LEARNING RESOURCE

Unit Standard 16337[v3]

Level 2 Credit 10

Outline NZ Greenshell™ Mussel (kutai, kuku) Farming

Seafood ITO
www.seafood.co.nz

Contents

Introduction

The information presented in this training resource is designed provide you with some background information about New Zealand Greenshell™ mussel farming; including:

- How to identify the Greenshell™ mussel.
- What structures and methods of Greenshell™ mussel farming are used in New Zealand.
- Where Greenshell™ mussel farming occurs in New Zealand, and its history.
- What the size and structure of the industry in New Zealand looks like.
- What sorts of products are made from Greenshell™ mussels, and where they are sold.
- What the environmental code of practice for the mussel industry is about and how it's applied.

This learning resource also gives you the information needed to successfully prepare for the assessment of:

Unit standard 16337 (version 3)

Outline New Zealand Greenshell mussel farming

(Level 2, 10 Credits)

Specifically you will cover information relevant to the following elements of the unit standard:

1. Identifying the Greenshell mussel. This includes:

- Giving the scientific name of the Greenshell mussel.
- Identifying **three** features of the Greenshell mussel that distinguishes it from other common mussel species.

2. Describing the structures and methods of Greenshell mussel farming in New Zealand. This includes:

- Describing the physical structure of a Greenshell mussel farm in terms of design and layout of lines.
- Outlining the different types of rope and their uses on a Greenshell mussel farm.
- Outlining the location of spat/seed, origin, current spat/seed catching or collection techniques and transportation methods.
- Describing how spat/seed quality is maintained in terms of temperature, length of time out of water, handling methods, size of spat/seed, and source of spat/seed.
- Describing how Greenshell mussels are seeded, harvested and bagged on a mussel farm, as per company requirements.
- Describing the factors that may impact on the farming of Greenshell mussels, and how to control them.

3. Describing the location and history of Greenshell mussel farming in New Zealand. This includes:

- Identifying **two** main regional areas and **two** other regional areas where Greenshell mussel farms are found in New Zealand.
- Outlining the farming methods used at the beginning of the Greenshell mussel industry in New Zealand.
- Outlining how methods of farming Greenshell mussels have changed to meet current farming practices.
- Outlining the establishment of the Greenshell mussel industry and identifying **three** reasons for its success.

4. Describing the mussel farming industry structure and size in New Zealand. This includes:

- Describing organisations in terms of their role in the mussel farming industry.
- Identifying the tonnage of annual mussel production and the percentage for export.
- Identifying the export returns of the annual mussel production.

5. Describing the consumer products and consumer markets for the Greenshell mussel. This includes:

- Listing at least **three** mussel products on the consumer market.
- Identifying at least **five** consumer markets for the Greenshell mussel.

6. Providing an overview of the principles stated in the environmental code of practice for the mussel industry. This includes:

- Describing how good farming practices will minimise the effect on the environment and other users.
- Describing methods for dealing with vessel discharge.

How to use this resource:

- At the beginning of each section, there is an outline that tells you what is included in the section.
- Throughout the resource **key information** has been highlighted.
- Activities have been included throughout the resource to let you practice what you have learnt, and help you to prepare for assessment.

Please feel free to use this Training Resource for all training purposes relevant to the Seafood Industry.

You are able to access further copies from the following sources:

- A copy can be downloaded from:

  Website: **www.seafoodito.co.nz**

- A paper copy can be requested from:

  Seafood Industry Training Organisation (Seafood ITO)
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  Wellington
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Development of this resource:

This resource has been updated by the Seafood ITO, with assistance from Jonothan Large, Elaine Bay Aquaculture Ltd; Campbell Barr, Sanfords Ltd; Dean Condon, Marlborough Mussel Company and Aquaculture New Zealand.

1. Some Background Information about Mussels

This section gives you some useful background information about mussels in New Zealand.

NZ Mussels were eaten for food by both the **Maori and European settlers**. They were either **picked by hand or dredged.**

Greenshell™ Mussel farming began in the **late 1960s** to replace the collapsing dredge fisheries and to support domestic demand. Mussel farming first started in both the **Hauraki Gulf** and **Marlborough / Tasman** regions.

At first, the farms used **Spanish Raft Systems**, but there were concerns with a number of factors:

- The visual and navigational impact
- The physical demand of the mostly manual farming techniques, and
- Spat/seed availability.

During the late 1970s, the Japanese "**longline**" system became common. This system:

- Reduced the visual and navigational impact
- Was more efficient, specialised and mechanized.

Research produced methods of predicting '**spat fall'** for a more regular and reliable spat/seed supply. Currently good progress is being made in the research for hatchery reared spat/seed.

New Zealand Greenshell™ mussels are harvested year round with the exception of a brief seasonal supply variation in August and September due to spawning and weather variations.

Mussels are grown until they are a suitable size for harvesting (**90 – 110mm**), which usually takes **12 to 18 months**.

In 2007 Greenshell™ Mussel production had reached 99,500 tonnes, with a total value of NZ$215 million, of which around 80 percent comes from export sales.

