

Theme one: Ecosystems

Level 5 Science



*Living
Waters*

TIAKINA NGĀ TAONGA - PROTECT THE TREASURES

Theme one: Ecosystems

Level 5 Science

Achievement Objectives:

- Investigate the interdependence of living things (including humans) in an ecosystem.
- Develop an understanding of social scientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate.

Conceptual understandings:

- The living organisms in Porirua Harbour and Catchment are inter-dependent on each other and are affected by environmental changes.
- Scientific investigations into biodiversity can indicate the health of an ecosystem and inform decision-making.

Learning framework

Links to social inquiry approach	Activities	What to look for
Establishing what we know		
How can environmental change impact on biodiversity?	1. Biodiversity	Building conceptual understandings Look for students' understanding of: <ul style="list-style-type: none"> • The various organisms that make up an ecosystem. • How environmental changes can affect the balance within that ecosystem.
Selecting a context		
What do we already know about the plants, animals and habitats within the harbour and catchment?	2. KWL chart -Ecosystems within the Porirua Harbour and Catchment	This section is designed to ensure students have a good understanding of the ecosystems of the Porirua Harbour and Catchment before they select one particular area to focus their own scientific investigations on.
Building on knowledge		
Finding information	3. Consequence Wheel and discussion 4. The impact of research on decision making	This section is designed to ensure students have a good understanding of ecosystems within Porirua Harbour and Catchment prior to starting their own scientific investigations.

Experiencing the Harbour		
What lives in the harbour?	5. Student scientific investigation a. Fieldtrip, or b. Living Waters Documentaries 6. Sharing findings	<p>Developing critical thinking</p> <p>By encouraging students to think about the different values and perspectives people have, and the impact these have on decision making.</p> <p>Analysing different responses and decisions made regarding the Porirua Harbour and Catchment. Evaluating consequences of changes to rules concerning this resource and considering ways to ensure people have sustainable access to this resource now and in the future.</p>
Planning for action		
Exploring values and perspectives Considering responses and decisions	7. Perspectives on decision making 8. Finding solutions	<p>This section encourages students to think about the different values and perspectives people have and the impact these have on decision-making</p> <p>In this section, students will analyze different responses and decisions that could be made to protect the biodiversity of the Porirua Harbour and Catchment. They will evaluate the consequences of any changes they have considered before selecting one option to plan a social action around.</p>
So what, now what		
What can I do to make a difference?	9. Student social action	This encourages the students to exercise their own kaitiakitanga around the harbour, putting what they have learnt into action.

Establishing what we know

Activity 1: Biodiversity

Explain to students that they are going to be looking at a local ecosystem within the Porirua Harbour and Catchment and consider how it has been affected by environmental change.

Write the word biodiversity on the board.

- Get students to write down all that they know about this term. Students can then share with the person next to them and add more to their brainstorm. Ask each pair to contribute to a class discussion.
- Repeat exercise for the term ecosystem.

Diagnostic

Ensure students have a good understanding of the ecosystems of the Porirua Harbour and Catchment before they select one particular area to focus their own scientific investigations on.

Selecting a context

Activity 2: Ecosystems within the Porirua Harbour & Catchment

Explain to the class that they are going to look at the diversity of ecosystems within the Porirua Harbour and Catchment. Have students complete a **KWL chart** in pairs (what I already know, what I want to know, what I learnt), considering:

1. What organisms exist in the Porirua Harbour and Catchment?
2. Where do they live and what makes them suited to that place?
3. What is interdependence?
4. How have environmental factors affected the ecosystem of the harbour and catchment?
5. What kind of scientific investigations are undertaken to indicate the health of the harbour and catchment?
6. How does this influence decisions made?

As a class, watch the Living Waters episode: July Pauatahanui Reserve. Ask students to continue to fill in the W part of their KWL chart

Watch the *Living Waters Episode: August Sediment* and discuss:

- Why are estuaries important?
- What two types of sediment exist?
- Why is sedimentation described as a crisis for the inlet?
- What are the causes of sediment?
- What are the effects on seagrass and cockles?
- What are some solutions?

