

TASMANIAN MUSEUM & ART GALLERY

ISLANDS TO ICE

THE GREAT SOUTHERN
OCEAN & ANTARCTICA

EDUCATION KIT



TASMANIAN MUSEUM
and ART GALLERY

Written by Andy Baird, Education Officer, TMAG
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ISLANDS TO ICE EDUCATION KIT

Introduction

The following material has been developed by the Education section of the Tasmanian Museum and Art Gallery to support the exhibition *Islands to Ice: The Great Southern Ocean and Antarctica*. The kit is divided into four sections.

The exhibition provides an overview of the content of the exhibition, and how teachers may use it for their classes, prior to a visit.

Teachers notes and exhibition guide provides information for teachers and activities for students around 5 key themes. Within this section there are sheets for students to use as conversation starters and areas of inquiry, plus additional material for classroom activities. Each of these themes also has a school program run by Museum education staff utilising the exhibition.

Resources provides additional teaching resources, which are also available as downloadable files, including maps, food webs, and a floor plan of the exhibition.

Visiting TMAG provides general information for teachers intending to bring a class into the Tasmanian Museum and Art Gallery, including booking procedures.

This kit is not intended to reiterate the numerous excellent resources available for teachers on the topic of Antarctica. There are two very useful kits that complement the exhibition. *Classroom Antarctica*, produced by the Australian Antarctic Division is focussed towards primary students. *Antarctica*, produced by the British Foreign and Commonwealth Office in collaboration with the British Antarctic Survey focusses more on the secondary level. Both are available on line at their respective websites: www.classroomantarctica.aad.gov.au and www.discoveringantarctica.org.uk

A web search will quickly identify numerous other resources available, and some of these are identified in the **Resources** section of this kit.



ISLANDS TO ICE THE EXHIBITION



Background information on the exhibition

The following descriptions give teachers an overview of what is in the exhibition and some of the rationale behind the choices of what is on display. Teachers can use it to plan their own pre and post visit activities along with the specific program material presented later in this kit.

Islands to Ice: The Great Southern Ocean and Antarctica is a new gallery featuring the region south of 40° latitude. This is Tasmania's backyard; the wild Southern Ocean, our neighbours the remote sub-Antarctic islands and the icy expanse of Antarctica. The connections between Tasmania and the far south have been strong for centuries: from the Tasmanian Aboriginal perceptions of the icy lands incorporated into dreaming stories, through the heroic era of exploration at the turn of the 20th century to the recent position of Hobart as the home of major Antarctic and Southern Ocean research organisations.

The exhibition brings these often inaccessible regions and times into focus with real specimens and artefacts. It follows a journey that highlights the elemental nature of the environment.



Wind or air, encapsulates the wild seascapes of the Southern Ocean where the latitudes are named almost poetically as the roaring forties, furious fifties and screaming sixties.



Earth, the sub-Antarctic mid oceanic ridge of Macquarie Island declared World Heritage for its geological features.



Fire, Australia's active volcano on sub-Antarctic Heard Island



Water, the frozen expanse of the Antarctic continent that holds 70% of the world's fresh water.

Whilst the poetic elements give us a framework for engagement, the journey carries us through time. An intimate multi-media space tells the stories of the region before it was charted by Cook in 1772–5, a time of Aboriginal Dreaming, Polynesian navigators, Ancient Greek hypothesis and European utopian imaginings. Further into the exhibition we learn what motivates people to go south, what whalers found, what explorers charted and claimed and what scientists have revealed. What it is like to live and work in some of the most inhospitable climates on earth.

This is a rich and varied exhibition that brings the humanities and the sciences together. It can be explored by students from all grades and interests and is an experience for everyone.

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Earliest Perceptions

A multimedia space brings the ethereal narrative of the earliest human perceptions of the region to life. In the creation story of Troweena, an Aboriginal name for Tasmania, the great icy lands and southern waters are a key feature, as they are in the Polynesian navigation achievements of Ui-te-rangiora who sailed into a frozen sea 'like arrowroot'. The ancient Greek Aristotle gave it the name 'Antarktikos' and used it to balance his globe, and the map makers of the Middle Ages populated the region with frightening creatures. It was a landscape of the mind, and this exhibition presents that in a fascinating manner.

The Southern Ocean

This section deals with one of the most important but least understood areas on the planet: the great ocean of the south. Mainly a graphic and text area, it presents stunning still and moving images of the Southern Ocean, and focuses on its role in climate—with updated weather web cams of the Australian stations as well as satellite data over the southern region. A large map places the exhibition in its geographical context and a model of Southern Ocean currents interprets the importance of the massive flow of water around the globe. And not forgetting the sea bottom, a transect of the bathymetry from Australia to South America shows the remarkable depths of areas such as the South Sandwich Trench, plus an underwater animated 'flythrough' reveals the hidden world of the sea mounts.

What to see?

- Imagery of the Southern Ocean
- A model of the ocean currents
- An interactive of the relative size of Antarctica compared to other continents
- Historic navigational objects: sextant, ships pilot, prismatic compass
- Web cams of the South Pole, Davis Base and Macquarie Island
- Geological samples of sea mounts

Wildlife in motion

Central to the exhibition, and swirling through the gallery, is a large diorama of amazing creatures from the region. From the whale bone graveyard on the ocean floor up through a churning bait ball of fish and plunging petrels, the diorama reaches into the skies with albatrosses and shearwaters. The waters are alive with Patagonian toothfish, Pacific sleeper shark, stingray and more. A pair of courting Wandering albatrosses on an island backdrop nearby show the breeding habitat of a truly beautiful species.

Adding to the interpretation are underwater soundscapes of Weddell and Leopard seals beneath the ice, and of whales communicating. A stereoscopic microscope brings to life the miniature world of the Protista, tiny creatures whose actual biomass exceeds that of all the larger fish and mammals by orders of magnitude. Tying it all together, a food web illustration explains the complexity of a natural system whose productivity belies the ocean's empty surface appearance.

The animals in the dioramas are a combination of taxidermy specimens and life-size models. Supplementing these are drawers of study specimens of island bird life and herbarium specimens from the islands.

ISLANDS TO ICE THE EXHIBITION



The sub-Antarctic islands

There are over 26 island groups in the sub-Antarctic region, most uninhabited even by researchers. Many have unique ecologies and a wealth of wildlife. This section highlights two main groups under Australian jurisdiction: Macquarie Island and the Heard/McDonald Island group, but provides brief descriptions and imagery of all 26 groups.

Macquarie Island, described by Sir Douglas Mawson in 1919 as 'one of the wonder spots of the world', is the only place on earth where mid-oceanic crustal rocks, all formed on or below the sea-bed, are exposed on the surface. In geological terms this happened very recently, less than 700,000 years ago. It is primarily for these geological reasons that the island was declared a World Heritage Area in 1997. Although Macquarie Island's earth story is remarkable, its wildlife is equally fascinating. It teems with vast colonies of seals, perhaps up to 100,000, and penguins, numbering around 4 million. Other seabirds such as the giant petrels, prions, gulls and skuas abound, as well as majestic albatrosses that wing across the oceans with a grace immortalised in the *Rime of The Ancient Mariner*. The island has, however, had a history punctuated with a voracious animal oil industry that devastated populations of Fur seals, Elephant seals and penguins between 1810 and the 1830s. At the same time, feral animal species arrived and it has taken until very recently to eradicate one of the most destructive, the cat.

The Heard and McDonald Island Group is altogether less known and understood, being the last of the Southern Ocean Islands to be discovered and lying as it does thousands of kilometres from any continental land. The first official report of the island was made in 1853, however a chart made in 1833 by sealers clearly shows the island. After the initial sealing parties, few visitors have braved the stormy Southern Ocean to reach this remote location though the region remains an important one for research today.

Heard Island is a volcanic cone covered in snow, ice, lava and glacial moraines. Rising up to 2,745m, the volcano named Big Ben grew from a magma plume that has been active for about 120 million years. It has given rise to a complex geology of recently formed igneous rocks and older sedimentary rocks on which pristine ecosystems exist. It is this remarkably intact ecology that was one of the main reasons for the island's World Heritage listing in 1997.

What to see:

- Geological samples from the islands, including lava tubes from Big Ben
- Plant specimens, including the unique Macquarie Island cabbage
- A beak from the now extinct Macquarie Island parakeet
- Penguin specimens from the islands: Gentoo, Rockhopper and Royal
- Many of the bird species found on the islands: prions, shags, Storm petrel, Cape petrel, fulmar, skuas
- Basalt head carved by a sealer
- Marine debris and a pack ice buoy

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Antarctica: the continent of ice

The cold expanse of ice that dominates the Antarctic continent actually begins far out to sea with the annual freezing of the sea ice. As visitors venture through the exhibition they travel further south and the icy world appears. With only approximately 2% of the Antarctic ice-free, this frozen watery continent that holds 70% of the earth's fresh water, rises up from the sea ice floor in a series of stunning images. Students can explore the information that the ice holds, the variety of its forms, the beauty of its ancient presence, touch an ice map of Antarctica, see an Antarctic ice core, and investigate the information hidden in these frozen records.

