

USE OF MUSSEL REEFS FOR BIOREMEDIATION IN ŌKAHU BAY

Over the past four years the Ōkahu Catchment Ecological Restoration Plan (ŌCERP) aimed to promote, develop and enhance Ōkahu Bay as the public face or gateway to the Whenua Rangatira while respecting its existing cultural and spiritual value to Ngāti Whātua Ōrākei and enhancing its relationship with the Waitemata. Up until March 2017 Richelle Kahui-McConnell was the Manager of ŌCERP at which time Ngāti Whātua Ōrākei decided to re-assess their restoration programmes under their new Kaitiakitanga Strategy, internalising all works and ceasing the management by Mrs Kahui-McConnell.

As Auckland has grown, urban development has greatly impacted Ōkahu Bay, and the adjacent Ōrākei Domain. The main sewage discharge for Auckland was located at the head of Ōkahu Bay from 1914 until 1960 when sewage was diverted to the Mangere Wastewater treatment plant. The construction of the sewer line, as well as the subsequent construction of Tāmaki Drive that now lies over the sewer pipeline, created a substantial disconnect between the land and the sea. In addition, the discharge of wastewater to the bay greatly impacted the health and wellbeing of both the bay and its residents.

Research into the anthropogenic impacts onto Ōkahu Bay indicates disturbed ecosystem health in accordance with expectations of an urban context. Productive relationships between Ngāti Whātua Ōrākei, the wider Ōrākei community, Tertiary Institutions and Local Government have developed to maximise efficacy of the restoration of the mauri (life force) of the bay.

Sediment testing and hydraulic modelling have clearly implicated coastal development pressures on Ōkahu Bay. The current hydraulics of the bay have likely caused sedimentation (mud/silt/clay) and heavy metal deposition rates to increase in the middle of the bay. 8 years of Kaimoana (shellfish) monitoring of the bay indicates exceedingly low abundance and diversity of both pipi and cockle; filter feeding bivalves have high mortality rates with such high levels of sustained turbidity caused by mud/silt/clay in the water column.

MUSSEL REEF BIOREMEDIATION

The use of Mussels (*Perna canaliculus*) as a bioremediation of polluted or impacted marine environments is gaining traction as a viable alternative to other methods of restoring degraded habitats due to typically lower costs and working with, rather than against nature. In the marine environment shellfish are well known ecosystem engineers that have suffered significant reductions in population sizes worldwide through dredging practices, including here in Aotearoa.

Mussels filter vast amounts of water, which once assisted in cleaning the waters of the gulf. An exploration of their bioremediation capacity seems warranted; we expect the filtering capacity of a mussel reef to be having potential for wave attenuation as well.

Information obtained from remnant mussel beds shows that mussel habitats have the highest secondary productivity of any marine habitat yet recorded in New Zealand. Available research indicates that mussel restoration will increase the overall biodiversity of the inner gulf.

ŌKAHU BAY MUSSEL REEF RESTORATION

The Ōkahu Bay Mussel Reef Restoration programme is aligned with the Revive Our Gulf Mussel Restoration Trust which is supported by a highly experienced team of scientists, environmentalists, experts in island restoration, fishers, resource planners, and communications specialists.

PHASE ONE

In August 2014, 100 years after the sewage pipe that introduced pollution and disease into Ōkahu Bay was constructed, Ngāti Whātua Ōrākei implemented the first stage of the Mussel Reef restoration programme that strives to restore the mauri of Ōkahu Bay.



PHASE TWO

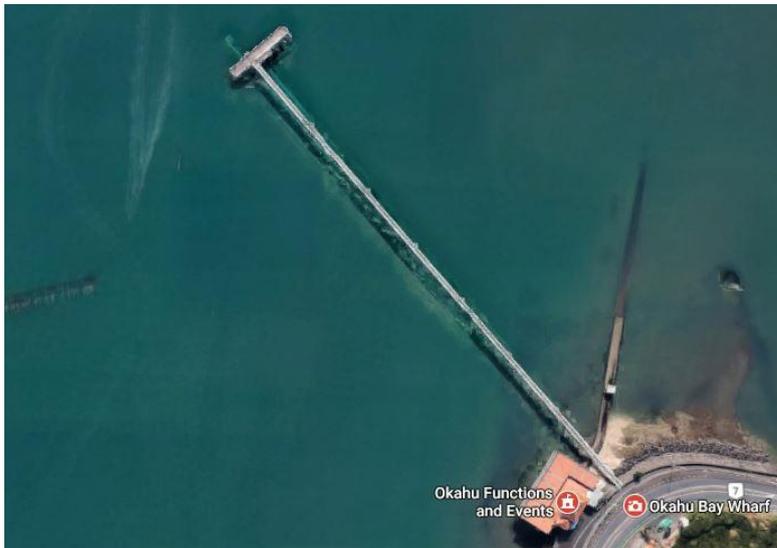
Since then two further mussel drops have been conducted totalling 5 tonne of mussel using a variation of methodologies under the guidance of mātauranga (local indigenous knowledge) to guide placement. Initial mussel drops combined weighted mussel-cultivated rope and singular mussels provided by the Aquaculture Industry. This approach has proven a ‘learning curve’ for the restoration programme, with individual mussels proving hard to settle, attach and locate for research purposes.

