



**INTERNATIONAL
ANTARCTIC
CENTRE**

Antarctic Adventures

UNIT 2: LOVE IT

Teacher Guide

Antarctic Adventures: Love it

Explore how our climate is continually changing, and how this can affect the environment and animals within Antarctica. Take a look at our ozone and how our actions are affecting this. Learn that the extreme Antarctic weather has led to animal adaptations and inspired human innovation. Look into geology and glaciology, where volcanoes and glaciers meet. Let us guide you through the effects of shifting sea ice, and dive into the Southern Ocean to learn about marine life. Find out about the acidification of our oceans and how this impacts not only our environment, but our wildlife too. Through this all, observe how our changing world relates to Te Ao Māori and gain insight into the importance of an indigenous worldview!

Curriculum Links

Aligned to Level 4 of the New Zealand Curriculum

Science

- **Nature of Science – Participating and Contributing**
Use their growing science knowledge when considering issues of concern to them.
Explore various aspects of an issue and make decisions about possible actions.
- **Planet Earth and Beyond – Earth Systems**
Develop an understanding that water, air, rocks and soil, and life forms make up our planet and recognise that these are also Earth's resources.
- **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.

Math

- **Number and Algebra – Equations and Expressions**
Form and solve simple linear equations.
- **Number and Algebra – Patterns and Relationships**
Use graphs, tables, and rules to describe linear relationships found in number and spatial patterns.

Literacy

- **Speaking, Writing and Presenting – Ideas**
Select, develop, and communicate ideas on a range of topics.

Mātauranga Māori

- Basic implementation of te reo Māori vocabulary.
- Brief introduction to pūrākau through Māori narratives, including creation stories and atua Māori.
- Introduction to Māori cultural concepts such as whakapapa, kaitiakitanga, and kōrero tuku iho, giving insight into Te Ao Māori relating to both people and the environment.
- Integration of whakataukī into both Māori and Western content, expanding te reo Māori vocabulary and worldview.
- Māori geography and place names within Aotearoa.
- The relationship with volcanoes and iwi through whakapapa.
- The importance of te moana and how the ocean is intertwined with every aspect of Māori life, like whakapapa and cultural identity.
- Highlighting Māori scientists, like Dr Daniel Hikuroa, who create change in both Te Tiri o te Moana and Aotearoa, and apply their own mātauranga to their work to improve our Māori communities.
- Traditional Māori methods of environmental tracking, observation and active protection, often seen throughout their daily lives for survival.
- The impact of climate change on Aotearoa, and Māori indigenous conservation strategies such as rāhui that would have value by being implemented in mainstream protection efforts.
- Outlining how melting sea ice could impact cultures, such as Māori and Pasifika, due to displacement from homelands.

Key Competencies

- Thinking
- Using language, symbols and texts
- Participating and Contributing

21st Century Skills

- Creativity
- Collaboration
- Critical Thinking and Problem solving

Useful Links!

- Animal Adaptations – Blubber Gloves Investigation
- Ocean Acidification – Shell Corrosion Investigation
- Science Learning Hub – Love It! Collection
- House of Science Resource Library
- Science Alive Mātauranga Facebook Group
- Science Alive Mātauranga FAQs
- Education Perfect Help Centre

Antarctic Adventures: Love It

Discovery

Students will be able to...

- ▶ Define key words: weather, climate, global warming, climate change
- ▶ Identify the impact of climate change in Te Tiri O Te Moana–Antarctica
- ▶ Define the atmosphere and its parts
- ▶ Describe the extreme environment in Antarctica
- ▶ Define geology and plate tectonics
- ▶ Define glaciology and glaciers
- ▶ Define sea ice in the Antarctic environment
- ▶ Define the terms "food chain" and "food web"
- ▶ Define ocean acidification

Connection

Students will be able to...

- ▶ Explain the role of humans in the greenhouse effect
- ▶ Explain the role of scientists and global actions in Te Tiri O Te Moana–Antarctica
- ▶ Analyse the impacts of the ozone hole in Antarctica
- ▶ Explain how living things adapt to the Antarctic environment
- ▶ Compare and contrast volcanoes in Antarctica and Aotearoa
- ▶ Explain the importance of using satellite data to analyse ice
- ▶ Describe how animal life on sea ice is affected by climate change
- ▶ Explain why krill is important in Antarctica
- ▶ Explain the effect of ocean acidification on Antarctica

Application

Students will be able to...

