

Revive
our Gulf 



2022/2023 IMPACT REPORT

18 MONTHS TO DECEMBER 2023

Kohikohi ngā kākano whakaritea te pārekereke kia puāwai ngā hua
Gather the seeds, prepare the seedbed carefully and you will be gifted with abundance

THE REVIVE OUR GULF PROJECT IS AN
INITIATIVE TO RESTORE THE SEABED KŪTAI
REEFS OF TĪKAPA MOANA / TE MOANANUI-Ā-TOI
/ THE HAURAKI GULF



WELCOME | NAU MAI

Thank you for your interest in the Revive Our Gulf project! Re-establishing kūtai / mussels in Tīkapa Moana / Te Moananui-ā-Toi / the Hauraki Gulf is an intergenerational mission. Experimental timeframes are long, and it can take years to see results. We still have much to discover and learn about how to restore, and we're doing that against a backdrop of a changing climate, illustrated throughout 2023 by several unprecedented weather events, and the encroachment of a new threat to the Gulf: the seaweed exotic *Caulerpa*.

Although we cannot easily speed up ecology, we can actively strive to accelerate our knowledge gains, and it feels like we are achieving this. For the first time in the history of this project, we have in place a regular monitoring programme. Over the past 18 months, eight compliance monitoring surveys and two additional surveys have significantly enriched our understanding.

Looking ahead to 2024, our commitment to knowledge gains intensifies thanks to the support of our newest funding partner, the BNZ Foundation. This collaboration enables us to have more eyes in the water, more often. Observation plays a fundamental role in adaptive management.

The University of Auckland continued to deliver important research findings throughout 2023 particularly focussed on settlement and recruitment - how juvenile mussels are attracted to settle into the kūtai beds. Our collaboration with the Kelly Tarlton's Marine Wildlife Trust has investigated which seaweed species, native to the Hauraki Gulf, are preferred by young kūtai.



The Revive Our Gulf project feels at its best when we are giving back to Tangaroa and Hinemoana by enhancing kūtai populations in the moana. This year's observations help us refine our methods, and we plan to deploy again in mid 2024, aligning with optimal water temperatures.

None of this can be achieved without the continued support of the Revive Our Gulf funding community, to whom we express our profound gratitude. You are an integral part of this kaupapa, enabling us to persist and advance our mission. Notably, The Nature Conservancy Aotearoa New Zealand (TNC NZ) raised an additional \$1 million for the Tīkapa Moana/Te Moananui-ā-Toi Challenge Fund for shellfish restoration with Foundation North.

To the projects' Tangata Whenua partners – thank you for your trust and choosing to work with us. Walking alongside you enriches and deepens the kaupapa and stretches us beyond measure.

On a personal note, it has been an absolute privilege to join the Revive Our Gulf whānau this year. Being part of a generation that is committed to turn the corner on environmental degradation is a powerful motivator and a huge responsibility. Our mahi extends beyond the present, sowing the seeds of restoration for kūtai and coastal ecosystems throughout Aotearoa. The potential for positive change in Tīkapa Moana / Te Moananui-ā-Toi / the Hauraki Gulf looms large!

Mauri ora!

Katina Conomos
Kaihautū / Programme Director
The Mussel Reef Restoration Trust



WHO'S INVOLVED

Revive Our Gulf is a collaborative project involving iwi/hapū, researchers and community. Participation is continuously growing.



MRRT was established in 2013. It was set up specifically to undertake kūtai reef restoration in Tīkapa Moana / Te Moananui-ā-Toi / The Hauraki Gulf. The Trust is the local entity responsible for growing capability and capacity for kūtai reef restoration for the Revive Our Gulf project. MRRT takes the lead on creating the conditions for the collaboration to be successful and is responsible for the resource consent and biosecurity permits. The Trust leads on communications and is the custodian of the Revive Our Gulf project brand.



Researchers at the Institute of Marine Science, University of Auckland, have been working on shellfish restoration research since the early 2000s. They lead the research and provide specific scientific expertise around restoration methodologies and the ecosystem benefits of restoration.



