

Shorebirds of Pūkoro Miranda

Learning about the amazing shorebirds
that spend time on
Tikapa Moana/the Firth of Thames

A resource for Primary School Teachers



Pūkorokoro Miranda Naturalists' Trust

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A letter to the students of New Zealand

Dear students, Tena koutou katoa

The flight of the kuaka (godwits) emphasises the importance of connections. Their journey from New Zealand, to China, Alaska and back again can only be made by joining distant lands into a single system. It's such a big story and yet we can see it happening just by going down to the coast with a set of binoculars or a telescope.

Sitting quietly on the shoreline at Pūkorokoro Miranda in the evening, watching the tide come in, the sun dropping behind the flocks of birds as they get closer and closer never fails to bring me a sense of connection with other people and other places.

My name is Gillian and I am chairperson of the Pūkorokoro Miranda Naturalists' Trust. We run the Shorebird Centre, an information and education centre located near the biggest shorebird roost on the shores of Tikapa Moana/the Firth of Thames.

Godwits from Alaska, knots from Siberia, wrybills, stilts and oystercatchers from the braided rivers of the South Island, and lots of other birds from around New Zealand and the world, all converge from the 8,500ha of mudflats to just a few roost sites at high tide. That's when you can come, hoping to see more than 10,000 birds in the one place. Over the year more than 25,000 birds will pass through, with different species at different times, creating a scene that's ever changing and always new.

But it's not necessarily safe. The high numbers of birds sound great, especially to New Zealanders used to hearing numbers like just

five black robins, 80 kakapo, 40 fairy terns or 150 Chatham Island taiko, but the dependence on this network of sites means species like the godwit are hard to conserve. Habitat loss is a real issue, with nearly all of the shorebird species that migrate to New Zealand showing declines over the last 25 years as mudflats in Asia are reclaimed for human use.

But it's not all doom and gloom. Members of the trust travel from New Zealand to Asia, Alaska and around the world to study and help preserve shorebirds and their habitats. And because of this work the site that most of our godwits use in China is still (mostly) a safe space for them. We are working in partnership with Ngāti Pāoa (who are the tangata whenua of this area) and other people and organisations here in New Zealand and around the world to make sure that the shorebirds are protected, but we need everyone to help.

We are keen for young people like you, to learn about shorebirds and visit the area to see and hear the shorebirds. We need young scientists willing to study the birds and their habitats and to talk to other people about the issues they face and the ways that we can work together to ensure that the birds are always part of this special place.

I hope you will come and visit and enjoy this very special place and the shorebirds that it supports.



Kind regards

Gillian Vaughan

Chair, Pūkorokoro Miranda Naturalists' Trust

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Where is the Shorebird Centre?





Godwit photo by Mandy Hague.

Introduction

At Pūkoro Mirānda on Tikapa Moana/the Firth of Thames an amazing story of ecological magnificence unfolds. The bar-tailed godwit and wrybill join other shorebird species to feed from the intertidal flats. A world without this diverse life is incomprehensible and yet with concerning international and land management choices we are faced with this possibility. Fortunately, local actions can also positively influence these ecological trends.

Through the learning context of shorebirds, students will have the opportunity to explore a local and internationally significant ecosystem. By exploring the migratory behaviour of these two iconic Pūkoro Mirānda shorebirds students will learn about habitat needs and the impact of humans on these fragile places.

Students will be encouraged to consider the issues facing the birds and their habitats and what our roles and responsibilities are for ensuring that godwits and wrybill continue to frequent the shores of Pūkoro Mirānda and that future generations of New Zealanders will enjoy the sight and sound of these special creatures.



Wrybill photo by Ian Southey.

Purpose

The purpose of this resource is to support primary school teachers to:

- Plan a learning programme that builds knowledge and understanding of shorebirds and their habitats.
- Engage students in learning about two key bird species (the bar-tailed godwit and wrybill) and their many adaptations for migration and feeding.
- Help students build knowledge and skills in order to be able to identify key shorebird species.
- Support students towards understanding the threats that these and other shorebirds face.
- Plan and deliver (with the support of Pūkoro Mirānda Shorebird Centre personnel and resources) a fun, stimulating and rewarding experience at the Shorebird Centre and Robert Findlay Wildlife Reserve and surrounds.
- Empower students to participate in decision-making and action towards shorebird protection.

Resource framework

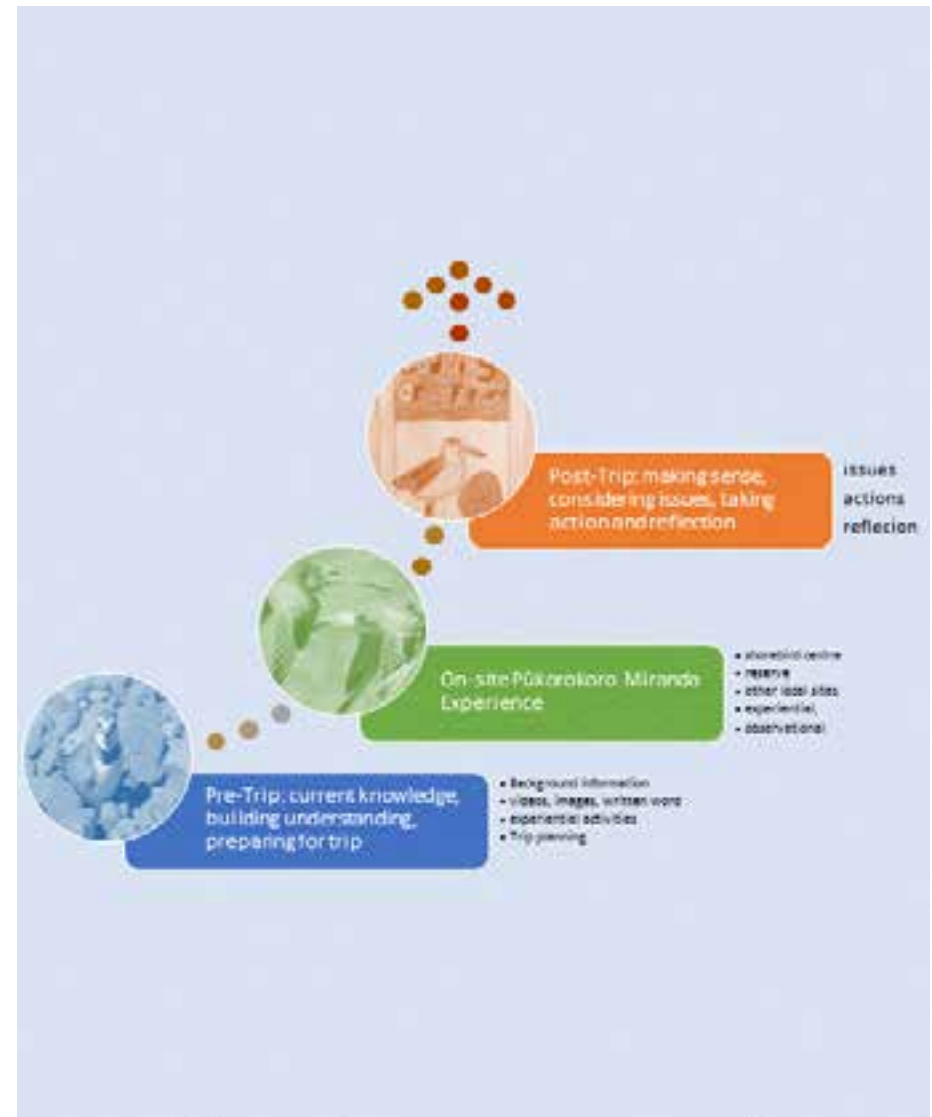
This resource provides material and activities to engage students in pre-trip integrated enquiry learning, gives options and insights into the on-site Pūkoro Miranda experience and supports teachers and students to consider this back at school in order that they co-construct an ecological and or social action, based on their developing knowledge of shorebirds and their plight.

The “poster birds” of the Pūkoro Miranda Naturalists’ Trust, the bar-tailed godwit or kuaka and the wrybill or ngutuparore, are the focus for the learning resource. Through these intriguing species there will be a connection built with the complex nature of shorebird migration and the ecosystems they rely on for breeding and survival.

This is not considered a finite process but one that will continue as the students reflect on their actions and consider how else they could engage in learning in, about and for their natural world.

A learning context of shorebirds and their habitats offers students and teachers:

- An approach which takes into account global and local influences on our shorebirds;
- An emphasis on the future, the dynamic nature of the shore and the capacity to choose and shape preferred futures;
- An opportunity to explore themes such as biodiversity, interdependence, change;
- A focus on cooperative learning, decision-making and action, and shared responsibility;
- An emphasis on critical thinking and communication;
- An opportunity to take action for the environment that helps ensure these birds continue to be part of the future.





As this scene from the Bioblitz at Pūkoro Mirānda illustrates, shore life is fascinating to students of all ages. Photo by Annette Taylor.

Key Concepts

- **Everything is inter-connected:** The bar-tailed godwit and wrybill are part of fragile and complex ecosystems. Changes in any of the links within and between these ecosystems will have a flow-on effect.
- **Species adapt to the environment:** Bar-tailed godwit and wrybill have particular features and adaptations that allow them to migrate to and thrive in different habitats.
- **Global citizenship and shared responsibility:** There are natural, social, economic and political links that influence people and the natural environment including the shore-birds. We can all participate in taking responsibility for and have a positive influence on our land and water.
- **Biodiversity loss is a choice:** We can choose through our actions to safeguard habitats around the world and in particular be involved locally.

The Pedagogy

The Pūkoro Mirānda Shorebird Teaching Resource draws on the pedagogy of Action competence (see toolbox reference) and action based enquiry learning. Action competence can be built through learning about ecosystems and relevant environmental issues in order that we can plan, and take informed action on them.

It is critical that as part of this competence building young people have the opportunity to develop an interest, awareness and sensitivity to the spectacular place that Pūkoro Mirānda is. Teachers can provide experiences that include learning in the environment and about the environment in ways that motivate and stimulate passion for further investigations and action. Through visits (the outdoor experiences in, about and for the Pūkoro Mirānda environment) students will be able to make connections with the place, the people and the ecosystem. Children can then make decisions about further action and learning through involvement. “Students require a range of

learning experiences to understand and develop attitudes and values towards the environment and sustainability issues”. <http://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability>

This resource helps guide learning prior to visiting the shorebird centre and reserve, supports preparation for the visit, gives ideas for activities during the visit and then suggests ways to reflect and put into action new knowledge and understanding post trip. Giving students time to reflect helps establish further connections to prior learning and engagement in next steps learning.

This focus will engage students with the world they live in and develop the ability to take meaningful, relevant action for a sustainable future.

There are a range of options for building knowledge: experiential activities mixed with quality online resources, video and podcast options and books as well as the outdoor experiences.