Life clings tenaciously to the limited environments on the continent on which it can exist. Displays featuring the flora, touch specimens of the fauna and magnifying interactives of the flora, fauna and geology allow visitors to see a world most will never visit.

In this area visitors can appreciate the world of Antarctic scientists, focussing on the unique sciences studied in the region. These include: upper atmospheric physics, meteorite studies, climate change, biological adaptation in animals, sea ice and oceanography. It is a rich and important environment for researchers, linked intimately with Tasmania where many of the nation's southern region research organisations operate.

What to see

- An Emperor penguin crèche
- Model of giant underwater sponges
- Antarctic ice core and an ice core scanner interactive
- Geological specimens including: ventifacts (wind sculptured rocks), erratics (glacier transported boulders), fossilised plant life
- Plant specimens including one of the only two flowering plants on the Antarctic continent, and diverse mosses and lichens.
- Scientific equipment, including a piece of the world's largest scientific instrument—the Ice Cube neutrino module and remote sensing equipment such as the Argo float and the XBT probe
- A multimedia interactive exploring the unique sciences of the region
- A frozen map of Antarctica and a South Magnetic Pole interactive
- Touch specimens of seal and penguin skins
- Specimens of Adelie penguin, Weddell seal skull and Snow petrel

Humans in the Antarctic region: why people go there

The exhibition is rounded off with the human stories. This is an object-rich gallery that explores two central questions: Why do people go there? How do they live there?

Captain James Cook is credited as the first person to circumnavigate the Antarctic continent in the *Resolution* during the 1772–1775 expedition, although the honour of this should really go to his second in command Captain Furneaux in the ship the *Adventure*. This expedition set in train a series of remarkable achievements by explorers and whalers/sealers over the next two centuries, and artefacts from these expeditions are presented in the gallery. Included are early navigation instruments, whaling equipment, provisions lists, letters, paintings, personal items, a sled from Borchgrevink's pioneering 1898 expedition. There is an original invitation to a ball on the Derwent River for the crew of the *Terror* and *Erebus* who, as part of James Clark Ross' expedition of 1830–43, sailed further south amongst the icebergs than any previous explorers. Another notable object is the first Australian flag flown at the South Pole, handmade by Jon Stevenson and flown during the first successful traverse of the Antarctic continent in 1957.

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Explorers covered in the exhibition

with expedition dates and ship names

James Cook	1772–1775	<i>Resolution and Adventure</i>
Thaddeus von Bellinghausen	1819–1821	<i>Vostok and Mirnyi</i>
James Weddell	1819–1824	<i>Jane and Beaufoy</i>
The Whalers: John Briscoe, Peter Kemp, John Balleny	1830–1833	<i>Tula, Lively, Magnet and Eliza Scott</i>
Jules Sebastian Cesar Dumont d'Urville	1837–1840	<i>Astrolabe and Zelee</i>
James Clark Ross	1839–1843	<i>Erebus and Terror</i>
Charles Wilkes	1838–42	<i>Vincennes, Peacock, Porpoise, Relief, Sea Gull and Flying Fish</i>
Wyville Thomson & Henry Mosely	1872–76	<i>Challenger</i>
Adrien de Gerlache	1897–1899	<i>Belgica</i>
Carsten Egeberg Borchgrevink	1894–1895 1989–1900	<i>Antarctic Southern Cross</i>
Louis Charles Bernacchi	1898–1900 1901–1904	<i>Southern Cross Discovery</i>
Robert Falcon Scott	1901–1904 1910–1912	<i>Discovery Terra Nova</i>
Ernest Shackleton	1901–1904 1907–1909 1914–1916 1921–1922	<i>Discovery Nimrod Endurance Quest</i>
Sir Douglas Mawson	1907–1909 1911–1914 1929–1931	<i>Nimrod Aurora Discovery</i>
Roald Amundsen	1910–1912	<i>Fram</i>

Additional people featured in the exhibition:

Charles Harrisson	Mawson's expedition	Biologist
Jon Stephenson	Hilary/Fuch's expedition	Geologist
Frank Debenham	Scott's 1910–1912 expedition	Geologist

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Tasmania has a special link with the historical story of Antarctica, exemplified by the many expeditions that visited Hobart on their way south. But we also have a strong tradition of Tasmanian explorers and expeditioners in their own right. The exhibition highlights the stories of these men including Louis Bernacchi, one of the first men to sleep on the continent, and Charles Harrison who was a biologist on Mawson's 1911–14 expedition.

Exploring was certainly not the only motivator for those heading south. Themes of commercialisation, including whaling, sealing and even 'penguining' are explored and put into contemporary contexts along with mineral exploration and the treaties, such as the Madrid Protocol, that now ban such resource extraction. In a world of rapidly changing values towards the environment and a recognition in the values inherent in other species, humans have turned to other reasons for visiting remote regions. Artists covet the aesthetic qualities, tourists the personal experiences and adventurers the physical challenges. How these groups fare on the icy landscape is told through paintings, interviews, artefacts, images and text.

What to see

- Celestial and terrestrial globes from Debenham, geologist with Scott
- Blubber press from Heard Island
- The first book published in Antarctica, the *Aurora Australis*
- Frank Hurley's movie footage of Mawson's expedition including the loading of ships from Hobart docks and life on Macquarie Island
- Steer the ships wheel south out of Hobart's port
- Whaling artefacts including harpoons, blubber ladles, flensing knives, whale oil, whale meat and ambregis
- Figure head of the historic Hobart whaler the *Aladdin*
- Scrimshaw
- Label from the Elephant seal oil industry
- Trypot used on Macquarie Island for boiling seals
- Model of Shackleton's whaleboat the *James Caird*
- Historic maps and documents

Theatrette featuring Frank Hurley's stereoscopic photography

The images taken by Frank Hurley, photographer with Mawson's Antarctic expedition, are probably amongst the most recognisable of the historic Antarctic photographs. The fact that much of his imagery was taken using a stereoscopic camera is far less known, and almost never seen. The 3D theatre in the gallery allows visitors to truly enter the Antarctica of yesteryear. The outstanding clarity of the original imagery, and the digital remastering and projection of them, gives viewers an intimate understanding of what life was like. Donning the 3D glasses, visitors can experience a 'reach in and touch it' sensation.

Humans in the Antarctic region: how people live there

There are fundamental requirements for human survival: food, shelter, warmth and companionship. Such fundamentals become readily apparent when the climatic conditions are as inhospitable as they are in the far southern region. But how humans have responded to these fundamentals is a story of innovation, makeshift practicality, and yes, mistakes.

This area of the exhibition focuses on clothing, transport, shelter, medicine and communication. Visitors can see examples of clothing changes from the 1920s to the 2006 range in Australian National Antarctic Research Expedition (ANARE) outfitting,

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a story surprising in its shift back to natural fibres and away from synthetics. See early radios, Mawson's original 1911 radio mast from Macquarie Island that relayed the first wireless transmission from the continent to the outside world, sleds, huskies, the weird and wonderful shelter responses to the elements. Find out what personal medical supplies were taken on a 1911 trip, what the layout of Mawson's Commonwealth Bay hut was, why the latest research bases on the ice are built to be continually elevated, and why the chef is one of the most important people on any expedition.

What to see

- Scale model of Mawson's hut at Commonwealth Bay
- Wilson's medical kit, from 1911
- The last huskies: taxidermy specimens of Satan and Coppo
- Clothing, including some weird and wonderful 'blizz' masks, ice travel equipment, and the latest Antarctic fashion
- Sleds: from 1890s Borchgrevink's to adventurer Tim Jarvis' 2000 version
- Multi-media interviews with expeditioners relating their experiences of going south
- Food rations including objects from Mawson's trips
- Historic documents including personal correspondence from expeditioners
- Ship model of an icebreaker



ISLANDS TO ICE TEACHER'S NOTES



Islands to Ice: the Great Southern Ocean and Antarctica provides a unique opportunity to engage and inspire students in the world of learning. Because of its breadth, covering elements of the natural and physical sciences, social sciences, history and humanities, the gallery is as an ideal setting for interdisciplinary studies. This makes it a great place to put into practice the new *Essential Learnings Framework*.