2. How to Identify the New Zealand Greenshell Mussel

This section covers how to identify the New Zealand Greenshell mussel, including:

A. What the scientific name of the Greenshell mussel is.

B. What features allow us to tell the Greenshell mussel apart from other mussel species.

A. The scientific name of the New Zealand Greenshell mussel

Background Information: What is a scientific name? [1]

In order to specifically identify a type of mussel it is necessary to use the **scientific name**. Every species of animal or plant has its own unique, scientific name. The same scientific names are used throughout the world.

Scientific names contain **two parts**: first, the name of the **genus** to which the organism belongs, followed by the **species** name.

If two animals have the same Genus name, it indicates that they are very closely related. This part of the name may be shared by close relatives, like a surname. However the two-part name is always unique to just one species.

By scientific convention the scientific name is always written in italics or underlined. The 'Genus' name is always written with a capital letter and the 'species' name with a small letter.

The scientific name often uses Latin words, which generally have some meaning relevant to the species being named. For example, words may be used which represent the country where the species is found or describe a distinguishing feature. Sometimes the species may be named after the person who discovered it.

Common names however are simply the names by which the animal is "commonly" known and can vary from country to country and even between people.

1

The scientific name of the New Zealand Greenshell™ mussel is: ***Perna canaliculus.***

The Māori name of the NZ Greenshell™ mussel is: **Kutai or Kuku.**

Common names include: Greenlipped mussel, Perna, New Zealand mussel.

[1] Sourced from Seafood ITO Learning Resource for Eel Biology, developed by Maumahara Consultancy Services Ltd.

B. Features of the New Zealand Greenshell

There are a number of features that allow us to tell the Greenshell mussel apart from other mussels:

- **Shell colour** – green to black shell with obvious green lip inside
- **Shape** – glossy, smooth shell, slightly rectangular
- **Size** – up to 240mm in height
- **Higher - meat to shell ratio** than other mussels at 55%, whereas blue mussels are 25%
- Distinctive **flesh colour** – creamy white or a bright peach colour (Blue mussel flesh is yellowish white or dull orange). Although no difference in quality of flavour, the colour of the mussel meat varies according to sex. The female is a deep apricot and the male, a soft cream.

Note too that the **shell pattern** varies between mussel spat/seed from Kaitaia, Golden Bay and Marlborough Sound.

Figure 1: Handful of Greenshell™ mussels

Activity 1 – How to Identify the New Zealand Greenshell Mussel

1. What is the scientific name of the New Zealand Greenshell mussel?

2. Give **three** features of the New Zealand Greenshell mussel that distinguish it or allow us to tell it apart from other species of mussel:

This section covers how the New Zealand Greenshell mussel is farmed, including:

A. How Greenshell mussel farms are structured, including design and layout of lines.

B. What sort of ropes are used and how they're used.

C. Where spat/seed is located, originally comes from, & how it's currently caught or collected and transported.

D. How spat/seed quality is maintained, in terms of temperature, length of time out of water, handling methods, size of spat/seed, and source of spat/seed.

E. How Greenshell mussels are seeded, harvested and bagged on a mussel farm.

F. What factors may impact on the farming of Greenshell mussels, and how to control those factors.

A. Structure of mussel farms

A mussel farm is made up of: **anchors, warps, backbones, floats, culture rope** and **marine lighting** (where required). Overall, farm gear depends on:

- backbone lengths
- site
- exposure, and
- general layout.

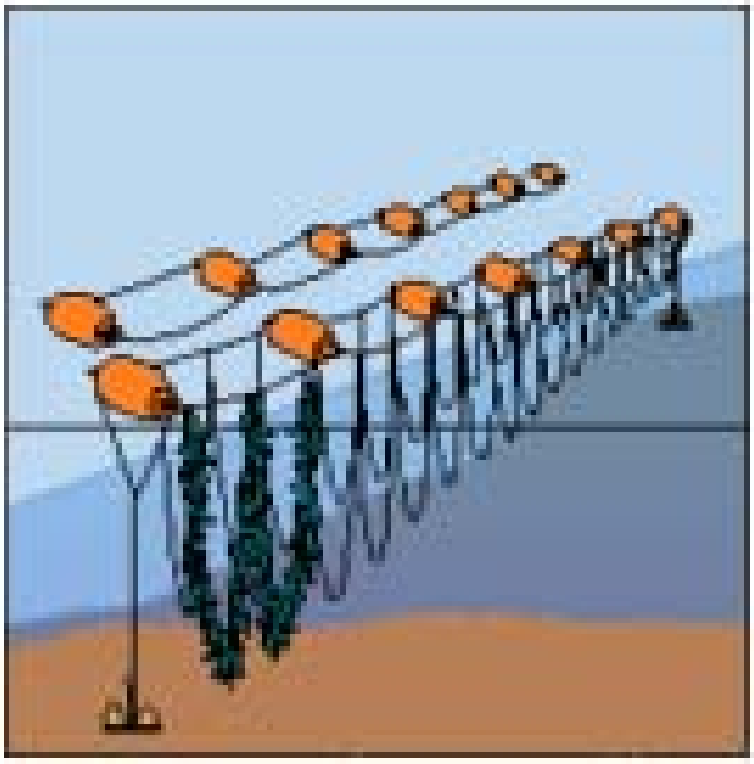

Figure 2: Basic long line layout structure (Source: Seafood Industry Council).

