

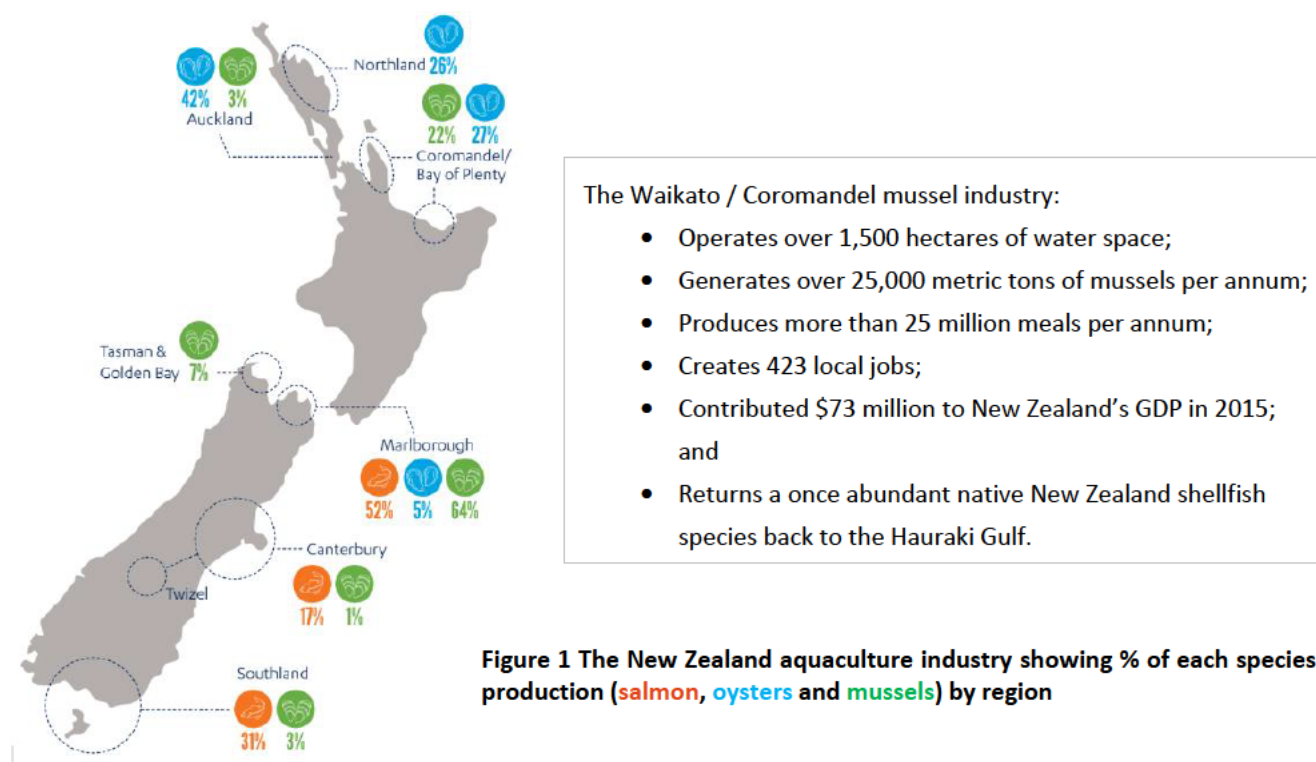
Schedule F Mussel Spat Nursery Background

1.0 Mussel Spat Nursery Context

1.1 New Zealand's Greenshell Mussel Industry

The New Zealand mussel industry is high on the Government's priority list as a sustainable opportunity to support economic and social wellbeing in these challenging times. It provides a unique opportunity for Māori through the aquaculture settlement, including advancing cultural provenance and providing positive career pathways. *'Its development through innovation and best practice can enrich our communities and our global reputation'*. A peer reviewed life cycle analysis of New Zealand mussels has found they have the lowest carbon footprint of any animal protein source¹.

The mussel industry is spread across the country, but the primary farming regions are Marlborough and the Hauraki Gulf/Coromandel:



One of the most pressing challenges for the mussel industry is a sustainable and resilient source of mussel spat. Mussel spat are the baby mussels that the industry needs to supply onto their farms in order to produce harvest sized mussels.

The Greenshell mussel industry has a sustainable growth goal to contribute around \$1 billion of the overall aquaculture industry goal to be a \$3 billion industry by 2035. This growth will predominately come from increasing productivity on existing farm space as well as some new space in selected regions. To enable this the industry, through its Spat Strategy, is projected to require a 40% increase in spat by 2025 and a 60% increase by 2035 as well as methods to better retain the existing spat supply on the mussel farms.

