POLAR SEA 0902 telecon debrief 1000-1130 PST on 01/12/10 (Rev 05/09)

Present: Robin Muench (Chair, AICC), Lee Cooper (Asst. Chair, AICC), Jeremy Mathis, (AICC), Robert Campbell (AICC), Merav Ben-David (Chief Scientist, Univ. Wyoming), Jon Alberts (UNOLS), Renee Crain (OPP. NSF), Dale Chayes (LDEO), CAPT D. Vaughn (CO Polar Sea), CDR J. Hamilton (XO Polar Sea), Ensign Jen Hom (Polar Sea), LTJG C. Verlinden (Science Officer, Polar Sea), LT T.J. Riley (CG HQ Icebreaker Ops.), Dr. Philip McGillivary (Science Liaison), LCDR G.M. Somers (Icebreaker Program Mgr., Pacarea), David Forcucci (Science Liaison, Healy), Hedy Edmonds (NSF).

Please provide comments on the topics and questions that are appropriate for your cruise.

1) How satisfied were you with meeting the overall science objectives of the cruise? (Categorize 1-10, and/or comment)

Category: 6-7 The main mission of PSEA 0902 was to recapture at least 8 individual polar bears (*Ursus maritimus*) that were initially captured in April-May 2009 and instrumented with satellite GPS collars and abdominal or subcutaneous temperature loggers. Three additional projects were invited to participate: 1. Diversity of life in Arctic pack ice (lead - Dr. Katrin Iken, University of Alaska Fairbanks). 2. Optics of seawater affected by loss of sea ice (lead - Dr. Marjorie L. Brooks - Southern Illinois University). 3. Marine mammals/seabird surveys (lead – Dr. Kathy Kuletz – US Fish and Wildlife Service, Anchorage, Alaska). In addition, a photographer, Daniel Cox, and a National Geographic film maker, Greg Marshall, and a middle school teacher (Cristina Galvan – Through NSF PolarTrec) joined the cruise.

Overall, we were able to accomplish between 60 and 70% of the tasks of the cruise. Of the 8 targeted bears only 4 were successfully captured, although 9 instrumented bears were encountered. Additionally, 2 bears instrumented with satellite collars by the USGS (but without temperature loggers) and 3 new bears were captured. This count does not include the 8 accompanying young also sampled with the captured adults (for a total of 17 individuals). Similarly, only 11 stations of 20 planned were sampled for both the "diversity of life in the pack ice" and "optics of seawater" projects, although these objectives were tentative given the main objective (recapturing polar bears) of the cruise. The crew of the "optics of seawater" project was able to fully complete the 3 planned on-deck incubation experiments. No specific objectives were set for the marine mammals/seabird surveys. Surveys were conducted and accomplished on 21 of 34 science days.

2) What percentage of the planned science objectives was met during this cruise? Please specify contributing factors that affected the completion of the science objectives, especially if not all of the objectives were met (i.e. weather, equipment failure, etc.).

The failure to meet all cruise objectives resulted from a combination of several factors:

(1) Bear distribution and movements – at the beginning of the cruise 11 target polar bears were distributed along the ice edge (Fig. 1). Unlike previous years, the distribution of ice led to the dispersion of bears from about 200 nm north of Wrangell Island, Russia (~ 170°W longitude), to

approximately 100 nm west of Bank Island, Canada (~ 132°W), or over 800 nm straight line. This required traversing a large area of the Arctic Ocean (encompassed by 70-78°N and 132-170°W). The satellite GPS collar of one bear failed prematurely (October 19), leaving only 10 individuals available for capture. For these individuals, the daily movement rate ranged from 10 to 20 nm (often in an opposite direction from the drifting pattern of the ice and thus the Polar Sea), requiring frequent relocation of the vessel.

The dispersion of bears and the need to frequently move, often over several days, limited the opportunities for dive operations and CTD casts.

(2) Ice conditions – Reformation of ice during October 2009 was the slowest on record (Fig. 2). Although our previous work indicated that polar bears are attracted to the edge of the ice, conditions this year were much worse than in the past, and the warm temperatures through October (only on 2 days temperatures dropped below 23°F and for less than 6 hours) prevented freezing and ice solidification. Of the 9 adults (and 8 cubs) captured, only 1 was found on solid multiyear ice. Two individuals were initially passed up and later (4 and 10 days, respectively) captured on marginal ice. An additional bear was captured on what appeared solid ice and had to be moved (via slinging) to a safer location (about 0.2 nm way) after one of us broke through the ice. Five of the 6 remaining target bears were observed from the helicopter 1 – 4 times (1 bear once, 3 bears twice, and 1 bears 4 times) but were not captured because they occurred on ice floes too small and disjointed for safe capture operations (Fig. 3). One bear was never encountered.