The exhibition covers a huge area of investigation, and students can branch off into many diverse, and personally relevant, areas of interest. The materials included are based on five chosen themes each of which has a museum education staff led activity. Whilst teachers are encouraged to book their class into these activities as part of their exhibition investigations, there is supporting material that can be used independently. Additional resources are the *Conundrum Guides*, which are designed to be individualised for topics your class may be investigating but that don't necessarily fit with the five chosen themes.

Please note that whilst the suggested year level is indicated for the themes below, teachers are encouraged to look at, and adapt, resources from other levels.

The Exhibition Guides on the five themes provide material for:

- Pre and post visit activities in the classroom
- Self guided gallery visits

Teachers are encouraged to visit the exhibition prior to their class visit or attend a pre-visit professional development session at the museum.

Why not worksheets?

Resources for use in the gallery are intended to be discussion starters and require no written response. Teachers may choose to use them as printouts for students or as notes for their own questioning. We recommend that teachers try and do the later, but if the resources are used as student printouts, have students focus on only a few questions of their choice. We encourage students to talk and share their discoveries. Experience in the museum has shown that students who have to gather written responses to set questions tend to spend most of their time copying down text, rather than looking at the objects. Invariably they then run out of time and leave feeling frustrated at missing sections of interest. It is also worth trying to ensure there is time in each visit for students to have an unstructured exploration of things that interest them.

It is strongly recommended that students undertake the related Museum Education Program led by museum staff as a first exposure to these themes.

The themes chosen here are limited but can easily be expanded to cover a vast range of possible themes relevant to a study of Antarctica. See the web resources for more information on these other themes. Note also that whilst web and book based research is limitless, the focus in this kit is on more experimental and experiential activities.

ISLANDS TO ICE TEACHER'S NOTES



Quick guide to program suitability

All programs can be tailored to meet specific class needs

Program	Preschool	Primary	Secondary	College
<i>Life in the Freezer</i>	•	•		
<i>Apples in Antarctica</i>		•	•	
<i>From Whaling to Wilderness?</i>			•	•
<i>Climate Change: Messages from the Frozen Continent</i>			•	•
<i>Underwater Wonderland</i>		•	•	•
<i>Conundrum guides</i>		•	•	•



ISLANDS TO ICE EXHIBITION GUIDE



Life in the Freezer

A day in the life of Antarctic and Southern Ocean animals

Albatross, penguin, elephant seal, krill... What is it like living in the coldest region of the world? How has the amazing wildlife adapted to this environment?

Why this theme?

The exploration of animals, their lives and habitats holds an inherent fascination for young students and teaches them about the interconnectedness of all things. Within this theme, nowhere holds children's fascination more than the environments of the far south: Antarctica and the Southern Ocean.

This region provides an ideal setting for an interdisciplinary study, bringing together elements of history and adventure, biological uniqueness and climatic extremes, human endurance and frontiers for new knowledge.

Within this study area it is best to take a systems based approach that focuses on the interactions of animals with their environments and with each other.

The Whole: the big picture

Students focus initially on the climate and environments of the far south.

The Parts

What species live in the region? What are the different habitats? —on the ice cap, on the sea ice, in the various depths of the oceans and on the islands.

The System

Food webs, life cycles, climate, ocean currents—the heat transfers between cold Antarctic and warmer tropical waters.

Human Impacts

As the only continent that has no indigenous people, Antarctica provides a valuable study for the way humans impact on a place. Such a study delves not just into the physical impacts on the landscape, on the wildlife or the atmosphere, but also on cultural aspects. What is Antarctic culture? Why does the place hold so much fascination? Why have so many sci-fi, utopian books been set there? Why do humans go there to study?

Life in the Freezer

A day in the life of Antarctic and Southern Ocean animals

CURRICULUM FOCUS

Thinking Inquiry
World futures investigating the natural and constructed world
Understanding systems

KEY LEARNING OUTCOMES

- Understands the process of inquiry and uses appropriate techniques for posing questions, defining problems, processing and evaluating data, drawing conclusions and flexibly applying findings to further learning and to creating new solutions
- Understands how to scientifically investigate the natural and constructed world, appreciating the tentative nature of knowledge and the value of creative, imaginative and speculative thinking
- Understands that the social, natural and constructed world is a complex web of relationships or systems

KEY IDEAS

Habitat, environmental conditions, evolution, adaptation, needs, webs, systems



Book a session with a Museum Educator for the program
Life in the Freezer: a day in the life of Antarctic and Southern Ocean animals.

This session involves role-play of 'character animals and close encounters with unusual animals.

Duration 1 hour

Suitable for grades K–6

ISLANDS TO ICE IN THE MUSEUM



Life in the Freezer

A day in the life of Antarctic and Southern Ocean animals

What's home like?

- What do you imagine the conditions of the Antarctic to be? Find the differences between conditions on the sub-Antarctic islands and the Antarctic continent itself. What do you think it *feels* like, what might you *see* and *hear*?
- The Southern Ocean might look on the surface to be a vast empty place, but is it? Can you find a reason why so many animals live in or depend on the Southern Ocean?
- Look at the web cams of the Australian bases in Antarctica to see the daily temperature and conditions.

Who lives there?

- We all know whales live in the sea, but what else depends on the oceans for their survival? Can you find an animal that you didn't previously know about?
- For animals needing land to breed it can be a big ocean with only little areas of ice free land. Choose a land breeding animal you'd like to be for a day and find the best place to live as that animal. Show your friends where it is on the big map.
- What special features allow different animals to live in this cold region? Can you find one animal that can do something remarkable that humans can't?

The neighbourhood

- Look at the food web illustration and see if you can find the really important animals that most of the others depend on. Whilst whales are certainly the biggest, if you collected all the animals of each type together (say all the whales, or all the fish, or all the krill, or all the penguins) which group would weigh the most?

The visitors

- Imagine you're a scientist conducting research on animals (zoologist) in Antarctica. What clothes would you need to wear? How would you travel to Antarctica?
- If you wanted to study the way an animal breeds, how would you go about it? Choose an animal and find out how it breeds, when it breeds and if you can't find the information, can you find out how scientists would investigate such a question?





Life in the Freezer

A day in the life of Antarctic and Southern Ocean animals

What's home like?

- How cold is cold? How cold is a fridge, a freezer? Freeze water of different salt concentrations (in insulated polystyrene cups) to see when sea water freezes (-1.9°C). Sea water can be made by dissolving 35g of salt in 1L of warm water.
- The cold Southern Ocean is very important. It is hard to imagine but cold oceans can be highly productive! One reason is because they can hold more oxygen. Discuss what this means for life within and around the ocean. What else is needed for high productivity?
- Freeze a tray of ice and have students carefully stand on it in bare feet. What might animals need to be able to walk on the ice and live in an icy environment?
- Insulation: Experiment with different insulating materials such as fur, feathers, fat. Place thermometers in small cups filled with these various materials and compare results after 10 minutes in the fridge.

Who lives there?

- Follow the life story of the a penguin as it breeds on the continent. Only two penguin species do this: the Emperor and the Adelle. Great DVD footage is available on *BBC Life in the Freezer Series*.
- Adelle penguins build their nests out of rock, and when birds in a colony number tens of thousands, rocks become scarce. Have students design a class game where they can model/enact out this scramble for nest material and the competition that results.
- Students weigh their lunch and compare that to their body weight. Emperor penguin chicks eat up to 30% of their body weight in one sitting!
- Spot the mistake: Often children's story books (and some adult ones) have penguins together with polar bears and walruses. Explore the different animals of the Arctic and the Antarctic and the niches they inhabit.
- Invite students to research a particular animal of their choice and identify key adaptive features. Produce a poster.
- Design the 'ultimate' Antarctic animal with as many adaptive features as possible. Draw details of its special adaptations; give it a 'scientific name'.

The neighbourhood

- Students play a 'food web game' where each animal identifies its prey and predators, and links to them via strings. Research the actual food web of the Southern Ocean and Antarctic. What are the keystone species? Food web diagram available at <http://www.tmag.tas.gov.au/education/education.html>
- Where do they live? Have students create a giant floor map of the region, including the southern parts of Australia. Plot the distribution of the various major animals they have chosen (usually the charismatic megafauna: whales, penguins, seals...)

ISLANDS TO ICE BACK AT SCHOOL



and then plot the distribution of the other vital food web components: phytoplankton under the Antarctic sea ice, krill (some of which occur either side of mid ocean boundaries such as the polar front), and fish, whales and seal species. A large map gives students a sense of scale in how far some of the animals move around the globe.

