

Hoea te Waka, piki te mātau

MARINE FORM AND FUNCTION

Why do some waka go faster than others? Are the shape and materials used to form the boat important? Or is it your partner or your paddle that makes the difference? Just as the shape of the waka affects its speed, stability and manoeuvrability, so does the shape of a fish. Compare different kai moana species and investigate how they are made for different lifestyles and environments.

Read the information about waka and share it with your group. You may find images, models or real-life examples of waka to help with the discussion. The activities in this section include making a waka from recycled materials.

The form of seaweeds is also important to its survival in marine conditions. In this section we look at different seaweeds and their uses and get to taste them too.

This module includes:

- Waka form and function
- Incredible and edible seaweed

Waka Form and Function - background reading

*Hoea te waka! Karawhiua!
Paddle the waka! Dig it in!*

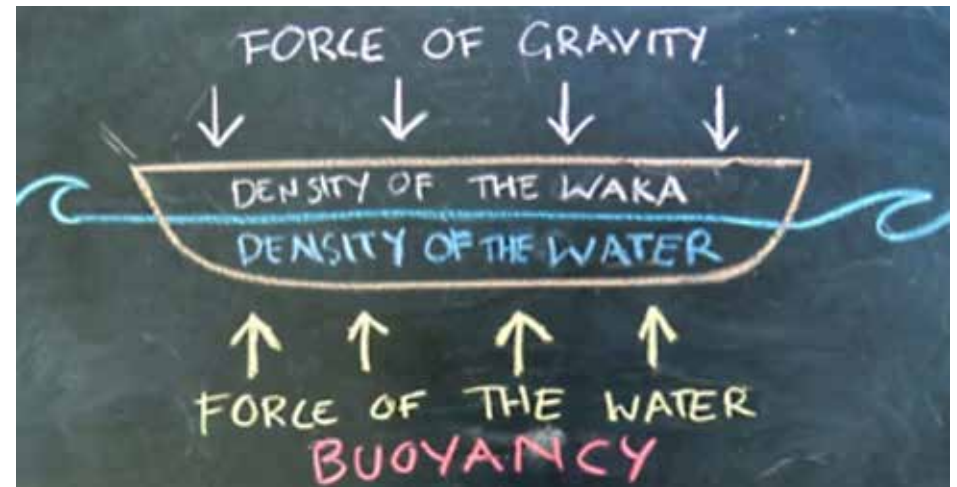
Which waka do you think would have been used by Māori to travel from Hawaiki to Aotearoa? What waka type would be used to race? To fish from? To travel through wetlands? Have a look at the different waka in your environment and have a kōrero about what their uses might have been. Discuss which waka might be faster and then race them! If you have some materials and a spare bit of time for some whakawhānaungatanga then you could try and make one!

Introduction

Traditional Māori knew which materials were good for making waka. They experimented to find buoyant woods and materials for lashing bits of wood together.

Buoyancy depends on the waka's displacement of water, meaning when gravity is trying to push water out of the way to make space for the waka, the water pushes back a force too. When a waka is buoyant it means that the density it is exerting (or pushing on the water) the same amount of force that is being pushed back.

Our ancestors relied heavily on waka for collecting kai and resources, we still use these for the same purposes today, but also, as classrooms to collect and pass on knowledge pertaining to our waters.



MARINE FORM AND FUNCTION

Waka tīwai

The most common form of waka, these were a simple hulled canoe with no carvings or decoration, and were made from a large hollowed out tree trunk of totara, rimu, kahikatea or kauri.

Waka hourua

Traditionally these waka were common throughout Polynesia. They have two hulls with a deck lashed between them and sails, making them perfect for sea voyaging. The sails are shaped specifically to catch the wind when the waka was sheltered from the wind in a trough (the lowest water level between two waves). A cabin on the deck was often built for shelter and the hulls used for storage of kai and other necessities. These are still popular today but are made from contemporary materials such as fibreglass and modern fabrics. If you are lucky you might get the chance to do some science on-board Haunui, one of our country's own waka hourua.

Patai - Have a look at the shape of the sail; are there any differences or similarities with yachting sails? How is the boat steered?

Waka ama

These are single hulled waka with an ama (outrigger) and are powered by paddlers. They are narrow and deep and this, combined with the ama, makes the waka very stable. Its stability makes it suitable for many activities from fishing to surfing! When the early settlers arrived to Aotearoa they rarely observed waka ama, but they were used predominantly in other Polynesian islands. Today waka ama has become very popular for recreational purposes, particularly for sport. The greater waterline length enables the waka to go faster by reducing resistance of the water, thus are perfect for racing.

Patai - What materials are used to build waka ama today? Why?



MARINE FORM AND FUNCTION

Mōkihi or mōkī

Mōkihi (a reed boat) was made out of fastened or bundled buoyant materials such as raupō (bulrush), kōrari (flax flower stalks), whau and houama. These were generally smaller waka and were operated by paddling with both the hands and feet, or, by using a small wooden paddle. These were handy for collecting kai and resources around wetlands, and were particularly common for traversing the many waterways throughout Te Waipounamu. These waka are easy to make as the materials required are usually abundant around the areas that you wish to use them.

