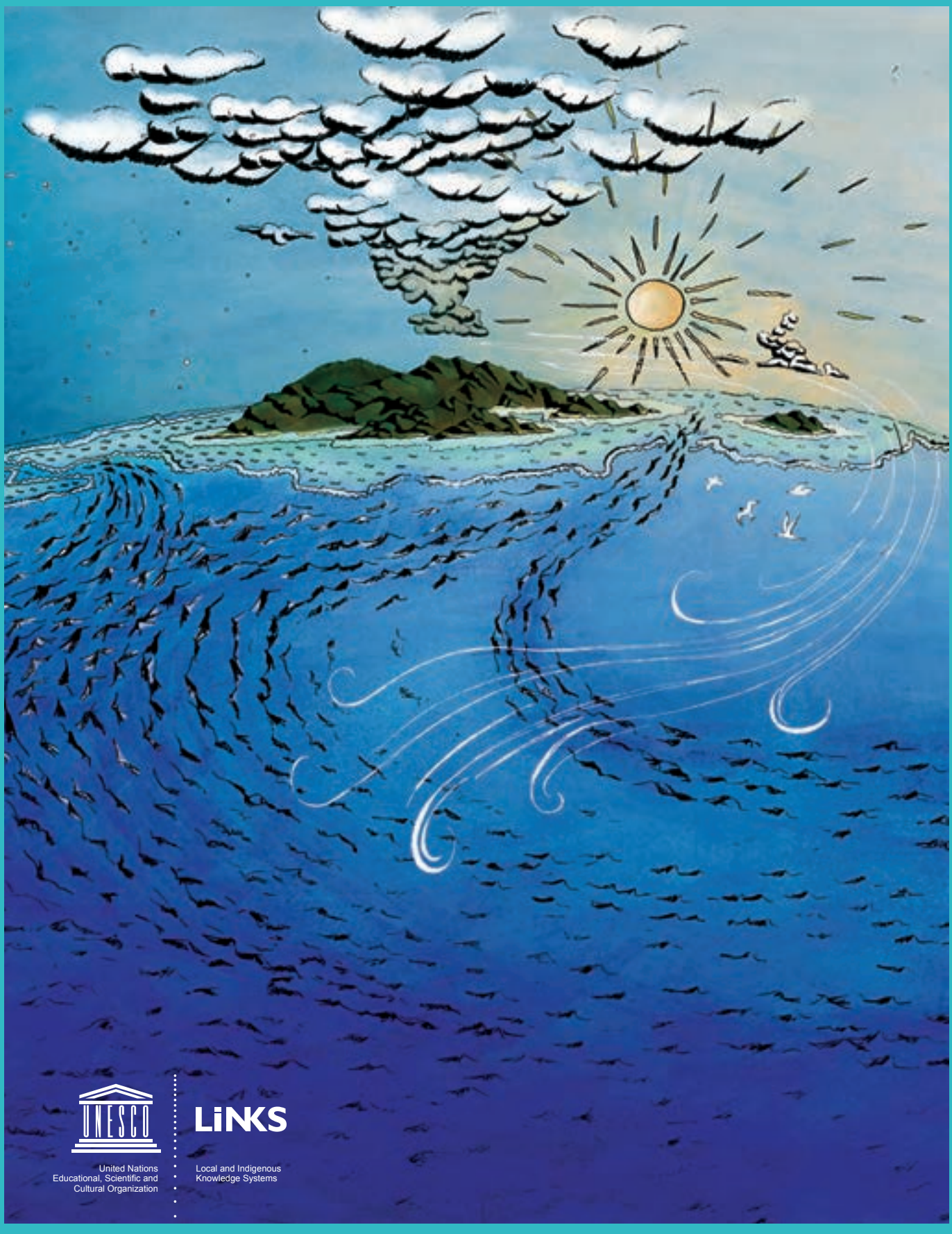
The Canoe Is The People
LEARNER'S TEXT



United Nations
Educational, Scientific and
Cultural Organization

LiNKS
Local and Indigenous
Knowledge Systems

The Canoe Is the People **educational Resource Pack: Learner's Text**
The Resource Pack also includes: Teacher's Manual, CD–ROM and Poster.

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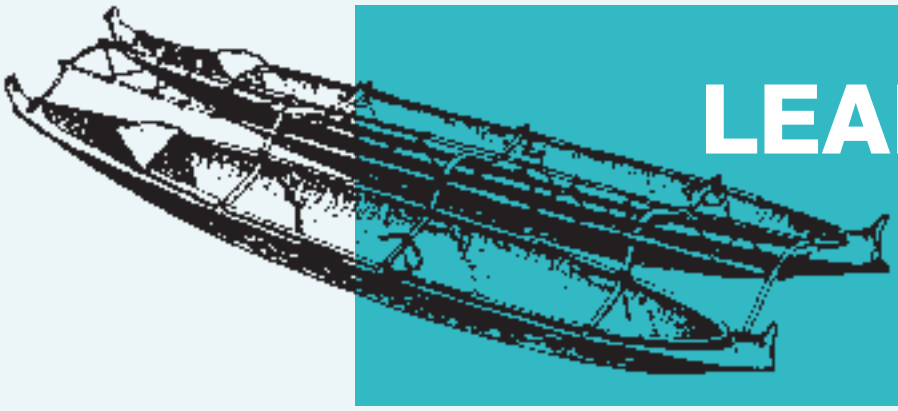

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Acknowledgements

The Canoe Is the People Resource Pack has benefited from the collaborative efforts of a large number of people and institutions who have each contributed to shaping the final product.

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University of Auckland team
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We would like to acknowledge the use of the *Tauhunu*, vaka (canoe) image which appears on the header of every page of the Teacher's Manual and Learner's Text.

It is from Manihiki, Northern Cook Islands. Made of wood, coconut fibre, pearl shell. 430 x 8860 mm. Purchased 1907.

Source: *Icons from Te Papa Pacific* pp.106–107

Contents

To sail across the ocean in the days that they sailed the ocean, the European voyagers thought that the world was flat. Polynesians always knew that the world was not flat. They always knew it was round. And when our children find out how far more advanced the Polynesian voyagers were, I just know that it will give them such tremendous self-esteem and respect for their ancestors.

Dorice Reid, Cook Islander

Outrigger canoes of Satawal, Caroline Islands 1880s

Source: Howe, K. R. (2006). p.104

Introduction

Have you ever wondered how people first came to your island country, and where they came from?

They arrived on canoes after sailing across hundreds or even thousands of kilometres of the Pacific Ocean. The Pacific is the largest ocean in the world and it covers one third of the Earth. The peopling of its islands was one of the greatest migrations of all times.

Many thousands of years ago, when people in Europe and other parts of the world were still sailing close to land and had not even thought about traveling long distances out into the unknown sea, Pacific Island seafarers and navigators were sailing thousands of kilometres across the Pacific in search of new land. From modern techniques for dating events, such as radiocarbon dating, we know that a canoe landed in the Marquesas Islands in 124 BC. We cannot be sure how long they were at sea, but they would have had to travel across hundreds of kilometres of open ocean to get there. Three thousand eight hundred and sixty two kilometres (2,400 miles) east of the Marquesas, there is evidence of an early voyage to Polynesia's eastern-most country, Easter Island, also known as Rapa Nui. It is not only the most isolated of the Pacific Islands, but is only 24 km (15 miles) long! A mere speck on the surface of a vast ocean.

Welcome to the world of indigenous navigation or 'wayfinding'[1] as it is becoming known in parts of the Pacific.

Wayfinding is a modern word which has been created by two Pacific Island navigators, Mau Piailug from the Caroline Islands and Nainoa Thompson from Hawaii, with Will Kyselka – a retired Professor from the University of Hawaii – to describe how Pacific Island navigators work out where a canoe is on the ocean and how to get it safely to its destination.

> *A Tongan navigator once said, 'The compass can go wrong, the stars never.'*
>
> David Lewis in Bader, H. and McCurdy, P., Eds. (1999).

1 *Wayfinding is a way of navigating across expanses of open ocean using only natural elements of the ocean, wind and skies, and the senses and memory of navigators. Pacific Island navigators do not use any kind of written chart or a mechanical instrument such as a compass. They have no need for such equipment. They rely only on what they learn from their parents, elders and ancestors, and many years of their own observation and practice.*

These traditional navigational skills still exist and are still in use in parts of the Pacific. But unless young people like you learn about them and ensure that your children and grandchildren also know about the great achievements of Pacific Island seafarers and navigators, there is a real danger that this exceptional knowledge could be lost forever.

By studying indigenous knowledge of navigation in the Pacific, you will be able to learn about this knowledge and these skills. To help you get started, the United Nations Educational Scientific and Cultural Organization (UNESCO) has produced an interactive multimedia learning resource called *The Canoe Is the People*. It is full of information to read and videos to watch and there are interviews with Pacific Island canoe builders and navigators, and other people in the Pacific who know a great deal about this subject.

The Canoe Is the People interactive resource is available online at www.canoeisthepeople.org or as a CD–ROM. This *Learner's Text* is based on *The Canoe Is the People* and can help organise your study of indigenous navigation.

The study of indigenous navigation is divided into four strands:

Strand A: Beginnings and origins

Strand B: Canoe building and sailing

Strand C: Becoming a navigator and navigation

Strand D: Voyages and revival

You may study all four or just one or two. The strands include interesting information on traditional Pacific navigation, as well as learning activities.

They are designed to help you to learn about indigenous knowledge of navigation and the important part played by your ancestors in developing the knowledge and skills of wayfinding. They will also help you to develop your abilities in maths, science, English and other subjects.

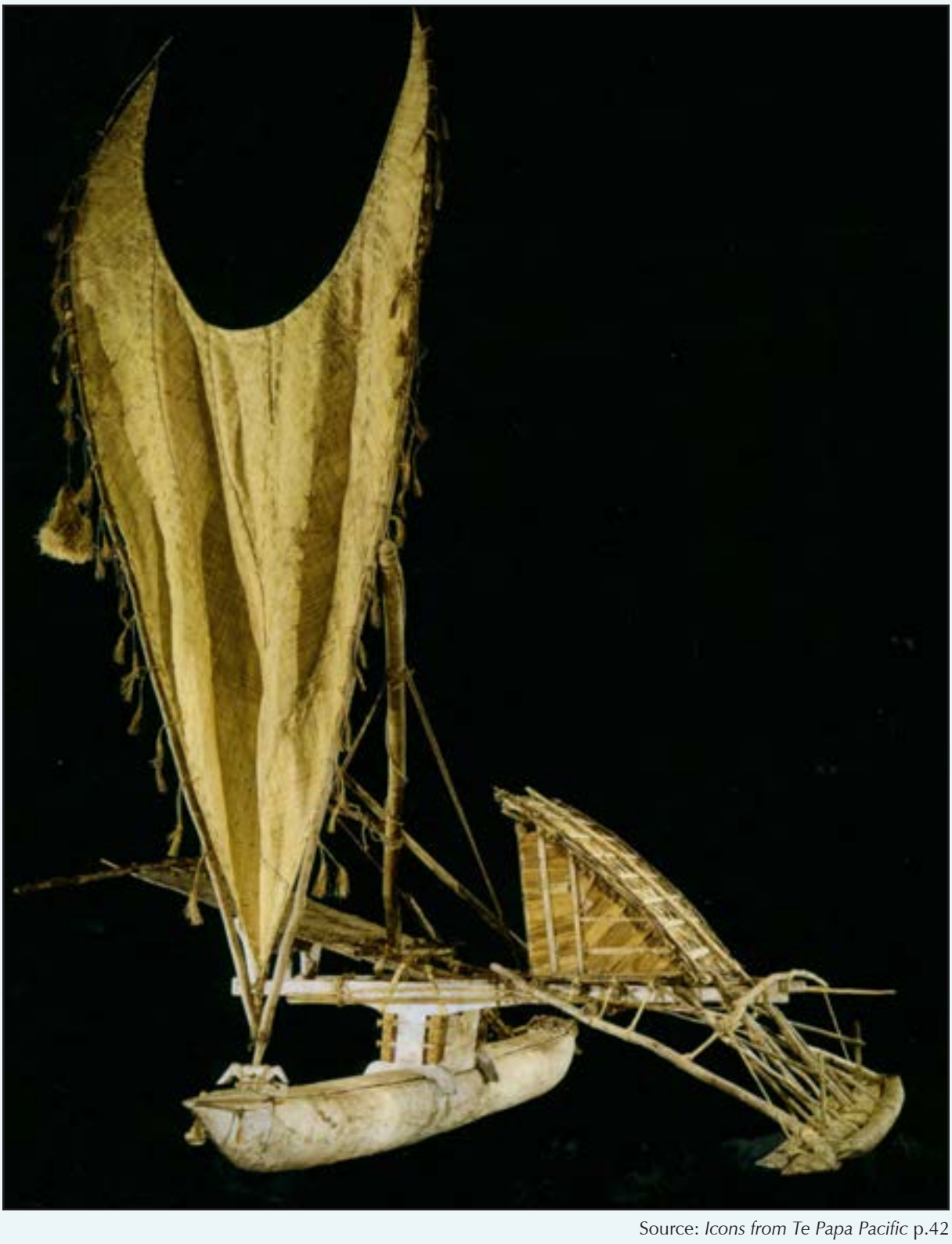
You will work on your own to complete some of the tasks and with your classmates on others. You can ask your teacher or someone who knows something about the subject for help.