A. Structure of mussel farms – continued.

Anchors:

The purpose of anchoring systems is **to anchor the farm to the seabed**. Anchoring systems may include:

- Screw anchors
- Danforths
- Concrete blocks (different weights and designs).

The type of anchoring system used on a farm is dependent on:

- Seabed geography (rocky, muddy, deep, high current, sloping)
- Site exposure to swells, and
- Water depth.

Warps

The purpose of warps is to attach the anchor to the backbone.

Warp methods can be single or double, and the ratio of warp is dependent to anchor design and depth of water. Warp size is chosen to suit conditions.

Backbone

The purpose of a backbone is to suspend the culture rope in the water.

Backbones can be of different types (mostly double, some single, i.e. spat), and size of backbone is determined by the strength required (mostly 24-28mm). The length of the backbone depends on farm area and site layout, and the distance between longlines is based on consent and permit conditions, then owner's choice.

Figure 3: Greenshell™ mussel farming, Stewart Island

A. Structure of mussel farms – continued.

Floats

The main purpose of floats is to support the weight of, for example, the crop and backbone.

There are many types of floats, e.g. orange, black, stalk, subsurface and their location on farm, and dependent on management practices, may be varied, with initially few floats, and more added as crop grows, and/or sea conditions dictate.

Culture Rope

The purpose of the culture rope (with its fluffy, bulky design) is to give surface area for mussels to attach to the rope.

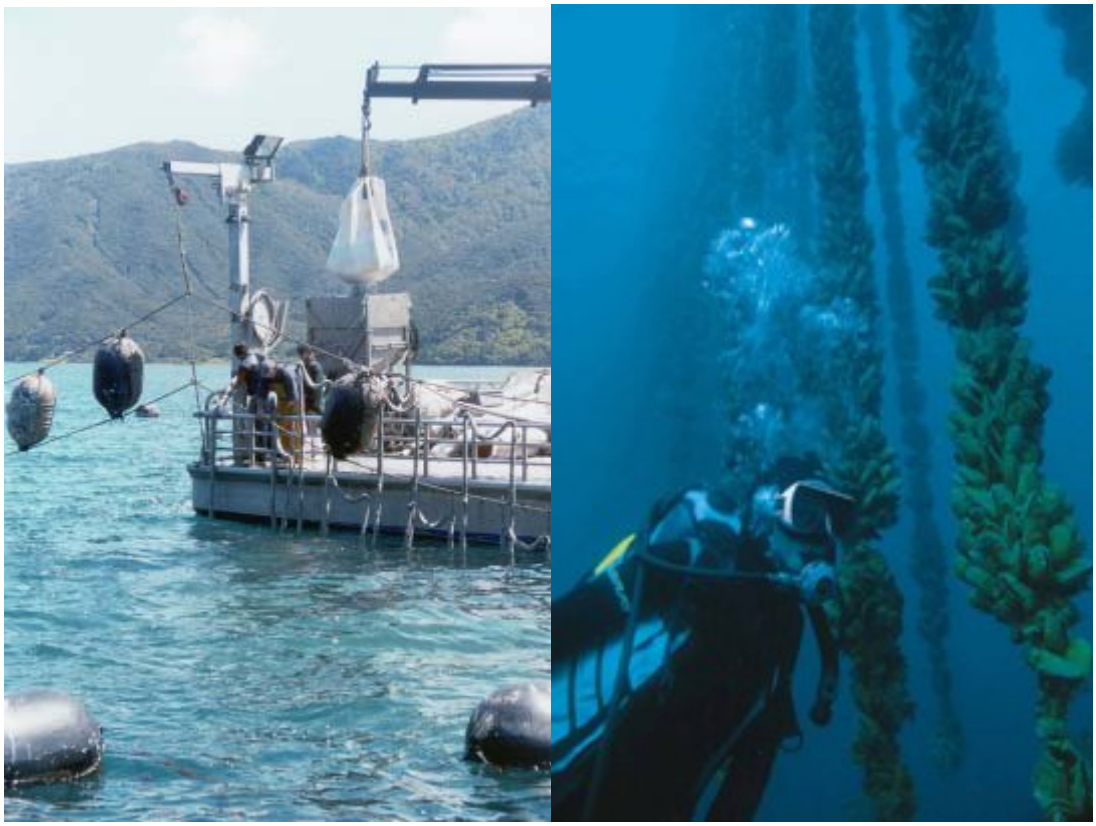

Figure 4: Left: Seeding of Greenshell™ mussels, Marlborough Sounds; Right: Diver in mussel farm.