- Encourage students to discuss the specific adaptations that particular animal species have made in order to occupy their niche.
 - Split the group into those studying the terrestrial continental animals (springtails, mites, endoliths) the marine animals (seals, penguins, whales, birds) and the sea life (fish, invertebrates) then look at the interactions between the three.
 - Topics include:
 - feeding: energy supplies, nutrients from animal bodies, droppings
 - the availability of fresh water in a frozen landscape
 - warmth and sunlight
 - breeding time and place
- Research: how do scientists research these animals? Look at the developments in tracking techniques, including satellite techniques. Visit the albatross sites:
<http://www.ladbrokes.com/bigbirdrace/>
<http://www.wfu.edu/biology/albatross/index.htm>

The visitors

- Human impact: Investigate a case study of the long line fishing industry and the problems of albatross by-catch. Students can conduct an experiment to design ways to minimise the by-catch. The problem: albatross feed on the bait that is hooked onto the line before it has sunk from view, and in doing so they get hooked on the fish hooks and drown as the line eventually sinks. Design needs: fast sinking lines that don't attract birds to feed on the bait. Parameters include: frozen versus unfrozen bait, sinkers on lines, a heavier lead-threaded line, lines cast off ships down low into the water rather than up high into the air.
- The book *The Worst Journey in the World* by Apsley Cherry-Garrard is about three men's attempts to gain information on the winter breeding of Emperor penguins. Read extracts of the story and lead a Community of Inquiry discussion on the text. Let the children raise questions. See the web resources for how to run a Community of Inquiry.
- Echolocation: Many whale and seal species navigate and communicate using high frequency sounds underwater. What happens when such environments become noisy with human activities such as shipping and sonic geological surveying? Play a modified 'bat and moth' game with blindfolded 'whales', noisy ships and echoing coastlines. Investigate whale strandings. Is there a link?

Specific resources

- See the Web of Life diagrams available with this kit
- <http://www.aad.gov.au/default.asp?casid=27> for Antarctic webcams
- http://assembler.education.tas.gov.au/item/edres/830fc76b-7685-af9c-37ca-1521c54dac7f/1/Ant_Foodweb.zip/indexbioall.html for a food web interactive



Apples in Antarctica: Humans in the ice box

Polar innovation from 1773–2006 and humans living in remote places. How technology helps humans survive in extreme climates

Why this theme?

The question of how people live is of central interest to most students. It's a question that resonates because it relates. We can all understand basic needs such as food, warmth, shelter and transport. All of us are generally inquisitive about how others live, especially when it appears different to the way we normally live but not so different that it is impossible to imagine. Buried in the question is a host of sub themes that relate to environmental conditions, innovation, technology, materials science, energy flow and psychology.

By looking at the extremes, at people living and working in Antarctica, these sub themes are teased out in an interesting and engaging way. Students living in Tasmania, and in particular those living in Hobart, have often had a personal connection with someone who has 'gone south'. Stories resonate in the community. It's a place that has pushed human survival to the limits, and nowadays pushes many materials and technologies to the limits.

Yet in the responses that humans have made over the centuries to these difficult environmental conditions is a story of innovation, sometimes in remarkably simple ways, and a story of human adaptation. It is a story that brings together heroic tales of endurance, farcical tales of trial and error and clever applications of science. A very human story.

Teachers may choose to follow this theme chronologically, with the changing responses of the explorers, sealers/whalers, scientists and tourist adventurers giving insights into the way people live. Alternatively they may wish to focus more on sub-themes such as the psychology of remote living, or the medicines/foods/communication devices used in polar regions. Finally they may choose to look at specific material sciences and technological advances made in construction of Antarctic and sub Antarctic bases.

**An 'Apple' in Antarctica is a reference to a transportable prefabricated Igloo hut.*



ISLANDS TO ICE EXHIBITION GUIDE



Apples in Antarctica: Humans in the ice box

CURRICULUM FOCUS

Thinking	Inquiry
Personal futures	Maintaining wellbeing
Social responsibility	Understanding the past and creating preferred futures
World futures	Investigating the natural and constructed world
	Designing and evaluating technological solutions

KEY LEARNING OUTCOMES

- Understands the process of inquiry and uses appropriate techniques for posing questions, defining problems, processing and evaluating data, drawing conclusions and flexibly applying findings to further learning and to creating new solutions
- Understands the interdependence of the physical, mental, emotional, social and spiritual dimensions of wellbeing and knows how to make wise choices and contribute positively to the overall wellbeing of self and others
- Understands that investigating the past and reflecting on the present are essential to understanding self and others and creating preferred futures
- Understands how to scientifically investigate the natural and constructed world, appreciating the tentative nature of knowledge and the value of creative, imaginative and speculative thinking
- Understands how to design, make and critically evaluate products and processes in response to human needs and challenges

KEY IDEAS

Human needs, environmental conditions, innovation, material science, energy flows, psychology

Book a session with a Museum Educator for the program Apples in Antarctica: Humans in the ice box.

This session involves students 'provisioning' expeditions to Macquarie Island and Antarctica and an investigation of transport, food, shelter and the psychology of remote living.

It looks at the technological changes over the years.

Duration: 1 hour

Suitable for grades 3–6 and 7–10

ISLANDS TO ICE IN THE MUSEUM



Apples in Antarctica: Humans in the ice box

How tough is it? Conditions in the far south

- Find out what the conditions are today at Macquarie Island, Davis and the South Pole. How does it compare to the temperature outside the Museum (you can have a look at the digital thermometer on the side of the Mercury Newspaper building across the street from the Museum entrance).
- Think about what you need to live at home and where those things come from—for example food, heating. What do you think you'd find in the environments at the above three locations to help you live? Look at the images and read the stories of the early visitors. Do you think you'd need to bring many supplies to the base? Are there any you wouldn't need to bring?

Being prepared

- In 1911 when Roald Amundsen first reached the South Pole, what did he take to survive? Find three differences between what he took and what Robert Falcon Scott took in his ill fated attempt.
- Sledges have been used over snow and ice conditions for centuries. What are some of the ways the sledges have been hauled, and what would be the modern version of a sledge?
- Navigating in the far south is not a simple matter; compasses behave in unusual ways, horizons disappear with drifting snow and there are few distinct features in many parts of the continent. How did the early explorers know when they reached the South Pole? Is there more than one South Pole? What did Edgeworth David, Mawson and Mackay find in January 1909 and is it still there today or has it moved?

Doing it better: innovation over the years

- Look at clothing worn by the expeditioners going south today. Can you spot three similarities and three differences to what was worn in 1911 by expeditioners on Douglas Mawson's expedition?
- Tents used in Antarctica are a very unusual shape compared with most bushwalking tents. What's the shape and why do you think it is used?
- Many of the buildings in Antarctica look fairly weird and wonderful, but all have a serious practical reason for their design. What features do they all have and what environmental condition are they responding to?



ISLANDS TO ICE BACK AT SCHOOL



Apples in Antarctica: Humans in the ice box

Check out the activities in *Classroom Antarctica*, especially Unit 1 The Big White, Unit 3 Community

<http://classroomantarctica.aad.gov.au/>

- Test different clothing materials for their insulating properties. Fill small, lidded plastic containers with water at body temperature (37°C) and wrap in various materials such as wool, cotton, synthetics, fur. Place in the freezer and then test the temperature every 15 minutes. Record the results. Compare with what you wear on cold days—should you be wearing something made from a different fabric?
- Sledge races: Feel what it was like hauling sledges by making simple harnesses from rope and then attaching different plank materials—old doors, joined floor boards, cardboard. What makes a good sledge? How much can you haul? Consider the surface over which it is pulled (soft snow= carpet, ice = grass). Load your sledge as if you were going on an overnight adventure, including all the food, clothing and tent.
- Draw your ideal design for a building on the ice cap. What do you think are the most important features? Start by making a list of environmental conditions and your design responses to them.
- Use the information on the Igloo hut (also known as an Apple) to build your own model. What advantages might a hut like this have over a polar pyramid tent?
- Research hypothermia. What are the symptoms? What is the first aid response if you find someone with hypothermia?
- Huskies were removed from Australian bases in Antarctica in 1992, after many years successfully assisting expeditioners. It was the end of an era and many people were sad to see them leave. Hold a group discussion on whether they should have been removed, what the benefits of having them were and what might have been some of the problems with keeping them on the bases. Research the stories of the last huskies.