There may be members of your family, community or village who know and use some or all of these skills. Find out who they are and talk to them about their experiences. You can learn a lot from them.

If you have the opportunity to use a computer, *The Canoe Is the People* interactive resource is available as a CD–ROM or online, if you have internet access, to help you to find answers to the questions.

But also use your imagination and think about what it might be like to be on board a canoe, navigating across the Pacific Ocean.

Parangaina, tepuke (sailing canoe)



Source: *Icons from Te Papa Pacific* p.42

STRAND A: Beginnings and origins

- Where did the islands of the Pacific come from?
- Where did Pacific Island peoples come from?
- Why did they leave their homelands?

Over the years, many people have asked these questions and they have been answered in many different ways.

Where did the islands of the Pacific come from?

There are two ways of trying to answer this question.

One way is to look for the answers in myths and legends, and the stories passed down through the generations. The other way is to explain it geologically. Geology is the study of how the planet Earth and its land and oceans were formed, and are still being formed. Sometimes we can see parts of a geological explanation in a myth or legend.

Myths and legends

Each culture of the Pacific tells its own stories. Some are similar but others are quite different. Here are just two examples:

1. From Langar, Pohnpei, Micronesia

Long ago, there was a huge rainfall, and Pohnpei was nearly washed away. The floodwaters took trees, rocks, and houses into the sea. A woman from Langar called Li en Lan saw this. She climbed onto a large rock. As things from Pohnpei washed by her, she grabbed them and piled them on Langar. When the flood was over, she saw that she had created a lovely high islet that looked like Pohnpei.

2. From the Kingdom of Tonga, Polynesia

Tangaloa, the god of art and invention, looked down from his sky home of Bolotu. 'I am hungry. Hungry for fish.' He let his great turtle hook go down, down, down. Soon, something heavy pulled on the line. Tangaloa pulled and pulled, but he couldn't pull up the hook. He had caught a huge rock, not a fish! He laughed and said, 'Today, I won't eat. Today, I'll have fun making islands.' He pulled up the very bottom of the sea. When the rocks reached the surface, the line broke. The land split into lots of little islands.

Then Tangaloa let pieces from the wood he was carving fall to the water. He told one of his sons to become a bird and fly down to see what happened. After some days, the pieces of wood became a beautiful island! He told his son to plant a seed on the island. The seed grew into a vine. His son pecked at the root until it broke in two and rotted. A big white worm formed there. He pecked at that, and it split as well. The three parts became the first men – Kohai, Kuau, and Momo.

Tangaloa named the island Eueiki, the first place of men. The three men became the first Tui Tonga (rulers of Tonga). The first true man (not from a worm) was Ahoei. He was born later to Tangaloa and a beautiful woman called Ilaheva Veepopua.

There will be myths and legends in your own culture, which explain the origins or beginnings of your country. Find out what they are. Elders in your family and community will still know them. Ask them to teach you so that you can one day teach your children.

Geological explanations

Geological explanations of how the Pacific Islands were formed include:

- Volcanic activity over thousands of years created the islands, sometimes very quickly after the eruption of a major volcano and sometimes slowly if eruptions were small but repeated.
- Earthquakes and the movement of the earth's crust or continental plates pushed up land that had been under the ocean.
- A piece of land broke away from a larger land mass and slowly moved across the Pacific as part of a continental plate.
- At times, when the Earth was warmer, melting ice raised the level of the ocean – and by flooding low-lying lands higher ground became islands.

- The skeletons of the very small animals that make up a coral reef formed some of the islands. These islands are known as atolls, and they would have grown very slowly over hundreds and thousands of years.

Where did Pacific Island peoples come from?

This question has been studied by archaeologists and linguists. Archaeology is the study of ancient living places and the artifacts, or objects such as stone or shell tools, which ancient people left behind. Linguistics is the study of languages, and how they change over time.

Archaeologists look at the types of artifacts that have survived for hundreds or even thousands of years. For example, there is a type of red pottery, known as Lapita pottery, which has been found in many different countries across the Pacific. Lapita pottery has become an important tool for following these early migrations through Melanesia to Polynesia. It is believed that Lapita pottery was first made in the Bismarck Archipelago in Papua New Guinea and the Solomon Islands between 3,000 and 4,000 years ago. Lapita pottery found in Samoa and Tonga is thought to be at least 2,000 years old. Here the culture and language of today's Polynesians began.

Linguists study how similar the languages are in different parts of the Pacific.

For example, the word for canoe is similar in many different countries:

Samoa	va'a
Hawaii	wa'a
Tonga	vaka
Tokelau	vaka
Solomons	vaka
Tuvalu	vaka
Marquesas	vaka or vaa
Papua New Guinea	waga in many languages
Aotearoa (New Zealand)	waka

Knowledge of archaeology and linguistics allows us to get a very good idea about where the first Pacific Island people came from, where they travelled to and when they first arrived.

There are also different ideas and theories about where the very first people to arrive in the Pacific came from.

Some people believed that thousands of years ago the ancestors of Pacific Islanders crossed a land bridge over the Bering Straits, between Russia and Alaska. Over many generations, they travelled down to the South American continent before sailing west into the Pacific reaching Easter Island first of all. In 1947, a Norwegian sailor called Thor Heyerdahl and his crew sailed a balsa wood raft called the Kon-Tiki 8,047 km (5,000 miles) from Peru to Raroia in Polynesia. The raft was a copy of the traditional type of raft used by people in South America and it showed that such a voyage was indeed possible.

However, today most people have been convinced by the extensive archaeological and linguistic information. This evidence shows that human occupation of Oceania, which includes all of Polynesia, Melanesia and Micronesia, probably first began on Halmahera in modern day Indonesia or maybe in nearby northwest Papua New Guinea where archaeologists have found stone tools on ancient campsites which could be as old as 25,000 years!

It is likely that people first arrived by canoes on Papua New Guinea. There are further archaeological signs that between 3,500 and 4,000 years ago they moved on to the Philippines and from there they settled in Palau, Yap and the Marianas Islands.

Between 2,000 and 3,000 years ago, people sailed by canoe to the Reef and Santa Cruz Islands, and from there on to Vanuatu, New Caledonia, Fiji, Tonga and Samoa. Lapita pottery has been found in all of these countries and there are some similarities in the languages.

By 2,000 years ago, the level of the ocean had dropped and uncovered the Marshall Islands and Kiribati, and they were visited and populated by people from Vanuatu and South East Solomon Islands.

Sometime between 700 and 2,000 years ago people from Fiji, Tonga and Samoa arrived at the more remote islands of Hawaii, Rapa Nui (Easter Island) and Aotearoa (New Zealand). Aotearoa was the last country to be settled in this way.

Why did they leave their homelands?

Think about this question for a moment. This would be a very big and even dangerous decision. Why would people decide to leave their homes, their families, their land and their ancestors and set off on a long and difficult journey across the ocean in search of new land?

There are many possible reasons for this.

Maybe the population of the island they were living on was increasing and there was a shortage of either land or resources. So some families may have decided to leave in search of a new homeland.

or

Maybe there was a war between the chiefs and the defeated chief decided to leave and take his people with him to start a new life somewhere else.

or

Maybe some people were just very curious and wanted to see what was out there over the horizon and far across the ocean. Maybe they wanted to be the first to find the land that they had heard about in myths, legends and songs.

Did they know where they were going and how to get back?

There are different views and beliefs about this.

Some people believe that ancient Pacific Island seafarers and navigators were brave and fearless sailors. They set off without really knowing where they were going to, or if there was any land in the direction they sailed, or how to get back to their home island. They just used the wind and ocean currents and their good luck to somehow find land and to survive the journey. This is called accidental or drift voyaging. The theory is most often associated with the ideas of a New Zealander called Andrew Sharp who started to publish his ideas in the 1950s.

Other people, such as Ben Finney and David Lewis in the 1960s, say that this is probably not true. Ancient Pacific Island seafarers and navigators had spent many years from early childhood carefully learning about navigation from their parents and grandparents. With their in depth knowledge of the stars, the wind, the ocean currents, and sea life such as birds and whales, they could work out where land

may be. But if they did not discover land, they could also return safely and accurately to the place where they had started out from. This is called intentional voyaging, or knowing roughly where you are going and how to get back to where you started.

We will be studying and learning about some of the knowledge and skills that were, and still are today, used by Pacific Island navigators. We will see that the voyages made by the first and early peoples into the Pacific were mainly intentional voyages under the protection and guidance of the 'father of the canoe'. Navigators used their deep knowledge and understanding of spirituality and the natural world to ensure that the canoe reached its destination safely, and if need be, to return to the place it had come from.

Learning activities

1. Do you know any myths or legends that explain the origins of your island or country?
2. Can you see any signs of a geological explanation in any of the myths and legends?
3. On the map in the educational Resource Pack look for and find:
   - Halmahera
   - the Malaysian Peninsula
   - north-west Papua New Guinea
   - the Philippines
   - the Marianas Islands
   - your country
   - your island
4. On the map in the educational Resource Pack: find and mark the route your ancestors may have taken to get to your island or country.
5. Is Lapita pottery on display anywhere in your country? Can you go to see it on your own and bring back a drawing? Where was it found? How old is it?

STRAND B: Canoe building and sailing

Canoes are a very important part of the history and culture of Pacific Island peoples. There are many different types, shapes and sizes. They were used for travel, trading, fishing and sometimes wars between countries and islands.

What did the first canoes look like?

Thousands of years ago the first canoe set off into the Pacific, probably from Halmahera in northeast Indonesia on its way to Papua New Guinea. No one really knows what that first canoe looked like. There are none left for us to look at and there are no paintings, drawings or written records.

Here, we will look at how the canoe began, and how it has developed and changed over the last three or four thousand years.

In the drawings in **Figure 1** you can see examples of boats and canoes.

It is likely that the very first boat was a raft.

Rafts are very simple boats and are made by using sennit rope to tie together planks of wood, or trees that have been cut in half. They would have been used to go only very short distances, such as for fishing close to the village. Paddles or oars would have been used to push them through the water.

On islands that had larger trees, the next stage in the development of the canoe was the making of dugouts. These are made from one large tree trunk that has been carved or hollowed out to make the main body of the boat and to allow someone to sit inside it. This main body is called the hull of the canoe.