TNC has been supporting kūtai reef restoration efforts in Aotearoa since 2017 through its local office TNZ NZ. As a global environmental not-for-profit (headquartered in Virginia, USA and active globally in more than 70 countries), TNC is involved in shellfish restoration projects around the world, supporting locally-led shellfish restoration initiatives with specialist expertise and funding.

TANGATA WHENUA PARTNERS



NGĀTI WHĀTUA ŌRĀKEI



NGĀTI MANUHIRI
SETTLEMENT TRUST



OUR STRATEGIC PRIORITIES



Active restoration activities



Advancing knowledge, research, and discovery



Nurturing our partnerships and developing a pipeline of people



Securing long-term supply of kūtai



Monitoring, evaluation, and reporting



Raising awareness and building support



Influencing regulatory policy



Driving long-term funding growth



Supporting the exotic *Caulerpa* response

HIGHLIGHTS: JULY 2022 - DECEMBER 2023

Whakatō kūtai (mussel planting)

October 2022 witnessed a milestone with the deployment of 100 tonnes of kūtai south of Te Kawau Tūmārō-o-Toi, in the rohe moana of Ngāti Manuhiri, surpassing the previous FY2022 deployment of 50 tonnes. This created the largest experimental mussel bed in the Hauraki Gulf to date, and likely the world!



Monitoring

Following deployments throughout 2022, attention shifted to monitoring, which occurred regularly at both Ōkahu and the restoration sites south of Te Kawau Tūmārō-o-Toi. We have now standardised our compliance monitoring and reporting.

6 x monitoring surveys were undertaken in Kawau Bay (Aug 22, Sep 22, Jan 23, Apr 23, Oct 23, Nov 23).

3 x monitoring surveys were undertaken in Ōkahu (Nov 22, Jun 23, Dec 23).

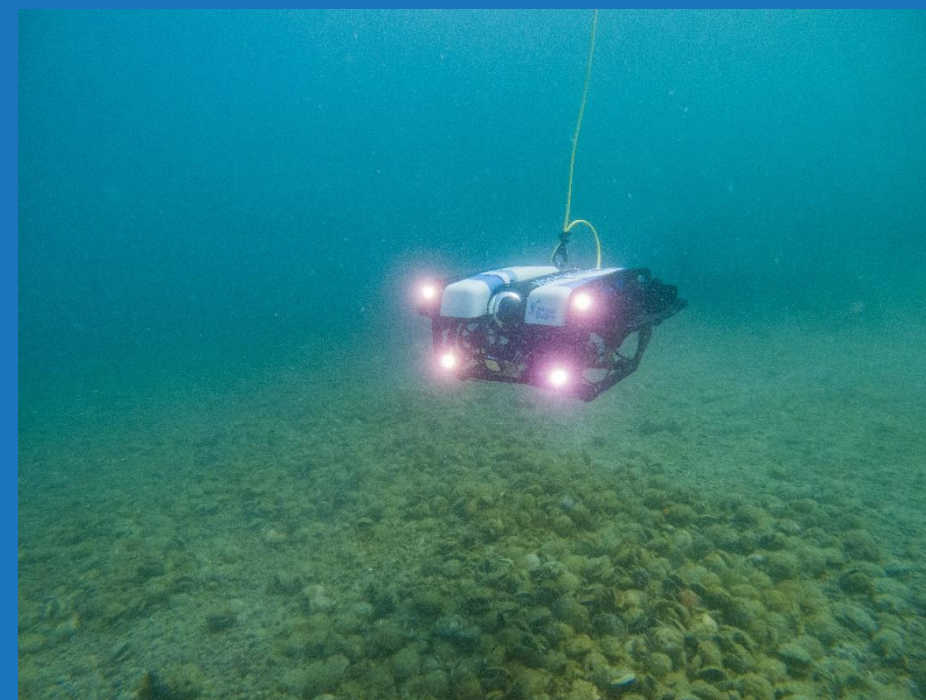
Monitoring reveals diverse outcomes, with persistence and growth in some areas and reasonable losses in others. Although natural recruitment back into restored beds remains elusive, with varied presentations across sites (it is still early days!), encouragingly, the Moturekareka and Ōkahu kūtai beds now support more diverse seafloor community with kūtai shell providing structure for other habitat and marine life.



