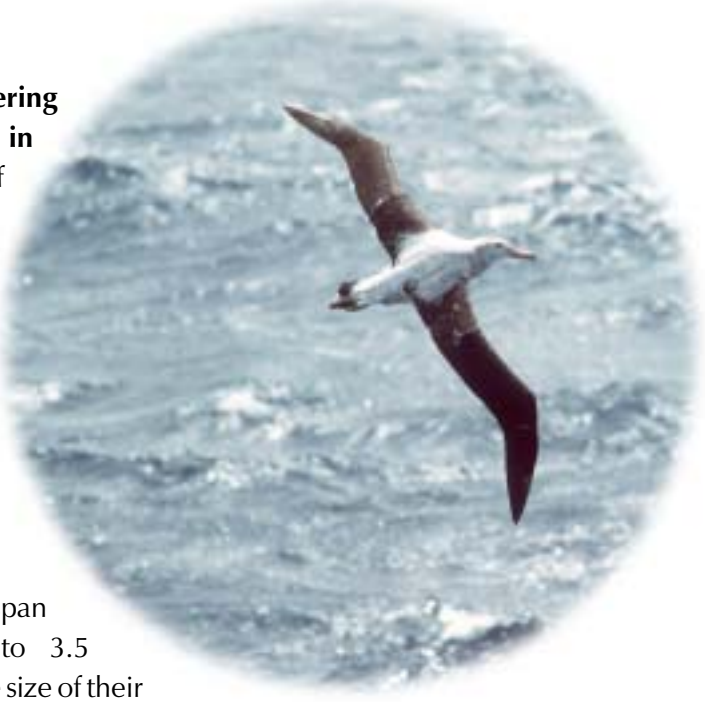
ALBATROSS

www.classroomantarctica.aad.gov.au

view the web-standard (html) version

WANDERING ALBATROSS



ENGLISH CURRICULUM REFERENCE

This English/Creative Writing activity relates to the English curriculum strand: Writing: Texts, Contextual understanding and Linguistic structures and features

Imagine that you are a wandering albatross, the largest flying bird in the world. You cover vast tracts of the Southern Ocean, flying up to 15,000 kilometres on a single foraging trip. Where have you been and what have you seen? Describe your return to your lifelong partner at Macquarie Island, narrowly avoiding being caught and drowned on a tuna long-line.

To get a sense of the size of the wingspan of a wandering albatross (up to 3.5 metres!), have students measure the size of their 'wingspan'. Students can read all about albatrosses, the "flying squad", in the brochure "Who's Eating Who")

For background information see the articles on the Australian Antarctic Division's web site, 'Seabird mortality in longline fisheries' at http://www.aad.gov.au/science/AntarcticResearch/AMLR/seabird_bycatch/default.asp , 'Can albatrosses and longline fisheries co-exist?' at http://www.aad.gov.au/magazine/09_can_albatrosses.asp and 'Wandering albatross: 10 Facts' at http://www-aadc.aad.gov.au/products/Data/ten_facts/flying_birds/wandering_albatross.asp For a really great, accessible site with lots of information, illustrations and activities about albatrosses, see The Albatross Project at http://www.wfu.edu/albatross/index.htm

view the web-standard (html) version for up-to-date links

NEXT ACTIVITY

CLASSROOM ANTARCTICA

SOUTHERN LIFE

CLASSROOM ANTARCTICA

Unit 5 - SOUTHERN LIFE

INTRODUCTION

View pdf version (56kb)

This Unit will enable students to understand and appreciate the special environmental qualities of the Antarctic ecosystem. It also explores the major components of this ecosystem from plankton and krill, to sea birds, penguins, seals and whales.

Students will find answers to these questions:

- What is the nature and dynamics of the Antarctic food web and what threat do introduced species pose?
- What are the particular physical and behavioural characteristics of krill, albatrosses, penguins and seals? How have they adapted to the Antarctic environment?
- How do we estimate the numbers of Antarctic and subantarctic animals?

The activities will lead to an understanding of food webs, animals and their adaptations to the harsh Antarctic environment, and the effect of introduced species. They look at sampling techniques and analyse data. They develop both an understanding of how every species in the ecosystem is interdependent, and develop an awareness of environmental issues.

Activities are currently being developed on Antarctic phytoplankton and fish.

