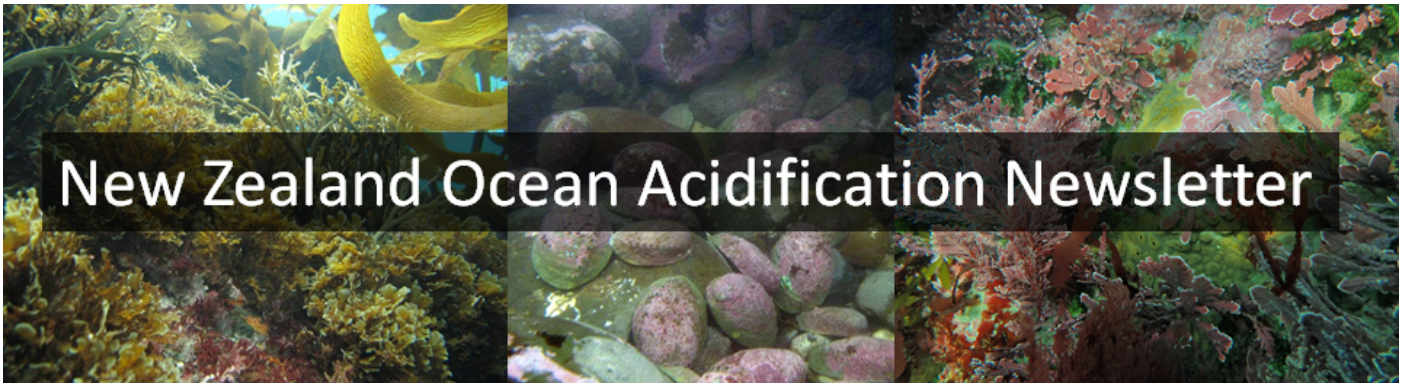
#67– September 2020 (http://nzoac.nz/)



Local News

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

The 14th annual New Zealand Ocean Acidification Conference will be held in Dunedin during the week of February 8th (final dates TBC). We are aware that institutional restrictions on travel may limit the ability of some of our members to attend, so we are considering a mix of virtual and live sessions. To assist the NZOAC in planning, please send Christina McGraw (christina.mcgraw@otago.ac.nz) a short e-mail indicating whether you plan to attend in person or would prefer virtual options.

NOAA capacity building project in the Pacific and Southeast Asia

The Ocean Foundation and NOAA are launching a new three-year project focused on building capacity to monitor and address ocean acidification in the Pacific Islands and Southeast Asia.

To shape the design of this project we seek the input of those who have an association with OA in the region. This includes those who are based in NZ, but researching in the Pacific or SE Asia; or Pasifika and SE Asian students who are studying OA in NZ. Please complete this survey so that we can assess current capabilities and needs in the region. The project ultimately will establish a regional training hub and fund scientific equipment distribution. Your answer to this survey will help us identify key partners, opportunities, and needs.

We invite you to share this survey link with your colleagues and partners in the region.

If you have any questions about this survey or this project, please contact Alexis Valauri-Orton at avalauriorton@oceanfdn.org.

Job opportunities

The Ocean Foundation, Programs Department, Washington, District of Columbia

Do you love the ocean? Are you ready to be part of a team to strengthen, support, and promote global organizations dedicated to preserving ocean environments around the world? The Ocean Foundation, a DC-based non-profit international community foundation is looking for a Senior Program Associate to join our team!

The position will be a member of our Core Programs and Consulting team and will directly support the International Ocean Acidification Initiative. This position can be based in either Seattle or Washington, D.C., however, until normal business operations resume per COVID-19 precautions this position may work remotely. This position offers opportunities for growth and promotion to a Manager level based on performance.

This position will be responsible for providing technical and operational support to TOF Core Programs, including the International Ocean Acidification Initiative. Job responsibilities include the development of technical training

materials related to ocean acidification and coastal restoration, programmatic budgeting, fundraising, program implementation including the design and delivery of training workshops, general operations, strategic partnership development, and communications. In addition, this position shall support efforts to foster greater diversity, equity and inclusion in the design and execution of all TOF programs.

The Senior Associate's work will include the development of technical training tools for ocean acidification including lab procedures, field guides, training videos, and template data reporting forms. The Senior Associate will also assist with the delivery of technical training programs, management of the Pier-2-Peer Scholarship fund and other grant-making programs, fundraising and strategic partnership development, including proposal drafting and preparation, and the development of communications and marketing materials.

Qualifications:

- A master's degree in ocean or coastal science OR at least two years of technical lab and/or field experience focused on ocean science
- Minimum 2 years' experience working in a non-profit or project-focused setting
- Strong working knowledge of ocean acidification or ocean and coastal observing
- Strong verbal and written communication skills
- Proficient with Microsoft Office Suite and Google products required; experience with Salesforce and Asana a plus; comfort in a Mac environment
- Multilingual verbal and written skills in English and Spanish a plus

Application link:
https://tof.bamboohr.com/jobs/view.php?id=21

Selection of recent papers

The origin and diversification of pteropods precede past perturbations in the Earth's carbon cycle. Pteropods are a group of planktonic gastropods that are widely regarded as biological indicators for assessing the impacts of ocean acidification. Their aragonitic shells are highly sensitive to acute changes in ocean chemistry. However, to gain insight into their potential to adapt to current climate change, we need to accurately reconstruct their evolutionary history and assess their responses to past changes in the Earth's carbon cycle. Here, we resolve the phylogeny and timing of pteropod evolution with a phylogenomic dataset (2,654 genes) incorporating new data for 21 pteropod species and revised fossil evidence. In agreement with traditional taxonomy, we recovered molecular support for a division between "sea butterflies" (Thecosomata; mucus-web feeders) and "sea angels" (Gymnosomata; active predators). Molecular dating demonstrated that these two lineages diverged in the early Cretaceous, and that all main pteropod clades, including shelled, partially-shelled, and unshelled groups, diverged in the mid- to late Cretaceous. Hence, these clades originated prior to and subsequently survived major global change events, including the Paleocene–Eocene Thermal Maximum (PETM), the closest analog to modern-day ocean acidification and warming. Our findings indicate that planktonic aragonitic calcifiers have shown resilience to perturbations in the Earth's carbon cycle over evolutionary timescales.