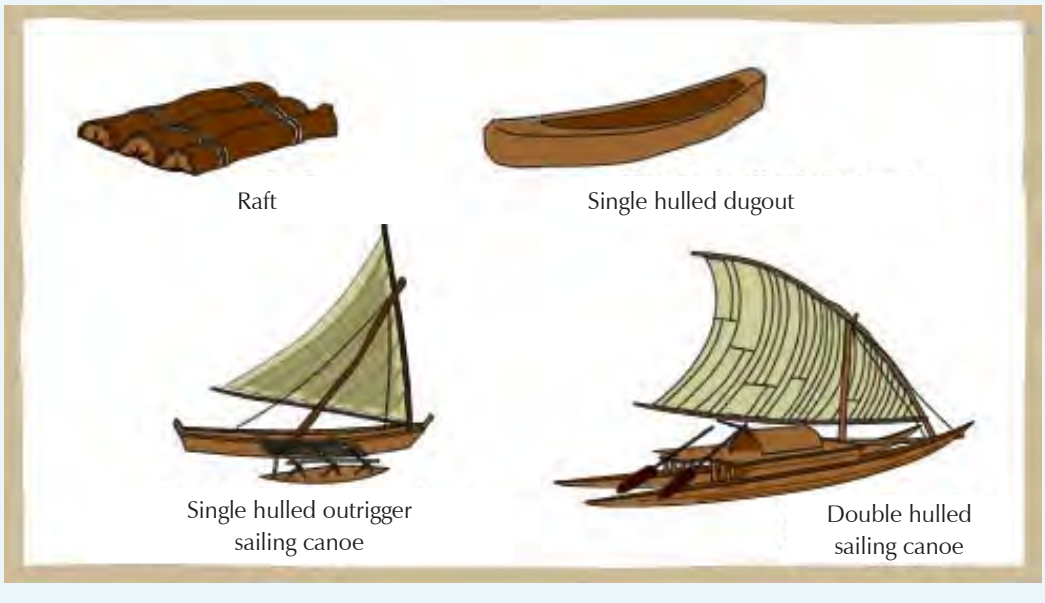
One of the problems with dugouts is that they are not very stable, so they can roll over easily if the water in the lagoon or ocean is even a little rough. So, someone thought of adding another tree trunk, smaller and shorter than the main one, tied to the side of the dugout, to help balance the dugout. These boats are known as outrigger canoes.

People in the Pacific still use small outrigger canoes and you have probably seen them many times in the lagoons and ocean around your country. They are the ancestors of the much larger canoes that you are going to be learning about.

These early outrigger canoes would still have used paddles or oars to move through the water. So, the next major development was the discovery that if a piece of mat was tied to an upright post, this caught the wind and made the canoe go faster. The larger the mat, or sail, the faster the canoe moved through the water. These sails were usually in the shape of a triangle. But, very large sails might catch too much wind and blow the canoe over, so a smaller sail was also sometimes used to make the canoe safer, especially in strong winds and rough seas. It was also soon realised that if wood was used to raise the sides of the canoe this helped to stop water from coming in, and people and goods from falling overboard.

As the people learnt more about how to sail these canoes and to control them, the size of the canoe got bigger and they were taken on longer and longer voyages. It was soon realised that if the outrigger was the same size, or almost the same size, as the main hull, these double-hulled canoes could go even longer distances and carry many more people and goods. Some of these canoes were over 30 metres long and could carry over 100 people. These canoes would have been used for long-distance ocean voyaging.

Figure 1: Drawings of a raft, a dugout, an outrigger and a double-hulled voyaging canoe



What are canoes made out of?

Knowing which building materials to use to make a safe and reliable canoe is very important if the canoe is going to survive a long journey across the Pacific Ocean. Pacific Island peoples have a very high respect for the environment and all living things, and they carry out rituals – such as asking permission from the spirit of a tree before it is cut down to make a canoe.

Men with this knowledge in the community are highly respected and they have a high social rank. They are known as master canoe builders. In the Caroline Islands, a master canoe builder is called a *senap*.

Hulls

The master canoe builder makes sure that only wood that is hard, but not too heavy, is used to make the hulls and that softer, lighter wood is used to make the outrigger and platforms for passengers. Sometimes, carvings are made on the wood asking the spirits to protect the canoe and its passengers.

If a country or island did not have trees that were hard or strong enough for canoe building, they would trade with neighbouring countries. For example, Tongan voyaging canoes were usually made with wood from Fiji.

Sails

The first sails were made out of strong leaves from plants such as the pandanus. The sails were woven by women and young girls in the same way as they wove mats and baskets (see The role of women and girls in navigation, Strand C, pp.30–33). When they had finished weaving, the sail was cut to size and the edges made stronger to withstand the force of the wind. It was very important that the sails were well made and were strong enough to last for weeks or months at sea, and to withstand very strong winds.

Ropes

Canoe building needs a lot of rope for tying together the wood, or as rigging for the sails. Master canoe builders do not use hammers and nails. Everything on the canoe has to be tied with rope. The rope is made from plant material. Sometimes the hibiscus plant is used, but often rope is made from coconut husk and known as *sennit*.

What do Pacific Island canoes look like?

Here are some examples of large canoes from Pacific Island countries. In canoes like these, Pacific Islanders made their great voyages of discovery and colonisation. Some of these great canoes could complete voyages of up to 8,000 km (5,000 miles). Voyaging canoes were usually double hulled in Polynesia and outriggers in Micronesia.

Figure 2: Papua: The Lakatoi (from Haddon, A. and Hornell, J. *Canoes of Oceania* 1975, BMP)

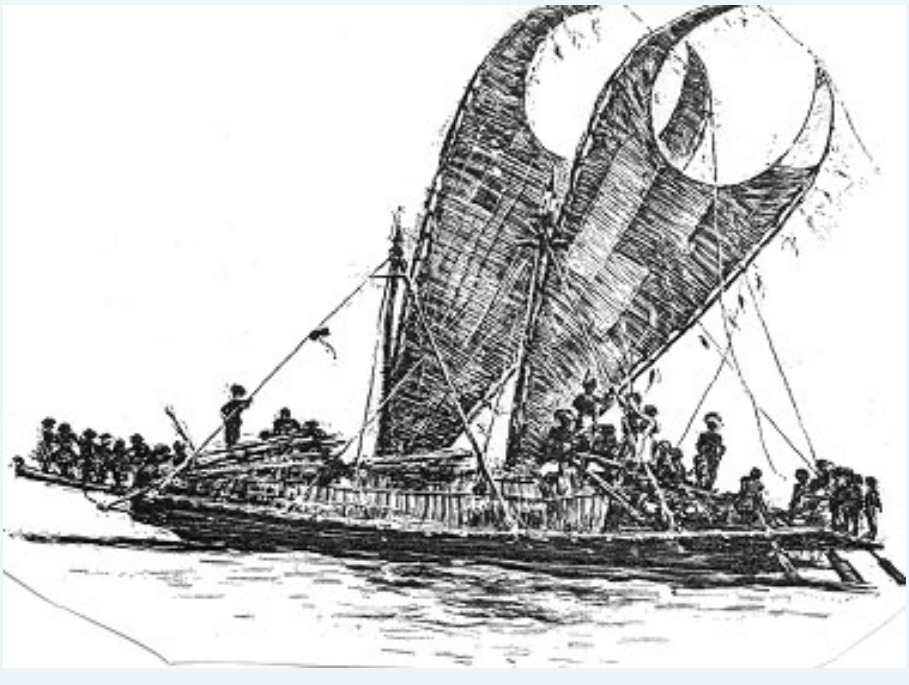


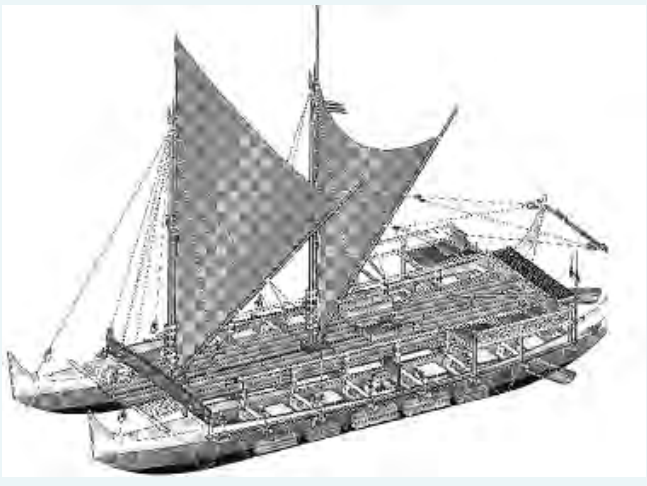
Figure 3: Fiji: A *ndrua* (from: www.janesoceania.com)

Figure 4: Tahiti: A *pahi* (from: www.janesoceania.com)

Figure 5: Marshall Islands: A small outrigger
(from Haddon, A., & Hornell, J. (1975). *Canoes of Oceania*, BMP)

Figure 6: Kiribati: A *baurua* under construction in 1935
(from www.janesoceania.com)

Figure 7: Hawaii: The *Hokule'a* is a modern-day re-construction of a traditional double-hulled voyaging canoe.



How are the canoes sailed?

The canoes are sailed by using the wind to push the canoe over the water. Sometimes, the wind fills the sails and other times only a part of the sail catches the wind. The stronger the force of the wind and the more of the wind caught by the sail, the faster the canoe goes.

But the crews of the canoes found that although they could sail away from the wind, or across the wind, or even very close to the wind, no matter how hard they tried they could not sail directly into the wind.

If the wind is coming directly towards the canoe, there is a 75° area, right in front of the canoe, in which the sail just cannot catch the wind; the canoe will just stop if it enters this zone which modern-day sailors call the 'No Go Zone'.

So, if the destination of a canoe is in the direction of the wind, the crew has to sail the canoe on a zigzag course. This means that instead of sailing in a straight line to get to its destination, the canoe has to sail from side to side.

There are two ways of doing this called tacking and shunting. Both of these actions turn the canoe through the wind so that it does not enter the 'No Go Zone'.

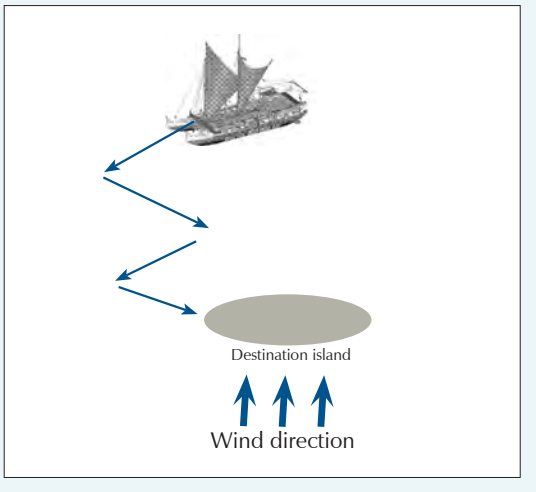
Tacking

Tacking involves turning the canoe so that the front, or bow, of the canoe passes through the wind and the sails and the crew change sides. The basic way of doing this is as follows (see also Figure 8):

1. The crew sails the canoe very close to the wind until the sail starts to lose the wind and flap about. This means that the canoe is right on the edge of the 'No Go Zone'. If nothing is done and the canoe continues to sail into the wind, the canoe will stop.
2. The canoe has to be moving quite quickly to do the next step. The crew now pushes the long pole, or boom, to which the sail is attached to the other side of the canoe and the crew also must change sides. The crew and sail must always be on opposite sides of the canoe after tacking. This will turn the front of the canoe across the wind, and out of the 'No Go Zone'.
3. The sail is now on the opposite side of the boat and fills with the wind on its other side and moves in a sideways direction in relation to its destination.

The canoe may continue sailing in this direction for many kilometres before the crew decides to tack again. Sometimes, a canoe has to be tacked many times before it reaches its destination. The distance to be travelled and the strength of the wind will determine how many times the canoe has to be tacked.