Put a large map of the Porirua Harbour and Catchment on the wall/board. In groups ask students to select an area that they would like to investigate. For logistical purposes the teacher may need to select the area that the class is going to look at.

Building on knowledge

Activity 3: The importance of scientific research

Watch the *Living Waters Episode: September Creatures Great and Small*. In this episode, Professor John Wells, a member of the group Guardians of the Pauatahanui Inlet, talks about the first cockle count in the 1970s in comparison with today's cockle count.

- Discuss what the cockle count shows us about the health of the ecosystem.
- Using the information that has been gathered, as a class fill out a **consequence wheel** demonstrating the interdependence of organisms within their area of the harbour.

In pairs get students to use **rally drive** technique to discuss the following questions.

1. Why is scientific research important?
2. In what way could this inform decision-making?
3. Does it really matter and who listens?
4. Ask a member of each pair to report back to their findings back to the class.

Activity 4: The impact of research on decision making

In groups, students read this monitoring report from Greater Wellington

- <http://www.gw.govt.nz/assets/Our-Environment/Environmental-monitoring/Environmental-Reporting/Porirua-Harbour-low-res.pdf>

then use a fish bone diagram to record notes on the following:

1. What was the research investigating and when was it carried out?
2. What were the key findings?
3. How does the research inform us of the health of the harbour?
4. What decision-making has been made already and what can also be done to ensure the health of the harbour?
5. What did the research tell us about the effect of environmental change on their particular ecosystem?

Suggestions for other research for extension

Current work is under way with Ngati Toa, NIWA and the Greater Wellington in the Porirua Harbour Iwi Project. This should be coming up on the Ngati Toa website soon.

Drs Leigh Stevens and Barry Robertson of Wriggle Coastal Consultants do the regular sediment and habitat surveys for Greater Wellington with Juliet Milne:

<http://www.gw.govt.nz/assets/council-publications/Porirua%20Harbour%20Intertidal%20Sediment%20Monitoring%202010-11.pdf>

Reports are also available on the PCC harbour management programme webpage as part of the list of harbour reports at the end of the page.

Jointly-funded work (PCC, WCC, GW) by Paul Blaschke et al on 'Ecorestoration Priorities for the Porirua Stream Catchment', 2009:

<http://www.gw.govt.nz/assets/council-publications/Eco%20rest%20%20for%20web.pdf>

Experiencing the Harbour

Activity 5: Student scientific investigation

The focus of this field trip is to explore the natural ecosystem of the Inlet. The intertidal zone is easily accessed by students, and provides an excellent opportunity to learn about interdependence of living things, and the amazing diversity of life within the harbour ecosystem.

The easiest place to access the Inlet with students is the car park at Motukaraka Point. There are public toilets here as well as an information board. At the road end a boardwalk starts which has excellent interpretation boards that could be used as the basis of small group learning activities for your students.

The Marine Metre Squared programme is a national citizen science project that monitors and records the health of marine ecosystems across New Zealand. Teachers could use this field trip as an opportunity to start their school's participation in this project, and it's a great way to teach students science skills:

<https://www.mm2.net.nz/home>

To help plan your field trip visit the Guardians of Pauatahanui Inlet website for suggested activities on site: <http://www.gopi.org.nz/let-s-visit-the-inlet/>

As with all field trips we strongly urge teachers to visit the site prior to taking students there. The Ministry of Education has excellent guides for safe outdoor experiences: <http://eotc.tki.org.nz/EOTC-home/EOTC-Guidelines>

If a field trip is not possible, students can gather the information they need by watching the films from the Living Waters documentary series (see below).

- Recreation (January): A good look at the various perspectives held by different members of the community regarding the harbour.
- Pollution (April): Here we see the effects of storm water and sedimentation on the Harbour. Juliet Milne Environmental

Science GWRC discusses the role of storm water in catchment. We are also introduced to scientists Leigh Stevens and Barry Robertson – Wriggle Coastal Services as they complete their annual broadscale mapping scientific investigation of the Harbour.