Peijnenburg K. T. C. A., Janssen A. W., Wall-Palmer D., Goetze E., Maas A. E., Todd J. A. & Marlétaz F., in press. The origin and diversification of pteropods precede past perturbations in the Earth's carbon cycle. *Proceedings of the National Academy of Sciences.* Article.

Keystone predators govern the pathway and pace of climate impacts in a subarctic marine ecosystem. Predator loss and climate change are hallmarks of the Anthropocene yet their interactive effects are largely unknown. Here, we show that massive calcareous reefs, built slowly by the alga *Clathromorphum nereostratum* over centuries to millennia, are now declining because of the emerging interplay between these two processes. Such reefs, the structural base of Aleutian kelp forests, are rapidly eroding because of overgrazing by herbivores. Historical reconstructions and experiments reveal that overgrazing was initiated by the loss of sea otters, *Enhydra lutris* (which gave rise to herbivores capable of causing bioerosion), and then accelerated with ocean warming and acidification (which increased per capita lethal grazing by 34 to 60% compared with preindustrial times). Thus, keystone predators can mediate the ways in which climate effects emerge in nature and the pace with which they alter ecosystems.

Rasher D. B., Steneck R. S., Halfar J., Kroeker K. J., Ries J. B., Tinker M. T., Chan P. T. W., Fietzke J., Kamenos N. A., Konar B. H., Lefcheck J. S., Norley C. J. D., Weitzman B. I., Westfield I. T. & Estes J. A., 2020. Keystone predators govern the pathway and pace of climate impacts in a subarctic marine ecosystem. *Science* 369 (6509): 1351-1354. Article (subscription required).

Ocean acidification induces distinct transcriptomic responses across life history stages of the sea urchin *Heliocidaris erythrogramma*. Ocean acidification (OA) from seawater uptake of rising carbon dioxide emissions impairs development in marine invertebrates, particularly in calcifying species. Plasticity in gene

expression is thought to mediate many of these physiological effects, but how these responses change across life history stages remains unclear. The abbreviated lecithotrophic development of the sea urchin *Heliocidaris erythrogramma* provides a valuable opportunity to analyze gene expression responses across a wide range of life history stages, including the benthic, post-metamorphic juvenile. We measured the transcriptional response to OA in *H. erythrogramma* at three stages of the life cycle (embryo, larva, and juvenile) in a controlled breeding design. The results reveal a broad range of strikingly stage-specific impacts of OA on transcription, including changes in the number and identity of affected genes; the magnitude, sign, and variance of their expression response; and the developmental trajectory of expression. The impact of OA on transcription was notably modest in relation to gene expression changes during unperturbed development and much smaller than genetic contributions from parentage. The latter result suggests that natural populations may provide an extensive genetic reservoir of resilience to OA. Taken together, these results highlight the complexity of the molecular response to OA, its substantial life history stage specificity, and the importance of contextualizing the transcriptional response to pH stress in light of normal development and standing genetic variation to better understand the capacity for marine invertebrates to adapt to OA.

Devens H. R., Davidson P. L., Deaker D. J., Smith K. E., Wray G. A. & Byrne M. in press. Ocean acidification induces distinct transcriptomic responses across life history stages of the sea urchin *Heliocidaris erythrogramma*. *Molecular Ecology*. Article (subscription required).

Physiological feeding rates and cilia suppression in blue mussels (Mytilus edulis) with increased levels of dissolved carbon dioxide. Gills of marine bivalves, the organs that mediate water flow for feeding and other physiological functions, are exposed to increasing levels of carbon dioxide (CO2) in seawater, in response to ocean acidification (OA). We examined the effects of elevated dissolved CO2 upon filtration and feeding behavior of the blue mussel, *Mytilus edulis*, under field conditions and in laboratory studies. We further investigated possible changes in cilia beat function in response to elevated dissolved CO2. Physiological filtration and feeding variables measured; included clearance, filtration, organic ingestion, and assimilation rates and selection efficiency, which decreased with increasing CO2. Absorption efficiency was not affected by dissolved CO2. Cilia beat frequency declined in excised lateral cilia (lc) exposed to increasing CO2 levels, which appears to account for decreased clearance rates observed in field and laboratory experiments. Our data suggest that under conditions of increased CO2 blue mussels will experience changes in physiological filtration, feeding rates, and cilia beat function that could have consequences for fitness and performance.

Meseck S. L., Sennefelder G., Krisak M. & Wikfors G.H., 2020. Physiological feeding rates and cilia suppression in blue mussels (*Mytilus edulis*) with increased levels of dissolved carbon dioxide. *Ecological Indicators* 117: 106675. doi: 10.1016/j.ecolind.2020.106675. Article.