Betty Trummel
Elementary Educator
Crystal Lake, Illinois
(retired 2015)

ANDRILL

Cape Roberts Project antarctica

NEW ZEALAND · UNITED KINGDOM · UNITED STATES · AUSTRALIA · GERMANY · ITALY

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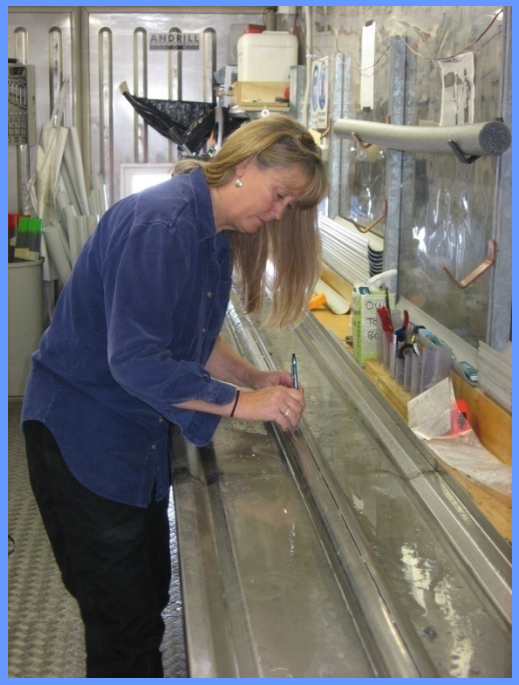

35 years of classroom teaching…
Three Antarctic deployments as part of education outreach teams, integrating science research and education:

Teachers Experiencing Antarctica and the Arctic (TEA) 1998
The Cape Roberts Project (geologic drilling)

ANDRILL (ANtarctic DRILLing) 2006

WISSARD (Whillans Ice Stream Subglacial Access Research Drilling) 2012-2013

Supported by grants from the National Science Foundation and various institutions/universities

Research and Education Svalbard Experience

RESEt

RESEARCH & EDUCATION SVALBARD EXPERIENCE

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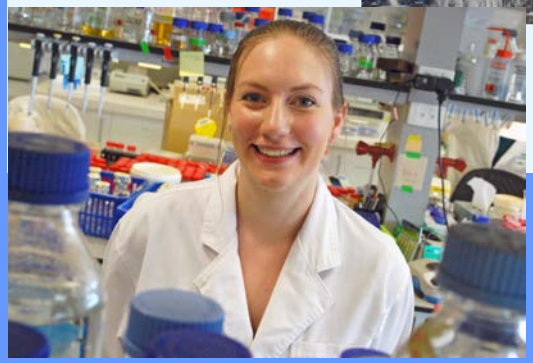
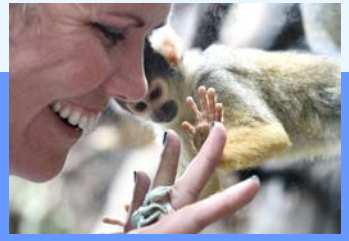
HOMEWARD
BOUND.

MOTHER NATURE NEEDS HER DAUGHTERS.

HOMEWARD BOUND.





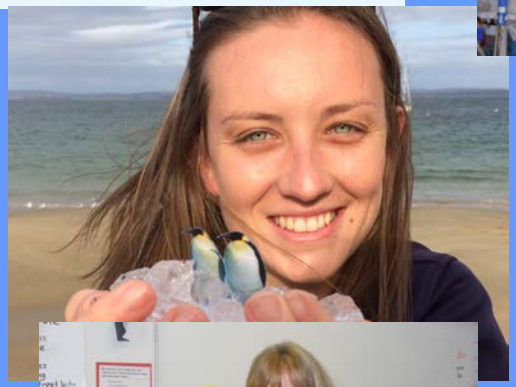


Photo from the camera of Ida Kubiszewski, HB participant

HOMEWARD BOUND.

A Scientist at Work…

The Southern Ocean

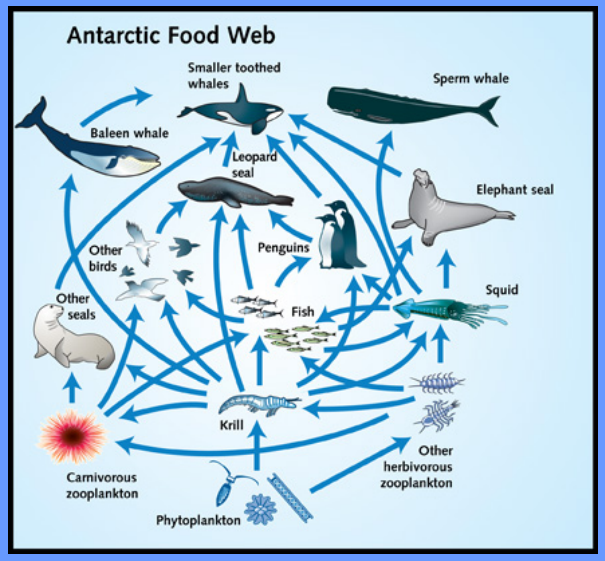
Ross Sea Marine Protected Area October 2016