Poor ice conditions, and the location of bears along the ice edge, limited the opportunities for dive operations.

(3) Weather – Throughout the cruise, flying conditions were less than desirable, largely because the warm temperatures and vast expanses of open water (even at 78°N), resulted in fog and sometime icing on the helicopter blades. In addition, on October 9 and 10 a large storm (with 20-30 knot winds and up to 15ft waves) prevented flying operations. Similarly, between October 20 and 25 we were unable to fly because of high winds (30-40 knots) and low visibility. By the end of October our flight operations were limited to 4 hours because of day length.

These weather conditions also limited diving operations and the early October storm prevented us from performing CTD casts.

(4) Vessel navigation and operations – It is important to note that the lack of cruise plan (because the location of bears changed on a daily bases) made navigation and planning difficult, as decisions were made and changed sometimes hourly. Nonetheless, several problems with vessel operation and navigation contributed to the already challenging mission. First, repeated breakdowns of engines and the rudder control system caused delays in moving the vessel near target bears or dive sites (in fact, sometimes changing to an alternate engine took hours). In addition, most of the crew was inexperienced in navigating through ice (for most this was a maiden voyage on the Polar Sea or any other CG cutter); contributing to time loss in moving the ship (at one point the ice drifting carried the ship twice as fast westward as we were motoring eastward). Moreover, the ship navigation system although connected to the radar system, was not

informed by ice images that were transmitted to the ship from the NIC, causing difficulties in plotting the course of least resistance, further exacerbating the ship maneuvering problems. Finally, because the Polar Sea was tasked with three missions consecutively with no opportunity for refueling, the captain and officers were reluctant to engage the turbines, which consume vast quantities of fuel. Thus, only towards the end of the cruise and only when the ice was impossible to penetrate were these powerful engines engaged, again resulting in unfortunate delays. Because these problems usually occurred in conjunction with bad weather and ice inadequate for capture they could be only implicated in a small portion of failed capture or dive attempts. Two attempts at CTD casts failed because the sewage system was not secured in time.

Added during debrief: Merav Ben-David: Accomplished 60-70% of tasks. Challenges included poor ice conditions (the worst ice recovery on record occurred in October 2009) and weather. Problems with navigation, due in part to a lack of crew experience in ice navigation, were compounded by weather and ice conditions.
CG: Agrees: not a lot of experience in ice. Navigating in ice in the dark is difficult even with experienced crew. Radar doesn't always show the leads accurately. The crew needs more time in operating environment to get better. Weather and ice were a problem.
Merav Ben-David: Agreed that inexperience only really compromised a couple of attempts, with other problems due to difficult conditions. Crew did adapt to changes well. Fuel planning was an issue.
CG: Agreed that insufficient fuel was an issue. In future, may need to plan to go back to Dutch to top off. Also emphasized that ice navigation in the dark is a risk, potentially resulting in becoming stuck. Helo ops that might have helped in some situations were limited by HQ restrictions on flying during twilight periods.
Renee*:* Would helos not fly during twilight?
CG: HQ said sunrise to sunset. Captain would however have preferred some latitude in making these decisions. Unclear exactly whose rules were invoked in this case, and this issue needs attention in regard to future cruises.
Phil McGillivary: What about the issue with CTD casts and sewage dumping?
Ship: The science party noticed some ice discoloration. The logs showed that no sewage was dumped. It was likely algae or brown ice, which is common for summer pack ice. No cast was taken, regardless.
Lee Cooper: Do you have a protocol for when to dump sewage?
Ship: Yes, we secure sewage based on the science plan, for example, try to pump the night before planned science activities.
Captain: I'm not saying that it didn't happen once but we don't have any specific records of it.

Helo Ops.
Merav Ben-David: No complaints about Helo Ops. There were some mechanical issues, but nothing unusual. Pilots, mechanics and coordination were all excellent. Fueling went well. Everything went perfectly.
Ice Maps
CG: Don't have many options here. It is a challenge to get any navigation use out of them. We get them on too short notice.
Merav Ben-David: Ice maps weren't very good at predicting ice conditions. Polar Sea doesn't have real-time input of ice maps. All icebreakers should have real time input.

