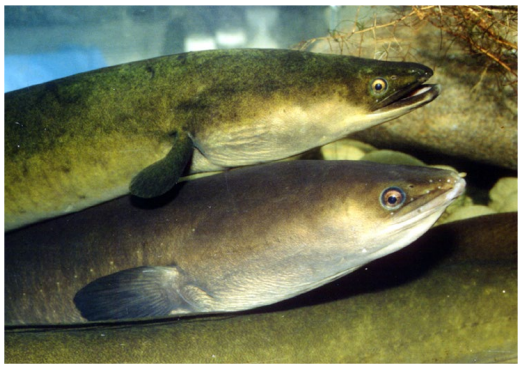
Protecting our estuaries

EDUCATION RESOURCE

YEARS 1–8



Department of Conservation
Te Papa Atawhai

New Zealand Government

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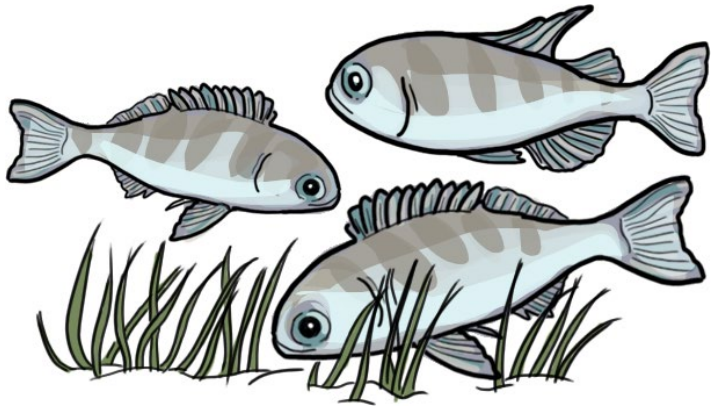

Illustrations: Lisa Paton

Cover photos: top left: Whangateau mangroves, *Lorna Doogan, courtesy of Experiencing Marine Reserves (EMR)*; top right: Finding mud crabs, *Shan Walker*
Bottom left: Tapotupotu Snorkel Day, *Samara Nicholas, courtesy of EMR*; middle: shortfin eel, *Stephen Moore*; right: exploring Orewa estuary, *Shan Walker*

Published by:
Department of Conservation
Tāmaki Makaurau/Auckland Office
Private Bag 68908, Wellesley St
Auckland 1141

February 2020

Editing and design:
Creative Services, Department of Conservation
Conservation House, Wellington

In the interest of forest conservation, we support paperless electronic publishing.

R141142

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ACKNOWLEDGEMENTS

This resource was prepared by Shanthie Walker (EFS Initiatives on contract to DOC) with Adrienne De Melo , Benjamin Moorhouse (DOC's Education Team) and Helen Kettles (DOC Marine Ecologist with an estuaries overview role).

The core team would like to offer sincere thanks to the following organisations and individuals for their contributions, feedback and help to develop this resource about New Zealand's estuaries:

- Lisa Paton at Morphological Environmental Communication for the beautiful illustrations and diagrams included in the resource.
- Sally Carson from the New Zealand Marine Studies Centre at the University of Otago, Samara Nicholas and Lorna Doogan from Experiencing Marine Reserves (EMR), and Rebecca Goffin from Auckland Council's Sustainable Schools team, for their review, feedback and suggestions to improve the resource drafts.
- Hugh Robertson and Graeme Taylor (DOC) for reviewing drafts and ideas for the bird life cycle diagrams: eg All Blacks!; Lloyd Esler for his hand drawings of the mud snail life stages, Islay Marsden and Phil Ross for assistance with the cockles and snail diagrams. Thanks to Northland Regional Council for the use of their existing life cycle diagrams.
- Dianne Edgoose, John Keoghan and the students of Rooms 10, 11 and 12 (2017) at Long Bay Primary School; Maureen Robertson and 2017 enviro students at Verran Primary School for their trialling of resources, feedback and suggestions.
- Artist Duane Moyle, photographer/writer Raewyn Adams and Terry Oliver Ward from Manawatu Estuary Trust, who kindly gave us permission to use their art and photographs for this resource.