598,000 square miles (more than twice the size of Texas)

Protected by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) made up by 24 countries around the world

This area is south of New Zealand, deep in the Southern Ocean

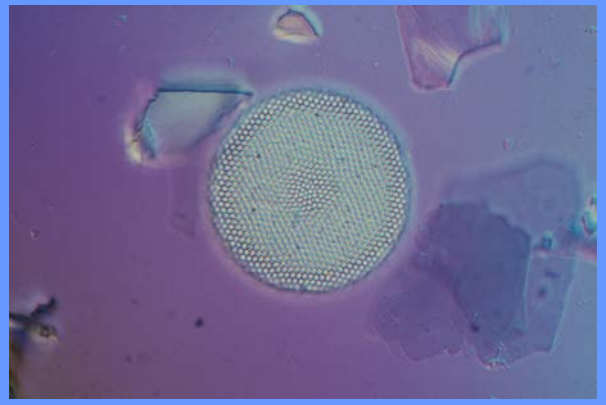
The 1.9 million square mile Ross Sea is considered largely untouched by humans



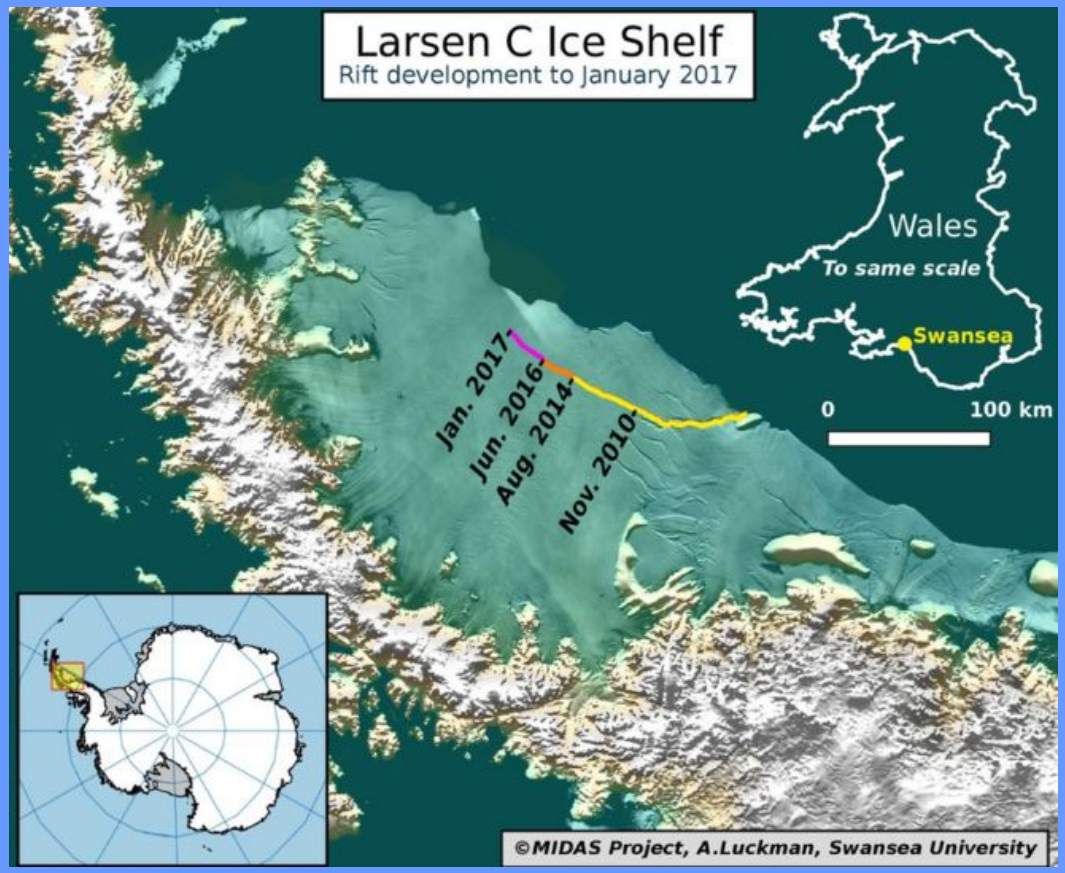
It is one of the most productive and nutrient-rich areas with large plankton blooms and swarms of krill that feed and support incredible numbers of fish, penguins, whales, and seals.

