Tarrant Lab blog posts related to Award OPP-1746087

Moving on up

By Ann Tarrant | December 31, 2018

The Antarctic adventure has begun! Right after Christmas, I left my family home in Chicago and headed off to Punta Arenas. The next day, was a whirlwind of orientation meetings, trying on ECW gear (extreme cold weather clothing loaned to cruise participants by the US Antarctic Program), last-minute shopping, and moving onto the ship. After all our gear was stowed, I furiously worked to finish up some last minute tasks from back at WHOI. I wasn't sure how good our internet connectivity would be during transit, so I wanted to clear off my administrative responsibilities as much as possible. It was a pretty late night.

Yesterday we left port and scooted around the coast of Chile. We organized our gear a bit more, and I spent some time reviewing my sampling plan. It's a little daunting to think about how I'll be able to get it all done, but it will be a lot of fun to try, and I'm in really good company. I've folded in with the "zooplankton group," run by Debbie Steinberg, who is also our Chief Scientist.

Today we had more safety training, including practicing climbing up a Jacob's ladder in our steel-toed boot and a float coat (picture above). This practice is important because this is the type

of ladder that is used to move from the ship to a small boat. After that I got to help string up a large plankton net, something I've never done before. I was thinking that my Dad would have been proud because he's the one that taught me to tie a bowline in the first place. Today I also tried out the treadmill for the first time. It's not particularly rough right now, but the ship was rolling enough to make running interesting. I had to hold on with at least one hand and sometimes two.

In a couple of days, we'll arrive at Palmer Station, and we'll be able to start sampling soon after that.

Ringing in the new year

By Ann Tarrant | January 1, 2019

Last night I joined in the LTER New Years Eve tradition of playing bingo. People who were "in the know" brought in a variety of quirky items to serve as prizes. Since I was new to this, I scrounged up some chocolate to donate to the prize kitty. I won the fourth game! My prize package included a kit to build a sled out of chocolate, some mini unicorn lights, and a ping pong ball-shooting penguin. I stayed up until midnight GMT, but barely woke up to acknowledge the local new year.

I went to bed early because I had volunteered for the 4-8 am shift with the XBT project. The water became much rougher around 3 am, so I got a little nervous about getting out of bed and

trying to do work. It ended up being okay-ish. Three of us had volunteered for the shift, in addition to our leader from the ship's technical staff. One of our volunteers was feeling pretty sick from the beginning and went back to sleep. The two of us remaining went through various states of mild to moderate queasiness, but we were able to make It through.

The XBT project is a long-standing project that conducts temperature profiles using the LMG (our ship, the Laurence M. Gould) as a ship of opportunity during crossings of the Drake Passage. Surface water samples are collected for measurements of carbon dioxide, carbon-13 isotopes and nutrient chemistry. Our job was to periodically deploy probes over the side of the ship using a special gun-shaped device. The picture above shows Ph.D. student Patricia Thibodeaux shooting the probe into the water. Once the probe is deployed over the side of the ship, it sends information back to the computer using a thin copper wire. It was interesting to watch the temperature profiles plot as the probe reported back and to see the small variations as we moved across the passage.

After 4 hours, my shift was over, and I decided to try some breakfast. Yeah…not so much. I ate a bit of pineapple and stared at a croissant for a while. Food started to seem like not such a great idea, so I went back to sleep. I woke up just in time for lunch feeling much better. Now that it's calmed down a bit, it looks like my next goal for today will be to assembly and configure my microscope. Once we start sampling, a big part of my day will be sorting copepods under the microscope and photographing them so I can make detailed measurements and observations.

A first glimpse

By Ann Tarrant | January 3, 2019

January 2 2019

Today we finished crossing the Drake Passage, I got my first glimpse of the Antarctic Peninsula. As we approached Smith Island, I learned firsthand how hard it is for an unskilled photographer to capture the majestic scale of the Antarctic landscape. Up on the bridge, the excitement was palpable as we looked out at the rugged island with its knife-like rocky ridges. Between us and the ship, humpback whales were fluking and blowing, and petrels were skimming the waves and riding the updrafts. Unfortunately, the best I could do was to take a distant picture of a snow-covered blob that's mostly obscured by the clouds.

Tomorrow we'll pull into Palmer Station. I'm really looking forward to seeing the field station, but I'll also have a lot of work to do. I did manage to set up my microscope yesterday (and YES, packed in with it was the crucial missing part that couples it to the camera…a huge source of panic a couple weeks ago), but I have a lot more preparation to do once we get into the station. The ship's "Aquarium Room" is currently full of fresh food to re-supply the station. Once we offload those supplies tomorrow, I'll be able to set up in a corner with a rack and some plastic buckets that I will use to incubate copepods (little crustacean animals, an important part of the 'zooplankton') during experiments on the ship. I'll be setting up some other equipment to filter seawater and measure algae in the water that will provide food for the copepods. I'm looking forward to getting this all set up, but these kinds of things always make me feel a little anxious. I'm not very experienced with seagoing research, so I'm still learning the best ways to set things up. I worked hard over the past several months to plan this work, but there will almost certainly be things I haven't thought of and adjustments that I'll need to make. It's a great opportunity to kick off 2019 a little bit out of my comfort zone.

Palmer Station

By Ann Tarrant | January 4, 2019

January 3 2019 (Note: this is the fourth in a series of posts describing my NSF-sponsored fieldwork in Antarctica about the Laurence M. Gould. For a brief description of the project, please visit https://web.whoi.edu/tarrant-lab/how-copepods-thrive-on-southern-cuisine/)

Today we pulled into Palmer Station, where we will spend the next two days. I was excited to explore, but first we had some work to do. I spent some time securing an instrument (fluorometer) that I will use to measure the algae in the water. I'll be using that algae as food for copepods, small animals that I'll be studying on board the ship. After that, I worked with the zooplankton group to tie a plankton net onto its frame. And then to round out the "scientific arts and crafts" we spent some time putting together a shelving unit that I had bought from a hardware store. I'll use the shelving unit to hold buckets of copepods during my experiment. I'm planning to share pictures of all these things in action during some of my future posts.

During the afternoon, I had some time off to explore a bit and enjoy two classic Palmer Station traditions. The first was a hike up the glacier from the Palmer "backyard." With the rest of the zooplankton group (affectionately called the "Krillers"), we headed off into the snow in our ECW gear (government issued "extreme cold weather" clothing). We had heard the snow was a bit soft, but opted to go without snowshoes. There were definitely some places where we sunk into to the snow ("postholed"), but it was manageable. We climbed up the glacier for about an hour at a leisurely pace and watched as the station got smaller and smaller behind us. As we climbed, we could see more of the surrounding countryside and saw some of the glaciers calving. After taking a few photos at the top (like the one posted above), we climbed back down to eat dinner and get mentally prepared for a second Palmer Station tradition…the Polar Plunge! We are lucky to have a hot tub on station, so several of a few got into the hot tub and hung out for a while. After we had socialized a bit and built up some body heat, we got out, quickly hustled along the walkway and down the rocks. One by one, we scooted to the rocks at the very edge,

and pushed off into the water…kind of like a seal. The icy water is….well, it really wakes you up! Some people really noticed a feeling of all the air being pushed out of the lungs. I think I was too excited. I felt completely surrounded by cold, it wasn't as bad as I had built up in my mind. Of course, I got out as quickly as humanly possibly (possibly while squealing a bit) and scooted right back into that hot tub. Checked one thing off my bucket list…lots of work to do tomorrow, but it was fun to have a break!

