New Zealand Government

Aquaculture in action

Aquaculture in New Zealand

These seven fact sheets offer students an opportunity to learn more about aquaculture, in particular marine farming, in New Zealand. The lesson plans were developed for Years 7 and 8. The plans were created to assist teachers in helping students investigate and learn about aquaculture, as well as its impact on our economy and our environment.

Learning outcomes

This resource provides students the opportunity to develop knowledge and understanding about

- what aquaculture is;
- why aquaculture is important to New Zealand's economy;
- the importance of aquaculture worldwide;
- examples of aquaculture species in New Zealand;
- the importance of ensuring aquaculture is environmentally sustainable; and
- balancing aquaculture with other coastal uses.

1. What is aquaculture?
2. New Zealand's mussels
3. New Zealand's oysters
4. New Zealand's salmon
5. Aquaculture and the environment
6. Aquaculture and the economy
7. Whose coast is it? Balancing coastal uses

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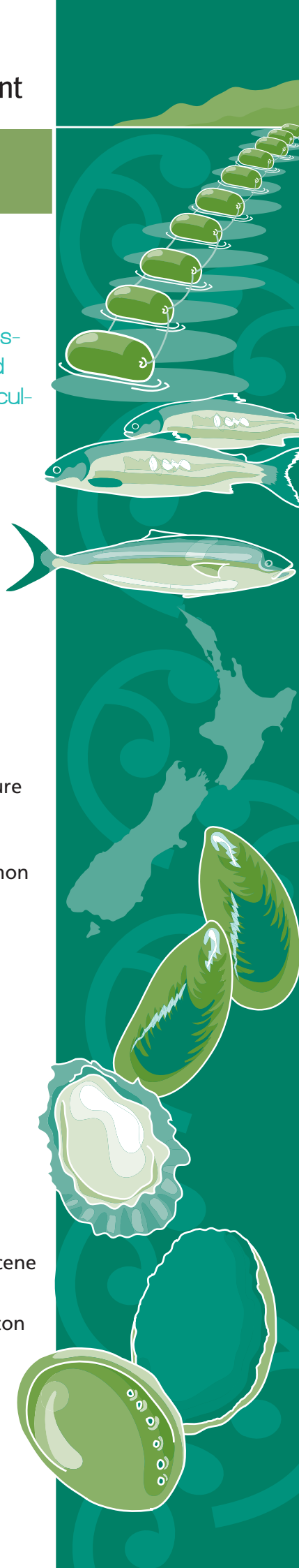

Glossary

Here you'll find a few of the terms that are used in the Aquaculture Fact Sheets.

Anadromous – animals that are spawned in fresh water, migrate to sea to live and return to freshwater to spawn.

Aquaculture – the raising of plants or animals in water. It can occur in coastal waters, rivers, lakes, and even on land – in constructed pools or tanks.

Bivalves – animals that are in the phylum Mollusca that have two valves (shells). Mussels, cockles, and oysters are just some of the molluscs that are in this class.

Customary fishing – fishing is culturally important for many iwi and hapū. New Zealand has customary fishing regulations in place to ensure that iwi and hapū are able to manage their customary fishing practices.

Depuration – the process of removing impurities from shellfish by leaving them for a period of time in a clean supply of water.

Greenshell™ mussels (*Perna canaliculus*) – are grown only in New Zealand. The ™ stands for trademark. Greenshell™ mussels are trademarked so people can tell they were grown in New Zealand.

Environmental sustainability – using natural resources in a way that ensures that ecological processes are maintained and not compromised for future generations.

Export – in economics, export is used to describe when a consumer good or service is legally transported from one country to another for the purposes of trade.

Foreshore – is the land that is regularly covered by the tide (the wet part of the beach). It includes land covered by high tides, the space occupied by the air and water above the land, and the soil and rock under it. (Source: Mark Hickford. 'Law of the foreshore and seabed', Te Ara – the Encyclopedia of New Zealand, updated 21-Sep-2007. http://www.TeAra.govt.nz/EarthSeaAndSky/OceanStudyAndConservation/LawOfTheForeshoreAndSeabed/en)

Fry – young fish.

Hydrocolloids – large, water soluble molecules in seaweeds. When extracted hydrocolloids can be used for their stabilising and gelling properties.

Kaimoana – food from the sea.

Kaitiakitanga – guardianship of natural resources.

Krill – are small shrimp-like marine invertebrate animals.

Larva – the early form of an animal before it matures or reaches the next developmental stage.

Marine farming – aquaculture that occurs in the marine environment.

Mollusc – marine animals of the phylum Mollusca. In Latin the word molluscus means soft. Common features that molluscs share include soft, unsegmented bodies.

Ocean ranching – is a type of marine farming where juvenile fish are released into the ocean to grow unprotected and unassisted until they are harvested. In New Zealand there were several attempts to ocean ranch salmon.