Specific resources

- See the TMAG Igloo Hut and Mawson's Hut designs available with this kit
- See the TMAG website for a panorama of Mawson's Hut as it is today
- See the TMAG website for short videos of Antarctic animals
- See *The Circle*, Department of Education Open IT module for equipping an expeditioner interactive
- See *The Mercury* Captain Cook sheet available with this kit



ISLANDS TO ICE IN THE MUSEUM



Apples in Antarctica: Humans in the ice box

How tough is it? Conditions in the far south

- Find out what the conditions are today at Macquarie Island, Davis, and the South Pole. What is influencing the weather?
- Millions of years ago something happened that greatly influenced the climate of the southern region. It changed in the way the ocean currents flowed. What was it? Why did it and does it continue to have such a profound influence?
- There's one fundamental difference between the weather on the sub-Antarctic islands and that on the Antarctic continent. Can you find out what it is and what it means for provisioning expeditions to these two different locations.
- Think about what you need to live at home and where those things come from—for example food, heating—what resources would you find in the environments at these three locations to help you live? Do you think you'd need to bring many of them to the base? Are there any you wouldn't need to bring?

Being prepared

- Antarctica appeared in the imagination before visitors ever saw the continent. Did all cultures see it in the same way? Whose belief do you think was closest to reality?
- From earliest times fur has been used in clothing for cold climate exploration. It's warm, but it has other properties that made fur lined hoods very practical. Can you find out what this is? What are some of the issues with using furs today? Should we be using more? What furs might we use?
- Listen to the stories from expeditioners who have been south. What challenges did they face? What do you think has changed since Hurley's time?
- Like other expeditions the *Discovery* Expedition of 1930–31 acquired supplies in Hobart. Find out some of the things they took on board.

Doing it better: innovation over the years

- There is medicine for the body, and medicine for the mind. Workers on the islands and in Antarctica can come under psychological pressure due to many factors. What do you think would be the hardest aspect of living south? Do you think it has become easier since Mawson's or Hurley's time? What happened to Mawson's wireless operator?
- Mawson's Hut provides a historic window into the early explorers lives. By combining it with Frank Hurley's images of life on the Antarctic continent, recreate a day in the life of an expeditioner living in those times. Think about entertainment, solitude, communal living, space and work.
- Technology is not all about the endless forward march of progress. How is this reflected in the latest Antarctic Division clothing issue?
- Choose one aspect of living in the region and see if you can identify changes to the technologies used, eg medicine, food, clothing, communications.
- Navigational tools have dramatically changed over the last 100 years. What is a sextant? Who or what is the Antarctic Pilot? What do you think is the most important navigational tool today?

ISLANDS TO ICE BACK AT SCHOOL



Apples in Antarctica: Humans in the ice box

Check out the activities in *Classroom Antarctica*, especially Unit 1 The Big White, Unit 3 Community

<http://classroomantarctica.aad.gov.au/>

- The coldest temperature on earth was -89.6°C recorded at Vostok Base in Antarctica. What happens to teeth at -89.6°C , to metals and exposed flesh? Research temperature impact on materials.
- Wind is a critical factor in dropping the temperature. Use the attached extract from the AAD ANARE *First Aid Manual* and look up the web site <http://www.aad.gov.au/default.asp?casid=27> for today's weather at each Australian base. Determine how cold it would be if you had to work outside in the wind. You may need to graph two differing conditions in the table to determine today's wind-chill factor. Which base is the coldest to work at today? Would you need to take extra precautions today? What might they be?
- Living together in close community is not easy. There have been some minor and more severe breakdowns in social cohesion in the Antarctic bases. Research the psychological stories of people going south, from Mawson's wireless operator who suffered a psychological breakdown to modern issues including isolation from family.
- Design your ideal building on the Antarctic ice cap. What do you think are the most important features? You may like to start by making a list of environmental conditions and your design responses to them. Remember that design is not just about external conditions but also has to address how people live together in close proximity, how they deal with waste disposal and how air quality impacts on them. You could research the effects of carbon monoxide.
- 2006–07 is planned as the first season Australian bases on Antarctica will be linked to Hobart by air. Whilst other countries have been flying to Antarctica for years, this is a significant step for the Australian program. What are some of the challenges that flying to Antarctica presents, and what are the benefits? What does it mean for that unique experience of making a long journey to a remote location, and having time to adapt to the dramatic changes when entering the Antarctic region?

Specific resources:

- See the TMAG Igloo Hut and Mawson's Hut designs available with this kit
- See the TMAG website for a panorama of Mawson's Hut as it is today
- See the TMAG website for short video's of Antarctic animals
- See *The Circle* Department of Education Open IT module for equipping an expeditioner interactive
- See *The Mercury* Captain Cook sheet available with this kit



From Whaling to Wilderness?

The changing values of natural resource management in the region

Why this theme?

'The world is a changing place' is a cliché. Yet perhaps the larger truth is that we have, and are, changing the way we perceive it. Issues debated today, such as ethical considerations, the intrinsic rights of animals and the way we use limited energy resources, have undergone some major shifts over the last 50 years. These discussions will not diminish, and young people today will be expected to make decisions on natural resource management issues that few of today's older generation have had to even think about.

Some regions are at the crossroads of these decisions right now. The Southern Ocean and Antarctica is one of those regions, if not the paramount one. It's all there, that romantic wilderness location, that purity of landscapes typified by penguins unfazed by humans, that sense there is still more to be discovered. That there is huge wealth of food resource in the Southern Ocean, that potential mineral minefield where coal seams gleam exposed to the naked eye, that place where 70% of the thirsty world's fresh water is 'locked up'.

It's also a region which has seen human responses at their best and worst. Massive collapses of industries, where sealing and whaling almost wiped out whole regional ecologies, foolhardy installation of a nuclear reactor to power a base, the establishment of international treaties based on cooperation of scientific discoveries, protocols protecting natural environments, and a whale sanctuary stretching all the way around Antarctic waters.

In very recent times however it's back in the news. Japanese whalers and Greenpeace activists battled it out in icy waters. Australian Navy ships gave chase to illegal fishing boats catching Patagonian toothfish. And looming over the horizon is the deadline for the end of the Madrid Protocol banning mining in the region.



ISLANDS TO ICE EXHIBITION GUIDE



From Whaling to Wilderness?

CURRICULUM FOCUS

Thinking	Inquiry Reflective thinking
Communicating	Being Information literate
Personal futures	Being ethical
Social responsibility	Understanding the past and creating preferred futures
World futures	Investigating the natural and constructed world Understanding systems Creating sustainable futures

KEY LEARNING OUTCOMES

- Understands the process of inquiry and uses appropriate techniques for posing questions, defining problems, processing and evaluating data, drawing conclusions and flexibly applying findings to further learning and to creating new solutions
- Understands that reflective thinking is a deliberate process, affected by emotions and motivations, and that it is used to develop and refine ideas and beliefs and to explore different and new perspectives
- Understands how to effectively access, interpret, transform, create, communicate, evaluate and manage information in ethical ways using a range of sources
- Understands that to be ethical requires caring about the consequences of action of self and others and that the quality of ethical judgements is based upon reasoning and the application of ethical principles
- Understands that investigating the past and reflecting on the present are essential to understanding self and others and creating preferred futures
- Understands how to scientifically investigate the natural and constructed world, appreciating the tentative nature of knowledge and the value of creative, imaginative and speculative thinking
- Understands that the social, natural and constructed world is made up of a complex web of relationships or systems
- Understands the environmental principles and ethical issues involved in creating and working towards sustainable futures

KEY IDEAS

Values, purpose, interconnection-interdependence, creating preferred futures, ethics, history, motivation, territorial claims/nation

Book a session with a Museum Educator for the program *From Whaling to Wilderness?*

This session involves students making choices as 'new arrivals' to a pristine environment and role-playing the consequences as: explorer, scientist, tourist, resource developer, whaler and others.

Duration 1.5 hours

Suitable for grades 7–12

ISLANDS TO ICE IN THE MUSEUM



From Whaling to Wilderness?

Why do they go there?

- Motivators are what get us all going. See if you can find 3 different motivators for the following people who went south. Did they achieve what they set out to do? Cook, Borchgrevink, Weddell, Harrison, Phillipa Foster.
- Can you see a change in the motivations for why people have gone south over the last 100 years?
- What's fame? Find out who flew the first Australian flag at the South Pole. Have you ever heard of him?

What's there?

- There are tangible and less tangible resources in the far southern region. What drew the earliest people to the sub-Antarctic islands? How long did these resources last? How did they process the resources?
- Some artefacts tell a multitude of stories. What do you think these can tell us?



- A less tangible resource that the region provides is expressed in the Alison Lester display case. What do you think she 'found' on her journey?

Should we be getting it?

- Before we had plastics, whales were hunted for their blubber. What was it used for? Whale baleen was used in corsets. There's one other use that whales are still hunted for, though in far smaller numbers. Can you find a tin of it?
- Why might harvesting krill be a risky business in ecological terms?
- The phrase 'we spoilt the very thing we loved' could easily apply one day to Antarctica. What special characteristics of the place appeal to you? What are the main threats, and what are three ways we could protect the region from over exploitation?