¹ <https://www.thinkstep-anz.com/resrc/case-studies/a-life-cycle-assessment-of-nz-mussels-and-oysters-lca-aquaculture/>

1.2 Spat Supply and Survival Issues

Historically the majority of the industry's spat has come from spat attached to drifting seaweed that washes up on Te Oneroa-a-Tōhē (90 Mile Beach). Another important source has been wild-caught spat which attach to specially designed catching lines deployed at dedicated spat-catching sites however changing environmental conditions have seen significant declines in catches at these sites in recent years. The remainder is sourced from the Shellfish Production and Technology NZ Limited (SPATNZ) hatchery and nursery in Nelson, which is still currently the only spat hatchery in New Zealand.

The industry is experiencing a significant challenge in accessing and retaining sufficient spat to maintain its current production. Changing environmental conditions and quota controls are impacting the resilience and accessibility of the existing spat supply. Noted changes in land use and the increasing farm run-off is also impacting on the levels of sedimentation and nutrients in the mussel growing areas, including the Firth of Thames. There is average warming of the water temperatures across the seasons and an increasing population and diversity of marine pests.

Alongside all this is an ever-increasing population of snapper amongst existing farms which has become a significant issue in the Hauraki Gulf as they can consume significant quantities of mussel seed when its growing through the range of 10-50mm. This has caused substantial damage and cost to the farm structures as well as loss of the crop. It is estimated snapper predation is costing the Coromandel industry \$5-10 million per year.

The results of this decline in production is hundreds of jobs lost due to factories closing, including the North Island Mussels Limited Tauranga factory in June 2024, farmers leaving the industry, no further investment, community financial hardship, and a return to a cottage industry².

Regardless of where spat is sourced from (Te Oneroa-a-Tōhē, wild caught or hatchery) industry needs more quality nursery space to raise that spat to a size where it is resilient enough to be re-seeded for grow-out. That means it needs to be able to withstand fish predation and warmer sea temperatures.

As such there is growing awareness that alternative spat sources are necessary through both the development of land-based hatcheries and by identifying optimal sites for catching wild spat and cultivating seed. In particular there is an increasing understanding of the crucial role that spat/seed nurseries will play in the industry's future productivity and resilience³. This proposal presents a superior spat nursery opportunity to deliver much needed diversity and resilience into the overall spat supply.

One unique characteristic of the Waikato west coast sites is that the seed can be grown to a size too large for snapper to eat then stripped off the nursery lines before being reseeded onto growout farms. Another is that the reliably high density of spat catch allows for the ropes to be transferred directly to grow out sites when the spat is smaller. This enables a much higher level of retention in more challenging growing conditions than other wild spat sources because the spat are more resilient from the cooler and productive waters. They can then maintain their original attachment to the ropes making them much less inclined to 'drop off'.

²<https://core.opentext.eu/pdfjs/web/viewer.html?shortLink=e8c0cb8b7bf7be98a95ee5dde3fd2d2f09e629823aaa258b8>

³<https://www.mpi.govt.nz/dmsdocument/65745-Enabling-spat-nurseries-to-grow-New-Zealands-mussel-sector/sitemap>

1.3 Mussel Life Cycle

From the time of spawning and fertilisation, mussels start their life as free-swimming larvae, after which they settle as microscopic spat onto a catching medium. Once the spat has settled onto a suitable medium (in a natural environment, this would be a seaweed or the like, see Figure 3 below), metamorphosis from the larval, to the adult form takes place. This process takes the 'spat' (up to 40 mm) through a juvenile or 'seed' stage of 30 to 90 mm then on to mature adult mussels at a harvest size of around 105 mm.