LEOTC Delivery

The Pūkoro Mirānda Naturalists' Trust has personnel available and resources (when pre-arranged) to help with the on-site delivery of the programme.

To maximise the value of this learning context the teacher will pre-load knowledge of the place and the birds (guided by this resource) and co-construct the outcomes for the day with students. The classroom teacher has an active role on the day of the experience to make connections with the classroom learning (through prompts and positive reinforcement) and the Pūkoro Mirānda learning. The teacher will also set expectations prior to and on the day of key competencies such as managing self, participating and contributing and thinking and remind students of the care code they have agreed upon.

Parent helpers are essential for safe and meaningful learning outside the classroom and can make a difference by being engaged in facilitating discussion and asking open ended questions of the students to encourage wider consideration. See appendix for a parent helper guide.



The Curriculum

Key Competencies and Values

This learning context provides multiple opportunities for development of the five key competencies and the values of The New Zealand Curriculum when explored, modelled and encouraged. In particular the competencies of self management and relating to others can be developed through ways including comparing students own behaviour to the birds' adoptions, feeding behaviour, abilities and resilience during migration. Your own school values can be reinforced through articulating these within this context discussing the need to be respectful and sensitive to the environment and to consider and take responsibility for special places.

Science

Nature of Science: Students will extend their existing knowledge of shorebirds and their habitats through research, exploration and outdoor experiences.

They will build their language and understanding of the ways that the natural world of shorebirds can be explained and represented. They will develop their own questions leading to investigations and possible explanations using resources including experts at Pūkoro Mirānda Naturalists' Trust.

Students will make the connections with their learning about the shorebirds and the issues they face, and take appropriate local action. This context allows opportunities to learn about the living world:

Level 1-2

Life processes: students will recognise that shorebirds have certain requirements to stay alive.

Ecology: shorebirds are suited to particular habitats. They will recognise that the wrybill and the bar-tailed godwit have particular features that help them live in these habitats. They will learn that these birds migrate to other places at particular times of the year.

Evolution: students will recognise that birds can be grouped depending on particular features.

Level 3-4

Life processes: students will learn that the bar-tailed godwit and wrybill have complicated life processes that involve migration.

Ecology: students will be able to explain the reasons the bar-tailed godwits and the wrybill have adapted to their habitats and how they respond to changes in seasons.

They will be able to consider both natural and human-induced environmental changes and the impact these may have on these birds

and their habitats.

Evolution: students will understand that plants and animals are able to be placed in scientific groups. They will understand the difference between indigenous, endemic and introduced. They will know that adaptation is an evolutionary process that means the birds are suited to their habitats.

Social sciences (L2-3)

Through learning about Pūkoro Mirānda and the partnerships with local, national and international groups and organisations students will understand that people have different roles and responsibilities and can work together towards a common goal. They will understand how places influence people and people influence places and that people view and use places differently.

Technology (L3-4)

Through the three strands of technology students will have an opportunity to develop an understanding of how equipment (such as binoculars, scopes, banding and tracking devices) function. They will be able to consider how these technologies have contributed to knowledge about bird behaviour including migration and how these devices are designed for a purpose. They may also want to consider the ethics of these techniques.

Because this is an integrated learning context many other aspects of the curriculum can be woven into it, including English, Maths and statistics.

Valuable supporting resources

Sifting through a wealth of literature and resources on line can be time consuming. We would like to direct you to some key resources that will provide quality relevant information. Refer to the Toolbox in the appendix for further resources.

<http://www.miranda-shorebird.org.nz/shorebirds-at-miranda>

Pūkoro Mirānda website: The “go to” place for back-ground information and also on-site learning experience booking information, tides and the current bird sightings.

<https://www.facebook.com/MirandaShorebirdCentre>

Pūkoro Mirānda facebook page for updates and news posts, great photos and a dialogue of interesting events.

The science learning hub is full of useful resources that support this learning context. <http://sciencelearn.org.nz/Contexts/Flight>

The online encyclopaedia of New Zealand is a wealth of information including on shorebirds and their habitats.

<http://www.teara.govt.nz/en/birds-of-sea-and-shore>

<http://www.teara.govt.nz/en/estuaries>

<http://www.teara.govt.nz/en/bird-migration/page-1>

<http://sciencelearn.org.nz/Science-Stories/Conserving-Native-Birds>

<http://nzbirdsonline.org.nz/> is a website maintained by Te Papa, the National Museum, with great information and photographs about all our native birds

There is also an excellent Shorebird Migration Education Kit put out by the Department of Conservation in 2002:

<http://www.doc.govt.nz/get-involved/training-and-teaching/teaching-resources/field-trips/auckland/miranda-wildlife-refuge/teaching-resources/miranda-shorebird-teaching-resource/>

The Shorebird Centre magazine, *Pūkoro Mirānda News*, carries a range of articles and photos about the birds and the issues they face.

Woodley, Keith. 2012 *Shorebirds of New Zealand; sharing the margins* Raupo Penguin 272 pages.

Woodley, Keith. 2009 *Godwits, Long-haul champions* Penguin. 240 pages

Hunt, Janet. 2009. *E3 Call home* Random House, 40 pages. A beautifully written children’s book that could be used to hook students into the topic.





The Learning Guide

Background information

The Place

The southern and south-western coast and intertidal zone of Tikapa Moana/the Firth of Thames is recognised as an internationally important wetland under the Ramsar Convention. The Firth's 8,500 hectares of inter-tidal flats support some 25,000 birds, with 43 wader or shorebird species recorded, most of which are migratory.

At Pūkoro Mirānda (shown in the aerial photo at left) there is one of the best examples of an active shell chenier plain anywhere in the world. A chenier is a beach ridge of material such as shell or gravel formed by currents and tides. A few hundred metres in front of the Shorebird Centre, the most recent ridge forms the present coastline. To the south it becomes a spit which, at high tide, is usually covered with roosting shorebirds.

Other important habitats present include coastal wetlands, river mouths, mudflats, shell banks, and sand bars.

The presence of so many shells is an indicator of just why those birds are here. The intertidal flats are rich in benthic fauna - ideal shorebird food. This habitat is where bar-tailed godwits, wrybill and fellow shorebirds can forage for bivalves, gastropods, crustaceans and polychaete worms. Once the incoming tide covers the flats, the birds flock to good roost sites on the adjacent shell banks. These spectacular high tide roosts offer excellent viewing to visitors and are easily accessible from the Shorebird Centre.

The estuarine waters and the subtidal zone beyond provide food and protection for a variety of resident and visiting fish species.



A good working relationship exists between Ngāti Pāoa, represented here by Wharekawa Marae chair Tipa Compain and iwi treaty negotiator Morehu Wilson, and the Pūkoro Mirānda Naturalists' Trust, represented by chair Gillian Vaughan and manager Keith Woodley. Photo by Jim Eagles.

The People

Ngāti Pāoa, the local iwi, say that Pūkoro is locally translated as "the long throated purse net", which describes the entrance to Pūkoro Stream and the regular fishing that occurred in the area. The combination of forest, streams and sheltered coastal waters provided a rich supply of food, water and shelter and other resources allowing these people to live in balance with nature.

Kuaka (bar-tailed godwits) were part of the yearly natural calendar that guided their life. They knew that at certain times of the year they left Aotearoa ("Kua kite te kohanga kuaka?" "Who has seen the nest of the kuaka?") But because no one had seen the eggs or nests it was reasoned that they came from Hawaiki their spiritual wellspring. They looked forward to and celebrated their return that would herald

spring and warmer times. <http://www.hekuaka.co.nz/the-kuaka-project/lessons-from-the-kuaka>

The Marutuahu confederation now represents descendants of this ancestor and other iwi from here and continues to advocate the protection, preservation and enhancement of the natural habitats of this area. Pūkoro-ro continues to be of cultural and ecological significance to them.

Local iwi now have a vision which they are working towards for a healthy and sustainable future where waterways in rural and urban areas have been restored to their indigenous state and the land and sea have once again become abundant food baskets. (see details of the plan towards this in “Whaia te Mahere Taiao a Hauraki – Hauraki Iwi Environmental Plan”).

A Maori perspective of the environment can be developed as part of this learning context. The resources on <http://eng.mataurangamaori.tki.org.nz/Support-materials/Te-Reo-Maori/Maori-Myths-Legends-and-Contemporary-Stories> are a place to start. You might like to invite people from your local hapu to join in school events and build a relationship with them. Often local purakau/ history/ stories are shared verbally and therefore a relationship needs to be built with the people that hold this knowledge.

The Name

In mid-1863 the Crown sent HMS Miranda as part of a naval blockade to suppress rebel forces. It shelled the peaceful and well-populated Ngāti Pāoa village of Pūkoro-ro and a number of Ngāti Pāoa people were killed. Crown forces later constructed a redoubt which was named Miranda after the ship. This name was

subsequently used for the surrounding area. However in 2015 it was officially recommended by the New Zealand Geographic Board, at the request of Ngāti Pāoa, that the area be known as Pūkoro-ro Miranda.

Pūkoro-ro Miranda Naturalists’ Trust story

Pūkoro-ro Miranda is one of the most accessible sites in New Zealand where people can readily see huge flocks of shorebirds. A group of people who knew that, and wanted to make it easy for people to visit while also protecting the birds and their habitats, formed the Pūkoro-ro Miranda Naturalists’ Trust in 1975. This community group operates the Pūkoro-ro Miranda Shorebird Centre which employs one full time manager, one part time assistant and otherwise relies on dedicated volunteers. 2015 saw the Trust celebrate its 40th anniversary with a series of events called Year of the Godwit.

Robert Findlay

Just south of the Shorebird Centre is the Robert Findlay Wildlife Reserve where the trust has two bird hides from which to observe the birds. Robert Findlay was one of the original Pakeha landowners in the district, arriving in the late 1860s, and his descendants farmed the land and allowed it to be used by naturalists.

Partnerships

Partnerships are a key theme for Pūkoro-ro Miranda Naturalists’ Trust. The Trust has always worked closely with Department of Conservation staff and the local community. The Trust also works with



The Chinese Ambassador to New Zealand, Wang Lutong, and the director-general of DoC, Lou Sanson, enjoy a joke during an official visit to Pūkoro Miranda.
Photo by Jim Eagles.

local iwi Ngāti Pāoa and Ngāti Whanaunga.

The Trust's increasing knowledge about the migration of godwits and other birds, shows the importance of working together to protect them with other countries in the flyway. PMNT has a partnership with the Yalu Jiang National Nature Reserve in China, the place where

most godwits from New Zealand stop to refuel during their northward migrations to Alaska. The Trust has longstanding links with scientists studying migratory birds in Siberia and Alaska. It also has a partnership with conservation officials in North Korea which is another important stopover area for migratory birds.



Above: The Upper Rakaia River is habitat for wrybill. Below left: Adult kaki. Right: Wrybill. Photos by Emily Sancha and Keith Woodley.



