

OCEAN ACIDIFICATION-IT WILL TAKE YOUR BREATH AWAY

Meg Brasell-Jones and Pam McKinlay

INTRODUCTION

Humans have developed a disturbing, self-destructive predilection to cause major destruction, pollution and chaos in our world – arguably more so than any other species inhabiting planet Earth. Humans, however, also have the crucial ability to reflect, be creative and disseminate complex ideas. As we become increasingly aware of the effects of human overconsumption and overpopulation in a world of finite resources, we need to become increasingly *active*, to use our collective abilities to draw attention to our uniquely human practices, to respond, to halt, to assess and restore. And . . . we need to breathe, if we want any kind of future at all.

OCEAN ACIDIFICATION

Our planet is more ocean than land, so it is not surprising that more *life* exists in this underwater domain. From water quality to climate change, what we do on land has long term and immediate impacts on our coastal and ocean environment. Many of the effects we are observing today are caused by our addiction to fossil fuels. We now see the consequence of adding excess carbon dioxide (CO₂) into our atmosphere, including the warming of our oceans and atmosphere, increased frequency and severity of extreme weather and rising sea levels.

The threats to the ocean are manifold including ocean warming, hypoxia (low oxygen), over-fishing, and ocean acidification (to name but a few). The degree of impact will depend upon the part of Earth that you inhabit. Ocean acidification, which can be described as the evil twin to climate change, is a major threat to the health of the marine ecosystem (Figure 1.). The oceans absorb about quarter of the CO₂ we emit into the atmosphere, which produces carbonic acid and increases the acidity of the seawater (National Institute of Water and Atmospheric Research [NIWA], n.d.). Ocean acidification is a significant, additional stressor for calcifying organisms and will increasingly become an issue as we continue to pump CO₂ into the atmosphere. Changes in seawater acidity affect the ability of corals and shellfish to build and maintain their shells and skeletons. The changes in acidity also affects the sensory system of fish, with negative consequences affecting their sight, hearing and navigation.

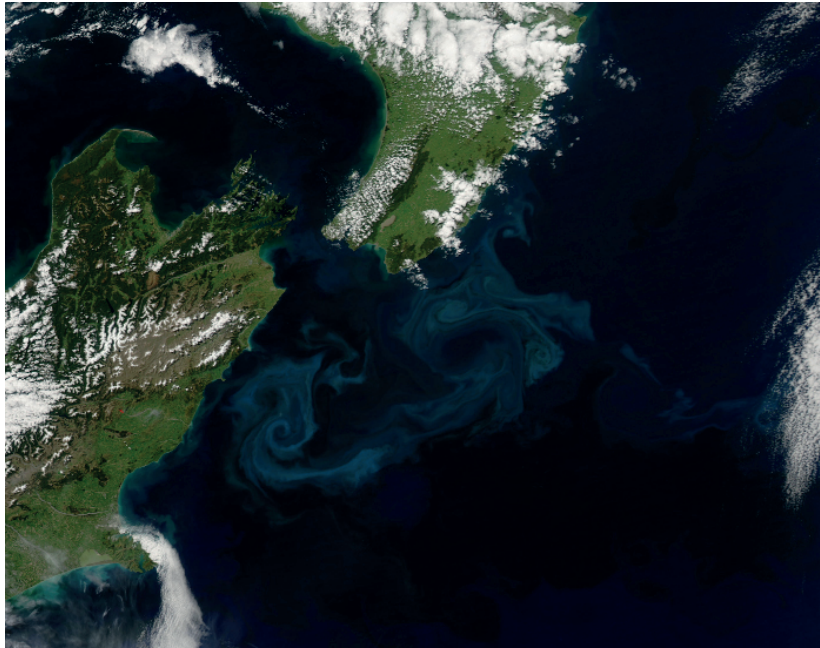


Figure 1. Image of the Day for October 28, 2009. Instrument: Aqua — MODIS. A phytoplankton bloom colored the waters east of New Zealand on October 25, 2009. NASA image by Jeff Schmaltz, MODIS Rapid Response Team.