Phylum – the second largest taxonomic division of the animal kingdom. Animals within a phylum will all have some basic similarities.

Plankton – are microscopic plants and animals found drifting in marine and freshwater environments.

Salmonid – a member of the Salmonidae family of fish, including salmon and trout.

Seabed – is the land that is underwater completely (the sea around the coast). (Source: Mark Hickford. 'Law of the foreshore and seabed', Te Ara – the Encyclopedia of New Zealand, updated 21-Sep-2007 http://www.TeAra.govt.nz/EarthSeaAndSky/OceanStudyAndConservation/LawOfTheForeshoreAndSeabed/en)

Smolt – juvenile fish that are ready to leave a freshwater environment and migrate to the ocean.

Spat – very young shellfish.

Spawn – to produce or deposit eggs or sperm.

Species – a group of plants or animals that when they interbreed are able to produce fertile offspring.

Water quality – is a measure of the suitability of water for different uses. To measure water quality, scientists test water and compare the test results to a set of established standards.

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Aquaculture in action

What is aquaculture?

When you fly over New Zealand you can see a patchwork of working farms – from apple orchards to deer farms to dairy farms to forests. As you fly over the coastal waters of our island nation you might also see marine farms.

Mussel farm. Photo: New Zealand Seafood Industry Council

Marine farming is a type of aquaculture. Aquaculture is simply the raising of plants or animals in water. It can occur in coastal waters, rivers, lakes, and even on land – in constructed pools or tanks.

People have been involved in aquaculture since ancient times. In Hawaii constructed fish ponds dating back at least 1000 years have been identified.

According to Polynesian legend, one pond in Hawaii was built by mythological elf-like people called Menehune.

Stories about the Menehune and their many great feats were told throughout Polynesia. Māori legends refer to these forest-dwelling creatures as Patupaiarehe.

Why aquaculture?

Aquaculture is thought to be the fastest-growing type of food production in the world.

One of the main reasons for this is that the world wild fish catch has levelled off or declined. The most recent global assessment of wild marine fish stocks of the Food and Agriculture Organization of the United Nations (FAO) found that out of the nearly 600 species it monitors over 75 per cent were being fished to capacity or were over-harvested.

Villagers of the picturesque Andaman island known as Panyee tend fish they are raising in cages. Once harvested, these fish will be sold to supply the restaurants catering to tourists in nearby Phuket. Country: Thailand. Photo: © FAO/24553/R. Faidutti

With some fish becoming harder to find or more expensive to catch, it is sometimes cheaper and easier to farm some species instead. Over a third of all seafood eaten in the world today has been raised on farms. In the United States, two of the top ten seafoods eaten in 2006 are only raised on farms – tilapia and catfish. In New Zealand, all the fresh mussels, salmon and Pacific oysters we eat are grown on farms here.

Many people predict that aquaculture development in the 21st century will be similar to how agriculture – farming on land – grew in the 20th century. Some of the reasons people believe aquaculture has potential for growth in New Zealand are because we have over 15,000 kilometres of coastline, cool enough waters to raise a wide range of species, and a clean environment.

More than fish and chips

Hunger is still an issue in many parts of the world. Researchers with the FAO believe that aquaculture has an important role to play in directly providing a nutritional source of food, as well as providing jobs and income.

Foods like rice, wheat, corn and cassava are the main sources of food for many poor people around the world. While these staple foods are important they do not provide people with all the nutrition they need to lead a healthy life. Seafood is rich in protein, essential fatty acids, vitamins and minerals that some people might not otherwise get in their daily diets.

Beyond sushi

There are at least 850 different types of seaweed found in New Zealand's waters, but only three are currently harvested commercially. Seaweeds are used commercially both as a food source and also for the hydrocolloids that are found in them. Hydrocolloids are large, water soluble molecules that give seaweeds their flexibility in the water. Many types of seaweed produce hydrocolloid extracts that make great gelling and binding agents and are used in a variety of consumer products from shampoos to ice cream.

In 2006 scientists from Industrial Research and the National Institute of Water and Atmospheric Research (NIWA) announced that they had successfully grown seaweed from spores for the first time in New Zealand. The red seaweed (*Gigartina atropurpurea*) spores were placed on three-metre strings and grown on mussel farms in the Marlborough Sounds.