Getting ready to roll out

By Ann Tarrant | January 4, 2019

January 4 2019

Note: this is the fifth in a series of posts describing my NSF-sponsored fieldwork in Antarctica about the Laurence M. Gould. Click here for a brief description of the project.

Another note: Before I talk about today's events, check out the picture above…this is where we did the "Polar Plunge" yesterday.

Today started bright and early with Boating Training. This wasn't training on how to drive a boat. It was training on how to *be a passenger* on a small boat (a type of inflatable boat called a

“zodiac”). I was rolling my eyes a bit at the idea. I imagined they would tell us things like “sit where you are told to sit,” “don’t move around too much,” and “bring some kind of floatation device.” Nope. It just shows that this is a completely new environment for me and I really needed the training. The environment is really harsh and hypothermia can set in really quickly, especially if you get wet. I learned that the station has cached emergency supplies (tents, sleeping bags, warm clothes, a stove, food, etc) at many nearby sites. They have also marked many common field sites with safe places to tie up a boat. All passengers must pack a dry bag with a full set of warm clothing, from head-to-toe, and the boat carries an extensive and often redundant set of emergency equipment…two fuel tanks, two GPS units, two radios…you get the idea. It reminded me of a line from the movie G.I. Jane: “Two is one, one is none.” The redundancy is completely necessary when your life may be depending on it. It also gave me a lot of confidence in the quality of this program.

After all that, I didn’t have any time for boating today (maybe there will be a chance on the way back). Instead, I calibrated the fluorometer, helped a bit with preparing our nets, dug out a lot of the equipment that we had secured in the cargo area while crossing the Drake Passage, and secured all my buckets and bottles in the aquarium area. While working on calibrating the fluorometer, I had to make a brief visit to the lab on station to use their spectrophotometer. I was impressed by how well-equipped the lab was, and also how helpful the lab manager, Carrie was. She completely dropped what she was doing to show me the instrument, helped me configure the settings, and found all the supplies I needed for the analysis. I laughed a little as a looked around the lab and saw a water bottle with a sticker from Ben Van Mooy’s lab. Ben was on station earlier this year…WHOI scientists really do go everywhere! Overall, it was a busy and tiring day, but I feel ready to head out tomorrow.

Departing Palmer

By Ann Tarrant | January 5, 2019

January 5 2019 (Note: this is #6 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

As we left Palmer Station around 10 am, it felt surprisingly bittersweet. I was energized and excited to start sampling, but as I watched the bowlines detach from shore one by one, I was sad to be leaving. Palmer Station felt like such an amazing little microcosm, and I wish I'd had more time to soak it up. We'll have a day there on our way back, but I'm guessing that will go by at lightning speed.

That little bit of melancholy soon gave way to much more mundane concerns. Along with about 80% of the scientific party, I was quickly struck by a wave of seasickness. Those hard-earned sea legs were fickle after a couple of days in port! Fortunately, I wasn't directly involved in today's mission, so I could take some medicine and sleep the afternoon away. I woke up right at dinner time, feeling a million times better and starving to boot.

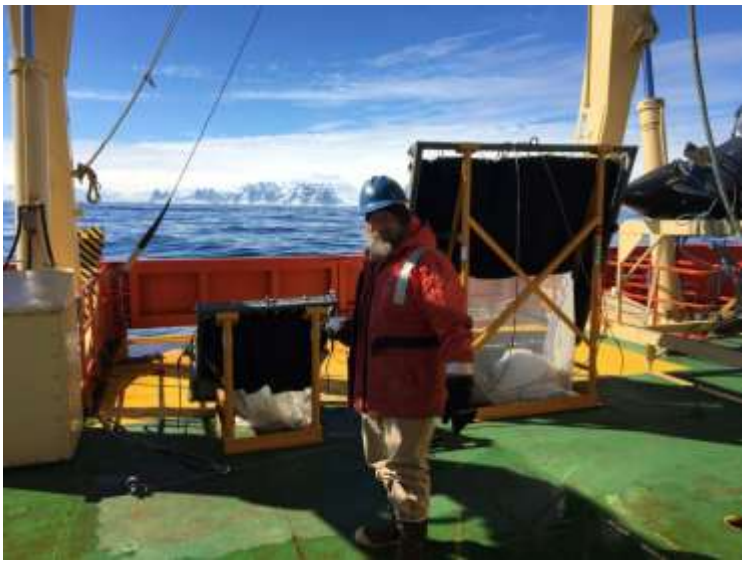
While I was konked out, the marine mammalogists and the ornithologists (the "whalers" and the "birders," respectively) got off the ship for several hours of penguin and seal censuses on Hugo Island. A primary motivation for this cruise and the larger program it fits into (LTER: Long-Term Ecological Research Program) is to observe how the Western Antarctic Pensinsula Ecosystem Changes over time. With warming of this geographic area, one anticipated pattern is a progression of sub-antarctic species southward. Part of today's mission was to check on a

recently discovered and newly established colony of fur seals, which are normally found in warmer waters to the north.

Tomorrow we'll start sampling our first official LTER grid station, including collecting our first zooplankton samples.

And finally…nets away!

By Ann Tarrant | January 6, 2019



January 6 2019 (Note: this is #7 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

It was a beautiful day. The seas were calm and the sun was shining, …AND ten days after leaving the states, we finally got to take our first zooplankton sample! We towed two different nets today – the openings ("mouths") of the nets are tied to the big square metal frames behind Joe (above). The larger net (2 meters or about six feet across) has a coarse mesh, and is used for catching larger zooplankton like krill. The smaller net (about 3 feet across) has a finer mesh and catches more of the small animals, like the copepods that I am "hunting." Today we did a total of three tows, and "the Krillers" sorted, measured and counted all the different groups of zooplankton.

Debbie emptying the contents of the cod end (the “bottom” of the net) into a tub. The larger elongated pink shapes are krill, a type of crustacean (favorite foods of lots of penguins and whales).

I learned as much as I could of the general zooplankton sampling routine, but I spent most of my time picking through one of the samples for copepods. I’m trying to sample three different species on this trip. Most of the copepods I saw were *Calanoides acutus*, and but I also spotted a *Rhincalanus gigas.* Since this is my first trip to Antarctica, I’ve never seen either of these “beasties” before, so I’m happy finally lay eyes on them. Since *Calanoides* seems to be the most locally abundant, I’m going to use my next sampling opportunity to preserve a whole bunch of them to bring back to my lab in Woods Hole for analysis (lipids, enzyme assays, gene expression). I’m also hoping to get enough to start a shipboard experiment with them. More about that tomorrow, I hope!

Welcoming Committee

By Ann Tarrant | January 13, 2019

January 7 2019 (Note: this is #8 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould). Photos in this post courtesy of Patricia Thibodeaux.

On our second day of sampling, I got my first chance to help deploy the 2-m plankton net. The net is big and heavy, mounted to a steel frame, and it can be really unwieldy, especially in heavy seas. It's hoisted into the water by a heavy-duty winch, but two people are needed on deck to guide the net up out of its cradle and into the water. In our case, an "MT" (marine technician, part of the ship's technical crew) and a member of our zooplankton group pair up for this job. Because the back of the deck is open during deployment, we each wear a safety belt with a line that tethers us into the ship. That's in addition to our floatation jacket ("float coat"), hard hat, and steel-toed boots. There's a lot to think about while deploying the nets, and it's helpful that the MT, Josh, is very skilled and could direct the process. While we are on deck, he communicates with the winch operator using a radio and hand signaling. Basically, we prepare the net by attaching the cod end and flow meter (parts that catch the sample and measure how much water we passed through), untie the net from the cradle, and open the back gate. Then we spread the net and bring the depressor forward (the heavy metal part that rides below the net and hold it vertically). As the net lifts, we guide the cable around the cradle, help the depressor move forward, throw the cod end off the deck, and then guide the net evenly into the water. Then we secure everything and wait for the net to come back with our sample.