“EVERY SECOND BREATH WE TAKE WAS MADE IN THE OCEAN”

The oceans are the seas of all life on our planet supporting life within it and producing half of the air we breathe on land. Dr Ro Allen, at a ‘Meet the Scientist’ session during Ōku Moana (My Oceans), at the NZ International Science Festival, noted that “every second breath we take was made in the ocean.” At an event where a species of plankton, *Syracosphaera azurea*, was named after the television series ‘Blue Planet’, world-renowned natural historian Sir David Attenborough stated,

If you said that plankton, the phytoplankton, the green oxygen-producing plankton in the oceans is more important to our atmosphere than the whole of the rainforest, which I think is true, people would be astonished. (Sir David Attenborough, quoted in Shukman, 2018)

While everyone in New Zealand is reaping the benefits of burning carbon (individually by driving cars, buying fast fashion, taking a holiday, and so on), there are a number of large industries whose economic models are predicated on short financial gains at the expense of the environmental benefits provided by the marine ecosystems. The tiny plant-like organism is regarded as a key element of the marine ecosystem and is described as being the “beating heart” of the ocean.

*They are an essential element in the whole cycle of oxygen production and carbon dioxide and all the rest of it, and you mess about with this sort of thing and the echoes and the reverberations and the consequences extend throughout the atmosphere. (Sir David Attenborough, *ibid.*)*

We all live in an open room and we all have a stake in our oceans’ future.

Scientists exploring the fossil records of the planet reveal that there have been several periods of life flourishing on Earth and several periods of evolutionary collapse. The periods of collapse are called extinction events, the most dramatic of which concluded 252 million years ago, at the end of the Permian era. At this time, conditions were ripe for bacteria, harmful to most life on the planet, to thrive and release noxious gases into the air. It is estimated that up to 95 percent of marine and 70 percent of terrestrial species went extinct. While the cause of excessive atmospheric carbon at that time was the result of cataclysmic volcanic activity on a young planet Earth, this graphically illustrates the consequences of massive global warming. Under those conditions, the resulting bacterial blooms wiped out life-sustaining phytoplankton, exhausting the air of life-sustaining oxygen and the resulting extinction event is given the infamous non-de-plume 'The Great Dying.' Carl Zimmer, in *The Sixth Extinction*, described the world of the end-Permian era as a "truly grotesque place" where glassy, purple seas released poisonous bubbles that rose "to a pale green sky" (Kolbert, 2014). This may seem completely far-fetched as we bask under balmy blue skies, breathing relatively clean air and focus our attention on the nuisance of plastic pollution and climate change, but scientists now report that we are in the midst of the next extinction event. Zimmer's evocative description serves as a dire warning of a world our descendants may not live to inherit. It prompts the questions: What are we going to do about this! What can *I* do about this?

ART-ICULATING THE DATA

The sixth Art and Science series, 2017-2018, embarked on an art-science collaboration with a theme of 'Oceans'. The project participants involved 27 artists and 20 scientists from a range of institutions including University of Otago (researchers from Surveying, Physics, Anatomy, Chemistry, Botany, Marine Science, Te Koronga (Indigenous Science), Dunedin School of Art, Otago Polytechnic School of Design, Cawthron Institute (New Zealand's largest independent science organisation), Landcare Research, National Institute of Water and Atmospheric Research (NIWA), Sustainable Seas National Science Challenge, CARIM (Coastal Acidification: Rate, Impacts & Management), Biodiversity Research Centre, and the University of British Columbia. The aim of the project was not illustration of the science but an artistic response to the research. Tackling the complexities of our changing marine world, artists and scientists interacted over several months to produce works that interpreted and extended science research in new contexts and imagine new generative interactions between science and art (Dunedin School of Art, 2018).

The project co-leaders for this original Art+Oceans Project and Exhibition were Dr Jenny Rock and Pam McKinlay. Pam is an artist with a background in applied science and history of art. As an artist, she works predominantly in sculpture, weaving and ceramics. She works in collaboration with other artists locally and nationally in community outreach and education projects around the theme of climate change, sustainability and biodiversity, and currently she works part-time at the Dunedin School of Art. Pam worked alongside Jenny, who has a background in science and art. Jenny has spent more than 20 years as a scientific researcher (particularly in marine biology) and is also an intaglio and relief printmaker, as well as occasional poet. She is currently a Senior Lecturer in Science Communication (University of Otago) focusing on aesthetics, participatory practice, sensory cognition, and ArtScience.