We acknowledge the many fantastic resources that already existed about New Zealand estuaries which we have touched on in this resource. Some new resources were created by us to fill gaps. We thank the many organisations and people who contributed their existing resources, photos, videos, games and diagrams to make this resource a rich experience for students: NIWA (the National Institute of Water and Atmospheric Research), Northland Regional Council, Science Learning Hub and the University of Waikato, LEARNZ, Carolyn Lundquist, Don Neale, The Guardians of Pāuatahanui Inlet (GOPI), Te Ara – The Encyclopedia of New Zealand, Experiencing Marine Reserves, New Zealand Marine Studies Centre (University of Otago), University of Canterbury, Whitebait Connection, Landcare Research, Outlook for Someday, LAWA, Living Waters Documentaries, Environment Southland and Mountains to Sea Conservation Trust.

Contributions for the *Estuaries field site notes* for visiting educators and students have been acknowledged in individual documents.

INTRODUCTION

Protecting our estuaries is a teaching and learning resource for New Zealand educators, teachers and students who want to learn about, explore and enhance local estuaries.

ABOUT THIS RESOURCE

Protecting our estuaries is an integrated curriculum teaching resource using New Zealand's estuaries as a real-life context for learning. It is based on the New Zealand Curriculum at levels 1–4 (years 1–8) but can be adapted for use at various levels.

This resource contains teaching and learning material to support a unit of work grounded in Environmental Education for Sustainability (EEfS)/conservation education themes. It incorporates aspects of Te Ao Māori (a Māori world view). The unit is based on an integrated, inquiry learning process, including science, social science, the arts and technology objectives alongside literacy and numeracy learning.

Manawatu Estuary. *Photo: Helen Kettles DOC*

What are estuaries?

Estuaries are areas on our coasts where the fresh water of rivers meets and mixes with the salt water of the sea. They are partly enclosed areas of shallow water and are affected by tides.

The big picture context for this resource

Estuaries help to keep our water and oceans clean and are part of the wider marine environment that is vital to life on Earth. Without fresh air, clean water, fertile soils, plants, animals and forests, we humans could not survive. We are all part of a bigger ecosystem. Everything is connected, from the deep ocean to outer space – and what we do, does make a difference.

The importance of New Zealand's estuaries

New Zealand has more than 300 estuaries and they are diverse, from deep, ancient fiords in the south to warm, mangrove-filled lagoons in the north. They are important habitats for many native birds and fish.

Estuaries make our lives easier. They provide us with food and other resources and also play a vital role in the wider environment by filtering river water before it goes to sea and cycling nutrients. Our estuaries also protect land from storms, cyclones, floods and large waves. Estuaries are culturally significant for tangata whenua.

Finding fish, Greymouth. *Photo: Henk Stengs*

Teaching and learning about estuaries

The Department of Conservation (DOC) is working to protect our natural treasures and preserve our estuaries and marine ecosystems. This education resource aims to equip students with the knowledge, values, skills, understanding and motivation to help them contribute to and protect New Zealand's estuaries and oceans for the next generation and beyond.

To learn more about marine reserves, see DOC's education resource

Protecting our marine world.

OBJECTIVES OF THIS RESOURCE

Overall vision

To provide students, teachers and their communities with opportunities to grow their knowledge, skills and understanding about estuaries, so that they can help resolve environmental challenges in their local coastal areas and beyond.

Long Bay Primary students at Long Bay Estuary. *Photo: John Keoghan*

Learning opportunities

Activities and suggestions in the resource enable the following learning opportunities.

Connecting to estuaries (Te Taha Wairua)

Students can:

- Form significant personal connections to their local estuaries
- Have awareness and sensitivity about local species and environments and start to care for them.

Knowledge, skills and understandings (Te Taha Hinengaro, Te Taha Tinana)

Students can:

- Grow their understanding of estuaries in New Zealand
- Recognise the role of tangata whenua in estuary management and use
- Learn skills to help address issues for estuaries.