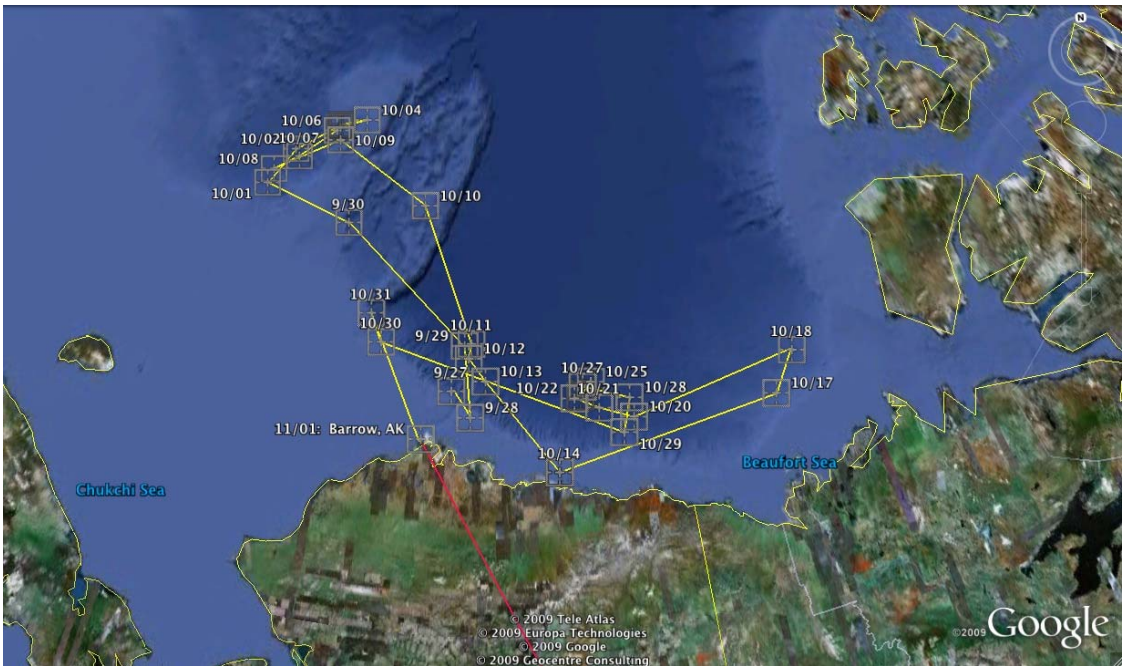

Figure 1 – the track of the Polar Sea during PSEA0902 cruise. Image courtesy of Cristina Galvan.

Figure 2 – An example of ice identified as 75-90% ice cover in remote-sensing ice maps. Image courtesy of Pamela Manns.

Figure 3 – Bear 21038 on poor ice. This and 4 other bears were sighted but not captured for safety reasons. Image courtesy of George Durner.

Lee Cooper: How about lights for navigation in ice.
CG: Not very useful. Only see a couple of hundred yards. At night can't really see leads.
Re: Engines
Merav Ben-David: The Polar Sea needs better engines. There were a lot of breakdowns. Engineers worked hard to solve the problems. Polar Sea needs these upgraded.
Captain: Agreed.

2) Pre-Cruise Planning

a) How beneficial and useful is the cruise planning form and the Icefloe web site?

The cruise planning form was very useful. As a first time Chief Scientist, however, I did not receive sufficient instruction on the timeline and procedures to fill the form. Therefore, I instructed the other project leaders to enter their own information. Every new submission erased all previous ones and in the end caused me more work, because I entered all the information 3 times.

Added during debrief: Merav Ben-David: It was a chore to enter everyone else's data. Chief Scientist had to do everything. Individual PIs can't go in and change it. They should be able to do this. This caused me a lot of extra work.