Patai: Can you see any materials around you that could be used to make a Mōkihi?



MARINE FORM AND FUNCTION

Marine Form and Function - activities

A Discussion

Out of all the waka that you have seen and talked about:

- Which of the waka are more streamlined?
- Which are more manoeuvrable? (You could turn it around quickly)
- Which would perform best in a big swell?
- Which do you think were used by Māori to travel to Aotearoa from Hawaiki?
- What are some other waka that you know of that has not been mentioned, what were/are their uses?

B Waka Racing

Now that you have heard about the different waka, race them! Pick a racecourse and in your teams discuss what tactics you think might help you win!

Afterwards discuss:

- Which waka will win and why?
- What features allowed the winning waka to be so successful on the racecourse?

C Make your own waka

- Upcycle some rubbish

Make your own waka using rubbish you have at home, school, or see what you can collect from your local beach. Plastic floats very well, this is why it can be found floating around in the ocean miles from land.

Hoea te Waka, Piki te Mātau



MARINE FORM AND FUNCTION

Buoyant materials such as bottles and wood are often found washed up on the beach, as well as rope and nylon – perfect lashing materials.

Using traditional waka as a guide, experiment and see what you can come up with!

There are videos and instructions on the internet.

- Using natural resources

Here is a video on one way you can make a Mōkihi as explained by Joe Waterfield (nō te waka o Aoraki) <http://www.simon.co.nz/> (scroll down to Mōkihi in the Kai Tahu Mahinga Kai series).

He explains that the shape is dependent on your lashing, also the tighter the lashing the more solid and waterproof your vessel will be. Joe explains that the buoyancy of the raupō is attributes to its honeycomb structure in the stalk, these hold little pockets of air in them – be sure to have a closer look!

Here are the instructions:

1. Collect plenty of rope, kōrari and raupō. You can use raupō as is, but it is commonly dried out. Make sure you know how to harvest the raupō, generally you want to cut the stalks from as far down the plant as you can. You will need enough to make three large bundles for the base, and another two bundles for the sides.
2. Once the raupō is ready for lashing, start on making the bundles for the base by laying the raupō into two thick bundles with the kōrari in the centre of the bundles.
3. Measure the rope (for lashing) based on 4 times the length of the bundles. Lash the bundles, starting from the middle of the bundle and working outwards to the ends. Joe lashes 3 times per either side from the centre lashing.



MARINE FORM AND FUNCTION

4. Join the two bundles and space them out to your desired width. Use another rope to form the puku (stomach) of your waka, then fill the puku in with more raupō and lash it in. This will be the inner part of your waka.
5. If you want to make sides to the Mōkihi, you can make another couple of raupō bundles lashed to the sides. This will stop water from coming into the waka.



Incredible and edible seaweed - background reading

*“He rimu pae noa”
“Seaweed drifting about”*

Did you know that there are approximately 850 native seaweeds? What is even cooler is that a third of these species are endemic to Aotearoa.

Traditionally they were a food source as well as a material to preserve kai. Pōhā are bags made out of Rimurapa (bull Kelp), the long and wide blades were harvested and hollowed out to be filled with birds such as; weka or tītī and were able to be kept up to three years. The Kāi Tahu people also used Rimurapa to make sandals and wetsuits for protecting the body from sharp rocks when collecting kaimoana.

Seaweed was eaten directly or sundried. Karengo is still popular amongst Māori, it is best harvested pulled from the rocks and then dried in the sun or fried. Karengo is high in protein, vitamins, fibre, omega-3 and minerals (e.g. iron and zinc), and low in calories.

Ecologically seaweed provides habitat and kai for many marine species. Notable marine animals that eat seaweed are Kina and Pāua!

The benefit to the wider marine environment is that seaweeds are able to utilise CO₂ from the water as well as sunlight, this means that they will be of increasing importance in combating the increase of CO₂ absorption by the ocean leading to its acidification.