Taking collective action and working with community (Te Taha Whānau)

Students can:

- Act alongside the wider community to contribute to healthy estuaries and marine environments
- Participate in active sharing with the community to celebrate success and action.

STRUCTURE OF THIS RESOURCE

Each activity has two parts: first the background notes and then the suggested learning experience. The background notes describe the key concepts for the activity. These promote deep understanding rather than surface knowledge. The suggested learning experiences include many teaching and learning ideas. Please note that these are suggestions only. Each activity also provides opportunities for reflection, extension and extra resources.

Format of each activity

Background notes:

- Curriculum links
- Learning intentions and success criteria
- Description of concepts in activity

Learning experience suggestions:

- Resources
- Vocabulary
- Reflecting on learning
- Extending learning
- Other resources

Links

To open the links throughout this resource without losing your place in the document, follow either of these steps:

- Right click on the link and click **Open Hyperlink**. Now the link will be opened in new tab.
- Hit the **Ctrl** key while you left click the link. This will also force the browser to open the page in a new tab.

Either of these methods will open the link in a new tab leaving the teaching resource open.

Symbols used in this resource

Curriculum links

This symbol represents New Zealand Curriculum links included in the resource.

Inquiry learning

This symbol represents inquiry-based learning experiences and steps in the inquiry cycle.

Māori world views

This symbol represents learning experiences around Mātauranga Māori (Māori knowledge and perspectives).

Outdoor experiential learning

This symbol represents a hands-on, outdoor learning experience. These experiences encourage student connection to the natural world.

Student activity ideas

This symbol represents student activities to learn about environmental action and reflect on their hands-on, outdoor learning experiences.

WHAT IS CONSERVATION EDUCATION?

Conservation education (or Environmental Education for Sustainability/ EEfS) provides authentic opportunities for learning and gives education providers opportunities to connect with their local communities in meaningful ways now, while embracing our past and our future.

Teaching conservation education provides real-life contexts to integrate learning across the curriculum, and opportunities for students to apply their learning to authentic local community needs and projects.

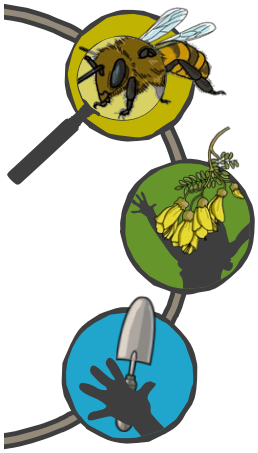
For more information about conservation education and EEfS, go to What is conservation education? and Environmental Education for Sustainability Strategy.

DOC's education strategy

DOC is working towards a target of 'one million conservation kids'.

A conservation kid is a young person who:

- is part of and connected to the natural world
- appreciates that Aotearoa is a special place with unique ecosystems
- understands that caring for our resources of the land and sea is important to our well-being and survival.



Conservation education integrates:

Education ABOUT the environment – developing knowledge and skills
Curriculum-based learning and inquiry, usually in the classroom. Education ABOUT the environment develops awareness and understanding of environmental issues.

Education IN the environment – connecting to nature and place
Learning that takes place outside – place-based learning. Education IN the environment fosters values and attitudes by encouraging personal growth and well-being through direct contact with nature.

Education FOR the environment – taking action to restore, grow and protect
Applying skills, knowledge and values to take environmental action and participate in local restoration. Education FOR the environment increases a sense of responsibility, confidence and empowerment through participating in active citizenship and taking collective action to resolve environmental issues.

MĀORI PERSPECTIVES

This resource incorporates cultural knowledge, kaupapa and te reo Māori. Concepts from Te Ao Māori such as whakapapa, manaaki/manaakitanga, kaitiakitanga, mauri and tikanga are woven through the resource. Activities include links and concepts aligned with Te Marautanga o Aotearoa.

For more information about Te Ao Māori and how to incorporate these important concepts into your teaching, go to Māori History in the NZ Curriculum.