Activity 2 – Structure of mussel farms

1. What are the main parts of a mussel farm and what is the purpose of each part?

2. Draw the basic physical layout of the mussel farm you work on, including labels that show each of the main parts:

B. Ropes used on a mussel farm

There are many different types of ropes used on a mussel farm, here are some of the types used:

Warps/Backbones/Ties/Snoods/Lashing

Synthetic ropes (e.g. polypropylene, polyethylene) are used for warps, backbones, ties, snoods and lashings.

These are designed for strength and abrasion properties, and the size used is dependent on the strength/breaking strain required for the task.

Culture Rope

Synthetic rope (e.g. polypropylene, polyethylene) that includes a filler material to give fluffy/bulky properties is used for culture rope. This gives more surface area for a mussel to attach to the rope.

Types include:

- Standard
- Extra fluffy ('Christmas Tree'), and
- Lead, mesh/netting for spat nurseries.

Activity 3 – Ropes used on a mussel farm

1. What types of rope are used on the farm you work on and what are they used for?

C. Spat/Seed

Where does spat/seed originally come from?

The stranding of spat is a natural event, and as yet the origin is unknown.

Spat/seed comes from '**somewhere offshore'**, probably from a large wild mussel source offshore.

Where can spat/seed be found?

Spat can be found in a number of locations:

- Northland(Kaitaia) – Ninety Mile Beach
- Golden Bay/Tasman Bay
- Coromandel region
- Marlborough Sounds – specific sites
- Aotea Harbour.

How is spat collected/caught?

Spat is collected or caught in a number of ways:

- At Ninety Mile Beach (Kaitaia), the spat that is stranded on the beach is collected.
- In Golden and Tasman Bays, clean culture ropes that either have lead strands running through them or are weighted with 'Standard weights' (reusable stone weights) to which the spat/seed attach, are hung on single leaded backbones.
- In the Marlborough Sounds/Coromandel region, clean culture ropes that either have lead strands running through them or are weighted with 'Standard weights' (reusable stone weights) to which the spat/seed attach, are hung on backbones.
- Frames, synthetic mesh or natural fibre are used to "catch" the spat/seed.

How is spat/seed transported?

Dependent on where spat/seed comes from, ways it is transported may include:

- Refrigerated vehicle from Ninety Mile Beach
- Covered road transport from Golden Bay – this transport method suits frames, or
- Water transport from Golden Bay or around Marlborough Sounds.

Activity 4 – Spat/seed

1. Where does spat/seed come from (give **three** locations)?

1.	2.	3.

2. How is spat/seed collected (give **three** methods)?

1.	2.	3.

3. How is spat/seed transported (give **two** methods)?

1.	2.

D. Maintaining spat/seed quality

There are a number of factors that need to be **controlled or managed** in order to keep spat/seed in the best condition possible. These include:

- Temperature
- Time out of water
- Handling of spat/seed.

The size of the spat/seed and the source of the spat/seed also contribute to how spat/seed is managed to maintain quality. Below are some of the methods used for maintaining spat/seed quality from the different locations:

Kaitaia

- Time out of water is minimised and spat/weed is kept in plastic bags or containers to protect from sun and wind.
- Temperature – spat/seed is kept cool or chilled until seeding onto culture rope. When storing its important spat/seed isn't stacked into piles but arranged in such a way that allows cooling to circulate around the maximum surface area (weed can overheat). Note: it's also important to avoid fresh water/ice contact.
- Handling – care is taken to avoid crushing or hard handling of spat/seed.

Golden Bay/Marlborough Sounds

- Time out of water is minimised, and spat/seed is kept covered to prevent drying out.
- Temperature – while transported, spat/seed is kept cool or chilled until seeding onto culture rope (see above).
- Handling – fall-off is collected, handled appropriately and reseeded out as for Kaitaia spat/seed.

Activity 5 – Maintaining spat quality

1. What are the important factors to control or manage so that spat/seed is keep in the best possible condition?

2. Why do you think it's important to control these factors?

E. Seeding, harvesting & bagging mussels

Seeding

Spat/seed can be seeded using **a stocking around the culture rope** (to support spat/seed until it attaches to the rope).

When spat/seed is about **10mm long**, it's stripped and reseeded onto continuous rope using automatic seeding systems (see **information box** below).

Intermediate seeding is carried out if the first seeding ('primary seed') has:

- Too many spat/seed growing per metre (limits growth), or
- Too few spat/seed growing (wasting growing space).

Automatic seeding machines – some more information:

- Spat/seed is fed through a hopper system
- Density is controlled by a gate system, hopper belt speed and seeding wheel speed.
- Mussel spat/seed drops into the tube entry, surrounded by stocking and culture rope, and fed into the water by seeding/hauling wheels
- Dropper length is controlled by manual or electronic counters (to suit water depth at each site)
- Ties are added to backbone and grow rope is tied on, or ties/snoods are added to grow rope and tied off onto backbone.

Harvesting by vessel

The basic process is that the growing/culture rope with mussels attached is **hauled** on board, the mussels **stripped off** and put through a **muncher** to clean, separate and grill out waste.

Further sorting is carried out on the conveyor belt prior to bagging.