Believed to be over 16,000 species that call the Ross Sea home

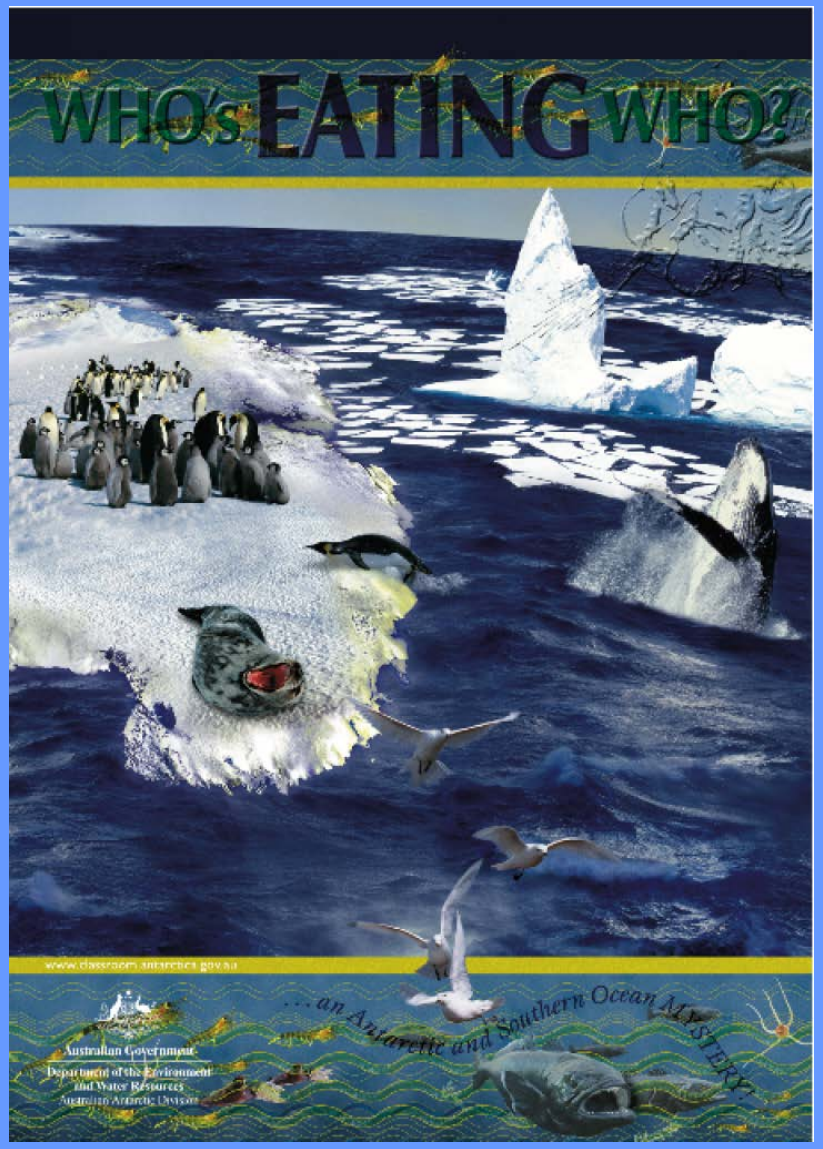
Terns, Skuas, Krill, Whales, Sea Stars, Fish, Birds, Weddell Seals, Phytoplankton and other marine life…



We experienced various sea ice conditions, glaciers, and of course, saw lots of icebergs.



Landings on ice, rock, islands, and the continent, as well as zodiac excursions and watching from the ship…brought us closer to wildlife.



Australian Antarctic Division Education Resources "Who's Eating Who?"

http://www.antarctica.gov.au/about-antarctia/education-resources/whos-eating-who

Solve an Antarctic and Southern Ocean mystery about the sudden disappearance of huge numbers of tiny krill and learn about the food web and environmental sustainability.

WHO'S EATING WHO?

In the icy waters of the Southern Ocean there lurks a dangerous new THREAT. After living together and eating each other happily for eons there is now rising PANIC amongst the residents.

Huge numbers of the tiny krill,  better known as LOW LIFE, are missing, FEARED DEAD. Is someone eating more than their fair share of the tiny krill?  Or is there something more SINISTER at work?

Krill  are a snack enjoyed by just about everyone. All of the Antarctic animals depend on this LOW LIFE for their survival. But something has upset the balance. The atmosphere is tense. Starvation is now a very real threat. The six rival Southern Ocean gangs are watching each other closely. The FEATHERED FIENDS  are blaming the SLIPPERY CHARACTERS.  The SLIPPERY CHARACTERS in turn are pointing their flippers at the MISTER BIGS.  The only ones with an alibi are the phytoplankton.  These LOW LIFE are vegetarians! But no one is above suspicion! Even the fish and squid  are inclined to think that SOME THINGS are very FISHY!

Everyone, it seems, has a motive. The black-browed albatross,  a member of the notorious FLYING SQUAD, is known to swoop down on the krill,  gorging on hundreds of the tiny fishy 'snacks'. And then there's the blue,  humpback  and southern right  whales, the MISTER BIGS of the sea world, who cruise through the schools of krill, mouths agape, swallowing hundreds of thousands of them in a single gulp. Even the krill  themselves, during moments of desperation, have been known to eat their own kind.

You are the special agent called in to investigate this dastardly crime, and it's a tough assignment. Your mission, should you choose to accept it, will take you to the end of the Earth.

