Picture Polar Science: Using Gigapan to Connect Classrooms to Antarctic Cryobiologists

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ABSTRACT

Ecophysiological cryobiologists from Miami University and Ohio State University traveled to Palmer Station, Antarctica for fours week in Dec 2009-Jan 2010 to research the effects of extreme cold and dessication conditions on the survival of the southernmost continent's largest land animal, the (7mm maximum length) larva of the Antarctic midge, *Belgica antarctica*. Using the Gigapan, still photography, and videography, the research team communicated with K-6 classrooms local to the researchers' and research institutions' home areas via blog posts, a Facebook page and direct annotated images uploaded to the Gigapan website. Images were taken specifically to both document the scientific data collection process and relay what a "typical day" in the life of an Antarctica scientist was like, with the goals of increasing student understanding of the nature of science, student excitement about science and interest in becoming a scientist. Feedback from the K-6 teachers and their students (approximately 600 students total, across many subject areas) was very positive; and the research team plans to take the Gigapan and other visual communication equipment with them during their next field season in winter 2010-11.

Keywords

Photography, cryobiology, Antarctica, K-12 science education, field work documentation, communicating science

INTRODUCTION

In an age where science education is weak and environmental issues are considered at crisis point, ecological scientists are increasingly asked to 1) communicate the nature and importance of their work to the public, and 2) share the excitement of their work with—that is, engage—children, the next generation, in hopes they will grow up to become scientists themselves. But, for many reasons, such communication and sharing is challenging for scientists, particularly when the research questions being addressed are complex, the study subjects are small, and/or the research sites are remote or unfamiliar to the audiences. However, recent visual and web-based technological advances have created avenues of science communication that are far easier, more interdisciplinary, more participatory, and that have the potential to reach substantially larger and broader audiences than in previous years. A group of ecophysiological cryobiologists from Miami University (http://www.muohio.edu/cryolab) and Ohio State University (http://www.oardc.ohio-state.edu/newentomology/personnelsingle.asp?strid=154), doing fieldwork in Antarctica (Palmer Station), researching the physiological mechanisms of freezing and dessication tolerance in the 7 mm maximum length larvae of the Antarctic midge (*Belgica antarctica*) (Figures 1a. and 1b) had quite a challenge ahead of them.

Yet, they were also dedicated to communicating their Antarctica work to youth in the researchers' and research institutions' home areas, and they were also keenly interested in using photography as a scientific documentary and communication tool. Richard Lee, the director of the Laboratory for Ecophysiological Cryobiology at Miami University, had a unique perspective: not only a scientist, he is also a former high school biology teacher, the current co-director of the university's Master's of Arts in Teaching in the Biological Sciences Program for K-12 teachers, and an avid photographer. In all previous Antarctic research trips, funded by the National Science Foundation, Lee has brought a K-12 educator to Antarctica, where the person's role is to both work with the scientists as a field research team member and communicate with their classroom or classroom

networks from the field through blogging and other means of communication. Several published science education articles and lesson plans have resulted from fieldwork teacher participants (e.g. Bugg et al. 2007, Constible et al. 2008, Sandro et al. 2007). Additionally, Molly Steinwald, a PhD candidate in Lee's lab and also a photographer, was an invited Fellow in the Fine Outreach for Science Gigapan program; and after receiving equipment and training, trained her fellow Antarctic-bound PhD student, Yuta Kawarasaki, on the Gigapan.

In a 4-week trip spanning Dec 2009 and Jan 2010, the team's most recent field expedition, and the first of three field seasons over the next three years, a collaborative effort was made to more fully incorporate photography into the communicative aspect of the trip. For the first trip, it was decided to use Gigapan for documenting the daily life of the scientists in the field, so student audiences would have a better understanding of what being a scientist in Antarctica was like.

PROJECT DESCRIPTION

Utilizing two online communication platforms, a blog, *Studying Belgica at the Bottom of the World: An Antarctic blog for students, educators, and science enthusiasts* (http://frozenfly.edublogs.org/) and a Facebook page, *Miami University's Antarctic Connection* (http://www.facebook.com/pages/Miami-Universitys-Antarctic-Connection/173771340473), both accessible via http://www.units.muohio.edu/cryolab/education/antarctic.htm and constructed and coordinated by Juanita Constible (this trip's K-12 educator), Kawarasaki, and Steinwald, the field research team kept in contact with students throughout the duration of their 4-week field research season.