Figure 8: Tacking a canoe

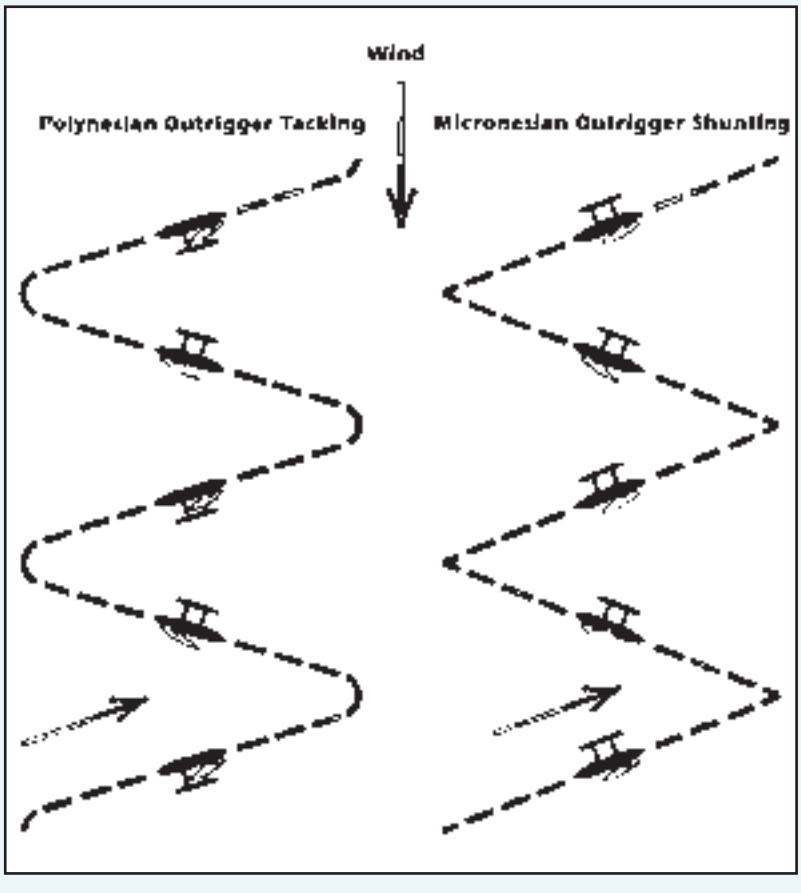


Shunting

Shunting involves moving the sail from one end of the canoe to the other. This means that the front of the canoe becomes now the back, and the back becomes the front. For this reason, shunting canoes are 'double ended' with the bow and the stern having the same design. After shunting, the canoe can now sail its zigzag path. With shunting it is very important to make sure that the outrigger is always on the opposite side to the sail. In this way the canoe keeps its balance and doesn't roll over, or capsize.

Shunting is more difficult than tacking, and it can only really be used in areas where the winds are steady and predictable. Ocean-going canoes from these countries usually change direction into the wind by shunting.

Figure 9: Shunting graphic



Source: Howe K. R. (2006). p.124

What is meant by ‘balance’?

We have used this word balance many times, but what does it mean? Making sure that the boat is well balanced is a very important part of sailing a canoe. When something is balanced, it is stable and steady and it does not fall or roll over easily or unexpectedly. This is very important for a canoe at sea, otherwise it could capsize and the crew be put in danger.

What is meant by ‘force’?

A force is a source of power or energy. The wind and ocean currents are forces that will try to move the canoe in the same direction that they are moving. If the force becomes too strong, or it begins to move the canoe in the wrong direction, the crew will have to change the position of the sails or use the steering oar to keep the canoe under control and upright in the water.

When a force is applied to any object it may, depending on the direction of the force:

- Move
- Stop
- Speed up
- Slow down
- Change direction

All Pacific canoes are designed to balance the forces of wind and water.

The hull, outrigger (also known as the balancing float) and the sail together form a triangle which, with knowledge and skill, can be kept well balanced, even in very strong winds and very rough seas.

The outrigger balances the effect of the force of the wind on the sail and the hull. Without it, a single-hulled canoe with a sail would easily tip over. The outrigger rides over the top of the waves and not under them. If the outrigger were underwater, it would act as a brake and slow the canoe down.

The crew always makes sure that they are on the opposite side of the canoe to the sail, so that their weight and position balance the force of the wind on the sail. They may also need to move objects around in the canoe to keep it balanced.

What is the main difference in the design and construction of Pacific canoes and Western sailing boats or ships?

The main difference between the design and construction of Pacific canoes and Western boats or ships is in how they balance the forces of the wind and ocean currents.

Western boats and ships use a keel, which is on the bottom of the ship, and ballast or weights deep in the hull, to keep the ship upright. The ballast used to be made up of rocks or sand or the goods that the ship was carrying. The keel and the ballast are below the water and work against the forces of the wind and the water to keep the boat stable and under the control of the crew. They may, however, also slow the boat down.

Figure 10: Balancing a boat or canoe

Pacific sailing canoes use an outrigger or a double hull to balance the forces of the wind and ocean currents (see Figure 10). The balancing weight is therefore above the water and to the side of the canoe. In this way the canoe works with the forces of the wind and water and it can move more quickly over the water.

The fastest boats in the world today are double-hulled catamarans. The design of these catamarans is based on Pacific double-hulled canoes.

Learning activities

1. Can you find out the name in your language for 'master canoe builders'?
2. Who are the master canoe builders in your country?
3. Are there trees in your country that have wood that is hard enough to make the main hull or hulls of a large canoe? What is the name of the tree? Where does it grow?
4. How would you explain the difference between tacking and shunting to someone who had never heard of these words?
5. Name four things that might happen to a canoe if it is unbalanced.
6. If the forces of the wind and ocean currents on a canoe are equal and opposite, they will cancel each other out and have no effect on its movement.

   Complete these sentences:

   - If the canoe is stationary, it will ……..
   - If the canoe is moving, the direction and speed will …….
7. To understand how a sail works, try a simple experiment with a spoon under a running tap. Hold the spoon lightly by the handle and move the back of the spoon slowly towards the running water. You would expect that the spoon would be pushed away by the water, but instead it is sucked into the flow of the water.

The same thing happens when air flows around a sail. The air traveling around the outside of the sail moves faster than the air on the inside of the sail. This produces a difference in pressure on the two sides of the sail that sucks the sail to the outside and pushes the canoe forward.

STRAND C:

Becoming a navigator and navigation

The skills of the navigator are part of our Pacific Island heritage. In many areas, (navigators) enjoy greater prestige than the local village chiefs. They were men of rare, unusual and impressive talent and skills. It is to be hoped that they are not lost to future generations.

Resture, J., The Art of the Navigators
www.janeresture.com/navigators/index.htm

What is indigenous navigation?

The exploration and settlement of Oceania and its Pacific Islands, an area that covers one third of the surface of the Earth, was probably one of the greatest human exploits of all time. Hundreds of years before European explorers dared venture away from the coastline, the ancestors of today's Pacific Island peoples had sailed across vast ocean expanses to occupy almost every habitable island in the Pacific.

For a long time there was disagreement about whether this huge area was settled by accident; by people who did not really know where they were going and who sailed where the wind and ocean took them. Or whether the voyages were guided by navigators with great knowledge and skills, who knew where they were going and how to get back. We now know that the latter was the case (see Strand A for more information on the origins of Pacific Island peoples).

European navigators used mechanical instruments such as the compass and sextant. They made mathematical calculations about latitude and longitude to work out their position and they also had maps or charts to guide them. Modern ships and boats also use complicated electronic equipment, such as global positioning devices (GPS), with links to satellites to know where they are at sea and how to find their destinations.

Traditional Pacific navigators, or wayfinders, had none of these tools and yet were able to find their way from island to island with remarkable accuracy.

What must navigators be able to do?

All navigators must be able to do three things:

1. Know in which direction their destination lies.
2. Know where they are at sea and make any corrections needed to stay on the correct course to the destination.
3. Arrive at their destination.

Traditional Pacific navigators used careful observation of natural signs and their memory to do these things.

These natural signs include:

- The stars. Indigenous navigators know how to use star compasses and remember the names and positions of over 200 stars.
- Ocean swells and ocean currents, and their interactions with winds, islands and reefs. Indigenous navigators know how to read the surface of the ocean and find sea paths to islands hundreds of kilometres away.
- The winds, especially the trade winds, but also other winds that almost always come from the same direction.
- The sun.
- The colour, position and movement of clouds over islands.
- The position of reefs and sea marks often many kilometres away from land.
- Birds as a sign that land is near.
- Other sea life such as whales, sharks and dolphins that are always found in the same area, or migrating along the same path.
- Light from organisms in the sea – also known as deep phosphorescence.

In studying and learning about these and other methods of indigenous navigation, we will see how navigators use each of them at different times and stages of a voyage to guide the direction of the canoe.

Becoming a navigator

First we need to know something about how young children are trained to become navigators. Navigation is not easy to learn. The knowledge and skills needed to be a navigator take many years of training, hard work and practice on land and at sea.

Often, the knowledge and skills are passed down from parent to child, and kept secret from other members of the community. The knowledge and skills are *mana* and highly prized, and seen as being magical and mysterious. It is a source of high status and rank for the families who have these abilities. There is also very close association between this sacred knowledge and the world of the spirits. Often activities associated with navigation and seafaring require important rituals to be carried out.

Although the training to be a navigator may differ from country to country, it is always very demanding and not everyone who starts is successful in becoming a navigator.

For example in the Caroline Islands, as in other countries in the Pacific, every child grows up knowing something about travelling by canoe. Even if they are not going to become navigators, most children learn from an early age about how to use a canoe, how the canoe feels at sea, how the wind and waves change the course of the canoe and the signs around them, such as birds, which tell them the direction of land.

But formal teaching for those few children who are destined to become navigators on Satawal begins on land, meaning that a very large amount of information has to be taught and memorised. The information about the positions of stars and the directions of winds and waves is very detailed and of life-and-death importance. In the canoe house, senior navigators and their 'students' sit and talk about navigation. Using pebbles and shells arranged in patterns on the ground, they go over the positions of the stars and wave patterns until the students know it by heart. This can take many years of hard work.

To help trainee navigators remember everything they need to know about the direction of islands, navigators in the Caroline Islands have developed practice exercises to learn sailing directions.

'Island Looking'

This is one of the most important of these exercises. It involves navigators and their pupils repeating many times where islands are located in relation to one another. First one of the pupils takes one island and goes around the star compass naming the islands that lie in each direction from that island. Then another pupil will do the same starting with another island. Often in the evening in the boathouse, the older men will turn it into a game and test the younger men and each other. Once the names of all the islands have been memorised, the pupil will learn about reefs and seamarks that lie in a particular direction from each island.

In this way the young navigators learn about the 'sea paths' between islands.

Aruruwow

Another example from Satawal in the Caroline Islands is a learning exercise known as *aruruwow*. It involves imagining a parrotfish (*ura*) hiding in a reef hole in the channel (*wow*) of an island. A fisherman tries to catch it with a small net, but it jumps out of its hole and swims to the reef channel of the next island. The fisherman tries again to catch it, but the same thing happens and it swims away to the next island. Eventually it returns to where it started. The sequence of reef channels represents the star paths between the islands. The names of the islands are never given so the navigators protect their knowledge and keep the star paths secret.

Special ceremonies and initiations

In some countries, young men are only confirmed as navigators after a formal initiation and training. In Satawal, and other parts of the Caroline Islands, this is known as the *pwo* ceremony. Christian missionaries forbade the *pwo* ceremony for many decades but it is beginning to come back.

The *pwo* ceremony is a very spiritual ceremony. The young men taking part are covered in oil and turmeric, and they must live in the canoe house away from female members of their communities.

The *pwo* ceremony itself lasts for about four days, and includes singing, feasting and dancing and the presentation of valuable mats, known as *tur*, by the family of a trainee navigator.

After the initiation is completed, new navigators must then take a canoe on a voyage and return safely to their home island. Once this is done successfully, they are declared navigators (*palu*).

The role of women and girls in navigation

Although it is true that most navigators were, and still are, men, women and girls have always been involved in navigation and seafaring.

Satawalese navigator Mau Piailug tells a story about the first navigators:

> *Women were the first navigators, and Pulap was the first navigator island. It started with a kuling bird (sandpiper), which was a ghost and not just a bird. The kuling flew from the Marshall Islands to Pohnpei, Chuuk, and Pulap and ate everyone along the way... but not the people of Pulap.*

The kuling said to the chief's daughter, "If you feed me enough, I won't eat the people here." The girl told her father this, and he said, "Take her a piece of wot *(taro) and a coconut." The girl did, and the kuling ate until she was really full. Then she said, "Tell your father to build me a house so I can teach you to be a navigator."*

Every evening, the girl learned from the kuling. She learned more and more. Then one day, the father said to the girl, "I know the story of the kuling… and do you know how we will kill her? Tell the kuling not to leave yet – we are going to give her something."