SLIPPERY CHARACTERS

All Antarctic and subantarctic seals are sleek and supple and live up to their nickname of SLIPPERY CHARACTERS. Their torpedo-like bodies are designed for efficient underwater travel.

Seals are mammals, which means that they give birth to live pups and suckle their young. Milk is an important part of a young seal's diet although they very quickly learn to hunt krill, squid, fish and other seals for themselves.

Crabeater seals *Lobodon carcinophagus* *are filter feeders and have a diet consisting almost exclusively of krill, which they strain through their special shaped teeth. Killer whales and leopard seals are their main predators and a high proportion of young crabeater seals carry open wounds or fresh scars in their skin and blubber from close encounters with these killers. Scientists count the number of crabeater seals in the pack ice from helicopters and from the Australian Antarctic research vessel, Aurora Australis.*

Weddell seals *Leptonychotes weddellii* *live in the pack ice and are often seen in tide cracks or sleeping on the ice.*

Antarctic fur seals *Arctocephalus gazella* *have thick, soft coats. Each square centimetre of their skin has about 40,000 hairs. This dense cover keeps them well insulated against the icy cold waters of the Southern Ocean.*

LUCKY TO BE ALIVE!

During the 1800s Antarctic fur seals were hunted to near extinction by sealers wanting their fur for ladies' coats. Records show that British and American sealing ships took as many as 112,000 fur sealskins in just one twelve month period (between 1800 and 1801). Fortunately fur seal populations have slowly recovered since the demise of the sealing industry.

The southern elephant seal *Mirounga leonina* *is the largest of the seals, with males weighing over 4 tonnes. It can produce a deafening roar from its trunk-like nose to scare off rivals.*

SIZING UP THE SUSPECTS

This is a cleverly written story with beautiful graphics, that sets the stage for your investigation.

FEATHERED FIENDS

Early explorers thought that penguins were fish, but we now know that they are birds. Unlike members of the notorious FLYING SQUAD, such as the albatrosses and petrels, FEATHERED FIENDS 'fly' through the water rather than through the air.

Penguin wings are flattened into strong flippers that are ideal for swimming. Penguins are very social birds and gather in large numbers each year to lay eggs and raise their chicks. Although there are seventeen different species of penguin in the world, only seven different species are adapted to living in Antarctica or the Subantarctic.

King penguins *Aptenodytes patagonicus*
have very striking orange and yellow markings. They are deep divers and feed mainly on fish and squid.

The **royal penguin** *Eudyptes schlegeli is a member of the crested penguin group named for the yellow crest on their heads. The only place in the world that royal penguins breed is Macquarie Island. Krill, fish, and squid are their favourite foods.*

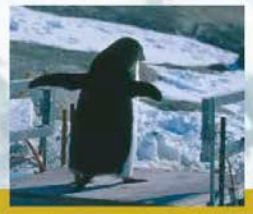
Chinstrap penguin
Pygoscelis antarctica
A thin black marking under the chin gives this penguin its name.

THINGS ARE HOTTING UP!

The evidence suggests that the Earth's climate is changing and scientists are predicting an increase in temperatures around the world. Even very small increases of a few degrees in temperature could spell disaster for plants and animals everywhere. Most forms of life, particularly those in Antarctica, could not adapt quickly enough to survive significant temperature changes. Phytoplankton and krill are especially at risk.

FAIR CONTEST?

Scientists use a computerised weigh bridge to weigh Adélie penguins as they go in and out of the colony. In the early summer an Adélie penguin regularly makes a 200 kilometres round trip to get food for its chicks. It returns with 0.5 kilograms of krill. By comparison, a krill trawler takes over 10 tonnes in one haul.



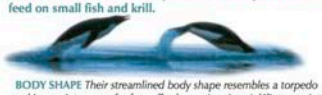
CLIMATE CHANGE

The great ice sheet that covers Antarctica is hundreds of thousands of years old. Using a special drill, scientists have extracted long, cylinder-shaped samples of ice called cores. Tiny bubbles of gas from inside the layers of ice provide information about the Earth's past climate.

Adélie Penguins

Adélie penguins *Pygoscelis adeliae* **spend winters in the Antarctic pack ice, and in spring travel great distances over sea ice to reach land, where they build their nests out of a scattered pile of pebbles. They are superb swimmers, and can use their speed to leap up to two metres vertically from the water on to ice floes to avoid their main predator, the leopard seal. Adélie penguins feed on small fish and krill.**

Feathered Fiends MENU
Krill kebabs
Fish pie
Squid beaks



BODY SHAPE *Their streamlined body shape resembles a torpedo and is very important for fast, effortless swimming. Adélie penguins can swim continuously at speeds of 4 - 7 km/h and swim in short bursts of up to 15 km/h.*

FEATHERS *They have almost a complete covering of feathers. Even the base of their beak is feathered! The feathers in the tough outer layer overlap each other to form a barrier against water, snow and wind that helps keep them warm. This layer is so effective that on sunny days penguins actually have a problem keeping cool.*

FLIPPERS *The swimming action of a penguin is similar to the flying action of a bird but penguins 'fly' through the water instead of the air!*

Once a year penguins moult, losing their old frayed feathers.