MATERIALS

Who's Eating Who brochure [PDF]
Sizes of penguins table
Sizes of seals table
Whale table
Krill survey grid
Counting Emperors article
Aerial photo of penguin colony
Expeditioner Profiles

Useful information - books, videos, web sites and places to visit - is listed in the Classroom Resources section.

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Activity 5.1 SOUTHERN OCEAN FOOD WEB

View pdf version (116kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

- Have students draw a food web for the Southern Ocean and look at how animals depend on each other for food.

  (Plants and animals that could be included are algae, phytoplankton, krill, squid, albatross, Adélie penguin, emperor penguin, crabeater seal, elephant seal, leopard seal, minke whale, killer whale.)

- Draw the animals to scale. What would happen if you removed one of these animals from the ecosystem? For example, what would happen if all the Adélie penguins disappeared? Or all the whales?

- As an extension activity, students could research the animal and plant life found in the Arctic, and compare the food web with the one they have made for the Antarctic. Why are polar bears found in one place, and penguins in another?

  Read all about the animals that are found in the Southern Ocean (and have your students solve an Antarctic murder mystery) when you download the lavishly illustrated brochure "Who's Eating Who" [PDF].

  For detailed information, and photographs of each of these Antarctic animals and their marine and terrestrial ecosystems see 'Ten Facts:Introductory information about Antarctic and subantarctic animals, plants and features' on the Australian Antarctic Division's website at http://www-aadc.aad.gov.au/products/Data/ten_facts/default.asp

  For a diagram of the Antarctic food web go to http://www.ciesin.org/docs/011-558/fig4-3.gif The Gould League features an Antarctic food web puzzle at http://www.gould.edu.au/foodwebs/kids_web/ant_web/main.html

  There is an illustrated lesson on the Antarctic Marine Ecosystem at http://www.botos.com/marine/antarctic01.html And a comprehensive module on Antarctic food webs, 'Who Eats Who In the Antarctic?', which includes a number of activities for students, at http://www.globalclassroom.org/antarct7.html

  See the World Wide Fund For Nature's series of articles on 'The Food Web Effect: Should Whales be Culled?' at http://www.panda.org/resources/publications/water/food-web/cull.html

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Activity 5.2 SOUTHERN OCEAN SEA BIRDS

View pdf version (87kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

- Ask students to describe the vital role that subantarctic islands have in the survival of animals in the Southern Ocean. (Emphasise their importance as places for breeding. The islands are also used for moulting, and some species are present during winter)

- Have students research which birds breed on Macquarie Island, which breed on Heard Island, and what sort of nesting sites they use.

  See http://www.parks.tas.gov.au/homemi/biology.html and http://www-old.aad.gov.au/environment/areaprotection/worldheritage/criterion2.asp See also 'Ten Facts:Introductory information about Antarctic and subantarctic animals, plants and features' on the Australian Antarctic Division's website at http://www-aadc.aad.gov.au/products/Data/ten_facts/default.asp

- Ask students to investigate the factors that have caused the decline in albatross numbers. (At most breeding localities albatross populations are decreasing as a result of being caught on long-lines and drowned. This is exacerbated by the fact

that they reach reproductive maturity later in their lives and then only lay one egg every two years.)

Has anything been done to address the problem? (Possible methods to reduce the albatross catch on long-lines include use of streamers to deter the birds from the longlines, measures to make baited hooks sink faster, prohibition of long-lining during daylight hours, and education of long-lining companies.)

There is comprehensive information on the Australian Antarctic Division's web site. Read the articles, 'Seabird mortality in longline fisheries' at http://www.aad.gov.au/default.asp?casid=1052. See also the Tasmanian Parks and Wildlife Service's Threatened Species information at http://www.dpiwe.tas.gov.au/inter.nsf/themeNodes/RLIG-53kupv?open 'The Cry Of The Ancient Mariner', an article originally published in Time, at http://www.seaweb.org/background/albatross.html and 'The Albatross Conundrum' at http://www.enature.com/feature/feature.asp?featureID=000503

- Some marvellous classroom activities about albatrosses, complete with printable materials, can be found at The Albatross Project, http://www.wfu.edu/albatross/index.htm. Particularly good are 'How big are your wings' in which students compare mammalian body parts to avian body parts and discuss how species have developed different survival techniques; 'Graph-ATross' in which students learn how to make visual representations of scientific data (using real albatross data); and 'Walk a Mile in Albatross Shoes' in which they learn about pollution and how eating plastic affects albatrosses in real life.

