

WHIO FOREVER

EDUCATION RESOURCE

YEARS 5-8 (SENIOR)



Whio Forever



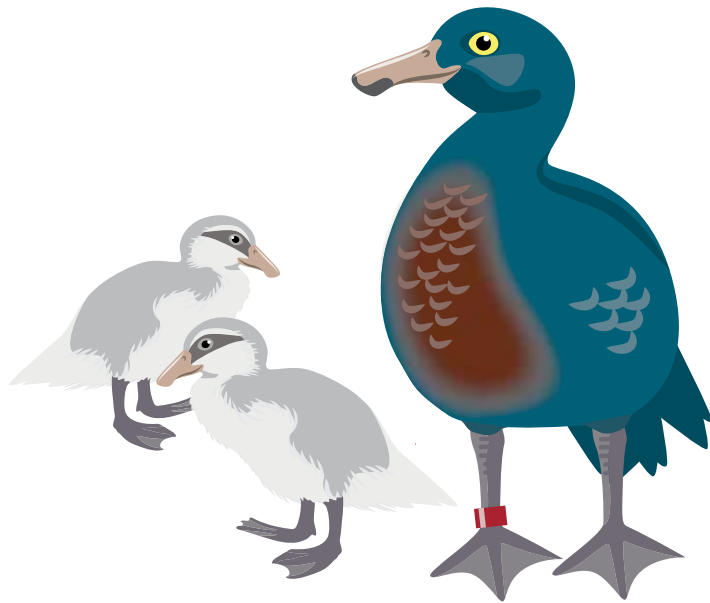
Department of
Conservation
Te Papa Atawhai



WHIO FOREVER

EDUCATION RESOURCE

YEARS 5-8 (SENIOR)



Illustrations: Lisa Paton

Cover photo: Bubs Smith

Published by:
Department of Conservation
Taupo Office
PO Box 528
Taupo 3351
February 2016

ISBN 978-0-478-15057-5 (print)

ISBN 978-0-478-15058-2 (online)

CONTENTS



Introduction	4
About the Whio Forever education resource	4
Structure of the resource	5
Inquiry Cycle	8
Example unit plan	9
Section One: The whio	
Activity 1: Meet the whio	10
1.1 Dive in and ask about whio	
Activity 2: Whio habitats	16
Activity 3: Whio adaptations	20
Activity 4: Life as a whio	24
4.1 Whio fact sheet	
4.2 Get to know the whio	
4.3 Life as a whio	
Section Two: Whio and people	
Activity 5: Whio and people	32
5.1 Genesis Energy	
5.2 Department of Conservation	
5.3 Tangata whenua	
5.4 Rafting and kayaking company	
Activity 6: Threats to whio	42
6.1 Whio graphs	
Activity 7: Visiting whio	48

Section Three: Helping whio

Activity 8: Whio in the future	54
8.1 Possible futures for whio	
Activity 9: Let's help whio	60
9.1 Brief for action	
9.2 Action plan for whio	
Appendix	
Glossary	66
Teaching strategies	67
Whio resources	69

INTRODUCTION



The whio or blue duck is one of our very special birds only found in New Zealand. It has some amazing unique characteristics and is one of only four ducks in the world living in fast-flowing rivers, surfing the rapids.

Whio is also an indicator species, so if you see it on a river you can be sure the river is clean, clear and healthy.

With fewer than 3000 left in the wild there are so many places throughout Aotearoa where you no longer find whio. So it is important to ensure the waterways where whio live are kept clean, clear and healthy. Making sure those areas are kept pest free to give the whio a fighting chance is also important.

We are all working hard to secure and protect this special duck and the places where you find them so they will be around for future generations.

One of the ways we can help is to make sure more people know and care about this specialist white water duck.

Whio Forever, a partnership between the Department of Conservation and Genesis Energy was formed to secure and recover the New Zealand whio/blue duck population. Teaching young people about this amazing duck is one of the ways to achieve this.

ABOUT THE *WHIO FOREVER* TEACHING RESOURCE

Whio Forever is an integrated curriculum teaching resource with the whio/blue duck as the real life context for learning. The resource covers multiple learning areas of the New Zealand Curriculum. It has been developed for primary school (Years 1–8) teachers.

The resource contains teaching and learning material to support a unit of work, grounded in Environmental Education for Sustainability (EEfS) themes and incorporating aspects of Te Ao Māori (a Māori worldview). The unit is based on an inquiry learning process, including student-centred, constructivist pedagogy.

What is a whio/blue duck?

Whio are grey-blue coloured ducks with spotted brown feathers on their chests. Whio live in our healthiest, fast-flowing rivers. Whio is the Te Reo Māori word for whistle. The birds were named after the loud whistling call of the males.

Why teach/learn about whio?

Whio are one of our most vulnerable New Zealand duck species. Without help from people, whio will most likely be extinct within our lifetime. The more people and communities who know about whio and are empowered to help them, the more successful whio can be in retaining and expanding their populations. These ducks are inspiring and provide a real life context for learning.

How do I use this resource?

It is intended for educators to use or adjust material in the resource to best suit their students' and community's needs. The programme can be adapted to suit a school's own inquiry model or teaching

perspectives. Timing will depend on your requirements. The unit plan following on page 9 provides an example of how the resource could be used as the basis of a teaching unit.

What will students understand by the end of the whio inquiry?

By the end of their learning inquiry, students will have a multi-faceted, deep understanding of whio, beyond just facts. They will learn about:

- **Whio ecology:** where they live, what they eat, their adaptations, and how they stay alive
- **How people are involved** with whio
- **Whio challenges:** Whio threats and how people contribute to these
- **Visiting whio:** Where to see whio and what we can learn by observing them
- **How they can act to solve an issue for whio** in their community

Other information depending on where their inquiry leads.

What is Environmental Education for Sustainability? (EEfS)

Environmental Education for Sustainability (EEfS) raises awareness of the connections between people and nature and empowers us all with the common vision, knowledge, values, practical skills and opportunities needed to create a sustainable future.

STRUCTURE OF RESOURCE

SECTION ONE The whio	SECTION TWO Whio and people	SECTION THREE Helping whio
Big idea: Whio are unique New Zealand birds with special features, adaptations and behaviours.	Big idea: People influence whio and their habitat.	Big idea: We can all contribute to a positive future for whio.
Introducing whio Habitats Adaptations and special features	How people impact on whio and their habitats. Threats to whio Visiting whio	Applying our learning to help make a difference for whio
Inquiry stages 1–3	Inquiry stages 4–5	Inquiry stages 6–9
This section relates to: Environmental Education: Learning ABOUT the environment Major learning area: Science	This section relates to: Environmental Education: Learning ABOUT and IN the environment Major learning area: Science, Social Science, Health and PE	This section relates to: Environmental Education: Learning FOR the environment Major learning area: Science, Technology and Social Science

INQUIRY LEARNING

Inquiry learning is a constructivist approach, where the student is at the centre of learning. Students form and develop a learning inquiry to investigate aspects of the topic and build a depth of understanding through questioning, thinking and research.

This teaching model incorporates a variety of thinking skills, information literacy skills and integrates well with information technology.

Working through your inquiry

NB: The learning experiences within the resource are a guide only. Teachers can adjust the activities and learning sequence to suit the needs and interests of students.

Stages in the inquiry model

Stage 1: Dive in

Introducing the topic and immersing students in the subject/context. Information is gathered about the prior knowledge of students in order to develop a unit plan which will meet their learning needs, prior experiences and interests. Key concepts are introduced to form a foundation of knowledge for a learning inquiry.

Key questions:

What do we know already?

What experiences have we had with whio?

Stage 2: Ask

Students now begin to ask questions about whio and explore their ideas. Questions can be grouped with one main 'big/essential' question and several minor questions. A big/essential question has multiple answers and is an open question, requiring extensive research to answer. This forms the foundation of the inquiry.

Key questions:

What are we wondering?/what do we want to know?

Which questions will we investigate?

Stage 3: Investigate

At this stage of the inquiry, students are investigating their questions and further exploring the topic. Their research should be driven by their interests and inquiry questions. Students can follow lines of further inquiry to find out more information from relevant sources. They begin to organise and filter information.

Key questions:

How will we answer our questions?

Which information is relevant to our inquiry?

How can we organise the information?

Stage 4: Extending thinking

At this stage of the inquiry, students are encouraged to use specific thinking skills to further explore a topic and seek a deeper understanding. Students now take the information they have gathered and begin to compare, contrast and sort. The information connects to what they already know or supports them forming new concepts. At this stage, students also look into aspects of social inquiry: values and perspectives and consider people's responses and decisions.

Key questions:

What does the information tell us?
Can we see any patterns/trends?
Do we need more information?

Stage 5: Coming to conclusions

Next, students take a holistic view of information they have gathered, compared and organised. They begin to draw conclusions. Students make decisions about the current situation for who and which issue is most engaging and relevant to them.

Key questions:

What did we find out?
What new ideas have come from this information?
What are we going to do with these new ideas?

Stage 6: Sharing our findings

Students can now share their ideas, information, conclusions and observations with a selected audience. This can be a powerful link to community and lead to collaboration and further information sharing. Sharing also helps students to consolidate their learning.

Key questions:

Who do we want to share this information with?
How can we communicate our knowledge and ideas?
What does our audience think?

Stage 7: Planning for action

Students now create a brief, outlining their action and how it will target the focus issue. Now there is a focus for action they can begin to plan how to take action for who.

Key questions:

What can we do to help this situation – what action will we take?
What issue will this address?
What will we need?/Who will help us?

Stage 8: Implementing action

Now it's time to have fun for who. Students do real work to help who and apply their learning and understanding to take action. The action should target the focus issue and aim to create a positive future for who.

Key questions:

Are we following our brief and criteria?
Is our action making a difference?

Stage 9: Review and reflect

After carrying out an environmental action students can now reflect on how it went. This may lead to further inquiry.

Key questions:

Did we do what we set out to do?
How did it go? What are the next steps?

Inquiry cycle



1. Dive in

- What do we know already?
 - What experiences have we had with who?
 - Introducing knowledge
- Reflecting and evaluating*

2. Ask

- What are we wondering?
 - Which questions will we investigate?
- Reflecting and evaluating*



3. Investigate

- Finding out more information
 - How will we answer our questions?
 - Understanding new concepts
 - Sorting and organising information
- Reflecting and evaluating*

9. Review and reflect

- How did it go?
- What did we learn?
- How did our action help?
- What are the next steps?

8. Implementing action



4. Extending thinking

- Exploring values/perspectives
 - What does the information tell us?
 - Thinking about patterns, trends
 - Do we need more information?
- Reflecting and evaluating*

Reflecting and evaluating

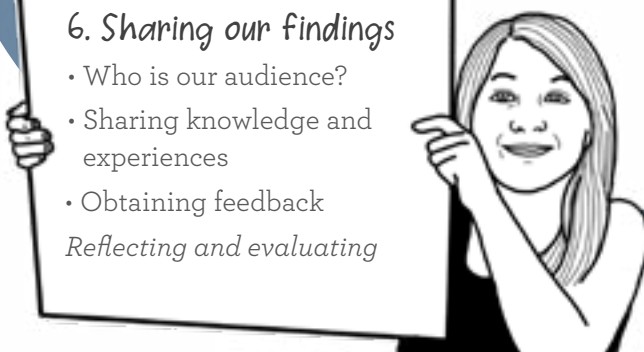


7. Planning for Action

- What can we do to help?
 - What action will we take?
 - Which issue will this address?
- Reflecting and evaluating*

6. Sharing our findings

- Who is our audience?
 - Sharing knowledge and experiences
 - Obtaining feedback
- Reflecting and evaluating*



5. Coming to conclusions

- What did we find out?
 - Problem solving/creating new ideas
 - What are we going to do with this new information?
- Reflecting and evaluating*

Reflecting and evaluating

EXAMPLE UNIT PLAN

Main ideas: Who are amazing and unique NZ ducks. They live on our pristine, fast-flowing rivers and are threatened due to habitat loss and introduced predators.	Curriculum areas: Science, Social sciences, English, Mathematics, Technology, Health.	Levels: 3–4 Years: 5–8
--	---	---

Overarching learning outcomes:

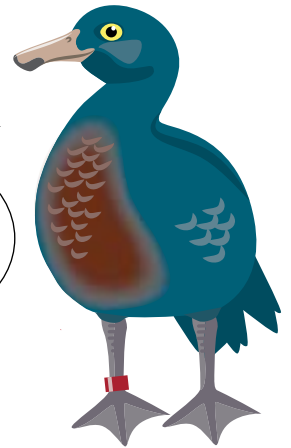
- Build knowledge and understanding of who
- Raise awareness of the current situation for who
- Understand how people are involved in who recovery
- Contribute to a positive future for who

Values	Ecological sustainability, respect, inquiry and curiosity, innovation, diversity, community and participation
Key competencies	Thinking; Using language, symbols and text; Managing self; Relating to others; Participating and contributing
Principles	Learning to learn • Cultural diversity • Community engagement • Future focus

Learning sequence	Inquiry stage/s	Curriculum links	Key concepts	Description	Suggested timing
1. Meet the who	1. <i>Dive in:</i> What do we already know? What experiences have we had? 2. <i>Ask:</i> What questions do we have?	Science: (Nature of Science, Living world: Evolution)	Who are unique NZ ducks. Introducing the key concepts for the resource	An overview touching on upcoming learning through a slideshow. Students then choose an inquiry question. Concept of whakapapa.	Week 1
2. Who habitats	3. <i>Investigate:</i> Finding out more information Understanding new concepts	Integrated curriculum areas	<i>Additional key concepts will depend on inquiry questions</i>	Students can work through an inquiry using these suggested lessons or alternative resources (see pages 69–70).	Weeks 2–6
<i>Learning through inquiry</i> Stages 1–9		Science: (Living World: Ecology)	Who live in clean, healthy, fast-flowing rivers	Suitable habitat and natural changes. Concept of Mauri (life-force). Looking at photos of various habitats to see which habitats are suitable for who.	Week 1
3. Who adaptations	3. <i>Investigate:</i> Finding out more information Understanding new concepts	Science: (Living World: Ecology, Nature of Science: Investigating in Science)	Who have adaptations which help them to survive in their habitat	Adaptations – examining how who special features help who to survive in their habitat. Experimenting with feathers, waterproofing and other structures.	Week 2
4. Life as a who	3. <i>Investigate:</i> Sorting and organising information and 4. <i>Extending thinking:</i> what does the information tell us?	Science (Nature of Science, Living world) English: (Reading, listening and viewing)	Research activity: finding out information. Who move, feed and breed to stay alive.	Breeding and life cycle. Literacy-focused research activity using science related texts.	Week 2
5. People and who	4. <i>Extending thinking:</i> Exploring values and perspectives. What does the information tell us?	Social Sciences	Groups of people influence who in different ways	Different groups of people involved with who. Exploring values and perspectives. How our actions affect who – extending inquiry to include human impacts.	Week 3
6. Threats to who	4. <i>Extending thinking:</i> Exploring patterns and trends	Social Sciences, Maths: (statistics)	Who are threatened by introduced predators, changes to their habitat and climate change	Focus on human induced threats: introduced predators, didymo, habitat loss etc.. Introducing the current situation through graphs of predators trapped, pairs and duckling survival in the Whanganui Catchment area.	Week 4
7. Visiting who	3. <i>Investigate:</i> Finding out more information. 5. <i>Coming to conclusions:</i> What did we find out? Problem solving/creating new ideas	Science: (Nature of science), Health: (Personal Health and Safety Management)	Experiential learning. We can learn more about who by observing them	How scientists find out information. How students can use scientific skills in order to gather information about who. Health and safety considerations. Planning for a visit and possible focus of visit.	Week 5
8. Who in the future	6. <i>Sharing and</i> 7. <i>Planning for action</i>	Science: (Nature of Science) Social Sciences	We can help create a positive future for who. Sharing what is happening for who	Current situation. Future-focused thinking. Striking the balance between human and ecosystem needs. Working together for who.	Week 6
9. Let's help who	8. <i>Implementing action</i> 9. <i>Review and reflect</i>	Science: (Nature of Science) Technology: (Technological practice)	Action for who and reflection on action	Action plan, examples of action. Reflecting on action and criteria.	Weeks 7–10

ACTIVITY 1:

Meet the whio



Hi, I'm a whio! Nice to meet you!