FEET *These feet are made for walking. At the end of the long, dark winter Adélie penguins walk up to 300 kilometres across the sea ice to their colonies to lay eggs and rear their chicks. They also use their feet for steering while they are swimming. The three front toes of their feet are webbed and this helps them to change direction quickly while chasing fish and krill or when trying to outrun killer whales and leopard seals.*

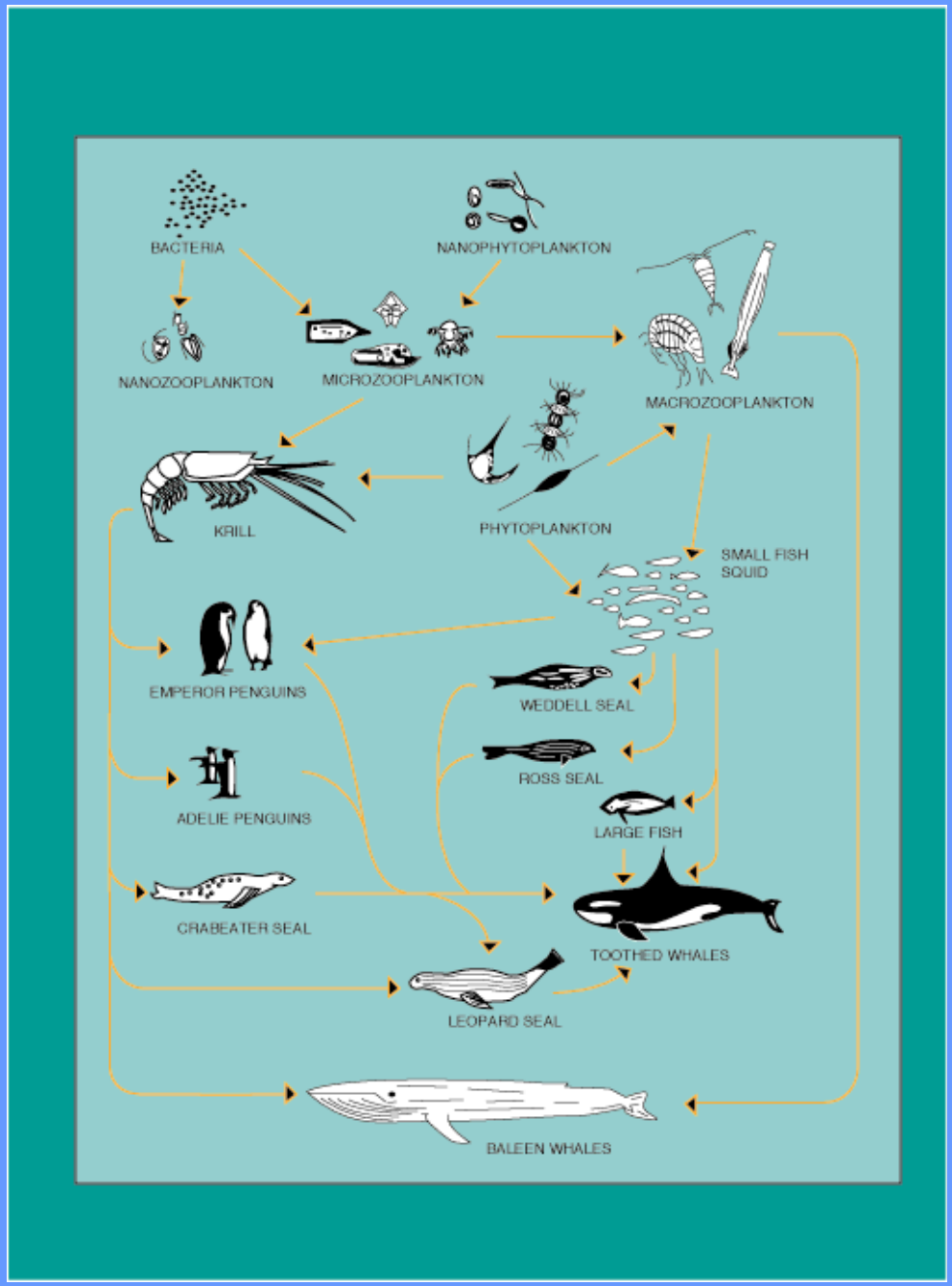
BEAKS *A penguin's tough beak is used for many important tasks. They build their nests out of small pebbles and rocks that they collect and carry in their beaks. They won't hesitate to give another penguin a sharp peck if they catch them stealing any of their rocks! They also catch and hold their food in their beaks. To make sure their wriggling, slippery prey of fish and krill don't get away, they have spikes on their tongues. Once they have caught their tasty meal the spikes stop the prey from escaping.*

WHO'S EATING WHO?