In the 2017-2018 edition of the Art and Science project, 'Oceans', the number of participants blossomed (to almost twice the size as previous projects). The exhibition had a long tail of satellite exhibitions and mini exhibitions: Ōku Moana (My Oceans) in The International (NZ) Science Festival (McKinlay, 2018), The Sustainable Seas National Science Challenge Conference and The Commonwealth Ocean Acidification Action Group Workshop (Gibb, 2019); each with different reconfigurations and iterations of the travelling exhibition. The Art+Oceans project had strong environmental leanings and we hoped with each iteration to reach a new audience and inspire the public to engage with environmental science, relevant to all our futures (Bingham, n.d.). All creatives/exhibitors were current or past students of the Dunedin School of Art or staff at Otago Polytechnic.

FROM GALLERY TO STREET

An opportunity arose in May 2019 to take another iteration of the exhibition literally to the streets, when Phantom Billstickers agreed to do a limited poster run in association with the curatorial team for the exhibition. Several sequential poster sites were earmarked for our gallery/exhibition space where we would run up to five framed poster sites in a row (at size MAX - A0). The 'street gallery' sites chosen were, in terms of foot traffic and high-profile locations (such as supermarkets, bus stops and high density tourism/pedestrian areas). We also booked two 'super sites' (these are the size of 4x A0 prints) for scaled visibility.

This opportunity required expertise in communication and poster design and Meg Brasell-Jones was approached to collaborate. Meg brought an essential element of critical and sustainable thinking to this communication design challenge. She has a varied background that includes visual communication design but also an invested interest in sustainability, ecology, graphic activism and art. As a communication team, Pam and Meg worked through a set of predetermined expectations to make use of the poster format opportunity.

EXPECTATIONS

During early planning, we discussed five potential levels of engagement:

1. Give a visual gift: showcase a series of beautiful images on the street, something inspiring to look at - so if people paused and noticed and liked what they saw, this would be a win - a stopping to smell the roses moment and a raising of winter spirits.
2. Draw attention to the 'ocean health label': provide a connection between each image and the notion of "oceans".
3. Make the connection to Ocean Acidification: through interpreting the ocean health label or maybe just wondering what Ocean Acidification is. This subliminal query might be answered at a later encounter in the viewer's life.
4. Engage further by reading the information at the bottom of poster: the quote by Sir David Attenborough often gets the response, "Wow, I did not know that!" (and the knowledge that Sir David Attenborough said it, carries the authority of truth and popular acceptance).
5. Fuel reaction on social media: at the awesome end of the response scale.
6. Inspire others to take further action - beyond expectations!

TRANSLATION – MEDIATING THE IMAGE AND TEXT

The design process involved reformatting or translating the presentation of the individual artworks from traditional gallery walls to the urban gallery of city streets. We noted in preliminary discussions that not all works (or photos of the works) would translate successfully to the billsticker streetscape. There were twelve images from the original exhibition in the first selection list for the posters, which then sorted itself to eight; with the file size of images provided becoming a determining factor in the selection of the final six. All of them provided other-worldly interpretations and expressions of a sententious change that affects all life in and out of the oceans, and work to support the underlying messages around our collective vulnerability.

The requirement to privilege the artwork in the composition meant compromises. One of the challenges of the designer is to synthesize text and image; to complement and enhance, without trampling artistic expression. Text, and in fact any additional graphic devices added to an image, ultimately changes or reframes the artwork. From a communication perspective, however, it was necessary to add text and graphic devices to develop a more informative means of conveying the message, and to thematically link such disparate, albeit creative, images. Helvetica, as ubiquitous as water, was chosen as a complementary typeface for its universally-recognized, clean structure, and association with so much instruction in society.