TEACHER NOTES

This learning experience introduces whio/blue ducks. These special, unique ducks only live in New Zealand (are endemic) and are an important part of fast-flowing river systems.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Investigating in Science

Build on prior experiences, working together to share and examine their own and others' knowledge

Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations

Living World: Evolution

Begin to group plants and animals into science-based classifications

Science capabilities

Interpret representations, Engage with science

Learning intentions

Students are learning to:

Share their prior knowledge and experiences of whio
Begin to ask questions about whio

Success criteria

Students can:

Record prior knowledge about whio
Ask appropriate questions about whio to develop a learning inquiry

Minor curriculum links

English: Viewing

Background information: Whio/blue ducks

What are whio/blue ducks?

Whio are also known as blue ducks. They are grey-blue coloured ducks with spotted brown feathers on their chests. Their bills are white. On the sides of the bill are fleshy lips to withstand scraping insects off rocks in the water. Whio live in our healthiest, fast-flowing rivers.

They are **endemic**: they live only in New Zealand. New Zealand is home to five other endemic ducks and 12 other species of ducks. Whio is the Te Reo Māori word for whistle. The birds were named after the loud whistling calls of the males. For more information about the difference between endemic, native and introduced animals see:

<http://sciencelearn.org.nz/Science-Stories/Conserving-Native-Birds/Endemic-native-or-introduced>

Why are whio important?

Whio are an important part of fast-flowing river ecosystems. Māori understood the importance of whio and saw whio as a sign of river health. Whio are an 'indicator species' (their presence indicates a river is very

healthy). You can tell what is going on with a river – its water quality, insect life, and structure, from the number of whio found there.

Three of the six existing New Zealand endemic ducks are threatened or endangered. Whio are the only endemic ducks to live all year round on fast-flowing rivers and are one of the most threatened species of duck in the world. They are the only living member of their group (genus: *Hymenolaimus*) and are not closely related to other ducks.

These unique ducks are near the top of the food web in a river ecosystem and therefore play an important part in keeping the populations of other animals and plants in balance.

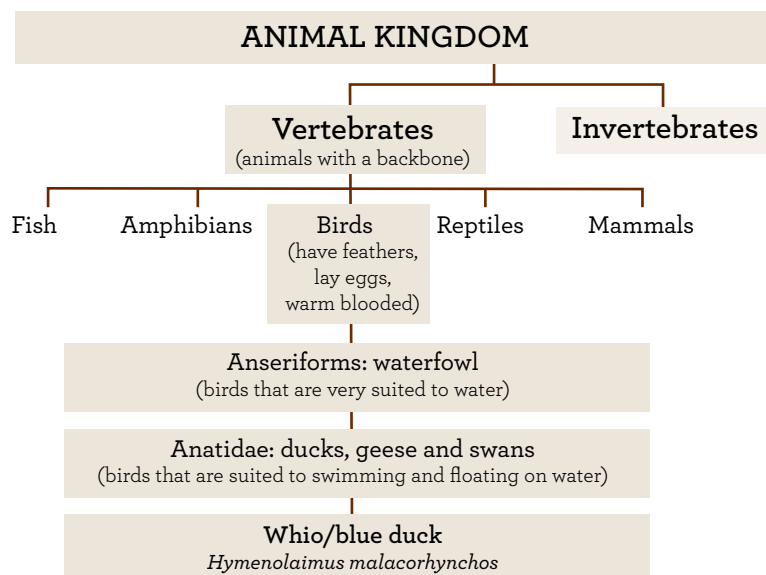
What is whakapapa?

Whakapapa is genealogy or a foundation in Te Ao Māori (a Māori world view). Whakapapa is about the connections of people to other living things and the wider world. Through whakapapa, ancestry can be traced through the past, right back to the beginning of creation: to Ranginui – the sky father and Papatūānuku – the earth mother. From Ranginui and Papatūānuku came their children, the atua (supernatural beings who existed before humans). Tāne Mahuta is the atua who created trees and animals before he created people. Animals and plants are also included in whakapapa traditions. In this way of seeing the world, all plants, animals and people are ultimately connected to each other and the environment.

Whakapapa is also a way of classifying animals and plants for Māori. When whakapapa are recited they are often based on a similar structure to the classification diagram below.

How are whio classified in a scientific classification system?

Whio are a type of waterfowl – birds that live on water. They belong to the family ‘Anatidae’ which includes all other ducks as well as geese and swans. They are the only remaining member of the genus *Hymenolaimus* – an ancient species of duck which evolved in New Zealand.



What is an ecosystem?

An ecosystem is a community of plants, animals, other life forms and the environment, living together and interacting with each other.

ACTIVITY 1:

Meet the whio



STUDENT LEARNING EXPERIENCE – MEET THE WHIO

Focus questions:	Resources needed:
What is a whio?	Whio/blue duck slideshow: http://www.doc.govt.nz/documents/conservation/native-animals/birds/whio/whio-blue-duck.pptx
What do I already know about whio?	Meet the locals: whio/blue duck video clip: http://www.whioforever.co.nz/world-of-whio/videos?page=1#1 Scroll to the 'Meet the locals' video clip
What do I want to know next?	Whakapapa and biodiversity: http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Sci-Media/Video/Whakapapa-and-biodiversity
	1.1 Dive in and ask about whio



Suggested learning sequence:

Introducing whio

- Introduce the whio/blue duck through the *Whio/blue duck slideshow* (see resources above).
- Use photos from the slideshow to discuss how whio are different from other ducks: e.g. whio have a blue-grey colour for camouflage in remote rivers. Their bills are white – unlike other ducks.
- Share experiences of meeting whio and/or other ducks. What can you infer from these experiences/lack of experiences? Whio are endangered (nationally vulnerable) ducks who only live in our cleanest, fast-flowing rivers. Depending on your location, students are unlikely to have seen them in the wild. Originally whio lived in rivers throughout New Zealand but have been displaced from much of their natural habitat because of human-induced changes to the environment.

How do we classify whio?

How are animals like the whio grouped by scientists? View the classification diagram (slides 5 and 6 in the whio slideshow). How are whio related to other animals? Whio are birds. They are the only living member of the genus *Hymenolaimus* and are not closely related to other ducks. Scientists classify animals so they can learn more about them and their relationships to each other.

Whakapapa

Māori have many links to the whio – cultural, spiritual and historical. They have their own system of classification and recording ancestry (family history) called *whakapapa*. What do students understand by the term *whakapapa*? How does this relate to biodiversity? (see teacher notes).

Explain whio are connected to people and other animals through whakapapa. Biodiversity is the variety of living things. All living things are connected through ecosystems, ancestry and whakapapa.

Reflecting on knowledge and starting a learning inquiry

- Use 1.1 *Dive in and ask about whio* to record students' knowledge and questions.
- Share ideas about what students would like to find out next about whio. Use students' questions as a basis for starting a learning inquiry.
- Decide on a shared inquiry question to guide the learning inquiry. Students could also individually or collectively research additional inquiry questions.
- Show students the integrated inquiry cycle and discuss the inquiry process (see introduction pages 6–8). Inquiry cycle poster <http://www.doc.govt.nz/documents/conservation/native-animals/birds/whio/whio-inquiry-cycle-a3-poster.pdf>

Extending learning

How is everything connected? View this clip about whakapapa and biodiversity as a starter for discussion around the interconnectedness of living things from both a scientific and a Māori perspective:

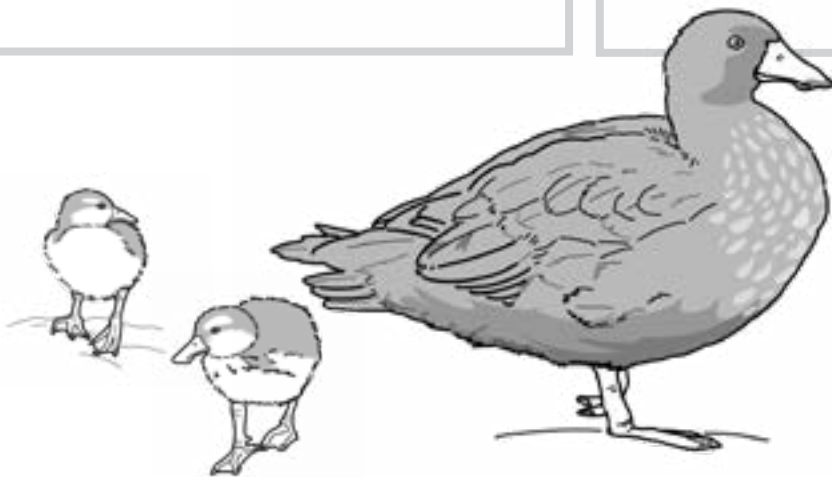
[http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Sci-Media/Video/Whakapapa-and-biodiversity/\(quality\)/mp4](http://sciencelearn.org.nz/Contexts/Toku-Awa-Koiora/Sci-Media/Video/Whakapapa-and-biodiversity/(quality)/mp4)

1.1 Dive in and ask about whio

I know:

Whio ...

Whio ...



Why are whio important?

What do I want to find out about whio?



ACTIVITY 2:

Whio habitats



TEACHER NOTES

This learning experience introduces students to the habitat of whio/blue ducks: high quality New Zealand rivers.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Investigating in Science

Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations

Living World: Ecology

Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

Science capabilities

Gather and interpret data, Interpret representations

Learning intentions

Students are learning to:

Identify habitat suitable for whio, where they will meet their needs
Explain how changes to their environment affect whio

Success criteria

Students can:

List requirements of whio habitat
Decide which habitats are suitable for whio
Discuss how changes to their habitat affect whio

Minor curriculum links

English: Viewing

Background information: Whio habitats

What is habitat?

A habitat is a place where a plant or animal normally lives.

Where do whio live?

Whio live in our cleanest, healthiest rivers. They can handle white-water conditions and are able to surf the rapids. Whio need stable river banks to nest in and forest around them. These vulnerable ducks can't survive in areas where there is farming or development close to the river because this degrades the water quality. They need rivers that are clear and free from mud, where the water flows quickly over rocks and boulders. Aquatic invertebrates (insect larvae living in the water) are the main food of whio and are only found in high quality rivers and streams. Wild whio live in various locations around the central North Island, for example; Tongariro, Whanganui, Taranaki, the Ruahines, Whirinaki and the Te Ureweras. In the South Island they are found in multiple locations, including Kahurangi National Park, Arthur's Pass, the West Coast and Fiordland.

List of requirements for whio habitat

Whio need:

- Fresh, cool, fast-flowing water
- Safe habitat: rocky bottomed rivers/ streams
- Rivers/streams lined with forest
- Food: lots of different aquatic invertebrates (insect larvae) to eat
- Clean and clear river water (not polluted or muddy)

They also require clean air to breathe and space to move and nest.



What is mauri?

Mauri is the essence or life-force which is present in all things. Mauri connects the environment, living things and other objects. We cannot see mauri but we can feel it. In an area where the mauri is strong, a place would look and feel vibrant, energised and healthy with plenty of life. When the mauri is weak, a place would have few living things and may look and feel degraded, uninviting or unhealthy.

What natural changes can affect whio habitat?

Heavy rain and floods can wash away whio nests and ducklings. High flows can also wash insect larvae (whio food) downstream. Storms can make it difficult for whio to keep warm and feed. Natural disasters can also change whio habitat. Volcanic eruptions can turn rivers a milky colour and make whio food less available.

Differences between a mallard and a whio

Colour:	The male mallard is brightly coloured green on the head, with a grey and brown body (pictured top right is a male). Females have no green on the head.	 <p>Photo: Dick Veitch</p>
	The whio is blue-grey in colour with a brown speckled chest (pictured lower right).	
Feet and legs:	Mallard: Feet and legs are orange. They are thick, making them strong swimmers. The legs are under the middle of the bird – a feature of dabbling ducks who flip up to feed.	 <p>Photo: Bubs Smith</p>
	Whio: Feet and legs are thinner and grey-ish. Their legs are set back compared to their bodies which makes them suited to diving.	
Bodies:	Mallard: the body is bulky and rounded, good for buoyancy, not as streamlined as the whio.	
	Whio: the body is sleek and streamlined for minimal resistance in the water.	
Bills:	Whio bill is white and has rubbery lips on sides for protection when feeding (scraping insect larvae off rocks). These larvae are a large proportion of their diet.	
	Mallards don't need these tough lips as they don't need to scrape insect larvae off rocks with their bills as often as whio, they have a more varied diet.	

These concepts will be further explored in the next lesson.

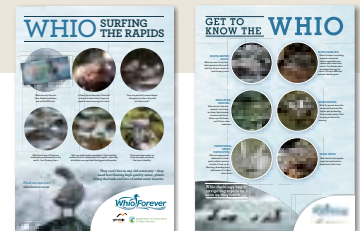
ACTIVITY 2:

Whio habitats



STUDENT LEARNING EXPERIENCE – WHIO HABITATS

Focus questions:	Resources needed:
What kinds of habitat are suitable for whio?	Whio facts poster: Whio surf the rapids http://www.whioforever.co.nz/wp-content/uploads/2016/01/Whio-Surfing-the-Rapids.pdf
How do they respond to changes in their environment?	Get to know the whio poster http://www.whioforever.co.nz/wp-content/uploads/2016/01/Get-to-Know-the-Whio.pdf DigiStore: R80685 Water: A river for blue duck and R80492 Biodiversity: Oparara Rainforest http://digistore.tki.org.nz/ Whio habitat slideshow: http://www.doc.govt.nz/documents/conservation/native-animals/birds/whio/whio-habitats.pptx Whio habitats Kahoot!: https://play.kahoot.it/#/k/bb516705-23ae-46d8-9725-c49105abad3c



Suggested learning sequence:

What is a habitat?

What is a habitat? Students can think about their ideas and then share with a partner.

Re-group and form a definition of habitat together (*see teacher notes*)

What is suitable whio habitat?

- View DigiStore: R80685 Water: A river for blue duck and R80492 Biodiversity: Oparara Rainforest <http://digistore.tki.org.nz/> (these are also LEARNZ 2009 resources) and ask students to look out for what they notice about whio habitat.
- Alternatively/additionally view the whio facts poster: Whio surf the rapids (*see resources above*)
- What do the pictures on the poster and videos show us about whio habitat? They show a white water river environment with forest/plants next to the stream. The water looks fast-flowing. Even the chicks swim in this challenging, changeable habitat.
- Ask students to make a list of requirements/needs of whio. Compare lists. Agree on a shared list of whio habitat needs to refer to later (*see teacher notes*).
- View the *Whio habitat slideshow*. Stop at each slide. Ask students: Would this habitat be suitable for whio? Will it meet the needs of whio? Ask students to vote 'yes' or 'no' and then explain why the habitat is or is not suitable for whio (*see notes in slideshow*).

- View ducks and their habitats (slide 11 in the *Whio habitat slideshow*). Compare the mallard duck and the whio and notice their differences in their body parts and habitats. Try to guess how their differences in colour and shape help them in their different habitats and for their different lifestyles (see *teacher notes*).