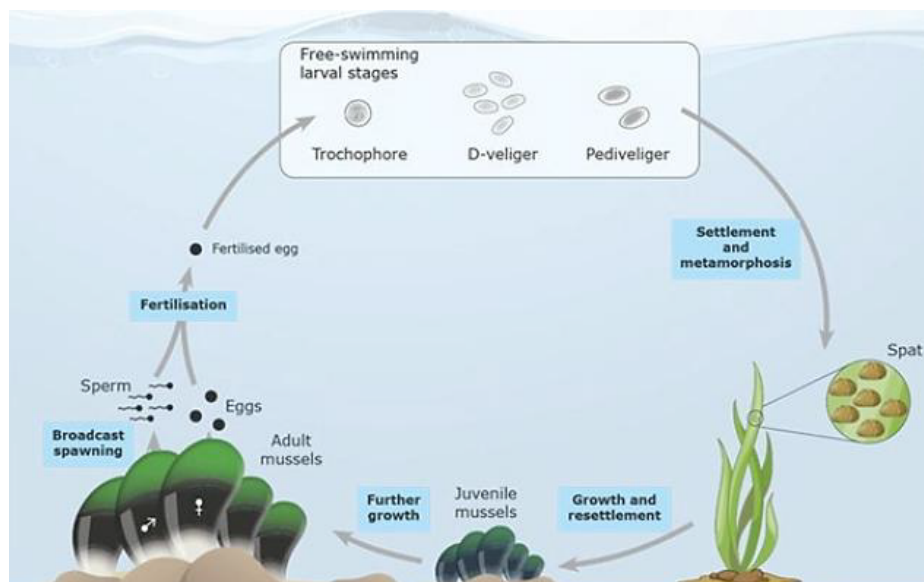


Figure 2 Mussel life cycle (University of Waikato)

1.3 Spat Catching

The purpose of a spat catching operation is to encourage microscopic spat larvae to attach themselves to a dropper rope, as explained below. Spat catching generally involves placement of lines, 'spat ropes' or 'dropper lines' in the water column during periods when spat are known to settle (usually a period of between 3-5 weeks each cycle). Various materials are used, including ordinary rope and lead-core rope.

The spat ropes are suspended from long-lines or 'backbones' which are supported on the surface by floats or buoys. After the spat has attached itself to the dropper lines, they are harvested (by removal of the dropper lines which the spat has attached itself to) and re-located to existing mussel farms, including in the Coromandel/Hauraki Gulf in the Waikato region, where they are eventually re-seeded in lower densities on holding droppers until they grow to a suitable size for seeding onto the final production lines.

In the New Zealand mussel industry generally, spat catching is defined by the process involved in catching the spat, ie putting spat catching structures in the water, not by the size of the spat when they are moved onto the growing area. Spat catching by its nature can include 'holding' mussels that have attached to the structure until the 'catch' is of a suitable density to be able to be transferred to an on growing site.

Spat catching has historically been undertaken at a range of sites across the country including in the Coromandel, Tasman and Golden Bays and the Marlborough Sounds. However, these have shown a steady decline in spat catching success over recent years such that now only Wainui Bay in Golden Bay and Aotea Harbour in the Waikato are considered reliable. This has resulted in an increasing reliance on Te Oneroa-a-Tōhē and a new focus on seeking alternative opportunities.

In 2020 the industry developed its New Zealand Greenshell Mussel Spat Strategy⁴ in recognition that 'a consistent and high-quality supply' of spat will be critical to achieving the industry growth goal.

1.4 Spat Nursery

It is common in the mussel industry to 'hold' the spat that is caught on a spat farm until the optimum conditions have been reached for it to be transferred to the grow out site. Mussel farmers often undertake an intermediate seeding process where they strip the spat from the lines then 'reseed' at the same site, or a site better conditioned for juvenile mussels, prior to the growout phase. This is called the nursery phase.

As noted above, the mussel industry is collectively seeking to address spat supply and retention challenges through implementation of its Spat Strategy. This includes research into understanding spat behaviour and optimal conditions for catching, holding and seeding. Depending on a range of conditions it may be beneficial to hold spat up to an average of 70mm in size prior to final seeding (whether through direct seeding or transfer on rope) on other farms. This is likely to provide them with sufficient resilience to survive the increasing water temperatures, snapper predation issues and land-use runoff challenges in the existing mussel farming areas such as the Hauraki Gulf.

Spat nursery sites are becoming increasingly more important for the collective industry response to changing climate conditions and the proposed locations have shown strong potential to provide a nursery site for the spat that is caught on the farm as well as potentially spat produced in land-based hatcheries. The characteristics of the proposed site, the clear, cool, nutrient rich waters of the Tasman Sea mean that the spat can build up their food sources and increase resilience, effectively fattening them up, so they have much better survival or 'retention' when introduced to farming areas.

The Spat Strategy estimates that if spat retention could be increased by just 1%, it would reduce the amount of spat required across the industry by 20% (or around 8 billion spat). This proposal has significant potential to increase retention by even more than that.

1.5 Mussel Farming

This application does not include the activity of mussel farming. Mussel farming is the stage of growing mussels after they have been seeded or reseeded, where they grow in place until harvest size. Under this proposal the mussel spat/seed will be removed from the nursery site prior to the final growing stage and seeded onto existing farms, including in the Coromandel/Hauraki Gulf in the Waikato region and further afield to the Bay of Plenty, where they will eventually be harvested for the domestic and export markets.