Dale Chayes: it may be partially intentional so that the chief scientist knows all the details.
LCDR Somers: Can we structure this so that if the Chief Scientist gives out the passcode they can enter information individually?
Dave Forcucci: that is the way it works
Lee Cooper: I don' t give out the key, it's kind of a tax on the chief scientist to insure that they know what is going on. This is part of the task of the chief scientist. This is mainly for the ship.
Merav Ben-David: it was kind of a pain. It didn't work for this project.
Lee Cooper: The Chief Scientist for the previous cruise (PSEA0901) didn't find the form very useful, so didn't put much effort into it.
LCDR Somers: It is of great use to the ship.
Lee Cooper: We really are doing it so that the ship knows what is going to happen, what is going to be loaded, and so on.
Merav Ben-David: Having to enter the minutia of detail for other projects was frustrating for me, mainly because I wasn't familiar with the procedures, depth of CTD casts for instance.
Robin Muench: Different viewpoints reflect different backgrounds and previous experience of the science parties. The bottom line is that this form is tailored to USCG needs and is very useful for them. The same mechanism is used for all cruises on the US Antarctic vessels, by the Germans for Polarstern, and others.
Phil McGillivary: There had been discussion about having the separate PIs fill out their own forms, but it didn't work out. It might be possible for the form to be restructured so that subsections can be changed without redoing the entire form.
Merav Ben-David: Not a big deal, just a bit irritating. I recognize the value.

b) Is it clear what is required to be provided to the ship and the schedule for receipt of that information (schedules, lists, plans, forms)?

It is clear what should be provided to the ship. It is nice that the Chief Scientist can update the form up until the beginning of the cruise.

c) Were the questions on the pre-cruise questionnaire appropriate and easy to respond to?

Yes.

d) Were you able to submit the questionnaire fairly early in the planning process?

I was able to submit the questionnaire in April about 6 months before the cruise because it had to be converted from the Healy to the Polar Sea. It was early enough for me but may be not so for the ship.

e) Did an operations (cruise?) plan get submitted in a timely manner? Was it useful for you and the ship before and during the cruise?

No operations plan was submitted. It was impossible to create one given the nature of the mission.

f) Do you have suggestions for how the website and questionnaire might be improved?

Yes! It makes a lot more sense to have the different PIs upload their plans and needs, rather than have the Chief Scientist collate the different ones and enter a single plan. It took me awhile to do that and I felt it was a waste of my time.

3) Pre-Cruise Communications

How were pre-cruise communications between the Coast Guard and the Science Party, especially the Chief Scientist? Were points of responsibility easily identified? Were responses to questions and concerns received in a timely manner? How were communications within the science party and did that impact communications between the Chief Scientist and the CG?

Communications between the CG and the Science Party were great as were the communications among members of the science party. I'd like to especially commend Mr. Verlinden on maintaining communications with me and with Dr. Brooks who handled the on-load operations in Seattle.

Points of responsibility were well identified except in the case of application for entry to Canadian waters. We found that we had to solicit support from local communities in Canada to obtain the permit to capture polar bears in Canadian waters only days before the cruise and massed a major campaign to obtain these permits. This was issue solved, however, with help from Dr. P. McGillivary from CG, E. Tirpak from the Department of State, R. Crain from NSF, and the Government of the Northwest Territories.

Added during debrief: Merav Ben-David: they were great, open communications on both ends.
Renee Crain: did you visit the ship before your cruise?
Merav Ben-David: No. Marj Brooks did the on-load, sent pictures, talked on the phone. I felt comfortable.

4) Communications and Coordination During the Cruise

How were communications and coordination during the cruise? Were lines of responsibility clear? Were the evening planning meetings effective for communicating information between the Coast Guard and the Science Party?

Communications during the cruise were good. The captain and officers were more than available and responsive to our requests. Most of the planning and reporting occurred during the evening weather briefing, because this is where all interested parties gathered: CO, XO, operations officer, flight manager, lead scientists and few others. Because much of the work depended on weather, this was the time and place to discuss plans for the following day.

Officers evening reports weren't as useful except to learn about equipment breakdowns, rule infractions, and to report discontent about the laundry facility (see below).

The only communication problems occurred with the operations officer, especially when I, the chief scientist, was off the ship during bear captures, and Dr. Iken who replaced me was performing a dive. For more details see specific project reports below.

Added during debrief: Merav Ben-David: Fine for my work, but a few more dives would have been helpful for Iken's project, and there were some issues with ship location during dives. Evening planning discussion with weather briefing was not formal, but all the right people were there and it worked well.
Captain: Comms went well. The plan was quite fluid throughout the cruise, but we were flexible. It was difficult to give Dr. Iken exactly what she wanted because of ice conditions. Perhaps our concerns over the safety of dive sites were not communicated effectively.
Merav Ben-David: we were unable to locate ice conditions suitable for her operations. I officially appointed Katrin as my replacement when I was off the ship, but she was often off the ship during the same periods of time.
Robin Muench: It would seem important that an appointed onboard replacement be able to remain on board ship. Perhaps there were issues with competing needs of the on-board science programs?
Merav Ben-David: All the projects that joined the cruise signed an MOU in which they agreed to operate under our plan, so they have no cause for complaint. Iken knew that she was not guaranteed anything. She did identify some problems and expressed some disappointment. However, she is not complaining formally, rather, trying to provide constructive criticism.