  And for a wonderful outline of the physical characteristics of birds and the mechanics of flight visit http://wings.avkids.com/Book/Animals/intermediate/birds-01.html

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Activity 5.3 ADAPTATION OF WILDLIFE

View pdf version (86kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

Discuss with students how animals adapt to their environment. Then ask them to:

- Choose an Antarctic animal. Find out all you can about it including where it lives, how it breeds, what it feeds on.
- Look at another animal from another harsh environment, such as a desert lizard, and discuss the ways in which it has adapted to its environment. Compare this to an Antarctic animal such as an emperor penguin. What similarities have been adopted by both animals? What differences can you see in the adaptations?
- Have students research emperor penguins and write down all their adaptations for survival.
  (For example: They are flightless, so they don't need to be light; and they must carry large reserves of fat to live in freezing weather conditions - the ratio of an animal's surface area to its volume affects the amount of heat it conserves or loses. As well as blubber for insulation, penguins have stiff tightly-packed feathers that overlap to provide waterproofing. Their wings are shaped like flippers to help them 'fly'underwater. Short, round shapes conserve heat, so animals with this body shape are found in cold regions, while tall skinny ones live in warm climates. The feet and skin of emperor penguins fold over their eggs in another adaption to the cold conditions. Their behaviour also counteracts the cold - they huddle together to conserve heat.)

  In groups, students can each research a particular adaptation and produce a poster. They can then give a talk to the class to share the knowledge they have gained.

  (For relevant information on the web see the 'Penguins' topic in this unit)
- Students can then discuss how humans have adapted to living in this environment. Have any anatomical or physiological changes occurred? What behavioural changes occur?
- Again, for detailed information on Antarctic animals see 'Ten Facts:Introductory information about Antarctic and subantarctic

animals, plants and features' on the Australian Antarctic Division's website at http://www.aad.gov.au/default.asp?casid=1134 And for information about humans living and working in Antarctica have a look at 'In the field - Get the facts' at http://www.aad.gov.au/default.asp?casid=90

For a very good exploration of the adaptation of many marine animals to become masters of 'flight' and speed under the water, particularly seals, dolphins and whales go to Cislunar Aerospace Inc.'s http://wings.avkids.com/Book/Animals/intermediate/marine-01.html

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Activity 5.4 INTRODUCED SPECIES

View pdf version (105kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

The ecological balance of Macquarie Island has gone through several changes. The native fauna and flora have been affected by the introduction of several animal species and some plant species, leading to the extermination of some of the native species.

- Have students research the population fluctuations from 1810 of the following: rabbits, skuas, cats, burrow-nesting petrels, fur seals, elephant seals. Ask them to extrapolate to a point ten years in the future and show what they expect to happen to these populations.
- Look at the effect introduced species would have on the native fauna of Antarctica. Look at the effect introduced species have in Australia eg rabbits, cane toads, prickly pear cactus.
- Conduct a debate on whether or not huskies should have been allowed to stay in Antarctica. See: http://www-old.aad.gov.au/information/news/newsreleases/1992/19921016.asp and http://www.aad.gov.au/default.asp?casid=6082

ISSUE - Wilderness

There are still some parts of the Antarctic that have never been visited by humans. Should there be areas set aside that are forever protected from humans?

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Activity 5.5 DISEASES IN ANTARCTIC WILDLIFE

View pdf version (77kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

- Discuss with students what might influence the introduction and spread of diseases in birds and seals in the Antarctic (Possible influences include migration, scavenging, overlap of habitat, discrete or interbreeding populations, tourism, global climate change. For example, the great distances travelled by many of the migratory birds provide lots of opportunity for them to come into contact with disease and the potential for them to act as carriers. Wilson's storm petrels and Antarctic skuas fly

from the Antarctic to the Northern hemisphere every winter. Arctic terns migrate from the Arctic to the Antarctic, and Tasmanian muttonbirds breed in south-east Australia and feed in the Southern Ocean before heading to the Arctic.)

What can be done to control the introduction and spread of diseases?

- Have students research what diseases can be spread from humans to animals. What diseases can be spread from humans to animals?