Other Places

Braided rivers of South Island, New Zealand

Braided rivers are a distinctive feature of the eastern South Island, especially in Marlborough and Canterbury. They are characterised by wide shingle beds, numerous snaking channels and highly variable water flows.

New Zealand's braided rivers are home to a diversity of unique plant and animal species. The broad expanses of gravel may look barren, but they harbour a rich tapestry of low-growing plants especially adapted to growing in a flood-prone environment, amongst shifting gravels, extreme temperatures and limited nutrients.

During spring and summer, at least 26 species of water birds (some threatened or critically endangered) feed or nest on braided rivers. The kaki/black stilt is perhaps the most well-known of these as well as one of the rarest waders in the world.

Another species that is highly specialised to this dynamic habitat is the wrybill/ngutuparore, the only bird in the world with a bill curved to the side. Wrybill are very important to people at Pūkoro-ro Miranda because that is where nearly half the population migrates to after breeding.

Other riverbed species are black-fronted tern/tara, the black-billed gull (which also breeds on the Pūkoro-ro Miranda shell spit) and the endangered robust grasshopper.

Native fish such as the alpine, Canterbury and upland long-jaw galaxids also favour the braided rivers of Canterbury and North Otago.

(Adapted from sources including DoC Braided Rivers pamphlet).

Yalu Jiang, China

The Yalu Jiang National Nature Reserve in the Dandong Region of China along the shores of the Yellow Sea is the single most important stopover site for shorebirds on the East Asian-Australasian Flyway. The mudflats along the 60 km long reserve, near the border with

North Korea, support hundreds of thousands of birds during their annual migrations to Arctic breeding grounds. At least 70% of all godwits from New Zealand stop there each year during northward migration. Like much of the coastline around the Yellow Sea, this area has been highly modified by marine farming and industrial development.



Bar-tailed godwits and fishermen in China.

Photo by Phil Battley.



Top: A well-camouflaged godwit on her nest in the Alaskan tundra. Bottom: Arctic foxes are among the threats to nesting birds.

Photos by Keith Woodley, and Jan Van De Kam.

Alaskan tundra

For much of the year the climate in Alaska is hostile, often severe with temperatures below -30°C . The ground is covered in snow for up to eight months and much of that time with little light.

With the spring melt however, comes an abundance of water, daylight and comparatively mild temperatures. This allows an explosion of life with plentiful plant and insect life providing sufficient food for the godwits to breed and raise their young.

Tundra describes a zone where low temperatures and short growing seasons limit tree growth. The word “tundra” usually refers only to areas of permafrost where the subsoil is permanently frozen.

Tundra vegetation is composed of dwarf shrubs, sedges and grasses, mosses, and lichens.

Over the two months of the brief Arctic summer this open landscape is full of insect life which means abundant food for nesting shorebirds and their chicks.

<https://vimeo.com/28239601> provides an amazing snapshot of the situation in the Alaska, the challenges of migratory bird conservation and the science that is helping. Shared conservation responsibility is a key concept.



Shorebird flocks at Pūkoro Miranda.

Photo by Keith Woodley.

The Birds

Shorebirds, also known as waders, gather in intertidal areas or on the fringes of freshwater wetlands. They generally have long legs in relation to their body size, no webbing on their feet and they don't swim very well. The shape and size of their bill gives a clue to their preferred diet and habitat.

Nationally, the Firth of Thames is ranked as one of New Zealand's most important areas for shorebirds. The wetland annually hosts about 25,000 birds of at least 43 species.

Some birds breed on the Miranda coast, including three species endemic to New Zealand (the New Zealand dotterel, the variable oystercatcher and the black-billed gull). White-faced heron, banded rail, bittern and other non-migratory coastal wetland inhabitants are also found there, as well as numerous species of seabirds such as terns, gulls, gannets, shags and petrels. PMNT has a longterm goal of habitat restoration to allow the return of fernbirds to this area.

Migration

The complexities of migration are not all understood however scientists are slowly unravelling some of the fascinating facts about it, what triggers it and what influences departures and arrivals or the flyway taken. We know that it is related to the axial tilt of the Earth – something that influences the seasons and the reasons for long haul migration (such as that which the godwit undertakes).

Birds migrate to move from areas of low or decreasing resources to areas of high or increasing resources. The two primary resources being sought are food and nesting locations.

Our godwits return north for the Arctic spring to take advantage of burgeoning insect populations, budding plants and an abundance of nesting locations. As winter approaches, and the availability of



Bar-tailed godwits in flight.

Photo by Phil Battley.

insects and other food resources drops, the birds move south again. Escaping the cold is a motivating factor but many species can withstand freezing temperatures as long as an adequate supply of food is available.

The mechanisms initiating migratory behaviour vary and are not always completely understood. Migration can be triggered by a combination of changes in day length, lower temperatures, changes in food supplies, and genetic predisposition.

Migrating birds can cover thousands of kilometres in their annual travels. Between leaving New Zealand in March and returning in September, the godwits are known to fly at least 30,000 km, while the tiny wrybill may fly from the South Island to Pūkoro Mirānda in one flight of 1000km. Birds often travel the same course year after year with little deviation (depending on weather).

The timing and response of migration are in large part genetically controlled. In contrast, the ability of migratory birds to navigate

and orientate themselves during migration is a much more complex phenomenon that may include both endogenous (internal) programs as well as learned behaviour.

Birds appear to navigate using a variety of techniques, including navigation by the stars, sensing changes in the earth's magnetic field, and even smell and possibly processes involving spectrums of light, electron excitation, and constant recalibrations!

Migration is often concentrated along well-established routes known as flyways, which are shaped by geographical, ecological, and even meteorological factors. These flyways are a series of linked habitats - breeding sites, wintering sites and refuelling sites during migration - that give birds the resources they need throughout their annual cycle. All are essential: to lose even one of the three would threaten a bird's survival.

(Adapted from various sources including a Cornell University website article on migratory birds.

Vegetation and plant species

The shore and salt marsh plants although not a focus of this resource are an integral part of this ecosystem. They help filter nutrients, help water retention and create habitat for numerous birds, invertebrates and other organisms.

The decay of vegetation releases nutrients that are a critical component of the food web. They range from the mangrove (see a reference in the Toolbox to an article in Pūkoro Mirānda News) through to shrubs such as *Plagianthus divaricatus* (which plays host to a rare, parasitic native mistletoe) to *Coprosma propinqua* (also a major host to the parasitic plant is on the grounds of the Shorebird Centre) and from small herbs (including the pretty *Mimulus repens* and *Selliera radicans*) to glasswort, rushes and sedges. Each has their own special features allowing them to inhabit what can be a quite harsh (wet, salty) environment.

Some of the plants are introduced and many of these are considered weed species, including the likes of silver beet which is periodically removed from shell banks and around the hides.

Terminology

A range of terms useful in the study of shorebirds are used through this resource. Definitions are given in the glossary in the appendix. Students' own definitions and understanding of these terms will develop with use in context.



Strips of glasswort and sea blite at Pūkoro. Photo by Ray Buckmaster.

The Stories

Bar-tailed godwit/kuaka – long-distance migrant

Godwits are long-legged waders with very long bills. For most of the time they are in New Zealand their upperparts are pale brown with dark streaks, while underneath they are very pale. Their long slightly upturned bills are pale pink at the base and become black towards the end. Female godwits are much larger than males and have longer bills.

Each year bar-tailed godwits, the most common Arctic wader at Pūkoro Mirānda, make enormous migrations involving a 30,000 km round trip between New Zealand and their breeding grounds in Alaska. During these epic journeys they make only one stopover on the way north (in the Yellow Sea region of China and Korea). Coming south from Alaska to New Zealand they cross the Pacific in one non-stop flight of up to 12,000km.

How do they make these enormous journeys? Let us follow some godwits during their annual cycle. We shall begin at Pūkoro Mirānda in September when the first godwits begin arriving back in New Zealand.

An adult godwit arriving at Pūkoro-koro Miranda is very tired and thirsty. Since leaving Alaska about 8 days ago it will not have eaten, drank or slept – nor will its feet have touched the ground. Having a drink and then sleeping are the first priorities; the bird may not eat for some hours after landing. Within days of arriving the bird needs to start preparing for its next migration north. But wait a minute that



will not be until March, 6 months away! Yes it will take all that time to get ready.

First the bird needs to replace all its flight feathers – the large feathers on the wing that do a lot of work when the bird is flying. The old feathers get worn and faded from use and other causes such as exposure to sunlight, and are not as efficient as new ones. It will take a bird over 100 days to fully replace all those feathers. This is called moulting. It takes a lot of energy to grow those feathers so the bird needs to find plenty of food during its moult.

Then the bird starts to replace all of its other feathers. This is called body moult. And this is when something rather amazing occurs, because the birds – especially the males – will start to change colour. Both males and females develop a mixture of dark and light patterned feathers on their backs, and the males turn orange on their face, neck and belly. This is called breeding plumage. There are two main functions of this plumage:

- It makes the birds perfectly camouflaged when sitting on a nest
- It helps males attract a mate

The next stage in the bird's preparations begins a few weeks before it departs. It needs to get fat, very fat. In fact, the bird doubles its weight. Of course, to do this the bird needs to eat a lot and its stomach expands so it can do this quickly and efficiently. But as the bird gets fatter, its leg muscles thicken up so it won't fall over! And then to get all that extra weight into the air, its flight muscles also become stronger.

By early March our godwit is ready: it has brand new flight feathers, it has put on its breeding plumage and it is fat and restless. All the godwits do not go at the same time; some will not leave until the end of March.

They usually leave in small flocks of 20-30 birds, although they can also go in groups of just three to four or in much larger flocks.



Above: Comparing male and female bill length.
Below: Godwits taking off.

Photo by Jim Eagles.
Photo by Phil Battley.





STAMINA: Bar-tailed godwit.

Photo by Glenda Rees.

Although the majority will leave, some, mainly immature birds will stay behind. Godwits do not breed until they are three to four years old, so the juveniles and teenagers stay behind in New Zealand.

Godwits are like cyclists: they prefer a tail wind or a side wind to head winds, and will try and time their departures for suitable conditions.

However, each bird has its own schedule and will leave New Zealand within the same 3-4 day period in March, year after year. If you are flying 10,000 kilometres through different weather zones, sometimes you just have to battle through whatever weather you encounter. Most birds seem to be successful and arrive at their destination safely.

While they are in New Zealand and during their stopover in East Asia, godwits are very social, forming huge flocks at high tide roosts. But when they get to Alaska they become quite solitary, spreading out in pairs over the vast tundra: At a roost site in New Zealand there may be 10,000 birds packed in together– on the tundra there may be only one pair in two square kilometres.

Wrybill/ngutuparore – inter-island migrant



Wrybills are small, pale plovers that migrate within New Zealand. The underparts of this endearing bird are white, with a black upper breast band from mid-winter to the end of the breeding season. The upper parts and sides of the face are pale grey, and the forehead white. The bill is long and black, and is curved $12-26^\circ$ to the right.