HIGHLIGHTS: JULY 2022 - DECEMBER 2023

Restoration know-how and tools

We increased our surveillance and monitoring capabilities by acquiring a remotely operated vehicle (ROV), enabling rapid response without deploying SCUBA divers. We stood up an ROV training programme, taking 6 x non-scientific members of the Revive Our Gulf whānau through this. We are now investing in how to achieve remote benthic (seafloor) imaging using the ROV platform. Increasing surveillance productivity for exotic *Caulerpa* has been a key driver in this project.



Science advances

Kelly Tarlton's Marine Wildlife Trust investigated seaweed species for kūtai settlement. Settlement trials with locally harvested seaweed and 20-day-old kūtai larvae were conducted to observe settlement preferences. Three seaweed species demonstrated the highest settlement rates. Further research on seasonality of the seaweeds and handling of seaweeds will be undertaken in 2024.

Read on for more science highlights (pages 12-14) from the University of Auckland.



HIGHLIGHTS: JULY 2022 - DECEMBER 2023

Advocacy & outreach

Active participation in events, conferences, and community engagement.

- >8 presentations at community events, clubs and conferences.
- Supported by TNC NZ, we had strong representation at the Australian Coastal Restoration Network Conference in Townsville, Australia, fostering international collaboration. All three of the projects' Tangata Whenua partners were represented and made presentations, as well as our Science Lead, Jen Hillman.

We made submissions on key bills and consultations, including the Hauraki Gulf Marine Protection Bill, bottom impact fishing consultation, and Waikato Regional Council's coastal plan. In late 2022, we ran a campaign in support of increased Hauraki Gulf marine protection (which would create areas for active restoration and protection of kūtai beds) resulting in over 500 submissions to the Department of Conservation.



Supporting the exotic *Caulerpa* response

Revive Our Gulf is collaborating with our Tangata Whenua partners, Auckland Council, and Biosecurity New Zealand to increase surveillance for exotic *Caulerpa* in the Hauraki Gulf. 4 x *Caulerpa* surveys have been conducted since August 2023, in collaboration with Tangata Whenua partners (with no *Caulerpa* identified). Support was provided to the Te Wero Nui community roadshow convened by Ngāti Manuhiri Settlement Trust.



NGĀTI MANUHIRI SETTLEMENT TRUST

The Ngāti Manuhiri Settlement Trust, as the mana whenua and mandated authority from Te Ārai to Takapuna on North Auckland's east coast, has collaborated with Revive Our Gulf for an ambitious project. This initiative, named Whakatō Kūtai, aims to establish interconnected kūtai beds across islands and bays, thereby enriching the ecological diversity of the Kawau Bay area. In 2022, the project involved creating two substantial kūtai reefs near Moturekareka and Motuketekete Islands, deploying 150 tonnes of kūtai across adjacent sites, marking the largest kūtai deployment in Te Moana nui ā Toi / Hauraki Gulf.

While the Moturekareka reef showcased persistence and growth throughout the year, the Motuketekete reef faced challenges and experienced notable losses. Issues related to sedimentation and the need for refining deployment methods at scale emerged as key considerations for future endeavours.

The discovery of exotic *Caulerpa* in Iris Shoal prompted immediate action from Ngāti Manuhiri Settlement Trust's kaitiaki. The latter part of the year involved dedicated efforts to comprehend the extent of the *Caulerpa* outbreak and explore various methods for its removal.

As part of their campaign named Te Wero Nui, Ngāti Manuhiri Settlement Trust organised an impactful roadshow. This event brought experts from California, energising all involved in the *Caulerpa* response.

