Since Susan Williams and I started our scientific careers in the mid-1970s, seagrass science has been transformed from a largely descriptive field to an increasingly quantitative and predictive endeavor that requires a mechanistic understanding of environmental influence on metabolic networks that control energy assimilation, growth, and reproduction. Although the potential impacts of environment on gene products are myriad, important phenotypic responses are often regulated by a few key points in metabolic networks where externally supplied resources or physiological substrates limit reaction kinetics. Environmental resources commonly limiting seagrass productivity, survival, and growth include light, temperature, and CO_2 availability that control carbon assimilation and sucrose formation, and regulate stress responses to environmental change. Here I present a systems approach to quantify the responses of seagrasses to shifts in environmental factors that control fundamental physiological processes and whole plant performance in the context of a changing climate. This review shows that our ability to understand the past and predict the future trajectory of seagrass-based ecosystems can benefit from a mechanistic understanding of the responses of these remarkable plants to the simultaneous impacts of ocean acidification, climate warming, and eutrophication that are altering ecosystem function across the globe.

Zimmerman R. C., in press. Scaling up: predicting the impacts of climate change on seagrass ecosystems. *Estuaries and Coasts*. Article (subscription required).