Pūkoro Mirānda is the best site in the world to see large flocks of wrybill. Endemic to New Zealand, their sideways turned bill is unique among birds. They breed only on braided river beds in the central eastern South Island before migrating to northern New Zealand.

The population is estimated to be around 5300 birds, over 40% of which spend their non-breeding season at Pūkoro Mirānda.

The ngutuparore/wrybill has adapted to feeding on braided rivers in the Canterbury region by being the only bird in the world to have a bill which curves to the side. The curve allows wrybills to more easily catch insects on the underside of river stones.

This threatened shorebird species spends winter on the North Island where it feeds in flocks in estuaries and mud flats. After 8 months in the north it then flies back to the South Island.

When on the South Island rivers the wrybill mostly feeds on mayfly and other aquatic insects (the larvae and the adults stages). These larvae are negatively phototactic, which means they hide from the light, so underneath a rock under the water should be a perfectly safe place for them. Except if a wrybill comes along. Scooping under stones with its unique bill gives it an advantage over other species in this habitat.



When it travels north to Pūkoro Mirānda you might see it scooping through the bio-film on top of the mudflat, or looking in the mud for small bivalves and univalves.

Wrybill are perfectly adapted to their nesting habitat. Imagine you are trying to find a bird on a nest in the middle of a huge gravel island in the Rakaia River. Unless the bird moves you will not see it because it is coloured exactly the same as the stones. Its eggs and its chicks are also the grey colour of the stones.

Wrybills nest in the middle of large open areas where they can see danger long before it approaches. The rivers where they nest can flood at any time, which means they often lose their nests. But the floods also provide a good service by keeping the riverbeds clear and preventing weeds from getting established. One of the reasons weeds are bad is because they provide cover for predators such as stoats or cats.

OPPOSITE PAGE, clockwise from top left: Wrybill foraging, photo by Ian Southey. Wrybill chick, photo by John Dowding. Wrybill chick in the hand, photo by Keith Woodley. Female wrybill on the nest, photo by John Dowding.

The issues

Shorebird Centre manager Keith Woodley says, 'Research by scientists at the University of Queensland has documented dramatic declines in many shorebird populations in the Asia-Pacific region. The most common Arctic-breeding species occurring in New Zealand, the bar-tailed godwit is showing a gradual but steady decline. The main cause of these declines is habitat loss at migration re-fuelling sites in East Asia.'

'To make their marathon migration flights between wintering sites in Australasia and breeding grounds in the Arctic, birds need to stop and refuel along the way. Many species may only require one stop, but that stop is essential if they are to complete their migration and breed successfully. However those vital stopover sites are rapidly disappearing before a tide of human development.'

The shallow estuarine waters of **Pūkoro Mirānda on Tikapa Moana/ the Firth of Thames** are important feeding and breeding areas for migratory birds. In spring, godwits, knots and other migrating birds start arriving from as far away as Siberia and Alaska. In autumn, these birds fly north, and at the same time, native birds such as the wrybill have arrived from other parts of New Zealand. This is an internationally significant wetland ecosystem and yet land management practices threaten this sensitive place.

Much of the Hauraki Plains (which is linked to the Firth of Thames through the Waihou and Piako Rivers) has been cleared of the natural vegetation, drained and developed for farming. Sediment, carried in freshwater and run off from land, has been identified as a major issue and threat to the health of the Firth. When sediment settles on the bottom of coastal environments it can smother marine life (such as the

small shellfish and worms the shorebirds feed on) and increase mud in the habitats (which can change the conditions and therefore the species that thrive there (eg increase in mangroves).

New Zealand's braided rivers are incredibly productive ecosystems. Teeming with insects, braided rivers provide great feeding and breeding opportunities for native birds such as the wrybill.

However, weeds such as willows, lupin, broom and gorse often limit available nesting spots and provide cover for predators. Nationwide, it's estimated that over 60 per cent of potential riverbed nesting sites have been destroyed because of weed encroachment (made worse by the demand for water from people).

The estuary at the **Yalu Jiang National Nature Reserve in China** (in the Dandong Region along the shores of the Yellow Sea) is the single most important site on the East Asian-Australasian Flyway. Migratory shorebirds use the area to re-fuel (rest, feed and preen) en-route to their breeding grounds. This makes this Nature Reserve and adjacent Yalu River a key link in the annual life cycle of our godwits.

It is, however, situated next to a rapidly growing industrial part of China. PMNT is working alongside people from Yalu Jiang National Nature Reserve of China to protect the habitat and ensure the birds have a stable future. Already this land is significantly modified, with a sea wall, villages and towns and aquaculture ponds on areas that used to be mudflats.

Experts are now saying that **global warming** is a factor at both ends of the East Asian-Australasian flyway.

A recent study has looked at winners and losers in the Arctic. The bar-tailed godwit is amongst the losers as its breeding habitat becomes increasingly shrubby (and therefore not suitable for nesting and producing quality godwit food). Changes to wind patterns associated with Global Climate Change may also affect godwit migration strategies.

At home in Pūkoro Miranda the mudflat-mangrove sea meadow progression is likely to be moved shoreward with sea level rise with a possible loss of valuable intertidal mudflats that are so important for the shorebird habitat. The fact that most of the shoreline has been hardened by roads and stop-banks creates a coastal squeeze.

In order to share spaces with nature we need to take responsibility for our actions so that we don't compromise natural systems while living and learning within and around them. Our attitudes will influence the future of godwits and wrybills.



Bird-watchers in China use a newly reclaimed area as a platform to observe the flocks of migratory birds which now have to share the foreshore with a growing port.
Photo by Xiao-Yang Liu.

Ecosystems

Mapping

The salt marsh, intertidal mudflats and chenier shell banks are extremely fragile and sensitive areas. This means that people access is restricted to those who are managing and researching these areas and plants and animals that inhabit these places.

To get an idea of what these special places are like, use a satellite image of Tikapa Moana/Firth of Thames and Pūkoro Mirānda. Work out distances between your school and the Pūkoro Mirānda Shorebird Centre. Look for the hides, the chenier shell banks, Stilt Ponds and the inter-tidal flats. There is a trail with interpretation panels from the Shorebird Centre to the Robert Findlay Reserve carpark.

Now using a large world map (internet or hard) look at the places that our birds migrate to (the Arctic for the godwits and South Island braided rivers for the wrybill). Think about and discuss the distances that the birds travel.

Ecosystems

Note for teachers: An ecosystem is a community of living organisms (biotic - such as birds, plants, bugs) in conjunction with the non-living components (abiotic) of their environment (things like air, water and mineral soil), interacting as a system. People are part of ecosystems.

Complicated natural systems exist within the inter-tidal zones of Pūkoro Mirānda. Everything is connected and so influences other elements. There are no limits on how large or small a space or an area can be to host an ecosystem so we could look at the ecosystem within one part of the Pūkoro Mirānda site (such as the Stilt Ponds or

we could look at the entire flyway that the godwits take as part of an international ecosystem.

International ecosystem

The ecosystem concept can be simplified by carrying out an experiential activity that gives the students a “role” within the ecosystem.

Use the estuaries food web from the Encyclopaedia of NZ and create cards for each entity. <http://www.teara.govt.nz/en/diagram/4620/estuary-food-web>

Use wool or string to link the elements and animals, inviting each student “food web character” to introduce themselves (who are they?). Think about how each character is connected and pass the wool between to signify this. <http://www.teara.govt.nz/en/interactive/4623/vegetation-profile>

Reflection: What happens if one “character” from your web is removed? What could cause that?

Now consider the epic journeys that these migratory shorebirds take and how, by doing so, they connect ecosystems across great distances – in the case of the godwit, an international ecosystem. What might cause the links to break?

The Pūkoro-koro Miranda Experience

Pre trip

Below is a range of suggested activities designed to gauge prior knowledge and build on this so that everyone will be able to enjoy the trip to Pūkoro-koro Miranda. These activities will support an integrated inquiry towards an outdoor experience and action.



Invitation Activity

The chairperson of Pūkoro-koro Miranda Trust has written to you in the frontispiece of this resource and challenged you to learn about and contribute to the plight of shorebirds in New Zealand and around the world. Read this as a class and discuss the key messages that she sends. Are you up to the challenge?



Prior knowledge Activity: What do we already know?

Noisy Round-Robin with questions/statements: in learning groups rotate around the room to each of the sheets with a statement that needs completion. Check in with students about their knowledge about godwits and wrybills (or any other shorebird!) and whether any have been to Pūkoro-koro Miranda.

A bird is

A shorebird is a bird that.....

A mudflat is.....

A native plant or animal is one that.....

Migration is when an animal.....

At Pūkoro-koro Miranda we will see

[For junior classes this could be a teacher led discussion about what they already know about birds (names, food, features), and what they know about the place (Miranda, Kaiaua or the beach, a mudflat or similar). Record on a big brainstorm sheet of paper or electronically to start their knowledge gathering and add to it as knowledge is built.]



Read

E3 call home, by Janet Hunt, 2009, Random House NZ.

Ria the Reckless Wrybill, by Jane Buxton, illustrated by Jenny Cooper, 2011, Puffin NZ





Reflect

What are the key words/ideas/things we need to find out more about?
Record.



Listen to

Keith Woodley at http://podcast.radionz.co.nz/ocw/ocw-20130404-2146-shorebirds_at_miranda-048.mp3

- What does Keith say about the term “shorebird” and where the birds actually live?
- Why is the Firth of Thames of international importance?
- How long might a godwit live?
- What did you hear about godwits fattening up before migration?



Watch

Pūkoro Mirānda have a collection of short videos or you might like to watch the following. Each of these contributes to the story of godwits and their amazing migration.

<https://api.tvnz.co.nz/ondemand/meet-the-locals/null/series-s2009-episode-series-2-episode-40>

<https://api.tvnz.co.nz/ondemand/meet-the-locals/null/series-s2009-episode-series-2-episode-38>

<http://sciencelearn.org.nz/Contexts/Flight/Sci-Media/Video/How-do-they-do-it>

<http://sciencelearn.org.nz/Contexts/Flight/Sci-Media/Video/Getting-ready-to-go>

There are also several more short videos on the Shorebird Centre Facebook page at <https://www.facebook.com/MirandaShorebirdCentre/videos>



Wonder

Students will start to develop an understanding of what a shorebird is and what makes these different to other birds. Before they are able to do this they will need to define what a bird is and how a bird is different to other animals.

Class brainstorm followed by round robin:

What is a bird? What birds can you name?

What is a shorebird?

Where might a shorebird live?

What might it eat?