5) Environmental Permitting

a) Was any environmental permitting required?

A permit to capture polar bears in Canadian waters was required and obtained from the Government of the Northwest Territories.

Added during debrief: Merav Ben-David: We found this out at the last minute, because a colleague from Canada who had a permit was unable to participate. There was quite a scramble to get another permit in time with the help of a lot of people. Now we know about this requirement.
Phil McGillivary: Renee helped out. The Canadians require original helo certificates, and this was one of the issues because they are on the helos which were on the ship.

b) If so, were these requirements identified at an early date and were there clear means to accomplishing those needs? In other words, how well did it go?

See above.

6) Communications with Local Alaskan Native Communities

How well did communications between the CG and science and local Alaska Native communities go during the cruise? (Examples: notifications to local communication centers, communications between Chief Scientists and/or CG and entities such as village tribal

governments (e.g. IRAs), village corporations, the Alaska Eskimo Whaling Commission and other appropriate wildlife co-management organizations, village whaling captains' associations, and other locally based interest groups.)

We provided information on the project including the Polar Sea cruise to local communities on multiple occasions:

On August 12, 2008, Dr. Ben-David presented the details of this project to the North Slope Borough Game Department of Wildlife Management. Commission members met at Nuiqsut, Alaska, in conjunction with the 35th anniversary of the establishment of the community. In addition to the presentation, Dr. Ben-David met and discussed the project with several whaling captains in the community.

On March 2, 2009, Mr. Whiteman presented the talk "How do polar bears cope with decreasing sea ice in the Arctic?" to a meeting of the Alaska Eskimo Whaling Commission in Anchorage, Alaska. The presentation provided an overview of this project and described upcoming field work on the USCG icebreaker Polar Sea. Commission members met to discuss whaling plans for 2009 and to receive updates on federally supported research in Alaskan waters.

On April 17, 2009, Mr. Durner and Mr. Whiteman hosted an open house in the community center in Kaktovik, Alaska, focused on polar bear research. About 12 residents attended in the town of 300. Mr. Durner and Mr. Whiteman presented several posters describing goals and methods of polar bear research, with a focus on this project. In subsequent discussion residents described polar bear behavior they have observed locally.

In addition, we maintained constant communications with the NSB Department of Wildlife Management, mainly through their Marine Mammal biologists, Jason Herreman. We contacted Mr. Harry Brower and Mr. Eugene Brower via email on several occasions and met with Mr. Eugene Brower the day before the embarkation in Barrow. His help in facilitating a smooth embarkation was highly appreciated! On October 14th we brought George Neakok from Barrow Alaska onto the Polar Sea. He served as an observer for capture operations in Canadian waters.

Added during debrief: Merav Ben-David: We did probably as much Alaskan Native outreach work as was possible for us, and also spoke with oil company personnel. I would not however say that the Natives were happy with our plans. I had presented the cruise plan to them in August 2008, but they did not keep track of the info. Our cruise was delayed due to late departure of the Polar Sea. There were problems getting in touch with the whalers due to the onset of whaling, though we did manage to contact them on our arrival in Barrow. They may have complained even if the on-load had happened on time. We did the onload on the first day of the hunt, nonetheless, they had a very successful hunt this fall and had got their whales before we started. Eugene Brower was very congenial, if not happy, and helped things to work out. One of the photographers got chased off (from hunting) because he did not ask permission first.
Renee Crain: thanks a lot to Merav and her team for the extensive outreach.
Merav Ben-David: we work with them on many aspects of polar bear research so it was no big deal.

7) Cargo/Hazmat/Materials Handling

a) How did any and all aspects (scheduling, communication, etc.) of the cruise onload and offload go?

Cruise onload occurred without any problems thanks to the excellent cooperation of Mr. Verlinden and the effort by Dr. Brooks and her 2 technicians, Dawn Sechler, and Daniel Whiting.

Offload occurred on December 10th, 2009 and went equally well.