ISLANDS TO ICE BACK AT SCHOOL



From Whaling to Wilderness?

Check out the activities in *Classroom Antarctica*, especially Unit 7 International and Unit 8 Environment

<http://classroomantarctica.aad.gov.au/>

- Choose an explorer and look at the social conditions of the times back in their home country. How do you think these factors may have influenced why they travelled to remote locations like Antarctica?
- The various International Treaties such as the Antarctic Treaty and the Madrid Protocol set up structures for cooperative management of resources and human behaviour. However all are dependent on compliance. Discuss the ways these treaties achieve compliance.
- Japanese whaling and the responses to it highlight some important issues in democracy and international cooperation. Research the following issues. See the media archive sheet of *The Mercury* Newspaper available with this kit.

The International Whaling Commission and who has voting rights

Foreign aid and its use as a bargaining chip

Protest and non-violence

Manufacturing public opinion through the media

Who has the right to speak out on issues.

- Convene a round-table *fishbowl exercise of an international body chartered with discussing the next phase of the Antarctic Treaty and Madrid Protocol. Research what resource management decisions are likely to have to deal with: food security, oil and gas reserves, geopolitical imperatives coming up to treaty time.

* A fishbowl exercise' is a role play activity that involves dividing the group in half with one half engaged in the role play debate in a round sitting arrangement. Participants take on the role of likely players, eg various country representatives, commercial interests, conservation interests. The other half are arranged behind them and tasked with watching and noting what's said, how it is said and what group roles are played out. At the conclusion of the debate the observers feedback to the role play participants what went on. Then they swap. It is important in such exercises to 'debrief' the participants to help them let go of their roles.

Specific resources

- See the TMAG Whaling media sheet available with this kit
- See the TMAG Earliest Perception's illustration available with this kit
- See the Australian Antarctic Division Australia's *Antarctic Connections 1770–1948* brochure, available from AAD
- See *The Mercury* Captain Cook sheet available with this kit



Climate Change:

Messages from the Frozen Continent

The Antarctic ice cap contains a frozen record of global climate change over the last 100,000 years and still influences our climate today. Find out why this region is so central to understanding climate change.

Why this theme?

What do we really know about the world's oceans? When we see the frozen ice sheet of Antarctica how many of us see a vast empty expanse containing no information? Were Captain James Cook's comments, upon circumnavigating the Antarctic continent, right in predicting the world wouldn't benefit from Antarctic discovery?

'that no man will ever venture farther than I have done and that the lands which may lie to the South will never be explored [should anyone have] the resolution and perseverance to find.... Beyond where I have been I shall not envy him the honour of discovery, but I will be bold to say, that the world will not be benefited by it

Capt. James Cook, Voyage of the *Resolution* 1772–1775

Why are scientists from around the world studying the Southern Ocean and Antarctica?

One topic that all students must come to terms with is global climate change, yet paradoxically it is one of the hardest to grasp. The evidence is sometimes scientifically complex and politically charged. By learning about the region and the sciences undertaken there, students gain a practical and important insight into these fundamental issues. Is climate change happening? Have humans caused it? Can we do something about it? What should we do?



ISLANDS TO ICE EXHIBITION GUIDE



Climate Change: Messages from the Frozen Continent

CURRICULUM FOCUS

Thinking	Inquiry
Communicating	Being numerate
World futures	Investigating the natural and constructed world Creating sustainable futures

KEY LEARNING OUTCOMES

- Understands the process of inquiry and uses appropriate techniques for posing questions, defining problems, processing and evaluating data, drawing conclusions and flexibly applying findings to further learning and to creating new solutions
- Understands how to scientifically investigate the natural and constructed world, appreciating the tentative nature of knowledge and the value of creative, imaginative and speculative thinking
- Understands the environmental principles and ethical issues involved in creating and working towards sustainable futures

KEY IDEAS

Climate change, sustainability, scientific research, cooperative treaties, proxy indicators, natural resource management

Book a session with a Museum Educator for the program *Climate Change: Messages from the Frozen Continent.*

This is an experimental exploration from the physics and chemistry of water/ice, sea ice and icebergs through to the World Futures questions of global climate change.

Duration 1.5 hours

Suitable for grades 7–12

ISLANDS TO ICE IN THE MUSEUM



Climate Change: Messages from the Frozen Continent

Do you think the planet is warming because of human impacts? Where do you look for evidence of warming? How can we see if it is linked to human causes? What information can you find?

- Heard Island has one of Australia's only active volcanoes and Australia's highest mountain—but it is also an island of ice with many glaciers flowing down the slopes. Something is happening to these glaciers. What is it? What might be causing it?
- Scientists have travelled to Antarctica and the southern region from the beginning of exploration. What are some of the earliest things they measured? What did TT Flynn and Sir Douglas Mawson measure?
- Up on the ice sheet scientists drill out cores of ice from hundreds of metres depth. Why? What have they found?
- The ice core scanner is not a real instrument but it does give an indication of what scientists find in cores. What is that?
- Spot the differences between sea ice and continental ice.
- Oceans hold information, not just what lives in them but in other ways as well. What are some of those ways?
- We know that oceans are salty. But is there the same salt concentrations throughout the oceans? What happens under sea ice? What does a difference in salt concentration cause?
- In studying global climate change scientists naturally look at atmospheric gas compositions and temperatures of the land, sea and atmosphere. But why do they look at animals such as krill? They're as 'common as mud', tiny and irrelevant. Or are they? Find the food web diagram, look at the sea ice exhibit on the multimedia screen and ponder the connections.
- Some things turn up in unexpected places. The pack ice buoy travelled an interesting route, but was its final resting place unexpected? What has it told us about currents and pack ice dynamics?

What more, if anything, do you need to find out to make an informed choice?



ISLANDS TO ICE BACK AT SCHOOL



Climate Change: Messages from the Frozen Continent

Check out the activities in *Classroom Antarctica*, especially Unit 6 Deep Freeze

<http://classroomantarctica.aad.gov.au/>

- Check out *The Circle* resource available as an Open IT Module through the Tasmanian Department of Education, E-Centre
- Research the latest figures in CO² and methane concentrations and plot them against temperature over the last 200 years.
- What does the 'precautionary principle' mean?
- What is 'proxy data'?
- Research the effects of increasing CO² on plants (including the difference between C3 and C4 plants).
- Check out this discussion between interested debaters using non technical sources <http://forum.physorg.com/index.php?showtopic=2611&st=15> What are some of the criteria you would use to judge who's 'right'?
- Research one of the scientific instruments listed below. Find out what it is used for and what information it has provided about the environments of the icy south. Does this information add anything to the climate change debate?

Argo float

Neutrino collector

XBT probe

Drift buoy

Drift cards and message bottles

Automated weather stations

Ice corer

- Research the sceptical positions on global climate. Look at the changes in these arguments over the last ten years as well as the political imperatives that have driven many of the changes.
- Research the Madrid Protocol. How does it work? Has it worked? Can this model be applied elsewhere to other international issues?

Specific resources

- See the TMAG diagram of bathymetry available with this kit
- See the TMAG diagram of ocean currents available with this kit
- See the *Ice Spy* Brochure available from Australian Antarctic Division



Underwater Wonderland: Biodiversity in the Southern Ocean

**500 million tonnes of Antarctic krill live in the Southern Ocean.
If we over harvest this resource what will happen?**

Why this theme?

Southern Ocean life is often presented as a food web featuring the characteristic megafauna, like the whales, seals, penguins and giant squid that fascinate us all. But the story is both far more complex, and far more interesting. It is also far more important. It is a story of nutrient flows, temperature exchanges, massive productivity in some areas and scarcity in others, of tiny diatoms, unusual fish, phytoplankton blooms and sea birds.

Increasingly it is a story of human harvesting. When other fisheries of the world collapse, there is an increasing focus on the Southern Ocean for new fisheries. We have seen it happen with the rapid expansion and subsequent decline of the orange roughy industry. This fishery provides a good case study for the need to understand the biology of new resources before their exploitation endangers their sustainability. Scientists found that the fish breed later and live longer than most other fish species. This means they are much less productive than other fish species and stocks take a long time to recover from heavy fishing pressures.

Encouraging students to understand Southern Ocean ecosystems, their wonder and beauty and the role they play in our lives is a great way to expose them to complex systems and our role in their management. With the aid of the giant diorama of Southern Ocean life featured in the exhibition this theme literally leaps off the wall.