2.0 Farm Detail

2.1 Site Selection

New Zealand mussel spat catching locations are small isolated well defined geographical locations where mussel spat catching has a more reliable catching record. For reasons of geography, underwater topography, current flows, weather and other unknown factors, spat falls have found to be particularly good in isolated areas. Such known spat catching areas are Wainui Bay at the Top of the South Island and Aotea Harbour in Waikato. These locations are rare and of national importance but relatively small scale.

⁴ <https://drive.google.com/file/d/1L28eNXLLcdMoPv-ByVBMr85EdEk64RD1/view>

As noted above, site selection for this proposal has been informed by ten years of research along the west coast of the North Island including in the Waikato, Auckland, and Northland regions. The proposed location is unprecedented for their reliability, quantity and resilience of spat supply and conditioning. The location is also optimal for farming logistics due to calmer seas than those further north and the proximity to land-based infrastructure at Whāingaroa/Raglan.

The site locations have been considered carefully for any potential conflict with marine values and chosen for their no more than minor impacts. In a general sense, there are no suitable alternatives to the proposed Raglan/Whāingaroa location.

The following table illustrates the significance of the proposed locations in the context of alternative locations:

Site Selection - Comparing Oceanic Sites and Whangape Harbour						
	Raglan	Ahipara	West Auckland	Kawhia	Whangape Harbour	Waikato East Coast
Spat Count	High – Very High	Very High	Inconsistent	Inconsistent	Ok	Unviable
Retention	Very Good	Very Good	Ok	Ok	Nil	Variable
Logistics	Very Good	Very Difficult	Limited	Ok	Nil	Very Good
Infrastructure and Wharfage	Yes	Nil	Yes	Limited	Nil	Very Good
Suitable Spat Catching Sites	Yes	Yes	Yes	Nil	Nil	Nil
Suitable Nursery sites	Yes	Yes	Yes	Nil	Nil	Yes
Resilience to Marine Heat Waves	Yes	Yes	Yes	Yes	Unknown	No

Visual confirmation of the consistency of spat catch over the last eight years of research is shown below:



Figure 3 Whāingaroa/Raglan Spat Catch Time Series

The proposal comprises four separate sites located at least 3.1 km from the coastline in water 20-40 m deep. The four sites will cover an area of 700 hectares (including moorings).

The southernmost Site D in particular has the most consistently high catches and is the only site where spat

counts have been a similar order of magnitude to those at Ahipara (Te Oneroa-a-Tōhē), New Zealand’s best spat collection source.

Spat catching sites in the mussel industry fall into the following broad classifications based on the density of spat catch per metre of rope or ‘spat count’:

Spat Count (Spat/m)	Classification
0 to 1,000	Poor
1,000 to 2,000	Moderate
2,000 to 30,000	High
Above 30,000	Very High

Ahipara where the majority of New Zealand’s mussel spat originates often records spat counts above 30,000/m. In the ten years of spat research NWML has found that Site D is the only site which records numbers above 50,000/m, similar to Ahipara’s highest counts. Sites A to C have moderate to high spat counts.

It is not entirely clear why Site D is so much more productive than the other sites, but this is potentially related to local geography, wind, currents, and the underwater topography of Jacksons Reef.

Site D has also exhibited the highest levels of spat retention on the ropes after settlement, thus is also the most important nursery site. An example of catch from Site D is shown below.



Figure 4 Exceptional spat catch at Site D

For these reasons Site D is an exceptional site of national significance in terms of mussel spat catching, retention and growth.

2.2 Farm Design

Site layouts and farm design details are provided in **Schedule A** of this application.

The proposed farm consists of four separate sites totalling 700 hectares to optimise the spat operation and ensure sufficient reliable supply for existing marine farms, including in the Hauraki Gulf/Tikapa Moana. Aspects considered in selection of site size and layout were:

- The volume of mussels produced by the three participant companies, Gulf Mussel Farms, Vela Fishing and OP Colombia and their respective requirements for mussel spat;
- The Tasman Sea environment resulting in low density farming techniques. The high energy environment, large swell and high winds requires large spacing between lines in order to navigate and prevent lines tangling; and
- Also due to the Tasman Sea environment, substantial vessels will be required to work the conditions and manage crossing the Whāingaroa/Raglan bar. These vessels will be expensive, and the operation therefore needs to be of a certain scale in order to be an economical and affordable enterprise.