  Read the article 'Disease and Antarctic Wildlife' at http://www-old.aad.gov.au/science/AntarcticResearch/HumanImpacts/wildlife_disease/default.asp ,the news release 'Australian research uncovers evidence of poultry virus in penguins' at http://www-old.aad.gov.au/information/news/newsreleases/1997/19970514.asp

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Activity 5.6 KRILL

View pdf version (96kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

- Pose the question: "Why are krill considered a key species in the Southern Ocean ecosystem?"
  The survival of conspicuous groups such as whales, seals, penguins, oceanic birds, squid and fish depend directly or indirectly on krill. Discuss how krill's swarming behaviour, its prolific seasonal production and its high protein content make krill such a valuable food source.
  How would you find out which animals feed on krill?

- Have students discuss/debate the value of krill as a human food source.

  - What are the significant problems (technological, ecological, economic and social) of krill catching, processing and selling? Discuss possible solutions to these.
  - All commercial fisheries on the planet are close to (or are) overfishing their resource. What special precautions would you take to ensure you weren't damaging the ecosystem by overfishing krill?
  - What lessons can we learn from the past when other living resources of the Southern Ocean, such as seals and whales, were exploited?

  See the articles on the Australian Antarctic Division's web site, 'Time to Krill?' at http://www.aad.gov.au/default.asp?casid=1143 and 'Krill: magicians of the Southern Ocean' at http://www.aad.gov.au/default.asp?casid=3523

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Activity 5.7 SIZE AND BEHAVIOUR OF PENGUINS

View pdf version (192kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

- Students can measure each other's height and weight and the teacher can help the students work out the average height and weight for the class. The class can then discuss why scientists use averages to measure sizes in animal populations, rather

than relying on a measurement of a single animal.

- Teachers can ask the students to compare their own size to the size of emperor penguins and Adelie penguins (see printable table).

Kind of penguins	Length	Approximate Weight
emperor	about 115 cm tall	from 23 to 40 kilograms
Adelie	about 70 cm tall	about 4.5 kilograms

Generally students find that emperors are heavier and shorter than the average student. Teachers can stress that emperor penguins have a very large mass for a bird and Adelie penguins are closer to the size you would expect of a penguin.

- An Adelie penguin fledgling weighs 3.2 kg, about the birth weight of the average human baby. Students could ask their parents if they have a record of their growth as a small child. This will allow them to find out what age they were when they weighed 4.5 kg, the average weight of an Adelie penguin adult, and how old they were when they were they were 70 cm tall. If this information is not obtainable then general growth plots for children can be obtained from any child health clinic, and this information can be used to compare the size of Adelie penguins with the size of human children.

- Students could weigh their lunches and work out the ratio of their lunch to their weight and convert this ratio to a percentage. They can then compare themselves to emperor penguin chicks, which can eat up to 30% of their body weight in one sitting.

  The students can then work out how much they would have to eat in one meal, if the percentage of their food weight to body weight were equivalent to that of an emperor penguin chick. Every student could bring along a piece of fruit. They could then work out how much fruit is the equivalent to 30% of the average body weight of the class.

- While emperor penguin females spend the winter at sea, the males incubate the eggs for nine weeks. During this time they are without food and lose around half of their original body weight. To avoid freezing to death they huddle together in groups of as many as 6000 with their backs to the wind (thus conserving heat and energy). In the huddle, they move constantly from the outside to the inside, rotating the warm and cold positions with minimal activity.

  Students can study the huddling behaviour of emperor penguins by measuring out one square metre of floor area. They can see how many of them can stand in this square metre. Then have them move from the outside to the inside and back (see the video Looking South to get an idea of how the penguins move).

- Other students can take the air temperature just above the huddle and compare that with the temperature of a similar spot away from the huddle. The students in the huddle can describe their feelings. They can also say whether they noticed feeling warmer when they were in the huddle. (This could be done outside on a cold windy day for even greater effect.)

- Students can research the life cycle of an emperor penguin.

- Students could make Adelie penguin meals out of milk cartons. Milk cartons are very useful to demonstrate meal sizes for chicks. A 250 ml carton holds the equivalent to the daily meal size of a smaller Adelie penguin chick weighing less than 1 kg, while a 600 ml carton holds the equivalent to a daily meal for a 2.5 kg Adelie penguin chick.

- The Adelie penguin has a number of ways of moving on ice or land (eg walking, running, tobogganing). It can also 'porpoise'. Ask students to explain when each method is used.

