Transcript to Accompany the

Antarctic Expedition Podcast

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SUSAN: This week we have a very special podcast for you about a recent scientific expedition to Antarctica. We'll hear the voices of several of the researchers and we'll get some questions from local high school and college students. Picture yourself in a freezing cold environment. All around you is a vast frozen world. All you have to survive is your instincts. Now imagine your only 18 inches tall and rockin' a tuxedo. Oh yeah you're a penguin.

JULIA: Specifically, you're an Adélie penguin living on the coast of the western Antarctic Peninsula. You're surrounded by thousands of other adults with that same classic tuxedo look – a black head and back with a white belly. And, they are all protecting nests built out of small pebbles. It's January and the chicks that hatched a month ago are fluffing their downy, gray feathers. The colony is a big, noisy, crowded and incredibly smelly place but, for a penguin, that's home.

SUSAN: On this particular January day, the colony has some different visitors. A group of researchers from the Polar Oceans Research group in Montana have been studying these penguins for over twenty-one years.

SUSAN: Emily Salfidi from Gaucher College in Maryland loves penguins.

EMILY: Definitely. "I was wondering how the studies were conducted?"

JULIA: The penguin research is one of many projects that are all part of Long Term Ecological Research or LTER. Every year the research vessel Lawrence M. Gould visits the LTER site at Palmer Station on the western Antarctic Peninsula. The study of the penguin colonies near Palmer Station and nearby islands is led by Dr. Bill Fraser but on this cruise it was his graduate students and some other researchers who were doing most of the work [research]. We talked with Dr. Ken Legg, a friend of the museum and a chemist who did research onboard the Gould and who also observed many of the other projects. (Note: Video clip (1:19): *Penguins Under Pressure)*

KEN: Kristin Gorman was aboard and she's been down many, many times. She and another fellow, Sean Ferry, would go out and spend time at three different colonies of Adélie penguins. And they're studying the Adélie penguins that have been there for years and years and seeing how their habitat is changing as the ice is melting because they require ice as a part of their ecology. They went ashore at a place called Avian island and we took them ashore and they spend five days, just the two of them, camped out doing their work with the birds something like 70,000 pairs of Adélie penguins. So it was quite loud and quite smelly.

JULIA: Some of the researchers' tasks included measuring the depth of the snow, counting the penguins and other sea birds and sampling their guano – their droppings - to find out what's in their diets. And they noticed some changes. The sea ice has been melting more in that Antarctic Peninsula area and that is putting pressure on the Adélies. One thing is that it's affecting their nest sites causing more flooding and more intense winds near where they need to build their nests. And another thing is it's reducing the amount of krill in the ocean and that's the penguins' favorite food. So it's pressuring the penguins to have to swim further to find food and that affects how much they can bring back to feed their chicks. That's especially a problem for Adélie penguins because they can't adapt quickly to changes in their environment like that. It's not easy for them to just choose a new location to place their nests, for example. So the population of Adélie penguins is dwindling [near the peninsula] and they're being replaced by other species of penguins, sub-Antarctic species such as Gentoos and Chinstraps. *(*Note: video clip (1:41): *The Adélie and their Neighbors)*

SUSAN: Well, that's sad for the Adélie , possibly good for the Gentoos and Chinstraps. "What does all of this mean for humans?" "Does this change affect us?"

JULIA: Good question. "What does stuff happening thousands of miles away in Antarctica have to do with us?" Well, the penguins are just the tip of the iceberg so to speak. There are a lot of other ecological changes going on there as well as the South Pole and the north pole too. Earth's poles change faster than the rest of the Earth in response to things like climate change. And, because this is one of the many sites in the world that is an LTER site, scientists can actually observe and record in great detail the changes in many aspects of the system over time.

SUSAN: "So what's the next step? Do they just keep coming back every year counting penguins and tagging them? Is there more to it than that? Or is that the way it's going to carry on?"

JULIA: Yes, they [Palmer LTER researchers] are going to continue coming back to this site, but every year they are bringing [and using] more sophisticated equipment. [For example] They have [been following] penguins tagged so they can track their locations. But tracking them on a map is one thing. Really getting information about where they are feeding – that's what they can do with this new technology.

SUSAN: Next we have Peter Kelly from Minuteman High School in Lexington who's curious about how this all works?

PETER: "So how are they able to follow the penguins?"

JULIA: Well, they don't exactly follow the penguins. The group [of researchers] doing this actually have lots of different things that they are working on. Dr.Ken Legg talks about Dr. Oscar Schofield from Rutgers University and his research.

