Tiny algae, big tanks: Growing local live feed for New Zealand shellfish aquaculture

Every healthy oyster or mussel spat depends on something far smaller than itself: microalgae. These microscopic algae are the live feed used in hatcheries and nurseries to support juvenile shellfish through their most delicate life stages. They provide the nutrients young shellfish need to grow, survive, and develop before being transferred into larger production systems. For shellfish aquaculture, reliable microalgae production is not just a laboratory detail, it is a major part of the engine room.

However, producing live microalgae is not always easy. Cultures need regular monitoring, careful handling, suitable light and temperature, and protection from contamination. When cultures grow well, they quietly keep a shellfish hatchery humming along. When they struggle or crash, feed supply can quickly become a bottleneck or a famine for vulnerable small shellfish.

For many hatchery and nursery operations, live microalgae production remains one of the most labour-intensive and costly parts of raising juvenile shellfish.

My PhD research is focused on this challenge. I am investigating whether locally isolated New Zealand microalgae could become useful live-feed options for the shellfish aquaculture industry. Rather than relying only on standard strains already used in aquaculture and imported from overseas, I am exploring whether microalgae from New Zealand waters can be isolated, identified, cultured, and tested under conditions relevant to local production.

Among the three summer microalgal species isolated during my first year PhD project, *Chaetoceros calcitrans*, *C. tenuissimus*, and *Conticribra weissflogii*, one species has especially caught my attention: *C. calcitrans* (**Figure 1**).

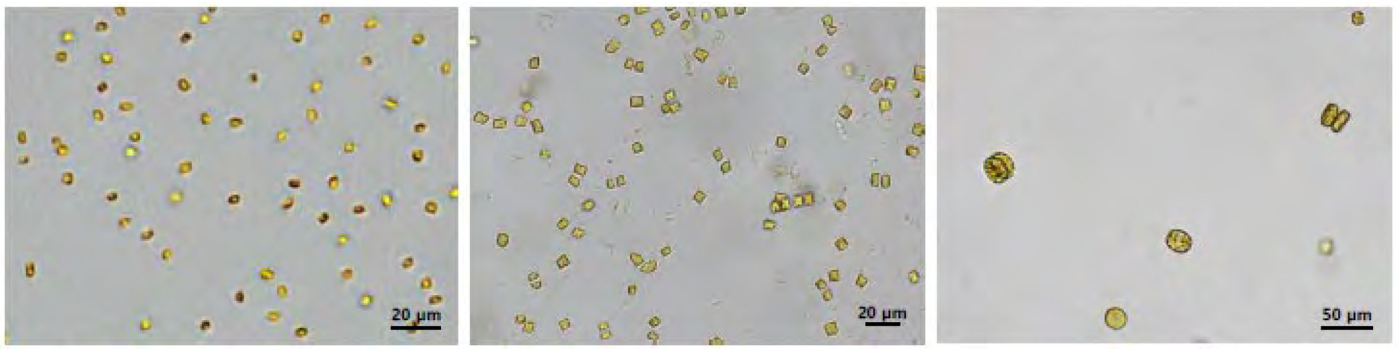

Figure 1. Microscopic images of isolated microalgae. *C. calcitrans (left); C. tenuissimus (middle); Conticribra weissflogii (right)*

This tiny diatom is already well known in shellfish aquaculture from strains originally imported from overseas. It is a suitable size for young bivalves and is widely valued as a live feed. But it also comes with a catch.

Although *C. calcitrans* is useful, it is often considered difficult to produce reliably at larger scales. In some hatchery systems, it may be easier to maintain in smaller, labour-intensive batch cultures, such as 20 litre bottles, rather than being easily expanded into larger tank systems.

That means more handling, more time, and less flexibility when larger volumes of feed are needed.

That is why our New Zealand strain was so interesting. As part of my PhD, I tested a newly isolated New Zealand strain of *C. calcitrans* under greenhouse tank conditions at Moana's hatchery near Nelson.

After being established and scaled up, the culture was grown in 500 litre volumes inside 1000 litre polyethylene tanks (**Figure 2**). There was no complex photobioreactor involved, and no highly specialised indoor system. The culture was grown in a practical greenhouse setting, with simple air bubbling used for mixing. And it grew.

Figure 2. 500 litre tanks with microalgae cultures in greenhouse tanks at Moana.

The 500 L tank results were encouraging when two types of grow nutrients were used. With Walnes nutrient (WP), the local *C. calcitrans* culture reached a mean cell density of 9 million cells mL^{-1} after 5 days and with F/2 nutrient, it reached nearly 6 million cells mL^{-1} after 6 days – that is more than a whopping 30 million cells in just a teaspoon of seawater – just what young shellfish love to eat. The local was also found to be the fastest growing species at this large scale among a variety of other microalgae species tested.

Put simply, this strain did not just survive in the 500 litre tanks. It grew strongly under two different culture media in a relatively simple greenhouse system.

For microalgae research, this step matters. A strain can look promising in a small flask, but a large tank is a different world. Light, temperature, mixing, contamination risk, and day-to-day handling all become more challenging. A useful aquaculture feed strain needs to be more than interesting under the microscope. It needs to be manageable, scalable, and reliable.

This research is not about replacing all existing microalgae strains used by aquaculture. The microalgae already used in aquaculture are used because they work. Relying on only a small group of feed species can make production vulnerable, hence, a broader "live-feed toolbox" that includes well-characterised New Zealand strains could make feed production more flexible and resilient.

There is still more work to do. I am now comparing local and reference strains, including summer and winter-associated species, for growth, nutrition, and feeding performance.

A promising microalgal strain must not only grow once; it must be reliable enough to become part of a practical production routine. For New Zealand aquaculture, local microalgae may offer a small but meaningful opportunity.

These organisms are invisible to the naked eye, but their impact on hatchery and nursery success can be large. The successful bulk cultivation of a New Zealand *C. calcitrans* strain in 500 litre tanks is one encouraging step towards a more reliable and flexible live-feed supply for our shellfish industry. It is still early days, but this tiny local diatom may have a useful role to play in growing the future of New Zealand shellfish aquaculture.

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