Salmon and seaweed are both raised on marine farms. Photo: Aquaculture New Zealand

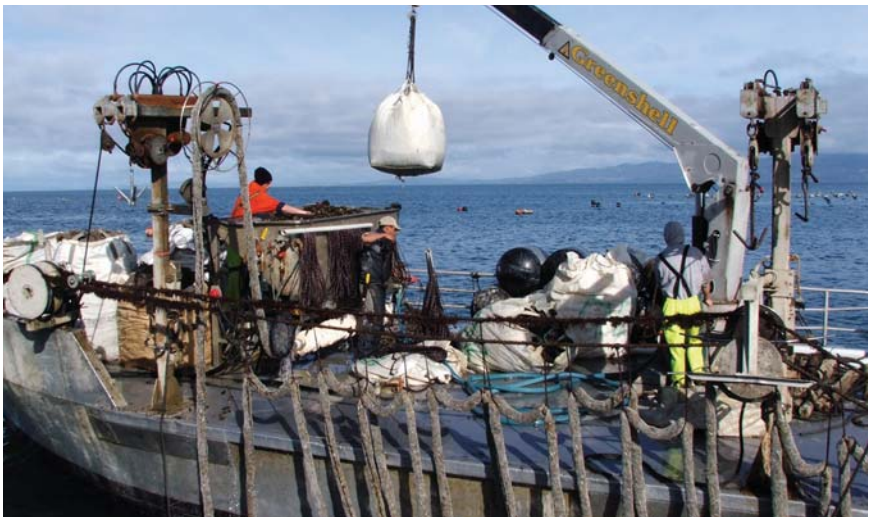
By the kilo

How much fish do you eat? Traditionally, fish has been important in the diet for many people living in parts of Oceania (Australia, New Zealand and island nations in the Pacific Ocean). How does New Zealand compare to other countries in Oceania?

Fish consumption in kilograms per person for selected countries in Oceania

Country	1979-1981	2000-2002
Australia	15.7	22.3
Fiji Islands	36.9	33.2
French Polynesia	43.1	54.0
Kiribati	70.4	76.6
New Caledonia	23.4	28.8
New Zealand	15.7	26.3
Samoa	54.7	92.7
Solomon Islands	56.9	39.8

Source: *FAO State of world aquaculture 2006, Fisheries Technical Paper 500*



Marine farmers at work. Photo: Graeme Silver, Environment Waikato

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Aquaculture in action

New Zealand green-lipped mussels

Mussels are found all over the world in both saltwater and freshwater. In New Zealand we have 22 different types of mussels. Two of these are grown on marine farms: green-lipped mussels (*Perna canaliculus*) and a small amount of blue mussels (*Mytilus galloprovincialis*). Green-lipped mussels that are grown on marine farms are known as Greenshell™ mussels.

Greenshell™ mussels. Photo: New Zealand Seafood Industry Council

Mussels belong to a scientific group of animals (phylum) known as Mollusca or Molluscs. In Latin the word molluscus means soft. The animals in the phylum Mollusca have no backbone.

Molluscs are broken down into classes based on their shared characteristics. Mussels are in the class of bivalves, meaning "two valved". In mussels the two valves (shells) are joined together by a small ligament at the back of the mussel. The ligament works like a hinge.

The main purpose of the mussel's shell is to protect its soft body. Scientists can tell a lot about a green-lipped mussel by looking at the colour, shape and size of the shell.

Mussel shells have growth rings that can help scientists figure out how old a mussel is and when changes occurred in its environment. They can even tell whether a green-lipped mussel has grown in the wild or on a marine farm. Although scientists aren't sure why, farmed mussels reach market size (90 – 120 mm in length) about twice as fast as wild mussels.

Filter feeders

Mussels eat drifting plants and some animals that are so tiny you can't see them without a microscope. These plants and animals are known as plankton. The mussels eat the plankton by opening their shells and creating a water current which sucks the water into the gills of the mussel where it is filtered.

Mussels can vary their water pumping rate based on the amount of food available to them. On average an adult mussel typically filters 6 – 9 litres of water per hour.

Can you tell a male green-lipped mussel from a female green-lipped mussel?

Yes. The flesh of mature male mussels is creamy white. Mature females have apricot-coloured flesh.

A female mussel and a male mussel. Photo: Queen Charlotte College

Harvesting mussels

Green-lipped mussels (kūkutai) were initially harvested by Māori and are still important to customary fishing practices in many parts of New Zealand.

In the wild, green-lipped mussels are found on rocky coastlines all around the country, although they are most common in central and northern parts of the New Zealand. You can see them attached to rocks, boat hulls, wharf piles and other solid surfaces. They also grow in dense beds on the seafloor. Beyond our wild green-lipped mussel populations, today there are also New Zealand Greenshell™ mussel farms from Northland to Stewart Island.