Use dictionaries or electronic devices to find out the definitions of:

- Endemic vs native vs introduced



Pūkorokoro Miranda Poster Birds activity

There are fact sheets on the two iconic Pūkorokoro Miranda shorebirds you will be studying above. Read these (and other material if you like) and think about all the different things you know about each of these birds. Using a double bubble compare/contrast map write facts about each of these birds in the bubbles, placing the similarities in the central overlapping section. You might want to prompt students to think about:

- Colours
- Bill shape and feeding methods
- Month they breed in
- Country they breed in
- The months they spend at Pūkorokoro Miranda
- Size
- Food sources
- Season they breed in
- Distances they travel

As your learning journey progresses you may want to return to this and add new facts.



Graphing activity

Look at the bird species list for Pūkorokoro Miranda of sightings through the year (provided in the appendix). This is a busy place! Lots of different species are always coming and going. Use the calendar chart information to graph changes of species numbers over the year.

Using the graph you have drawn up consider:

- When the godwit are in Alaska where are the wrybill?
- When the godwit return to Pūkorokoro Miranda will there be wrybill here? (Is there a time of overlap?)



Predicting migration movement activity

Brainstorm what migration is. What animals migrate and why they migrate (see background information above).

The godwit and wrybill have different migration pathways. Look at the map of New Zealand and track the wrybill journey (see page 25).

Compare this with the godwit journey on the flyway map (on page 22). Use the information on the life cycles image, the calendar (in the appendix) and your graph from above to help with where they go and when they go.

After reading the fact sheets and stories and watching some of the videos about the godwits and wrybill, list all the things that these migratory birds need to do to prepare for their long flights.

Now visit the website: <http://earth.nullschool.net/#current/wind/surface/level/orthographic=-183.21,-39.55,549>

Think about the wind currents (using the global wind map) and how these could benefit or hinder migration. Look at the current wind currents and pretend you were a bird trying to reach the Canterbury plains.

- What would happen if you flew today? Would the wind help or hinder you?
- What about a godwit flying or returning from Miranda to Alaska?
- Using your knowledge of migration months (from your graphing exercise of bird sightings) predict when the birds might start flying to take advantage of the wind (and stay away from storms) This will depend on the time of year and where the birds are at that time.

Reflection

If you were the godwit or wrybill travel agent, planning a trip away from Pūkorokoro Miranda, what would you need to consider and what advice would you give the birds? What would you recommend?

Compare the birds' migration to a trip you will take to Pūkoro Mirā. How will you prepare? What will you wear? What direction will you travel in and for how long? What energy will be used (for you and the car/bus)? Will you need a stop? What might affect your journey?



Woolly worms

Scatter different coloured worms (have some that will be camouflaged on different surfaces) on the school field/grass area (prior to students seeing) and get them to hunt for these. Students will have 30 seconds to pick up as many as they can. Repeat on a concrete area that may be similar to the shell bank or mudflat. Each time ask:

- Which ones do you have the most of?
- If you were a bird feeding on these worms which ones would be easiest to find, which ones are well hidden?

Look at a photo of the mudflat area and talk about the colour of that area.

- If you were a crab or worm in this environment what colour would you want to be? (adaptation).

Note to teachers: You could repeat this as part of the Pūkoro Mirā experience but do it away from the hide so as not to disturb the birds in the rush and enthusiasm to pick up worms.

(Thanks to Kristina Frydberg – good for juniors and an addition to the activity with bills.)



Shorebird bill feeding zones

Materials

“Bills”: Tweezers (plastic); bulldog clips; scissors (or clothes pegs); spoons.

Food: Toothpicks; elastic bands; knitting wool pieces; paper clips.

Other: Cups (either per group or per student); recording sheet.

Background information

This is a fun activity which provides a chance to gain an understanding of a number concepts such as adaptation, generalist and specialist feeders, food webs and ecosystem balance.

Check current knowledge and understanding of adaptation with your students. “Adaptation is the evolutionary process whereby a population becomes better suited to its habitat.”

Adaptations are produced in a variable population by individuals with better suited form/attribute reproducing more successfully (natural selection). Give an example of natural selection (there are green and brown beetles in a population; the green ones are better camouflaged against the leafy vegetation they eat. Therefore more of the brown beetles get eaten and there are more green beetles to breed and pass on the green gene). (Or think about the woolly worms activity below.)

Description

The students are split into about four groups, with each group given a cup and one type of “bill”. The food is then scattered in a circle and students have five minutes to collect as much food using their bills as possible.

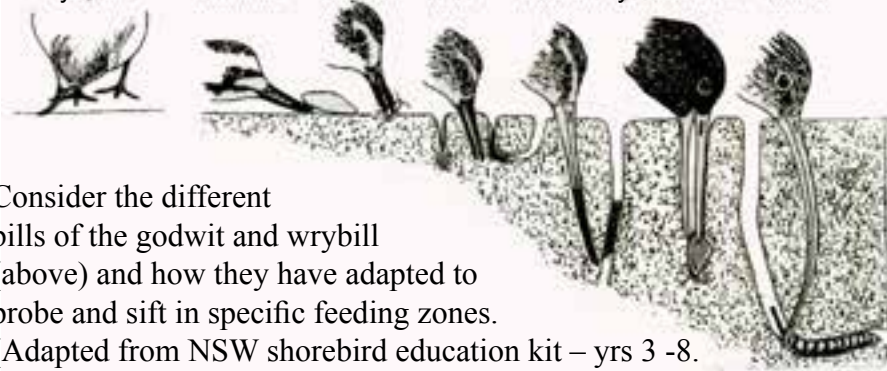
Students must all start behind the line and one member from each team runs into the circle, picks up one piece of food with the bill, places it in the cup and then hands the bill to the next team member. No hands can touch the food and students can only pick up one piece at a time. Once the first round has finished the students can count up the total number of each food type they collected during the round. Record each team’s results on a group sheet.

Reflection

Talk about which birds (bills) can survive on a wide range of foods (generalists) and which are a little more fussy (specialists). If a bill collects even amounts of most food types it is a generalist. If a bill favours one food type, it is a specialist and can only survive on that one or two types of food.

Then ask the students what might happen if a particular food was wiped out of the ecosystem? If this food type is important to a specialist, the specialist beak will also be wiped out. Which bird/bill would survive best in a habitat with only one specific type of food?

Wrybill Turnstone Dotterel Knot Godwit Oystercatcher Curlew



Consider the different bills of the godwit and wrybill (above) and how they have adapted to probe and sift in specific feeding zones. (Adapted from NSW shorebird education kit – yrs 3 -8. Illustration by Keith Woodley.)



Scientific activity

Practice being a scientist by carrying out observations and recording activity.

- Try two minutes of silence and observation
- Keep a home bird record (see link below for the garden bird survey including techniques)
- Learn identification of key species prior to trip (What do you expect to see at this time of year? What are you looking for (features)? Use the fact sheets available and PMNT shorebird identification guides.



The technology

Learn about binoculars and scopes. Use the information provided in the appendices pages to familiarise yourselves with the equipment that can be used as part of a shorebird experience. If you can try using binoculars and spotting scopes before visiting Pūkoro Mirānda.



Scientific monitoring of bird behaviour

A crucial part of research into migratory birds is catching individual birds and fitting them with coloured bands (as on the godwit at right), flags with letters or in a few cases GPS transmitters. This allows scientists to track the birds, either by sighting their bands or flags in different places, or by following their transmitter signals.

Reflection

How has technology helped us learn about bird migration?



TRACKING: This famous godwit called E7 (after the plastic flag on its leg) was fitted with a transmitter which allowed scientists to track its flights from New Zealand to Alaska and back. You can see the transmitter aerial sticking out at the back of the bird.

Photo by Keith Woodley.



Birdwatching hides

Have a look at the photos of the bird hides above. On the left is the permanent hide at Pūkoro Mirando. The one on the right is a temporary hide erected for bird banding. Discuss the purpose of a hide. What other buildings are similar in purpose to a hide?

Building a hide at school

Purpose – to design, and build with reused or natural local materials a simple structure that can be used to unobtrusively observe birds

- What materials are free and readily available and won't hurt the environment?
- How permanent/strong/structurally sound will it need to be? (Read the story in the Pūkoro Mirando News magazine no. 93 about how the hide was damaged by a storm and had to be re-built).
- Does it need to be weather (rain/wind) proof?
- What colours will work best?
- What design will work best (measure and draw)?
- Who could be involved, and who can help?

Reflection

- What materials did you use for your hide?
- Did your hide meet the purpose (bird observations)?
- What design aspects worked well?
- What would you do differently next time?



Flight behaviour activity

Firstly, if you have not already done so, have a look at the videos and photos that show how the shorebirds such as godwit and wrybill fly together as they take off and land around the tidal flats. This moving, evolving pattern is called a scarf. Using the silhouette master provided (see appendix) or your own design, create a flock of birds on your classroom window. Talk about the benefits of flying together (consider energy use, wind, safety).

Reflection

Think about how birds travel in flocks. When do you travel with others?



Before the trip predictions

I expect to see?.....

I expect to hear?.....

I expect to smell?.....

I would like to learn.....

(have one question ready to ask the shorebird guides - work in groups and check as a class that there is no major repetition and key points are covered).

I will be able to identify a godwit because of the following features

- Their plumage is.....(colours)
- Their bills are.....and (length, shape)
- Their legs are.....(length)
- Other.....

I will be able to identify a wrybill

- Their plumage is.....(colours)
- Their bills are.....and (length, shape)
- Their legs are.....(length)
- Other.....

I will be able to identify a

- Their plumage is.....(colours)
- Their bills are.....and (length, shape)
- Their legs are.....(length)
- Other.....

See <http://nzbirdsonline.org.nz/> (cheat sheet)



Creating a care code for the day

Help look after this land/sea interface: The mudflats, marshes and shell banks are fragile environments and many of the birds who spend time there are also sensitive to human disturbances. If possible organise your visit through the Pūkoro Mirānda Naturalists' Trust who will guide you to ensure minimum impact on the environment. If you make your own way please ensure your students understand the sensitive nature of this place and act respectfully.

This learning experience provides a great way to help students build understanding of the key competencies and link these with school values and/or virtues.

Print out words of the school values along with key competencies you want to focus on and any other relevant “attitudes and values” or behaviour words such as: respect, responsibility, excellence, innovation, inquiry, curiosity, diversity, sustainability, equity, integrity, managing self, contribution, participation, thinking, relating to others, resourceful, resilient

Discuss what the students know about these words and ask for examples of how they might be displayed at school and at home. You could talk about role models in the community or historical examples. You may already have a school care code that can be adapted.

Now shift the discussion to the Pūkoro Mirānda experience. They may not know what to expect but they can be ready to show some of the behaviour that is appropriate in a natural, sensitive space. They may have had similar experiences or may relate to more familiar places like the library, school bush or gardens.

Students should be able to explain the class care code for Pūkoro Mirānda: When we are at Pūkoro Mirānda we will act/behave/manage ourselves by:.....

.....

Trip Planning



What to do, what to pack

Check tides

Two hours either side of high tide is best for viewing the birds as they move closer to the shore as the tide rises and so are easier to see. Check on the Metservice website at <http://www.metservice.com/marine-surf/tides/thames> for high tides at Thames which is just over the water from Pūkoro Mirando before you decide on the date of your trip.

