Blue Mussel Processing

Overview

Aquaculture is one of the world's fastest growing primary industries and demand for aquaculture products is expected to continue to grow as the world's population grows and wild-catch levels remain relatively static. Globally, aquaculture will soon produce more seafood than wild fisheries.

The New Zealand aquaculture industry, although relatively small on a global scale has positioned itself at the high-end of the market, exporting premium seafood products around the world.

The most significant sector within NZ aquaculture is the green-lipped mussel (GLM) industry. GLM are farmed on hanging lines suspended from buoyed longlines in Marlborough Sounds, Coromandel Peninsula, Canterbury, Tasman, Hauraki Gulf, and Stewart Island.

There are approximately 1200 GLM farms, producing about 100,000 T/pa (2017). Approximately 60% of mussels are grown in Marlborough Sounds.

Several invasive and unwanted species settle and grow on GLM mussel farms to the detriment of the NZ mussel farming industry, the most significant is the unwanted blue mussels. The abundance of blue mussels has increased dramatically in the Marlborough Sounds in the last 10 years. Mitigation strategies such as the blue mussel over settlement project have provided some relief for growers, but more effective uses for blue mussels have not been fully exploited

Blue Mussels

Blue mussels grow near the top of the mussel lines above the favoured green mussels and as the green-lipped mussel industry consider them to be a pest or low value product they are discarded during harvesting, line cleaning and land based processing. The total volume of discarded product in the Marlborough Region is estimated to be 6000 MT per year. Disposal of blue mussels at sea or in landfills is expensive and causes adverse environmental effects.

Opportunity

A 2012 University of Auckland study claims that the New Zealand fishing and aquaculture Industry has thrown away $1.5 billion in potential revenue by discarding much of its catch and by-products at sea.

Some counties, such as Iceland, identified similar wastage issues within the fishing industry and adopted policies to increase yields and improve utilisation of all raw materials. The industry in Iceland accepted that total catches were more or less fixed and the only way to increase value was to utilize as much of each fish as possible into as valuable products as possible. Increased utilization has contributed to significant value creation from the by-products and has led to better profits and environmental performance within the sector. As a result Iceland’s fishing industry EBITDA margin ratio is 30% against New Zealand’s ratio of less than 10%.

The Marlborough District Council has identified the aquaculture sector as a significant economic driver within the Marlborough business community, and indeed across Te Tau Ihu (the top of south). Not surprisingly, the sector has prominence within the Marlborough Sounds with mussels, salmon and oyster farming and is considered a major local employer, particularly in Havelock.

Marlborough Smart and Connected is an economic development strategy that implements a vision developed by Marlborough District Council in partnership with the community. The vision will see Marlborough become a globally-connected district of progressive, high-value enterprise, known for economic efficiency, quality lifestyle, desirable location and natural environment.

Smart relates to thinking strategically, becoming more efficient, creating new solutions, and leveraging those solutions to create new opportunities. Connected involves participation from industry and community, being informed, and getting local, national, and international support.

The Smart and Connected Aquaculture group is one of several groups that the Council has helped set up for various industries and communities in Marlborough. Within the group the Value and Innovation team is focusing on a solution to the problems presented by blue mussel by-catch. Participants include Sanford and Kono, an associated company of Nelson tribal group Wakatu Incorporation.

While the group has seen some success surrounding mitigation of blue mussels it has not been provided with a solution to transform the mussels in to a value added product using an economically viable process.

CfarmX is currently working with the Value and Innovation team in order to be able to meet the group's and CfarmX's objectives. The support of the Aquaculture group has greatly assisted with refining and validating the process and the development of a business plan.

Current Processing Methods

Because the blue mussel is a low value product it is not economically viable to harvest and process them using current industry practices. Processing GLM mussel powder and oil in New Zealand typically involves freeze drying, solvent extraction of the oil and/or supercritical extraction. The capital cost of the equipment and cost of production are high. Toll freeze drying of mussels costs between $20 and $30/kg of dry material depending on volume. Initial price indications for blue mussel powder range between $10 and $15/kg depending on the fatty acid profile. Furthermore current processing methods are not capable of removing all of the meat from the shell which limits their use due to odour/resource consent issues, meaning the majority of shells are disposed of via landfill.

The Solution

CfarmX has completed pilot scale and pre commercialisation trials at Callaghan Innovation using enzymatic hydrolysis to produce a stable liquid from blue mussels. The method is rapid and reproducible, avoids the extremes of chemical and physical treatments, minimises undesirable reactions which can destroy valuable components, and its liquid form allows separation of high value bio functional ingredients using a unique combination of known and novel techniques.

Specifications and costings have been finalised for a Marlborough based facility capable of processing 15 MT of blue mussels for 220 days per year, which accounts for approximately 50% of the blue mussels harvested in the region. CfarmX intends to scale up the operation to be able to take all available blue mussels within five years.

Initially the hydrolysed mussels will be concentrated via membranes/evaporators and exported to Australia for use as a component in salmon and shrimp/prawn feed. Although the aquaculture feed market is not the highest value proposition, the market is established, demand is high, and trial results have been promising. Inclusion of 5% mussel hydrolysate in shrimp feed trials resulted in an improved immune system, increased survival rates and enhanced growth rates.

The shells will be free from meat and can be crushed for use as an alternative to pesticides on vineyards to control grass grubs and brown beetles which affect grape yields. Alternatively the shells can be milled and used as a source of calcium in animal feed.

Long term the company will establish a new market for high value isolates. Trials at Callaghan Innovation showed excellent results for separation of a peptide fraction and an oil/insoluble fraction. The oil was isolated from the insoluble materials and the peptide fraction was dried.

Blue mussel peptides have exhibited antioxidant and virus inhibiting activity against influenza viruses making it a promising ingredient for functional foods and nutraceuticals. Furthermore, Plant and Food have demonstrated that a blue mussel extract with a high proportion of low molecular weight peptides exhibited anti-inflammatory properties. Due to good solubility the peptides can also be used as a functional ingredient in products such as soups, sauces, and special beverages.

Relevance to Marlborough Smart and Connected

The CfarmX blue mussel solution provides the following opportunities

1. Lifts the productivity potential of the Marlborough region

2. Provides extra jobs in Marlborough and upskills/trains staff. Four FTE positions will be offered initially. Staff will not require previous experience as full and ongoing training will be provided

3. Aligns with the objectives and regional priorities of the Marlborough District Council and regional stakeholders by developing a progressive, high-value enterprise that is economically efficiency, and increases the environmental performance of the aquaculture industry.

4. Improves the sustainability of natural assets via mitigation of adverse effects relating to disposal of mussels at sea and on land.

5. Adds value to a natural resource.

6. Minimises risk by using a validated process with customer demand for end products.