Farm design includes the following:

- Within each row, double (paired) or single backbone lines are 50m apart anchored by screw anchors.
- Deployment of single or double backbones will be according to operational requirements but as a guideline, double backbones may be installed over approximately half of the total area.
- The screw anchors will be buried to a depth of approximately 6-12 m, depending on the substrate.
- The mooring line length will be between 29-75 m, depending on the depth.
- The backbones will be oriented parallel to tidal flows.
- The backbone lines will each be suspended approximately 3 m below the surface using approximately 20 300L buoys.
- The buoys will be separated by 2-10 m, depending on the length of dropper lines.
- Dropper lines will be approximately 8 m long and joined to the backbone in a continuous catching rope.
- The dropper lines consist of 'hairy' weighted 60-80 mm like rope onto which the microscopic free-swimming spat larvae will settle and grow.



Figure 5 Underwater example of single backbone configuration (except floats sit flat on water due to paired stroops)

During development of the proposal NWML have amended the design to significantly increase the negative buoyancy characteristics of the rope by adding weight in the form of coated lead, which is non buoyant to the catching rope. This stiffens and tensions the catching rope, preventing entanglement. The coated lead core adds weight, tension and sonar deflection to prevent entanglement. The expanded catching rope also has a greater visual optic.

They propose a mix of single and double backbone longline structures, anchored at either end with anchors, 60 to 80 meters of 44 mm durashield warps with a breaking strain of 31,000 kg, and backbone of 40 mm with a breaking strain of 25,000 kg. The catching/nursery medium is heavily weighted hairy spat catching rope, of 75 to 80 mm in diameter.

They have trialled this structures combination on 40 longlines of the open ocean mussel farm at Opotiki for 3 years with no entanglements.

The structures amendments are summarised over:

Structure component	Amendment
Warp diameter	Increase from 28 mm to 44 mm
Backbone diameter	Increase from 24 mm to 40 mm
Catching/nursery rope diameter	Increase from 15 mm to 80 mm
Catching/nursery rope weight	Increase the specific gravity
Dropper spacing	Increase from 300 mm to 600 mm

NWML also recognise the importance of best practice maintenance and management of the farm, including carefully securing structures and marine farming gear.

2.3 Marking and Navigational Aids

Aids to navigation will be in accordance with Maritime New Zealand (MNZ) 'Marine farm guidelines: navigational safety (2018) and MNZ 'New Zealand's system of buoys and beacons' 2008 and/or as required by Maritime New Zealand and as directed by the WRC Harbour Master.

The proposal is as follows:

- Orange buoys will be placed at each end of the backbone and one at the mid-point of the outside longlines
- Navigation marker buoys with yellow flashing lights will be placed 200 m outside the nursery sites
- Reflectors will be placed on the corner buoys of each block
- Perimeter lights will be placed at each 950 m interval and 650 m interval along the length and width (respectively) of each site 200 m outside the edge of the spat catching/nursery operation.
- Alternative marking and navigational aids will be installed as appropriate if guided by the Harbourmaster.



Figure 6 Single backbone (left) and double backbone (right) layout examples from Hauraki Gulf/Tikapa Moana

2.4 Farm Development/Staging

Development can commence within three months of the granting of consent, subject to consent conditions. The NWML shareholders have committed funding, the necessary equipment is readily available, and the industry has a critical need for spat. It is then proposed to implement the project over stages.

A staging development plan (SDP) will be formulated to ensure that appropriate monitoring is in place to inform development of further stages. The SDP will commence with a pilot farm of up to 82 lines at Site C (which is closest to Raglan Harbour). The SDP will include provision for monitoring of marine mammals and hydrodynamic effects in consultation with relevant experts prior to moving from one stage to the next. Importantly, in recognition that Site D is closest to juvenile Māui dolphin inshore activity during summer, and surf breaks of regional significance, it is proposed to delay that development until after sites A to C.

Apart from the initial pilot, and subject to consent conditions, construction is proposed to be undertaken 25 lines at a time. As more is learned about the logistics of operating in the west coast environment, adaptations to the construction process and specifications may be made. Timing is also highly dependent on weather conditions and operational logistics.

The stages proposed are as follows:

	Site A			Site B			Site C			Site D			Total		
	Area	Rows	Lines	Area	Rows	Lines	Area	Rows	Lines	Area	Rows	Lines	Area	Rows	Lines
Stage 1							120ha	2	82				120ha	2	82
Stage 2	90ha	1.5	61	90ha	1.5	61							180ha	3	122
Stage 3	90ha	1.5	62	90ha	1.5	62	60ha	1	41	60ha	1	31	300ha	5	196
Stage 4										100ha	1	51	100ha	1	51
Total	180ha	3	123	180ha	3	123	180ha	3	123	160ha	2	82	700ha	11	451

Construction of the sites will be undertaken by a four to five person team of specialist contractors and NWML.