Things went pretty smoothly, thanks to guidance from Josh, and some coaching from Debbie. But there was also a special bonus this time. Four crabeater seals had come out to watch the tow! If you look closely, you can see them in the image at the top, as black patches in the middle of the water. The seals were probably hoping for a free snack, but as I watched them all lined up with their heads bobbing above water, I felt like they have come out to welcome me to come kind of "zooplanktonologist club."

Copepods!!

By Ann Tarrant | January 13, 2019

January 8 2019 (Note: this is #9 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

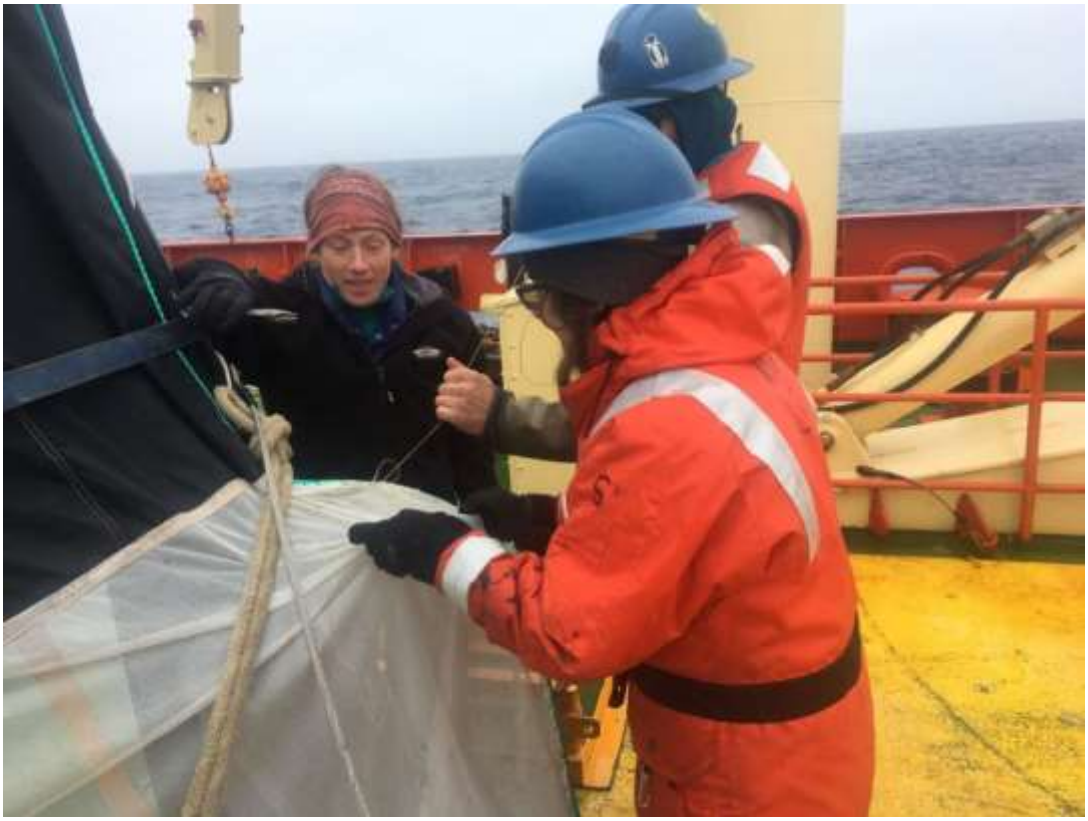
I'm on my 9th post about this copepod project and I'm finally showing my first picture of a copepod! It sounds a little strange, but the logistics of working here are pretty extreme. It took a couple days to get on ship, then several days for crossing, then a couple days on station, then more transit and whale/bird surveys. It takes about 10 days from the time I left the door of my house to the time I could take a first sample.

The picture above shows *Calanoides acutus*, one of the species I'm targeting in this study. This copepod is mostly herbivorous, foraging on algae. Over the long polar winter, there isn't much light for algae to grow, so there isn't much food for this "vegetarian." it survives by moving into deep water and going in "hibernation" (entering a dormant state called diapause). I'm comparing it to other copepods that have a more omnivorous mixed diet and manage to stay active during the winter.

It's taken me a couple of days to get a feel for identifying these different copepods. I need to be able to tell them apart when looking from the top (dorsal view like above) and from the side. It's one thing to be able to do this under the microscope, but to speed up my sampling, I'm also trying to get better at identifying them with my naked eye, when they are still swimming around in the sample bucket. Since they are small (smaller than a grain of rice) and almost transparent, this is tricky. Slowly I'm learning to pick out subtle differences in shape and color.

"Foul weather embroidery," is that really a thing?

By Ann Tarrant | January 13, 2019



January 9, 2019 (Note: this is #10 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

One thing I like about being in the field is that problems happen and you have to deal with them. I guess that's true of life in general, but in the field, often your work can't move forward until you solve the problem. Sometimes there is urgency about finding a solution. Fieldwork is expensive and the opportunities are precious and often time-limited. On the other hand, sometimes I have a sense of time expanding. Nothing can move forward until you solve the problem, one way or another, however long it takes, using whatever resources you have on hand. Today's problem wasn't particularly unexpected, and the solution was relatively straightforward. The net came back with a large gash next to one of the seams. The ship technicians and the zooplankton group were both prepared for this kind of thing and had heavy duty needles and line on hand for mending. Sewing skills are intricately linked with seafaring, constantly needed for making and repairing sails and nets. Still it's funny to think of deploying a "softer" skill under harsh conditions, and we laughed as Debbie pulled on her foul-weather gear and hard hat to try some "embroidery." [In fact, I did check out the repair, and it's a straight, neat, well-reinforced line. I didn't actually see any fleur-de-lis or other embellishments.] The repair was finished surprisingly quickly, and we were back in business. Overall, work is continuing to progress well. We used a modified method to collect plankton more gently (non-filtering cod end), so we could get live plankton in good condition for experiments. Now we have copepods and pteropods both incubating in different sets of experiments on the ship.

In the ice

By Ann Tarrant | January 13, 2019

January 10 2019 (Note: this is #11 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

Yesterday was another set of firsts for me, filled with moments where I was struck with, "Wow, I'm really in Antarctica." We've moved steadily southward, zig-zagging toward and away from the coast as we complete our surveys. As we moved inshore along yesterday's line, we first hit brash ice, a kind of watery, slushy mix and then pancake ice, flattish chunks of ice coating the surface with larger ice floes sprinkled into this mix. THIS is really Antarctica, right?! It was the first time I've ever seen waves moving across a field of ice. Everyone with a spare moment took a break to head on deck as we passed dozens of crabeater seals lounging on the ice floes. To a careful eye, the colors in the ice tell a story. I learned that a red streak across the ice isn't necessarily evidence of a murderous rampage, but more likely a sign that a seal has taken a bathroom break (the "crabeater" seals actually eat a lot of bright red krill). Back home "yellow ice" would most likely indicate a popular spot for dog walking. Around here, the yellow and brown layers in the ice indicate the growth of ice algae, mostly diatoms, embedded in the ice. This creates a really interesting ecosystem, because the ice is fresher than ocean water, and as it melts, the salts come out first, creating very salty pockets called brine channels. The algae are adapted to grow in a wide range of salinities and they can benefit from receiving high levels of light near the surface of the water. All this ice algae is a welcome food resource for the zooplankton (including my favorites, the copepods).