  The Australian Antarctic Division's web site has many articles on Adelie penguins at http://www.aad.gov.au/default.asp?casid=6018. For information regarding current reseach, such as the satellite monitoring of Adelies and including diagrams of how far they have been tracked, the depth to which they dive, and details of their foraging patterns see http://www.aad.gov.au/default.asp?casid=6017. For general information regarding emperor penguins see http://www.aad.gov.au/default.asp?casid=6073 while information regardin research on emperor penguins can be found at http://www.aad.gov.au/default.asp?casid=6074 and king penguins go to http://www-old.aad.gov.au/science/AntarcticResearch/AMLR/aptenodytes/default.asp

  For a truly comprehensive resource (150 information pages and over 200 photographs), go to Pete and Barb's Penguin Pages, at http://www.adelie.php.blueyonder.co.uk
  There are very good classroom activities on Penguin Adaptation at http://octopus.gma.org/surfing/antarctica/penguin.html

Ever wished you could be a penguin? Here's your chance! You're just a click away from an emperor penguin rookery somewhere in the virtual heart of Antarctica at http://www.neaq.org/learn/bap

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Activity 5.8 SEALS

View pdf version (150kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

The following is a list of the approximate sizes and weights of subantarctic and Antarctic seals (see PDF printable version).

Weddell Female length 2.9 m weight 400 - 450 kg

Weddell Male length 2.8m weight 400 - 450 kg

Ross Female length 2.0 m length 175 - 190 kg

Ross Male length 2.0 weight 175 - 190 kg

Crabeater Female length 2.3 m weight 200 - 300 kg

Crabeater Male length 2.2 m weight 200 - 300 kg

Fur Female length 1.5 - 2.0 m weight 150 - 170 kg

Fur Male length 1.5 - 2.0 m weight 150 - 170 kg

Leopard Female length 3.5 m weight 300 - 400 kg

Leopard Male length 3.0 m weight 300 - 400 kg

Elephant Female length 2.5 m weight 300 - 500 kg

Elephant Male length 5.0 m weight 3000 - 4000 kg

- Have students weigh themselves and work out how many individuals are needed to equal the weight of each seal. The students could also measure their height and compare the length of children to each type of seal. The male elephant seal is obviously the big 'daddy' of them all.
- Elephant seals are much better at holding their breath and swimming under water than we are. Their blood/oxygen adaptations have clearly evolved to enhance their underwater performance. The following activity helps students understand this and how it compares to humans.

  It has been reported in scientific papers that approximately 21.2% of an adult elephant seal is blood. Assuming 1 g = 1 ml, the students could work out the litres of blood in an average male elephant seal of 3500 kg. It would be interesting to compare the percentage blood in the elephant seal to the percentage in humans and calculate how much that is in litres. A child weighing 30 kg has 2.4 l of blood approximately, and an adult man of 70 kg has 5.0 l. Women have slightly less blood

as they tend to be smaller. They usually have around 4.5 l unless they are pregnant, when this figure rises.

- Students could research the amount of blood in humans, or the teacher could give them some of the above data and ask them to work out the percentage blood in adult males and females as well as children. This can also be related to the fact humans can only hold their breath under water about 3 minutes, while elephant seals can hold their breath for as long as 2 hours.
- Students can investigate how the subantarctic and Antarctic seals have adapted to their habitat - warmth, movement, food gathering, protection from predators.

  What is the role of each species of seal in the food web?
- Suppose that you wanted to investigate the depths to which seals are able to dive. What methods would you use?
- To what extent are subantarctic and Antarctic seals harvested now? Students can discuss the international agreement that protects seals.

There are a number of articles on the Australian Antarctic Division Web Site. These include:
general information about Antarctic seals (http://www.aad.gov.au/default.asp?casid=6107); a summary of information on elephant seals which can be found at http://www.aad.gov.au/default.asp?casid=6122; "southern seals: aquatic performers" which is located at http://www.aad.gov.au/default.asp?casid=1770; and the international agreement that ensures the protection of seals from any possible future re-introduction of sealing activities at http://www.aad.gov.au/default.asp?casid=3107. To find out how we study whales and seals, have a look at 'Applied Marine Mammal Ecology' at http://www.aad.gov.au/default.asp?casid=5978

Video shots of Weddell Seals can be found at http://whyfiles.news.wisc.edu/061polar/seal.html The Tasmanian Parks and Wildlife Service has some great information on seals at http://www.dpiwe.tas.gov.au/inter.nsf/ThemeNodes/LBUN-5362N?open Information and photos of elephant seals can be found at http://www.whaletimes.org/whaelsl.htm