Teachers checked the blog or Facebook page alongside their students on a daily basis, or every few days, as their schedules permitted; and several teachers incorporated Antarctica and *Belgica*-themed activities into their classroom work. Teachers were able to post questions for the researchers to the blog, or emailed them questions directly; and researchers posted trivia challenges and questions for the classroom students to answer. Also, to increase the connection the researchers made with the student audiences, field research team members visited participating classrooms before their field research trip to present on what they would be doing while in the field and connected to subjects students were learning in their classrooms; upon their return, the researchers again visited classrooms to "share their findings" with students.

The figures below are examples of some of the Gigapan images and accompanying text embedded on the blog and posted on the Gigapan website; all text accompanying the images was written directed to the child audience. To view more of the research team's Gigapan images, go to http://www.gigapan.org/profiles/18293/.

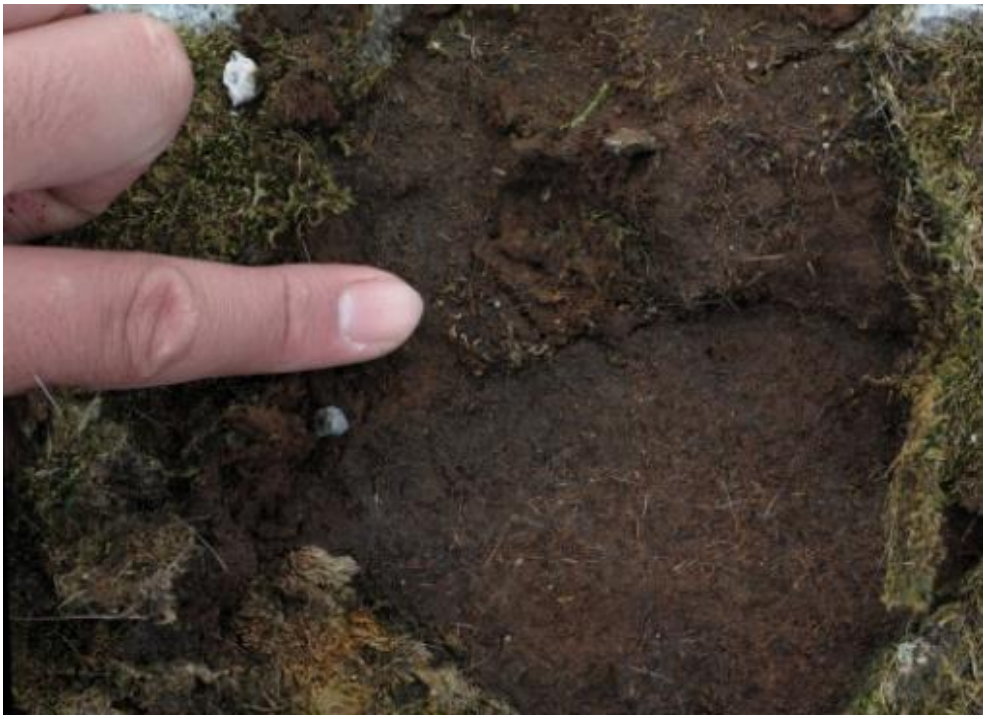

Figure 1a. Here is the largest land animal on Antarctica that stays on land all year round! The larvae go through four

instars to become adults. It takes two years owing to the harsh environment of Antarctica. (For zoomable image, see: http://www.gigapan.org/gigapans/40287/.)