Check availability of Shorebird Centre guides and book equipment

Email admin@miranda-shorebird.org.nz phone 09 232 2781 with your school details, contact teacher and preferred times and dates.

A phone conversation is a good practice at an early stage of the planning as Shorebird Centre staff can answer questions and clarify aspects of the planning.

Check and follow school policies and procedures for LEOTC experiences near water

Water activities are not part of the general Pūkoro Mirando experience. However, if you choose to include a swim at the beach or stream studies at the mouth of one of the streams (both great options when the weather is right) you will need to include this in your risk assessment). Having an adult responsible for a small “learning group” for the whole experience (even before leaving school) supports safety and allows discussion and activities to be facilitated and carried out in these small groups easily and efficiently.

Clothing

Bring seasonally appropriate clothing including hats and comfortable walking shoes.

Food and water

Each person should take responsibility for their own needs. There are no food or drink purchasing facilities at the centre, though you can make tea or coffee, so come self-catered. In case of emergencies the Pink Shop down the coast at Kaiaua sells food and drink including filled rolls, pies . . . and rather good coffee.

Equipment

Bring binoculars if students have them, recording booklet or sheet and pencil/pen, and camera. The centre has a number of scopes.

Confirm arrangements

Confirm booking with the Pūkoro Mirando Shorebird Centre, including arrival and departure times and check availability of a guide and possible equipment usage. Also check with staff/volunteers about possible action-taking (this will need to be pre-arranged and supervised).

Organise transport and adult support

In the appendix is a parent helper guide and some basic facts about the Pūkoro Mirando experience that will ensure supporters are prepared.

Group activity sheets

Negotiate/plan with the Shorebird Centre people the activities that you would like to undertake. These will differ from group to group depending on the focus and the time of year (and whether an educator is available). The Shorebird Centre staff can put together a group instruction and recording sheet for you to print out for each student group (working in learning groups of about 4-6 with an assigned adult helper works well for this sort of experience.)

But wait there's more....

When you are thinking about the sort of experience that will help student learning and make a fulfilling meaningful and worthwhile trip you might like to consider some of the other attractions and learning opportunities in the area.

Because the Reserve areas are sensitive students are unable to dig around in the sand/mud to observe food sources for the birds. They will also be discouraged from running around or making noise which would disturb the birds that everyone has come to see. There are other areas closer to Kaiaua that are more suitable for exploring the mud/sand and letting off steam so this can be built into the programme. Talk to the Shorebird Centre people for suggestions and other options for local attractions.

Is this an overnight or day trip? Accommodation options include the Shorebird Centre (accommodation available for up to 25 people). There are also school camps near-by.



Crabs are important to the ecology of the salt marsh community. They feed on the glasswort plants and then form part of the shorebirds' diet.

Photo by Robyn Irving.

At Pūkoro Mirando



Possible programme

The programme for the day will depend on your travelling arrangements, tides, weather, and time of year however below is a basic outline of the day that could be developed more (in line with the environmental factors) to meet your student needs. Remember that you will need to book in with the Shorebird Centre if you plan to use that space and in particular if you want a talk and guide.

10am Arrive, welcome .

Morning tea, toilets.

10.15 Short briefing/health and safety.

Talk from an expert and check out displays.

10.45 Divide into “learning groups” (to meet school LEOTC ratios and facilitate positive learning) and rotate through chosen/pre-arranged activities. Visit reserve and hides to experience this shorebird ecosystem.

12.15pm Reflection.

12.30 Lunch at Kaiaua beach (option of other activities here).

1.15 Return to school.

At right, top: Children celebrate a great day at Pūkoro Mirando. Bottom: Youngsters enjoy discovering shore life.

Photos by Keith Woodley and Jim Eagles.



Experiential Activities

Below are some suggested activities at the shorebird centre, along the walkways and at the hides. You may also want to pre-organise a talk at the centre by one of the staff or volunteers. Talk to the shorebird centre well in advance to co-construct your experience.



At the Shorebird Centre

There is a huge amount of information at the Shorebird Centre. There are also very knowledgeable people (when booked) to talk about the birds and their habitat. If you have a particular focus let the centre people know. Have students pre-prepare questions they want answered (see pre-trip predictions).

- Interpretation panels, photographs, life sized models and taxidermied birds and pests. These are being upgraded but there will be an up-to-date fact finding hunt for you to carry out.
- Scientific monitoring: Explanations of the different tracking devices from flags and bands to solar powered battery-powered transmitters and satellite telemetry equipment. A PTT satellite transmitter and a geolocator will be available for examination.
- A well-stocked shop: including educational reference and story/picture books for children.
- Migration game: This is a great experiential game that has been developed by the Shorebird Centre that one of the PMNT people can guide you through. It is available on the DOC website

• Alternatively you could use this game: <http://sciencelearn.org.nz/Contexts/Life-in-the-Sea/Teaching-and-Learning-Approaches/Bird-hotel>

• Outdoor classroom: Next to the main bird hide is an outdoor classroom. This is the area where you will meet once on the reserve and where initial instructions will be given. It is also suitable for discussions and reflections after the activities.



The outdoor classroom at the hides.

Photo by Jim Eagles



Along the trail

Follow the trail from the Shorebird Centre to the hides or walk in from the carpark, using the interpretation panels (shown in the photos) to help build knowledge and make sense of the surroundings, the habitat, birds and the history of the area. You could assign a panel to each student asking them to photograph it and note down key facts from it. This would provide valuable material and visual reminders to reflect on back in class.



Colour observation

This activity is a good one to do at the beginning of the experience. It will help students focus in on detail and set the scene for observational skills. Using the colour cards provided (talk to the Shorebird Centre about this) find the range of colours within the local natural environment. Link shells, mud, water, landscape to bird colours. Reflect on woolly worm activity.



Shell Observation

The shells that make up the chenier plains and surround the Findlay Reserve hides are an indication of the rich food source in intertidal flats and the Firth of Thames food the birds come here for. Of the hundreds of species of small animals that live here, a few are more obvious because of their shells left behind. Use the Pūkorokoro Miranda Trail Guide to help you identify shells you see along the walkway. Which ones are most common? Are there any unusual ones?



Shell banks at Pūkorokoro Miranda.

Photo by Robyn Irving.



Use and technology of the binoculars and telescopes

Guidance and explanations can be given about correct/ appropriate use of the scopes and binoculars. PMNT can arrange for you to borrow their school set and there will be simple instructions given to take care of and make the most of this equipment.



Bird identification

To get maximum benefit from your time at the bird hide area everyone will need to stay quiet and respectful of the birds. You can use both your eyes and your ears to identify the birds.

Use the bird identification field guides available (there are some in the hides) to identify key species.

Record sightings in your notebook and key features that helped you identify the birds. If you are lucky you will see a variety of shorebird species feeding and flying around the mud flats. Listen to the different sounds and try to work out which noises are being made by the different birds.



Bills and feeding observation

Depending on what time of year you visit you will see a range of birds that feed on the intertidal flats. Each species holds a unique niche (special place) in the ecosystem and has adapted its bill to give it an advantage over others after food. (Remember the activities of different food and bills you did back at school?)

Choose a bird and over a timed two minute period count and record the number of times the bird probes the mud to feed. Repeat. (Note you can repeat this with the same bird, the same species but a different bird, and with a different bird of another species.)



Bar-tailed godwit feeding.

Photo by Phil Battley.



Behaviour observation

Choose a bird and follow it with your eyes (using a scope or binoculars if you like) for two minutes. Record everything it does. (Eg feeding, preening, flying, resting). Repeat with another bird. Make sure you record your findings as this information will be used back in class.



Species number assessment

Most days there is a lot of bird activity at Pūkoro Miranda but the greatest activity occurs in the warmer months when thousands of migrants from the Arctic are present. Scan the mix of shorebirds and make an estimate of numbers of the species you see. Which species are there most of? Which species are there least of?



Bird activity on a typical summer day at Pūkoro Miranda.

Photo by Stefan Soderlund.



Sketching

Once you have carried out some of the observational activities you will have started to see the differences and similarities of some of the bird species. Sit quietly with a pencil and clean piece of paper to sketch a godwit or wrybill.



Mud observation

Sit quietly (the mud crabs or papaka will feel the vibration of your footsteps and might think you are a large bird about to eat them) at a place along the walkway that you have a good view of the mud.

Watch carefully and see if you can spot the mud crabs that create holes in the mud for their homes. Why is the mud crab colour important for their survival? What other adaptations do you think they have? You might also spot a mud snail. Think about the food chain of the intertidal flats. What does the mud snail eat? What does the mud crab eat? What might eat the mud crab?

If we are able to work in a less sensitive area of mudflat (probably near Kaiaua) we can try to sort the various crabs, polychaetes, univalves, bivalves and other organisms in the mud. This will require large whitetrays with good quality magnifying glasses attached.

We can also use the 0.25 m sq quadrats provided and locate these in an area of crab holes. Count each crab hole within the study quadrat. Record. Repeat x5. Calculate average per metre population. The average weight of a mud crab is 2.5gm, so if one crab lived in each of the holes, what would be the biomass weight in each quadrat you have measured? Each metre squared? What will this mean for a crab eating shorebird such as the heron? (You might like to finish the calculations back at school).



Use quadrats for crab hole counts.

Photo by Ray Buckmaster.



Pests

For many years PMNT has been involved in pest management around the shore. Look at pest monitor tunnels and stoat traps. What do the stoat traps do? Why are the stoats a problem? (ground nesting and roosting birds). Can you see the bait used? Why do you think this is used? What is the difference between a monitoring tunnel and a trap?

Why do you think it is important to have the monitoring tunnels? Talk about presence/absence of pests as opposed to specific numbers.



Stoat caught in a DoC 200 pest trap at Pūkoro Miranda.



Action taking

Pūkoro Miranda Shorebird Centre employs a full time manager and a part-time manager, but as a community group it relies very much on volunteers for much of its work and activities. Volunteers can have many different roles which include:

- Guiding
- Cleaning
- Building maintenance
- Serving on the Council of the Trust
- Maintaining the membership database
- Relieving in the shop
- Gardening
- Counting birds

Students might also want to take action to assist the Trust's work. There are examples of ways that you can do this in the post trip section. If you are interested in on-site action as part of the Pūkoro Miranda LEOTC experience please check with the Shorebird Centre manager well in advance of your trip.

Post trip

The activities below are designed to check in on how students are progressing and what is making sense after their trip. Group work sheets that observations and measurements were taken will be valuable material to help students reflect on their experience.



Experience Reflection activity

The questions below or those that the students have co-constructed will help to reflect on the experience and cement learning:

We sawat Pūkoro Mirāda

We heard.....at Pūkoro Mirāda

We smelt..... at Pūkoro Mirāda

We learned that

.....at Pūkoro Mirāda

I managed to identifybirds

How did this make you feel?