During the process of negotiation between the image and the message, an 'Ocean Health Label' was conceived (Figure 2.). This graphic device is based on the pared-back, disciplined pharmaceutical label. It is both generic (of almost universal blandness) in translation across different products and functionally direct in its communication. For the purposes of the Oceans campaign, it was also adopted as a visual reminder of improving one's health. The label was further developed to include a fading white line – this, to bring to mind a litmus scale for measuring pH or acidity. The label was placed systematically throughout the series, but always with a consideration for the original focal point of the image. The black banner in the posters, gave uniformity and a weighted base to the composition, as well as a position for acknowledgements and links to further information.



Figure 2. Ocean Health Label

COMMUNICATION CHALLENGE

How would we explicitly link the message of increasing carbon emissions in the atmosphere to ocean acidification? How could we make an emotional connection with this message using the artworks from the exhibition as the carrying images? At each iteration of the posters, the text was pared down. The final black banner still retained image credit acknowledging the participating artists and scientists, but after many drafts we settled on using a signature quote to encapsulate a message that might resonate with the most people who took the time to read on the streets. It was felt that the aforementioned quote by Sir David Attenborough, summed up the message best (Figure 3.).



Figure 3. Informative Banner

BEYOND THE STREET

To further its reach, a Facebook page was set up as an online interface for the poster campaign (Ocean Acidification - Poster Campaign, 2019). This was indicated on the posters with a Q-code and, after some research, using the hashtag #Ocean_Acidification across the three main social media platforms, Facebook, Twitter and Instagram. Happily, the timing of the campaign, 30 June – 21 July, coincided with the Puaka Matariki Festival. We became a late entrant in the Festival Programme with a community night of celebration to officially mark the launch of the campaign in Ōtepoti/ Dunedin. Dr Christina McGraw, Senior lecturer in Chemistry McGraw Research Group Analytical and Marine Chemistry, was invited to speak at the launch of the event. Christina was one of the original scientists who took part in Art+Oceans and was also the co-chair of The Commonwealth Ocean Acidification Action Group Workshop held at the University of Otago, a conference at which several other artists had exhibited at a mini exhibition earlier in the year, 17 – 19 February, 2019. The launch event was held at Heron Hall at Knox Community Halls, partly due to the proximity of the halls to the Phantom Billsticker sites and partly again to emphasize the community facing action of the poster exhibition/campaign. Other speakers that evening included local leaders of the School Strike for Climate whose intelligence and heartfelt message is a reminder to their elders that we need to do things differently. A feature of the evening was sharing food, music and *hongi* (sharing of breath). This extended to an invitation for all to be photographed in front of the launch posters, a set of which were on display in the Hall venue, or to step outside into the Matariki night and take a selfie in front of the posters on the street at a site opposite the Church and tag it to the Facebook page with #Ocean_Acidification. The artwork, the science, the designed poster series and an online presence thus came together to form a realised campaign (Figures 4-9).