Mauri

What is mauri? (see *teacher notes*). Is the mauri strong or weak in each photo in the habitat slideshow? Discuss how students might be able to tell.

Territories

How much space do whio need? Students could look at poster: *Get to know the whio* (see *resources*) and find information about how whio defend their territory and how big territories are.

Whio are very territorial. They will fight for territory. The space they need depends on the habitat they are in and how much food is there. Usually they have about one kilometre territories.

Where do whio live?

- Look at the Whio Forever website: find a whio <http://www.whioforever.co.nz/about-the-whio/find-a-whio> to find your nearest wild whio population. Why is this location suitable for wild whio? (Refer to the whio habitat requirements list you made earlier).
- What changes have occurred in your local environment over time could have affected whio habitat?
- Where is the nearest captive whio population? (Make a note of these locations for later in the unit – Activity 7).

Reflecting on knowledge

Share ideas about where wild whio live and why they live in those habitats.

Try the *Whio habitats Kahoot!* (an online, interactive quiz) to assess students' learning:

<https://play.kahoot.it/#/k/bb516705-23ae-46d8-9725-c49105abad3c>

Extending learning

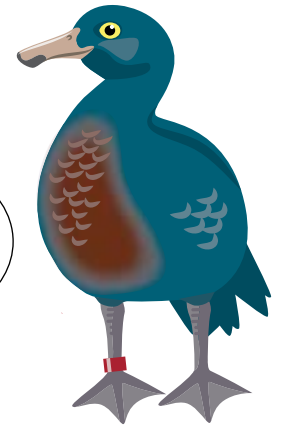
- What natural events in a habitat could affect whio? Students could use websites and books to find out about natural changes and challenges in whio habitat. Discuss how these changes could affect whio.
- Look into the history of your area and find out if whio ever lived in your neighbourhood. What changes to the land over time have made it suitable/unsuitable as a habitat for whio, native birds and other animals?



Photo: Bubs Smith

ACTIVITY 3:

Whio adaptations



Let's learn about whio adaptations

TEACHER NOTES

This learning experience introduces students to whio special features (adaptations) which help them to survive in a fast-flowing river habitat.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Investigating in Science

Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations

Living World: Ecology

Explain how living things are suited to their particular habitat

Science capabilities

Gather and interpret data, Use evidence

Learning intentions

Students are learning to:

Identify special features and adaptations of whio
Explain how adaptations help whio to live and survive in their habitat

Success criteria

Students can:

Draw a whio and label several adaptations
Create models of whio body parts and describe how these structures help whio survive in fast water

Minor curriculum links

Technology, Visual art

Background information: Whio adaptations

What are adaptations?

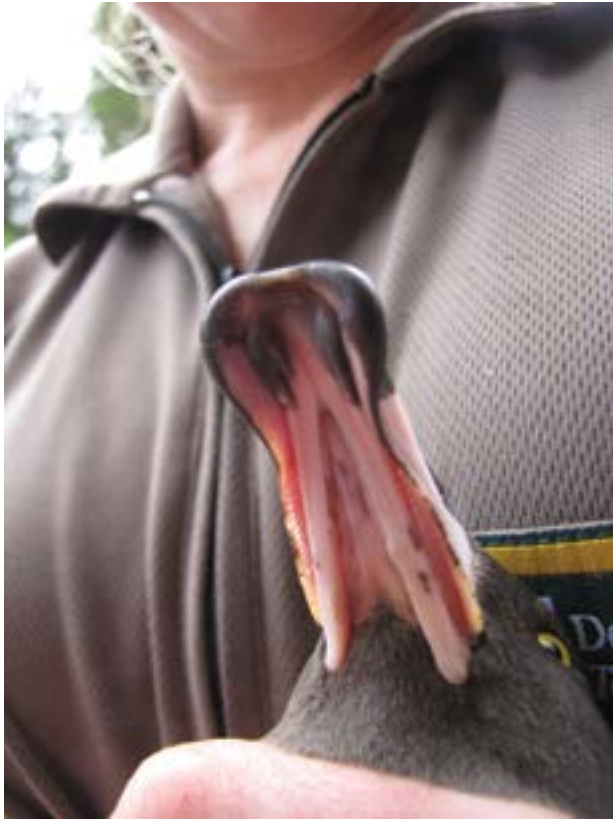
Adaptations are features animals or plants have evolved, to enable them to live in a particular habitat. Animals have evolved over time to live in different areas – on land, in rivers and at sea. Our native birds have evolved special adaptations to cope with their New Zealand conditions and to access different food sources. Whio have both physical and behavioural adaptations. This activity examines only their physical adaptations.

What physical adaptations do whio have?

- Large webbed feet: for easy swimming. The feet can also fold back like an umbrella to reduce drag
- Waterproof feathers: to keep warm and dry (Waterproof feathers have an oily coating to repel water. They must be preened to keep resisting water)
- Blue-grey colour: for camouflage among the river rocks and water
- Designer lips/soft bill flaps: The rubbery flaps protect the bill while helping to scrape the insect larvae off rocks like spatulas
- Streamlined body: so water runs easily off whio and they can swim and dive well
- Downy feathers underneath outside feathers: for warmth
- Forward facing eyes: for hunting aquatic insects/bugs.

Why do who need adaptations?

Adaptations help animals to cope with the conditions of their environment. Who are adapted for life in fast flowing rivers. These adaptations help them to thrive in the strong currents and unpredictable flows of rivers.



Photos: Bubs Smith



ACTIVITY 3:

Whio adaptations



STUDENT LEARNING EXPERIENCE – WHIO ADAPTATIONS

Focus questions:	Resources needed:
What special features/adaptations do whio have?	Meet the locals: Whio tastic (4:08) https://www.youtube.com/watch?v=Ho_XXeuux_A
How are they suited to their environment?	Special features slideshow: http://www.doc.govt.nz/documents/conservation/native-animals/birds/whio/whio-special-features.pptx Poster: Meet the whio http://www.doc.govt.nz/Documents/conservation/native-animals/birds/whio/whio-meet-the-whio-a3-poster.pdf



Suggested learning sequence:

What are adaptations?

Share ideas about special features/adaptations. Explain what an adaptation is (*see teacher notes*).

Whio adaptations

- Watch *Meet the locals: Whio tastic* (4:08) and ask students to listen for information about whio adaptations.
- View the poster: *Meet the whio* (*see resources above*).
- Using information from the video clip and the poster, ask students to share examples of adaptations of whio which help to make them suited to their environment/habitat.
- Examine the *Special features slideshow* to learn more about some of the whio's special features/adaptations (*see link above*).

Investigating adaptations

- Students could choose to investigate one of these whio adaptations:
- **Waterproof feathers:** Collect real feathers from a variety of sources and experiment with how well they repel water. Can students find any similarities between feathers that repel water? Which feathers are the most/least waterproof?
- **Webbed feet:** Students could make a model of a whio webbed foot using pipe cleaners, plastics and other materials. Experiment with different shapes, structures and amounts of webbing. Test models in water to see how they function. Which would be most suited to a fast-flowing river habitat?

- **Bill:** Students could use plasticine, pipe cleaners, old spatulas or putty to create models of whio bills. Test the strength of their models by pressing them against hard objects. Which were the strongest models? Why? How do whio bills work?
- Students can then share their ideas about how these adaptations help whio to survive in fast-flowing rivers.

Reflecting on knowledge

- What have students discovered about how whio are suited to their environment? Why do whio need adaptations? *For teachers:* What further learning (if any) do individuals need around adaptations?
- Students could then draw or make a model of a whio and label its adaptations as an assessment activity.

Extending learning

- Challenge students to design a fictional bird with features that would make it even more suited to a fast-flowing river environment.
- Further investigate an adaptation of your choice, e.g: why birds preen their feathers.

MEET THE WHIO

What's one of our rarest birds, has a very unusual bill and appears on the \$10 note?



It's the whio - a feisty, rapid-running, aquatic acrobat that's commonly known as the blue duck (*Hymenolaimus malacorhynchos*) - and there are only around 2500 left in the wild.

This little bird is one of our national, ancient treasures; it has a host of amazing adaptations which have seen it survive in environments other ducks wouldn't shake a feather at - New Zealand's fast flowing rivers.

Once found throughout the country, whio are now mainly found in Te Urewera, the Central North Island, Fiordland, the West Coast and northern parts of the South Island. And, wherever you find whio, you know the river they're living on is clean as whio only live on healthy waterways.

WHAT'S UNIQUE ABOUT THE WHIO?



Camouflage

The whio's blue-grey feathers give them the 'blue' duck name, but they also have a very important function - camouflage. They help whio blend in to their river environments and hide from avian predators. They are nick-named 'ghost ducks' by Maori because they are often heard, but not seen.



Designer lips

The whio bill has been designed like no other. It has the black rubbery lip at the end that works like a bumper-bar, protecting it from wear as it bounces over rocks searching for food. It also has filters like those of a baleen whale enabling it to extract aquatic invertebrates from the water.



Navigation

Whio are nimble navigators with large webbed feet that act like flippers in the water. Even newly-hatched ducklings have the large feet for paddling against the fast current; they fold back like an umbrella to reduce drag when moving quickly downstream.



Eyes Forward

The whio have very distinctive yellow eyes that are forward-facing like humans so they can see what's happening ahead.



Size

Adult males weigh in at about 1000-1300 grams - that's about two packs of butter - with the females slightly lighter at 800-1000 grams.



Call & character

Adult males make a distinctive 'fee-o, fee-o' call that gives the bird their name. Female whio make a rattly growling noise.

When walking in certain areas, you might be lucky enough to encounter a whio, especially in the early morning or late evening when they are most active.

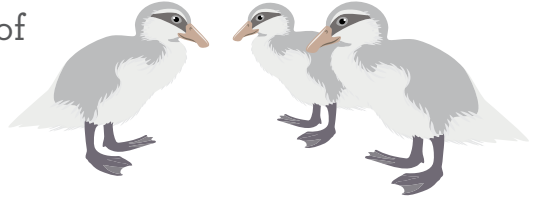


ACTIVITY 4:

Life as a whio



Did you ever wonder what life is like for a whio? Let's find out!



TEACHER NOTES

This learning experience explores the life processes of whio/blue ducks – how they feed, breed and move in unique ways.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Investigating in Science

Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations

Living World: Life processes

Recognise that there are life processes common to all living things and that these occur in different ways

Science capabilities

Use evidence, Interpret representations

Learning intentions

Students are learning to:

Find information about the life processes (feeding, breeding, movement) of whio
Select relevant information from a range of sources to better understand the life of a whio. Present this new learning to others

Minor curriculum links

English: Writing and presenting

Success criteria

Students can:

Find information about whio from texts/other sources
Express their learning/new understanding about the life of a whio in an interesting presentation format

Background information: Life as a whio

Where do whio nest?

Whio nest close to where they feed and socialise, on fast-flowing rivers. The nests are varied: some are close to the river, others quite raised up from it. You can find whio nests high on river banks, on islands in the river, in caves, and under bushes.

Breeding

Breeding is reproducing or having babies. For a whio, life starts as an egg. The egg hatches after about 35 days. The female whio sits on the 4–9 eggs until they hatch. The male stands guard. Usually between 4–6 chicks will successfully hatch. The parents work hard to look after the chicks for about 80 days, when they are ready to fledge (leave their parents).

Moulting

Every year, when breeding has finished, adult whio moult. Moulting means they lose a lot of feathers and replace them with new ones. During this time, whio are vulnerable because they cannot fly. They hide away in small side streams or in caves, only coming out to feed at sunrise or sunset.

Feeding

Whio like to eat mayfly, stonefly, and caddisfly (types of insect) larvae. They scrape these off rocks using their rubbery lips. They also eat biofilm off the rocks (their greens), and other insects including freshwater snails.

Growing up

Chicks must leave their parents at about 11-12 weeks old. The young whio often flock together at this stage. Then males start to find their own territories and find a mate. They will defend the territory and breed there. There are fewer females as they are vulnerable to predators during nesting season.

Research and information literacy

This learning experience is designed to encourage the skills of sorting, finding and recording relevant information. Students need to begin to ask their own questions and extend their own learning. They are encouraged to look for information from a variety of sources: books, web-based material and journals.



Photo: Bubs Smith

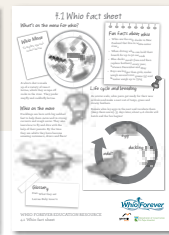
ACTIVITY 4:

Life as a whio



STUDENT LEARNING EXPERIENCE – LIFE AS A WHIO

Focus questions:	Resources needed:
What is life like for a whio?	<p>The whio year poster http://www.whioforever.co.nz/wp-content/uploads/2016/01/The-Whio-Year.pdf</p> <p>Whio facts poster: Get to know the whio http://www.whioforever.co.nz/wp-content/uploads/2016/01/Get-to-Know-the-Whio.pdf</p> <p>4.1 Whio fact sheet</p> <p>4.3 Life as a whio</p>



Suggested learning sequence:

Reflecting on your learning inquiry

- Review 1.1 Dive in and ask about whio and your inquiry questions. Which questions/parts of the question have you answered?
- Discuss and record ideas about how the remaining questions could be answered. Have other questions come up for students? Use the resource activities where appropriate or seek out other sources of information to find answers to these questions (see whio resources pages 69-70).

What would life be like as a whio?

- What would it be like to be a whio? Ask students to share ideas.
- Introduce the vocabulary: breeding, feeding and moving. (see teacher notes). These are known as ‘life processes’ and are unique for each animal.
- Using the resources provided, (4.1 Whio fact sheet, The whio year poster, and the Whio facts poster: Get to know the whio), students can work in groups to find information about the life processes of whio. They can record the information on 4.3 Life as a whio.
- Students can then use their notes on 4.3 Life as a whio as a reference to create a slideshow, poster, book, blog post, website story, newsletter update or presentation to reflect their learning.
- After viewing each other’s work – what can you infer from the information gathered so far? Do you have new questions? Do you need more information?
- Perform or publish their slideshow, poster, book, blog post, website story, newsletter update or presentation to an audience. Seek feedback and make changes. This is an opportunity for teachers and students to share their knowledge and understandings with a range of audiences and through a range of media.

Reflecting on knowledge

- What have students learnt about whio? What does this information tell you? How has this changed your thinking?
- How is life for whio different to other ducks? (whio live in a more challenging, changeable habitat than most other ducks).

Extending learning

- Will the knowledge we have about whio ever change? Yes it will, scientists are constantly finding out more about whio and their knowledge changes over time.
- View <http://sciencelearn.org.nz/Contexts/Saving-Reptiles-and-Amphibians/Sci-Media/Video/Fat-skink-thin-skink> to learn about how changing the diet of captive reptiles can influence their survival in the wild. How could this research relate to whio? This could influence the amount of food given to captive whio before their release into the wild.

THE WHIO YEAR



APRIL – JULY	AUGUST	SEPTEMBER	OCTOBER
<p><i>Time for romance – whio start looking for a mate, find their match and settle down.</i></p>	<p><i>Time to find a piece of paradise, build a nest and breed.</i></p>	<p><i>Female whio sit on their eggs for around 30 days while their mate stands guard.</i></p>	<p><i>Excitement the ducklings are hatching.</i></p>
			
NOV – DEC	JANUARY	FEBRUARY	MARCH
<p><i>The whio family hangs out for about 80 days from birth to fledgling when the young whio start to find their wings.</i></p>	<p><i>Teenage whio fledge and leave the nest. Adult whio are now vulnerable as they start to moult.</i></p>	<p><i>Time to release WHIOWE (captive breed) fledglings back into the wild.</i></p>	<p><i>WHIO-AWARENESS MONTH Time to let people know about whio – lots of whio activity including Whio Family fun days at Auckland Zoo.</i></p>
			

4.1 Whio fact sheet

What's on the menu for whio?