The construction process consists of:

- Installing screw anchors:
 - There will be a total of 451 lines, with each line having two screw anchors (one at each end). This equates to a total of 82 anchors per row.
 - The anchors are installed with the use of a drill operating from a surface vessel. The anchors will be drilled to approximately 6-12 m depth into the substrate (depending on the specifics of the chosen location). Because the substrate is expected to consist only of sand, minimal resistance and/or disturbance is expected.
- Once the anchors are in place, the backbone and mooring lines and buoys would be attached. Navigation and lighting would then be installed as required.
- Finally, the dropper lines would be hung out to catch spat and/or to seed spat for the juvenile nursery activity.

An indicative timeline is provided:

Milestone	Timeline
Detailed design	Complete
Procurement	Within 3 months of granting consent
Funding	Already committed
Site works commencement	Within 3 months of granting consent depending on consent conditions
Stage one (up to 82 lines at Site C)	Developed within 6 months
Completion of pilot	
Stage one monitoring expert consultation	Approximately 6 months dependant on expert timings and findings
Stage two (122 lines sites A – C)	Developed in groups of 25 lines taking 6 months per group to a total of 3.5 years
Completion of stage two	
Stage two monitoring expert consultation	Approximately 6 months dependant on expert timings and findings
Stage three (196 lines Sites A – D)	Developed in groups of 25 lines taking 6 months per group to a total of 4.5 years
Completion of stage three	
Stage four monitoring and expert consultation	Approximately 3 months dependant on expert timings and findings
Stage four (51 lines at Site D)	Developed in groups of 25 lines taking 6 months per group to a total of 1 year
Completion of stage four	Within 11 years dependant on expert timings and findings

Note that this staged development approach provides multiple opportunities to monitor and manage the activity and innovate to optimise the operation.

2.5 Spat Catching/Collection Operations

As outlined above, microscopic spat will attach themselves to the dropper lines during the free-swimming larval stage (which lasts approx. 3-5 weeks each cycle). NWML have been undertaking spat research in the Tasman Sea every year since 2013 with monthly sampling over 193 site visits generating 683 rope spat samples analysed

over the 12 intervening years.



Figure 7 Spat catch over three seasons, autumn (top left), winter (top right) and spring (bottom on coir twine)

This research has produced data showing when spat is readily available in the area by:

- Collecting samples of spat catching rope which had soaked for differing lengths of time;
- These catching samples were then frozen to release the byssus thread of the attached microscopic mussel spat;
- After this, the samples were thawed, soaked in water and rapidly agitated, removing the spat from the catching material;
- The spat was then poured through and collected on a series of four sieves ranging from 350 (0.35 mm) to 3,000 (3 mm) microns in size;
- The sieves were then back-flushed into a bowl corresponding to each sieve size. By stirring the spat and water in one direction, the microscopic spat would accumulate in the centre of that bowl, followed by pipetting onto a microscopic slide for counting under a dissecting microscope, resulting in a spat count of numbers per metre.

NWML have now established that there are three spat settlements per year namely autumn, winter and spring. The autumn settlement is 60% reliable with the winter and spring settlements 100% reliable.

This data has given the applicant a rare yet in-depth insight into the specifics of successful spat catching on the Waikato West Coast. They intend to rely on this data when determining the logistics of the spat/nursery operation and to carry on using this same spat counting method when assessing how much each rope has caught, to determine whether tweaks are required to the spat catching methodology.

2.6 Spat Nursery Operations

Depending on range of factors, including the prevailing ENSO cycle, seasonality, conditions at mussel growout sites and the qualities of the spat being caught at the site or brought in from a hatchery, a range of potential nursery configurations may be carried out at any one time.

Potential options are:

- Remove the dropper lines from the farm when the spat is still at 'spat stage' then relocate those dropper lines to existing mussel growing areas, including in the Coromandel/Hauraki Gulf.
- Let the spat grow to a juvenile 'seed' stage prior to transfer
- Introduce spat from an alternative source, such as a hatchery, in accordance with the proposed Biosecurity Management Plan, by introducing it onto mussel spat 'stocking' hung from the lines, then allow it to grow to juvenile 'seed' stage prior to transfer

Spat nursery options enable spat to be grown to 'seed' to an average of 50 to 70 mm. This mussel seed will then be transferred to the Hauraki Gulf for on growth to harvest size. Growing mussel seed on these sites spreads the geographical risk over a wider range of sites in relation to spat mortality, particularly in the summer months, when marine heat waves occur and snapper predation increases in the Hauraki Gulf. The larger the seed, the lower the risk of fish predation due to shell thickness.