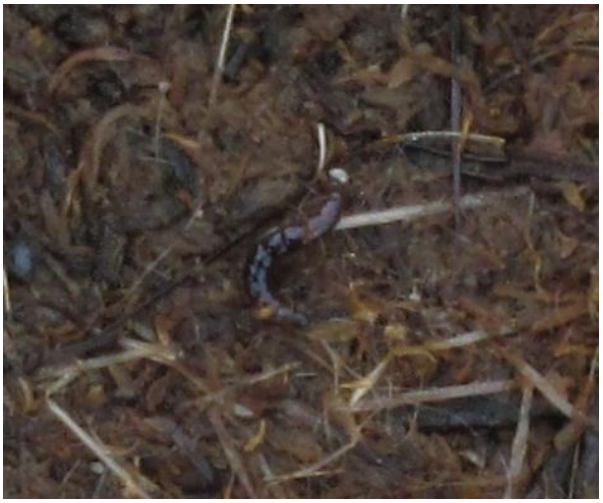

Figure 1b. Snapshot of Fig 1a. *Belgica* larva - a whopping 7mm (less than 1/3 of an inch)! (See: http://gigapan.org/gigapans/40290/snapshots/116735/.)

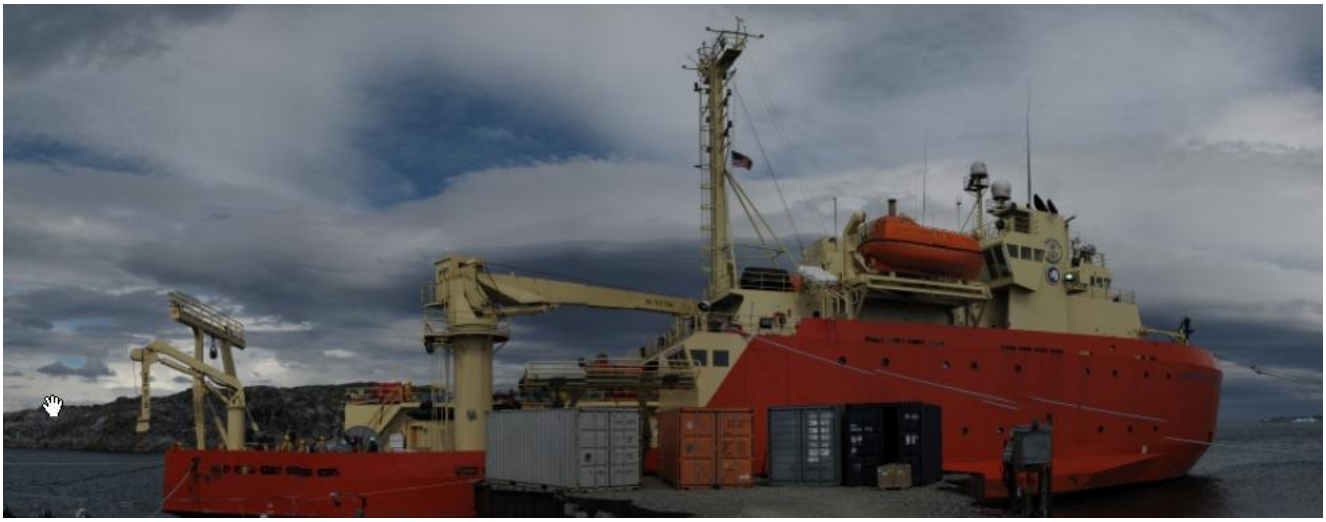

Figure 2a. The primary function of Palmer Station is to support science on the Antarctic Peninsula. The station houses state-of-art instruments and equipments for scientific research, so we could do almost everything we normally do in our home institutions. Many of the instruments, equipment, and chemicals we regularly used were stocked in vans at the station and meticulously inventoried. Special items have to be shipped from South America via icebreaker. Because the shipment only comes about once a month, we had to plan what we wanted very carefully before we deployed to Antarctica. (For zoomable version, see: http://gigapan.org/gigapans/40290/.)

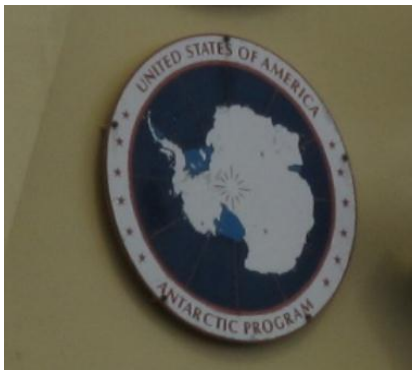

Figure 2b. Snapshot of Figure 2a. USA Antarctic Program sign. (See: http://gigapan.org/gigapans/40290/snapshots/116735/.)