- Tides (May): This looks at the role of the estuary as a rich feeding ground for animals. Crabs, Mud Snails, Oyster Catchers, Pied Stilts, Marine Worms, Sea Squirt, White faced Heron etc.
- Rural catchment (October): This episode looks at the effects of deforestation, erosion, sedimentation on the harbour and catchment.

Activity 6: Sharing findings

Once students have completed their own scientific investigations, come together as a class and discuss observations and findings. Possible questions for discussion include:

1. What did you discover about the biodiversity in your particular area?
2. Were there any patterns or surprises?
3. What are examples of changes in biodiversity? How did you know these changes had occurred?
4. How might these changes have affected interdependence?
5. How do we find out the extent of the effect of environmental changes, such as pollution, on biodiversity?

Planning for action

Activity 7: Perspectives on decision making

Explain to students that not all solutions are clear-cut, as decision makers have to take into consideration many different values and perspectives.

Using the Porirua Harbour and Catchment Strategy and Action Plan select an issue affecting the ecosystem: i.e: increase in sedimentation. In small groups, brainstorm possible solutions that decision makers could make in response to the findings. For the example given previously, a possible solution could be dredging.

In groups, construct a T chart, looking at both the positive and negative aspects of the issue. Who might be for the solution and who might be against it? Why? Debate the issues as a class.

Activity 8: Finding solutions

Remind students that as members of the Porirua community they can help bring about change.

Using examples from the previous section, choose a problem to use as a class model. Use the POOChI model to help the class decide on the best way to solve the problem:

1. Identify the **Problem**: This is informed by findings from scientific investigations. e.g. high zinc levels in the harbour.
2. Generate **Options**. Encourage students to come up with a range of solutions that they will be able to carry out.
3. Predict **Outcomes** for each option – analyzing both short- and long-term positive and negative outcomes.
4. **Choose** the best option.
5. **I** – What do I think about this? How does this affect me?

Students can then use the POOChI model to generate the best solution for a problem they identified when carrying out their own scientific investigations and/or from other research. Encourage the students to consider the outcomes for various groups before they choose their solution.

So what, now what?

Activity 9: Student social action

Use the following template for planning action: <http://efs.tki.org.nz/Curriculum-resources-and-tools/Action-Planner>

Plan the action.

- Consider what exactly needs to be done to achieve the vision. This could include several smaller projects within the larger project that either the whole class is involved with or small groups within the class.
- Check that the action addresses the issue.
- Consider the skills required to carry-out the action and identify where more information can be found.
- Consider how people will think and feel about the planned action and how you will find this out.
- Make some decisions. What could influence the decision on what to do? List the options and criteria in a decision-making matrix to choose the action. Criteria should include:
 - ensuring the action addresses the issue
 - resources required
 - time and learning
 - Add your own criteria as required.
- Carry out the action.
- Reflect on Change. Some questions may include:
 1. How can we make people more aware of the issue and our action(s)?

2. Did our actions meet our vision?
3. Did our actions impact on the issue we identified?
4. What do we need to do next?

Students will now choose the best way of implementing their solution. Some ideas are:

- Create a petition
- Write letters to the government
- Create an awareness campaign in the community
- Clean up an area of the harbour or catchment
- Create a plan or model
- Contribute to the scientific studies. (eg, nature watch – details below)

Students set up own project to monitor the health of the harbour. Use the monitoring database <http://naturewatch.org.nz/projects/ecological-restoration> to record the survival, arrival, regeneration, growth and behaviour of species in the Porirua Harbour and catchment.

Appendix: Helpful links and resources to support student learning about estuaries

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

<http://www.gopi.org.nz/natural-history/>

'At the Beach – explore and discover the New Zealand sea shore'
Ned Barraud and Gillian Candler, 2012