Added during debrief: Merav Ben-David: off-load went well, though there were some issues regarding firearms. These were solved with help from LTJG C. Verlinden.

b) How did materials handling, including hazmat, go during onload/offload and during the cruise?

8) Laboratory and Other Vans

a) Did you use vans from the UNOLS van pool or from another source (specify)?

No.

b) How did the procurement go?

NA

c) Were lines of responsibility clear for obtaining appropriate vans and for setting up and maintaining the vans on board?

NA

d) Was adequate time available to obtain the vans?

NA

e) How well did the vans perform?

NA

f) Were they appropriately equipped with ship connections?

NA

g) How well did load and offload go?

NA

9) Lab and Your Science Equipment Setup/Installation

a) How well did set-up of the labs and science equipment go? For example, were you able to have the lab counters and unistrut adjusted appropriately to fit your needs?

Yes, lab space was excellent for the polar bear project (dry lab and aviation room), and adequate for the other projects. I can not, however, imagine having more project or scientists on-board the Polar Sea because we have definitely occupied every available spot.

The MST have done a spectacular job assisting with lab set up and helping us secure the instruments for rough seas.

Added during debrief: Merav Ben-David: we had the best lab arrangement ever. The other teams, adding up to a total of four projects, were happy as well. More or larger projects might have had space difficulties, however. We had multiple projects (bears, divers, CTD ops, photographer, and observer) and had great space for a total of ~20 folks. I can't however see many more people in this space without conflicts.

b) Did installation of science equipment outside of the ship's equipment go well? Were there any unexpected surprises in terms of needs or ability to support such scientific equipment? How clearly were special requirements for science equipment defined prior to the cruise?

Requirements for science need were clearly described on the questionnaire and there were no negative surprises. In fact we were happy to find enough refrigerator and freezer space; more than we were initially promised. There were no problems with equipment installations.

c) Was anything identified during your cruise that should be recommended as a permanent addition to the ship's science equipment?

A -20°C chest freezer.

10) Information Technology On Board and On Shore

a) Communications (Local and remote E-mail, account set-up, internet access, data transfer on/off and within ship or between ships, Inmarsat and Iridium, radio). Were you satisfied with the capabilities? Were there computing resources or communications enhancements that you could have used but that were not available on board?

b) How was the user account use and set up process?

The internal email user accounts were efficiently set. In fact, Dave Hassilev has set them up in advance and easily configured our computers to work on the local network. It was a bit of a learning curve to learn the specific of the apple based system.

c) How did E-mail work for you both on the Network and on the local machine?

Email was very slow on some personal computers (newer IBMs), but adequate on older laptops and the ship stations. We had hardly any access to the internet outside the ship email system. I was unable to log onto my University webmail account in the entire 36 days on the Polar Sea. A few from the science party were able rarely to log onto internet accounts. It was frustrating at time but probably to be expected given the latitudes and satellite configurations. Ms. Galvan was able with Dave's help to post her blog on a regular basis. In fact, Dave was very diligent trying to facilitate communications for us.

d) How did General Purpose laptops work for you and your institutions computer on network?

See above.

e) How did Communications work on and off ship (INMARSAT and IRIDIUM)?

We had moderate success connecting via Iridium both regular and open port system. For example, while our conference call with PolarTrec on Oct 8 was very successful (only few interruptions). The one on October 21 was a total failure.

INMARSAT and IRIDIUM were really important for us for downloading polar bear locations every day. Although with Dave's help we were successful downloading data most days, we ended up relying on a colleague in the USGS, Dave Douglas, who automated the downloads and had the data sent to our Polar Sea accounts routinely. In fact, we had the data sent to Dave Hassilev who would transmit the information to the bridge where the JOOD would call the coordinates to the helicopters via VHF communications.

The internet station for flight management on the bridge worked well. We were able to download weather and use flight following service most days.

f) Were there computing resources or communications enhancements that you could use but, were not available on board?

Although sea ice maps were misleading (i.e. ice cover DOES NOT correspond with ice thickness as we found!), it would have been beneficial to have NIC data transmitted and processed directly by the ship navigation system. As things were, we (or rather George Durner) got updates from USGS and NIC, processed them on our laptops with GIS, and then hand carried them to the bridge for plotting the edge of the ice; an important feature given our attempts to avoid thick areas.