The following Māori values will be explored in this resource:

- **Mauri** – all things are united through mauri, the life force or life essence. People are part of the natural world and connected through mauri. The mauri of the natural world has been weakened by pests and habitat destruction, but we can restore mauri by looking after our environment.
- **Mana** means respect, power and authority. Everything in the natural world has mana.
- **Tapu** means something is sacred. Every part of the natural world, including ourselves, has tapu. Some places have a tapu placed on them if they are sacred or for spiritual reasons.
- **Manaaki** means to look after and take care of. It is our responsibility to manaaki (care for) our natural resources.

Big Picture values are drawn from the Māori perspective of the natural world. Use these as a starting point to explore your own values about the natural world. Go to Big picture values.

INTEGRATED INQUIRY CYCLE

This resource is based on the integrated inquiry learning cycle (see page 11). 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, which allows them to apply these and contribute to real-life authentic action. The teacher supports this process and guides the students on their journeys.

This teaching model incorporates a variety of thinking skills, information literacy skills and integrates well with digital technology. The cycle incorporates objectives from science, social science, technology, values, key competencies, literacy and numeracy, as well as EEfS.

For more information about DOC's inquiry cycle, go to Integrated inquiry learning cycle.

Using the inquiry cycle

Teachers and students can select material and parts of activities from the resource to suit their learning inquiries. The resource is not meant to be taught from beginning to end but can serve as a pool of ideas to draw from. Suggested inquiry steps for each activity can be found in the top right-hand corner of the initial page.

The inquiry cycle follows a thread throughout the resource and each inquiry step is described within activities. For further information about inquiry steps, see: pages 12–13.

Use the *Inquiry plan for your estuary* to guide your student's learning journey through the resource using the integrated inquiry model.

See the student worksheet *Inquiry plan for your estuary* on pages 18–19. For a Google Docs version, go to the Inquiry plan for your estuary.

Student inquiry learning cycle

The Environmental Education inquiry cycle is a continuous learning process. The solid lines represent the opportunity for focussed teaching and learning ABOUT, IN or FOR the environment. The dotted lines reflect the potential for ongoing opportunities in these dimensions.

Developing knowledge and skills

Education ABOUT the environment

Connecting to nature and Place

Education IN the environment

Taking action to restore, grow and protect our nature

Education FOR the environment

1. Dive in

- What do we know already?
- Sharing experiences
- Introducing knowledge

2. Ask

- What are we wondering?
- Which questions will we investigate?

3. Investigate

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

4. Extending thinking

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

5. Coming to conclusions

- What did we find out?
- Problem solving/creating new ideas
- What are we going to do with our new learning?

6. Sharing our findings

- Who is our audience?
- Sharing knowledge and experiences through citizen science
- Sharing our new understandings

7. Planning for Action

- What action will we take?
- Which issues will this address?

8. Implementing action

9. Review and reflect

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

Inquiry learning: Stages in the inquiry cycle

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. The teacher supports this process and guides the students on their journeys.

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

Stage 1: Dive in

Introducing the topic and immersing students in the subject or context. Taking into account prior knowledge and experience, students and teachers can develop a learning sequence which will meet learning needs and interests. Key concepts are introduced to form a foundation of knowledge for a learning inquiry.

Stage 2: Ask

Students now ask questions and further explore their ideas and how they relate to their prior knowledge. Student questions can be grouped with one main 'big/ essential' question and several minor questions for those needing more guidance. A big/ essential question has multiple answers and is an open question, requiring extensive research to answer. This forms the foundation of the inquiry.

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. They begin to organise and filter 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 to form new concepts. At this stage, students also look into aspects of social inquiry – values and perspectives – and consider people's responses and decisions.

Stage 5: Coming to conclusions

Look back at overall findings. 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 their estuary and wider marine environment. They identify which issue is most engaging and relevant to their communities.

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.

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 they will act for their estuary and marine environment.

Stage 8: Implementing action

Now it's time to have fun and take action. Students work in a real-life context to apply their learning and understanding to take action. The action should target the focus issue and aim to create a positive future for their local estuary or marine environment.