Whio Menu

Tonight's special:
insect larvae



A whio's diet is made up of a variety of insect larvae, which they scrape off rocks in the river. They prefer mayfly and caddisfly larvae.

Whio on the move

Ducklings are born with big webbed feet to help them swim well in strong currents and rough water. They also learn how to fly and dive with the help of their parents. By the time they are adults they have become amazing swimmers, divers and fliers!



Glossary

Diet: What they eat

Larvae: Baby insects

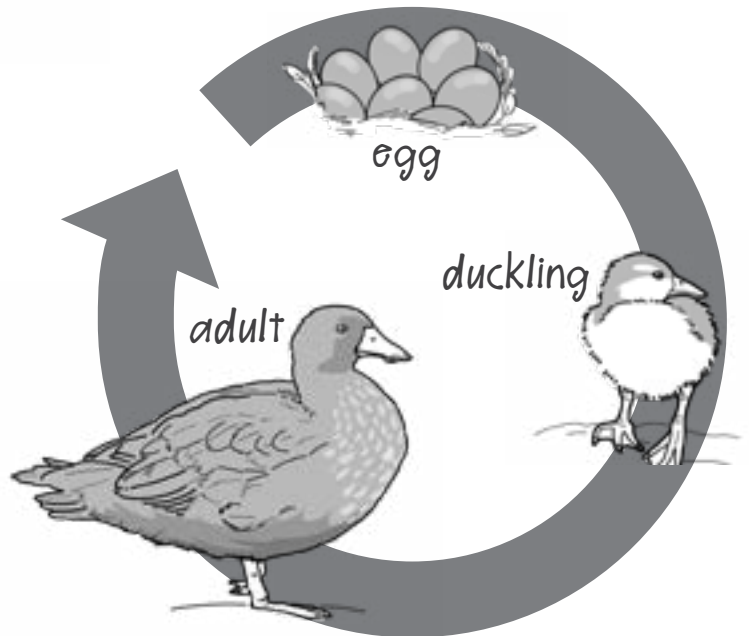
Fun facts about whio

- Whio are the only ducks in New Zealand that live in white-water rivers
- When diving, whio can hold their breath for up to 90 seconds
- Blue ducks moult (lose and then replace feathers) every year, between December and May
- Boys are bigger than girls; males weigh around 1000 grams (g) and females weigh up to 750 g.

Life cycle and breeding

As winter ends, whio pairs get ready for their new arrivals and make a nest out of twigs, grass and downy feathers.

Female whio lay eggs in the nest and incubate them (keep them warm). 35 days later, about 4-6 chicks will hatch and the fun begins!



Whio Forever

GET TO KNOW THE

WHIO

WHITE-WATER DUCK

Whio are one of only four duck species in the world who live all year round on fast-flowing rivers.



WHIO FAMILIES

When it comes to nesting, logjams, caves and dense vegetation are where whio make their nests. The female whio incubates the egg for about 35 days while her partner stands guard.



INDICATOR SPECIES

Whio are an 'indicator species', only living on clean, fast-running streams and rivers. Where you find whio, you'll find a clean waterway.



WHIO PATROL

Whio fly up and down the stream at low levels like fighter jets protecting their borders early in the morning or late in the evening.



TERRITORIAL (WHIO FISTICUFFS)

Whio are aggressive defenders of their patch, which can be a stretch of river up to 3km long. Breeding pairs will chase off or fight other ducks



WHIO FOOD

Whio feed on the aquatic insect larvae found on the rocks in their river.



Whio ducklings begin navigating rapids as soon as they hatch.



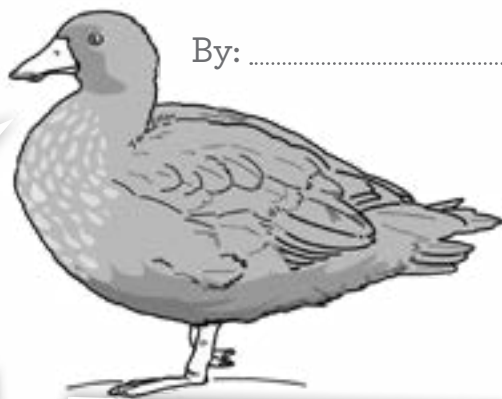
Whio Forever



Department of Conservation
Te Papa Ihaka

4.3 Life as a whio

Make notes or draw pictures about how whio live, move, breed and feed. Use your notes to help you plan a presentation to share information about how whio live



By:

How do whio move?

Breeding

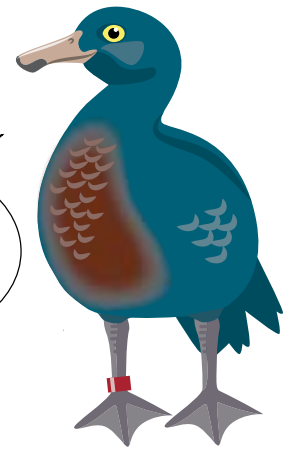
Feeding

Other notes



ACTIVITY 5:

Whio and people



Let's find out how people help whio

TEACHER NOTES

This learning experience investigates how different groups of people help whio in different ways, according to their values and roles.

Curriculum links

Achievement objectives

Social Sciences: Levels 3 and 4

Understand how people make decisions about access to and use of resources (L3)

Understand how formal and informal groups make decisions which influence communities (L4)

Science capabilities

Use evidence, Interpret representations, Engage with science

Learning intentions

Students are learning to:

Investigate how and why different groups of people are helping whio

Success criteria

Students can:

Explain how groups of people are involved in whio recovery
Identify why they are helping whio

Minor curriculum links

English: Reading

Background information: Whio and people

How are people involved with whio?

Many groups of people are involved in helping to save our unique whio in New Zealand. Trampers, kayakers, rafters and other river users sometimes encounter whio in the wild. Groups such as DOC, Genesis Energy, zoos and wildlife sanctuaries, kayaking/rafting companies, tangata whenua and environmental organisations are helping whio to survive and thrive in the wild.

Why do people need to help whio?

Without help from people the whio could easily become extinct – probably within our lifetimes. There are fewer than 3000 whio left in the wild and they are vulnerable to many threats, especially introduced predators. The habitats available to whio have decreased as time goes on and they have been forced to move to less accessible rivers, often high in the mountains. Whio cannot be moved to offshore islands like many of our other native birds because they need the fast-flowing rivers that only exist on the mainland.

What is a role?

A role is the part a person or group of people play in a situation.

What are values?

Values are deeply held beliefs about what is important or desirable. We can tell a lot about the values of people by the way they speak, behave and act.

The key values identified in the NZ Curriculum are: excellence, innovation, curiosity and inquiry, diversity, equity, community and participation, ecological sustainability, integrity, and respect. For more information about values in schools see: <http://nzcurriculum.tki.org.nz/Curriculum-stories/Media-gallery/Vision-and-values>

Te Ao Māori and whio

Māori are regarded as *tangata whenua*: this can be loosely translated to ‘people of the land’. Tangata whenua are tied to the land in many ways: through birth, whakapapa and ancestral links, spirituality and other relationships.

In Te Ao Māori (a Māori worldview) all of the natural world is seen as being connected. People, animals, plants and the environment are connected through mauri – a life force that exists in all living things. These things are also interconnected through whakapapa (genealogy/ancestry). In whakapapa traditions even natural features such as rivers are tūpuna/ancestors. Whio are part of this web of connections to the river and to people.

Early Māori named places after whio – e.g. Kapuawhio stream flows into a tributary of the Tongariro River. It was named Kapuawhio because it was high up in the mountains and was often enveloped in clouds (kapua) and there were many whio there.

Whio were treasured as a taonga by many tribes. Traditionally some tribes harvested the first clutch of whio eggs at certain times. In the past, during hard times, they would take adult whio for food and then use their feathers as swabs and skin for bandages.

Whio are children of Tāne Mahuta (Atua of the forest)

For more information see: www.teara.govt.nz/en/papatuanuku-the-land

How are people working together for whio?

NB: The groups of people given in this example are helping whio in the central North Island. There are many other groups of wonderful people working for whio around the country. For more information on groups working for whio around New Zealand see: <http://www.whioforever.co.nz/get-involved/friends-of-whio>.

Genesis Energy and DOC work collaboratively with other groups to ensure whio survive in the central North Island.

Central North Island Blue Duck Trust

This trust was set up in 2000 as part of a package to offset the effects of the Tongariro Power Scheme. Members include Genesis Energy, the Department of Conservation (DOC) and the Royal Forest & Bird Protection Society Incorporated (Forest and Bird). The trust works to enhance, protect and promote whio populations and habitat.

Blue Duck Project Charitable Trust

Garth Oaken of Tongariro River Rafting and Craig Morey of Parklands Motel set up this trust to protect whio on the Tongariro River. They set traps alongside the river from the Poutu intake to Turangi township. The rafting company regularly monitors traps and works with DOC to maintain them.

Tangata whenua: Ngāti Tūwharetoa (Tangata whenua in the Tongariro area)

Ngāti Tūwharetoa – Genesis Energy Committee

This committee helps to fund projects that will benefit the people and the land around the Tongariro Power Scheme. These are often environmental and cultural projects involving waterways and whio habitat.

Ngāti Hikairo

Ngāti Hikairo, a hapū (subtribe of Ngāti Tūwharetoa) are mana whenua within the Tongariro Forest Conservation Area which is situated on the western side of Tongariro National Park. As whio are a highly valued species to Ngāti Hikairo, they are committed to a collaborative approach with the Department of Conservation to control pests within the 22,000 hectare Tongariro Forest Conservation area. Ngāti Hikairo have installed up to 400 Henry A24 traps along the Whanganui River to compliment the trapping project carried out by the Department of Conservation to control pest such as rodents and mustelids.

Other hapū and iwi:

Tribes such as Ngāti Rangī, Te Atihaunuiā-Rangī and other hapū and iwi are making valuable contributions to whio projects and pest control efforts around the central North Island.

ACTIVITY 5:

Whio and people



STUDENT LEARNING EXPERIENCE – WHIO AND PEOPLE

Focus questions:	Resources needed:
How are groups of people involved with whio?	<p>Whio forever videos: Captive breeding (3:20) http://www.whioforever.co.nz/world-of-whio/videos?page=2 Scroll to 'Captive breeding' video clip</p> <p>The whio forever project (3:12) http://www.whioforever.co.nz/world-of-whio/videos?page=2#5 Scroll to 'The whio forever project' video clip</p> <p>Whio facts poster: Giving the whio a fighting chance http://www.whioforever.co.nz/wp-content/uploads/2016/01/Giving-the-Whio-A-Fighting-Chance.pdf</p> <p>Groups of people and whio PDFs:</p> <ul style="list-style-type: none">5.1 Genesis Energy5.2 DOC5.3 Tangata whenua5.4 Kayaking and rafting company



Suggested learning sequence:

People, rivers and whio

- Re-visit your inquiry question(s). If relevant to your inquiry, use this learning experience to further investigate how people are involved with whio.
- What activities do students enjoy doing in/around rivers and streams? Students can share their ideas through 3-2-1 sharing strategy – see pages 67-68: teaching strategies
 - Each student shares with a partner:
 - 3 things they like doing around/in rivers and streams
 - 2 ideas about how being close to rivers and streams makes them feel, and
 - 1 idea about how these activities on or near rivers or streams could affect whio (if they lived there)?
- Watch Whio Forever videos: *Captive breeding* (3:20) and/or *The Whio Forever project* (3:12)
- During viewing, ask students to listen for information about how people are involved with whio. Which groups of people are described in *The whio forever project*? DOC, Genesis and volunteers.
 - What are the different groups doing to help whio? (see teacher notes).
 - What is captive breeding and why is it necessary? Chicks are very vulnerable to threats such as stoats and floods. With captive breeding they have a much higher chance of survival.
 - Why do whio need help from people? (see teacher notes).
- View the poster *Whio facts poster: Giving our whio a fighting chance* for other ideas about why people need to help whio to ensure their survival.

- How are other groups of people involved with whio? (see *teacher notes*).

Roles and values

- What are roles and values? (see *teacher notes*).
- Discuss the role of the teacher and the role of the student in a classroom. How do these roles compare to the roles of Principal and parents?
- What kinds of roles do groups of people have for whio and when working on the river?

Thinking about groups of people and their actions

- There are many examples of groups of people interacting with each other, whose decisions affect whio. One possible context for discussion is a river which is used for power generation. The resources provided are based around central North Island rivers such as Tongariro and the people who influence them.
- NB: Students could instead find out about groups working with whio/rivers in their local area. These are fictional examples and are not the views of the groups described.
- Use *Groups of people and whio/PDFs* to learn more about groups of people working in the central North Island who influence whio:
 - 5.1 *Genesis Energy*
 - 5.2 *DOC*
 - 5.3 *Tangata whenua*
 - 5.4 *Kayaking and rafting company*
- Groups of students could each examine a different group. Give a set time for them to:
 - Examine the possible roles and values of the group in relation to whio
 - Investigate the past decisions and actions of this group of people. How does this influence how they are involved in whio recovery?
 - Students can present the information about their group through a presentation, mime, rap, song, dance or role play (depending on students' interests and capabilities).
 - After sharing their presentations, groups can discuss how roles and values affect the decisions and actions of different groups.

The following websites provide additional research information about each group:

Genesis Energy

Helping whio – <https://vimeo.com/102281265> Cam Speedy explains how Genesis Energy are helping whio throughout NZ

Information about hydro power – <http://www.schoolgen.co.nz/students/our-generation#Hydro>

Genesis Energy's work for biodiversity – www.genesisenergy.co.nz/environment-biodiversity

DOC (Department of Conservation)

www.doc.govt.nz/nature/native-animals/birds/birds-a-z/blue-duck-whio/our-work/tongariro-forest-whio/

www.doc.govt.nz/nature/native-animals/birds/birds-a-z/blue-duck-whio/stories/

Whio Forever

www.whioforever.co.nz/world-of-whio/videos?page=1#1

Rafting and kayaking guides

A Valuable River – <https://vimeo.com/102281374>

Meet Garth Oakden at the Tongariro River Rafting Company and listen as he describes why his company relies on good quality freshwater.

Helping Whio on the Tongariro River – <https://vimeo.com/69653343>

Rafting operator Garth Oakden explains how people are helping to bring whio (blue duck) back to the Tongariro River. Find out which animals are being trapped, that are a pest to whio.