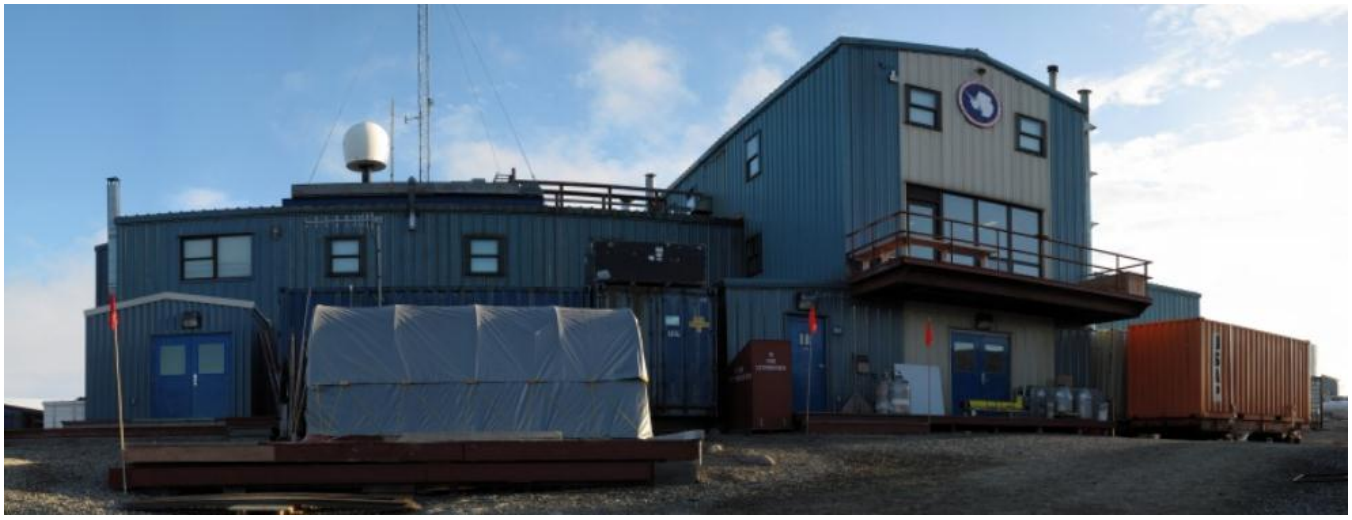

Figure 3a. Palmer Station houses total of 45 people, including both scientists and support staff. A day at the station starts very early for some people. Typically, we get up around 7:00 am, trying to get ready to leave to collect *Belgica* around 9:00 am. Often, we have to take care of some experiments before we go out. Captured in this panorama is the station before the festivities of a day. The doors on the lower right are to Laboratory 10: Laboratory 10 is the space where our team did the most of our work. Very exciting place to be, if you are interested in *Belgica antarctica*! (For zoomable version, see: http://www.gigapan.org/gigapans/40272/.)