MARINE FORM AND FUNCTION

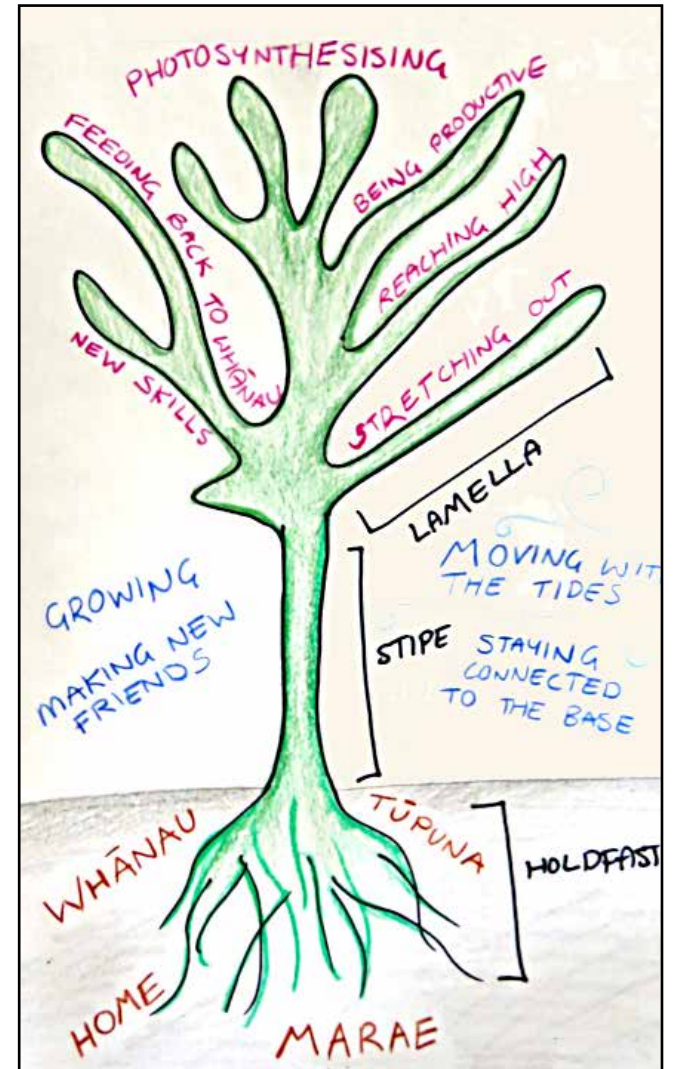
Kelp analogy

Bull kelp can grow up to metres long and withstand very rough seas. The basic biological knowledge of seaweed can be linked to life. The holdfast is the base of the seaweed, which secures solid foundation so that it can grow. This can be represented by the supportive structures in our life that enable us to grow like our whānau, tūpuna, marae, hapū, and iwi.

The base grows into the stipe, a flexible structure that allows that plant to move with the tides and wave action. This structure can be likened to growing and developing as a person; in life we are challenged and make mistakes but from those experiences we grow if we are still holding on to our base structure. The stipe can also symbolise new friends and connections to different kaupapa that allow us to grow and achieve higher goals.

The lamella float up and reach up to the higher levels of the water column so that they can utilise sunlight as energy for the plant. We can link these structures to the development of new skills and aiming high. Like the energy generated from sunlight, the skills and knowledge gained by a person feeds back to our base to make it stronger and thus ensure a positive future for the generations to come.

Here is something to kōrero about with your students: Can you think of any of analogies of the ocean and how marine plants and animals remind us of things in our everyday lives?



Incredible and edible seaweed - activities

A Seaweed form

What are the bumps for? What about the colours?

Have a look along the rocky shore and see if you can find some of the following seaweeds in the Rocky or Sandy and Muddy shore guides and discuss some different features and their purposes.

If you are on the rocky shore, then see if you can identify the following in the water: Karengo, Ulva spp, Neptune's Necklace and Undaria (an invasive pest species).

Patai to discuss:

- Where are they found growing?
- What is inside the Neptune's necklace? Why?
- Where are each type mostly distributed in the area?
- Have a think about what different features the Undaria might have in order to allow it to successfully outcompete the other seaweeds?
- What do you think we could do to control a pest species such as Undaria?



MARINE FORM AND FUNCTION

B Seaweed function

Seaweed absorbs CO₂ and produces O₂, see if you can observe this in our own experiment.

1. Collect different types of seaweed (not the dried up dead stuff) and a bucket of water.
2. Set up 4 different containers with lids and fill them with water; 1 with no seaweed, 1 with seaweed, 1 with seaweed and an animal (such as a crab), and another with seaweed and put in the sun.
3. Measure and see if there is a change in O₂ after 40 minutes. If not then re-incubate the jars for another 20 minutes. Return everything to the moana when you are done.

Patai to discuss - Which had more or less O₂, why?



MARINE FORM AND FUNCTION

C Kai time!

Feeling peckish for a bit of seaweed? You can eat it raw (give it a go) or you could test out one of our recipes. Harvest seaweeds at a low tide but leave the holdfasts attached to the rocks, this is so that the plant can continue to grow.

Bladder kelp (*Macrocystis pyrifera*) chips

1. Collect some blades from the bladder kelp – make sure that it is fresh.
2. Wash the blades thoroughly in the ocean to return any critters back to Tangaroa.
3. Cut the kelp into bite-sized pieces.
4. Pour a thin layer of olive or sesame oil into frying pan or wok. Toss the kelp continuously in the oil and let cook over a medium-high element for 2 to 3 minutes.
5. Sprinkle with sesame seeds or honey. When green and crispy, take off the heat and drain on paper (should be hardly any excess oil).

Japanese potato salad

1. Cut harvested and cleaned kelp (*Macrocystis pyrifera*) into squares and thinly slice celery and onion.
2. Mash boiled potatoes in a bowl.
3. Add mayonnaise and capsicum to the bowl and mix, season to taste.
4. Roll into balls and serve.

Seaweed crackers

1. Spread some crackers with a bit of cream cheese.
2. Top with some washed and sliced up Neptune's necklace (*Hormosira banksii*).