Figure 5: Mussels being stripped

E. Seeding, harvesting & bagging mussels – continued.

Bagging

Mussels are bagged into bulk bags and stacked around deck to maintain vessel stability and safety.

Grow rope is passed through a washer and re-bagged for: reseeding; or further processing onshore.

Figure 6: Mussels being bagged.

Activity 6 – Seeding, bagging and harvesting mussels

1. Thinking about the methods used on the farm you work on, how is spat/seed seeded? What reseeding or intermediate seeding takes place?

2. Again, referring to the mussel farm you work on, what are the harvesting and bagging processes followed?

F. Factors that may impact on mussel farming

There are a number of factors that may impact unfavourably on the farming of Greenshell mussels. Below are some examples, along with ways to control or overcome them:

Oversettlement

Oversettlement is the growth of other marine plants and animals on the seeded mussel crop and equipment (i.e. unwanted species). These may include but are not limited to:

- other mussel species
- oysters
- scallop spat
- sponges
- tubeworms
- anemones
- ascidians
- hydroids or
- seaweed

Some of these species **compete with or smother** the mussel crop, others just **increase crop weight** and/or **increase current drag** on lines and/or **increase sorting required** at harvest, and they may cause '**slippage**'. This is when mussels detach from the lines.

Figure 7: Example of oversettlement.

Oversettlement can be controlled by scraping the unwanted species off the backbones and ties/snoods.

The oversettlement can be controlled on the seeded mussels by making sure that the **density of mussels seeded** is correct and the rope is **fully covered** with no bare patches for unwanted species to attach to the rope.

The lines may also be **"subsurfaced"**. This is where they're sunk below the surface of the ocean, usually to a depth of 3 to 5 meters, by tying the floats to the backbones by ropes of the desired length. This puts the seeded mussel lines below the blue mussel spat which predominately resides in the top 5 meters of the surface water.

F. Factors that impact on mussel farming – continued.

Storm events

A **severe storm** can cause **the warps or backbones to break** if they are not in good condition or the correct diameter for the location (deeper water and high tidal areas combined with a storm cause a great deal of stress to backbones and warps).

Severe storms may also cause **damage to droppers** by tangling them around each other or the backbone. Severe tangling may need to be cut and discarded, along with the mussel crop.

As storm events are natural occurrences, it is difficult to control the effect(s) but they can be managed by making sure that the structures are kept in good condition, floats are tied on correctly and correct seed densities are used for the location

Rainfall can cause **harvesting closures** due to the effect of water runoff from the surrounding land, for example:

- Pollution (over flow of sewage); &/or
- Contaminants (chemical residues and coli forms) from forestry and farming users.

Because mussels are filter feeders they pick up any contaminates out of the water.

Rainfall can be managed by predicting the weather (as in the amount of rainfall): if it looks like there is going to be enough rain to effect a rain closure then extra mussels can be harvested to keep the factory operating during this time.

In places that have shallow water, such as the Kenepuru Sound, you would avoid seeding mussels when heavy rain is predicted, therefore avoiding the fresh water killing the spat.

Slippage

This is when the attachment of the mussels to the crop rope breaks, causing mussels to fall off the rope as it is lifted out of the water.

This can be caused by '**oversettlement**' where the weight of the over settled material is too much for the mussels beard to support. Note the '**beard**' or '**byssus**' is the part of the mussel that it uses to attach to crop ropes. See **Figure 8** – this shows the byssus or beard attached to the crop rope.

Figure 8: Mussels attached to crop rope via the byssus or beard.

Slippage can also be caused by the mussels being **left on the line too long** and the mussels get too big and old to hold themselves onto the ropes, also if the culture rope has deteriorated to a level where there is little or no fibre extending from the rope then the mussels don't have enough surface to attach to.

Other factors that may have an undesirable effect on a mussel farm are:

Bio Toxins

Some types of **photo plankton** can produce a harmful **bio-toxin** when it "blooms"; if this happens a marine area **may be closed for harvesting** until levels of bio-toxin fall to a safe level.

In some areas, bio toxin levels are closely monitored by programmes, such as the **Marlborough Shellfish Quality Programme (MSQP)**. See section **4. Structure and Size of the New Zealand Mussel Industry** for more information about MSQP.

Predation

Mussels may be **eaten** by fish, starfish, flatworms or other animals. Usually newly seeded lines or small seed is most likely to be affected.

Predation may be controlled by seeding only large seed in areas where fish predation is known to occur and not seeding in times when it is known that there are large numbers or fish about (such as not seeding in the Kenepuru in the height of summer when predator fish are about in large numbers).

Activity 7 – Factors that impact on mussel farming

1. What is "oversettlement" and what effect could it have on a mussel farm?

How can "oversettlement" be controlled?