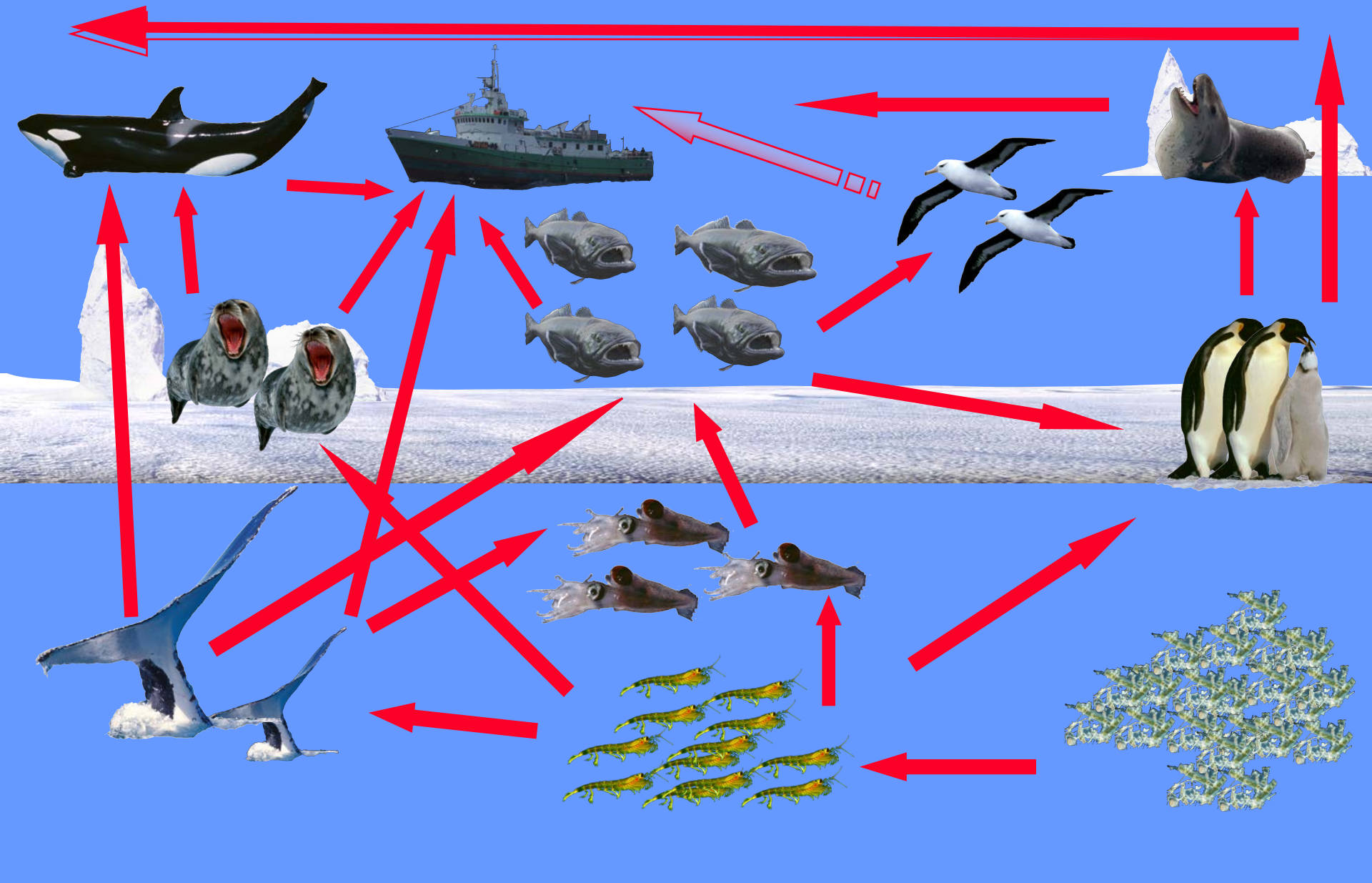
Low life: phytoplankton
Flying squad: storm petrels to albatross
Feathered friends (fiends): penguins
More feathered friends: emperors
Slippery characters: seals
Mister Bigs: whales

Also included is a food web page that shows the transfer of energy among creatures in the Southern Ocean.

This leads to an activity I'd like to share that has to do with building an Antarctic food web and taking a look at factors which can impact that food web.



Who's eating who in Antarctica?