ISLANDS TO ICE EXHIBITION GUIDE

Underwater Wonderland Biodiversity in the Southern Ocean

CURRICULUM FOCUS

Thinking	Inquiry
Communicating	Being numerate
Social responsibility	Understanding the past and creating preferred futures.
World futures	Investigating the natural and constructed world
	Understanding systems

KEY LEARNING OUTCOMES

- Understands the process of inquiry and uses appropriate techniques for posing questions, defining problems, processing and evaluating data, drawing conclusions and flexibly applying findings to further learning and to creating new solutions
- Understands and has confidence and disposition to use the mathematical concepts and skills required to meet the demands of life
- Understands that investigating the past and reflecting on the present are essential to understanding self and others and creating preferred futures
- Understands how to scientifically investigate the natural and constructed world, appreciating the tentative nature of knowledge and the value of creative, imaginative and speculative thinking
- Understands that the social, natural and constructed world is made up of a complex web of relationships or systems

KEY IDEAS

Biodiversity, fisheries, precautionary principle, history, making hypotheses, traditional knowledge, ethics, modelling, systems

Book a session with a Museum Educator for the program Underwater Wonderland—Biodiversity in the Southern Ocean

This is an Community of Inquiry activity looking at what lives in the Southern Ocean, the diverse habitats, and the importance of harvest management of these resources.

Duration:	1 hour	grades 4–6
	1.5 hours	grades 7–12

ISLANDS TO ICE IN THE MUSEUM



Underwater Wonderland Biodiversity in the Southern Ocean

What's it like down there?

- It's a underwater garden of strange proportions, from whales to tiny diatoms. Find five creatures you didn't know about that live in the Southern Ocean.
- Don't forget the bottom of the ocean—it may be too harsh for humans to live on but others like it. What is it like? What lives there?
- It's not all plain sailing on the top of the ocean with huge waves and icy storms. So why not travel underneath. Check out the underwater trip from Australia to the Antarctic shelf and back.
- How deep is deep? See if you can find the deepest part of the Southern Ocean.
- Ice fish are very unusual fish. Can you find one in the exhibition? What's unusual about it?

Can we over harvest such a massive food resource?

- Who likes fish! Two species in the display have been heavily fished and are now regulated. What are those species? Can you still buy them? Hint: One's a sunset colour and the other has a big smile.
- Humans eat fish, but so do millions of other species. What types of species can you find that eat fish?
- Life underwater....is it happy families or an underwater jungle with lurking dangers? Who needs who? Can you find an animal type that doesn't appear on the food web illustration? If so, who do you think is dependent on it, and who does it depend on? Is anything not connected to others in the whole planet?
- There's millions of them, they make up the biggest volume of species in the Southern Ocean so does it matter if we take lots for our dinner? What are they?



ISLANDS TO ICE BACK AT SCHOOL



Underwater Wonderland: Biodiversity in the Southern Ocean

Check out the activities in *Classroom Antarctica*, especially Unit 5 Southern Life and Unit 8 Environment and the brochure *Who's Eating Who?*

<http://classroomantarctica.aad.gov.au/>

- Investigate a fish species from the Southern Ocean. What does it look like? Where in the ocean does it live? What does it eat? What eats it? Draw a picture of the fish in its home, making it as accurate as possible.
- Create your own little diorama (model) of Southern Ocean life in a shoebox on its side. You can use materials from the beach such as sand and shells, as well make as cut-outs of fish and hang them from the ocean 'roof'.
- Play a fishing game. Make small paper fish of different sizes, each with a paperclip mouth. Fishing rods with magnets as hooks are used by each student fishing team to catch fish of a certain size only, and with a strict fishing quota for each team. You can 'replenish' fish stocks at appropriate times, and make it more complex by introducing rogue fishing boats, natural events that decrease fish numbers etc.
- Visit the Albatross Game at the Ladbrokes website: <http://www.ladbrokes.com/bigbirdrace/>
- Ocean currents and their carrying capacity is humorously shown in the film *Finding Nemo*. Watch the film

Specific resources:

- See the TMAG diagram of bathymetry available with this kit
- See the TMAG diagram of ocean currents available with this kit
- See the TMAG food web diagram available with this kit



ISLANDS TO ICE IN THE MUSEUM



Underwater Wonderland Biodiversity in the Southern Ocean

What's it like down there?

- The underwater world has a mass of different habitats and is not a uniform space as may first be perceived. Find 5 different habitats and some of the animals that live there.
- Great depths can be reached in the ocean, requiring strange adaptations for survival. What are some of these adaptations, and what life forms exhibit them?
- How deep is deep? See if you can find the deepest part of the Southern Ocean.

Why is there such abundance in the Southern Ocean?

- It is not uncommon to think that the warm tropical waters have a greater abundance of life than cold Antarctic waters, but is this so?
- What are some of the factors that make for abundant life in the Southern Ocean?
- Who are the 'big guys' in terms of total biomass, not individual organism size?

Is life evenly distributed throughout the ocean?

- If you're going to fish the region, where are the best places? Why are they in those locations?
- Sometimes you can spot one type of animal by the presence of another animal or plant. What are some examples of this correlation?

What roles have humans played in the ecology of the region?

- The Southern Ocean has attracted commercial enterprises for centuries. Can you find the earliest hunters to visit the region. Can you find some artefacts from their trips.
- They might have been hunting but in many cases they were also the first visitors. What are some of the places that these hunters discovered?
- What effects did they have on the region's wildlife?

Can we over harvest such a massive food resource?

- Many creatures in the diorama have been used by humans for food. Some are still used. Which ones?
- Joseph Hatch operated a factory in Battery Point. What was it for? Why was he at the centre of an international row over cruelty to penguins?
- Which fish was named the Fish of the Year and what has happened to its fishery?

ISLANDS TO ICE BACK AT SCHOOL



Underwater Wonderland: Biodiversity in the Southern Ocean

Check out the activities in *Classroom Antarctica*, especially Unit 5 Southern Life and Unit 8 Environment and the brochure *Who's Eating Who?*

<http://classroomantarctica.aad.gov.au/>

- Use the case study of the orange roughy to explore how fisheries operate and some of the problems with managing new fisheries. Explore development of the orange roughy fishery in the Southern Ocean, and the international cooperation needed to manage such a broad area. See the web sites listed below.

Orange roughy sites

<http://www.starfish.govt.nz/science/facts/fact-orange-roughy.htm>

<http://www.marine.csiro.au/dag/fishery/index.htm>

http://www.amcs.org.au/campaigns/sustainable_fisheries/ss_orange_roughy.html

<http://www.abc.net.au/pm/stories/s34606.htm>

http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/Y3992E/y3992e01.htm

- The history of the oil industry operating from Heard and Macquarie Islands is fascinating. Research the development and decline of these industries. Use the Joseph Hatch product label to introduce the inquiry. Could these types of commercialisation happen today? What are the modern versions of these exploitations?

Notes on Joseph Hatch

www.parks.tas.gov.au/fahan_mi_shipwrecks/journals/Sealers/sshatch9.pdf

- The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was established in 1982, mainly in response to concerns that an increase in krill catches in the Southern Ocean could have a serious effect on populations of krill and other marine life—particularly on birds, seals and fish, which mainly depend on krill for food. Research how this convention works and what significant results it has achieved. What other conventions govern the Southern Ocean region?

<http://www.ccamlr.org/pu/e/gen-intro.htm>

Specific resources:

- See the TMAG diagram of bathymetry available with this kit
- See the TMAG diagram of ocean currents available with this kit
- See the Web of Life diagrams available with this kit
- See the TMAG Joseph Hatch product label available with this kit
- See the Southern Ocean Biomass diagram available with this kit

CONUNDRUM GUIDES

Self-guided inquiry sheets for individual classes

The Education section of the Museum can provide an individualised sheet of inquiry questions students can use on themes of their choice. We have compiled a database of hundreds of questions that the *Islands to Ice* exhibition deals with, and arranged them in searchable fields so that during the pre-visit booking discussions teachers can request sheets on a topic their class is studying. This service is available only when reasonable prior notice of a visit is given.



ISLANDS TO ICE RESOURCES



Downloadable resource files

- Floor map of exhibition
- Overall map of region
- Earliest perceptions map
- Diagram of bathymetry of Southern Ocean
- Captain Cook Sheet, *The Mercury Newspaper*
- Whale Media Archive
- Web of Life diagram
- Southern Ocean Biomass
- Shelter in Antarctica
- Wind chill chart
- Engine of the oceans: ocean circulation
- Under the ice: cross section through Antarctica
- Joseph Hatch product label

Web resources

www.tmag.tas.gov.au includes the teaching resources that are being developed for the Tasmanian Museum and Art Gallery *Islands to Ice: The Great Southern Ocean and Antarctica exhibition* downloadable .pdf files of the education kit are available.