It was exciting and challenging to work in this environment. We had to be very careful in deploying and recovering instrument, as it could be dangerous if anything snagged on a chunk of ice. Operations required extra hands on deck and careful coordination with the people driving the ship and operating the winch. Everything went smoothly today. The samples were worth it! We got a big yield with all different kinds of critters….the biggest amphipod I've seen so far and a carnivorous comb jelly (*Beroe)* were among the stand-outs. The copepods didn't disappoint either…I got a mix of *Calanoides acutus* and *Calanus propinquus* (my two "top targets") and both species were really brightly pigmented, with parts of their bodies bright red or orange from the carotenoids they obtained from their diet. Check out the bright red antennae, the spots along the urosome (the "tail") and the colorful gut running along the main part of the body.

The "Aquarium Room"

By Ann Tarrant | January 13, 2019

January 11 2019 (Note: this is #12 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

I've been conducting experiments in which I incubate copepods under different food conditions. I'm hoping to use these experiments to get insight into how fast copepods respond to a lack of food. I don't know about you, but I get grouchy after 4-5 hours. I haven' t seen any evidence of grouchy copepods, but I'm hoping that the expression of their genes will provide insight into their metabolic responses. Which genes do they use to burn through their fat stores, and how long does this take? If I can figure that out, I'll have a key to understanding the conditions these animals have experienced in their recent past.

We do all these experiments in a big room (think single-car garage) open to the deck of the ship. It's set up as a "wet lab," meaning that we have access to continuous flowing seawater, and we can dump water all over the floor without worry (water pours through grates on the floor and is channeled to drain off the ship). My initial problem in using the room for experiments is that it was too warm! The room temperature was running over 40 degrees Fahrenheit, but the seawater was right around freezing (32 Fahrenheit, or 0 Celsius). It might not sound like a big different, but Antarctic animals have famously narrow thermal tolerances (they don't do well when it gets too hot). We were able to get around this problem with some creative plumbing to continuously circulate cold flowing seawater around my experiment. Right now my animals are in the white buckets on the top shelf of the unit. I'm planning to fill up a lot more buckets in the coming weeks!

You're camping WHERE?

By Ann Tarrant | January 13, 2019

Today we approached Avian Island where our birders planned to set up a field camp and spend the next five days surveying the resident penguin population. I think most of the other scientists on board are envious of this remarkable opportunity. When I was describing it to my mother over email, she thought it sounded like a terrible time…so I guess extreme scientific camping isn't for everyone. As we approached, the mountains rose spectacularly from the water, but that's not what really caught the eye of our crew. There was more interest in the belt of brash ice and larger flows surrounding the island. It would be tricky to safely approach the camp site with a small boat. The technical crew (ASC, Antarctic Support Contractors…I think) took the birders out for a cautious foray. It took a long time to approach the site, and the ice was thick in places. It would be too risky to make multiple trips ferrying people and gear to the island. A strategic decision was made to wait a bit. The ice can be very dynamic…a small shift in the winds and currents can make a big difference. The area might open up overnight…or might not. So we wait.

Waiting isn't so bad. I have my experiments to tend and a blog to write. One of the scientists has a birthday today, so there will be cake in a few minutes. And we are surrounded by penguins. Yes, things could be worse.

Jackpot!

By Ann Tarrant | January 15, 2019

January 14, 2019 (Note: this is #14 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould). Today's "featured image" isn't particularly

related to this post, but I thought everyone might like to see a seal

Are you on twitter?? (I'm not…maybe a goal for 2020). If you are, you might want to check out **@PalmerLTER**

I woke up this morning to find that the birders had safely made it to Avian Island. Apparently the ice had cleared during the night, and the approach was relatively straightforward. Around dinnertime we were sampling a southern onshore station (200.040), our 44th zooplankton tow of the cruise. It was completely PACKED with the copepod *Calanoides acutus.* That meant it was a great time to do a special gentle tow to collect live animals (tow #45, special just for me!). It was similarly teeming with copepods, and even better, they were actively swimming and well-pigmented. I furiously picked copepods for the next three hours or so, first filling up vials for RNA studies. Then setting aside pools of live animals for shipboard experiments, and finally freezing animals for studies of enzyme activity, lipid content and maybe even epigenetic marks

(Neel Aluru…that one's for you!). All totaled, I picked out 307 copepods yesterday. Definitely more than any other station, and possibly more than all the previous stations put together.

Sampling this station has allowed me to scale up my shipboard experiments from 1-L bottles to 2-gallon buckets. That meant I needed to engineer ("McGyver") a bigger system for keeping those animals cool. Some of the bins I had intended to use didn't make it with my shipment, so I improvised. I had shipped a lot of my equipment in a large, sturdy bin (Action Packer). I called the "Action Packer" into action! We placed it in front of my sample rack, and piped the outflow from the top shelf into the tub. We then used a hole saw to drill a hole halfway up the side for the outflow. It works great, but that hole is going to be kind of odd when I ship my equipment home. I guess duct tape covers everything!

It was a great day all around! I feel like I'm really doing what I came here to do. I'm glad I didn't reach this station earlier in the trip…it would have been somewhat wasted. Yesterday I was fully ready to take advantage of the bounty.

Creatures from the deep

By Ann Tarrant | January 18, 2019

January 16 2019 (Note: this is #15 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

Yesterday was relatively uneventful for me. We had some technical difficulties, so there wasn't much sampling and sorting going on. Instead, I had time for my shipboard "hobbies": tending to my experiment, catching up on data entry, reading graduate school applications for my department back home, and a brief trip to the gym.

Today was more exciting. Everything was working perfectly, so we were able to do vertically stratified sampling using a MOCNESS. Basically it's a fancy set of nets that lets us sample different depths in the water column, like a stack of layers on a cake. We sorted through nets that sampled as deep as 1000 m (over half a mile down!). This was my first time sorting through deep samples, and it was really fun to explore the differences between each sample. I've pasted in a couple of my favorites…we got 4 small squid from the 200-300 m sample One of them even released some yellowish ink. The squid in the picture at the top was about the size of a dime. I also liked this little larval fish (Probably from family Paraleptidae). It was probably about a centimeter long (similar to the diameter of a dime), but very narrow and clear. The mouthparts look pretty fierce to me. Tomorrow we'll go back to sampling our regular stations, which should mean more copepods for me!

The grind

By Ann Tarrant | January 18, 2019

January 17 2019 (Note: this is #16 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

Can you see the little copepod near my fingertips on the spoon? That's *Calanus propinquus*. I guess I shouldn't play favorites with my "subjects," but, between us, It's kind of my favorite. If you get a nice well-fed specimen, the red antennae really stand out. They are also really graceful in the water, kind of like aerial artists, sometimes they'll do flips end-over-end.

Pretty copepods aside, I'll admit that yesterday was kind of a grind. I had the opportunity to sample two stations, and they were both teeming with copepods. I sampled and sampled and

sampled. I had just finished one station when it was time to start the next one. Then when I finished all that, I still had to do water changes for my experiment. It was a long day with a lot of time on the microscope and a bunch more time squinting at nearly transparent small animals in a bucket. When it was all over, I was happy to stretch out my back and spend some time focusing my eyes on more distant things. I'm glad I made a big push today because it will be my last chance to sample for a few days. Tomorrow we'll be doing more MOCNESS tows (cool, but not really part of my project) and the next day we'll be visiting Rothera, a British Antarctic station, for a scientific exchange.