The Ngāti Manuhiri Settlement Trust actively collaborates to envision a future where their tamariki mokopuna (children and grandchildren) thrive in a healthy taiao (natural environment). By learning from both successes and setbacks, the aim is to strive for sustainable and scalable restoration, ensuring a brighter future for generations to come.



NGĀI TAI KI TĀMAKI

In April 2023, a two-day wānanga was held with Ngāi Tai ki Tāmaki whānau which gave light to the importance of the Revive Our Gulf project to the iwi and to the social and cultural benefits engagement such a kaupapa holds.

Exotic *Caulerpa* is the forefront issue for Ngāi Tai ki Tāmaki. Proactive surveys have been conducted in Tīkapa Moana: around The Noises, the north-eastern section Rakino Island, the western and eastern sides of Rotoroa Island and the north and east side of Pōnui Island/Te Pounui a Peretu. Exotic *Caulerpa* was not identified in the surveyed areas.

As the final stages of planning unfold, anticipation builds for the upcoming kūtai deployments on the eastern side of Ponui in 2024. Additionally, experimental endeavors are underway, involving the introduction of restoration structures to conduct tests on larval settlement dynamics.

For Ngāi Tai ki Tāmaki, success is intricately tied to succession. With the support of Revive Our Gulf, Isabella Penrose, a Ngāi Tai ki Tāmaki rangatahi, completed a summer internship with the University of Auckland in 2022/2023, and her ongoing commitment to the kūtai kaupapa now continues in her role as Hoe Piripiri Waiora Coordinator with the iwi. Isabella is preparing a monitoring plan for the kūtai deployments which incorporates a contemporary science view and a Mātauranga Māori view and hopes this plan can be applied more broadly across the Revive Our Gulf project.



NGĀTI WHĀTUA ŌRĀKEI

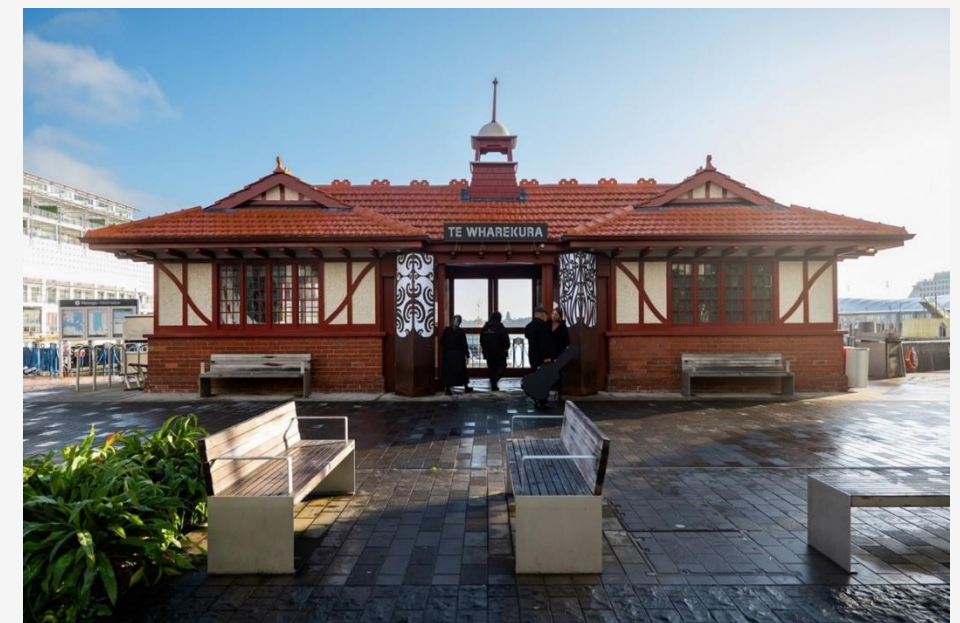
Over multiple generations, Ōkahu (Bay) has suffered severe degradation as a result of human activities, particularly the discharge of human waste, runoff, and changing land use. Collectively these have significantly impacted the mauri of the bay. Unfortunately, this year proved to be another challenging chapter for Ōkahu and Waitematā.