What surprised you?

What didn't go so well?

What could we learn more about?

Go back to expectations/predictions and compare.

Completing the loop

Let the people at Pūkoro Mirāda know about the experience you had and the learning outcomes. Go onto the Trust's Facebook page.



Recount

Now that you have seen and heard and smelt and observed this ecosystem, write about this experience. Highlight things you have learnt about Pūkoro Mirāda and the way that you feel about the godwit and the wrybill [For junior levels this might be carried out as a combination of drawing and words]. Share with the class things that you would like to find out more about.



Sharing and comparing

If you carried out bill probing counts, bird behaviour observations or crab hole counts, collate this information and share by graphing and discussion.



Ecosystems under stress activity

View the animated clip from birdlife international about sharing the shoreline. <https://www.youtube.com/watch?v=Ml32UJxDmiU>

- What were some of the issues?
- How did these affect the birds?
- What were some of the solutions/ alternatives?
- What do you need to be aware of when sharing the shore with birds?

You might also want to re-watch the Meet the locals tv clip <https://api.tvnz.co.nz/ondemand/meet-the-locals/null/series-s2009-episode-series-2-episode-40>

Reflect on what the main issues are that Keith Woodley talks about both overseas and in New Zealand and how this might affect the godwit.



Global issues activity

Read the global issues affecting shorebirds outlined on page 27 then consider the “imagine if..” scenarios:

Imagine if... The Pūkoro Mirānda wetlands became clogged with too much sediment?

- How would this affect the birds?
- What other changes might occur?
- How will people be affected?

Imagine if people worked together to reduce sediment coming in? Who would need to be involved? What would be the benefits?

Imagine if... The Yalu Jiang estuary was drained so that factories could be built?

- How might this affect the lifestyles of these people, the way they lived and earned a living?
- What could the affect be on the bar-tailed godwit?
- What ways can we use wetlands that don’t destroy them (different values).

Imagine if climate change meant the Arctic tundra where the godwits breed warmed up so much that it no longer provided the good nesting sites and rich food the birds need to raise their chicks.

Imagine if the godwits were unable to reach their breeding grounds and return to New Zealand?



The food-rich mudflats (above) are what attract huge flocks of shorebirds to Pūkoro Mirānda. Changes to the Arctic tundra (below) could mean it is no longer such a good place for this female to incubate her eggs.

Photos by Gary Speer and Keith Woodley.





An aerial view of the lower Ashley-Rakaia River, a breeding area for wrybills, as it passes through Rangiora. Photo by Nick Ledgard.

Imagine if.... Weeds increased even more on our braided rivers?

- What would the impact be on wrybill breeding?
- What other changes would take place?
- What could people do to change this?

How can we look after/value our natural spaces as well as be productive?

(Extension: An alternative approach to using the scenarios above would be to place students in the various roles of people and animals – eg indigenous people, farmers, reserve managers, industry developers, fishers, etc.)

Consider the scenarios above and see if you can make links with your own lifestyle and what is happening in these significant habitats. (For example, think about where your food and clothing and electronics come from).

Reflection

What are the big issues facing shorebirds?

- Thinking about the life cycles of these birds, what could go wrong if temperatures changed (internal triggers, food supply not available at the right time).
- What are reasons/influences this might happen?
- What actions can we take now to help?



Making choices: a vision for the future

How can this new knowledge be used in a way that is relevant to your community?

What local groups are working towards healthy ecosystems in our place? (land-care groups, stream-care groups, Department of Conservation programmes, Enviroschools)

In what ways can we change our behaviour so that there is less impact on the natural environment?



Class brainstorm or bus stop activity

- What does caring for our environment mean?
- What could we be doing if we were “Caring for Our Environment?”
- What would this look like?
- How would you feel if you were caring for your environment?

If we were going to “care for the shorebird environment” what could we do?

Possible actions and ideas for further learning

- Fund a predator control programme near you or donate to the PMNT so that they can continue their predator (pest) control and monitoring.
- Raise awareness of issues and the importance of these and/or other natural ecosystems. (Create a poster, write letters to newspapers, local politicians, make posters and signs to display, design a t-shirt)
- Write an article for the Pūkoro Mirando News
- Use your knowledge and understanding to find out more about how to become involved in a local restoration programme (land, beach or stream care groups, naturalist groups)
- Waste minimisation at school and home
- Water conservation at school and home
- Reduction in chemical usage – consider what cleaning products are used at school and at home. Look at where your food comes from and how it is produced.
- Reduction in fossil fuel use (consider your travel and think about how you can reduce use of fossil fuels)
- Local food supply means less pressure on our natural ecosystems. Find out more about what you can do. (eg Grow your own food in an organic way and share the surplus.)

Reflection on learning and action

Think about the birds you have seen and the remarkable journeys that they undertake to reach their breeding grounds and return to Pūkoro Mirando.

Have another look at a map that shows where you have been (Pūkoro Mirando) and the time it took to travel there. Now look at the journey that these birds take (the bar-tailed godwit to Alaska and the wrybill to the braided rivers in the South Island of New Zealand) and consider their size and what they need to do in order to reach their destination and return after breeding to Pūkoro Mirando.

- What are some key features that enable these birds to be so resilient?
- What are some challenges these birds face in order to complete their journey?
- How do people contribute to these challenges?
- What can we do to help?

Consider the letter written to you from the PMNT chairperson. How would you respond to this letter now that you are familiar with the godwit and wrybill and their habitat and the issues that they face? Extension: If you want to explore this further you might find the thinking tools (biotech) in the Toolbox useful, or use the maths example from t.k.i (again in toolbox) to consider wind, size and shape.



Appendices

Glossary

Arctic: a region of the Earth, north of the Arctic Circle (an imaginary line located at 66°, 33'N latitude), and includes the Arctic Ocean, most of Greenland, Baffin Island and northern parts of Europe, Russia (Siberia), Alaska and Canada.

Bill: also known as beak, or rostrum - an external anatomical structure of birds which is used for eating, probing for food, and for grooming, manipulating objects, courtship and feeding young.

Braided riverbed: A braided river flows in multiple, mobile channels across a gravel floodplain. The channels repeatedly branch and re-join creating an interwoven pattern of low islands and shallow bars.

Chenier: a beach ridge resting on silty deposits which has become isolated from the shore by a band of tidal mudflats. The Miranda-Kaiaua cheniers are first formed as sand and cockle-shell bars on the foreshore or intertidal flats.

Ecosystem: a system, or a group of interconnected elements, formed by the interaction of a community of organisms with their environment.

Endemic: specific to a country, only naturally found here. eg the wrybill.

Flyway: The routes that shorebirds travel along on their annual migration are called flyways. A flyway is a series of inter-linked habitats broadly defined as the migration route of a population, species, or group of species of birds, between a breeding area, through the staging sites and non-breeding area.

Forage: search for food.

Habitat: the place or type of place where a plant or animal naturally or normally lives or grows.

Hide: area/structure built to observe the birds without them observing you.

Intertidal: the area of the foreshore and seabed that is exposed to the air at low tide and submerged at high tide, ie the area between tide marks.

Introduced: Not originally from here, brought here from another country, native to another.

Migratory: moving from one place to another at particular times of the year.

Native: native, belonging naturally. (A wrybill is endemic and is also native. A godwit is a native but is not endemic because it occurs in NZ but also other countries).

Phototactic: Moves in response to light (negatively phototactic = away from light)

Plumage: a bird's feathers, which may change at particular times of the year.

Salt marsh: coastal flats exposed at low tide and at least partially flooded at high tide, so only salt resistant forms of vegetation can grow there.

Shorebird: Shorebirds, also known as waders, feed, rest and preen on intertidal areas or on the fringes of freshwater wetlands.

Extras



Plants

Use coastal plant guides to help you identify particular species you find at Pūkoro Mirānda. Some of these plants are specialists at growing in damp salty conditions.



Mangroves

Mangroves are a common coastal tree in New Zealand estuaries and inter-tidal wetlands north of Ohope and Raglan. They have a role in filtering nutrients and providing protection for fish and shellfish during breeding. Mangroves are often maligned as weed species, taking advantage of high nutrient and sediment loads resulting from land development and spreading into previously open inter-tidal areas.



Plant weeds

Weeds are plants that take advantage of a disrupted ecosystem and through their vigorous growth and often prolific seed or vegetative spreading take over and change the balance of a plant and animal community. One example of this is the fennel along the trail. Another is the silver beet that has spread along the shellbanks. On the braided rivers of the South Island weeds such as gorse, broom, lupins and pampas threaten the habitat of the wrybills.



Puppet making

You can use this to model the behaviour of birds feeding and migrating.



Scientific names vs common names

Why do we use them and what do they tell us about the birds and plants?

The wrybill's common name helps identify the bird because of the unique bill (see below). Its scientific name is *Anarhynchus frontalis* which may be a mouthful but is unique to the wrybill and tells where it fits in the list of living things. This prevents confusion because many species may share a common name. There are, for instance, many robins around the world but they are very different birds.



Toolbox

Resources that could add further depth and breadth to student learning and understanding:

<http://www.doc.govt.nz/get-involved/training-and-teaching/teaching-resources/field-trips/auckland/miranda-wildlife-refuge/teaching-resources/miranda-shorebird-teaching-resource/>

This comprehensive education resource created in 2003 is still valuable and full of useful material.

<http://nzcurriculum.tki.org.nz/Curriculum-resources/EFS>

<http://www.landcareresearch.co.nz/publications/factsheets/rare-ecosystems/coastal/shell-barrier-beaches-chenier-plains>

<http://sciencelearn.org.nz/Science-Stories/Where-Land-Meets-Sea>

<http://sciencelearn.org.nz/Science-Stories/Resource-Management/Sci-Media/Video/Farmland-run-off-into-estuaries>

http://biotechlearn.org.nz/thinking_tools/ethics_thinking_tool

http://biotechlearn.org.nz/thinking_tools/futures_thinking_tool

<http://www.teara.govt.nz/en/wading-birds>

<http://www.teara.govt.nz/en/estuaries/page-1>

*Pūkoro*ro Miranda News – Journal of the Pūkororo Miranda Naturalists' Trust.