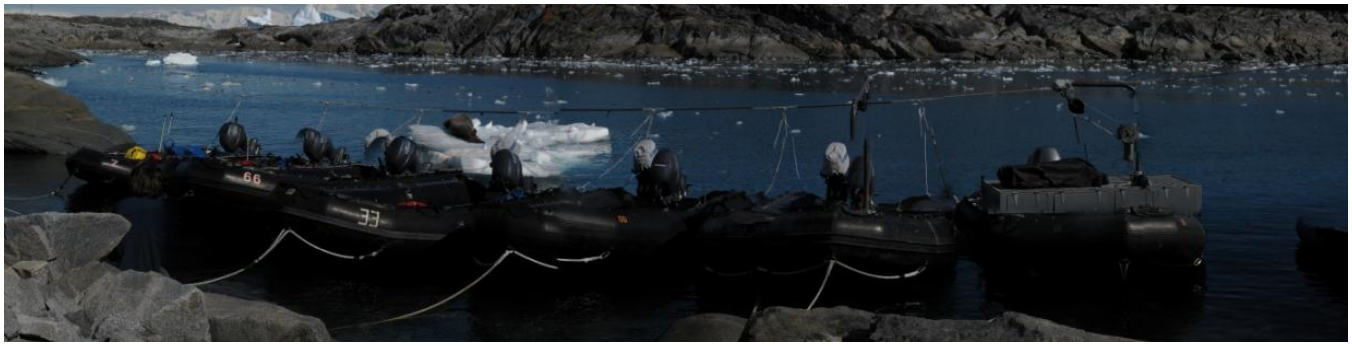

Figure 4. We move from one island to another using a Zodiac boat. Captured in this panorama is the Zodiac dock right outside of Palmer Station. As you can see, we often get visits from wildlife! This leopard seal was basking on a floating ice, just away from our dock! For more information about traveling in a Zodiac, visit http://frozenfly.edublogs.org/2010/01/09/staying-safe-on-the-water/.

(For zoomable version, see: http://www.gigapan.org/gigapans/40305/.)

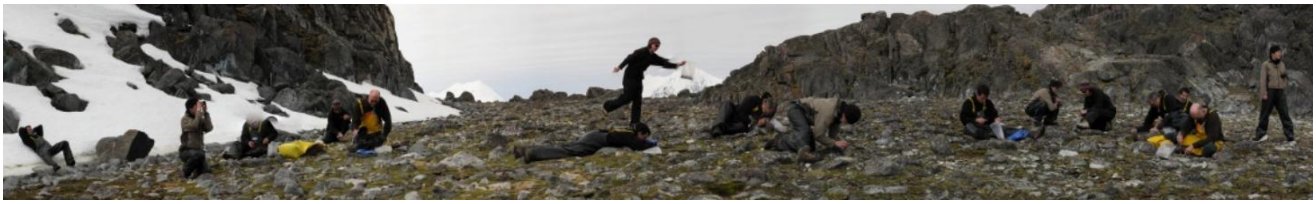

Figure 5. Illustrating scientific teamwork and the whole process of field collection in an engaging, entertaining and creative way. (For zoomable version, see: http://gigapan.org/gigapans/cc3e9d423941003da8c81847f0227481.)

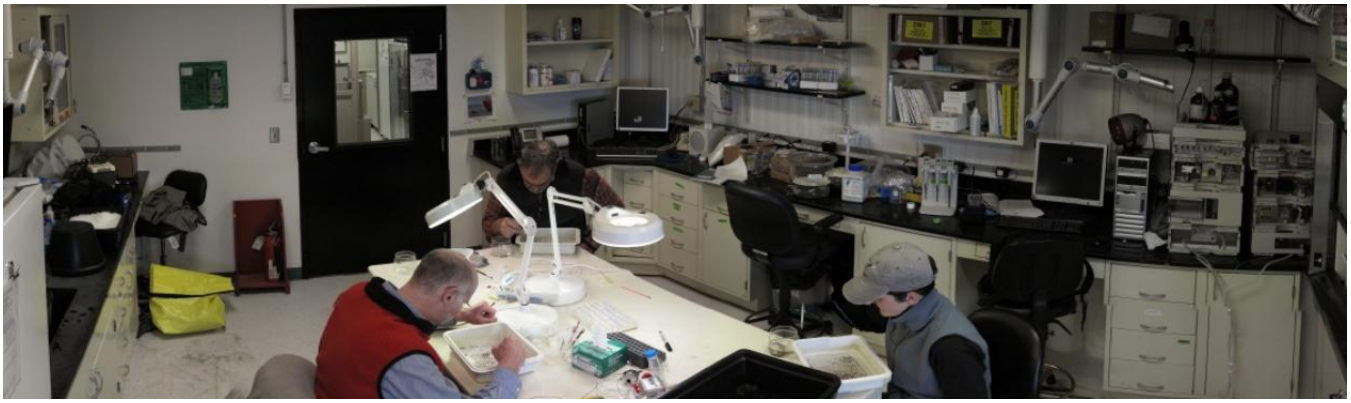

Figure 6a. Once the initial extraction was complete, *Belgica* larvae would be wiggling in ice water. Although big chunks of soil were removed by the screens, the water still contained soil particles. In order to use the larvae for our experiments, we had to go through a series of cleanings. We usually spent most of our afternoon sorting *Belgica*. It was a serious business because dirty larvae would ruin our experiments. (For zoomable version, see: http://www.gigapan.org/gigapans/42190/)