For a very good exploration of marine animals adapting to their environment to become masters of 'flight' and speed under the water (particularly seals, dolphins and whales) see http://wings.avkids.com/Book/Animals/intermediate/marine-01.html

For background information on Antarctic seals and sealing see http://www.asoc.org/general/seals.htm

For an outline of the official Norwegian position on seal-hunting, and a justification of their seal-hunting practices in the North Atlantic see http://odin.dep.no/fid/engelsk/032001-990087/index-dok000-b-n-a.html

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Activity 5.9 WHALES

View pdf version (93kb)

SCIENCE CURRICULUM REFERENCE This activity relates to Science curriculum strands: Life and Living: Living Together, Structure and Function and Biodiversity, Change and Continuity Working scientifically: Planning Investigations, Conducting Investigations, Processing Data and Evaluating Findings

The following is a table showing the approximate sizes and weights of whales found in the southern hemisphere, and the best estimates of their original and present abundance. (see PDF printable version).

Kind of whales	Length (metres)	Approximate weight (tonnes)	Original population estimate	Latest population estimate

Blue	23 to 27	up to 200	228,000	11,700
Humpback	11 to 16	about 40	115,000	10,000
Orca (Killer)	8 to 10	up to 9	?	unknown worldwide, 180,000 Antarctic
Minke	about 9	about 10	490,000	880,000
Sei	about 16	about 25	256,000	54,000
Sperm	up to 12 (females) up to 19 (males)	about 14 (females) about 40 (males)	2,400,000	1,950,000
Southern Right	13 to 18	up to 74 tonnes	100,000 right whales	3,200 right whales

Source of population estimates: Congressional Records Service of the Library of Congress, 1997. Estimates from the April 1994 issue of Audobon.

- As with the seals activities (and preferably combined with them), have students weigh themselves and work out how many individuals are needed to equal the weight of each whale. The students could also measure their height and compare the length of children to each type of whale.

  (Blue whales may be the largest animals that ever lived, although it's now thought that some sauropods (herbivorous dinosaurs) may have been larger. The biggest blue whale ever weighed was nearly 200 tonnes and over 30m in length!)

  Students can create life-size scale drawings of whales, either with chalk on playground, or in the school hall or hallways (if you can get butcher's paper large enough).

- Ask students to use the whale table to draw a graph that shows both the original estimated numbers, and current estimated numbers, of different whale species.

  - What has been the decline in each species - in numbers, and in biomass?

    The massive reduction in the stock of whales as a result of commercial whaling activities is the single largest human impact to the Southern Ocean ecosystem. Ask the students to suggest reasons why the population of minke whales has increased. (Minke whales have only been commercially hunted since the 1970s, after the stocks of blue and fin whales had been exhausted.)

    Japan kills about 300 to 600 minke whales a year in the Southern Ocean for scientific research. As the minke whale populations is so large, should sustainable whaling in Antarctica be allowed? If not, why not? Are whales a special species that need to be specially protected? Is it more profitable to take tourists to watch whales, or to hunt them and sell their meat?

- Ask students to research the history of whalers and whaling. If whalers operated out of your local port in the 19th century, ask students to research the local history of whaling.

- It is very difficult to determine accurately the number of whales of different species. The size of most whales populations is only known to an accuracy of plus or minus 50%. All population estimates are based on a count of the whales sighted on each side of a survey vessel as it zigzags its way through a designated stretch of water.

  Ask students to discuss why it is difficult to make accurate counts of whales numbers.
  (Only a small percentage of whales will be visible on the surface as the vessel passes. Seeing whales is very dependent on sea and light conditions. As whales are now so rare and widely dispersed, extrapolations must be made from the sightings of only a tiny fraction of the populations.)

- For information on blue, humpback, minke, sei and southern right whales and orcas go to the Australian Antarctic Division's site at http://www.aad.gov.au/default.asp?casid=6110. See Environment Australia's Whale web site at http://www.environment.gov.au/marine/species/cetaceans/whale.htm . Don't miss the ABC's 'Whale Dreams' at http://www.abc.net.au/oceans/whale/default.htm The American Cetacean Society's website features fact sheets on many whale species at http://www.acsonline.org/factshts.htm Have a read of the World Wide Fund For Nature's series of articles on 'The Food Web Effect: Should Whales be Culled?' at http://www.panda.org/resources/publications/water/food-web/cull.html You can read about the subsistence whaling of grey whales by the indigenous Makah tribe of North America, and a

discussion of the issue of minimum viable populations, in the Why Files at http://whyfiles.news.wisc.edu/shorties/whale.html

Try 'Whales: A Thematic Web Unit' at http://curry.edschool.Virginia.EDU/go/Whales/ for learning activities across an integrated curriculum.