Food Web Layout Diagram

Fishing boat

killer whale humpback whale

albatross leopard seal

squid toothfish

emperor penguin Weddell seal

krill

phytoplankton

Food Web Activity: Catchy Catch

Albatross, emperor penguin, squid, leopard seal, Weddell seal, fishing boat, killer whale, humpback whale, toothfish, krill, plankton

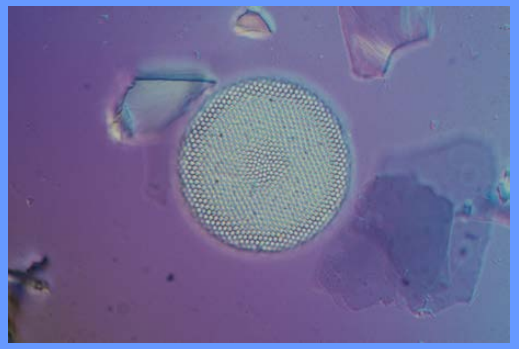
Ropes – Each student is assigned one animal in the food web. Once students have their designated animal, join the colored ropes according to the description below. I've often used name cards or picture cards to pass out to students.

Thick green: phytoplankton to krill (can cover a clothesline/other rope with colored duct tape or cloth bits)
Green/white: krill to squid, fish, emperor penguin, Weddell seal, humpback whale, albatross
Yellow/black: squid to fish
White:
1.Fish to killer whale, albatross, emperor penguin, Weddell seal and leopard seal
2.Squid to killer whale, albatross, emperor penguin, Weddell seal and leopard seal
Orange (I used red):
1.Emperor penguin to killer whale and leopard seal
2.Killer whale to humpback whale, albatross, leopard seal, Weddell seal

Action:

There are impacts on the food web and ecosystem.

Krill shakes lines as impacted by overfishing – Who can feel it? Who can't feel it (killer whale). Now if you can feel it, shake the rope also. It now impacts all.



Show another impact on the ecosystem, such as loss of phytoplankton due to global warming. Students affected drop their line (phytoplankton) and if a student has a connecting line, they drop it also.

Talk about various links in the food web and what would happen if individual links were affected. What would happen to the ecosystem?

** you can also use ONE rope and link the various parts of the food web together

** add more cards (for example two-three of each card or other members of the ocean food web).

PEI Master Class Series

- Linking a scientist and educator to present a world-wide webinar

- Goals: reach out to researchers who are interested in improving their science communication skills and to educators who want to build their science knowledge

An Introduction To Antarctic Marine Ecosystems…

- With Jess Melbourne-Thomas from the Australian Antarctic Division
- Archived on the PEI website and you can Google the title of the Master Class on YouTube
- Each Master Class has a discussion group for approximately 2 weeks after the webinar