- ▶ Propose actions that you can do in your daily life to reduce greenhouse-gas emissions
- ▶ Analyse global actions against climate change
- ▶ Propose actions to help the recovery of the ozone hole
- ▶ Analyse how humans use technology to adapt to extreme environments
- ▶ Analyse the impacts of volcanoes in Antarctica
- ▶ Predict how climate change could affect glaciers
- ▶ Analyse scientific research into sea ice in Antarctica
- ▶ Analyse visual representations of food webs
- ▶ Analyse how researchers use technology to understand and predict changes in Antarctica

Description

Learning Objectives

Key Concepts & Skills

Follow Up Activities

The Climate Environment in Antarctica

What is the weather like in Antarctica, and is it the same as the climate?

Knowing what the difference between weather and climate is, learn about the relationship between human activity and climate change. Explore easy ways to reduce greenhouse gas emissions.

- Define key words: weather, climate, global warming, climate change.
- Explain the role of humans in the greenhouse effect.
- Propose actions that you can do in your daily life to reduce greenhouse-gas emissions.

- Understanding weather, climate, global warming, and climate change.
- The Earth's axial tilt and climate zones.
- The relationship between human activity and climate change, i.e. the greenhouse effect.
- Atmospheric carbon dioxide concentration.
- Reading and interpreting graphs.
- The biggest greenhouse gas emitters in Aotearoa.
- Finding a solution from looking at a problem.

- Create an appealing poster about what you have learnt about climate change, how it links with global warming, and the greenhouse effect. Think about how your viewers could make a change.
- Get creative and create a comic strip or drawing of at least three things you could do to take action against climate change.
- Imagine... You're a climate scientist in Antarctica, being interviewed for a documentary. The journalists asks, "What impact have humans had on climate change?" Film your answers or act the interview out in a group.

Tackling the Changing Climate in Antarctica

What effects does global warming have on Antarctica and the Southern Ocean, and how do we know about them?

Without scientists, like those at Aotearoa's research station Scott Base, we would not have the knowledge to take global action against climate change. Learn about the physics that cause these changes. Also, meet Dr Michelle LaRue, who researches penguins!

- Identify the impact of climate change in Te Tiri O Te Moana–Antarctica.
- Explain the role of scientists and global actions in Te Tiri O Te Moana–Antarctica
- Analyse global actions against climate change.

- The reflection or absorption of heat by light or dark surfaces.
- Warming ocean water and melting sea ice.
- Ocean water temperature and carbon dioxide absorption,
- Research methods such as ice core drilling and analysis.
- The effects of climate change on Antarctic wildlife.
- Source of renewable energy and their use and potential in Antarctica.
- The power of unity and the Paris Agreement.
- Becoming a scientist in Te Tiri o Te Moana.

- Pretend to be a scientist who answers the following question in an essay: What do you think Antarctica might be like if the climate continues to change in this way? Think about the impacts global warming has on the environment as well as on the living things in Antarctica.
- Create a poster or infographic that displays at least three ways scientists are tackling climate change in Antarctica. Make sure your information is clear and fun to look at!
- Every country in the world has a flag right? The Paris agreement saw 197 countries come together to sign an agreement acting on climate change. Design one flag to represent this agreement.

Ozone: the Invisible Blanket

What is between the space and the ground of our Earth? Why is ozone important there?

Explore the different layers of the atmosphere of our planet, from the troposphere, where clouds travel, to the thermosphere, where the Southern Lights dance. Zoom in on the stratosphere to learn about ozone, the ozone layer and what a hole over Antarctica has to do with sunburn.

- Define the atmosphere and its parts.
- Analyse the impacts of the ozone hole in Antarctica.
- Propose actions to help the recovery of the ozone hole.

- Rangi-tūhāhā, the Māori understanding of the atmosphere.
- The different layers of our Earth's atmosphere.
- The composition of ozone
- The ozone layer, sunburn and UV protection.
- The causes and effects of the ozone hole.
- The Montreal Protocol and the efforts to close the ozone hole.