Ngāti Tūwharetoa (Tangata whenua in the Tongariro area)

Info about Ngāti Tūwharetoa - <http://www.teara.govt.nz/en/ngati-tuwharetoa/page-1>

Whio awareness month: Talking about kaitiaki - <https://www.youtube.com/watch?v=OjoxDcBMnrc>

History of Tongariro National Park -

<http://www.greatlaketaupo.com/things-to-do/outdoors/national-parks/tongariro-national-park/legends-stories/>

Other possible groups to investigate:

Forest and Bird

www.forestandbird.org.nz/saving-our-environment/freshwater-/wild-rivers

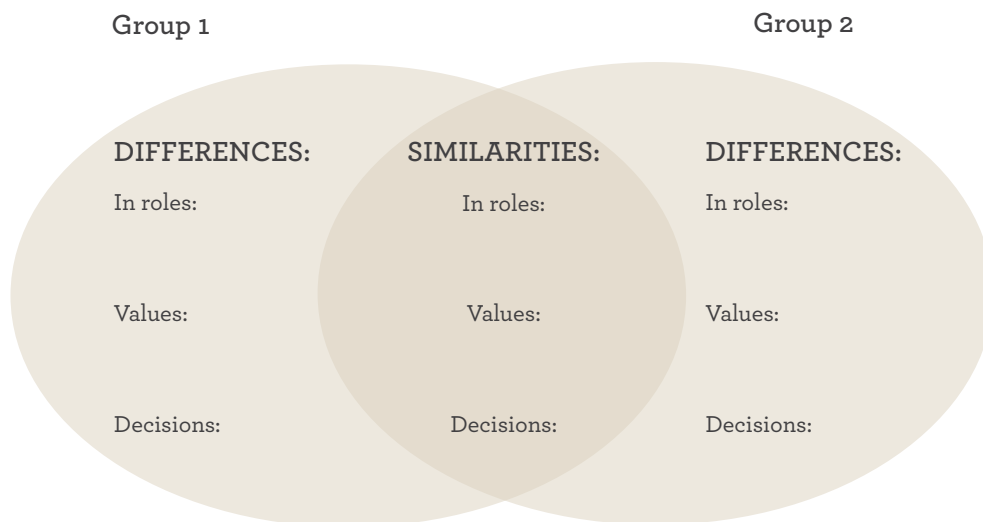
Central North Island Blue Duck Trust

<http://www.whioforever.co.nz/whio-forever-project/blue-duck-trust>

NZ Fish and Game

<http://www.fishandgame.org.nz/>

Reflecting on knowledge



Compare and contrast groups' roles, decisions, actions and values to find similarities and points of difference. This could be done with venn diagrams or using a compare and contrast chart:

Extending learning

Review information from your compare and contrast charts about values, roles and decisions of groups. Think about how groups could work together to benefit whio. (*see teacher notes*).

Explore the LEARNZ Freshwater Ecology field trip:

<http://rata.learnz.org.nz/summary.php?vft=freshwaterecology143>

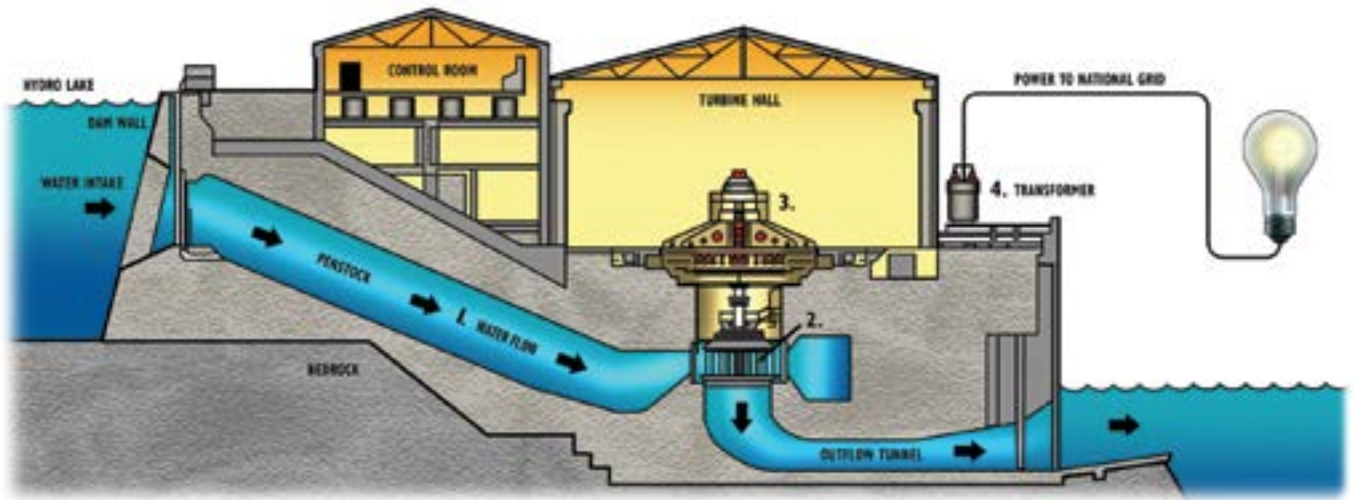
This virtual field trip explores how people affect freshwater ecosystems and the roles of different groups of people.

5.1 Genesis Energy

Role: To supply renewable electricity to the community, while balancing the needs of the environment

Actions: Genesis Energy produces electricity from hydro power stations in the central North Island and South Island. They use dams, tunnels, canals and pipes to channel the flow of water from rivers, lakes and streams to power stations. Inside the power stations, water is passed through a turbine (2) which turns a generator (3), creating electricity to power our towns and cities. We all use electricity in our homes, schools and businesses.

How electricity is made inside a hydro power station



A team of people measure the effects of the power stations on rivers and lakes to make sure there is always enough water flowing for whio and other animals to survive. Genesis Energy provides funding and resources to assist DOC and community groups to trap pests and do other work for whio in their natural habitats, all over New Zealand. As part of this partnership with DOC, the company also help breed whio safely in wildlife centres: to try to increase their numbers.

Why does Genesis Energy help whio?

Genesis Energy believes in striking a balance between the need to produce electricity for the community and the need to protect our rivers and wildlife. When they can see whio in nearby rivers, Genesis Energy staff know they are doing a great job at looking after the river habitats around their power stations. The more whio there are, the healthier the river is.

Other resources:

For more information about hydro power and Genesis Energy see:
Hydro power: <http://www.schoolgen.co.nz/students/our-generation#Hydro>

Whio Forever Project: <https://www.youtube.com/watch?v=imYPkK6mWMQ>
<http://www.whioforever.co.nz/whio-forever-project/about-the-project>



Genesis Energy staff releasing whio back into the wild. They also help to raise awareness in the community about whio and the issues they face.

5.2 Department of Conservation (DOC)

Role: To protect and restore New Zealand's unique biodiversity and environment

Actions: The Department of Conservation (DOC) works with other groups to look after New Zealand's animals, plants, environment and historic places.

One of the animals DOC cares for is the whio. DOC rangers work in many different whio habitats around New Zealand. They keep track of how many whio are in each place, how many have ducklings and how many survive. Rangers make sure that whio are safe and their numbers are increasing. They trap introduced predators (e.g: stoats, rats and cats) and help with other threats to whio.

DOC also look after whio habitats and help to make sure they are not disturbed. As they do their work, they keep the community informed about their actions.



Above right: Ranger Bubs Smith carrying out a whio health check

Above left: Releasing whio back onto the river

Right: Ranger shows students how a stoat trap works



For videos of rangers showing how they work with whio also see:

<http://www.doc.govt.nz/about-us/our-partners/our-national-partners/genesis-energy-whio-recovery-programme/whio-forever-videos/>

<https://www.youtube.com/watch?v=oRVZjduHJJc>

5.3 Tangata whenua

Role: To care for and protect ancestral land, water and living things for people now and in the future

Who are Tangata whenua?

The tangata whenua of Aotearoa are Māori people. They have a deep connection to the land through their histories, culture and family ties. Tangata whenua can be translated as 'people of the land'. Tangata whenua have special rights and responsibilities for their land. They have traditional knowledge of rivers and whio.

Actions: Knowledge of whakapapa and wisdom about the connections between people and animals has been passed down the generations through tangata whenua. This knowledge is needed when speaking up for the river and river animals to make sure they are healthy and protected. Local tangata whenua often help with restoring rivers, trapping pests and other projects which help to keep the river healthy. They work with others to help whio and other animals in their tribal area. This is their responsibility as kaitiaki (guardians or protectors of their land).

Who are tangata whenua in Tongariro?

The Māori tribes around Tongariro National Park are Ngāti Tūwharetoa to the north and Ngāti Rangī and Te Atihaunuiā-Rangī to the south.



Ngāti Hikairo/Ngāti Tuwharetoa supporting the opening of the whio facility at the National Trout Centre in Turangi

Other resources: Māori and the Whanganui river: <https://www.youtube.com/watch?v=m7jSJEvJmog>



5.4 Rafting and kayaking company

Role: To provide real experiences outdoors that are fun and challenging for both locals and tourists, while looking after the river.

Actions: Guides take people rafting and kayaking on the river. They have fun surfing the rapids. During their trips they show people whio and other animals in the wild. They tell people about whio and what they can do to help them.

Guides and volunteers from the community set and check traps alongside the river to help catch rats, stoats, weasels, hedgehogs and wild cats. They send the trapping information and results to DOC.



Blue Duck Project Charitable Trust

The Blue Duck Project Charitable Trust was created in 2008 to protect whio on the Tongariro River. Garth Oakden of Tongariro River Rafting and Craig Morey of Parklands Motel started the trust with people and businesses in the community. They have helped to set traps alongside the entire length of the river from Poutu to Turangi.

For more information about kayaking and rafting companies and their work with whio see:

<http://www.blueduckproject.co.nz/>

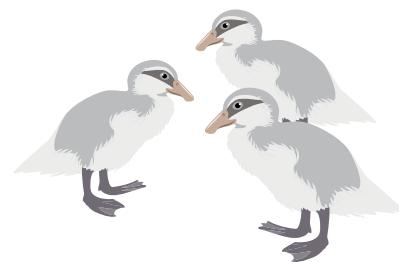
<http://trr.co.nz/>



Tongariro River Rafting staff show off their trapping network to visitors.
Photo: Bubs Smith

ACTIVITY 6:

Threats to whio



TEACHER NOTES

This learning experience investigates how whio are threatened by introduced predators, changes to their habitat, natural events and other factors.

Curriculum links

Achievement objectives

Social Sciences: Levels 3 and 4

Social Studies

Understand how people make decisions about access to and use of resources

Understand that events have causes and effects

Mathematics: Levels 3 and 4

Statistics: Statistical Investigation

Conduct investigations using the statistical enquiry cycle: gathering, sorting, and displaying multivariate category and whole-number data and simple time-series data to answer questions; identifying patterns and trends in context within and between data sets

Science capabilities

Gather and interpret data, Engage with science

Learning intentions

Students are learning to:

Identify natural and human-induced threats to whio

Understand how events and actions cause changes to whio populations

Success criteria

Students can:

List natural and human-induced threats to whio

Identify events or actions affecting whio populations

Minor curriculum links

Science, Technology, English:
Reading and Viewing

Background information: Threats to whio

Natural threats to whio

Whio have always been vulnerable to natural threats, such as extreme weather and natural disasters. Volcanic eruptions and floods have the most impact on whio. Natural predators of whio chicks include eels, falcons and black-backed gulls. These predators take only the occasional whio. In the past, huge extinct native birds like the Haast eagle would have also been natural predators of whio.

The moult (when whio lose lots of feathers and replace them) is a vulnerable time when whio are not able to fly as well as they usually can.

Human-induced threats to whio

Other threats to whio are caused by people. The main human-induced threats are:

1. **Introduced predators** – Stoats are the number one threat for most whio populations. They are commonly seen taking eggs, chicks and female adults on nests. Rats, weasels, ferrets, cats, and dogs can also prey on

whio and their eggs and chicks. Unfortunately these animals are also harming and killing other native birds.

- 2. **Habitat loss** – Loss of suitable habitat is a major threat to whio. Whio need high quality, fast-flowing rivers to survive, but the quality of our rivers in many places is being degraded by urbanisation, deforestation, agriculture and development.
- 3. **Climate change** – The release of greenhouse gases like carbon dioxide, nitrous oxide and methane by people have caused changes to our climate over time. In the future these changes will also influence whio habitats and cause more flooding, droughts and extreme weather.

How have human-induced changes affected whio habitat?

Before Europeans arrived in New Zealand, whio lived in rivers throughout the North and South Islands. Since people have come here forests have given way to farming, development, and deforestation, over huge areas of land. There have been other changes to waterways such as draining, damming and river diversion. Changes to wild rivers over the years have made less habitat available for whio populations.

What defences do whio have against threats?

Whio are very well camouflaged against the rocks and water. This prevents them from being easily seen. They are very good at flying, diving and swimming away from predators. They also have a spur on their wing which helps them to fight other whio if necessary, but is not effective against other enemies.

What can we do about these threats?

People can't control the natural threats to whio, however threats brought about by humans can usually be solved by us. Introduced predators can be trapped, and changes to rivers and landscapes can be minimised to reduce the impact on whio. Climate change can be influenced by reducing our emissions. We can slow down climate change by making good choices about how we travel, how we dispose of waste and how we use electricity to minimise the production of greenhouse gases. For more information about climate change see: <https://www.niwa.co.nz/education-and-training/schools/students/climate-change-global-warming-and-greenhouse-gases>.

Why be concerned about whio threats?

In around 2003, whio were on a path to extinction within 20 years. There were many whio threats present and in most areas, populations were getting drastically smaller every year. Few chicks survived each year to become adults.

In the last 12 years, with lots of help from other agencies and groups, including Genesis Energy, the Department of Conservation are helping the whio populations to slowly bounce back.

Whio are an important part of a river ecosystem and they help to keep the balance in their habitat and between other animals.

Answers to 6.1

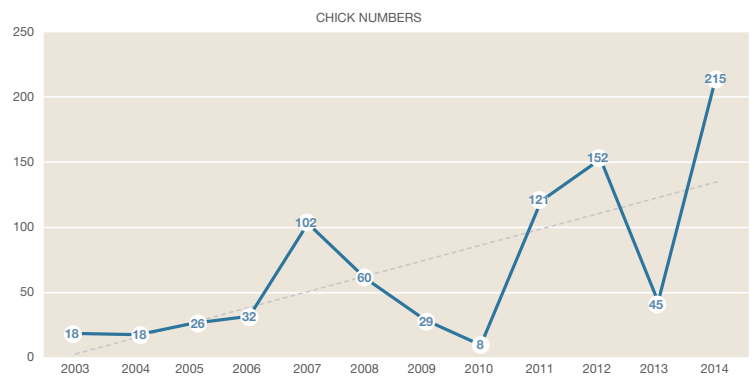
6.1.1

- A) 2013
- B) Numbers of pairs are slowly increasing

6.1.2 Graph of chick numbers should resemble: →

6.1.3

- A) Rats. Even though rats are the most numerous predator, research has shown that rats kill a small number of whio compared to stoats.
- B) 239 in 2010
- C) Arrows represent 1080 drops



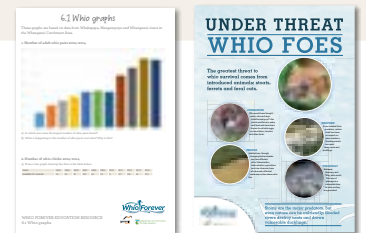
ACTIVITY 6:

Threats to whio



STUDENT LEARNING EXPERIENCE – THREATS TO WHIO

Focus questions:	Resources needed:
What are the main threats to whio?	<p>Under threat: Whio foes poster http://www.whioforever.co.nz/wp-content/uploads/2016/01/Under-Threat-Whio-Foes.pdf</p> <p>6.1 Whio graphs</p> <p>Information on pest animals and stoats: http://www.doc.govt.nz/nature/pests-and-threats/animal-pests/animal-pests-a-z/stoats/ http://www.doc.govt.nz/nature/native-animals/birds/birds-a-z/blue-duck-whio/threats/</p> <p>DOC website: Methods of pest control http://www.doc.govt.nz/nature/pests-and-threats/animal-pests/methods-of-control/</p> <p>Video clip: The Blue Duck Project (04:07) https://vimeo.com/102281468</p> <p>Meet the locals: Whio blue duck www.youtube.com/watch?v=mroN8mISgE0</p> <p>Climate change information from NIWA: https://www.niwa.co.nz/education-and-training/schools/students/climate-change-global-warming-and-greenhouse-gases</p>



Suggested learning sequence:

Introducing threats to whio

- What is a threat? (see teacher notes). What kinds of things could harm or kill whio?
- View *Meet the locals: Whio blue duck* www.youtube.com/watch?v=mroN8mISgE0. Listen for several threats to whio. After viewing, discuss and record any threats mentioned. Make a list of other natural or human-induced threats to whio you know about or have come across during your research (see teacher notes).
- View the poster: *Under threat: Whio foes* (above). In groups, students could each investigate one of the threats to whio from the poster (introduced predators, people, weather or the moult) and report back to the class about their findings.
- Students could also refer to: www.doc.govt.nz/nature/pests-and-threats/animal-pests/animal-pests-a-z/ for further information about animal pests such as rats, stoats, ferrets, weasels, and uncontrolled cats and dogs.