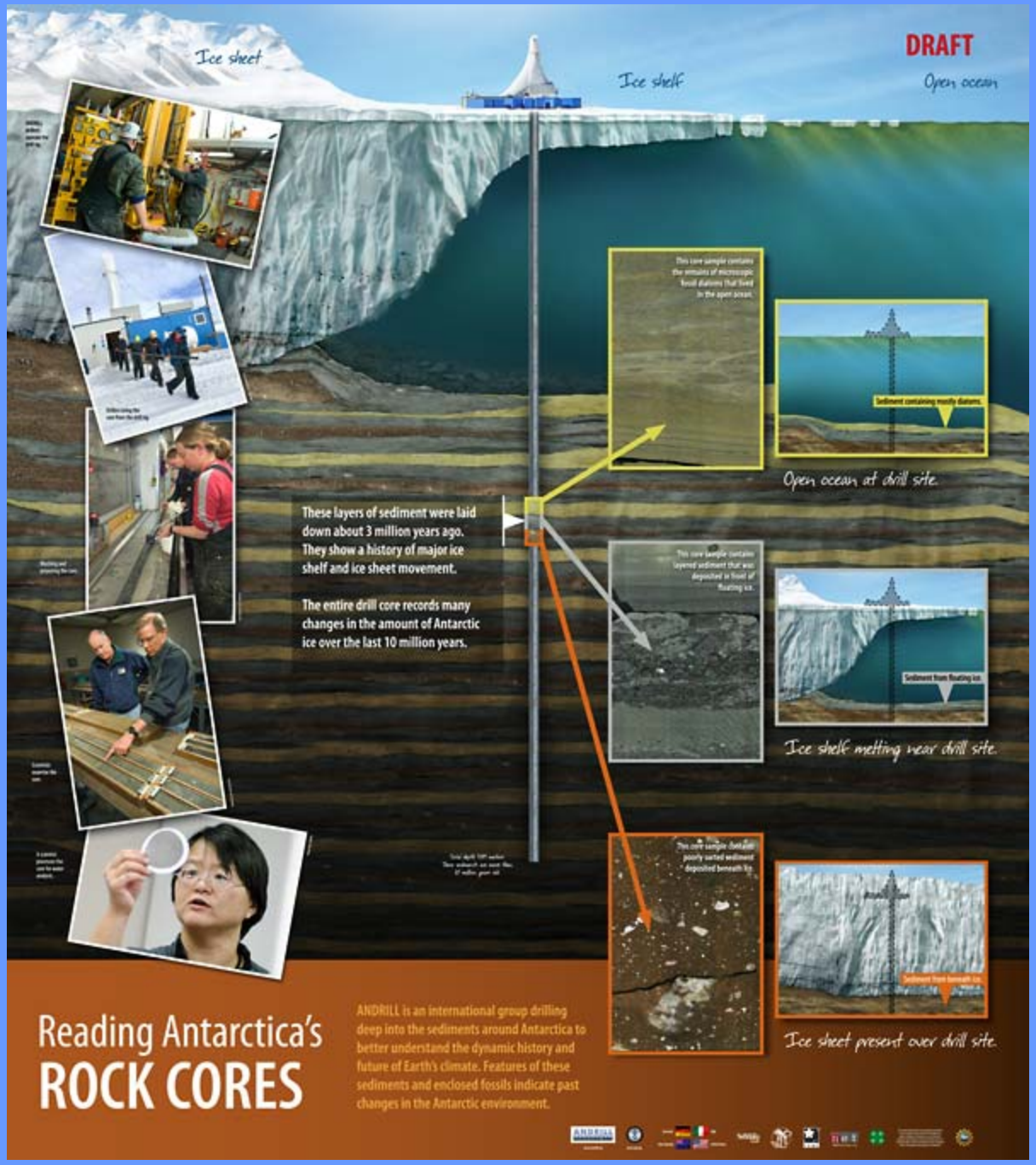

Questions?

Flexhibit: Antarctica's Climate Secrets

- 5 themes
- Kids become the teachers
- Funded by the NSF to increase public understanding of ANDRILL and climate science.

Hosting the Flexhibit…learning how to teach others…

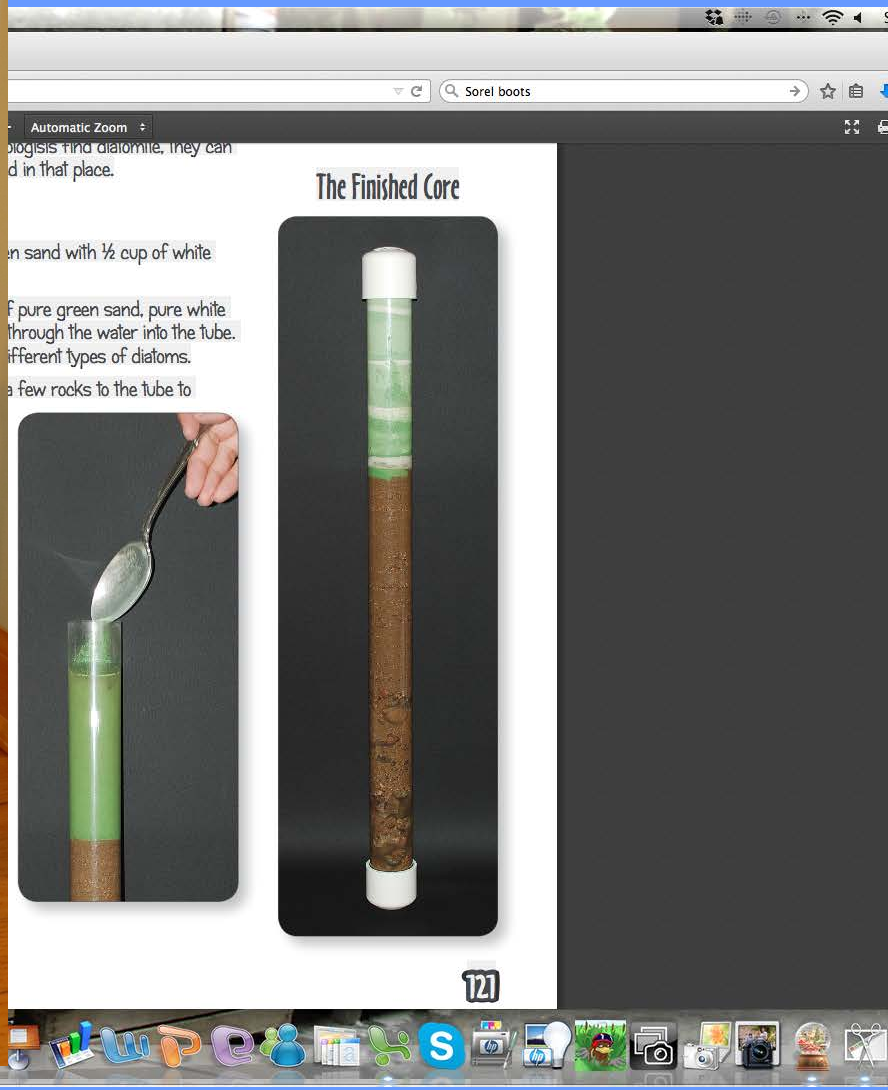
Kids teaching kids….
A great model that builds knowledge, confidence, experience…



Reading Antarctica's Rock Cores

How do scientists retrieve sediment cores and interpret them?

Mix Up A Model Rock Core



Building a Drill Site Model…

http://www.andrill.org/flexhibit/flexhibit/materials/activities/Activity 3A-BuildADrillsite.pdf

Building a model of the ANDRILL drill rig; simulating the drilling process

www.scienceroadshow.wordpress.com