Added during debrief: Merav Ben-David: Linking to external email or web was very poor, as we were too far north for good satellite coverage. We gave up attempting satellite downloads of data for GPS on bears, and instead had someone onshore email bear positions and ice prediction figures. Internal communications worked well. There were problems with NIC. They had no idea what we needed for the first couple of days. We got some raw microwave data (from Dave Douglas, not from NIC) that was helpful. The Norwegian ice maps were more informative than

the NIC interpretations.
Phil McGillivary: They were given plenty of warning. They have three ice analysts who work in sequential shifts. At times, this interfered with the continuity of communications regarding urgent image requests.
Robin Muench: The NIC cycles people through on short rotations, so it's difficult for them to develop a desirable level of expertise.
Captain: I have been doing this for 20 yrs. The Canadians are better. NIC complains for lack of funding. I have given up on them.
Dale Chayes: On the Healy we bring our own expertise onboard, and this has worked well.
Captain: its been frustrating for a long time

g) How did the shipboard data collection, management, and archiving go? Were these services provided efficiently and made available in ways that promote rapid transfer of data to users?

I can not answer the question yet. I had no chance to review the cruise data handed to me by Dave Hassilev on a CD 10 minutes before disembarkation. I'm sure there could be ways to have automated ship data transmitted to the Chief Scientist computer in real time.

h) How well did operational technology work? (Map Server, board of lies, web cameras on board, monitors for changing among closed-circuit cameras, functionality of the closed-circuit cameras on board, winch display on back deck)

We had not used the board of lies, web cameras on board, monitors for changing among closed-circuit cameras, functionality of the closed-circuit cameras on board, winch display on back deck. The Map server was good to have, although we had to update it manually.

Added during debrief: Ben-David: The map server had to be manually updated, we had to use the ESRI map with the ice edge and manually enter the locations.
Lee Cooper: the "Map server" isn't really a map server in the same sense as that aboard Healy, but this is primarily a terminology issue.

The ship GPS was easily and effectively connected to the USFWS computer for real-time logging of marine mammals and bird observations.

Added during debrief: Merav Ben-David: The depth sounder did not work, for reasons unknown to me. The weather station needs to be moved to a different location on the ship, but we all knew that, and it didn't impact our project.
Ship: The Bathy was down. The Knudsen was working. The navigation sounder only works in shallow water and so was shut down for much of the cruise.

11) Shipboard Science Systems

a) How well did these perform? This includes deionized water, multibeam, winches, environmental chambers, freezers, refrigeration, science seawater , underway data acquisition systems, ADCPs, depth sounders, etc.)

De-ionized water worked well. CTD and underway data acquisition (i.e., water temp., air temp, salinity, etc.) equipment worked well as did refrigerator and freezers.

No depth sounders – or at least they weren't working!

The weather station was placed incorrectly and in many cases wind speed was not accurate – a big problem for helo operations. In fact, on many days we used a cheap hand held device to measure wind speed and direction.

b) Do you think anything needs to be upgraded?

12) Deck Operations and Deployment/Recovery of Science Gear

a) How well did the planning, understanding of responsibilities and approaches, and implementation go for both science and crew?

Most deck operations for both CTD casts and dive operations went very well. The Marine Science Technicians (MSTs) were extremely helpful, accommodating our research needs rapidly and efficiently. For example, when problems arose with our fluorometer the MSTs offered parts from a defunct fluorometer in storage. They skillfully maneuvered and deployed the CTD from the J-frame and were extremely helpful when deploying the radiometer by hand.
The crane operators were very efficient and made deployment of dive team fairly smooth. They deck force assisted with loading and unloading the crane with gear and most did it enthusiastically. Unfortunately the cranes themselves were in poor shape. In one case the crane brakes failed and the retrieval of the dive team was done via ladder with gear hauled up by hand. In another the bow crane was not operational and the dive team was brought back to the ship via helicopter. Definitely need new cranes!

Added during debrief: Merav Ben-David: the crane issues were not new.
Captain: we have new cranes purchased, it's just a matter of getting them put in.

b) Was appropriate and appropriately sized safety equipment available?

Floatation gear was available for helicopter operations and for dive support team. We have not been individually fitted with survival gear so it is unclear that we had enough appropriately sized safety equipment. We did bring our own flight helmets (via CPS and AMD).

Added during debrief: Ben-David: couldn't locate any small sizes.

c) Were operations safe? Did everyone comply with safety requirements? Were any unexpected safety issues identified and were they dealt with?