- Research five products that release CFCs and find alternatives. Present your findings in a poster.
- Draw and label a diagram of the atmosphere and its layers.
- Write a diary entry that will describe a day in your life where you would take different actions to help the ozone layer.
- Imagine... You're in Antarctica to shoot a TV advertisement. Your goal is to explain why people in Aotearoa should care about the ozone layer. Film your advertisement or act it out with your classmates.

Description

Extremes: Super Cold, Windy and Dry

Why is it so super cold, windy and dry in Antarctica? How do animals survive these conditions without the comforts of woolly sweaters and thermal insulation?

Learn how Antarctic animals have adapted to the extreme environment, and how humans imitate their adaptations for our own survival.

Learning Objectives

- Describe the extreme environment in Antarctica.
- Explain how living things adapt to the Antarctic environment.
- Analyse how humans use technology to adapt to extreme environments.

Key Concepts & Skills

- Kūnāwiri is the cold, discovered by Māori atua, the children of Ranginui and Papatūānuku.
- The extreme conditions in Te Tiri o Te Moana.
- The adaptations of krill, penguins and seals to survive the extreme environment.
- Thermal insulation and transport: the steps undertaken by humans to survive on this continent in order to conduct research.
- The elements of survival training.
- Humans have observed animal adaptations and copied features such as wearing layers of clothing and well-insulated research bases.

Follow Up Activities

- Write a diary entry as if you are living in Antarctica. Describe how you prepare for the day ahead and what extreme environments you run into during the day.
- Think about the ways animals have adapted to survive in Antarctica. Invent an Antarctic outfit that could change the way humans survive in Antarctica.
- Have a go at designing the new Scott Base. Think outside the box! How could your design help protect humans from the extreme environments in Antarctica?

Geology: Where Fire Meets Ice

What is geology? How are volcanoes an important feature of our environment? Understand that volcanoes have cultural importance to Māori, and gain knowledge about volcanoes both in Antarctica and Aotearoa.

Explore the volcanoes that hide under the ice in Antarctica, and the work that scientists do to investigate these volcanoes. Learn what would happen if these volcanoes erupted on the icy continent or in Aotearoa!

- Define geology and plate tectonics.
- Compare and contrast volcanoes in Antarctica and Aotearoa.
- Analyse the impacts of volcanoes in Antarctica

- Geology involves Earth as a whole, which includes volcanoes.
- The Pacific ring of fire explains the large amount of volcanoes in the Pacific.
- Volcanoes relate to whakapapa (ancestry) for Māori iwi.
- Antarctic volcanoes remain under the ice sheet.
- The difference between active, dormant and extinct.
- Mount Erebus and Deception Island are two active volcanoes on the Antarctic continent.

- Record a video that teaches someone else about the layers of our earth. Remember to use keywords and describe each layer. You could even make a model volcano to share how and why they erupt!
- Create an infographic that informs readers about volcanoes in Antarctica! Think bright images and clear labels and descriptions! Don't forget to use the key words we have learnt in this lesson. This could be on paper, online or done in a group!
- Invent a backpack that could be used to protect humans from volcanic activity in Antarctica. What would it include and how would it work? Draw a labelled diagram with an explanation of its features.

Glaciology: Stay Frosty!

What makes glaciers interesting? What exactly is glaciology? Follow the work of glaciologists and gain insight into the study of ice.

The shrinking of frozen freshwater glaciers shows the impact of climate change, Understand how the work of scientists helps to observe changes in our glaciers and prevent melting ice from causing sea level rising.

- Define glaciology and glaciers.
- Explain the importance of using satellite data to analyse ice.
- Predict how climate change could affect glaciers.

- The slow moving and melting of glaciers.
- Science projects like NASA's ICESat project.
- The use of satellites and technology to track changes in the glaciers around the world.
- Aotearoa has many glaciers that are at risk of melting.
- Melting of freshwater ice can cause sea levels to rise.
- Rising sea levels affect the ocean, people, and wildlife.
- Climate change is the driving force.