<http://www.nzmaths.co.nz/resource/winging-it> a math resource using wing structure to predict strength and durability and use.

http://www.tki.org.nz/r/maori/wharekura/whare40_st4_e.html in te reo Maori

<http://www.seachange.org.nz/The-Hauraki-Gulf/Gulf-Factsheets/>

<http://sciencelearn.org.nz/Contexts/Flight>

<http://nzbirdsonline.org.nz>

<http://osnz.org.nz/arctic-wader-colour-banding>

www.doc.govt.nz/.../braided-rivers-canterbury-lowres.pdf

<http://tvnz.co.nz/meet-the-locals/s2009-e38-shorebirds-video-2833676>

<http://tvnz.co.nz/meet-the-locals/s2009-e40-video-2833612> godwits

http://www.neilfitzgeraldphoto.co.nz/articles/spp-profile_wrybill.html

<http://www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/garden-bird-surveys/activities-for-schools> Annual garden bird survey

Shorebirds visiting Pūkoro Mirando through the year - (approximate numbers)												
Species sighting	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Migrants												
Bar-tailed Godwit	5000	5000	decreasing	500	500	500	500	500	Increasing	5000	5000	5000
Red Knot	3000	3000	decreasing	800	200	200	200	200	Increasing	2000	3000	2000
Pacific Golden Plover	40	40	40	10	1	1	1	1	3	30	40	40
Ruddy Turnstone	20	20	20	3	2	2	2	5	10	20	20	20
Sharp-tailed Sandpiper	6	6	4	1					2	2	6	6
Curlew Sandpiper	3	3	3	1	1				2	4	4	4
NZ Species												
Wrybill	1000	2000	2000	2000	2200	2200	2200	decreasing	1000	80	25	150
Banded Dotterel	50	100	100	100	100	100	50	50	5	5	5	5
S. I. Pied Oystercatcher	4500	5000	5000	5000	5000	decreasing	decreasing	800	400	400	500	1800
Pied Stilt	400	400	2000	2500	2500	2500	2500	400	400	400	400	400
Royal Spoonbill	20	20	25	35	40	40	40	40	30	5	5	10
Black-billed Gull	800	800	200	50	50	50	50	50	50	50	600	800
Caspian Tern	20	20	10	5	5	5	5	5	5	5	10	20

Birds of Pukorokoro Miranda: New Zealand Shorebirds



Pukorokoro Miranda Naturalists' Trust
Education Resource

www.miranda-shorebird.org.nz

Birds of Pukorokoro Miranda: Visitors from the Arctic



www.miranda-shorebird.org.nz

Other Birds of Pukorokoro Miranda



Kahu/Harrier



Black Swan



Ngutupapa
Royal Spoonbill



Kotuku/White Heron



White-faced Heron



Kawaupaka/Little Shag

Little Black shag



Karuhui
Pied Shag



Kawanui
Black Shag



Putangitangi
Paradise shelduck
(male)



Putangitangi
Paradise Shelduck
(female)



Mallard
(Male)



Mallard
(female)



Tete/Grey Teal



Kuruwhengu
Shoveller
(female)



Kuruwhengu
Shoveller
(male)



Skylark



Moho pereru
Banded Rail



Kotare/ Kingfisher



Warou
Welcome Swallow



Pukorokoro Miranda Naturalists' Trust
Education Resource

www.miranda-shorebird.org.nz

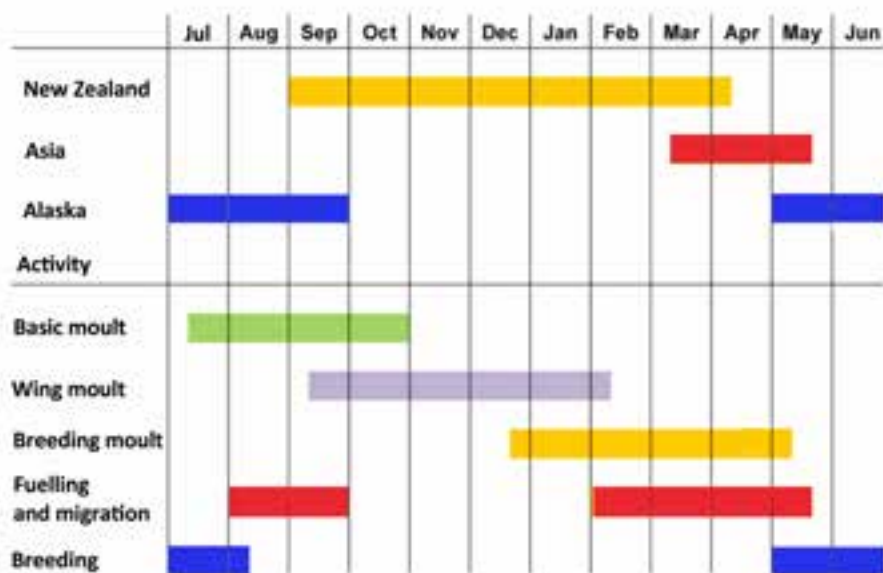
Shorebird Food: animals of the mudflats



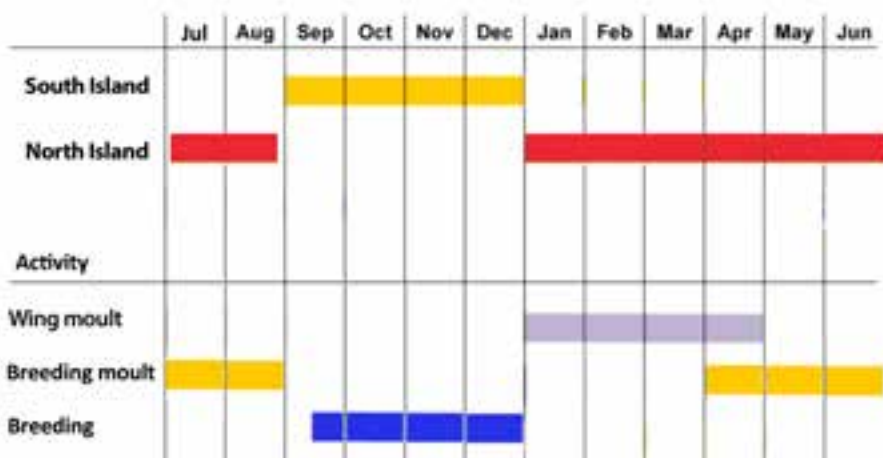
Common coastal plants of Pukorokoro Miranda



Annual cycle: what does a godwit do all year?



Annual Cycle: what does a wrybill do all year?



This is the Shorebird Centre which will be the base for the experience at Pūkoro Mirānda.
Photo by Keith Woodley



This is Keith Woodley, the Shorebird Centre manager and an authority on shorebirds, who will be the principal host for the visit.
Photo by Jim Eagles.

Pūkorokoro Miranda guide for parent help/supporters

This learning outside the classroom experience allows students to make sense and connect the knowledge and skills they have developed in the classroom with the natural ecosystem. As a supporting adult you play a key role in the success of this, support the sense of wonder and discovery as well as guiding them to follow instructions and complete tasks.

Safety is important, both yours and the children in your group. Stay in your groups and in sight of each other at all times. Work together to learn about this wonderful natural setting.

In no way should your fitness or behaviour compromise the opportunities of the students. You are here as a learning supporter and role model.

Encourage the students to read the instructions and the interpretation panels. If they are unsure about what they are required to do, help them understand. If you don't understand ask for help from the teacher or the Pūkorokoro Miranda guide (if available).

Encourage curiosity, observation, problem solving and discussion by posing open ended questions.

- What do you think might happen if.....?
- Why is it that.....?
- How can we.....?
- Where do you think the?
- What else might be influenced, affected, connected?

Ask the students what they have learnt in class and how this is related to what they are observing.

Help them make the connections and make sense of what they are experiencing. And it's ok not to know everything – learn alongside the students and note questions that arise.

Be an inquisitive role model and have fun!

Basic background information

At.....School we have been finding out about the bar-tailed godwit and the wrybill, their habitat at Pūkorokoro Miranda, their breeding ground and the staging sites on their migration journey between the two. To help you engage in learning alongside the students on the following pages we have provided you with some basic facts on the birds. We hope you enjoy the trip, the birds, the place and working with young people.



This is a bar-tailed godwit (photo by Judi Mitchell).

- They are found on New Zealand harbours and estuaries where they can find sufficient food to support their migratory lifestyle.
- They mostly eat marine worms but also take shellfish and small crustaceans.
- Each year godwits migrate between Alaska, where they breed, and New Zealand where they spend the northern winter.
- During northward migration in March and April godwits stop to refuel on the coast of the Yellow Sea in China and Korea.
- Each migration cycle involves flights totalling over 30,000km.
- They start arriving back in New Zealand in September after a non-stop flight covering 11,500km in 8-9 days.



This is a wrybill (photo by Keith Woodley).

- The wrybill is the only bird in the world with a bill curved to the side.
- They are found only in New Zealand.
- They breed only on the braided river beds of the eastern South Island, mainly the Rakaia, Rangitata and in the Mckenzie Country.
- One purpose of the bent bill is for finding food on the riverbeds – such as insect larvae that hide underneath stones under the water.
- After breeding most of the wrybill population migrates to the Auckland region.
- From January to August each year 40 % of all wrybill can be found at Pūkoro Mirinda.
- Both these birds feed alongside other shorebirds on the intertidal mudflats of the Firth of Thames.

Use of binoculars and scopes

Your students will have the opportunity to use both of these pieces of equipment so it is worth knowing just a bit about them.

Spotting scopes



Telescopes (scopes for short) come in two types. One for looking at the stars, called celestial telescopes, and the terrestrial telescopes, or spotting scopes, your students will use. Scopes magnify a lot more, perhaps 20x 80, but they can also be adjusted, using a zoom lens, to magnify up to 60 times. Most scopes are far too heavy to hold still and they must be supported by something or the image will be shaky. Often an adjustable three legged device known as a tripod is used for support. The scopes that your children will use will be attached to various parts of the bird hide. Our binoculars are pre-focussed but the scopes are not. Our

shore-guide will show the students and parent helpers how to adjust the focus. Each person has slightly different vision, but the adjustment to get a sharp image will be only slight.

Since you can only look with one eye it might help if a student closes the eye that they are not using. People who use scopes a lot generally keep both eyes open. It really helps to get the best out of both bins and scopes if students ask themselves questions about what they are seeing. What shape is the bill? What colour are the legs? How is it different from that other bird over there?

Binoculars



Binoculars are really just two telescopes that are hinged together at the middle. The binoculars your students will use have only one moving part and that is the hinge. People's eyes aren't all the same distance apart so the hinge adjusts for this.

This model is very easy to use as it is already focussed and needs no further adjustment.

Always ensure the binocular strap is around the student's neck. Arms do get a bit tired when trying to hold binoculars still for a while so it

helps if you can rest your elbows on something to steady them.

These binoculars (bins for short) are 7x35. The first number is the amount that they magnify.

Children will think that things are much closer.

The second number is the width, in mms, of the lens at the front of the bins. These have quite a big front lens and it lets in a lot of light to give a bright image and also lets you see quite a wide area. This helps you to find what you are looking for.

AN INTERESTING FACT

When telescopes were first invented many of the instruments showed the images upside down. Sailors saw inverted boats sailing in a sea that was where the sky should be. Today prisms are used in scopes and binoculars to get the image the right way up. Your science specialist might be able to show this happening in your classroom.



Produced as an educational resource by

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Funded by a bequest from Dinah Francis Gavin