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. Reviewing and reflecting is also helpful at each stage of the inquiry learning cycle.

EXAMPLE UNIT PLAN: PROTECTING OUR ESTUARIES

Note: Teachers and students are encouraged to adjust the activities, unit plan and learning sequence to suit students' needs, interests and inquiries.

For a Google Docs version, go to Investigating estuaries example unit plan.

Make a copy and edit to reflect your local context and students' needs.

Key outcome:

To provide students, teachers and their communities with opportunities to grow their knowledge, skills and understandings about estuaries, so they can help resolve environmental challenges for local estuaries and protect coastal environments.

Curriculum areas:

Science, Social sciences, English, Mathematics, Technology, Health, the Arts.

Te Marautanga o Aotearoa: Pūtaiao, Hauora, Tikanga ā iwi.

Levels: 1–4

Years: 1–8

Overarching learning outcomes:

- Build knowledge and understanding of New Zealand's estuaries and how to protect them
- Raise awareness of the current situation for their local estuaries and marine environment
- Understand how people are involved in estuaries
- Contribute to a positive future for estuaries and the marine environment.

Values	Ecological sustainability, equity, 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, Treaty of Waitangi, High expectations, Inclusion, Coherence, Community engagement, Future focus

Lesson sequence	Inquiry stage/s	Curriculum links (Levels 1–4)	Key concepts	Description
1. Introducing estuaries	1. Dive in, 2. Ask	Science: Living world: Planet Earth and Beyond Nature of Science (NoS): Participating and contributing Te Marautanga o Aotearoa (TMoA): Pūtaiao: The natural world	Recognising estuaries. Reflecting on prior knowledge and wonderings.	Introducing estuaries. Introduction to types of New Zealand estuaries and the structure of an estuary.
Learning through inquiry ***Stages 1–9 (throughout the learning)***		*Integrated curriculum areas*	*Additional key concepts will depend on inquiry questions.*	*Students can work through an inquiry using relevant materials and suggested lessons or alternative resources.*
2. The importance of estuaries	3. Investigate	Science: Planet Earth and Beyond: Earth systems Nature of Science: Communicating in science, Investigating in science Te Marautanga o Aotearoa (TMoA): Pūtaiao: The natural world	Why estuaries are important for people, animals and beyond.	Estuaries as resources and how they provide for us as humans. How estuaries also maintain the wider environment and provide habitat, foods and shelter for animals.
3. Estuaries as habitats	3. Investigate, 4. Extending thinking	Science: Living world: Ecology Nature of Science: Investigating in science TMoA: Pūtaiao: The natural world	Estuaries contain a variety of different habitats for native animals.	Learn about habitats within estuaries and how some native animals are suited to living in estuary habitats, such as mangrove forests, saltmarshes, mudflats, and sandy shores.
4: Life in an estuary	3. Investigate, 4. Extending thinking	Science: Living world: Life processes Nature of Science: Investigating in science TMoA: Pūtaiao: The natural world	Common New Zealand estuary animals.	Integrated literacy reading sheets about how plants and animals such as seagrass, mangroves/manawa, snapper/tāmure, eels/tuna, īnanga and cockles/tuangi feed, reproduce and live in estuaries.
5. Experiment-ing with water	3. Investigate	Science: Material World, Planet Earth and beyond: Earth systems, Interacting systems Nature of Science: Investigating in science TMoA: Pūtaiao: The material world	Water in estuaries: mixing salt and fresh water, buoyancy and other concepts.	Experiment with salt water and fresh water to see how they mix and flow in estuaries.
6: Estuaries for everyone	4. Extending thinking	Social Science: Social Studies Science: Planet Earth and Beyond: Interacting systems Nature of Science: Participating and contributing TMoA: Tikanga ā iwi, Pūtaiao: The natural world	People and estuaries. How different people view and value estuaries.	Exploring views and values people hold about estuaries and finding out about the perspectives of the wider community.