2.7 Harvesting and Maintenance

The spat catching/nursery activity will be carried out year round. The dropper lines will be seeded, harvested and maintained by specialist vessels (e.g. a 25m long aluminium mussel barge) and supported by land-based activities in that spat/seed will be transported to and from Whāingaroa/Raglan by road. As is normal in mussel farm seed nursery operations there will be instances where the spat will be transferred or re-seeded onto other ropes in lower densities to ensure that they have enough room to grow into mature, adult mussels.

Harvesting of the spat/seed ropes from sites A to D will occur intermittently with 2-day fortnightly visits, with maintenance carried out as part of these visits, as required. If there are times where the spat/seed operation is not active maintenance will be carried out through 2-day monthly visits to assess the structural integrity and rectify any wear and tear on lines, buoys and lighting. The most common maintenance activities expected include:

- Tightening ropes and fittings;
- Replacement of worn ropes;
- Fixing or replacing navigational lights;
- Fixing or replacing buoys; and
- Inspecting and tightening anchors.

2.8 Best Management Practices

Gulf Mussels are registered to New Zealand Sustainable Management Framework for Greenshell Mussels, A+⁵ and NWML intend to operate in the same manner. As such, all appropriate industry best management practices will be undertaken. In recognition of the unique character of the proposed site and in response to expert recommendations, NWML have developed an Operational Management Plan (OMP), Marine Wildlife Mammal Plan (MWMP) and Biosecurity Management Plan (BMP). They have undertaken to liaise with the Waikato

⁵ www.aplusaquaculture.nz

Regional Council, the Department of Conservation and Fisheries New Zealand to refine and incorporate these into draft consent conditions prior to lodging a substantive application.

2.9 On-Shore Landing Requirements

The farm will be harvested and maintained by specialist vessels and supported by land-based activities. The specialist boat will be based in Whāingaroa/Raglan Harbour and make its way to and from the sites from there. The specialist mussel barge will be moored in Whāingaroa/Raglan Harbour (using an existing mooring) and once the dropper lines have been harvested, the lines will be transported overland to the Hauraki Gulf/Coromandel Peninsula for further on-growing and eventual harvest.

3.0 Alternative Options

3.1 Not Building the Spat Catching/Nursery Operation

The first alternative option to the spat catching/nursery operation involves not establishing it. This would mean that the Applicant will need to continue to collect spat attached to washed-up seaweed on Te Oneroa-a-Tōhē. As noted above, this method is inherently unreliable as it relies on the right conditions to be in place for the seaweed to wash up. Following that, the seaweed containing spat needs to be collected, loaded, and transferred to its destination, all without losing or killing it in the process. This impacts significantly on the ability to make investment decisions across the industry.

In addition, collecting and transferring spat washed ashore on seaweed on Te Oneroa-a-Tōhē is much less passive than the proposed spat catching/nursery operation as it involves physically removing spat with the use of tractors in the surf zone (which brings to light a raft of other environmental considerations and potential effects).

3.2 Utilising a Full-Scale Marine Farm

The second alternative option involves using a full-scale marine farm. This is not viable as the site is unique and valuable for its spat catching/nursery characteristics and not suitable for full scale mussel farming.

3.3 Locations

As noted above, NWML has carefully considered the locations of the proposed spat catching/nursery sites after undertaking many years of research over multiple sites across the North Island. In summary, alternative locations were discounted for the following reasons:

Area	Reason
Northland northern west coast	Good spat catches but economically and logistically unviable due to a lack of port infrastructure
Northland Whangape Harbour	Some spat catch but little spat retention observed
Auckland west coast	Inconsistent spat catches
Waikato east coast	Inconsistent spat catches
Waikato west of Kawhia	Inconsistent spat catches, shallow water and landscape and sensitivity issues

In contrast, the proposed sites on the Waikato west coast have consistent spat catches, the locations are appropriate in the context of marine values and the proximity to Whāingaroa/Raglan Harbour makes them economically and logistically viable.

NWML have also ensured that the sites are located away from known reefs (such as Jackson's Reef south of Whāingaroa/Raglan) and sufficiently distant from shore to reduce any potential environmental effects even further. The sites have also been located outside the very high natural character overlay in the NCSWCE and the regionally and nationally significant swell corridors in the draft Waikato Regional Plan maps.

In other words, all four locations have been selected as the most suitable and will ensure that any environmental effects are minimised.

The reason for the four sites is that mussel larvae have a 3-4 week free swimming phase where they are at the mercy of wind, tides and current dispersing them. By locating the four sites over a wide geographical area it increases the chance of securing a catch at one or more of the sites. Success at all four sites in one season is not guaranteed, but highly likely to occur in any one or two sites in any one period.

