

Determining the source of green-lipped mussel spat landing at Ninety Mile Beach

Aotearoa New Zealand's green-lipped mussel aquaculture industry is worth more than \$380M a year, and the government's aquaculture strategy includes a plan to expand the industry further over coming years. This industry is largely reliant on wild-caught spat (baby mussels): 80% of production uses spat collected from Te Oneroa-a-Tōhē / Ninety Mile Beach. Year in and year out, the spat wash up on the shore attached to seaweed and other branching material, from where it is collected and transported to mussel farms nationwide for grow-out.

The source populations (adult mussel beds) have not been identified, which poses risks to the long-term sustainability of the mussel aquaculture industry because it means the continued supply of spat cannot be safeguarded.

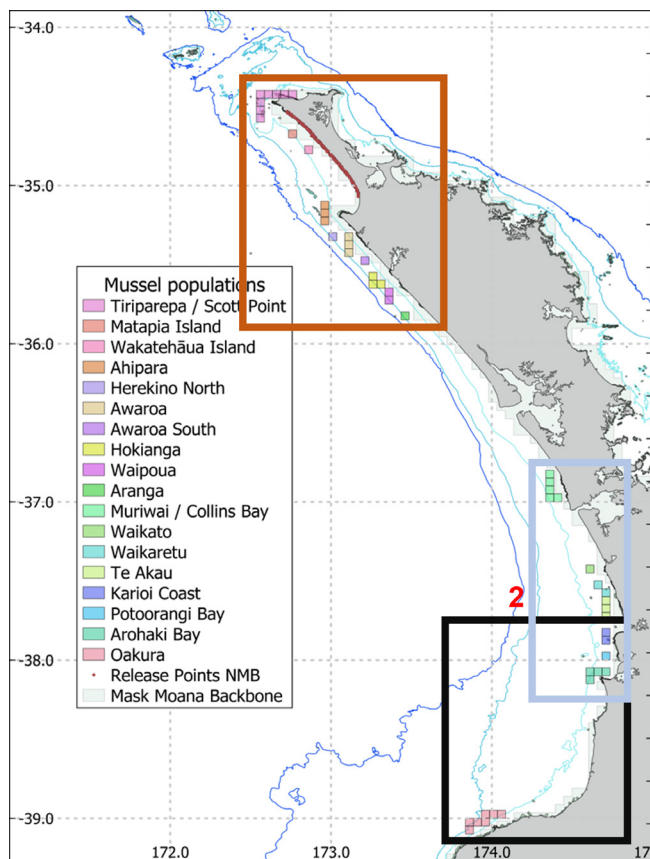
Backtracking spat landing at Ninety Mile Beach

Mussels spend up to six weeks as larvae and may be transported considerable distances by ocean currents. Our research uses a mixture of mussel genetics (determining the whakapapa or relatedness of mussels from different locations) and ocean models (determining the direction and strength of currents from particle tracking) to identify the likely source beds.

Using the ocean models, we backtracked the spat from Te Oneroa-a-Tōhē / Ninety Mile Beach to the known beds and found that the source populations are likely to be the beds off Tiriparepa / Scott Point, Ahipara and Herekino.

Mapping the connectivity between mussel beds

Mussel larvae swim up and down in the water column, which affects where they are transported. Using a sophisticated model that incorporates these behaviours, running for 10 years (2008-2017), we forward-tracked the movement of larvae between mussel populations in the wider area.



The results show that there are two blocks of connectivity off the western Northland coast, and that there is limited connectivity between the two. This means that recruitment is likely local – i.e., that self-settlement is very important for local mussel reefs. So, although mussel larvae can theoretically be transported hundreds of kilometres at sea during the month they are in the water column, we now know that for the west coast Northland populations they are not transported very far at all. Kaitaia spat are derived from local mussel beds not from distant beds.

Genetics confirm Kaitaia spat comes from local beds

Preliminary genetic analyses show that wild mussels from Te Oneroa-a-Tōhē / Ninety Mile Beach and Kaitaia spat are very similar genetically but are different from mussels from other regions (Cook Strait, Christchurch, Wellington, and Raglan).

In conclusion, genetic analyses and physical oceanographic modelling both clearly indicate that Kaitaia spat are derived from local (e.g., Ahipara, Tiriparepa / Scott Point) mussel beds and not from distant (Raglan) or far distant (Cook Strait, Wellington Harbour, Christchurch) mussel beds. This is the first clear demonstration of the source of Kaitaia spat.