Young mussels growing on a longline. Photo: Cawthron Institute

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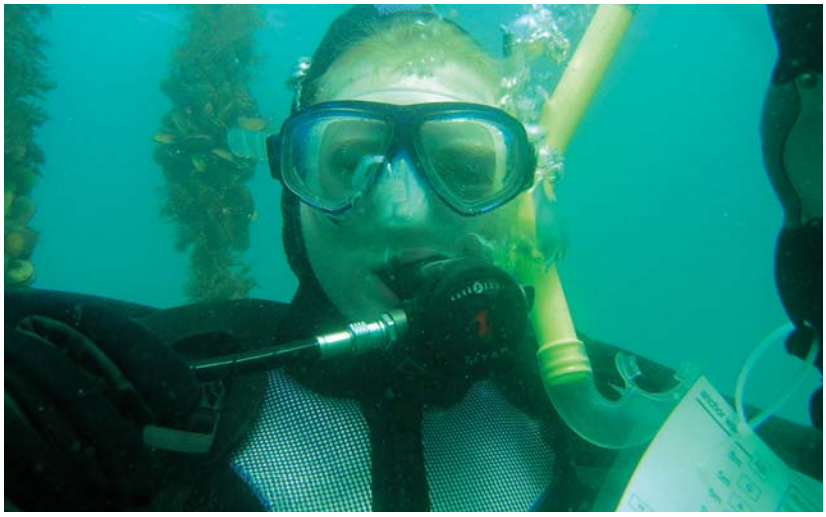

Amanda Riley (year 13 aquaculture student) in the water in front of a recently deployed experimental mussel dropper. The mussel dropper is attached to Queen Charlotte College Aquaculture Academy's research line in Shakespeare Bay, Marlborough. Amanda was getting ready to video the mussels at various depths on the dropper and shell drop on the seabed. Photo: Queen Charlotte College

Growing mussels

Farming mussels began over 30 years ago. A mussel farm usually occupies three to five hectares of water space. New Zealand Greenshell™ mussels are grown using a system known as longline farming, where groups of plastic buoys are held together by long lines attached to each side of the buoy. The line is anchored to the seafloor at each end. A series of ropes, on which the mussels are grown, hang down from these lines.

Mussels are broadcast spawners. That means the males release their sperm and females release their eggs into the water. One mature female can produce up to 100 million eggs per season.

Once an egg is released by the female it needs to be fertilised by sperm released by the male. The fertilised egg becomes a larva that goes through two stages of development before becoming a small adult-looking mussel. When mussels reach this stage they are called spat. The spat attaches itself to seaweed where it continues to grow. At different times of the year seaweeds filled with spat will wash up on to the shore.

Most marine farmers rely on spat that is collected from the wild. Over half of New Zealand's commercially grown Greenshell™ mussels originate from spat collected on 90 Mile Beach at the top of the North Island. The rest comes from local spat caught on special spat catching lines, or from hatcheries where it is selectively bred.

Local spat collectors keep an eye on when the spat washes up on the beach. They gather it (still attached to the seaweed) and quickly ship it to farmers all over the country. Once a farmer receives the spat they will carefully put it on special 'nursery' ropes and place it in the water. Three to six months later the farmer will raise the nursery ropes out of the water and the young mussels will be moved to underwater long lines to finish growing.

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Aquaculture in action

New Zealand's oysters

New Zealand has two native oysters: dredge oysters – also known as bluff oysters — (*Ostrea chilensis*) and rock oysters (*Saccostrea commercialis*). Both species are traditional foods for Māori. The Māori name for oyster is tio.

Pacific oysters. Photo: Queen Charlotte College

By the mid-1800s both dredge oysters and rock oysters were being commercially harvested. In fact, dredge oysters were one of the first commercial fisheries in NZ.

The over-harvesting of rock oysters led to the beginning of New Zealand's aquaculture industry. By the 1960s marine farmers were raising native rock oysters in many parts of the northern North Island.

The farmed oysters were more popular with consumers because they were bigger and sweeter than oysters harvested from the wild. Not only that, but farmers were able to raise rock oysters to a marketable size within 3 years – half the time it takes rock oysters to grow to the same size in the wild.

In 1971, marine farmers in Mahurangi Harbour, North Auckland, found a different type of oyster growing amongst the native rock oysters on their farm. It is believed the Pacific oyster (*Crassostrea gigas*), a native of Japan, was accidentally introduced to New Zealand waters in the 1950s on the hulls of freighters from Japan.

A shag sits on oyster racks. Photo: New Zealand Aquaculture magazine

The Pacific oyster depends on similar habitat as the native rock oyster, but because it grows bigger and three times faster than its native cousin it soon outcompeted native rock oysters both in the wild and on farms.

At first oyster farmers tried to remove Pacific oysters from their farms, but that proved nearly impossible. Besides that, with their shorter growing time, larger size and the fact that they spawn more often than the native rock oyster, Pacific oysters were soon the oyster of choice on New Zealand's oyster farms. With Pacific oysters very popular to eat in places like Europe, the United States and Japan, New Zealand oyster farmers started selling the Pacific oysters they grew to many different countries. Today Pacific oysters make up 98 per cent of the world's aquaculture oyster production.

Oyster biology

Like mussels, oysters are bivalve molluscs. Inside their two shells they have soft bodies and a muscular foot which is used to attach to hard surfaces like rocks or even other oysters.

Oysters are filter feeders that feed on phytoplankton and algae. They have hair-like frills that are called cilia. Cilia are used to draw in and push out water which helps them gather their food.