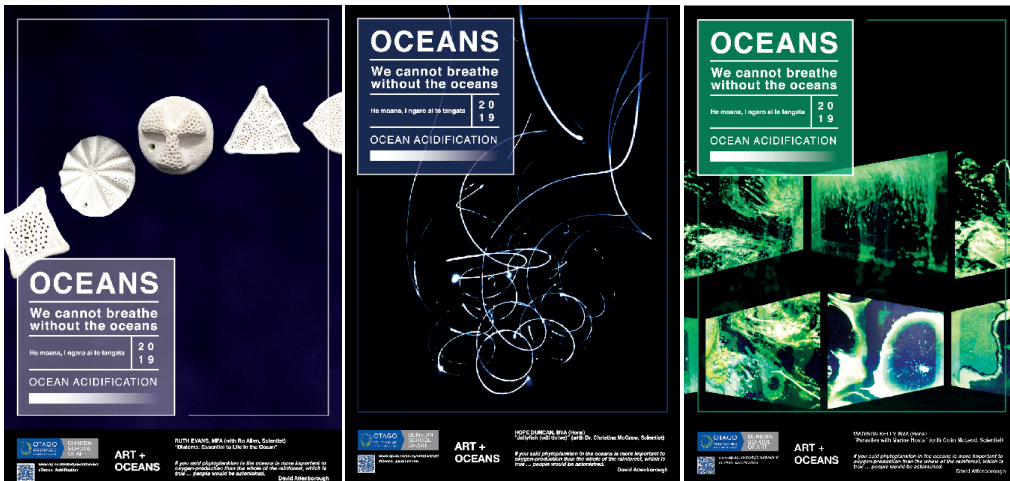




IMAGE CREDITS

Figure 4. Poster #1 Ruth Evans, MFA, *The great carbon trappers: how does ocean acidification affect diatoms?* (with Ruth Allen, Scientist). "If you said phytoplankton in the oceans is more important to oxygen-production than the whole of the rainforest, which is true ... people would be astonished." David Attenborough Wednesday, 18th April 2018.

Figure 5. Poster #2 Hope Duncan, BOT (Occupational Therapy) and Grad Dip in Art, *Jellyfish (will thrive)*, (with Christina McGraw, Scientist). While marine species with shells begin to dissolve with increased acidification, jellyfish are predicted to become more abundant. The ocean absorbs 30-50% of CO₂ gas. An acidifying ocean is no place to be a creature that needs to make its own shell.

Figure 6. Poster #3 Madison Kelly, BVA Hons, *Drawing to Discern Parasites*, (with Colin MacLeod, Scientist). Fluorescent pigment is used to visualise changes enacted by ocean acidification in parasites with marine hosts. *Toitū te marae a Tane-Mahuta, Toitū te marae a Tangaroa, Toitū te tangata. If the land is well and the sea is well, the people will thrive.*

Figure 7. Poster #4 Pam Mckinlay (Dip HSc, BA) and Jesse James Pickery, BVA, *Call of the Ocean*, (With Anne-Marie Jackson et al). Kaitiakitanga comes from a spiritual place – if the spiritual aspects have been adhered to, then right conduct will follow. *He moana, I ngaro ai te tangata. Without the ocean we are lost.*

Figure 8. Poster #5 Jessica Ritchie, MFA, *What Transpires from a Collection of Encounters*, (with Candida Savage, Scientist). Subtle changes can have cumulative effects. When will we reach a tipping point in global decay and destruction of crucial ecosystems?

Figure 9. Poster #6 Thomas Lord, BVA, and Blair Thomson, BSc (Hons) in Ecology, *Marine Microbial Ecology*, (with Blair Thomson, Scientist). Marine microbes are the "gatekeepers of the carbon cycle" playing essential roles in global cycles which regulate climate and underpins productivity and stability of oceanic food webs.

CONCLUSION

There are myriad of possible responses to address the effects of climate change and this is part of our ongoing contribution to its development. We have much to learn and much to do as a species, to manage the negative, but inevitable consequences of such epic change. One place to start was by bringing perspectives and knowledge together with a shared goal. *Oceans* was initially conceived as a collaboration between artist and scientist, but became an important catalyst for a continuation of the conversation with, well, anyone who wanted to take note. This was enabled by an evolution of one project to another; via a cohesive visual language that held its own among the bombardment of messages in our visual, urban environment (usually so focused on relentless consumption). As such, the artworks were reframed as a series of message-bearing posters. This may seem like a drop in the proverbial ocean, but we did *something*. And what is knowledge without action?

A living poem from the *Bull and the Burning Ocean and other Modern Tales from the Sea* (poems and performance written by Pam McKinlay)

IV

There's something in the water:

You put it there.

The breath of the ocean thickened,

And pastures sullied under the sea.

Bleached references sketch out a lost coralline city in ghost writing

like a drought just hit under water:

As you combust, so shall we corrode;

fire skies reflected beneath the water:

No sound of silent scream as acid on shell

Nowhere to shelter under the sky in our burning sea

Silence of the dawn chorus in reef and sand.

In the commodification of everything

you monetised the searoses in now sunburnt waters.

As fish among men if only

You would breathe our water.