Like two ships passing in the…nearly perpetual polar day

By Ann Tarrant | January 20, 2019

January 18 2019 (Note: this is #17 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

Today we met up with the other US Antarctic icebreaker, the Nathaniel B. Palmer ("NBP"), visible off in the foggy distance. The scientists on board have been working to characterize aspects of Antarctic physical oceanography (basically the way water moves around, mixes, and changes over time). Unfortunately, two of their autonomous vehicles (gliders) didn't make it to Chile in time to be loaded onto the ship. Because our cruise started later, we were able to pick up the gliders and deliver them. A small party from the NBP drove over on zodiacs and came

aboard. Among them was Caltech's Andy Thompson, who I believe is leading this glider research. After a brief visit, the crew of the Laurence M. Gould (the "LMG," of course) helped load up the gliders, and the NBP party headed back to their ship. The NBP is on its way back to Punta Arenas for the end of the cruise, but luckily the scientists still had time to deploy the gliders. These autonomous vehicles will continue collecting and transmitting data for an extended period of time ("couple of months" based on my rough understanding). It's great that we were able to coordinate our activities and help out another group. It's also fun to think of robots swimming through the icy oceans, collecting data, while we are warm and snug in our homes, eating cookies and binge-watching our favorite tv shows (or maybe that's just me).

Rothera

By Ann Tarrant | January 20, 2019

January 19 2019 (Note: this is #18 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

View as we Approached Rothera. The British Antarctic Survey ship, the RRS Ernest Shackleton, is docked in front of the station.

Today we had the opportunity to visit Rothera Research Station, the largest British Antarctic facility. The visit is a tradition on the Palmer LTER cruise that provides an opportunity for the British and American scientists to exchange samples, and cross-calibrate equipment. It also provides a much needed break and morale boost for both groups. This year's visit posed extra logistical challenges due to dock rebuilding and other extensive construction at Rothera. Because our ship couldn't pull up to the dock, we needed to don drysuits and lifejackets, ride over in RIBs (rigid-hulled inflatable boats, like zodiaks on steroids), and wade the final feet into shore. Our drysuits did a great job of keeping us safe and dry, but they were very cumbersome and not too aesthetically pleasing.

Inside Rothera's hangar. My Dad would have loved seeing this, the tour reminded me of him.

Once we got to Rothera, we had several hours to tour their facilities, take some guided hikes, and visit the station shop. As the largest station, Rothera serves as a hub and starting point for expeditions to more remote field camps. Some scientists arrive at Rothera via ship, but others are transported via an airplane that flies from the Falkland Islands. We visited the hanger and saw the large Dash 7 plane, as well as smaller planes that are used for aerial surveys and measurements, as well as transport to field camps. Some of the instruments are used to measure changes in the ice thickness and density.

It was a windy, blustery day, and I hadn't packed enough warm clothing to make hiking enjoyable. After the initial tour, I decided to skip a hiking opportunity. Instead I curled up for an hour in the library, looking out through the telescope, writing postcards, and studying annual photos of the people who had overwintered each year (and until recently, sled dogs!). It felt a lot like hanging out in a ski lodge, and it was really unusual not to have a big list of things to do. Because I was a little worried about the drysuit/RIB/wading situation, I hadn't even brought my computer. I had a really nice day off…well, most of a day…after we got back on the ship, I had

to spend a few hours sampling copepods from my experiment and changing water. Honestly, I grumbled a little, but that's the way it is sometimes.

The "other" grind

By Ann Tarrant | January 26, 2019

January 20 2019 (Note: this is #19 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould).

Three days ago I posted about the "grind" of processing samples day after day. Today we moved back into the ice, and experiences the "grinding" of the ship as it moved through the sea ice. As we moved into thick ice, the science party clustered up on the bow to get a look. It was captivating to peer over the edge as brash ice swirled by, as we passed floes with layers of ice algae near the water surface, and as we broke through more solid chunks. One of my colleagues remarked that it was like picturing Pangea breaking apart [the ancient land mass that eventually split to form our modern continents]. It was truly captivating. The ice was so thick and viscous on the surface that it looked like peaks of whipped cream on top of a cake. Later, when I was sitting in the galley, I could actually feel a sliding and bumping sensation as we moved over and through the ice.

Working under such icy conditions is very challenging and requires judgement calls based on experience. The ship quickly drove a path through the ice to make a clear area. Then we carefully deploy and recover instruments. It's a calculated risk because the ice eventually moves back into the cleared path and can snag on lines or nets. In this case, we took a conservative approach and just did a shallow tow with our smaller net. It was still a little tense in the wet lab as the net was being deployed and recovered.

I'll confess that there was some extra "drama" going on in the background. Because I was not directly involved in this net tow, I was streaming the score during the last five minutes of a certain championship game for a major US professional sport (I'm pretty sure the National Science Foundation and the US Antarctic program don't endorse any professional sports teams, so I'll just let you guess). In the end, the net tow was safely recovered, I helped process the samples, and "my" team won in overtime. A very solid day, indeed.

The “yellow brick road”

By Ann Tarrant | January 26, 2019

January 22, 2019 (Note: this is #21 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

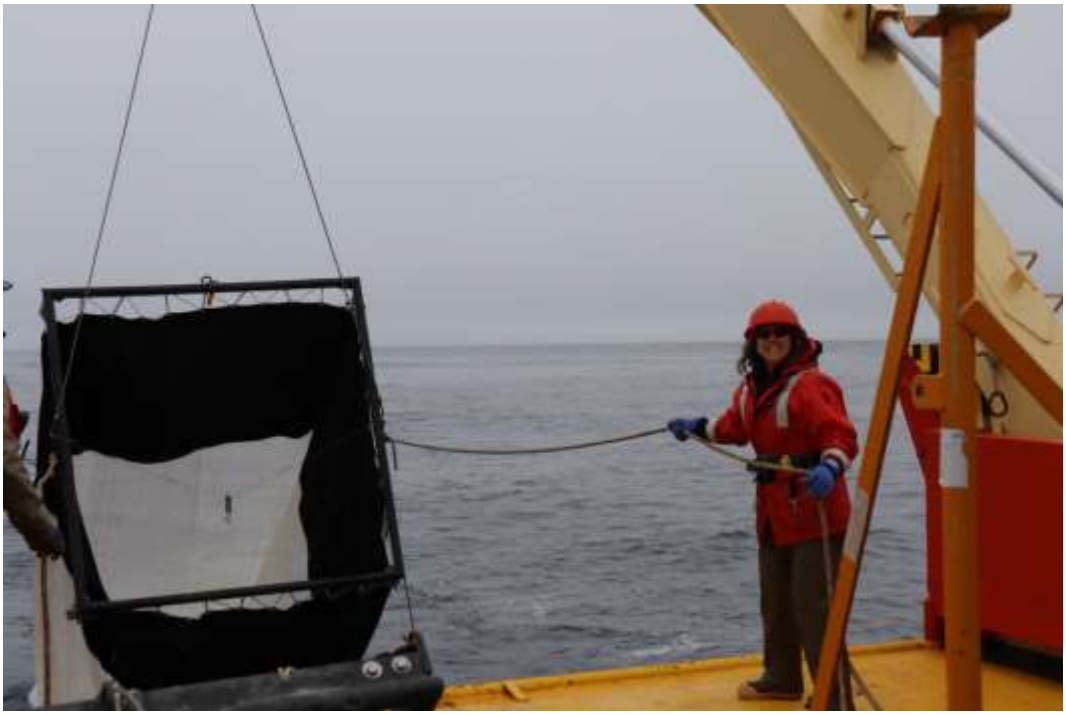
At lunch today, my colleague Kim Thamatrakoln asked me if I have been able to collect all the samples I hoped to get. I’m not sure if I audibly sighed, but I certainly sighed a little on the inside. I told her that I was getting a lot of good samples, but I really hoped to get a station with a lot of *Calanus propinquus.* I’d been able to collect some, but I really wanted enough to do a substantial experiment. I was still hopeful but a little bit discouraged.