The chief told the women of Pulap to get many baskets of wot *and the men to get many coconuts. They loaded everything onto the kuling bird. The kuling took off and flew between Chuuk and Pafang, but then she fell down and changed into an octopus. Every navigator always protects himself from this octopus by using* pwanur *(a mystical practice that navigators use to protect themselves from danger).*

Lewis (1994) suggests that it has been women, whether ashore or on board a canoe, who 'held the ocean in their keeping, sharing a common affinity with the moon and with fruitfulness… [It] is [not] an accident that in the origin myths of the Carolines, navigation was the gift of women.'

The changing roles of men and women in voyaging and navigation illustrate the dynamic nature of culture. *Makali'i* captain Chadd Paishon of the Big Island, Hawaii, observed in 1999: 'Right now Micronesians are on the verge of either changing over everything to Western society, or trying to figure out the balance, the best of both worlds. We tell them not to rush too quickly. If they can hold onto their values and culture, that will enable them to have a strong healthy place for their future.'

Paishon notes that some Micronesians have been shocked by contemporary aspects of wayfaring: 'Traditionally women don't go on canoes,' Paishon said. Yet in contemporary times in some parts of the Pacific, women do play an active role in voyaging. The seafaring *waka*, *Hokule'a*, for example has a busy schedule that reflects renewed interest by men and women in Polynesian culture, in Hawaii and in other parts of Polynesia. New navigators and sailors, both men and women, are learning the traditional skills and are keen to test their knowledge on the open sea.

The influential role of women in indigenous navigation has been largely ignored in the literature. We need to know more of the story about women and Pacific voyaging. What was and is the role of women in indigenous navigation?

Navigation skills in Kiribati – a woman's perspective

By Maria Louise Robertson & Claire Anterea Kaitaake

In Kiribati very few accounts of navigation exist. Navigation is a powerful skill that is veiled in mystery and secrecy and therefore not easily shared with non-family members. Even if navigation skills do not appear in much of the literature about Kiribati, it still plays a pivotal role in the cultural heritage of this Pacific country.

Teueroa is a woman navigator from Kiribati. She lives on the main island Tarawa, but hails from the outer island Maiana where she was born and raised, and where she learned the navigation skills from her father. When she was just 7 years old, her father began teaching her. She started by learning to name the stars, just simple constellations. For another 7 years, her father taught her several times a week, and once she reached the age of 14 she was working alongside her father in predicting weather patterns and sailing conditions for the days to come.

Teueroa distinguishes between technical skills and magical skills. Technical skills are related to predicting sailing conditions and wayfinding, whereas magical skills relate to shaping the sailing conditions using weather magic. Instruction in navigation has traditionally been carried out in communal meetinghouses (*te maneaba*) where the roof of the meetinghouse represented the night sky. Young navigators would sit by the central pole facing east and look up. The various rafters and poles divide the sky into sections and the stars could be imagined in the thatch of the roof. Students would first learn the stars in one section and where the stars are for each season, and then in the next sections. Navigators may have to remember the names and positions of more than 100 stars and their star paths. Stories about gods or heroes help the students to remember. Once sailing in the ocean, navigators refer to the sky as 'the roof of voyaging' (Grimble 1931:197–198).

Teueroa's father was a renowned navigator, as Teueroa herself is today. During the time of British colonialism, for safety reasons, islanders were not allowed to travel between islands. However, the former Resident Commissioner, in recognition of his skills, gave Teueroa's father a license to travel. When Teueroa was 14 years old, she travelled with him on the local canoe between Tarawa and Maiana where the ocean is deep and dark. He asked her to pick up something and when she leaned over he pushed her into the sea and sailed away. Teueroa still remembers this experience vividly. She cried in the ocean and called her mother while she watched the canoe sail away and disappear. She cannot remember how long she was in the ocean for, but eventually her father returned. He pulled her back on to the

Teueroa

Source: Maria Louise Bønnelykke Robertson

canoe and demanded that she use the skills he had taught her to identify their island of destination. Today, Teueroa understands that this was a test for her to overcome her fear of the ocean, and a reminder from her father that even skilled navigators can lose their bearings in the island world.

Today, Teueroa is aging and suffering from arthritis, like so many other women who have lived arduous lives on the islands. But throughout her life she has used the skills not only for wayfinding on the oceans, but also for agricultural purposes. When she knows the sun will be strong, she tells her family to harvest coconuts for copra production. The strong sun will ensure that the meat will dry quickly. But most importantly, she is from time to time called upon for assistance when people are lost at sea. In 2009 a ferry capsized on its way from Tarawa to Maiana, Teueroa's home island. The government patrol boat and the New Zealand air force joined forces in trying to find any survivors. Teueroa was also asked to be the captain of a boat that would bring home the bodies of the deceased or, better yet, find survivors. She remembers that the government patrol boat went west, but she guided her boat east. Once sailing east she found the current and gave orders for the boat to float. By using her skills and knowledge she was able to find several victims from the capsized ferry that could be brought home to their relatives.

Many people, especially on the main island of Tarawa, believe that navigation is a dying skill in Kiribati. The general opinion is that the young generation wants to live in urban areas. Even if some will eventually make a living on the ocean as seamen or fishermen, they think that traditional skills are not relevant to them anymore. The world and island life is changing quickly. Teueroa may be part of the last generation to devote her entire life to the skills of navigation.

Navigating

Starting out on a voyage

The success of a voyage always depends on how well prepared the canoe and its crew are for their journey. An important part of any voyage takes place long before the canoe goes out to sea. These preparations for the voyage will help to ensure that the canoe and everyone on board arrives safely at their destination.

Navigators have the most responsibility and must think very carefully and plan the course for the canoe. They must decide which star and sea path to follow, and go over it many times in their heads to make sure that they remember it and know it very well. They will not have any charts and maps on board to remind them. They must also have an alternative course in mind, just in case the canoe gets taken many kilometres off course by strong winds and currents

The canoe must be well prepared for the voyage and be in very good working order. It is very important to check it thoroughly and to take spare parts such as wood, sennit (rope or cordage) and pandanus so that repairs can be made, at sea or on land, and that there is breadfruit sap on board to repair small leaks. Careful thought also has to be given to where to store these things, so that they will not take up too much space or unbalance the canoe. Often, they are tied to the sides, so that if the canoe tips over, or capsizes, they are not lost.

Food. The journey may take many weeks, or even months, so there must be enough food for all of the crew and any animals to survive the voyage. Depending on what is found on the island of origin of a canoe crew, the food to be taken may be:

- breadfruit, taro and pandanus which are cooked, dried, grated
- ripe coconuts for eating and young green ones for drinking
- fish which is cooked or dried
- sugar cane

Additionally, food must be prepared that will serve as gifts for the islands visited, such as for the Yapese during the old sawei voyages (for more information on these traditional voyages, see Strand D, page 48).

Food for voyages is prepared year around. On Satawal, women prepare taro throughout the year, for example by cooking it in earth ovens or over open fires at home. Breadfruit is prepared when it is in season and then preserved in the ground for subsequent use on voyages.

To keep the food dry and clean, it is wrapped in leaves.

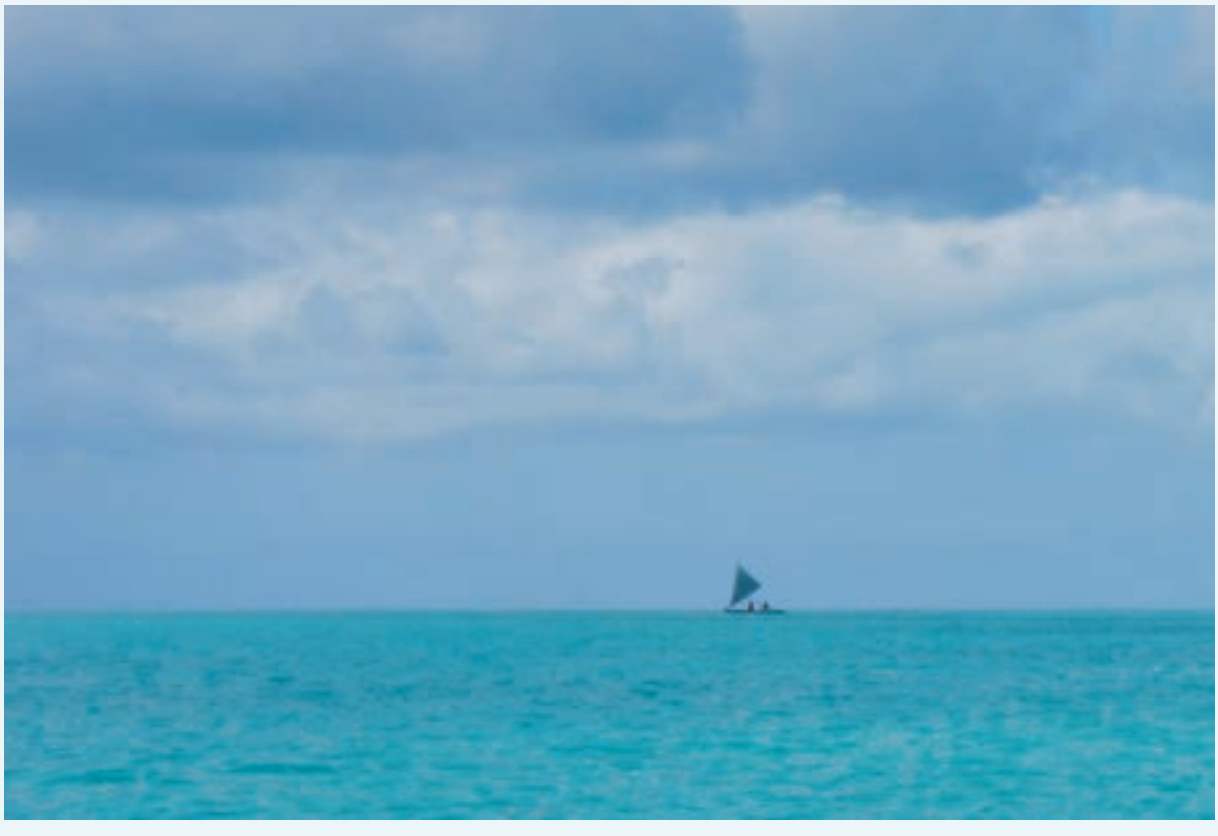
During the voyage, the canoe crew also collects rainwater for drinking and catches birds and fish. They sometimes cook them on fires of coconut husks inside wooden bowls lined with sand and small stones.

When to go. One of the most important decisions is the time of year and the time of day that the canoe will actually leave. This may take some time to work out and be changed many times, often delaying the start of the voyage by weeks. But the successful and safe arrival at the destination will depend on getting this right.

So, it is up to navigators to decide on:

The right season for the voyage. Navigators must have detailed knowledge of the seasons and the different phases of the moon. Stars rise and fall at different places at different times of the year, so the star paths will also be different, and it is very important that the canoe is following the correct star path right at the beginning of the voyage.

The weather and wind conditions. It is very important to know which direction the wind is coming from and when it might change and when there may be a storm. Navigators also need to know the signs to look out for, such as cloud formations and ocean currents, that tell them that the wind direction is about to change.

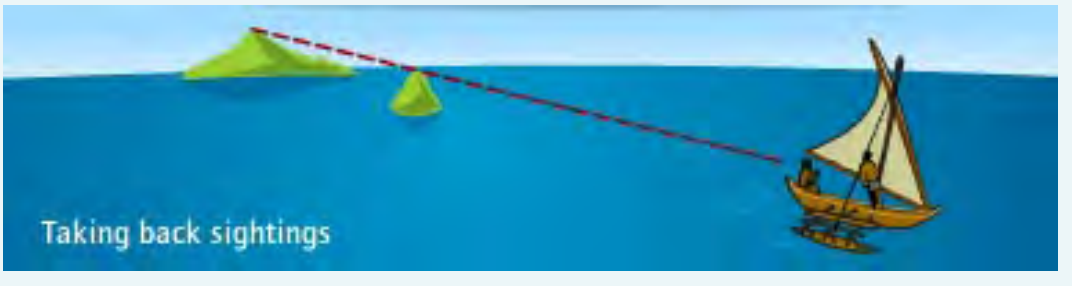


Source: Maria Louise Bønnelykke Robertson

The best time of day to set out. Often, navigators time the departure so that the canoe leaves at dusk in order to get a good sighting of the star path the canoe is to follow. Navigators also try to arrive at dawn or dusk, so that sea life such as birds can be used as a guide to the destination island.