Threats to whio in the Whanganui River Catchment

- View *6.1 Whio graphs*. These graphs are for the Whanganui River catchment – the western rivers of Tongariro forest: the Whakapapa, Mangatepopo and Whanganui rivers.
- Discuss the changes over time of numbers of pairs of adult whio, chicks and their predators. What events or actions could explain these changes?

- Show the table of events. Look at the peaks and troughs of the graphs and match these to the consequences of events/actions.
- The most serious threat to most who populations are introduced predators such as stoats. Stoats are enemy number one for who! Animals like stoats, weasels and ferrets belong to a family of animals called mustelids. How can these animals threaten who?
- The vimeo clip: *The Blue Duck Project* <https://vimeo.com/102281468> is about the Blue Duck Project Charitable Trust. It shows how volunteers are involved in setting and maintaining traps for weasels, stoats and rats along the Tongariro River.
- For more information on pest animals and stoats see resources on previous page.

Identifying threats in your local community

- Which threats to who are relevant for your community?
- What events in the past have caused these threats to be such a problem for who in the present? How did these events happen? Find out more about threats from local organisations and experts.
- Share ideas on how these threats could be dealt with.
- Which threats are out of your control?

Why should we be concerned?

- Why be concerned about who threats? What would happen if who became extinct because of the threats in their environment? What impacts would this have on other species? (*see teacher notes*)
- Which values are relevant when considering protecting and managing who?

Reflecting on knowledge

- What does this information tell us about the main threats to who? How are people involved?
- Do you have any further questions? How could you find answers to these questions?

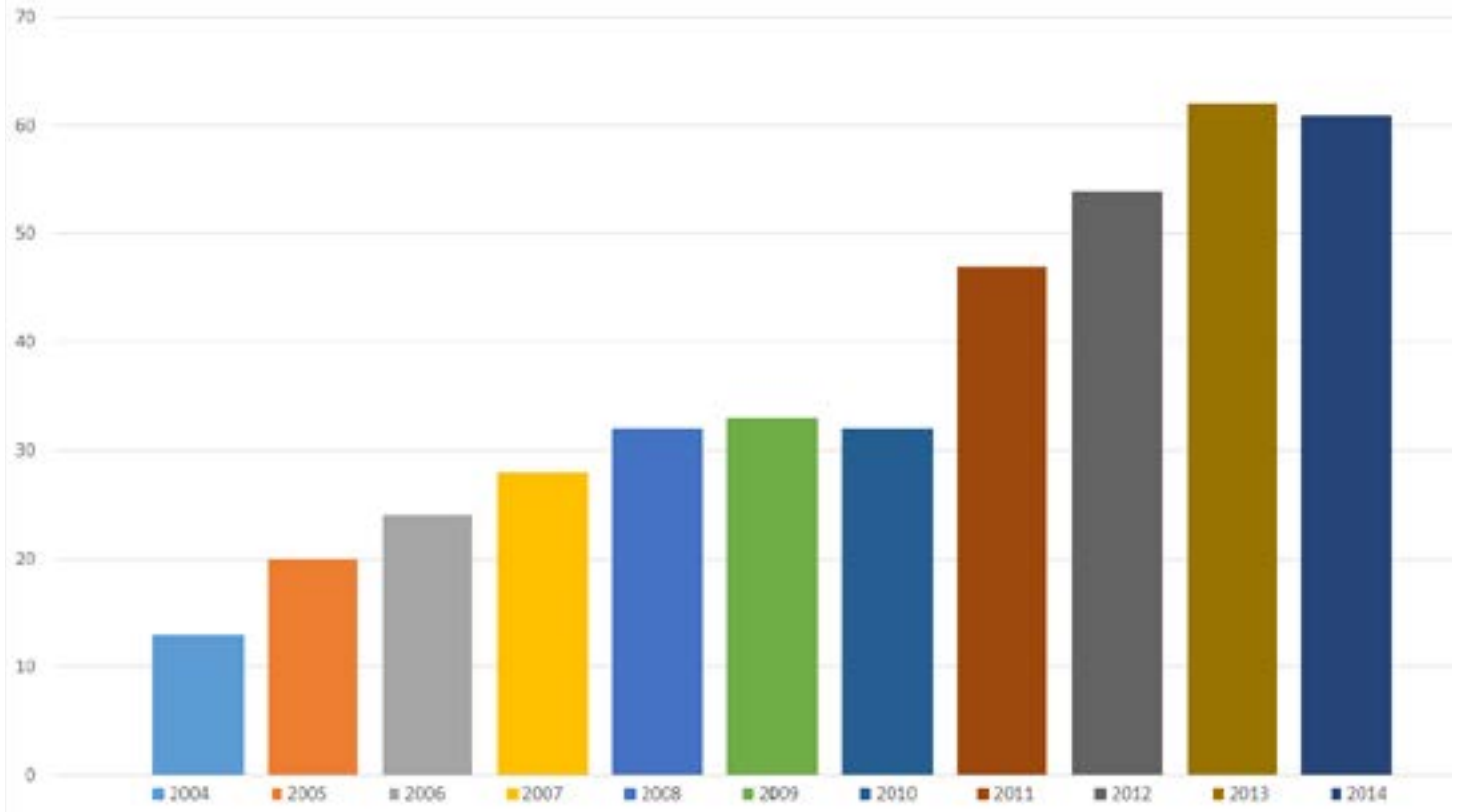
Extending learning

- Find out more about a massive threat to who – **didymo**: <http://mpi.govt.nz/funding-and-programmes/other-programmes/campaigns/check-clean-dry> (Ministry of Primary Industries – Information about didymo)
- <https://www.youtube.com/watch?v=pPIzJs6ZHWQ> (Check, clean and dry song by Sarah Ridsdale)
- Listen to: <http://www.radionz.co.nz/national/programmes/ourchangingworld/audio/2582950/who-and-predator-trapping-in-arthur-s-pass> to find out about who threats in Arthur's Pass and what people are doing about them.

6.1 Whio graphs

These graphs are based on data from Whakapapa, Mangatepopo and Whanganui rivers in the Whanganui catchment area.

1. Number of adult whio pairs 2004–2014



- In which year were the largest number of whio pairs found?
- What is happening to the number of whio pairs over time? Why is this?

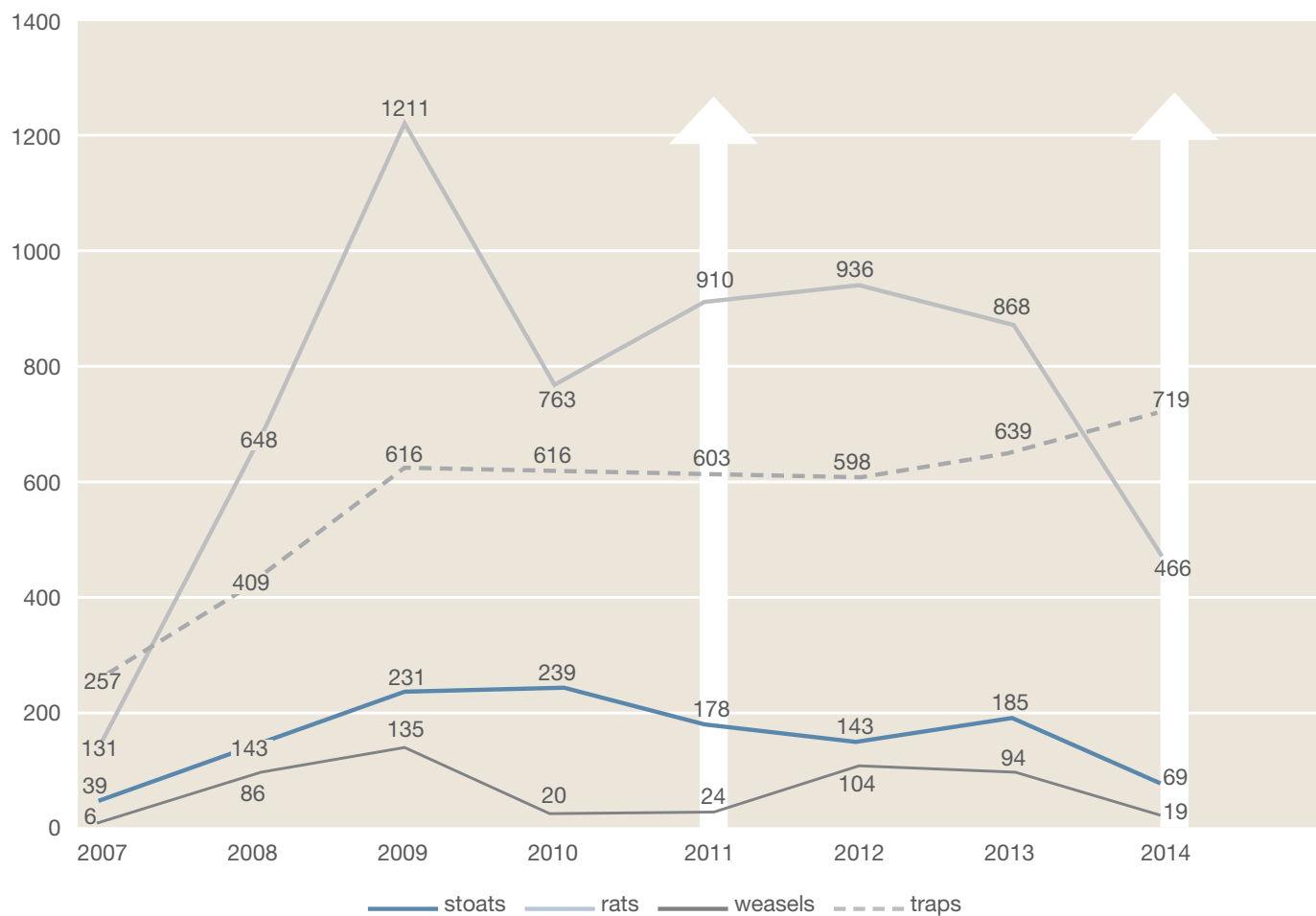
2. Number of whio chicks 2004–2014

- Draw a line graph showing the data in the table below:

YEAR:	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
NUMBER OF CHICKS:	18	26	32	102	60	29	8	121	152	45	215



3. Changes in introduced predator numbers 2007–2014



Questions to encourage discussion:

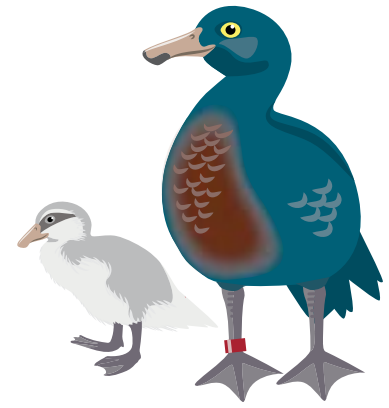
- Which predator is most common in the Whanganui catchment area? Is this predator the most concerning threat for who?
- What was the greatest number of stoats trapped between 2007 and 2014? Which year was this in?
- What do you think the vertical arrows represent?

Reference chart: Major events in Whanganui River catchment 2003–2014

- 2004 Intensive pest control started: 1080 drop, trapping systems set up
- 2006 1080 pest control
- 2009 New who recovery plan published
- 2010 Severe floods
- 2011 1080 pest control
- 2013 Two large floods about 6 weeks apart
- 2014 1080 pest control

ACTIVITY 7:

Visiting who



TEACHER NOTES

This learning experience involves visiting whoo and learning more about them.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Understanding about science

Identify ways in which scientists work together and provide evidence to support their ideas

Nature of Science: Investigating in science

Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations

Health: Levels 3 and 4

Personal Health and Safety Management

Identify risks and their causes and describe safe practices to manage these

Science capabilities

Gather and interpret data, Use evidence, Critique evidence, Engage with science

Learning intentions

Students are learning to:

Find evidence to support or challenge their ideas about whoo
Identify risks in the outdoors and learn how to manage them

Success criteria

Students can:

Record observations and find evidence to support or challenge their ideas about whoo
Describe risks in a river habitat and how to manage them

Minor curriculum links

Science: Living world;

English: Writing

Background information: Visiting whoo

What could be our focus during a visit to see whoo?

The focus of your field trip will depend on the direction of your inquiry. Students may have come across an area of interest during their inquiry which they would like to investigate further. A visit should address any gaps in knowledge and deepen their understanding of rivers and whoo. Students could focus on an aspect of whoo behaviour/feeding/breeding/moving or threats to them. Alternatively, they could look at past/potential whoo habitat or investigate the health of local rivers and streams.

Experiential learning

Experiential learning is a personal experience exploring a relevant context and then reflecting on the experience. A field trip to see whoo is an excellent opportunity for experiential learning in an authentic context.

Seeing real whio and how they live will allow students to gain a deeper understanding of these birds and integrate their knowledge.

What do students and schools need to consider before a field trip?

Staff, students and the BOT will need to consider safety, logistics, special needs, adequate supervision/ratios and equipment needed. Information about safe practice in the outdoors can be found at the EOTC (Education Outside The Classroom) TKI website: <http://eotc.tki.org.nz/EOTC-home/EOTC-Guidelines>. This site includes information on planning, staffing and supervision, emergency preparedness, legal responsibilities, and accepted best practice for EOTC.

How do scientists form new ideas?

Scientists test their ideas and share them with others. They reflect on what they already know and pose new questions. They make observations and gather data which may support or challenge their ideas. Then they interpret and critique their data and observations. Scientists look for patterns, apply problem solving skills and think creatively in order to come up with new ideas.

This Science Learning Hub link provides an interactive about how science and scientists work:

<http://sciencelearn.org.nz/Nature-of-Science/Sci-Media/Interactive/How-science-works>

How do scientists research birds like the whio?

Scientists monitor individuals and groups of whio. Sometimes the birds are captured, banded and/or microchipped to identify individuals. They are often weighed and checked over to get an indication of their health. Sometimes instead of capturing whio, photos are taken and numbers of adults, chicks and eggs are counted. Some particular birds are closely observed and their behaviour recorded. Using a wide range of tools and techniques, scientists and rangers can find out new information about whio behaviour, feeding, movement, territories, habitats and breeding. This information can be used to learn about whio to help them thrive.

ACTIVITY 7:

Visiting whio



STUDENT LEARNING EXPERIENCE – VISITING WHIO

Focus questions:	Resources needed:
What can we find out about whio when we visit them?	Counting kākahi (Level 3 Connected Journal) http://ow.ly/YuWmW Inspired to discover (Te Papa Tongarewa) 04:12 https://www.youtube.com/watch?v=bq4M2YRDe9c
How can we plan for a safe visit?	Find a whio website (showing locations of whio throughout New Zealand) http://www.whioforever.co.nz/about-the-whio/find-a-whio Amy Whitehead: saving the whio (Radio NZ) 11:25 http://www.radionz.co.nz/audio/player/2049399 NatureWatch NZ website: http://naturewatch.org.nz/

Suggested learning sequence:

Thinking like a scientist

- How do scientists research birds like the whio? Share ideas (*see teacher notes*).
- Watch *Inspired to discover* (Te Papa Tongarewa) (04:12 m) to find out what it takes to be a scientist.
<https://www.youtube.com/watch?v=bq4M2YRDe9c&index=26&list=PLoBDDoD7oBC6D94D8>
- This clip shows how scientists and the community can help to discover new information. Scientists look at what is already known about a subject and use this to come up with their own ideas. They test new ideas through gathering information and data.
- What ideas and techniques from Te Papa scientists could be useful for your visit to see whio?
- View *Counting kākahi* (Level 3, Connected Journal) <http://ow.ly/YuWmW>
- This article is about freshwater scientist (Hannah) who is researching kākahi (freshwater mussels).