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Activity 5.10 COUNTING ANTARCTIC ANIMALS


View pdf version (176kb)

MATHEMATICS CURRICULUM REFERENCE This activity relates to Mathematics curriculum strands: Working Mathematically: Investigating, Conjecturing, Using problem-solving strategies, Applying and verifying, and Working in context Measurement: Choosing units, Measuring and Estimating; and Chance and Data - Understanding, estimating and measuring chance variation, Collecting data and Organising data

In order to be able to assess and predict the possible effects of environmental change and human impacts on Antarctic wildlife, it is important to have reliable data on the distribution and abundance of the key species in this ecosystem before changes occur.

Counting krill

Antarctic krill are probably the most abundant species of multi-celled animals on earth. Krill occur in vast swarms, often containing tens of thousands of tonnes of krill. There are estimated to be some between 300,000,000,000 and 1,000,000,000,000,000 individual krill in the Southern Ocean at any one time with a total weight, or biomass, of between 150,000,000 and 500,000,000 tonnes. (The total weight of humans on the planet at the moment is around 160,000,000 tonnes.) (These figures can be used to create some interesting problem solving and number work.)

To manage the krill fishery, we need to be able to assess krill populations accurately. The abundance of krill is currently estimated using scientific echo-sounders that measure the reflection of sound from objects below a ship. The distribution of krill occurs over an area of 30 million square kilometres (compared with the area of Australia - 8 million square kilometres). In a summer survey a single ship can only survey less than 1 million square kilometre - it's impossible to survey the whole area. And krill swarms are patchy in their distribution.

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- To help students understand the principle of surveying, including its 'hit and miss' nature, divide them into pairs and have them play a variant on the game 'Battleships'. Provide them with two sheets of paper each marked with a grid 10 cm by 10 cm, numbered horizontally 1 to 10 and vertically A to J. (or use a PDF printable grid)

  Student A places at random eight swarms of krill of varying sizes as follows: two x four squares, two x three squares, two x two squares and two x one square. Student B then tells Student A the grid route to be followed by the ship, seeking maximum coverage with minimum passes (it might be row B, then back via row D, two rows down, then row F and so on, then vertical passes at similar intervals). Each time there is a 'hit', Student B will have to work out location and size of the swarm by deviating from the track, and then must return to their agreed tracking route. The students then change places and repeat the exercise. The object is to find the krill swarms with the smallest number of passes.

  - What effect does it have if the swarms are all heavily biased in one direction?
  - What effect does swarm size have?
  - What are the possible real-life implications?
  - How likely are you to estimate the numbers correctly if you use only one pass of the ship? Two? Ten?

Counting emperor penguins in a huddle

"The best time to count emperor penguins is in the middle of winter when the males are enduring their long incubation fast. At this time of year the females are at sea feeding, and since there are only a few mavericks (non-breeding birds) each bird represents one breeding pair. Unfortunately for the counters, winter presents its own special problems - the birds cram tightly in hectare-size huddles to keep warm making it difficult to count them, day-length is only three hours of twilight and wind-chill temperatures occasionally reach minus 50 degrees Celsius".

Graham Robertson, Ornithologist, Australian Antarctic Division

"Fifteen people from the stations assisted with the counts, and we tried every method we could think of. We made snap estimates (gut feeling of numbers with no attempt to actually count). We counted them from a three-metre high step ladder, then from 11 metres up on a scaffold tower mounted on a sledge that we towed behind a vehicle along the flanks of the birds. We counted them by eye at the colony and later on from photographs taken from our lofty vantage points. We measured with a range-finder the area of huddles and multiplied this by the density of bird in huddles (estimated by measuring the circumference of incubating males - we achieved this by passing a cloth tape measure around birds while duck-waddling behind them as they shuffled along, egg on feet, on the sea ice) to derive the total number of huddling birds. We used reference groups of 100 or so birds and estimated the number of these groups in the whole mob. And we gently herded small groups of birds between two people and counted them sheep-like as they passed by (after one brief attempt we declared this method too disruptive). Finally we floated a remotely controlled camera from a helium-filled balloon about 50 metres above the colony to get aerial pictures from which we could count the birds".