Where to start out from. Often, the canoe leaves at dusk from the same place on the crew's home island. This means that for many kilometres out to sea navigators look back and use natural features such as mountains, or trees to make sure that the canoe is on the right course. This is known as back sighting. Sometimes the people in the village light fires so that navigators can check their course.

In addition to these navigational preparations, no voyage starts without first asking the spirits and the gods for protection and guidance. Often navigators and other members of the crew carry with them a charm or special object.


Taking back sightings

The stars

Once out to sea, navigators rely on other natural signs to continue in the direction planned for the voyage.

At night, the most important of these signs is the stars. Indigenous navigators' knowledge of the stars is so detailed that they can name over 200 of them, and even on cloudy nights when only a few of the stars can be seen, navigators are still able to follow the chosen star path.

Hawaiian navigator Nainoa Thompson of the Polynesian Voyaging Society explains how a star compass is used to find the star path and tell the direction of a canoe without instruments:

> *The star compass is the basic mental construct for navigation. We have Hawaiian names for the houses of the stars – the place where they come out of the ocean and go back into the ocean. If you can identify the stars as they rise and set, and if you have memorized where they rise and set, you can find your direction. The star compass also reads the flight path of birds and the direction of waves. It does everything. It is a mental construct to help you memorize what what you need to know to navigate.*
>
> On Wayfinding, Hawaiian Voyaging Traditions
> http://pvs.kcc.hawaii.edu

The star compass surrounds the canoe at sea, and is sometimes also known as the sidereal compass.

Stars rise at a particular point in the east and set at corresponding points in the west. As the earth turns, the star paths trace arcs in the night sky.

Experienced navigators need only one star to orient the whole star compass, and find the correct star path for the canoe to follow.

In Figure 10 there is an example of a traditional Carolinian star compass. It is divided into thirty-two points, and each point is marked by a star or constellation (a group of stars).

To steer a course, navigators point the front of the canoe towards the rising or setting point of the star which they know shows the way to their destination. For example, if they want to sail to an island to the east, they choose a point on the compass marked by the star that, at this time of the year, rises above, or nearly above the island they want to go to.

Figure 10: Carolinian star compass

The Carolinian navigators used pieces of coral to represent the 32 compass points, and bundles of coconut leaves to represent the 8 swell directions.

But remember, this star compass is not written down on a piece of paper or inside a metal object. It exists only in the memories and minds of navigators who know all of the changes to the star compass during the different seasons when the stars rise and fall at different times, and the different star paths for all of the different known islands.

But, when teaching children and youth how to use the star compass, the compass is made out of stones and shells and many hours are spent repeating and memorising the hundreds of star paths.

Here, Mau Piailug is teaching young boys on Satawal how to use the star compass.

Source: *The Last Navigator* © INCA 1989
Directed by Andre Singer

Zenith stars

Stars always rise in the east and set in the west. At some time in the night, each star will reach its highest point before it starts to go down. This high point is known as the zenith. When a star reaches its zenith, it may be directly above an island. If so, it is known as the zenith star for that island. Navigators learn the name of the zenith star for many islands, so, for example, if they see the star known as Hokule'a (Arcturus) and know that it has reached its highest point, navigators know that the Hawaiian Islands are underneath, and that if they aim for that star, they will find Hawaii.

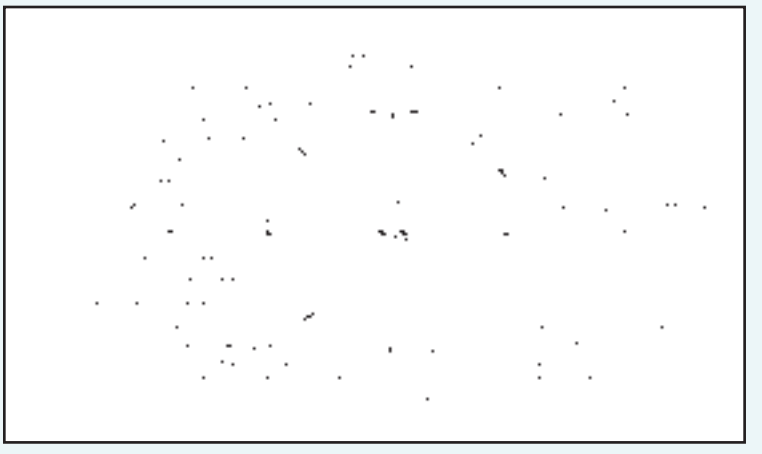
The sun

The sun rises in the east and sets in the west, but it can only be used for direction finding when it is low on the horizon during the early morning and late afternoon. At these times, navigators must carefully keep track of its changes in position and compare its position with the rising or setting stars of the destination island.

When the sun is high in the sky or when clouds cover the sky, day or night, navigators have to use winds and ocean currents to determine the direction of the canoe.

The wind

Figure 11: A wind compass



The wind often changes direction and sometimes it is not there at all, so it is not as predictable or reliable as the stars. But knowledge of the wind and in which direction it blows at different times of the year is important as a secondary indicator of the direction the canoe must sail in.

For example, in the south western Pacific, the trade winds blow from the southeast for most of the year. But during the cyclone season, from December to March, they come from

the west. In the old days, navigators in the South Pacific would wait for the west wind because they knew that this would make the canoe go faster and speed up their journey. They also knew that the trade winds would return after a few months and help them on their return journey.

In the Caroline Islands careful observations of wind directions over many generations have enabled Carolinian navigators to construct and memorise a wind compass. It is known as a wind compass because it divides the horizon into thirty-two points and relates wind direction to star positions.

Sea marks

Navigators also use sea marks which they learn through experience as well as through stories and songs.

One example of sea marks are reefs. The colour of the water above a reef is light green and thus different from the sea around it which is blue. Additionally, short and steep waves can be caused by currents hitting the reef. If the sea is calm, skilled navigators can see them from kilometres away. They can also feel them as the canoe moves over a reef.

Another example is sea life. Animals such as sharks or dolphins often appear at the same location. Some are well known and have been given special names by navigators.

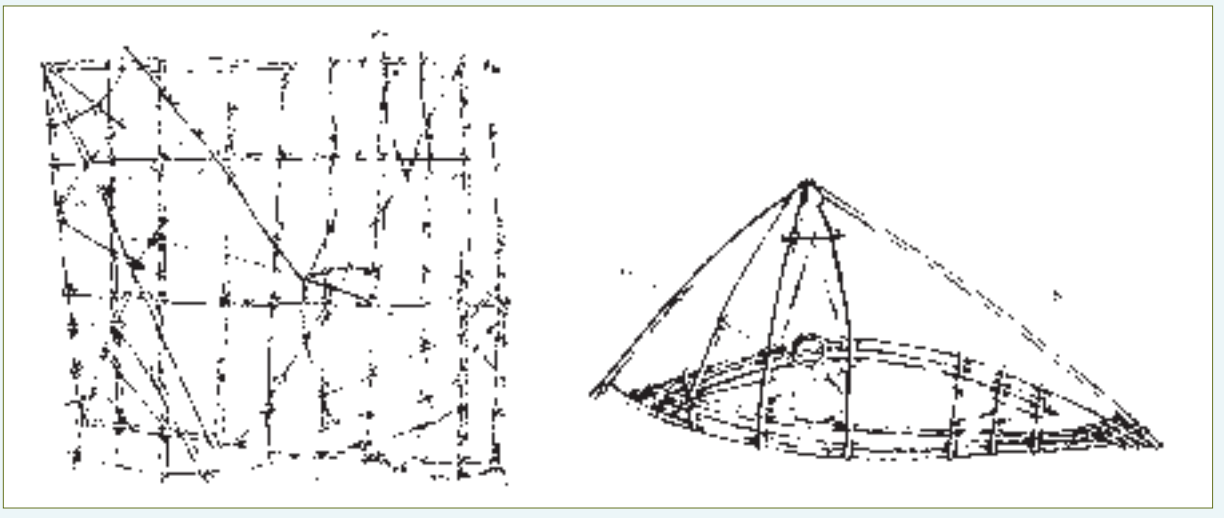
Navigators might prefer to take a longer way to an island in order to be able to use sea marks to guide them.

Ocean swells

Swells are waves that have been created by distant winds. The most reliable swells are those produced by the trade winds. The northeast trades press down on the surface of the sea and create the northeast swell, and the southeast trades create the southeast swell.

But being able to identify the right trade wind swell is very difficult, and swells may be hitting the canoe from many different directions at the same time. Navigators learn how to use the movement of the canoe to set a course and which type of swells show the direction of land. Over time, they observe and remember the wind and swell direction at different times of the year, and may construct stick charts to help them to learn and remember the swell patterns for important islands (see Figure 12).

Figure 12: Examples of stick charts



Source: Oliver p.410

Stick charts are made out of small thin sticks with shells to show the location of islands and large reefs. Other sticks on the inside of the frame bend in different directions to show the swells and currents. The places where the sticks meet show where there are strong currents and rough seas.

Navigators 'feel' the swells rather than observe or see them.

Sailing and navigating a canoe by using swells 'seems to be a matter more of feel than sight. Tevake told me he would sometimes lie down and wait patiently until (the swell) he wanted has become more noticeable' (David Lewis in *We the Navigators*). The most sensitive part of a man's body are his testicles, so at night or when the sky was obscured, they would help navigators 'feel' the ocean swells. (Best, cited in Strongman 2009).

The canoe on the ocean becomes an extension of a navigator's body, and from the knowledge of swell direction a navigator knows where land is located beyond the horizon.

Indigenous navigators in Oceania are skilled in 'feeling' the direction of swells and using them to work out the direction that their canoe needs to go in. They do not need eyesight to navigate. In fact, some indigenous navigators are blind.

Knowing and adjusting position

Ocean currents

The main ocean currents in the Pacific are the:

- North Equatorial Current, which lies north of the equator and flows from east to west
- Equatorial Counter Current, which flows along the equator from west to east
- South Equatorial Current, which lies south of the equator and flows from east to west

These are powerful forces and can make a canoe drift many kilometres off course. Navigators have to know where these and other smaller currents are encountered, and be able to move the sails, or tack or shunt the canoe, to stay on course.

A destination island may have many different star paths in order to take into account the effects of these currents. As with swells, navigators have to 'feel' which direction the currents are flowing and be able to make adjustments to the course.

Experienced navigators will also be able to read the direction and strength of a current by observing how the water moves in relation to the wind direction. The types of waves on the surface of the ocean can tell navigators much about the direction and strength of the wind and ocean currents.

Judging speed

The wind does not always blow at the same speed. That means that the speed of the canoe also changes. Navigators need to take this into account when estimating their position at sea and the distance to the destination island.

Pacific navigators use various indicators to judge speed. They watch the spray from the water on the canoe's sides. They also feel the wind on their face and watch how it affects the sails or things hanging from them.

Judging leeway

When sailing into the wind, a canoe is pushed forwards but also sideways by the wind. This sideways movement is called leeway. Leeway means that there is a difference between the course steered by a navigator and the course the boat actually travels (the course 'made good'). Pacific navigators judge leeway by looking at the angle between the centre of the canoe and the trail the canoe leaves on the water (the wake).

Dead reckoning

In the past, Western navigators used to keep track of their course with a magnetic compass. This way of tracking a boat's position, called dead reckoning, is quite different from the *etak* system that Carolinian navigators use (see below).

For dead reckoning, the distance that has been sailed was worked out by throwing an object overboard and measuring how fast it was left behind. Leeway and speed were also taken into account. Using all this information, navigators reckoned (estimated) how far and in what direction their boat had sailed over a certain time period. The boat's position was then marked on a navigation chart and course changes were made if necessary.