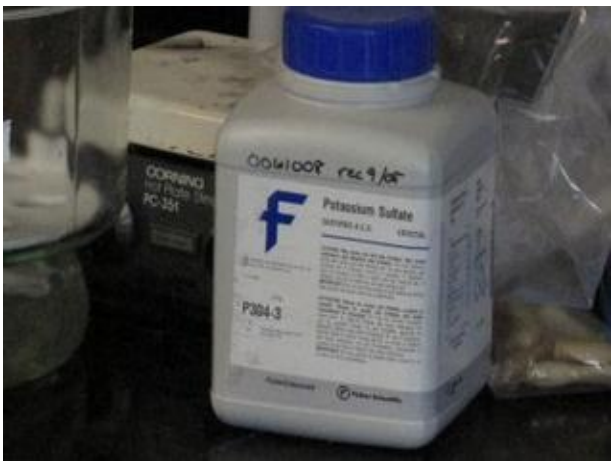

Figure 6b. Snapshot showing detail of Figure 6a. Potassium sulfate is a chemical that decreases the amount of moisture in the air, and so it is used to create different experimental conditions for testing dessication stress in the *Belgica antartica* larvae. (See: http://www.gigapan.org/gigapans/42190/snapshots/139297/.)

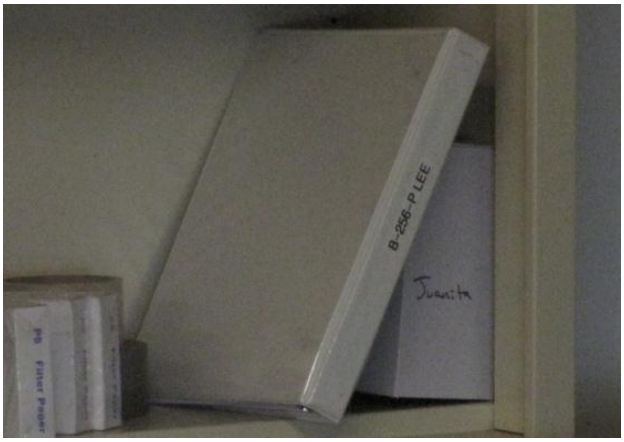

Figure 6c. Snapshot of Fig. 6a. Many researchers work in Antarctica and use Palmer Station's research facilities. To reduce confusion, each research group at Palmer Station has its own unique identifying code; B-256-P identifies our group. (See: http://www.gigapan.org/gigapans/42190/snapshots/121709/)

FEEDBACK, LESSONS LEARNED, AND FUTURE PLANS

The activities reported here were the team's first attempts at incorporating Gigapan technology into our science education outreach, and it was during the pilot time in the field that we discovered many more potential uses that we did not plan for.

At first, we documented the researcher's work, outdoors, the equipment used, mode of transportation and data collection, etc. However, we began to realize that having humans more prominent in the pictures (e.g. Fig 1a. and Fig 6a.) and also making the pictures more creative and humorous while still transmitting information about the scientific process (e.g. Figure 5) were ways to potentially engage child audiences more substantially. The Gigapan images taken in the latter half of the trip appear to successfully show that science can be fun and interactive. The researchers received many positive comments back from students and teachers about how they students felt as if they were there with research team.

The team will return to Antarctica for another field season in the winter of 2010-11, and will take the Gigapan; but this time with a specific plan for capturing images that can both be readily embedded into the team's blog and also be used sequentially in developing and publishing interactive online lesson plans that can address specific state and national science education standards. We also intend to have the blog more interactive so that students and their can more easily dialogue with the researchers, such that the researchers can answer audience questions through images. Additionally, during this past trip the team did not take advantage much of the seek-and-find features Gigapan has to offer in turning images into a game; we intend to this next trip. We are also in the process of going through many Gigapan images captured on the first trip and creating lesson plans from there. We have found that we are just at the beginning of exploring Gigapan's potential in connecting scientists working on complex questions, with small specimens, in remote locations, with children audiences back home and communicating to them the excitement and dedicated work involved in being a scientist.

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