Most types of oysters begin life as males, but they change to females over time. Most Pacific oysters become females at about one year of age.

Native rock oysters and Pacific oysters are broadcast spawners – meaning they release their sperm or eggs into the waters around them. Fertilised eggs grow into larvae that float in the water for about two weeks. In their next stage of development they find a clean, hard surface to attach themselves to. Once they have found the right spot they release a glue-like substance called byssus cement to permanently attach themselves to the surface. In the wild oysters will stay in the same place for the rest of their lives. This action is called spatting and oysters at this stage of development are called spat.

Oyster farm. Photo: Graeme Silver, Environment Waikato

Oyster barge. Photo: Graeme Silver, Environment Waikato

How they grow

Most New Zealand oyster farms still depend predominantly on oyster spat from the wild, however as with mussels some farmers source their oyster spat from hatcheries where the spat is selectively bred. Oyster spat is usually collected by placing bundles of wooden sticks underwater in certain harbours and inlets (mainly in Kaipara Harbour). Oyster larvae drift in the water, settling or spatting to the sticks. In late December the spat-laden sticks are collected and transported to oyster farms around the country. On North Island farms most farmers leave the spat on the sticks. They attach the sticks to large racks that are then put underwater in sheltered harbours and inlets. In the Marlborough Sounds area in the South Island oyster spat is stripped from the spat sticks and placed on long lines to finish growing.

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Aquaculture in action

New Zealand's salmon

Many wild salmon are well known for the amazing journeys they make from streams and rivers as young fish out to sea and their return journey several years later back to the same stream to spawn before they die.

Species that do this are known as "anadromous" meaning they hatch in fresh water, migrate to sea and return to freshwater to spawn.

There are no native salmon or other members of the salmonid family in the southern hemisphere. In other words, members of the salmonid family in New Zealand have all been introduced from the northern hemisphere.

Marine farmer with New Zealand King Salmon. Photo: New Zealand King Salmon Company

Three species of salmon were introduced to New Zealand: Chinook or king salmon (*Oncorhynchus tschawytscha*), sockeye salmon (*Oncorhynchus nerka*), and Atlantic salmon (*Salmo salar*). Of the three species introduced only the king salmon was able to establish significant runs to the sea and back to their spawning grounds. New Zealand's king salmon initially came from the McLeod River in California, United States, and were introduced into several rivers just over 100 years ago. The offspring of those first salmon have established stable spawning runs on rivers in Canterbury, Otago and the West Coast.

King salmon growing in sea cages. Photo: Aquaculture New Zealand

Unlike most of the others of their species, the sockeye salmon and Atlantic salmon that were transplanted in New Zealand did not become anadromous.

New Zealand's Atlantic salmon do not swim to the sea, but instead swim to Lakes Te Anau and Manapouri to grow before returning to the streams where they hatched to spawn. The sockeye salmon that were introduced here lived in Lake Ohau and later Lake Benmore, but it is believed the wild population has died out. The offspring of those sockeye salmon transplants are still raised on some salmon farms.

Marine salmon farming

King salmon are also farmed in New Zealand. The first attempts to farm salmon came in the 1970s when people tried to raise the salmon in freshwater and then release them out to the ocean. These early salmon farmers hoped the salmon would return to the freshwater they were raised in when it was time to spawn – similar to how they do in the wild. This type of marine farming is called ocean ranching. In New Zealand not very many of the salmon returned so people found other ways to raise salmon.

Most salmon farmers in New Zealand now use sea-cage farming to raise salmon. Once the fry have hatched they are raised in freshwater until they reach smolt stage. Imitating nature, the salmon farmers move the fry when it reaches the smolt stage into net cages at sea. These net cages are about 25 metres wide and 15 metres deep.

The net cages are put in places where the tides will constantly flush the water around them. This is so waste from the cages (mainly leftover food and faeces) doesn't build up and pollute the water. The salmon grow in the sea cages for about 18 months before they are harvested.

Mt Cook salmon farm. Photo: New Zealand Aquaculture magazine

Fishy feed

Salmon are carnivorous fish. In the wild they eat small fish and crustaceans like krill.

On fish farms salmon are usually fed food pellets that are often made up of fishmeal and fish oil. These fish products often come from fish caught in the wild – either accidentally, which is known as by-catch, or specifically caught for fish farms. Most fishmeal is used for feeding animals raised on land, especially chickens and turkeys, but aquaculture now accounts for 35 per cent of the world's fishmeal consumption. As fish farming grows that means so does the need for fish food. New Zealand fish farmers make sure their fish feed comes from sustainable sources and have also reduced the amount of food wasted. Scientists are looking at ways to include more vegetables in fish food.