Events such as the Auckland Anniversary weekend storm, Cyclone Gabrielle, and the sewage leak into Waitematā due to a sinkhole in the Ōrākei Main Sewer (in September 2023) underscore the environmental crisis we are currently in, and the urgent need for accelerated knowledge and action in remediation and restoration of our moana.

Working in Ōkahu highlights the critical connections between the whenua and the moana. The muddy seabed of Ōkahu presents a distinctive challenge for restoration efforts. Since laying 60 tonnes of kūtai in 2021 in Ōkahu, we have monitored the site and observed a steady decline in kūtai survival, however, the kūtai had the fastest growth rates compared to other sites. Additionally, the presence of small amounts of kelp, sea stars, sponges, and sea squirts observed in the area underscores the importance of habitat and seafloor structure as essential factors for supporting various forms of marine life. Sedimentation emerges as a significant concern, with fine sediment covering portions of the mussel beds likely affecting mussel health.

Ngāti Whātua Ōrākei and Te Kaunihera o Tāmaki Makaurau / Auckland Council collaborated to present Te Wharekura, the revitalised heritage ferry kiosk – repurposed into a cultural and marine education space on the downtown waterfront. Revive Our Gulf is honoured to be part of the storytelling within Te Wharekura, and furthermore was pleased to provide Ngāti Whātua Ōrākei with technical advice and support throughout the year in relation to Government consultation processes and the Ōrākei Main Sewer failure, and support kaimahi Jessica Hiscox, Raukura Tūhono (Regenerative Practices Lead) to attend the Society of Ecological Restoration World Conference in Darwin.

“Ngāti Whātua Ōrākei have always considered the protection of Waitematā as essential to the wellbeing of our people. By sharing our stories and heritage, Te Wharekura inspires everyone living in and visiting Tāmaki Makaurau to treat the water as a taonga.”



SCIENCE HIGHLIGHTS

The University of Auckland conducts extensive studies on kūtai in the Hauraki Gulf and Top of the South – locations which all suffered devastating losses of kūtai and kūtai habitat over the last 100 years. Research from all sites is collated to inform future restoration activities and research. Research is currently focussed on better understanding the factors that contribute to survival and population growth.

Examining seaweed, turbidity and location

Wild and transplanted seaweed (macroalgae) in Kenepuru Sound were sampled to examine the patterns of abundance of spat in a degraded environment. The results suggest that spat can settle to and survive on natural substrates following the removal of kūtai reefs, but not in the areas where historically it's been ecologically relevant for them to be. Specifically, almost no spat were recorded on substrates near the sea bed, the area where almost all settlement to seaweed would naturally occur. Instead, spat were primarily recorded on seaweed on docks suspended above the sea bed. A transplantation experiment verified this trend, demonstrating that substrates transferred to surface waters recorded a 36-fold increase in spat abundance compared with substrates near the sea bed. Turbidity was significantly higher near the sea bed than near the water surface, suggesting that high turbidity following the loss of wild kūtai (and resulting damage to the sea floor) may be hindering natural spat settlement or survival.

How to evaluate progress?

A theoretical reference system for Australasian kūtai species has now been prepared. In the absence of remaining natural kūtai reefs, theoretical reference systems can be used to evaluate restoration progress towards what could be expected in natural conditions.

Testing habitat suitability

Small-scale pilot plots of kūtai over five sites were deployed in Pelorus Sound to understand the factors affecting habitat suitability. Of the five locations tested, four had high survival after two years, and one had total mortality by 18 months from the eleven-armed sea star. This has helped to inform site selection for future studies in all regions and shows the utility of small-scale plots as an early restoration tool for an area.

SCIENCE HIGHLIGHTS CONTINUED

Using shell in restoration

Adding substrate is common for oyster restoration. The effectiveness of using waste whole kūtai shell for kūtai in two different soft sediment habitats in Pelorus Sound was tested. After one year, there was no observed difference in adult kūtai survival between the shell and soft-sediment areas. However, the shell plots were found to create habitat for other organisms that we are planning to quantify in the near future! Similarly, a test was conducted using shell hash in Ōkahu Bay, and after two years, no significant difference in adult kūtai survival was observed between the shell site and the soft-sediment site.