KEN: Oscar Schofield had a group that was multifaceted. The major part of what [at least I thought] was cool that he did was work with remotely operated autonomous vehicles (AUVs), especially underwater gliders. It was really, really neat and they could get a lot of data. They put oceanographic sensors, chemical sensors, sonar sensors on them. And, these things go flying around underwater getting data, tons and tons of data, that we can correlate with the other data that we get.

PETER: "So I've heard about underwater vehicles but how are these different?"

JULIA: Well, there are two types of vehicles that they're working with. One type, called REMUS – remote environmental monitoring unit- that's more of your typical underwater vehicle. They first put transmitters on the penguins and identified where the penguins are going. Then, they can send the REMUS vehicles to those locations and have them measure qualities of the water and look at what the penguins are eating. But, then the other underwater vehicle is different. That one is called a SLOCUM glider.

KEN: I think the idea of the glider actually goes back a decade or more, maybe even two decades. But they've sort of caught on more recently. An

underwater vehicle looks something like a torpedo and most of them act like a torpedo in that they have a propeller on the back and then they zip around through the water [under control] one way or the other, but they are very energy inefficient. The propellers that move them require a lot of battery power and most of the time these vehicles don't have a lot of battery power so they're underwater life is short.

Well, the glider is a really unique way of doing this where they actually have wings so it can fly underwater and it has a compartment up forward that they can bring water into and it becomes heavier than water and sinks. But of course as it's sinking it has the wings and so it glides forward. They let it go until it reaches a certain depth or after a certain time and they [the gliders] squirt this water out and now its lighter than water and it rises and it flies up. So, it almost goes through the water, like a porpoise through the top few hundred meters... and its loaded with sensors and sonar and it can take all this data. It's so efficient that a couple years ago the Rutgers group flew one from the New Jersey coast all the way across the Atlantic Ocean to Spain. *(Note: video clip (1:19): Penguin Tracking Robots/The Remus)*

SUSAN: So the REMUS vehicles are basically checking out what the penguins have been doing, what the penguins have been eating. But what exactly do the SLOCUM gliders do? *(Learn more about the SLOCUM glider from inventor Doug Web http://rucool.marine.rutgers.edu/COOL-Videos/)*

JULIA: The SLOCUM gliders are used to complement the R/V LMG's [Research Vessel Lawrence M Gould] ability to measure the water, so the gliders can take measurements real quickly as they travel horizontally so they can get a lot of information at closely spaced horizontal points. But, they don't get as much information going all the way down to the sea floor. So once you've used the SLOCUM glider to scan the area that can then help you identify where you want them to bring the big ship the LMG and then from the Gould they'll deploy an instrument that can make detailed measurements around lots of depths in the water. So, then you get both the vertical and horizontal resolution. *(Note: video clip (1:34): Underwater Robots / The Slocum)*

SUSAN: So the SLOCUM is like a good little scout checking out the ocean?

JULIA: Yes

SUSAN: Mike Everdell from Oberlin College in Ohio is curious about the water.

MIKE: "So the researchers keep taking these measurements. What do they actually plan on doing with them?"

JULIA: They are looking at the physical and chemical and biological qualities of the water. Physically they want to know about the temperature changes. There are [also] layers of unexpected warm temperatures in the water. And, then chemically they're looking at salinity or other things dissolved in the water. For the biological [aspect] they can make measurements to look at the concentrations of [for example] phytoplankton in the water.

MIKE: "So phytoplankton isn't that like little tiny plants that are floating around in the ocean all the time?"

JULIA: Yea. Phytoplankton is the foundation of the food web, not just in Antarctica but throughout the oceans. And they can tell how much phytoplankton there is just by the color of the water. If the water's really green there is an abundance of phytoplankton. If not, then that might indicate that [particular] area is not as healthy for the phytoplankton or it might mean that other microscopic critters are eating it all up really fast. So, the color of the water is a way to assess the health of that area.

SUSAN: So... so far in the water we've looked at really tiny things, we've looked at chemicals and salts in the water. We've looked at little phytoplankton. We've also looked at big penguins. Is there anything they looked at in between?

JULIA: Yes, there is. There is a category of tiny creatures called zooplankton and there was a whole [research] group that were studying that led by Dr. Debbie Steinberg from the Virginia Institute of Marine science. I'll let her post doctoral student Dr. Kim Bernard explain why it's important to study zooplankton.

KIM: Zooplankton are the drifting animals that live in the world's oceans. They range in size from tiny creatures that you need a microscope to see, all the way up to very large things like jellyfish, which can be as big as seven feet across. Zooplankton are very important because they act as a central point in the marine food web. And, what I mean by this, is that zooplankton eat the phytoplankton which are the tiny drifting plants of the oceans. Then, they transfer that energy over to bigger animals like whales and penguins that eat zooplankton.