After reading the article discuss:

- What ideas did Hannah have before her research trip? Where did these ideas come from? (*Hannah had heard from local kaumatua that the kākahi were disappearing from Whanganui River*)
- What did she want to find out? (*She wanted to find out how many kākahi were left*)
- What techniques did Hannah use find out information about kākahi? (*Observation – visual searches and feeling for shellfish, collecting data*)
- What ideas or techniques from Hannah’s research could be useful for your visit to see whio? (*Observation – visual searches and collecting data*).

Deciding where to visit whio

- Plan to visit an area where whio live using *NatureWatch NZ* or *Find a Whio* (see below). You may be lucky enough to live near wild whio. If not, you can visit captive whio in Auckland, Hamilton, Turangi, Rotorua, Otorohanga, Christchurch, Wairarapa, or Queenstown. It may be possible to visit both a captive and a wild population, which would be ideal if you wanted to compare wild and captive whio behaviour and life processes. Where you decide to visit whio will influence the focus of your visit.
- Select an appropriate site to visit using one of these tools:
- *NatureWatch NZ* website – <http://naturewatch.org.nz/>
- A community tool for sharing observations of NZ plants and animals. View sightings of blue duck on *NatureWatch*: http://naturewatch.org.nz/observations?taxon_id=7183
- *Find a whio* (*Whio Forever* website) – <http://www.whioforever.co.nz/about-the-whio/find-a-whio>
- This website shows locations of captive whio, and whio security and recovery sites. Security sites are more established, priority sites where there will probably be more whio. Recovery sites are lower priority sites that may have less whio and may not have as intensive management, monitoring or trapping.

Safety considerations

- Why is it important to think about safety before a school trip?
- Use a scenario (such as the example below) or sharing a personal experience to start a discussion about safety in the outdoors.

Example safety scenario:

Mr Tumble takes his class of 30 students to the local river to try to spot whio. They have one adult helper and a first aid kit. As they walk towards the river it starts to rain heavily. Only a few students have wet weather gear. The others quickly become wet and cold.

The track is muddy and slippery.

One student loses sight of the group and becomes lost . . .

- What risks or potential problems are mentioned in the scenario? (*wet weather, lost students, hypothermia, slippery track, possible flooding . . .*)
- How could Mr Tumble and his students have planned to minimise these risks? (*adequate adult supervision, ensure students have appropriate gear, check the forecast etc . . .*).

Teacher safety considerations

- Teachers will also need to consider the needs (medical, behavioural and learning) of students going on the trip.
- Locations where whio are found in the wild are often remote and can be difficult to access. Make sure you (as the teacher) visit the area before taking students into an unpredictable environment. Take photos for students' reference.
- Ask members of the local community for their advice about locations and access. Consider where you could get the best view of whio without unnecessary risks.

Identifying and managing risks

- What will students and teachers need to think about to make sure your group are safe in the location you are visiting? What risks could there be?
- Decide on how you will minimise or eliminate any risks present and record your thinking on your SAP/ RAMS (Safety Action Plan or Risk Assessment Matrix) forms.

- Use the appropriate forms from the EOTC Toolkit: <http://eotc.tki.org.nz/EOTC-home/EOTC-Guidelines/Tool-Kit> to work through with students. Forms 17, 18 and 19 are common for schools to use. Students can assist to complete these documents or feed into or writing a safety action plan (SAP) which describes how you will manage identified risks. Being near a river will mean certain risks such as flooding and slips may be a consideration.

Prior to your visit

- Reflect on your whio inquiry. Identify any gaps in students' knowledge. These gaps could help to determine a focus for your visit. Brainstorm ideas and questions that could be investigated.
- Select a question or idea to investigate during your visit.
- Decide on a format for collecting data, recording information and making observations.

During your visit

- Collect data and record in an agreed format.
- Make observations and record any evidence which supports or challenges your ideas.
- Follow your health and safety plans.
- Use a camera or digital device to take photos and record experiences on the day.

After your visit

- Review the data, observations, images and information you collected during your visit. Share several reflection questions to critique any evidence you have gathered so far:
 - Were there any patterns or themes that emerged from your observations/data?
 - How sure are you of your results?
 - What limitations did you have?
 - How could you check your findings?
 - Did these results surprise you?
- Share evidence and let others critique it to check reliability. Discuss your results with others, including any available experts.
- Think creatively to interpret your results. You may need to use problem solving skills to create new ideas about whio.

Coming to conclusions about the situation for whio: Inquiry stage 5

- Brainstorm learning from previous activities.
- Sort and display information gathered during the unit and visit through a mural, artwork, mind map or presentation. Look for evidence and examples which support similar ideas. Identify other patterns or themes.
- Looking at your information as a whole: 'What is happening at the moment for whio in your area?'
- Discuss possible conclusions and find supporting information.
- Summarise your findings with a report or recount of your visit, including the conclusions reached.

Reflecting on knowledge

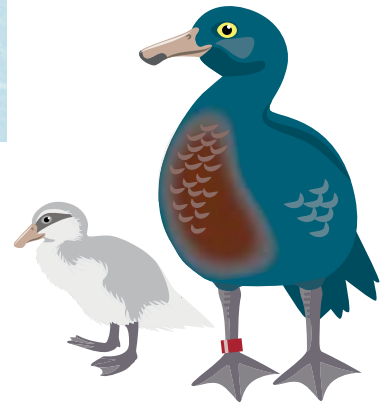
- What did we learn about whio from our visit?
- Which questions remain unanswered?

Extending learning

- Record any sightings of whio on the website *NatureWatch NZ* - <http://naturewatch.org.nz/> to share your experiences with others.
- Listen to an interview with a whio scientist: *Amy Whitehead: saving the whio (Radio NZ)* <http://www.radionz.co.nz/audio/player/2049399> (11:25)
- Scientist Amy Whitehead has completed research into the effectiveness of whio conservation efforts. Amy gathered a large amount of data and information about the impact of threats on whio populations. A short summary of the research can also be found at: <https://www.youtube.com/watch?v=xT7f3xp0HLk>

ACTIVITY 8:

Whio in the future



TEACHER NOTES

This learning experience applies student learning to help create a positive future for whio.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Participating and contributing

Use their growing science knowledge when considering issues of concern to them

Social Sciences: Levels 3 and 4

Understand how people make decisions about access to and use of resources
Understand how people participate individually and collectively in response to community challenges

Science capabilities

Engage with science, Critique evidence

Learning intentions

Students are learning to:

Use their knowledge of whio to consider a local issue and the future of this issue
Examine how people have been involved in the focus issue

Success criteria

Students can:

Research an issue of concern and describe the possible futures that could happen for this issue
Describe how people have been involved in an issue for whio in their community

Minor curriculum links

English, Visual Arts

Background information: Whio in the future

What does the future hold for whio?

The future for whio is still uncertain, but at this stage it is looking promising for most wild populations. Thanks to the efforts of thousands of New Zealanders, including organisations like DOC (the Department of Conservation) and companies like Genesis Energy, whio are coming back from the brink. We can all contribute and make a difference to maintain and grow whio populations.

What is future problem solving/future-focused learning?

Future problem solving is thinking about an issue in relation to the future: thinking about what could happen and what might be possible. Students look to the future to identify challenges and underlying problems. They then focus on potential positive outcomes. When participating in future problem solving, students will use a range of thinking skills to extend their knowledge. Future-focused learning integrates a range of curriculum areas and creates opportunities for higher order thinking. For more information see:

<http://nzcurriculum.tki.org.nz/Curriculum-stories/Media-gallery/Future-focus/Future-Problem-Solving>

Contexts for looking at a future focus

When considering an issue and looking to the future, it can be helpful to consider the following contexts:

- **Sustainability:** Environmental Education for Sustainability (EEfS) is about learning to think and act in ways that will safeguard the future wellbeing of people and our planet. How could the issue have become

more/less sustainable? How could the situation have become worse or better? Are the numbers of whio increasing or decreasing? How has their habitat changed?

- **Globalisation:** How could the issue be influenced by people and places in other countries? How could technology and communication methods affect the issue?
- **Citizenship:** How could people have changed their thinking or behaviours in relation to this issue? How could laws and guidelines have changed?
- **Enterprise:** How could the situation have been influenced by businesses and industries (new and existing)?

What is kaitiakitanga?

Kaitiakitanga is a way of thinking about and looking after the environment in order to help maintain the balance of everything within it. It can be loosely translated into English as protection or guardianship. In Te Ao Māori, humans have a responsibility to keep the physical and spiritual balance of the environment intact. Traditional ways of managing hunting and fishing were able to ensure enough resources were handed down to the next generation, to maintain the mana and mauri of ancestral land.

Kaitiaki are tangata whenua who hold the responsibility to protect and look after an area's resources. They act to restore ecosystems through a holistic approach, recognising that all things are interconnected.

What is guardianship?

In Pākehā terms 'guardianship' is a way of thinking about looking after and protecting the environment.

Issues for whio at Kahurangi National Park

Whio in Kahurangi National Park face similar issues to those elsewhere – flooding and stoats have affected recent breeding and survival. Genesis Energy, Isaac Conservation and Wildlife Trust/Peacock Springs, Air New Zealand and DOC are assisting with pest management and a captive breeding programme to boost the numbers of whio in Kahurangi. Volunteers from the community, including school groups, assist with monitoring and trapping in the area.

ACTIVITY 8:

Whio in the future



STUDENT LEARNING EXPERIENCE – WHIO IN THE FUTURE

Focus questions:	Resources needed:
What could the future be like for whio?	<p>Article about whio in Kahurangi National Park: http://www.whioforever.co.nz/world-of-whio/news-articles/eight-new-arrivals-a-boost-for-kahurangi-national-park-whio</p> <p>8.1 Possible futures for whio</p> <p>‘A balance between use and conservation’ (04:24): https://www.youtube.com/watch?v=bXk16Y96tN8</p> <p>Kaitiakitanga on Te Ara (NZ Encyclopedia): http://www.teara.govt.nz/en/kaitiakitanga-guardianship-and-conservation</p>



Suggested learning sequence:

The current situation for whio

- Review your conclusions about the current situation for whio in your area.
- Reach a consensus on several statements which sum up your findings so far.
- You have now considered the past and present situation for whio, now we will begin to consider the future of whio.

Kaitiakitanga/Guardianship

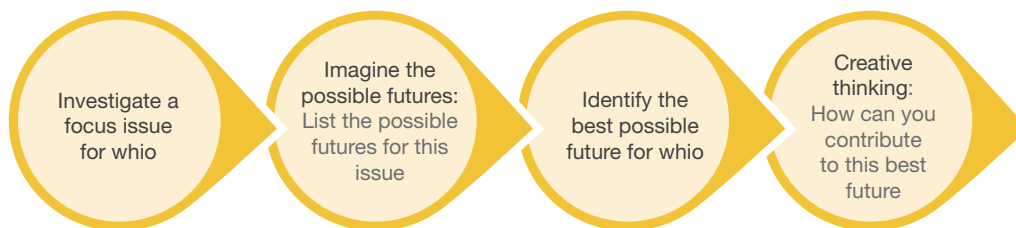
- Explore the concept of kaitiakitanga (protection/guardianship) (see *teacher notes*). Kaitiakitanga involves looking at the interconnectedness of the environment, people, animals and everything else. Kaitiaki are the representatives from tangata whenua who have responsibility for maintaining mauri in their rohe (tribal area).
- Think about any local rivers and streams. Is the mauri of these rivers and streams strong or weak? Why is this? What events have contributed to the health of these waterways?
- Find out about kaitiaki in your local area. Are they involved in restoring mauri around rivers? How could you support their work?

An example of local issues and responses

- Students can read the article and identify issues for whio in Kahurangi National Park: <http://www.whioforever.co.nz/world-of-whio/news-articles/eight-new-arrivals-a-boost-for-kahurangi-national-park-whio>.
- Prompts for discussion: What are the issues for whio at Kahurangi? What have people done about these issues? Which groups of people are involved in helping whio here? How are students involved? What is the future of wild whio in this area looking like? (see *teacher notes*).

A local context

- Where is your nearest wild whio population/where did you visit whio?
- What are the issues for whio in your area? How are people involved in these issues? What challenges have you seen or learnt about are facing local whio? What local threats did you identify in Activity 6? Are there any underlying problems causing these issues?
- Investigate these issues and their causes. Decide which is the most important local issue for whio. This should be an issue that students can influence e.g. pests/climate change/didymo etc. . .
- Choose an underlying problem to focus on: **a focus issue**. This should be a major issue for whio in your area that you can do something about. Record this issue on *8.1 Possible futures for whio*.



Future-focused thinking

- What will the future be like for whio? Students can imagine they are ten years into the future. What could the future look like for whio in your area?
- What might be the main challenges for local whio in future?
- Imagine that there are multiple futures available to us (depending on the choices we make- in relation to the focus issue). Record these possible futures from the worst possible imagined future to the absolute best possible outcome for the focus issue on *8.1 Possible futures for whio*.
- Discuss the **best possible** future you have imagined for whio in your local community. Share ideas and form a collective picture of what this future could look like. This could take the form of a shared drawing or description.

Overcoming an issue for whio

- How can you use creative thinking to overcome the focus issue and achieve this best possible future? Encourage futuristic ways of thinking (with no boundaries). The issue may need breaking down into parts. Ask students to consider the following questions:
 - What will need to change to overcome the issue?
 - How can we influence this issue?
 - What is out of our control?
- Write the above questions on your whiteboard or display them. Students can share ideas using the Walk and talk strategy – (see *teaching strategies* pages 67–68).

Reflecting on knowledge

- View the *Timeline of conservation events* to see how they relate to your focus issue: https://en.wikipedia.org/wiki/Timeline_of_the_New_Zealand_environment
- Make a timeline of events in your community that have led to the focus issue becoming a significant problem for whio.
- Invite guest speakers and interview members of the community who are currently working on the focus issue. What decisions have people made about the focus issue in your community?

Extending learning

Hold a debate to discuss the topic: “It is possible to balance the needs of people with the needs of plants and animals in rivers”.

View *A balance between use and conservation* (04:24) for ideas to start your debate:

<https://www.youtube.com/watch?v=bXk16Y96tN8>.

This clip describes how Genesis Energy are striking a balance at the Tongariro Power Scheme between producing energy for the community and maintaining the mauri and flow of rivers for people and animals to thrive.

Sharing your findings: Inquiry stage 6

- Share the knowledge you have gained during your inquiry and the conclusions you have come to with the community.
- Find an opportunity to tell others about your experiences and observations from your inquiry and visit. This may be through an assembly, newsletter, blog, website, hui or other public event.
- Invite parents, whānau and/or the wider community to be involved in your action. Consider the following questions:
 - *Who would you like to share your knowledge and experiences with?*
 - *Why would these people be the most suitable audience? Decide on who will be in your audience for sharing information.*
 - *What information will you share? Include problems, issues, questions and misconceptions. Explain your insights and creative ideas.*
- How will you communicate your ideas? Decide on a format for sharing information. This could be anything from a production to a hui.
- What is the call to action? How are you going to capture their interest and willingness to support action? How do you want these people to help? What are the key messages for the audience to take home?
- Ask for feedback from your audience to plan your next steps.