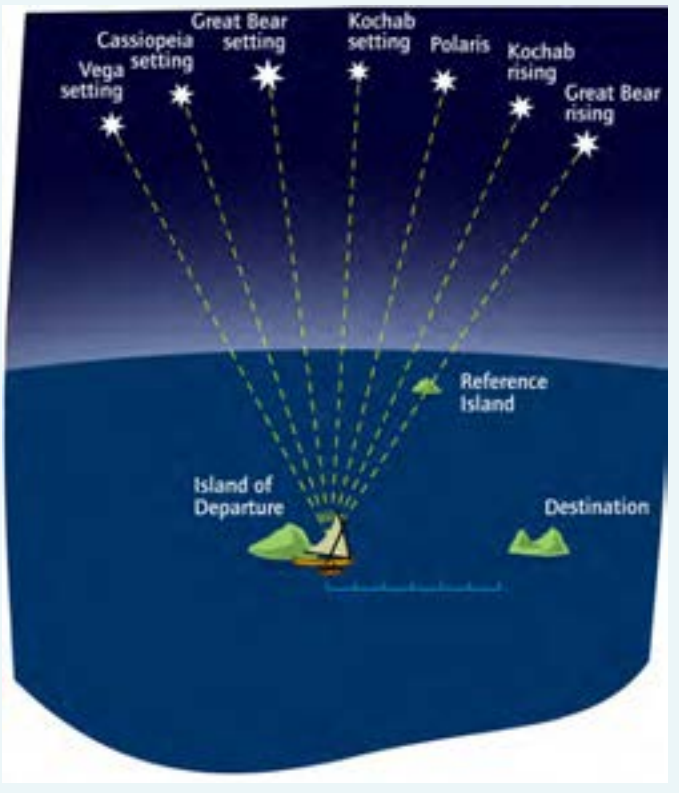
Today, the Global Positioning System (GPS) makes instrument navigation easier. It is a hand-held computer that automatically tells sailors their position by communicating with satellites.

The *etak* system

In the Caroline Islands, a method of using the stars to set a course and check position was developed that is very different from other parts of the Pacific.

In the *etak* system, navigators imagine that the canoe stays still and that the sky, ocean and islands are moving past the canoe. Navigators do not think in terms of the compass points of north, south, east and west.

Figure 13: The *etak* system



Navigators choose a star path closest to the destination island and divide the journey into stages, or *etaks*. They then imagine an unseen 'reference island' off to the side of the course to take. This may be a reef or some other seamark. Navigators never see the reference island, but always know where it is and which *etak* it is in and therefore which star it is under. By estimating the speed of the canoe they keep track of the movement of this reference island under the navigation stars. In their imagination the island appears to move backwards, and they think of it as moving, as if the canoe is stationery and the ocean is being pulled backwards from under it.

But knowledge of the stars is not enough. How do navigators know where the canoe is during the day? And, what if the sky is full of clouds for days at a time?

Fortunately, navigators know how to use many other signs from the natural world. During the day, and when it is cloudy, navigators use the sun, winds, ocean swells and currents.

Finding land

The stars, sun, wind and the ocean swells and currents will all enable navigators to plan a course, but as the canoe gets closer to its destination island navigators begin to look for other signs that land is near.

This is also sometimes known as 'expanding the target' or 'increasing the size of the destination island'.

Some of the destination islands are very small and may only be a few kilometres wide. Even a small change from the planned course may mean that in the thousands of kilometres of the Pacific Ocean it would be easy to sail past the destination island and miss it altogether. But there are other signs that can increase the size of the area around the island and make it more likely that it will be found.

One of the best ways to to do so is to use sea life.

Examples of sea life include birds, whales, fish and schools of dolphins which are always found in the same place or which have predictable migratory routes.

There is also a very strange and little understood phenomenon caused by organisms in the sea called 'deep phosphorescence'.

Sea life

One of the most important forms of sea life for navigators is birds.

At dawn, birds leave their home islands in search of food and they return at dusk, when the sun is setting. Sea birds can be found up to forty-five kilometres out at sea. All navigators have to do is to sail their canoe in the same direction as the birds are coming from or going to and they will find land.

Birds found in the Pacific that are used for navigating to land include boobies, terns and noddies.

In Pulawat, navigators have created sea life inventories that list the sea life that will be found in a particular location on the way to a destination island. For example, if you sail away from Pulawat on a particular star course you will find the following every few kilometres along the way:

Star Name	**Sea Life**
Altair	A whirlpool, a large shark and two sooty terns
Orion's Belt	Two skipjacks, a school of fish, two sooty terns
Corvus	A frigate bird, two porpoises, sea snails
Antares	A school of fish, a reef and dragonflies
Shaula	A large barracuda, two plovers
Southern Cross at rising	A white tailed tropic bird resting on the water, ten small plovers
Southern Cross upright	Manila Reef but no sea life because close to Pulawat

(From: T Gladwin, East is a Big Bird Harvard Press 1970)

Sea life knowledge is very precious, or *mana*, and was sometimes taught secretly and in the form of a code. Sighting something from a sea life inventory in bad weather could make the difference between life and death.

Interrupted swells

Interrupted swells are a very good source of information about where to find land, and they can be felt up to fifty kilometres away from land.

When a swell meets an island it may:

Stop and bounce off of it. This is known as a reflected swell

or

Bend around it. This is known as a diffracted swell.

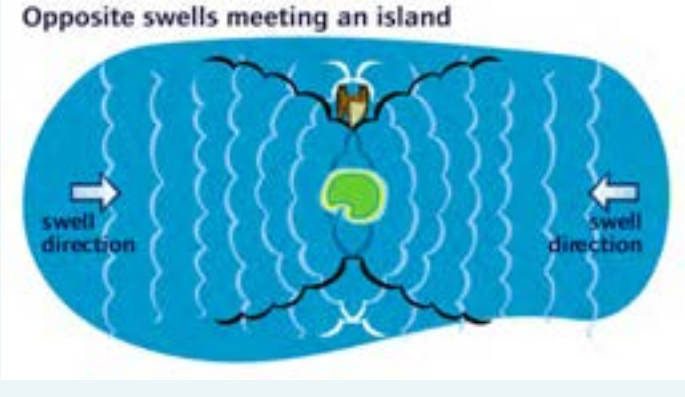
When one swell crosses with another, the ocean will become rough and choppy. This means that there is likely to be land nearby.

Sometimes, swells hit an island from more than one side. In this case, the rough or choppy sea will be to the side of the island. Navigators will know the difference between these types of swells, and all they have to do is to follow it like a road that will lead to the island.

The characteristics of interupted swells are shown in Figures 14 and 15.

Figure 14: Reflected and diffracted swells

Figure 15: Opposite swells



Deep phosphorescence

Deep phosphorescence are flashes of light, thought to be caused by very small sea creatures, but no one really knows for sure. The lights can be seen up to one metre below the surface of the ocean and up to one hundred and fifty kilometres out to sea. The closer the canoe gets to land the faster the flashes become.

Deep phosphorescence is known as *te lapa* in Santa Cruz in the Solomon Islands and *te mata* in Kiribati.

Clouds

Certain cloud formations can show the presence of land. Knowledge about which type of clouds show the presence of land underneath may be very important for making landfall during daylight.

Because the white sands of a coral atoll reflect more heat than the surrounding ocean, a small cloud is created almost directly over the island. This type of cloud will not move like other clouds, but sits over the island, so navigators learn that a cloud that is not moving usually means land. The first Maori settlers to arrive in New Zealand saw one of these clouds and named it Aotearoa, meaning 'The Land of the Long White Cloud'.

If the island has a lagoon, the bright blue/green colour is also reflected on the underside of the cloud and can be seen many kilometres away. Experienced navigators can see this reflection of the lagoon in the sky even if there are no clouds.

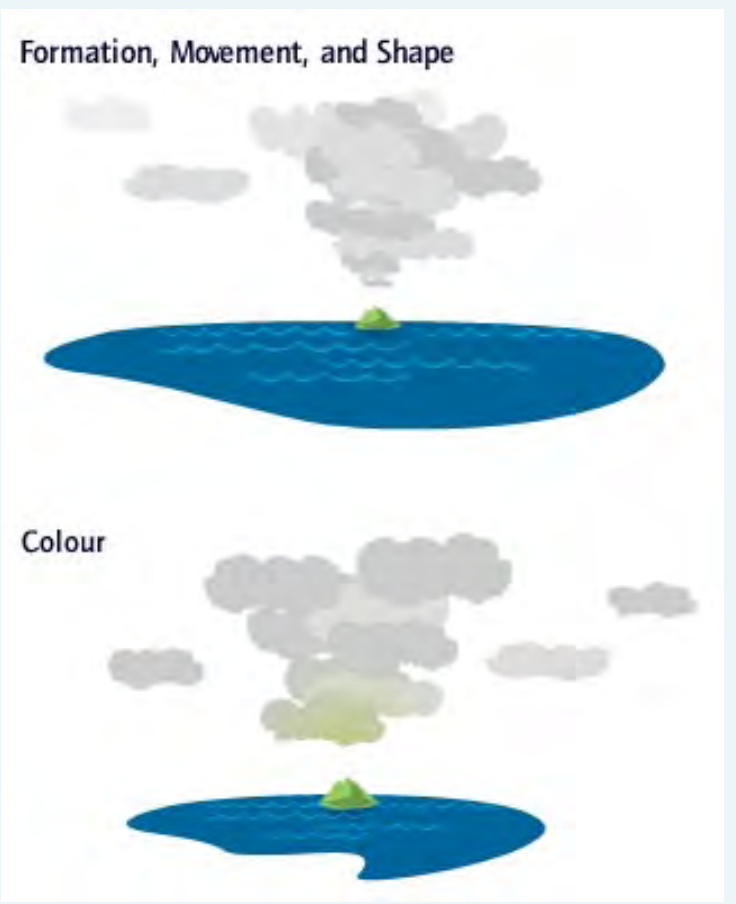


Figure 16: Using clouds to find land

Summary

Indigenous navigators use star paths and zenith stars to set the right course. In daylight, or if the skies are very cloudy, they check their course by using wind, ocean swell and ocean current direction. Then, when they begin to get close to their destination island, they rely on sea life, clouds and other sights and sounds such as:

- Volcanic smoke
- Reflections of lagoons in the sky
- Smells from the land of cooking and vegetation
- The sounds of waves crashing on the reef

Figure 17: Expanding the size of the destination island

Learning activities

1. Imagine that you are going to be a member of the crew on board a voyaging canoe, which will be going on a two-month voyage in about 6 months time.

   Make a list of all of the preparations that will have to be completed before the canoe can leave.
2. What are the three things that all navigators must be able to do?
3. Build a stick chart to show imaginary currents and islands.
4. Name and find pictures of the sea birds that live on your island.
5. What sort of sea life is found around your home island?
6. Explain what is meant by 'increasing the size of the destination island', to someone at home who has not studied indigenous navigation.