Faunal biodiversity

Three faunal classifications, infauna, epifauna, and pelagic fauna were examined on the small-scale kūtai plots in Pelorus Sound compared to adjacent control plots with no kūtai to understand the “faunal community” response to the kūtai within the first-year post-restoration. The aim was to effectively identify biodiversity variations, which could provide valuable insights to inform further restoration activities. The restored kūtai habitats recorded 42 times more demersal fish than control areas, including triplefins and the commercially important blue cod. Macroalgae and mobile benthic invertebrates were over two times higher in abundance on the kūtai habitats than control plots. However, infaunal organisms decreased in abundance and diversity, likely from the high organic enrichment under the restored kūtai beds.

Using spat for restoration

Novel ways to restore kūtai reefs using baby kūtai (spat) attached to seaweeds were explored. Kūtai commonly settle on seaweeds for protection early in their life cycle before transitioning to a reef. The objective was to investigate whether spat attached to seaweeds could be utilised for restoration instead of adult kūtai. To test this, a series of trays were employed—25% empty, 25% with adult kūtai, 25% with spat attached to seaweeds, and 25% with both adults kūtai and spat. These trays were placed in an area requiring restoration, and after 1-2 months, were retrieved to examine any new kūtai recruitment. The exciting finding is that trays with spat and seaweeds showed significant kūtai recruitment (up to 10 times more than trays with only adult kūtai).

SCIENCE HIGHLIGHTS CONTINUED

Understanding kūtai predator behaviour

Counting predators from timelapse camera images taken in the first four days after deployment helped gauge potential predator pressure. 2,371 individuals from 10 different mobile species were seen, including five known kūtai predators, with tāmure (snapper) making up 98% of overall species counts. Kūtai survival ranged from 0 to 56%, primarily predicted by changes in turbidity and the total predators count. The abundance of predators was most explained by the time of year. Planning deployments of kūtai during cooler periods when water clarity is high and low predator abundance may substantially increase immediate survival of translocated kūtai and improve restoration success.

Can intertidal restoration work?

Approximately 5 tonnes of kūtai from a kūtai farm were transplanted – half in the intertidal and half in the shallow subtidal at three locations in Keneperu Sound, and monitored for a year to see if survival, condition, and growth changed between the depths and locations. After a year the subtidal sites all had very high survival (~95%), and one of the intertidal sites also had very high survival, showing that successful

intertidal kūtai restoration is possible, even using kūtai grown in the subtidal! Two intertidal sites did experience some mortality, which directly correlated with exposure to extreme heat (>40°C) in the summer. So, while intertidal kūtai restoration is possible, location and corresponding heat stress matter, especially as our planet gets even warmer.

Does size matter?

Two sizes of kūtai (80 and 60 mm) were transplanted, as a single size class and as mixed cohorts at three shore heights (i.e., neap low tide, spring low tide, and subtidal). Shore height had a greater effect than size class on kūtai survival, with a 100% loss of kūtai transplanted into areas that were exposed at neap tides, in contrast to 61% kūtai loss transplanted into areas that were only exposed on spring low tides. Further, kūtai transplanted in the adjacent subtidal had lower overall losses (26%). This suggests that aerial exposure time determines the upper vertical limit for restoration by transplantation of kūtai sourced from aquaculture, despite their historical distribution. The results of this study also support the use of smaller kūtai (~60 mm) for transplantation for kūtai reef restoration, as a 25% reduction in size resulted in 50% more kūtai being deployed.

A MASSIVE THANK YOU | NGĀ MIHI NUI

CORE COLLABORATORS



TANGATA WHENUA



PRINCIPAL PARTNERS & FUNDERS



PROJECT SUPPORTERS & CORPORATE SPONSORS



**IF YOU WOULD LIKE TO TALK TO US ABOUT
THE PROJECT OR ANY ASPECT OF THIS
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