2. How can storms or rainfall affect a mussel farm?

3. What is 'slippage' and what causes it?

4. What are some other factors that may have an undesirable effect on a mussel farm?

3. Location & History of Farming in NZ

This section covers the history and location of New Zealand Greenshell mussel farming, including:

A. Where Greenshell mussels farms are located in New Zealand.

B. How mussels were farmed at the beginning of the Greenshell mussel industry in New Zealand.

C. How methods of farming have changed to meet current farming practices.

D. Why the Greenshell farming industry was establishes and why it's a success.

A. Where farms are located in NZ

In 2008, the **main areas** mussels were farmed in New Zealand included:

- Marlborough Sounds, 68 percent
- Tasman / Golden Bay, 3 percent
- Coromandel region, 22 percent
- Southland, 3 percent.

Figure 9: Main Aquaculture production areas in New Zealand.

Mussels were also grown, in smaller amounts, in Northland and Bank Peninsula.

Activity 8 – Where farms are located in NZ

1. Where are the main areas for mussel farming in New Zealand (give **two**)?

In which other areas are mussels farmed (give **two**)?

B. Farming in the beginning

Farming of mussels was labour intensive and physically demanding, often carried out on small sized farms.

Square raft structures were used to hang single droppers for on-growing, and spat/seed was manually seeded onto culture rope by wrapping a medium around both.

At harvest, the droppers were manhandled onto a small boat or work raft, and mussels stripped by pulling between the harvester's boots, or pulled off by hand.

Mussels were put in a bin, separated, washed clean and bagged by hand.

The first steps in mechanisation including changing old **agitator washing machines** to become **strippers** and **mini munchers**.

(See Activity 9)

C. Changing farming methods

Over the years new methods of farming mussels have been established and used.

For example:

- The longline system has been introduced, along with continuous rope culture.
- Automated techniques have been developed, e.g. automatic seeder, spat grading. This has resulted in efficiency gains.
- Equipment for production and harvesting has been specialised.
- More reliable spat/seed supply has been identified, and techniques to catch and hold spat/seed improved.
- Innovation has led to improved stocking, lead rope, culture rope.
- An increased understanding/focus of seeding rates to meet nutrient levels and conditions has resulted in consistent product quality throughout farms.

Because of these changes, year round harvest of quality mussels is now possible.

The ways mussels are farmed are continuously being improved. For example, research into subsurface longline mussel farming is currently occurring, to test how well mussels can be farmed in the deeper, more exposed waters of the open ocean.

Activity 9 – Farming then & now

1. How were mussels farmed at the beginning of the Greenshell mussel industry in New Zealand?

2. How are mussels farmed differently now?

D. Successful mussel farming

Mussel farms have been successfully established in New Zealand. Reasons for the successful establishment of mussel farms and overall success of the mussel farming industry include:

- A co-operative approach by industry, e.g. establishment of industry bodies such as New Zealand Marine Farming Association, Mussel Industry Council.
- The formation of a trade name for farmed NZ green-lipped mussel; i.e. "**NZ Greenshell™ Mussel**", which was registered in the 1980's.
- The growth and development of export markets.
- The establishment of a bio toxin programme (resulting in increased food safety and quality).
- The sustainability of the product i.e. mussels.
- The development and commitment to the Environmental Code of Practice for the Mussel Industry.
- An innovative approach to farming, resulting in purpose built, specialist equipment for farming and processing.
- Overall focus on quality product.
- Persistence and perseverance.
- Consolidation or merging of farms – allowing farms to operate more economically and with increased investment.

Activity 10 – Successful mussel farming

1. What **three** factors do you think have been important in the establishment and resulting success of the mussel farming industry in New Zealand?

4. Structure & Size of the NZ Mussel Farming Industry

This section covers the farming industry structure and size in New Zealand, including:

- A. Which organisations are involved in the mussel farming industry.
- B. What New Zealand produces and what's exported.
- C. What the export returns of the annual mussel production are.

A. Role of organisations in the industry

There are a number of organisations involved with the mussel farming industry in New Zealand. The main ones have been outlined below.

Aquaculture New Zealand

Aquaculture New Zealand **represents the interests of New Zealand's mussel, salmon and oyster farmers**. It was formed in 2007 as a result of the NZ Aquaculture Strategy that was released in 2006, and its vision is to make the New Zealand aquaculture sector **recognisable within New Zealand and around the world as producing healthy, high quality, environmentally sustainable aquaculture products**. The goal of the strategy is that by **2025 the New Zealand aquaculture sector will have sales in excess of $1 billion.**

Aquaculture New Zealand comprises representatives from the current species bodies:

- Salmon: NZ Salmon Farmers Association Inc (NZSFA)
- Oysters: NZ Oyster Industry Association Inc (NZOIA)
- Mussels: NZ Mussel Industry Council (NZMIC).

Based in Nelson, Aquaculture New Zealand represents its stakeholders' interests at central, regional and local government levels throughout the country. It has also developed and is implementing market development and research strategies to further the growth and development of the industry.

A. Role of organisations in the industry –continued.

Local Marine Farming Association

Local Marine Farming Associations are regional, subscription based organisations whose role is **to support the rights and interests of its members and the marine farming industry in general**. For example:

- The **Marine Farming Association Inc (MFA)**, represents marine farmers in the top of the South Island of New Zealand, and has been set up with the objective to promote, foster, advance, encourage, aid and develop the rights and interests of its members and the marine farming industry in general.