<http://classroomantarctica.aad.gov.au/> A hugely valuable resource in studying the region, with lots of good classroom activities.

There are several LTAG's produced that relate to the Antarctic themes in the exhibition, and more appearing all the time. Have a look at <http://itag.education.tas.gov.au/planning/unitsamples/livingonedge/default.htm>

http://assembler.education.tas.gov.au/item/edres/830fc76b-7685-af9c-37ca-1521c54dac7f/1/Ant_Foodweb.zip/indexbioall.html Food web interactive

<http://itag.education.tas.gov.au/proflearn/pedagogy/communityofinquiry/default.htm#cond> How to run a *Community of Inquiry* session

www.aad.gov.au Australian Antarctic Division

<http://www.ladbrokes.com/bigbirdrace/> Albatross by-catch information.

<http://www.cmar.csiro.au/research/> CSIRO Marine and Atmospheric Research

<http://www.bom.gov.au/> Bureau of Meteorology

Other places of interest

In addition to the materials on display in the Islands to Ice: The Great Southern Ocean and Antarctica exhibition, the Tasmanian Museum and Art Gallery's collections include a wealth of Antarctic and Southern Ocean specimens, relics, equipment, artworks and historical photographs.

The Maritime Museum of Tasmania features information and artefacts from Hobart's role as a southern outpost and port, whaling, shipbuilding and shipwrecks.

ISLANDS TO ICE RESOURCES



Hobart's **National Archives Office** contains a wealth of written and video information covering early exploration of the coast of what is now Australian Antarctic Territory and Antarctic research during the era of Sir Douglas Mawson. The National Archives also houses significant post-war records from the early years of the Australian Antarctic Division.

The **Tasmanian State Library** also possesses a wealth of material on Antarctica and the Southern Ocean. The library's Allport Collection contains some wonderful material - paintings, photographs, silver and ceramic ware and rare books - from Dumont D'Urville's French Antarctic Expedition of 1837 to 1840, from the collection of Henry Allport. The Crowther and Tasmaniana Libraries both have excellent material on Tasmanian-based sealing, whaling and Antarctic expeditions.

Hobart's **Royal Tasmanian Botanical Gardens** features the unique Sub-Antarctic Plant House where plants from the sub-Antarctic islands are displayed in a climatically-controlled environment, with chilly fogs and mists mirroring the wet, cold conditions of their island homes.



Guidelines and booking procedures

Do I need to book?

Yes, all groups whether self guided or participating in a program need to book to avoid overcrowding in the exhibitions and ensure you get the best out of your visit.

How do I book?

Contact the Education & Visitor Services booking line on (03) 6211 4189 or Sally.Scott@tmag.tas.gov.au.

You will need to provide the following information:

- Date for the excursion. Have an alternative date in case your first preference is already booked out
- The exhibition(s) and/or education program(s) you are interested in
- The approximate number of students and adults (including teachers) coming, as well as any special requirements.
- The school year group or level of the students coming
- The name of the person supervising/arranging the excursion, a contact email address and telephone number
- The name of the school/organisation and a postal address.

Once a date is confirmed, we will send you a booking confirmation via email with information to lead you to the relevant teacher resources on our website. On receipt of this information please:

- Check that all details are correct – if not, contact us as soon as possible on (03) 6211 4189 or Sally.Scott@tmag.tas.gov.au
- If applicable, follow the instructions to the TMAG website Education pages and download the relevant teacher resources. If using Activity Sheets, make copies for the students and accompanying adults.

Costs

Where there is a program charge, the total number of students will be confirmed on your arrival and an invoice will be sent to the school. Adults assisting student groups are free. Please refer to the TMAG website Education pages <http://www.tmag.tas.gov.au/education/schools.html> for individual program costs.

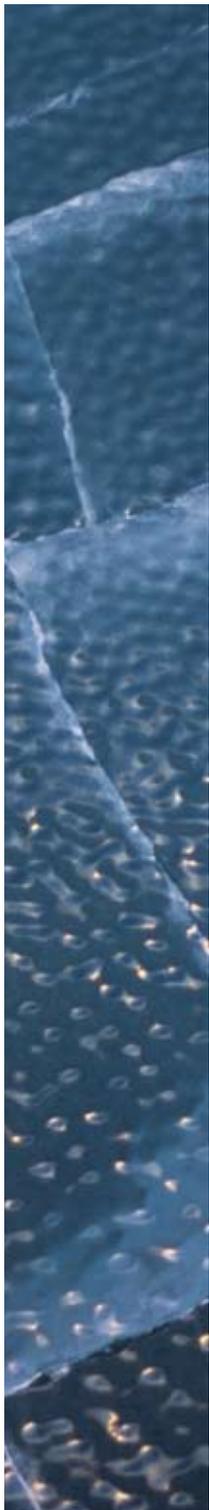
TMAG is open 10–5 every day

(except Christmas Day, Anzac Day and Good Friday)

Buses can drop off and pick up students in Argyle Street, outside the Maritime Museum.

Car parking, including disabled parking, is available in the Dunn Street car park, Council parking fees apply.

ISLANDS TO ICE VISITING TMAG



On arrival at TMAG

Groups are requested to enter through the Courtyard gates. Student bags can be left on the southern side of the verandah, please be careful to keep doorways free from obstruction. Toilet facilities are located beyond the large double glass doors.

If you have booked an Education Program, an Education Officer will meet you in the Courtyard before the program start time. We understand though that some groups will arrive earlier to give students a break before commencing their program. Your group should remain in the Courtyard with a supervising adult while another adult checks in at the Front Desk—located through the double glass doors and up the ramp from the toilet facilities. Your Education Officer will be contacted to inform them of your arrival and confirm a meeting time.

If you are on a self-guided visit, follow the same procedure and please check in with the Front Desk before your group proceeds through the Courtyard entrance towards the gallery areas you wish to visit.

Is there anywhere to eat in TMAG?

Groups may utilise the courtyard and North side of the verandah to sit and eat. The Courtyard Café is available for purchasing beverages and light meals but please note that the chairs and tables on the south side of the courtyard are for Courtyard Café patrons only. Please ensure that all rubbish is disposed of in the bins provided and that groups are under effective control at all times for the enjoyment of all visitors.

How far in advance should I book?

The earlier you book the better chance you have of getting the dates and services you want. Some sessions are particularly popular and are quickly filled.

How many adults should I bring to accompany a school group?

Group leaders and accompanying adults are encouraged to actively enjoy and assist during the programs and with management of their group. We strongly recommend the following student/adult ratios in order to maximise the student learning experience: Primary 5 students per adult, Secondary 10 students per adult.

Tips for your visit

To ensure that your students and other visitors have an enjoyable experience, TMAG requests that you:

- Talk to your students about appropriate behaviour, including voice volume, moving through the galleries and respecting other visitors
- Remind students to touch only those objects they are invited to by a TMAG employee or signage
- Please keep your group together and ensure that students have adult supervision at all times
- Brief students on the purpose of the excursion and where appropriate undertake pre and post visit activities on the chosen theme.

Food and drink are not permitted in TMAG galleries

Photography is not permitted unless notified otherwise

ISLANDS TO ICE CONTRIBUTORS



Photographers:

Australian Antarctic Division (AAD) (p 18, detail p23)

Christo Baars/AAD (detail p14, seals p14)

Andy Baird (p10, p12, detail p22)

Simon Cuthbert (details p36, p37)

Grant Dixon/AAD (cover, p3, thumbnail p4, details p30, p40)

Peter Dombrovskis (detail p6)

Jim Dragisic (detail p38)

Wade Fairley (p32)

Stuart Fitch (thumbnail volcano p4)

Lyn Irvine (details p5, p12, p13, p41, ice sheet p30)

Kate Kiefer (penguin p14)

Hau Ling (red snow algae p38)

Mark Loveridge/AAD (thumbnail island p4)

Astrida Mendis (p28)

Image Science and Analysis Laboratory, NASA (thumbnail weather p4)

David Nielson (detail p31)

Wayne Papps/AAD (penguin and seal p38, penguins on berg p30, details p28, p29, 32)

Rosemary Gales (details p4, p27)

Queen Victoria Museum and Art Gallery (blubber press p26)

Martin Riddle/AAD (details p3, p9, p33)

Graham Robertson (detail p2)

Salome Rosa (watercolour illustrations of penguin and seal p15, p16, p17, p19, p20, p21, p34, p35)

Tasmanian Museum and Art Gallery collection (Details p8, p24, harpoon p26)

Undersea Explorer, Queensland Australia (whale p24)

Wikipedia (seal p24)

Richard Willam/ AAD (details p7, p25, p26, p39)

Eric Woehler (detail p11)

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