STRAND D: Voyages and revival

Traditional voyages

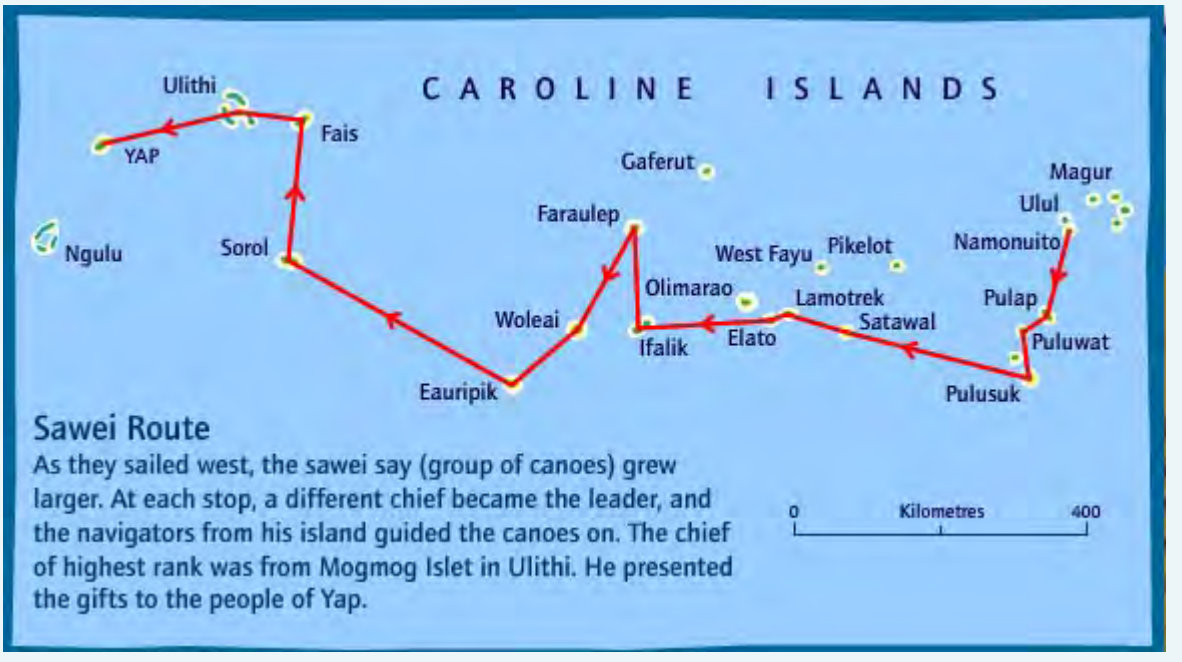
Traditionally, most voyages would have been to find new islands, or to trade or fight wars with people on other islands.

Sometimes, the voyage had a special cultural or religious significance, as in the *sawei* voyages between the small coral atolls of the Caroline Islands and Yap.

The people living in the remote Carolinian atolls believed that the Yapese people had power over the weather, and that if they did not take them gifts, their islands would be hit by bad storms. The gifts were taken in specially woven baskets called *sawei* baskets. But in return the Yapese also gave gifts of valuable items that the Carolinians did not have on their home islands.

The *sawei* voyages were stopped by the Germans in the early 1900s.

Figure 18: The *sawei* voyages



Modern voyages

The principles of wayfinding are simple; the practicalities are very complex.

Nainoa Thompson

'A vanishing art' is how traditional indigenous navigation has been described.

Lewis, D., 1994

In some parts of the Pacific, particularly Polynesia, indigenous navigation using observation of the stars, wind and ocean has already almost disappeared. It has survived in some part of Micronesia, particularly on Satawal in the Caroline Islands, where master navigator Mau Piailug was one of a small number of navigators who kept the knowledge and skills alive.

In 1973, Ben Finney and a group of Polynesian specialists and canoe enthusiasts formed the Polynesian Voyaging Society. They wanted to build a replica of a traditional Hawaiian voyaging canoe and, using only traditional navigational methods, sail it from Hawaii to Tahiti and back again. Because there were no Polynesian navigators left, Mau Piailug was asked to be the navigator.

The canoe was called the *Hokule'a*, after the zenith star for Hawaii, and it was launched in 1975. Other than notes and drawings by European seafarers and verbal information handed down by chants and legends, there was little to guide the construction of the canoe, and it was built mainly using modern materials. But the voyage was a great success. Throughout the journey, Mau kept the canoe on course. Even when many days of completely cloudy skies hid the stars, sun and moon, Mau was never more than 64 km (40 miles) from where he wanted to be. Throughout the voyage he held in his mind an accurate image of the canoe's journey to Tahiti. It was one of the most remarkable adventures of modern times. Since then, the *Hokule'a* and her sister canoe the *Hawai'iloa* have made many more successful voyages.

The revival of indigenous navigation in Polynesia has been continued by Hawaiian navigator Nainoa Thompson. Nainoa learnt about navigation on voyages aboard the *Hokule'a* with Mau Piailug, and he was the first modern day Polynesian to learn and use wayfinding for long distance, open-ocean voyaging.

The voyages of Mau Piailug and Nainoa Thompson have inspired many other Pacific countries to reconstruct their own voyaging canoes and sail them over historical sea routes. For many countries this has also led to a revival of interest in other aspects of traditional culture and a rediscovery of cultural identity and values.

Other voyages

Hawaii–Tahiti

1980

Hawaii to Tahiti and back: Nainoa Thompson, who was taught by Mau Piailug, navigated the *Hokule'a* and became the first Hawaiian in over 500 years to navigate a canoe using only traditional methods.

Voyage of rediscovery

1985–1987

The *Hokule'a* was taken on a 25,750 km (16,000 mile) voyage along the ancient migratory routes of the Polynesian triangle, from Hawaii to the Society Islands, the Cook Islands, New Zealand, Tonga and Samoa and then back home via Aititaki, Tahiti and Rangiroa in the Tuamotu Archipelago. This voyage showed that it was possible for Polynesian canoes to sail from west to east when the prevailing easterly trade winds were replaced by seasonal westerlies.

Hawaiki-Nui

1985

Many replica canoes are criticised for not being really traditional. For example, the *Hokule'a* was made from modern materials and other canoes have had outboard motors and even GPS. However, the *Hawaiki–Nui* is relatively traditional and was carved by Matahai Avauli Whakataka Brightwell out of totara wood and tied with sennit. The mast was made from bamboo and the sails from pandanus leaves. The only piece of modern equipment was a radio. In 1985, Matahai Avauli Whakataka Brightwell and Francis Cowan, a Tahitian navigator, sailed *Hawaiki-Nui* from Tahiti to Rarotonga and then on to New Zealand.

Te Aurere

1992

The voyages of the *Hokule'a* inspired Hekenukumai Busby from Northland, New Zealand, to build *Te Aurere*. The first voyage was to Rarotonga and once again the canoe was navigated by Mau Piailug. Not long after the start of the voyage, it ran into some very bad storms. The New Zealand Meteorological Service advised the canoe to change direction. Mau disagreed with this advice but the *Te Aurere* followed it and sailed into even worse weather. A few days later the same thing happened. This time the crew followed Mau's advice and they found calmer weather.

In 1995, the *Te Aurere* sailed from the Marquesas Islands to Hawaii, and then non-stop for thirty days to Rarotonga and on to New Zealand.

Te Au-O-Tonga

1995

Te Au-O-Tonga was built and navigated by Sir Thomas Davis of Rarotonga, and has made many voyages around and across the Pacific proving that it is possible to sail from West Polynesia as Maori ancestors may have done.

Na 'Ohana Holo Moana

'The Voyaging Family of the Vast Ocean'

1995

The Hawaiian voyaging canoes *Hokule'a*, *Hawai'iloa* and *Makali'i* sailed from Hawaii to the Marquesas and back via Tahiti and Ra'iatea. The Hawaiian fleet was also joined by the *Te Aurere* from New Zealand and the *Te Au O Tonga* from the Cook Islands.

Voyage to Rapa Nui (Easter Islands)

1999–2000

The *Hokule'a* completed its exploration of the Polynesian Triangle.

Hokule'a

2004/2007

The twenty-nine-year-old canoe went on a voyage of the Northwestern Hawaiian islands following a route believed to be similar to the one used by Polynesian voyagers hundreds of years ago.

On 19 January 2007, *Hokule'a* left Hawaii with the voyaging canoe *Alingano Maisu* on a voyage to Micronesia and Japan. The voyage was expected to take five months. On 9 June 2007, *Hokule'a* arrived in Japan.

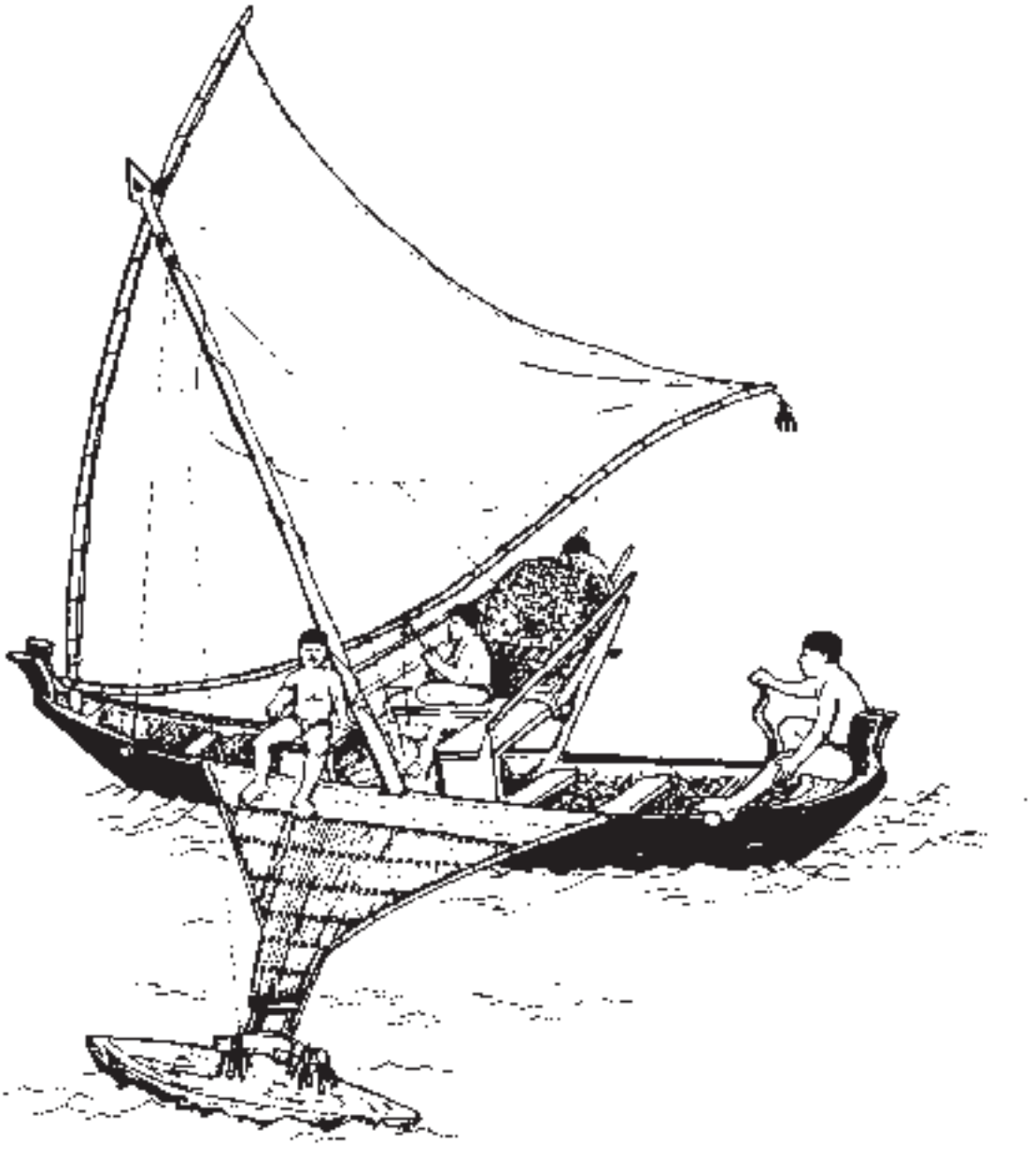
Matahai Avauli Whakataka Brightwell captures the spirit of the revival when he says:

> *I would sit beside the Hawaikinui, next to my father's tipuna photograph, my mind, spirit embraced in the beauty of our canoe – the hull adze cut, the family-tree sculpture, the scent of the wood, the fibre rope lashings. I searched the Maori horizon for a solution to ancestral landlessness, the lack of culture and language, the poor health and unemployment of my tribe.*
>
> (Source: Nelson, A. (1991). *Maori Canoes, Nga waka Maori*. Auckland: Macmillan)

Learning activities

1. Are there any cultural and/or religious voyages in your country's history? If they have died out, find out why.
2. Research in detail one modern voyage and write it up as a newspaper article with at least one photograph.
3. In groups of 4, plan and prepare a short oral presentation for your classmates about traditional beliefs and seafaring and their place in modern life.

   Invite staff and students from other classes, members of your family and the community to attend and listen to your presentations.



Source: Oliver, D. L. (1989). p.385

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