Salmon farm in the Marlborough Sounds. Photo: Graeme Silver, Environment Waikato

Freshwater farming

In the central South Island a few salmon farms are located in hydroelectric canals. In these canals young salmon are kept in net pens until they are harvested. One of these farms, the Tekapo canal salmon farm, is the highest salmon farm in the world (677 metres above sea level).

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Aquaculture in action

Aquaculture and the environment

The ocean provides important habitat for many plants and animals. For many New Zealanders it is a source of kaimoana (food harvested from the sea), as well as a place for recreational activities like surfing, swimming and boating. The ocean is also important to New Zealand's economy by providing jobs and income through activities like fishing, tourism and aquaculture.

Mussel farm. Photo: New Zealand Seafood Industry Council

New Zealand's waters are some of the cleanest in the world. This is partly because of our small population and our distance from population centres. Being "clean and green" benefits our health, our environment and even the way we do business with the rest of the world. For example, because of New Zealand's generally clean waters we are one of the few countries in the world where shellfish do not require depuration (being moved to clean water for a period of time to remove potential contaminants) before being processed. That's a big saving to individual marine farmers and it also means that New Zealand's shellfish are more sought after by consumers.

When thinking about our marine environment it is important to weigh the benefits of marine farming with any environmental impacts. In the case of aquaculture, environmental impacts depend on what type of animal or plant is being grown, where the marine farm is located, and what practices the marine farmer uses.

To feed farmed fish, for example, farmers spread food pellets over the water's surface. The pellets sink to the fish below, similar to how you feed fish in an aquarium. New Zealand salmon farmers carefully monitor the amount of food they feed their fish (using cameras and mathematical modelling tools) to ensure that there is minimal food wastage. In sites with low current flow, any food that is wasted and falls to the seafloor along with the fish faeces can build up and make the water polluted. That's why fish farms need to be built in areas that are frequently flushed out by the tide.

Environmental sustainability – a Māori perspective

Environmental sustainability means ensuring that when natural resources are used ecological processes are sustained for future generations. Kaitiakitanga takes this concept one step further.

In simple terms kaitiakitanga has been described as the guardianship of our natural resources. Others have described kaitiakitanga as "a web of obligations: to the taonga (treasures), to the atua (god) and to ourselves and our uri (future generations). Kaitiaki (guardians) have a responsibility to provide for everyone and ensure everyone benefits."[1]

Environmental trigger points

Regional councils like Environment Waikato monitor marine farms to make sure they don't have negative environmental impacts. To monitor the marine farms, Environment Waikato has identified "trigger points" for a number of environmental factors (i.e. water quality and what animals live on the seafloor below the farms). This trigger point system is an early warning sign for regional council staff, marine farmers and scientists so that they can take steps to solve any environmental problems right away.

Children carrying pīngao plants as part of community restoration project to protect sand dunes. Photo: Nicola Vallance, Department of Conservation

Molluscs and water quality

Three of New Zealand's top four aquacultural species are molluscs: Greenshell™ mussels, Pacific oysters and pāua. Molluscs operate a little like your vacuum cleaner – they suck up particles in the surrounding water which then concentrates within their body. That means that the mussels can help clean the water in which they are grown. It also means that the pollution can become concentrated in their bodies and could be passed on to animals (even humans) that eat them. That's one reason why good water quality is so important to marine farmers. Activities on land and at sea can impact water quality.

Scientists continually monitor the water in the marine farming areas. Sometimes farmers are not allowed to harvest their shellfish because the water quality has been affected by other human activities and the shellfish may not be safe to eat.

Many plants and animals like little blue penguins depend on the New Zealand coast for habitat. Photo: Rod Morris, Courtesy of DOC

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Aquaculture in action

Aquaculture and the economy

Marine farming is an important part of New Zealand's economy. In places such as Havelock in the South Island, and Kaeo and Manaia in the North Island a good percentage of the population are employed in the marine farming industry.

In 2006 marine farming accounted for $350 million in sales. The New Zealand aquaculture industry has a goal to reach one billion dollars in sales by 2025.

Meeting global demand

Innovation and research are important to New Zealand aquaculture to breed better mussels. Photo: Cawthron Institute

Since the mid-1980s, aquaculture has sustained a growth rate of around 8 per cent per year. New Zealand's aquaculture development mirrors what is happening in the rest of the world. Aquaculture is our fastest growing food production sector. Between 1985 and 2005 the industry grew an average of 11.7 per cent per year in volume.