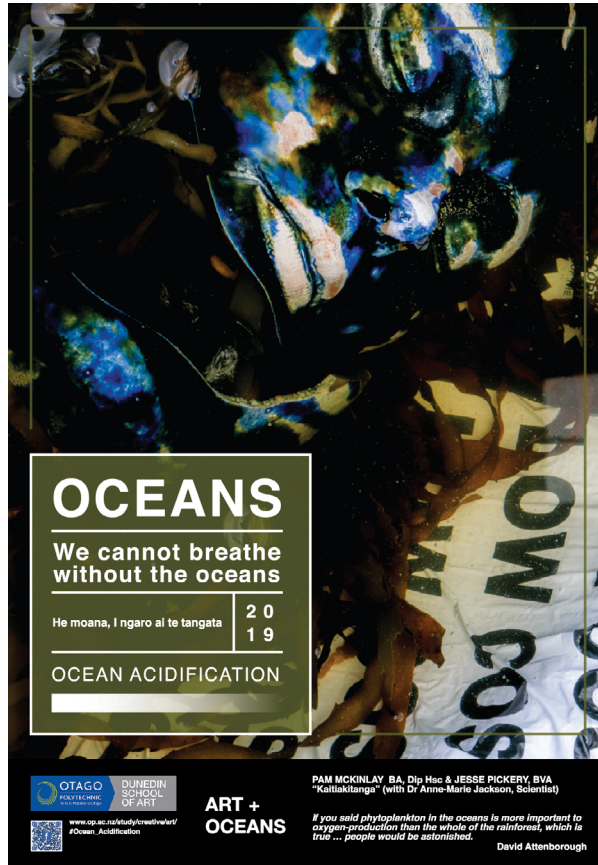


Figure 10. Phantom Poster #4 in series – based on image by Pam McKinlay and Jesse-James Pickery, *Call of the Ocean*, 2018.

BIOS

Pam McKinlay has a background in applied science and history of art. She works predominantly in sculpture, weaving, ceramics and photography in collaboration with other artists locally and nationally, in community outreach and education projects around the theme of climate change, sustainability and biodiversity. She works part-time in the Research and Post-graduate office and Dunedin School of Art at Otago Polytechnic.

Meg Brasell-Jones is a Senior Lecturer in visual communication design at The College of Art, Design and Architecture (ADA), Otago Polytechnic. Her research expertise is in design, social responsibility and sustainability. She is also a practicing creative, producing commercial graphic design as well as personal work, in the medium of painting, mixed media and stitch, with a particular interest in engaging in social commentary.

REFERENCES

- Bingham, B. (n.d.). *Climate Outcome: Ocean Acidity*. Retrieved from <http://www.climateoutcome.kiwi.nz/ocean-acidity.html>
- Dunedin School of Art. (2018) *ART+OCEANS Exhibition 2018*. Retrieved from https://issuu.com/dunedinschoolofart/docs/art_oceans_catalogue
- Gibb, J. (2019, February 19) Group ready to take action on ocean acidification. *Otago Daily Times*. <https://www.odt.co.nz/news/dunedin/campus/university-of-otago/group-ready-take-action-ocean-acidification>
- Kolbert, E. (2014). *The Sixth Extinction: An Unnatural History*. New York, US: Henry Holt and Company.
https://archive.org/stream/TheSixthExtinctionAnUnnaturalHistoryByElizabethKolbert/The%20Sixth%20Extinction%20An%20Unnatural%20History%20by%20Elizabeth%20Kolbert_djvu.txt
- McKinlay, P. (2018). Ōku Moana (My Oceans). New Zealand International Science Festival, 6-15 July 2018, Dunedin. Retrieved from <http://www.scifest.org.nz/events/ku-moana>
- National Aeronautics and Space Administration (NASA). (2009, October 25). Retrieved from https://eoimages.gsfc.nasa.gov/images/imagerecords/40000/40924/NewZealand_AMO_2009298_lrg.jpg
- National Institute of Water and Atmospheric Research (NIWA). (n.d.) *Ocean Acidification*. Retrieved from <https://www.niwa.co.nz/research-subject/ocean-acidification>
- Ocean Acidification - Poster Campaign. (2019). *Facebook*. Retrieved from <https://www.facebook.com/events/334055867509195/permalink/346140799634035/>
- Shukman, D. (2018, 18 April). Plankton named after BBC Blue Planet series. *BBC News*. Retrieved from <https://www.bbc.com/news/science-environment-43796939>

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