Lesson sequence	Inquiry stage/s	Curriculum links (Levels 1–4)	Key concepts	Description
7: Estuaries and Te Ao Māori	4. Extending thinking	Social Science: Social studies TMoA: Pūtaiao: The natural world, Tikanga ā Iwi Nature of Science: Investigating in science	Exploring Māori perspectives on estuaries to encourage thinking from a bicultural perspective.	Cultural, historical and traditional uses and beliefs of Māori relating to estuaries. Whakapapa, Tangaroa, mauri, mahinga kai, kaitiakitanga.
8: Healthy estuaries	4. Extending thinking	Science: Living world: Ecology Nature of Science: Understanding about science, Investigating in science, Participating and contributing Health: Healthy communities and environments TMoA: Tikanga ā iwi, Pūtaiao: The natural world	Features of healthy estuaries. Issues for estuaries.	This activity explores why we need healthy estuaries, how we can test the health of an estuary. Students also learn about issues threatening estuaries such as: pollution, sedimentation, climate change, and invasive species.
9: Visiting estuaries	3. Investigate, 4. Extending thinking	Science: Living world: Evolution Health: Personal health and physical development: Safety management Nature of Science: Investigating in science, Participating and contributing TMoA: Pūtaiao: The natural world	Connecting to estuaries and thinking like a scientist. Students will have direct experience of estuary ecosystems.	Planning and carrying out a visit to an estuary. Making predictions and finding evidence and observations to support or challenge ideas. Explore how to manage risks in the outdoors.
10: The current situation	5. Coming to conclusions, 9. Review and reflect, 6. Sharing your findings	Science: Living world: Ecology Nature of Science: Communicating in science, Participating and contributing Social Sciences: Social studies Mathematics: Statistics TMoA: Tikanga ā iwi, Pūtaiao: The natural world	Organising and reviewing inquiry information in order to come to conclusions about an estuary.	Reflecting on findings. Summing up the local situation and sharing findings with the community.
11: The future for our estuaries	4. Extending thinking, 7. Planning for action	Social Science: Social studies Science: Levels 1–4: Living world; Nature of Science: Investigating in science, Participating and contributing TMoA: Tikanga ā iwi, Pūtaiao: The natural world	Looking at what the future might look like for New Zealand's estuaries and what can be done to help with estuary issues.	Examine an issue for their local estuary with futures thinking. Thinking about possibilities for action and how to improve estuarine health.
12: Environmental action for estuaries	8. Implementing action, 9. Review and reflect	Technology: Technological practice Nature of Science: Participating and contributing TMoA: Tikanga ā iwi, Pūtaiao: The natural world	Taking action for a local estuary or marine environment.	Brief and action plan templates. Examples of actions they could undertake. Next steps, monitoring and reflection.

Lesson sequence	Inquiry stage/s	Curriculum links (Levels 1–4)	Key concepts	Description
Appendix: **Site visit notes** **Teaching strategies**	3. Investigate	Science: Living world Nature of Science: Investigating in Science, Participating and contributing	Visit notes for ten popular estuary sites throughout New Zealand. Ideas for observing and gathering data. Information about facilities and education options at each site.	1. Whangateau estuary, North Auckland 2. Manukau Harbour/Ambury Regional Park 3. Miranda/Firth of Thames 4. Ohiwa Harbour, Bay of Plenty 5. Ahuriri inlet, Napier 6. Pāuatahanui inlet, Wellington 7. Manawatu estuary, Manawatu 8. Waimea inlet, Motueka 9. Ōkārito Lagoon, Westland 10. Otago Harbour, Dunedin 11. Avon-Heathcote estuary, Christchurch 12. Ashley River/Rakahuri estuary, Rangiora 13. Awarua estuary, Invercargill

Inquiry plan for your estuary

Describe your estuary

What have you noticed, experienced and/or observed in this estuary?

Ask: What are your questions about this estuary?

Investigate: Planning investigations

How will you answer your questions? Where can you find information?

Which people are involved in your estuary?

Make a prediction about your estuary based on your knowledge, observations and experiences

Inquiry plan for your estuary (continued)

Findings and results of investigations
Conclusions
Possible actions to enhance our estuary