I guess that sometimes pouting works… At the very next station, along the shelf edge, we collected a whole bunch of my coveted *Calanus propinquus*! I preserved plenty of specimens and also had enough to start a feeding experiment. Life is good!

After we finished the station, we moved back into the ice. It was too icy to deploy the CTD, so we turned back to continue on our path. As we doubled back, we could see our old tracks as a yellow line through the ice, just like the “Yellow Brick Road” from the “Wizard of Oz”. The yellowish color is from the diatoms that were released from within and between the chunks of ice. Earlier in the day, Kim collected some chunks of the ice so she can study viral interactions within the ice algae. It’s not every day someone makes good productive use of “yellow snow.”

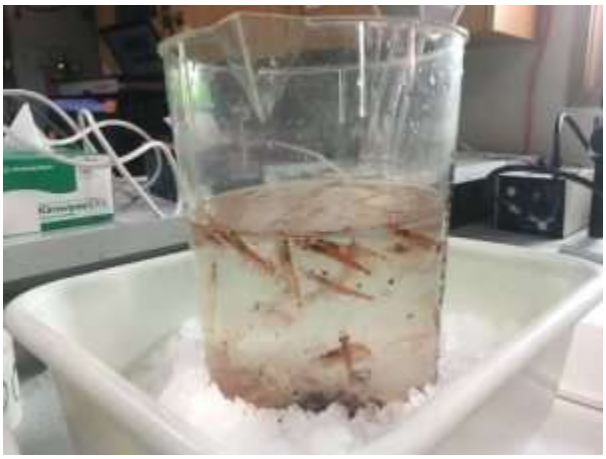
Krill on alert

By Ann Tarrant | January 26, 2019



January 23, 2019 (Note: this is #22 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould). The photo above of Debbie Steinberg deploying a plankton net was taken by Patricia Thibodeau.

We're working away like busy little bees here on the ship, trusting that our day-to-day efforts will ultimately be synthesized to provide insight into the bigger picture of the workings of the Antarctic ecosystem. Sometimes insight comes in flashes (a "eureka" moment) and sometimes it's an image that slowly forms layer by layer. As an example of the latter, a major new study was released this week in Nature Climate Change showing that Antarctic krill distributions have shrunk nearly 300 miles southward in association with warming of the oceans (links to the publication and VIMS press release). This matters because krill are a big part of the biomass (living material) in this polar ecosystem. They are an important source of food for penguins and whales and seals (and sometimes people). Changes in krill populations affect how energy moves through the food web and eventually how carbon dioxide that's captured via photosynthesis can sink out and be buried in the deep sea. The study used data from zooplankton net tows conducted between 1926 and 2016, including net tows conducted within the Palmer LTER project.



Krill awaiting sorting and measuring in the ship's wet lab.

Our Chief Scientist, Debbie Steinberg is a co-author on the manuscript. Over the past few weeks, I've been watching her tirelessly leading the zooplankton sampling effort while also managing the overall cruise plan to adjust to local ice conditions and accommodate the needs of the diverse scientific teams. I've been particularly impressed by her attention to detail. With each net tow, the plankton are sorted into species. Krill and salps are individually measured and observed for reproductive condition. Other groups are counted, and their bulk volume carefully recorded. The sorted samples are preserved for later studies back in the lab. If it were up to me – and thank goodness it's not – I think the operation would probably have been a lot sloppier. What's the difference if a few krill stick to the sides of the bucket and don't get counted? Who cares if an Antarctic krill (*Euphausia superba*) accidentally gets mixed in with a *Thysanoessa macrura*? It matters if you are trying to detect changes over time and space. The recent paper shows that the northern populations of Antarctic krill have been declining. But that's just only the short version of the story. The sorts of precise careful measurements Debbie's group has been making over the years provides fine-scale, high-quality data that can be used to more finely predict how the ecosystems responds to year-to-year changes and smaller scale environmental gradients. It's a reminder that the details matter.

Sea butterflies

By Ann Tarrant | January 28, 2019

January 25, 2019 (Note: this is #23 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould). The featured image by Patricia Thibodeau shows a bunch of pteropods…look to see the beautifully extended wings on a few in the lower corner.

While I've been developing increasing copepod-centric tunnel vision, we are zipping up and down the coast, inshore and offshore, through ice and ocean swell. Seals curiously watch our bright orange

ship steam by, and we pop out of the labs and away from the back deck every once in a while to take in the splendor. While Antarctica is passing by all around me, I'm also surrounded by a "sea" of different research projects. My shipboard lab-mate Patricia ("Tricia") Thibodeau is Ph.D. student in Debbie Steinberg's lab at VIMS. She plays an important role in collecting and processing the zooplankton tows, but she's also fitting in her own experiments to study the metabolism of the pteropod *Limacina helicina antarctica.* Pteropods, sometimes called "sea butterflies, are marine animals related to snails. But unlike the humble snails, they spend their whole life swimming around in the water column . They are beautiful to watch as their "wings" undulate and "flap" through the water. Many pteropods form delicate shells out of aragonite, a form of calcium carbonate that is particularly sensitive to ocean acidification. [My lab has also done some work on pteropod physiology…see papers by Thabet et al. and Maas et al. here].

Tricia preparing to measure pteropod respiration in the lab.

Antarctic pteropods could be particularly vulnerable to environmental changes. Along with ocean acidification, they are facing the same warming temperatures that have already been shown to cause significant southward range contraction of the Antarctic krill. Effects of climate change can be complex, and manipulative experiments are a valuable approach to understanding how different types of animals might respond. For example, changes in temperature are related to changes in ice cover, which can in turn affect the light and nutrients available to algae: food for many animals, including some pteropods. In her "spare time" Tricia is conducting experiments to test how differences in food and temperature affect pteropod metabolism. She is incubating the pteropods under different conditions and measuring their rates of feeding, respiration and excretion. Her Ph.D. research has already provided insights into pteropod ecology. Analyzing over 20 years of data, she has found that changes in *Limacina* abundance are strongly associated with multi-year ocean circulation patterns (the ENSO index) but have not (yet?) shown overall changes in abundance, such as might be predicted with acidification and warming. As for what we might see in the future, Tricia's experiments are one of the best ways to get a glimpse.

Safely in the books….er uh, the freezer

By Ann Tarrant | January 28, 2019

January 27, 2019 (Note: this is #24 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

Today was a good day. I collected samples of copepods (*Calanus propinquus*) that I've been incubating in the lab for five days. I'm trying to understand how different species of copepods, feed, store fats, and use stored energy to survive the long Antarctic winter. I've been sampling copepods from different environments…up and down the coast, along the diatom-rich ice edge, and in the food-poor blue ocean waters. I'll look at differences in their physiological condition from those different sites, but help me interpret the patterns I see, nothing beats a good old-fashioned lab experiment. I've been keeping the groups of copepods in buckets of chilled seawater, either with natural food sources, or filtered to remove all the food. I set up the experiment, I've been maintaining it, and I've been holding my breath and hoping for the best.

Check out this poor hungry critter! Compared to the well-fed copepod at the top of the post, this one doesn't have a stripe of dark green algal matter inside it's gut (in a stripe along the body). Don't worry too much though…they store lots of fats inside their bodies and can last a long time without food!