3.4 Alternative Spat Supplies

As noted above, the mussel industry has a spat strategy in place to reduce reliance on Te Oneroa-a-Tōhē wild caught mussel spat over time. The reasons that this source is not sustainable is that it is intermittent and unreliable and transporting the spat from Northland can reduce its resilience thereby contributing to spat losses if it is introduced straight onto farms in the warming waters of the Coromandel/Hauraki Gulf.

The industry has identified that land-based mussel hatcheries will be an important component of the future total spat strategy, but it is not economically or logistically feasible to develop sufficient hatcheries to supply the whole industry. Furthermore, it will always be essential to include wild caught spat in the total mix to ensure diversity, productivity, and resilience.

NWML's future spat strategy, echoes that of the broader industry in the need to adapt to climate change. NWML are seeking to optimise diversity by:

- Continuing to source beach cast spat from Te Oneroa-a-Tōhē
- Pursuing a hatchery spat opportunity through discussions with Cawthron including initial investigations, and the preparation of a feasibility study.
- Wild catching spat in the most optimal locations on the west coast of the Waikato region

The latter two options, hatcheries and wild spat catching offer opportunities to adapt to climate change. Hatchery technology and development is underway but has its challenges and difficulties as *Perna canaliculus* is a difficult animal to breed in a hatchery compared to species used elsewhere in worldwide hatcheries. Wild spat catching in this application is well developed and has a long-proven history in New Zealand.

All three spat sources have their challenges thus a diverse portfolio of spat sources is required to spread the risk of any one source having a low outcome at any one year. Long term hatcheries offer the advantage of genetic breeding to adapt to climate change, but nursery locations, as in this application, will be required to transfer the hatchery spat to the marine environment, something that is lacking in the present farms in the Hauraki Gulf.

The industry has confirmed that spat nurseries are a key step toward increasing the resilience and retention of spat when it is transferred to grow-out farms. Recent research⁶ has indicated that '*improvements in spat*

⁶ <https://www.sciencedirect.com/science/article/abs/pii/S004484862100778X>

retention may come from altering the arrangements for deploying spat to mussel farms, such as seeding out with larger, single seed spat.'

The ongoing requirement for sea based spat catching/nursery sites, particularly on the west coast of the Waikato region has been confirmed by the industry representative organisation Aquaculture New Zealand in its letter of support for this proposal:

'One of the key challenges facing the industry is improving the security of mussel spat supply. More reliable, consistent, high quality sources of spat are needed if the industry is to maintain its present volumes, and greater spat volumes will be needed for the industry to grow. The NWML application aligns well with the first strategic goal of AQNZ's Mussel Spat Strategy⁴, 'to secure a consistent, diverse, and high-quality supply of spat to support the industry's productivity and resilience goals'.

Given the lack of sea-based nursery sites in the Waikato/Hauraki region, in part due to the constraint on new marine farming in the current Waikato Regional Coastal Plan, industry collectively has few options available for alternative growing locations to adapt and mitigate adverse environmental conditions and climate change. A sea-based spat catching and nursery site in the cooler waters off the West Coast as proposed by the applicant would be a strategic asset for the region's mussel farming industry.

The need to diversify nursery and grow-out sites in the Waikato region was highlighted during the 2021 mussel spat mortality event that was associated with warmer sea temperatures and adverse climatic conditions. Alternative cooler water sites will strengthen the resilience and productivity of the region's mussel farming sector⁷.

The following table illustrates the significance of the ocean based spat catching and nursery sites in the context of alternative spat sources:

Comparing Alternative Spat Sources			
	Ocean based catching/nursery	Beach cast spat	Hatchery spat
Availability	Yes	Fully Utilised	Not in Waikato
Capital Outlay	Moderate	Low	Very High
Adaptable Scalable Operation	Yes	Yes	No
On-farm Resilience to Fish Predation	Manageable	Mostly	No/Vulnerable
Autumn Catch/Supply	60%	Rare	Yes
Winter Catch/Supply	100%	Yes, Weather Dependent	Yes
Spring Catch/Supply	100%	Yes, Weather Dependent	Yes
Climate Change Adaptability	Yes, in Nursery Phase	No	Yes

Alternative spat supplies are important, but not an option on their own.

⁷ Aquaculture New Zealand (2023). Letter of support for North Western Mussels Limited application

4.0 Conclusion

In conclusion, the NWML mussel spat nursery proposal has been well researched over a significant period of time, is very carefully designed and planned, is shovel ready, and is the best opportunity for the Waikato and Bay of Plenty farmers to ensure access to high quality affordable mussel seed to optimise productivity of existing farms and ensure ongoing diversity, resilience and economic growth for the New Zealand mussel industry.