8.1 Possible futures for whio

Focus issue

Why is this issue important?

Describe the best possible future for whio for this issue

Describe a future that is similar to now

Describe the worst possible future for whio when thinking about this issue



ACTIVITY 9:

Let's help who



TEACHER NOTES

This learning experience applies student learning to solve an issue that whoo face, with informed action.

Curriculum links

Achievement objectives

Science: Levels 3 and 4

Nature of Science: Participating and contributing

Explore various aspects of an issue and make decisions about possible actions

Technology: Levels 3 and 4

Technological Practice: Brief development

Describe the nature of an intended outcome, explaining how it addresses the need or opportunity.

Describe the key attributes that enable development and evaluation of an outcome.

Science capabilities

Engage with science

Learning intentions

Students are learning to:

Create a brief to describe how you could address an issue for whoo

Carry out informed, meaningful action for whoo

Evaluate the success of your action

Minor curriculum links

Technology: Technological Practice: Planning for practice, Outcome development and evaluation

Success criteria

Students can:

Write a brief to describe how you could address an issue for whoo

Take part in meaningful, informed action for whoo

Reflect on the brief to evaluate the success of your action

Background information: Let's help whoo

How can we help whoo?

Every little bit of help for whoo counts! Even a small project can make a difference to an issue facing whoo and educate, empower and inspire students. Location is not important – if you live far away from wild whoo you could concentrate on raising awareness, supporting captive whoo or work to solve an issue for whoo which may affect other birds in your area.

How do we choose what to do?

The environmental action students choose will be a natural progression from their inquiry. An action should make a difference for the focus issue and contribute to a positive future for that issue. Sharing decision making and leadership with students will increase their enthusiasm and engagement. An aim of EE/ Education for Sustainability is that students are motivated to take action for their own reasons. Consider the time and resources you have available when making decisions. A decision making tool such as a PMI (Plus, Minus, Interesting) (see *teaching strategies pages 67–68*) may also help to select which action will be most effective to address an issue.

Where will we get the resources needed to complete an action?

For ideas about where to get funding see: <http://www.naturespace.org.nz/national-funding>. Your local council, large businesses and not for profit groups may also have funding programmes available to schools.

The school community can also be a source of resources and people power. Advertise in the school newsletter or through home sharing for what you need and you may be surprised what can happen!

Who could be involved?

When planning for action, it is important to consider who could be affected by your choices and also who might be of help and/or want to be involved.

Working with other people outside the school can reduce the workload on staff and students and can also make valuable, long-term connections between you and your community. If you are setting up a partnership with an external group or individual, ensure you give clear guidelines and define timelines, roles and responsibilities. Agree on stages of the project and communicate regularly.

Monitoring and reflecting on change

It is important to include a process for monitoring results and measuring change when planning for action. This information will be useful for future funding applications, reporting and sharing your success with the wider community. Record any changes which have occurred as part of your project: these can be useful to refer back to when working on future projects.

After taking action to help whio, it is important to reflect on the action to help steer your next steps.

ACTIVITY 9:

Let's help whio



STUDENT LEARNING EXPERIENCE – LET'S HELP WHIO

Focus questions:	Resources needed:
<p>What action can we take that will make a difference for whio?</p>	<p>Action examples:</p> <p>Kohanga helping whio example: http://blog.doc.govt.nz/2015/08/04/kohanga-passion-for-whio/</p> <p>Protect Blue Ducks (04:22) https://www.youtube.com/watch?v=KVYTcL8dIIs</p> <p>Other resources:</p> <p>9.1 Brief for action</p> <p>9.2. Action plan for whio</p> <p>Community restoration information and data: http://naturespace.org.nz</p> <div data-bbox="1121 663 1461 891" style="text-align: right;"> </div>

Suggested learning sequence:

Looking back; why help whio?

- Briefly review your whole learning inquiry. What ideas about making a difference for whio have come up during your inquiry?
- Reflect on the focus issue and the best possible future in relation to this issue that you established in Activity 8. Can you see a solution for this issue? Share ideas.
- Also review the feedback you received from the community.
- Show students examples of previous actions for whio – e.g:
 - *Protect Blue Ducks* (04:22)
 - Kaitieke School students made this video for Outlook for Someday (2011) about how we can help whio: <https://www.youtube.com/watch?v=KVYTcL8dIIs>
 - Kōhanga passionate about whio article: <http://blog.doc.govt.nz/2015/08/04/kohanga-passion-for-whio/>
This article from the DOC blog describes how Hāpaitia Kōhanga and Te Kura o Kauwhata are involved in fundraising for and raising awareness of whio protection in the Ōroua valley.
- Which issues did these actions target?
 - Kaitieke School: Fertiliser spraying, cats, rubbish in streams.
 - Kohanga: Introduced predators.
- Why have these schools taken action to help whio? After learning about the issues and problems for whio, many students will want to take this knowledge and act upon it to make a difference for whio. Discuss any thoughts or feelings students have about helping whio.

Deciding on meaningful, effective action

- Which actions come to mind after reflecting on your inquiry and focus issue? Brainstorm and record ideas about possible actions.
- Find out what has already been done in your area for whio. Is there a way you can contribute to what is already happening?
- Make a decision about which action would be most effective to target the focus issue you have chosen. It may help to do a PMI (record plus/minus and interesting factors) of each option to make the decision easier. To make sure that any action you take is effective, look at why you are doing it and how you know it will make a difference.
- How will you know you have been successful? Brainstorm ideas about criteria: what must the action achieve and what will it include?
- Use *9.1 Brief for action* to help set criteria for action and keep the focus on a specific issue.

Planning for successful action

- Now for the logistics for making it all come to life! What steps will there need to be for planning?
- What resources will you need to complete your action?
- Who could you work with? During your inquiry, did you come across any groups working for whio in your area? Students could work to support a project that is already going or create something new.
- Plan your action for whio using *9.2 Action plan for whio*.

Carry out your action

- Allow time for completing an action.
- Keep to the criteria you have set and use the ideas in *9.1 Brief for action* and *9.2 Action plan for whio* to guide you.

Reflecting on action – how did we help whio? Inquiry stage 9

Students can complete a self or peer assessment for themselves or each other by asking questions such as:

- How did our action address the issue we are concerned about?
- Did we achieve what we set out to do?
- What did we do well?
- What challenged us?
- What surprised us?
- What didn't we do?
- What would we do differently next time?
- Also discuss what students enjoyed the most and the least. Did it go well with the people you worked with? Why/why not?
- How will you continue to involve whānau and the community in your project/action? Could it continue in the future?
- Measuring and monitoring action: Did any change happen because of your action? How could you measure this change? How will you maintain and monitor your action? (if necessary).

Reflecting on knowledge

What did you learn from completing this action? Was there a learning gap?

9.1 Brief for action

What will the future be like for whio if we solve the focus issue?

-
-
-
-



Our action will be:

How would this action help whio and help to solve the focus issue?

Criteria for action

What does the action need to achieve?

-
-

The action **must include:**

-
-

9.2 Action plan for whio

What we will do:	Why are we doing this?
------------------	------------------------

Step number	Details of step	Timing
1		
2		
3		
4		

What we need	Where could we get it?	Cost
Total cost		\$

Who could help?	What could they help with?



Extending learning

- Work with other schools in your area to enable wide-reaching actions for whio.
- Spread the word about your action and inspire others. Take time to celebrate your success.

GLOSSARY

Adaptation	Features (traits and characteristics) that animals or plants have evolved, to enable them to live in a particular habitat.
Breeding	To produce offspring/have young (e.g. eggs and ducklings).
Fledge	Leave the nest and find their own way in the world.
Ecosystem	A natural system of complex relationships, including the physical environment, plants, animals and other living things.
Endangered	A plant or animal species that exists in such small numbers that it is in danger of becoming extinct.
Endemic	A living thing that has evolved in New Zealand and breeds and lives naturally, only in this country.
Habitat	A place where a living thing/population naturally lives.
Incubation	Keeping the egg(s) warm and safe.
Introduced	Has been brought to New Zealand by people.
Issue	A problem or difficulty of concern.
Juvenile	A young animal that has not yet reached adulthood and hasn't yet had offspring.
Kaitiaki	Tangata whenua who have been given responsibility to protect and look after an area's resources. They act to restore ecosystems through a holistic approach, recognising that all things are interconnected.
Kaitiakitanga	Kaitiakitanga is a way of thinking about and looking after the environment in order to help maintain the balance of everything within it. It can be loosely translated into English as protection or guardianship.
Life cycle	A series of stages a living thing passes through during its lifetime – from birth to death.
Mauri	The essence or life force present in all living things.
Native	A living thing that has come to New Zealand by themselves and have established populations here. They may also live in other countries.
Predator	An animal that hunts and eats other animals.
Threat	Something that can harm or kill a whio.
Value	A deeply held belief about what is important.
Whio	New Zealand blue duck – a fast-flowing river specialist.

TEACHING STRATEGIES

Walk and talk sharing strategy

Students are given a topic or question. They walk around the classroom (or a learning area outside) quietly in their own space, until a signal is given. On the signal they turn to the nearest person and share their ideas. The partner must be actively listening. On another signal they swap roles with the other person talking and the first talker listening. Then students continue to walk around room and repeat the process.

3-2-1 sharing strategy

Students pair up and take turns to talk about three subjects. Write the subjects down in a visible place for students to refer to. A signal is given after defined periods of time to change the subject to the next topic.

Each person shares:

3 things about . . . then

2 ideas about . . . then

1 idea/experience.

Think, pair, share

Briefly introduce the question/topic.

Think: Allow students time to think about what they know or have learned about this topic for a set amount of time (around 1–2 minutes).

Pair: Students can then share their ideas with a partner. This could be sitting or standing. You could also allow time for pairs to ask each other questions. Emphasise listening skills.

Share: Once partners have shared and discussed ideas, they can share with another group or the whole class their collective thoughts.

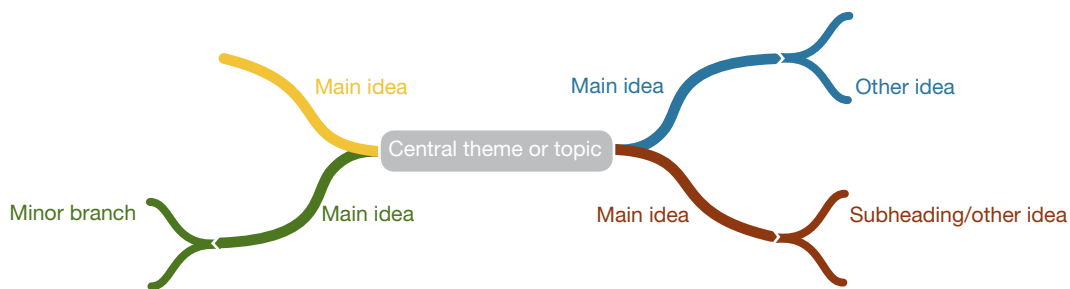
Brainstorm

The brainstorm begins with introducing a topic or question.

The students share ideas, thoughts, relevant words and answers when given an opportunity. The teacher or scribe is responsible for recording the ideas without judgement on an electronic document, whiteboard or paper. The recording should be visible to students. Alternatively students can record their ideas on individual pieces of paper and then these can be displayed and grouped accordingly.

Mind map

A mind map is a diagram which helps to organise information. A central idea or topic is in the centre and the main ideas branch out from this central topic. Other ideas branch off from the main ideas. The mind map below was created using <https://coggle.it>



PMI (Plus, Minus, Interesting)

A PMI graphic organiser is a tool for thinking about positives, negatives and other variables of an idea or option. A table is drawn up of the pluses (P), the minuses (M) and the 'interesting' (I) factors (what could be interesting or is of interest). See <http://www.globaleducation.edu.au/3011.html> for more information.

Plus (P+)	Minus (M-)	Interesting (I)

Compare and contrast chart

A compare and contrast chart is a graphic organiser which is useful to encourage thinking about how two things are alike and different. It lists both similarities and differences. It can be used as an alternative to a venn diagram.



WHIO RESOURCES FOR STUDENTS AND TEACHERS

Websites

General whio information

Whio on the DOC website – <http://www.doc.govt.nz/whio>

Whio Forever website – <http://www.whioforever.co.nz>

NZ Birds Online whio page – <http://nzbirdsonline.org.nz/species/blue-duck>

Posters and education resources by Whio Forever

Whio Forever education resources – <http://www.whioforever.co.nz/about-the-whio/educational-resources>

Poetry and songs – <http://whioforever.co.nz/about-the-whio/whio-poetry>

Where to see whio

NatureWatchNZ website – <http://naturewatch.org.nz/>

A community tool for sharing observations of NZ plants and animals. View sightings of blue duck on NatureWatch: http://naturewatch.org.nz/observations?taxon_id=7183

Find a whio (Whio Forever) website – <http://www.whioforever.co.nz/about-the-whio/find-a-whio>

The Whio Forever site shows captive whio, whio security sites and recovery sites. Security sites are more established sites where there will probably be more whio. Recovery sites are lower priority sites that may have less whio and may not have as intensive monitoring or trapping.

<http://www.whioforever.co.nz/get-involved/where-to-see-a-whio>

Journals

(In approximate order of reading level)

Suitable for Year 1–4

Haast's eagle L2 Junior Journal 51, 2015

Looking after ducklings Children as authors, No. 1, 2001

The prayer of the little ducks (story) Y3: Junior Journal 5 1990

Bully (story) Y3: Junior Journal 13, 1995

Catching sprats Y3: Junior Journal No. 31: 2004

A present from pudding (story) Y4: Part 1: 1: 2001

The ducks dip out (play) Y4: Part 1: 1: 2001

Get your hands dirty! (article) Y4: Part 1: 4: 2009

Going fishing Y4: Part 1: 1: 2008

River bugs (white-water rafting) Y4: Part 1: 2: 2001

Suitable for Year 5–8

Power (hydro) L2 August 2011

Going after Humbug (story) Y6: L3 April 2012

Feathery Friends Connected (CN) 1, 2001

Hinaki (catching eels) SJSL No 4 2000

Testing the north river (article) CN 2 1998

The water cycle CN 2 2002

Feathers (article) Y6: Part 02 No 3 2001

Counting kakahi (article) Y6: CN 3, 2014

The fish highway (article) Y6: CN3 2013

Awa (poem) Y4: L2 August 2012

At the river (poem) Pt 3: No. 2: 1996

Eel (poem) Pt 3 No. 3: 2009

Other resources

Building Science concepts Book 4: Animal Life Histories: Reproduction, Growth, and Change

Levels: 1-4

Books

Whetu the little blue duck by Jennifer Beck.

A good introduction to people and whio, this book tells the story of a little blue duck and a woman who helps him.

Suitable for Years 1+.

Auckland, N.Z. : Duck Creek Press, 2011.

ISBN: 9781877378522

The little blue duck by Chris Gurney.

Little blue duck decides to make a pavlova but her friends are unwilling to help. A retelling of the little red hen story.

Suitable for Years 1-4.

N.Z. : Scholastic: 2009.

ISBN: 9781869439149

Whio: saving New Zealand's Blue Duck by David Young.

A very thorough account of the recent history and events in the conservation of blue duck around New Zealand.

Suitable for Year 7+.

Nelson, N.Z. : Craig Potton Pub., 2006.

ISBN: 9781877333460

1877333468

Whio by Jenny Jones.

Auckland: Heinemann Education, c1994. WWF.

ISBN: 1869440722.