SUSAN: "Did they get the samples of zooplankton from the same water samples that we were talking about before?"

JULIA: No. This group [*of researchers*] used a different method. What we we were talking about before is this big cylindrical instrument that they lower all the way down to the sea floor, and then as they bring it up they stop it at various depths to collect bottles of water. They sometimes call that instrument a rosette [*or CTD*]. But, the zooplankton group dragged nets behind the ship, kind of like fishing nets to collect their samples.

KEN: What they do is, when they put the nets in the water they come up with whatever they catch, called zooplankton. Then they take that into another area and put it in some big tubs of water on the floor. They spend a lot of time segregating and separating the various zooplankton in those tubs by species [*placing them]* into smaller containers. Then, they take those into the lab and actually count each one and measure each one - ad infinitum it seems. So, it is very, very tedious work.

JULIA: So to summarize up to this point: We've talked about the four projects that we're going on this cruise. There was the penguin research, the gliders and the other underwater vehicles, the zooplankton; and also a little bit about the phytoplankton and the qualities of the water.

SUSAN: Next we have Brittany Jeye from Boston College who has a more general question.

BRITTANY: "Were there any surprises during the experiments? Did everything come out as expected?"

JULIA: A lot of what they observed was kind of continuations of trends that they had already started to see from previous years. But some of those changes were more dramatic than they'd expected. For example the water really showed signs of warming up.

KEN: And we saw unusually high sea surface temperatures up above 3 degrees centigrade. Between 3 and 3.5 degrees centigrade. And they hardly have ever seen this in the past.

JULIA: And that rise in water temperature is being felt on many different levels of the food web in many different parts of the ecosystem. For example, another surprise they saw going back to the zooplankton - was that while usually they expect to see a lot of krill (these tiny little shrimp that penguins like to eat), this year they found an unexpectedly high abundance of this other little animal called a salp.

KIM: Alright, so salps are also zooplankton and they're jelly-like animals. They are not actually jellyfish. They belong to a family called

tunicates, but for all intents and purposes, they're jelly like animals. They're see thru and they range in size from the tip of your finger all the way up to the length of your hand, probably. And some of the ones that we were collecting in Antarctica, they would typically range in size from about 1 cm through to 8cms, I would say. So this year, which was really surprising for us, is that we caught salps everywhere. We caught them at every single station which is really quite incredible. In the past we caught salps before, but never at every station, and the reason this was so alarming is that salps are normally not found close to Antarctica. They avoid ice at all costs. And we were sampling right alongside the continent. So normally we catch a lot of Antarctic krill, but in recent years, as the Antarctic Peninsula has been warming up, krill numbers seem to be dropping off, and what we're seeing instead is more and more salps. And both salps and krill are important grazers of phytoplankton, so they're important to the food web, but the difference between the two is their nutritional value. So krill are highly nutritious, especially to penguins and whales, but salps, unfortunately, are not at all. So if we see more salps along the peninsula instead of krill, then the food web is going to be affected and animals that eat krill like the Adélie penguin are going to probably struggle to find food.

SUSAN: It sounds like the salps are consuming a lot of nutrients by eating the phytoplankton, but then they're not aren't passing on those nutrients to the other species in the food web, like the penguins. So, it's no wonder the Adélie s on the peninsula are having a tough time.

JULIA: Yeah, it's impressive when you have data with this level of detail, you can really see how changes in one seemingly small thing, like amount of salps, can ripple through the system and affect so many other things. Our final guest, Beth Simmons, a past expedition member, explains why this is important.

BETH: There are quite a few delicate connections and I think the scientists continue to travel down to station just to get a better understanding of the whole process - how everything interacts, where the species go, how and who they eat, the relationships between the animals. They have to figure all of these things out. So the scientists come from all over the United States, from different universities, and everybody focuses on different components, but then lends their stories to the greater picture. One can't do it without the others, so that interdisciplinary nature about the science is what is key about the LTER. You've got to have all those different scientists contributing. It's not just one perspective.

JULIA: And many of those teams of researchers will be returning to Antarctica on the Gould at the end of 2011 to continue this long-term study.

BETH: All these changes that we're seeing help to keep us going back because these changes are a prelude to what's going to happen in our environment here.

SUSAN: Julia and I would like to thank all of our guests today who gave us a little bit of an inside look as to some of the amazing changes in the environment of Antarctica.

For More Information:
Palmer Long Term Ecological Research : http://pal.lternet.edu