Today after five days, I sampled about half the animals. I was excited to see that they were all still alive and actively swimming. Almost all the animals in the "fed" group had bellies full of dark green algae. The "unfed" animals were still swimming around, they still retained orange algal pigments, but their guts were completely empty. I photographed each animal, and preserved them for measurements of gene expression, enzyme activity and lipid stores. I'm still running the experiment for a few more days, and those samples will need to travel a long way back to Woods Hole, but for now they are safe in the freezer. Whew!

Birding

By Ann Tarrant | February 3, 2019

January 29, 2019 (Note: this is #25 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

I've been a bad blogger. I mentioned a while ago that we dropped the birders off on Avian Island for a few days of intensive bird studies. I forgot to write that we did eventually recover them safe and sound (and smelling strongly of penguin…it's pretty unmistakable). They brought back several bags of penguin diet samples (the penguins are "encouraged" to regurgitate, and the scientists learn what exactly they have been eating). The diet samples were stored in the aquarium room, where my experiments were also housed. After the birders returned, we spent several hours transiting in rough seas, so the aquarium room was sealed shut. I later unlatched the door to change the water in my experiment. The seas were still pretty rough, and the smell in

that room was intense! I had to dash outside and take a few deep breaths of fresh air before going back to finish my work. [Interesting 'job hazard'].

They are now spending a couple more days documenting the status of seabird colonies. Yesterday, it was too icy for them to get onto Minnow Island, but today they have been able to survey colonies on several small islands near Prospect Point.

The picture above shows some adult Adelie penguins (black and white feathers) and their chicks (downy brown feathers). The chicks have started to molt, some of them have bare patches or bits of white on their chests already. They'll grow in the typical streamlined black and white feathers that move smoothly through the water. The penguins eat a lot of krill, so much that the rocks below them are stained pink, and the white feathers of some of the penguins is coated with pink excrement. It seems pretty icky to me, but apparently it doesn't bother the penguins.

While the birders have been working hard, it's given the rest of us some time to catch up on data entry and other tasks. We're gradually working our way north, and the cruise is starting to feel like it's winding down.

MOCNESS

By Ann Tarrant | February 4, 2019

February 2, 2019 (Note: this is #26 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

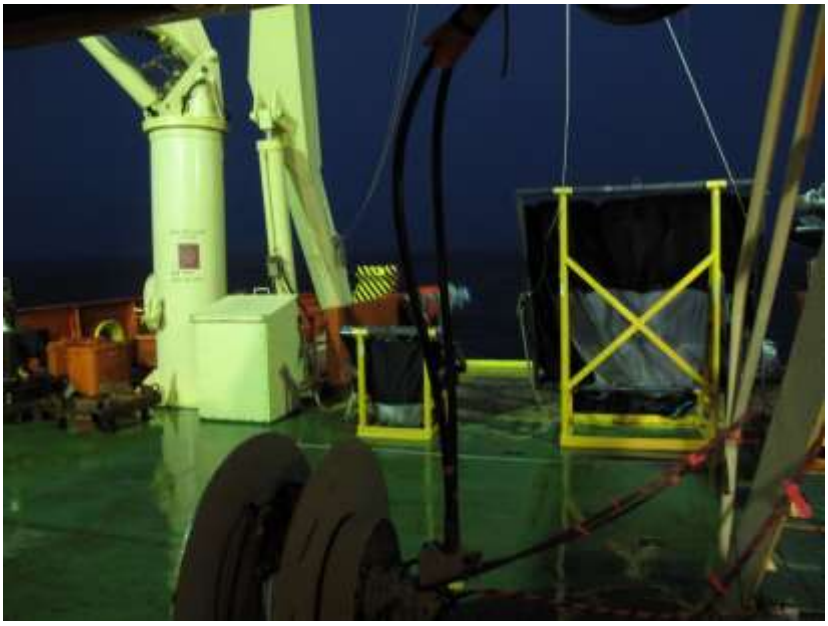
A big old pile of nets in the aquarium room!

Last night and today we did our last night/day pair of depth-stratified net tows (see my earlier post about the MOCNESS). The image above shows a 5-gallon bucket filled with the contents of a deep net sample (750-1000 m). The red and pink shapes are jellyfish (*Atolla* and *Periphylla*), three of them intact and one broken to pieces during the sampling. The orange things toward the upper right that look like a pair of eyes are an unusually large form of ostracod crustaceans (*Gigantocyprhis*). From these tows, it looks like most of the copepods were pretty deep at this station…around 300 m…deeper than I sometimes sample. They can't hide from me!

Since these were our last tows, the lab group took apart the nets after we were done, and piled them up in the aquarium room. We're starting to clean things up, pack away bits of gear and plan out our last days in the field.

Nightfall

By Ann Tarrant | February 4, 2019



February 3, 2019 (Note: this is #27 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

It's the first time I've seen true night since crossing the Drake Passage. These days the sun is down from about midnight until around 4 am. So far, it's been too overcast to see stars, but I've heard there can be good stargazing during our trip back across the Passage. Time on the ship is different from time on land anyway. We are assigned 12-hour shifts (noon-midnight or midnight-noon), but we often start earlier or stay later

if important work is going on. When we are transiting or not involved with specific field operations, such as when the whalers are out tagging, the whole schedule slides a bit. So the shifts are a little weird and slippery, and it's almost always light. On top of that, meal times are not what most of us have back home. We have breakfast from 7:30 to 8:30 am. I almost always sleep through this because lunch is not far behind (11:30 am-12:30 pm). Dinner is 5:30-6:30 pm. This is all kind of normal, but then we also have "mid rats" (midnight rations) from 11:30 pm-12:30 am. Mid rats is kind of interesting…it tends to be the best meal of the day. If I don't have work to do in the lab or on deck, I would often go to sleep before mid rats, but a few times I've stayed up an extra hour or two just to enjoy the mean. I'm absolutely not the only one who does this! We're probably done with late-night net tows and station operations, so a lot of us are starting to move onto more traditional sleep schedules. Over the next couple days, the whalers will be particularly busy, trying to tag animals in the area around Palmer Station. They'll take advantage of every moment of daylight. I still have a little sampling to do. Then I'm hoping to sort through my 1000+ photos, starting to measure the copepods and note whether I can see algal material in their guts. It's tempting to postpone some of this until I get home, but it's very useful to go through my samples, photos and notes now and make sure everything makes sense. There's a cute saying, "Your most important collaborator is your past self, and that collaborator doesn't answer emails or return phone calls." The idea is to document things clearly while you still remember what the heck you were doing. It makes sense, but is sometimes more easily said than done.

Back to Palmer

By Ann Tarrant | February 8, 2019

February 6-8 2019 (Note: this is #28 in a series of posts describing my NSF-sponsored fieldwork in Antarctica aboard the Laurence M. Gould)

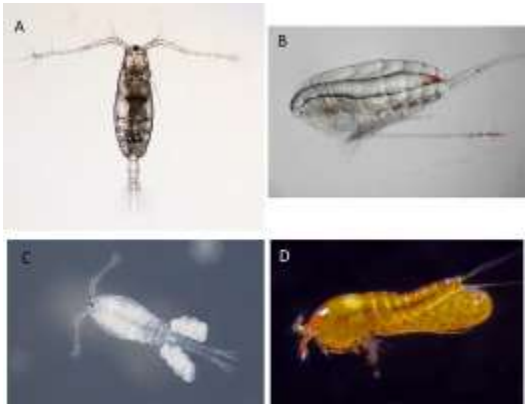
The members of the zooplankton group, hanging out at Palmer Station. We're each "channeling" our favorite zooplankton species. Photo by Srishti Dasarathy.

