Collecting data to help protect Australia's waters from toxic algal blooms

June 22 2016, by Penelope Ajani

A mass proliferation of Noctiluca scintillans, a red tide forming dinoflagellate at Clovelly Beach, NSW. It can form dense aggregations that deplete oxygen and produce ammonia. Credit: Gurjeet Kohli, Author provided

Ever heard of *Thalassiosira*, *Detonula*, *Leptocylindrus* or *Chaetoceros*? No, they are not the names of Greek gods but arguably some of the most important and beautiful organisms on earth: the diatoms.

Diatoms are largely unseen due to their microscopic size but they are the

most abundant and diverse single-celled phytoplankton (or microalgae) in the ocean.

These ancient lifeforms arose during the Triassic period, about 200-250 million years ago. They house themselves in intricate glass cases, the patterns and structures of which delight artists, architects and engineers as well as marine biologists.

Take a breath

But are they really important? Take a breath in. Ocean phytoplankton produce up to 50% of the oxygen we breathe, so half of every breath you take is dependent on them.

Phytoplankton also power our marine ecosystems by providing food to higher trophic levels, including fisheries and aquaculture. They underpin our coral reefs, being the microalgal symbionts that are essential for coral growth and health.

Outside the natural world, they also have a use in drug therapy. It's the diatom case or frustule that is providing the blueprint for a genetically engineered biosilica "backpack" that can deliver anticancer drugs to tumour sites.

On the downside, some microalgae can bloom spectacularly on our beaches, such as the one that turned several Sydney beaches red in November 2012. Others can produce some of the most harmful and deadly toxins known to science.

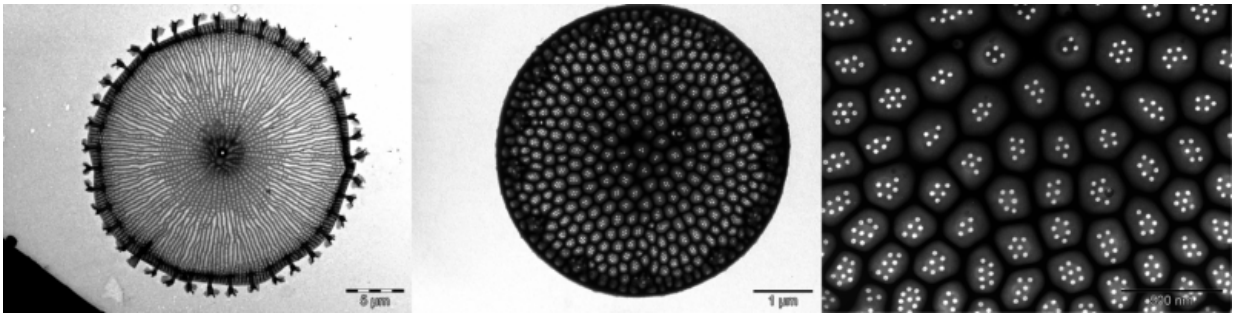
Crazy birds

In fact, contamination by toxic diatoms is better known than people

think. In the early 1960s, the strange, violent behaviour of seabirds in California is thought to have been caused by the diatom, *Pseudo-nitzschia*.

The birds were reported as "crazed" and were seen regurgitating anchovies. The famous British movie director Alfred Hitchcock, who lived in Santa Cruz at the time, used this toxic event as the inspiration for his film The Birds (1963).

Yet it was only in 2010 that archived samples from this time were analysed showing large quantities of the toxin producing diatoms in the guts of the anchovies. This provided the first direct evidence that this event was indeed caused by a toxic diatom bloom.



Various transmission electron microscopy close-ups of the marine diatom, Thalassiosira sp., found in Sydney coastal waters. Credit: Penelope Ajani, Author provided

Despite their importance and abundance, we still know very little about diatom diversity, function and life histories. Moreover, climate change is altering our marine ecosystems, with some victors and some losers expected.

Will toxic species of microalgae be the victors?

Gathering the Australian data

In an unparalleled collaboration, phytoplankton experts from around Australia have come together to establish the Australian Phytoplankton Database to further understand our ocean's invisible forest, with details published this week in Scientific Data.

It currently includes 3.5 million records of marine phytoplankton from Australia and is publicly available through the Australian Ocean Data Network (AODN).

This database has been painstakingly gathered from the literature, active and retired researchers, consultancies, archives and databases. Records extend from 1844 to the present, providing more than 170 years of data on phytoplankton communities in Australian waters.

For example, the database includes phytoplankton species data from an expedition to the Great Barrier Reef in 1928, 50 years of intermittent data collected from Sydney's long-term coastal monitoring station offshore from Port Hacking, as well as phytoplankton data collected by the NSW Food Authority in oyster-growing estuaries for the protection of consumers from contaminated shellfish.

This is not the first such database. There are others in different parts of the world such as the United States and Europe.

There were many small datasets across Australia too. But while these small phytoplankton datasets have limited impact, collectively they can provide valuable additions to large scale projects.

This new dataset will define Australia's phytoplankton communities

allowing biogeographic analyses and range changes overtime. It will also help us understand the dynamics of harmful species so that we can help to inform local and regional aquaculture, fisheries and tourism.

Establishing a link between climate change and trends in phytoplankton is challenging and requires the collection of suitably long-term data. So new data will be continually added as it becomes available and will be maintained in perpetuity by the AODN.

This national initiative may help answer some basic questions about microalgae in our coastal oceans, such as how many species do we have, how many are toxic and how will they perform in a warmer world.

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