- Pretend you are an explorer in Antarctica and you discover a glacier! What might you see? What do you do? Do you climb the glacier? Is it dangerous? What if you were able to name the glacier?
- Create a presentation to share with your classmates about the glaciers in Aotearoa. Find out where they are and how people can visit them. Have these glaciers changed much? Will they stay the same size?
- How are glaciers formed? Create a diagram that clearly shows the process of glaciers being formed. Make sure your diagram has labels and descriptions to explain your ideas.

Description

Learning Objectives

Key Concepts & Skills

Follow Up Activities

Sea Ice: Ice, Ice Babies!

Who has explored Antarctic sea ice? How is sea ice integral to the environment?

Find out how Antarctic sea ice sustains living creatures such as penguins and algae.

Understand that the melting of sea ice affects our land as well as wildlife. Note that rising sea levels threaten the Pacific areas, which can affect culture too.

- Define sea ice in the Antarctic environment.
- Describe how animal life on sea ice is affected by climate change.
- Analyse scientific research into sea ice in Antarctica.

- Early explorers encountered sea ice surrounding Antarctica.
- The different types of Antarctic ice.
- Sea ice is salt water that has frozen, and is home for a wide range of wildlife.
- Salinity and buoyancy.
- Climate change and melting sea ice.
- Melting sea ice has large effects on the environment.
- Rising sea levels will impact coastal areas, like the Pacific Islands, most prominently.
- Researching sea ice through NASA satellites.

- Create a fun infographic to illustrate the four types of Antarctic Ice in this lesson! Remember to include diagrams, labels, and descriptions to explain your ideas.
- Write a poem or rap verse about how animal life in Antarctica is being affected by the melting of sea ice.
- You are building a house on the beach. Make some modifications to the design so that your house will survive a 2 metre rise in Sea Level. You could do this on paper, TinkerCAD, CoSpaces, Minecraft or make a model!

Marine Life: Under the Sea

How do animals rely on one another for survival, and how does this affect us? Learn about the importance of food chains and food webs, which are constantly changing as our environment changes.

Take a look into the importance of krill, and the role they play in keeping the ecosystem balanced. See how human actions can prevent negative impacts on the food web, and why this protection is needed!

- Define the terms "food chain" and "food web".
- Explain why krill is important in Antarctica.
- Analyse visual representations of food webs.

- Understanding the fragile nature of food chains and food webs.
- The difference between omnivores, herbivores and carnivores.
- The importance of krill and how actions such as krill fishing can affect the ecosystem.
- Human impact on Antarctica eco-systems and environment.
- Knowing that the Ocean is taonga tuku iho, treasure passed on from our ancestors.

- Design an out-of-the-box 3 course menu for one of the organisms based on what you know about the Antarctic Food web. Make it as delicious or as crazy as you like! Share your menu in a presentation online or on paper with your class!
- Create a fun diagram that illustrates the Antarctic food web! Include a description of what a food web shows and what could happen if something from the web becomes unavailable.
- Get together with a group of friends and plan a clean up of your local waterways. You do not have to live near the beach to do this! Count how many pieces of rubbish you find and sort them into categories—present your findings to your class

Ocean acidification: Dipping in the Southern Ocean

How do our actions affect the Ocean? Gain understanding about the effects of climate change on the Ocean.

Find out more about how burning fossil fuels and polluting the Earth is changing our Oceans and making them more acidic. Understand the effects this acidification has on wildlife, and why this needs to change!

- Define ocean acidification.
- Explain the effect of ocean acidification on Antarctica.
- Analyse how researchers use technology to understand and predict changes in Antarctica.

- Chemistry behind Ocean Acidification.
- pH scale: acidic, alkaline, and neutral.
- Carbonic acid causing corrosion of shelled marine life.
- The fragile nature of the food web.
- Scientific research conducted by organisations such as NIWA and ICECUBE.
- Scientists gaining more knowledge about the changing ocean and how this affects the ecosystem.

- Create a clear diagram of the ocean acidification process. What happens first? Then what happens? Clearly label your diagram to explain what is happening.
- Invent something that could help with the effects of ocean acidification. Could it stop the absorption of carbon dioxide into the ocean? Could it be a replacement shell for the sea butterfly? Make sure you explain your idea clearly with drawings and labels.
- Create a piece of visual art that represents ocean acidification. This could be a painting, drawing, sculpture, photograph or even an installation! Share your thoughts and artwork with the class.