We're making our long journey home and were able to stop off in Palmer Station for a couple of days. This is a chance to pick up samples, drop off bits of equipment, and exchange passengers. We rinsed off gear, logged our samples and started packing up the lab. I got a chance to do one more polar plunge, to hike back up the glacier, and to finally see a leopard seal (from a safe distance). It was fun to meet up with the Palmer Station residents, particularly the people we had dropped off about a month ago

We had nice calm waters today, but the swell is starting to pick up as we get closer to the Drake Passage. The science is pretty much done now…we're down to organizing cargo logistics and lots of travel. I'll end this cruise blog here and go back to monthly(ish) posts for the log. It will take a little while to get the samples from this trip, and longer to process them. But stay tuned, you'll be hearing more about this project!

Cuckoo for Copepods!

By Ann Tarrant | March 26, 2019



We've just had a new review article published:

Tarrant AM, Nilsson B, and Hansen BW. 2019. Molecular physiology of copepods – from biomarkers to transcriptomes and back again. Comp. Biochem. Physiol. D: Genomics and Proteomics. 30:230-247.

I will post the "author's manuscript" as soon as I'm allowed, and I can share the proof/pdf upon request (email atarrant "at" whoi "dot" edu if you are interested).

It was fun to put together. The idea started when I served as an external examiner for Birgitte Nilsson's Ph.D. defense at Roskilde University in Denmark. Birgitte had done beautiful work characterizing the molecular responses of the copepod *Acartia* to stress and during embryonic diapause. I was struck by the large body of literature that she reviewed in her introductory and closing chapters. She compiled large tables summarizing and comparing the molecular approaches that have been used over the years to study copepod physiology. She had built tables synthesizing information about the wide variety of genes that people have studied as biomarkers, housekeeping genes, de novo transcriptome assemblies, and RNA-seq based studies of differential expression. I thought that it would be a shame for all of this work to stay buried in a dissertation, and I encouraged her to consider writing a review article. Birgitte was moving on to a job as a bioinformatician, so she and her advisor, Benni Hansen, invited me to work on this project with them.

I thought it would be pretty easy, I mean Birgitte had already done all the hard work. It turned out to take longer than I thought it would. Once you dive into the "rabbit hole" to reviewing literature, it can take a long time to wade through the references and try to wrangle them into order. It was great to work on this with Birgitte and Benni, and particularly exciting to see Birgitte's view of the field as a newly-minted Ph.D. I was proud of the manuscript we initially submitted. But the final manuscript was greatly improved by the reviewer comments. The reviews this time were unusually thoughtful and detailed. I feel a little guilty that we made the reviewers work so hard, but I am sincerely appreciative of their efforts. The core of the manuscript was the same, but we re-arranged several sections, wrote some new passages, added references, and further developed some critical sections. We always intended to demonstrate how early "candidate gene" studies have grown into transcriptome wide studies and then come "back again" to show how transcriptomics has allowed us to better identify and understand the roles of individual biomarker genes. Our original draft fell a little short of this goal, but I am hopeful that the published version hits the mark and will be useful to the community.

photos courtesy of Dr. Minh Thi Thui Vu (A), A.M.T. (B), Dr. Hans van Someren Gréve (C), and Dr. Greg Rouse (D).

The Waiting

By Ann Tarrant | August 30, 2019

I'm waiting anxiously to get some RNA-seq data back from the sequencing provider. This data will allow me to construct a transcriptome from the Antarctic copepod *Calanus propinquus,* to see how gene expression changes with environmental conditions, and to learn how these animals vary their physiology in response to food availability. This copepod is particularly interesting to me because unlike many *Calanus* species, it typically stays active all winter, feeding opportunistically on whatever it can find. We already know that this species biochemically different from Arctic species of *Calanus* and Antarctic copepods that rely more heavily on dormancy. It stores different chemical classes of lipids and even has a different ionic composition in its bodily fluids. How has the gene complement changed to accommodate these differences, and how do these genes respond when the environment changes. I think there are some fascinating answers out there….But I want to know NOW!!!

Rhincalanus resources

By Ann Tarrant | March 4, 2021

(Featured image: Rhincalanus gigas, by Miram Gleiber) We recently produced of a high-quality transcriptome for the Antarctic copepod *Rhincalanus gigas* and described changes in gene expression during the transition between the last juvenile stage and adult female stage. The work is available here:

Berger CA, Steinberg DK, Copley NJ, and Tarrant AM. (In press). De novo transcriptome assembly of the Southern Ocean copepod *Rhincalanus gigas* sheds light on developmental changes in gene expression. *Marine Genomics*, p.100835.

https://doi.org/10.1016/j.margen.2021.100835. Open access, pdf of corrected proof available here

This is part of an NSF-funded project to investigate the physiological ecology of lipid-storing Antarctic copepods in an evolutionary context. I collected the samples in 2019 along the West Antarctic Peninsula as part of the Palmer Long-Term Ecological Research Program assessment cruise. The analysis was led by MIT-WHOI Joint Program PhD candidate Cory Berger.

In discussing the changes in gene expression, we focused largely on genes related to lipid storage and metabolism. This is because *Rhincalanus* is part of a group of copepods that store lipids in a specialized organ called the oil sac. This mode of energy storage helps copepods survive periods of low food availability and fuel egg production in adults. Not surprisingly, we found genes related to lipid synthesis to be highly expressed in the lipid-storing juvenile copepods. Some of these genes are similar to lipid storage genes we have previously identified in another lipid-storing copepod, *Calanus finmarchicus,* but we've also identified some differences. For example, different forms of long-chain fatty acid elongases and delta-9 desaturases are up-regulated in both species. We are broadly interested in how these gene families have evolved and diversified within copepod lineages and how those patterns may relate to different patterns of lipid synthesis and storage.

To analyze these broader evolutionary patterns, we will need access to more data. We are working on similar analyses within two other Antarctic species, *Calanus propinquus* and *Calanoides acutus.* We also plan to compare the data we have collected with analyses done by other researchers in a wider range of species. We are particularly interested in trying out CrustyBase, a new crustacean community database developed by Cameron Hyde and Tomer Ventura at the University of the Sunshine Coast. The database provides a convenient online format to compare expression patterns of homologous genes across crustacean species. We've added a couple copepod datasets (transcriptomes and gene expression information) to the database and are hoping to recruit some other copepod researchers to contribute their work.

A Lovely Surprise

By Ann Tarrant | March 12, 2021

I almost never get interesting mail at work. It's 99% bills, credit card statements and junky catalogs. With the Covid-19 pandemic ongoing, I am grateful for the hours I'm able to spend in the lab, but sometimes it seems a little grim. This week, I found a large nondescript envelope waiting for me. I had low expectations as I opened it, and was delighted to find an Antarctic Service Award. It is awarded to civilian participants who deploy to an Antarctic research station or vessel and remain south of 60 degrees South latitude for at least 10 cumulative days.

My excitement at getting this award was completely out of proportion to anything I've done to deserve it. As you can see, it's a "participation award" (yeah…I got some of those during childhood as a kid of dubious athletic talent), but it sure is fancy! It reminds me of the times when it was easier to travel and of my excitement of joining the expedition. It reminds me of all the work I did to develop the proposal, prepare for the trip, and conduct research during the cruise. It made me proud to be part of the U.S. Antarctic Program, which manages the amazingly complex logistical needs of its participants. I was proud to have received an award from the Department of Defense. It made me feel a little closer to my parents, who both served in the US Navy, and I think my father would have been proud to hear of it.

It also reminded me of my responsibility to make the most of the opportunity I was given. We have recently published one paper based directly on this research, (led by PhD student Cory Berger, blog post here), but we have lots more to share.