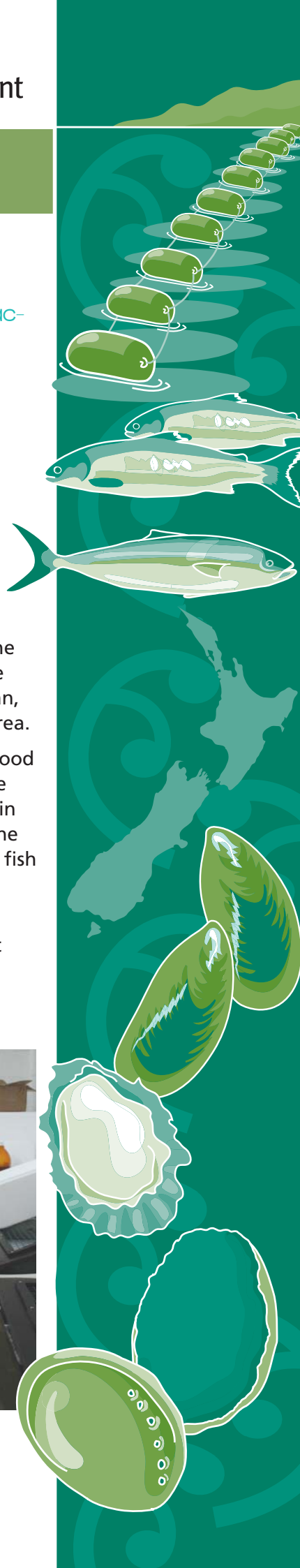
Part of this growth is because by raising plants and animals on farms – ensuring they have quality food, are protected from predators and have good conditions to grow in – we are often able to increase the number of plants and animals grown. For example, scientists have found that in some areas farmed mussels reach market size (90 – 120 mm in length) about twice as fast as wild mussels.

You can find New Zealand aquaculture products in grocery stores and restaurants here, but we also send our aquaculture products to many parts of the world. Right now the main places we export our aquaculture products to are the United States, Japan, the European Union, Australia and Korea.

Researchers with the United Nation's Food and Agriculture Organisation (FAO) are concerned there are "not enough fish in the sea". They say that there is only one option for meeting future demand for fish – through aquaculture.

The FAO notes that the amount of fish caught in the wild has remained about the same since the mid-1980s while the demand for fish has significantly increased.

Researchers work with redfin perch which is a freshwater species that has potential for aquaculture in New Zealand. Photo: Mahurangi Technical Institute



2006 Aquaculture Industry Farm Statistics – Top four species harvested in New Zealand

Species	Number of farms	Total ha of marine space	Tonnes harvested
Greenshell™ mussels	645	4,747	97,000
Pacific oysters	230	750	2,800
King salmon	23	60	7,721
Pāua (abalone)	18	20	n/a

Source: *New Zealand Aquaculture Council Annual Report 2006-2007*

Why New Zealand's Greenshell™ mussels are trademarked

New Zealand's Greenshell™ mussels are known to be some of the finest mussels in the world, which is why the New Zealand mussel industry has trademarked Greenshell™ mussels. That's so people can tell they were grown in New Zealand by certified farmers.

In fact, our Greenshell™ mussels are so well-known for their high quality that some Chinese mussel producers have illegally copied New Zealand's packaging and brand name and try to sell them in places like the United States.

Mussel farmers are concerned that one high profile case of food poisoning from these counterfeit mussels could be devastating for the New Zealand mussel industry.

China produces more than 50 species of mussels, including a green-shelled mussel (*Perna viridis*), which is similar in appearance to New Zealand's Greenshell™ mussel (*Perna canaliculus*).

It's against the law to copy the Greenshell™ trademark. To make sure the law is enforced New Zealand works closely with the United States and other countries we export to so we can stop this illegal activity.

Sources

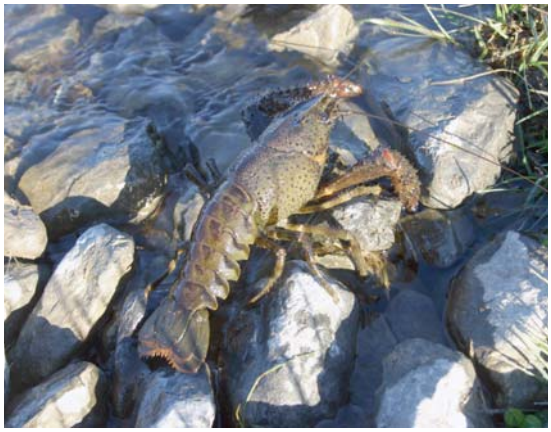
Our Blue Horizon
(http://www.aquaculture.govt.nz/obh_document_0.php)

Aquaculture in New Zealand Market Intelligence Report
(http://www.aquaculture.govt.nz/files/pdfs/aquaculture_market_intell.pdf)

Scientist offers way to combat counterfeit NZ mussels
(http://www.growfish.com.au/content.asp?contentid=1644)

Currently the New Zealand marine farming industry relies heavily on New Zealand Greenshell mussels™, Pacific oysters and king salmon. Researchers say we need to expand our aquaculture production and grow lots of different types of plants and animals that earn more on the global market.

Some researchers predict that farming species that sell at higher prices means we could increase the amount of money generated from aquaculture by up to 10 times as much without having to increase the amount of water space we are using for aquaculture now.