Graham Robertson

(For the full story, read the Counting Emperors article by Graham Robertson)

- Have the students list the various ways of measuring the numbers of birds. Can they think of any other methods? Which method would be the most accurate?

  Or give the students a similar situation (such as the numbers of spectators at a football match) and have them come up with various counting methods."

- A closely related species, king penguins, breed on subantarctic islands. It doesn't get cold enough to huddle but scientists have similar difficulties on counting the breeding birds in the colony. Ask students to come up with their own ways of counting king penguins in this aerial photo of a penguin colony (they could estimate, then subsample, and then verify their result by actually counting the number of birds).

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Activity 5.11 WANDERING ALBATROSS

View pdf version (96kb)

ENGLISH CURRICULUM REFERENCE This English/Creative Writing activity relates to the English curriculum strand: Writing: Texts, Contextual understanding and Linguistic structures and features

- Imagine that you are a wandering albatross, the largest flying bird in the world. You cover vast tracts of the Southern Ocean, flying up to 15,000 kilometres on a single foraging trip. Where have you been and what have you seen? Describe your return to your lifelong partner at Macquarie Island, narrowly avoiding being caught and drowned on a tuna long-line.

  (To get a sense of the size of the wingspan of a wandering albatross (up to 3.5 metres!), have students measure the size of their 'wingspan'.)

  There is comprehensive information on the Australian Antarctic Division's web site. Read the articles, 'Seabird mortality in

longline fisheries' at http://www.aad.gov.au/default.asp?casid=1052. See also the Tasmanian Parks and Wildlife Service's Threatened Species information at http://www.dpiwe.tas.gov.au/inter.nsf/themeNodes/RLIG-53kupv?open 'The Cry Of The Ancient Mariner', an article originally published in Time, at http://www.seaweb.org/background/albatross.html and 'The Albatross Conundrum' at http://www.enature.com/feature/feature.asp?featureID=000503

Activity 5.12 PICTURE A PENGUIN


View pdf version (70kb)

ARTS/TECHNOLOGY CURRICULUM REFERENCE This Visual Arts / Technology activity relates to the Arts curriculum strand: Visual Arts: Creating, making and presenting

A new species discovered

- Imagine that you have just discovered a new animal in the Southern Ocean. Describe where you found it, what it looks like, what it eats, what eats it, how it behaves and what its name is. Have a think too about how many of these animals there are. How would you count them? Are there other species with which they compete (for breeding sites, food etc) (There is a good chance that students will describe a species that already exists!)
- Using photographs from web sites listed in the Penguins activity (5.7), ask students to draw the outline of a king or emperor penguin. They should then attempt to colour in the shades around the head. Have them experiment with techniques and materials to most effectively reproduce these striking effects. Students who are skilled with computer art software might try to accomplish the shading by computer rather than with a pencil.

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Seabird mortality in longline fisheries

What are longline fisheries?

Longlining is one of the main methods used to catch fish and longline fisheries occur in most oceans and seas in the world. While there are many variations of what constitutes a longine fishery, in general there are two types - pelagic longline fisheries and demersal longline fisheries.

Pelagic longline fisheries target tunas (eg. blue fin tuna, yellow fin tuna, big eye tuna, albacore tuna) and swordfishes. These species are caught from 50-300 metres deep in the water on longlines suspended by floats. Operations vary from small boats that fish close to the coast to vessels that fish on the high seas. Vessels that fish on the high seas might have freezers of 200-300 tonnes capacity and can stay at sea for several months. Pelagic longliners might deploy longlines up to 130 km long with 3,000 hook-bearing branch lines. Branch lines are usually 30-40 metres in length and 50 metres apart on the longline, and are light enough to bob up and down in the water column in order to attract fish. Longlines are set and hauled back in on every day of the fishing operation.

Patagonian Toothfish being hauled aboard a fishing vessel. Photograph: Graham Robertson - Cat:

Demersal longline fisheries are also called ground fisheries because they target fishes that live at-or-near the seabed. Species targeted include hake, ling, cod, sablefish, halibut and Patagonian toothfish. Demersal species are often caught in very deep water – for instance the Patagonian toothfish can be caught from 500-2,500 metres deep. Demersal longlines differ from pelagic longlines in that the branch lines (holds the hook) on demersal lines are only 0.4 m long and are spaced 1.4 m apart. This means that even reasonably short longlines might carry a very large number of hooks: demersal longline vessels might set and haul up to 40,000 hook/day.