Funding for this work was received from the Outboard Boating Club, the Marina Fund and the Whenua Rangatira Reserves Board for the management of ŌCERP. In-kind support has been given by the University of Auckland, Marine Sciences Department and the Aquaculture Industry.

PHASE THREE

Monitoring of methodologies from the first two phases of the restoration programme highlighted the limitations of dropping mussels into the environment because of the current and sediment that is present in the area; the sediment smothers the mussel and the current flushes the mussel out of the bay. Traditional harakeke taura (flax rope), woven by Ngāti Whātua Ōrākei Kairaranga

(weavers) is currently being trialled as a new methodology of hanging cultivated ropes off existing vertical habitats or pylons to avoid 'washing out' of mussels which is what happened in the last three mussel drops.

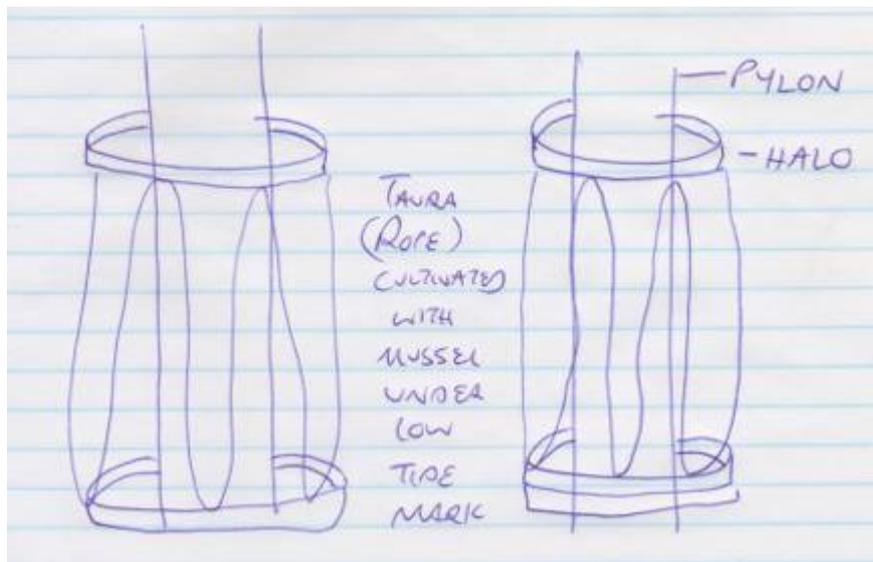


Originally the wave break pylons in Ōkahu Bay were assessed for their ability to house the suspended ropes but due to their age, condition and stability it was decided that this was not a feasible option. An alternative approach is to assess and hang cultivated taura (rope) from the pylons on the end of the Ōkahu Bay wharf (furthest away from Tamaki Drive). These pylons are stable and in a very good condition and can be easily accessed for monitoring and maintenance for research.

The presence of this cultivated rope provides more seed source for 'spat'

dispersal throughout the bay and the wider Waitemata Harbour, greater abundance of adult mussels which will create their own reefs under the structures as they mature, break off and build 3D structures that rise above the sediment at the base of the pylons and they will also provide excellent food source for fish populations. (keeping the fishermen very happy on the wharf)

The Ōkahu Bay wharf is an infrastructure asset of Auckland Council Parks which come under the jurisdiction of the Ōrākei Local Board, permission to assess and deploy these cultivated mussel rope on the pylons will need to be received to continue this mussel reef restoration programme. The management of the Ōkahu Bay Landing have given their in-kind support to provide boats/launches/coastal engineers to assist with this development.



THE FUTURE OF MUSSEL REEF RESTORATION PROGRAMME

Whilst taura (rope) is presently available, funding for the facilitation of the Mussel Reef Restoration Programme has now ceased. Continuation of the deployment and development of this methodology requires facilitation of assessment of the pylons on the wharf, definition of deployment methodology with engineers, confirmation of permission to use this asset and confirmation of provision of free mussel spat from the Aquaculture Industry.



An important part of this restoration programme is the continued engagement with Ngāti Whātua Ōrākei and the wider community of the Ōrākei Local Board. An integrated environmental education and engagement plan has a real potential of being developed to include all schools and interest groups within the catchment; it is vital to inform, build capacity and connection with the community so that they become guardians/kaitiaki in their own actions developing a higher potential for restoration of mauri (life force) in the people and the environment.

The long term viability of this mussel reef restoration programme is dependent on sustainable sources of funding and the weaving of its environmental outcomes into Ōrākei Local Board environmental programmes. The potential to weave this restoration programme into the currently developing Environmental Policy of the Local Board proves an exciting prospect into the future. Whilst mussel reef restoration is in its infancy, the coastal implications of research and implementation of these types of methods has the potential to be rolled out along the coastal margin of the Ōrākei Local Board.

PROPOSAL

Contract Richelle Kahui-McConnell for 40 hours a month at \$100/hour over two years to

- Implement Step Three of the Ōkahu Bay Mussel Reef Restoration Programme and develop further stages of the programme*
- Develop an environmental engagement and research strategy for the community of Ōrākei Local Board*
- Advise on the development of the Ōrākei Local Board with the Environmental Policies and Programmes (this will include the potential roll out and further development of the Mussel Reef Restoration Programme along the coastline of the Ōrākei Local Board)*