Kōura is just one example of the many aquatic species that can be raised through aquaculture. Photo: New Zealand Aquaculture magazine

Pāua aquaculture is poised for growth because of high demand from overseas. Photo: Queen Charlotte College

New Zealand Government

Aquaculture in action

Whose coast is it? Balancing coastal uses

When was the last time you visited the coast? What did you do there? Did you fish or gather shellfish? Did you swim or surf? Did you kayak or boat? Did you explore a tide pool? These are examples of recreational uses.

Children about to go snorkelling, Te Angiangi Marine Reserve, Hawkes Bay. Photo: Catherine Tiffen, courtesy of the Department of Conservation

Think about all the other ways our coasts and oceans are important, including providing habitat for many different types of plants and animals, scientific exploration, customary fishing and harvesting, commercial fishing, aquaculture, transportation, tourism, boat building and more.

Over 80 per cent of us live close to New Zealand's coast. As New Zealand has grown in population the pressures on our coasts and oceans have also grown. Certain parts of our coastline face strong demands from competing interests. One of the primary roles of regional councils and of the government is to balance these competing interests and demands, and to make decisions on how those demands are best brought together for the overall public good.

Where does aquaculture fit?

When aquaculture began in New Zealand around 40 years ago there was not much thought given to planning for marine farm developments in each region. By the end of 2000, 8,500 hectares of coastal waters had been approved for marine farming activities. Some councils had large numbers of applications for marine farms and it became clear that New Zealand had to develop a better system to plan new aquaculture developments. This new system would need to take into account the desires of marine farmers, what the communities where the aquaculture was being proposed wanted as well as any environmental impacts that may occur.

In 2005 a new system for managing New Zealand's aquaculture development was introduced. One of the biggest changes is that now new aquaculture projects can only now occur where Aquaculture Management Areas (AMAs) have been identified by a regional council in their regional coastal plan. When establishing AMAs, councils are required to consider the effects of aquaculture on the environment, fisheries resources and other uses of the area.

Before regional councils finalise an AMA and give marine farmers the right to apply for marine farms, they have to identify 20 per cent of the AMA and allocate it to Te Ohu Kai Moana Trustee Ltd, which is the trustee for settlement assets under the Maori Commercial Aquaculture Claims Settlement Act 2004. Te Ohu allocates the space to the coastal iwi of the region. The Settlement provides iwi with the equivalent of 20 per cent of the water space rights created in coastal waters from 21 September 1992 forward.

Foreshore and Seabed

In 1997 eight iwi from the South Island applied to the Māori Land Court for a determination that the foreshore and seabed was Māori customary land. Part of the reason they did this is because they felt that they were missing out on the rights to develop mussel farms in the Marlborough Sounds.

The case wound its way through the court system and in 2003 the Court of Appeal decided that the Māori Land Court had the jurisdiction to consider the issue. However, before the case came before the Māori Land Court the Foreshore and Seabed Act 2004 was passed.

This Act sets out the Crown as the owner of all the foreshore and seabed except for any privately owned parts. The public has the right of access over the foreshore for recreation and over the foreshore and seabed for navigating boats. The Act also protects customary activities and rights that can be proven to have been in place since 1840.

Marine farm in the Coromandel. Photo: Peter Singleton, Environment Waikato

View of oyster farm. Photo: Aquaculture New Zealand

Mapping coastal use and values

Mapping an area's coasts and showing current uses or values (i.e. commercial shipping lanes, marine reserves and culturally significant areas) is one way regional councils can make good coastal planning decisions. For example, in 2002, Environment Bay of Plenty began working on the region's Aquaculture Management Area Project. One part of the project was developing coastal use and value maps to show all the values and uses associated with the Bay of Plenty coast. Once these maps were drawn up Environment Bay of Plenty took them out to the public to ensure that the maps were accurate. Changes were made to the maps where necessary and now the maps will be used to help decide how and where AMAs will be put in the region.

Sources

Aquaculture reform 2004: The Rules of the Game – Creating Aquaculture Management Areas (http://www.mfe.govt.nz/publications/rma/aquaculture-info-game-rules-jan05/aquaculture-info-game-rules-jan05.html)

Mark Hickford. 'Law of the foreshore and seabed', Te Ara – the Encyclopedia of New Zealand, updated 21-Sep-2007 (http://www.TeAra.govt.nz/EarthSeaAndSky/OceanStudyAndConservation/LawOfTheForeshoreAndSeabed/en)

Environment Bay of Plenty AMA project (http://www.envbop.govt.nz/Coast/AMA-project.asp)

Details of the Maori Commercial Aquaculture Claims Settlement:

Ministry of Fisheries (http://www.fish.govt.nz/en-nz/Maori/Details+of++Settlement/default.htm)

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Ahu Moana:The Aquaculture and Marine Farming Report (report Wai953)