- The **Coromandel Marine Farming Association Inc (CMFA)** is a subscription based organisation representing marine farmers in the Coromandel, Thames and Auckland areas.

Local Water Quality & Bio toxin Programmes.

These are organisations that monitor and maintain water quality standards for shellfish production in growing areas, for example, the **Marlborough Shellfish Quality Programme Inc (MSQP).**

The MSQP was set up to **monitor and maintain water quality standards for shellfish production in the Marlborough Sounds and Golden Bay**. It provides assurance that all shellfish from the local area meet the requirements of the National Water Quality and Marine Bio toxin programmes and strict USFDA standards.

District and Regional Councils

District and Regional Councils are responsible for **issuing Resource Consents**, for example:

- Coastal Permits (for new marine farms and extensions to existing licenses / leases)

- Discharge Permits (for land based aquaculture)

- Water Permits (for land based aquaculture).

New Zealand Food and Safety Authority (NZFSA)

The NZFSA's overriding "mandate" or "job" is **to protect consumers.**

The NZFSA was established as a stand-alone Government department in 2007. Its role is to protect consumers by providing an effective food regulatory programme covering food produced and consumed in New Zealand, as well as imports and exports of food products.

NZFSA is responsible for all of New Zealand's **food safety related legislation**, including:

- Animal Products Act 1999 – this covers the primary processing and export of animal products, (including seafood such as mussels), and

- Food Act 1981 – this covers food for sale and food imported into New Zealand.

A. Role of organisations in the industry –continued.

Ministry of Fisheries (MFish)

The over-arching role of the Ministry of Fisheries (MFish) is to ensure that fisheries are used in a sustainable way and that New Zealand has a healthy aquatic ecosystem.

In relation to the mussel farming industry, this organisation is responsible for issuing and administering permits for farms approved after 1991 and for new applications, for example:

- Marine Farming Permit
- Spat Catching Permit
- Special Permits (for research).

The MFish is also the body responsible for **updating the legislative framework for Aquaculture**, e.g. Aquaculture Law Reform, Māori Aquaculture Claims Settlement Act 2004.

Activity 11 – Role of organisations in the industry

1. What organisations have you been involved with? What is their role in the mussel farming industry?

B. Annual mussel production & value[2]

In 2008, about **90 tonnes** of mussels were harvested. Of this, about **85%** or **33,295** tonnes of processed mussels were exported, while the remainder were sold domestically.

The estimated value of mussels exported in 2008 was **$204.3 million.**

[2] These figures have been sourced from Aquaculture New Zealand.

Activity 12 – Annual mussel production & value

1. How many tonnes of mussels are produced in New Zealand each year?

2. What sort of value does this tonnage have?

5. Consumer Products & Markets

This section covers the types of mussel products on the consumer market, where products are marketed to.

A. Mussel products

There are many different types of mussel products sold on the consumer market. New products are continually being developed and marketed as consumer needs change and evolve.

This table shows the type and percent of product exported in 2008[3]:

Product Category	Export weight (kgs)	percent of exports
Half Shell Frozen	27,990,138	84.05
Meat Frozen	2,906,762	8.73
Whole Frozen	1,261,319	3.79
Preserved/Marinated	448,723	1.35
Live	430,337	1.29
Freeze-dried Powder	201,447	0.61
Other not Live/Chilled/Frozen	20,311	0.06
Meat Chilled/Fresh	8,917	0.03
Whole Chilled	7,323	0.02
Smoked	6,528	0.02
Processed in Can, Jar	6,484	0.02
Half Shell Fresh/Chilled	5,577	0.02
Powder in Capsule	2,132	0.01

[3] Source: New Zealand Seafood Industry Council Ltd.

A. Mussel products – continued.

In 2008, New Zealand exported NZ$204.3 million worth of Greenshell™ Mussels to the global market.

The product was mainly exported in **Individually Quick Frozen (IQF) half shell format (84.05%)** due to the convenience and versatility of preparing the mussel from this format.

Figure 9: Mussels being processed.

B. Consumer markets

There are many different markets for New Zealand Greenshell mussels.

For example, the frozen half shell product is mainly exported to the **US** (about 39 percent or around 11,000 tonnes in 2008), followed by **South Korea** (about 10 percent); **Spain**, **Canada, Japan, Hong Kong,** and **UK** (between 4 and 5 percent); with smaller amounts being exported to Australia, Germany, and other countries.

About **15 percent** of the mussels produced in New Zealand are sold locally.

Activity 13 – Consumer products & markets

1. How are the mussels grown in New Zealand further processed for sale? (i.e. what type of mussel products is sold?)

2. Where do mussels grown in New Zealand get sold to?

6. Principles of the Environmental Code of Practice

This section covers the principles that are covered by the Environmental Code of Practice for the Mussel Industry. It includes:

A. Why an Environmental Code of Practice for the Mussel Industry?

B. What good farming practices are and how they minimise the effect on the environment and other users.

C. How vessel discharge can be dealt with.

A. Introduction – Why have an Environmental Code of Practice?

The environment needs to remain **healthy, clean and green** for the mussel industry to remain **robust and sustainable**.

The mussel industry has long recognised this, and in 1997 developed an **Environmental Policy**, followed in 1999 by the **Environmental Code of Practice**. The Code formalises the industries commitment to the environment and to ensure best industry practices are used throughout.

In simple terms, the Code outlines **ways the industry can go about its operations while minimising the effect on the environment**. The Code is regularly reviewed, as new processes, technologies etc are developed to further minimise the effect on the environment.

Figure 10: Environment of Greenshell mussel farming.

B. Good farming practices

There are a number of ways **good farming practices** will minimise the effect on the environment and other users, for example:

- Using specified equipment to prevent loss of equipment and/or discharge of waste into the marine environment.
- Checking farms for secured anchoring and floats, again so equipment isn't lost into the marine environment.
- Appropriately removing waste so it's not discharged into the marine environment.
- Using appropriate lighting, both on the vessel and the farm.

Each of these practices discussed in detail below.

Using specified equipment / procedures, such as:

- Appropriate anchor systems to prevent anchor drag.
- Navigation lights, reflectors and floats to show where the farm is/avoid inadvertent collision or entanglement by other users.
- Sewage tank pump to shore systems, where available, to safely remove sewage.
- Regular boat maintenance to ensure the noise level is minimised.
- Oily water separators on large vessels for bilge water or equipment for land-based pumping in bilge pumps to minimise the amount of oil released into the environment.

Checking security of anchoring and floats, by:

- Carrying out regular farm maintenance.
- Using good rope, and checking it's in a good state of repair.
- Making sure floats are tied securely - all lashings cut off during float retrieval.
- Making sure there are a sufficient number of evenly spaced floats on longlines.
- Checking lights are correctly fitted and operating.
- Putting radar reflectors in place where required.
- Regularly removing organic matter growing on lines.
- Making sure the spread of exotic organisms is minimised.
- Checking anchoring systems are secured to eliminate / minimise impact on the seabed, e.g. screw anchors do not have the same impact as large concrete blocks; undersized concrete blocks will move.

B. Good farming practices – continued.

Appropriate waste removal, such as:

- Cutting ties to prevent lashing being lost in the water.
- Flipping over floats to expose encrustation to the sunlight.
- Reporting damage/repairs required, to eliminate future problems.
- Safely storing chemicals, fuels and oils so they cannot end up in the environment if containers are spilled or they leak.
- Retrieving and storing synthetic material for safe disposal so that it isn't lost into the marine environment.

Lighting, for example:

- On the vessel - using lighting that's angled on to the deck/backbone rather than away from the vessel.
- On the farm – lighting the farm as per the lighting plan. This may include solar lighting with radar reflectors on the outside corners of the farm, with passive reflectors on the inside line/lines of the farm. There are also requirements for light colour, flashing frequency, visibility/reflectivity.

Additional good farming practices may include:

Minimising unwanted organisms, by:

- Minimizing the settlement of encrusting organisms and their transfer among farms by cleaning / exposing to sunlight.
- Reporting any new, unusual or exotic species to your local marine farming organisation.

Activity 14 – Good farming practices

1. In the table below, write down the good farming practices that are routinely followed on the mussel farm you work on:

Specified equipment/procedures:	Security of anchoring and floats:
Waste removal:	Lighting:

2. What other good farming practices can you think of that may help minimise the effect on the environment?

C. Dealing with vessel discharge

Ways of disposing of vessel discharges will vary depending on company requirements.

The main objective of methods for dealing with vessel discharge is to make sure that no non-biodegradable (synthetic) material is lost into the marine environment; and any biodegradable material is managed appropriately.

The table below lists types of discharge, how they're dealt with at the moment, and ways they could be dealt with in the future:

Discharge	Present discharge	Developing or future disposal
Lashing	Retain on board; store in litter bins / rubbish bags for transfer to land-based skips and landfill	Recycled into other product
Synthetic material -ropes, mesh bags, plastic bags	Retain on board; store in litter bins / rubbish bags for transfer to land-based skips and landfill	Recycled into other products
Domestic rubbish	Retain on board; store in litter bins / rubbish bags for transfer to land-based skips and landfill	Recycled and composted
Wastewater	Into the sea	Treated in land sewerage treatment plants
Sewage	Sewage containment or retention facilities for all harvesters	Treated in land sewerage treatment plants
Noise - pumps, voices, radio, music	Noise awareness in areas with residents e.g. face speakers towards crew, keep noise to a minimum, especially at night, e.g. turn radio and VHF down or off between 8pm and 7am. New technology developing quieter pumps, engines	Continue to develop 'quieter' vessels
Oil	Oil collection, some recycling	Reduce oil change times, less use overall, recycle

C. Dealing with Vessel Discharge – continued.

Figure 11: Working on a vessel - attaching stockings to the backbone.

Activity 15 – Dealing with vessel discharge

1. How is vessel discharge dealt with on the farm you work on?

2. How do you think your vessel (if you work on a vessel) could better deal with vessel discharges?