Yes, operations were safe. Lt. Kellee M. Nolan who served as the liaison between the science divers and the Polar Sea Command, did a marvelous job ensuring the safety of divers. Also, the polar bear patrol seemed well trained (and luckily unemployed). Also Ms. Christine Nesse was

very effective at handling out firearms. She cleaned them more than we do, brought them up to the flight deck and retrieved them at the end of operations. Superb treatment!

The only big safety issue was the less than adequate briefing of evacuation. We were never shown to our respective evacuation boats and during the first drill when we all gathered in the hanger the officer in charge had the wrong list of names. Also, there was no training on how to put on the survival suits (we helped each other). In fact, this was the least rigorous boat safety instruction I've ever seen. This was not rectified despite my request.

Added during debrief: Merav Ben-David: this could be improved. During the drill the CG had the wrong cruise list. They did not show us where life rafts were.
Captain: I was surprised by this. We usually do a better job. We must have missed some people.
XO: by the time we got folks aboard we were into dinnertime so we were not as thorough as usual. Thank you for the comment.
Captain: You will get the opposite treatment the next time.
Lee Cooper: Did you do any night time CTDs?
Merav Ben-David: the program wanted casts w/ daylight
Ship: there was one specifically requested at night which we did.
Captain: There is plenty of light on the CTD deck but not aft for coring as on Coffin's cruise.

d) Was there enough assistance as needed and/or requested with deployments and recoveries?

Yes. Only on one occasion, due to communication problems (literally radio problems), our request for recovery from the ice was not addressed immediately.

e) Were communications effective with the bridge and winch control during deployments?

Definitely yes for dive operations. Initially not so good with helicopters although after a few debriefing they have improved to satisfactory and above levels.

f) Other

13) Ice Conditions

How well was information about the ice conditions in the area of operations provided to the ship and to the scientific party?

Not well enough! See my previous comments.

14) Small Boat Operations

NA – the only small boat operation occurred on the day of embarkation in Barrow and we were on shore for all planning and briefing. See my comments above on safety issues.

If appropriate, please comment on:
a) Adequacy of boat briefs

b) Provision and availability of appropriate safety equipment
c) Identification of science needs and requirements
d) How well the operations went
e) Other

15) Helicopter Operations

If appropriate, please comment on:
a) Adequacy of flight briefs

Flight briefs were excellent. It was good from multiple respects to have Dave Kreutzer from OAS on board! He did a spectacular job organizing the briefs communicating with the bridge and coordinating our work. I liked the GAR (green-amber-red) model because it allowed people with different knowledge of the ship, helicopter, and crew condition to express their concerns. I will adopt this system in my other research projects.

b) Provision and availability of appropriate safety equipment

See above

c) Identification of science needs and requirements.

The helicopters were chartered directly by us and were 100% allocated to the project with full understanding of our needs. We have worked with maritime helicopters before and as usual they did an excellent job. The few helicopter breakdowns (radio, GPS unit, and crack in bubble) were quickly and efficiently by our mechanic Anthony. Howard Reed, the capture pilot was wonderful as always – professional and cooperative, and Bill Springer was very accommodating and efficient! The best thing was how well they handled the down time which was very hard at times for all of us. And of course together with Dave K. they made sure we were safe.

The Commanders and crew of the Polar Sea were very committed to the success of the polar bear operations and it was evident from the efficiency of the flight deck crew. Refueling and traversing the helicopters in and out of the hanger took a few minutes at most, and landing and take –off occurred very efficiently.

d) Other

In the first few days of helicopter operations communications with the "tower" were a bit confused, largely because many of the JOOD were inexperienced. These problems disappeared rapidly as people became trained and aware of the safety issues.

Added during debrief: Merav Ben-David: helo ops were excellent.

16) Food Service

a) How well were special dietary requirements (vegetarian, vegan, low-fat, etc.) identified and met?

Food was excellent! We had to work out a lot in order not to gain too much weight! All our needs were met.

b) How was the quality of service and food, including outside of the three main meals of the day (e.g., (quality and availability of food/experience for those working overnight)?

Too much too good!

c) Other

17) Berthing and shared spaces (science conference room, gyms, laundry)

a) How did all aspects of housekeeping go?

There was no house keeping.

b) How did the berth assignments go?

Berth assignments were fine. A few state rooms leaked (AC system) and the chief scientist room flooded.

Added during debrief: Captain: that wasn't too cool. They are working on leaks today.

c) How were the check-in/check-out processes?

Simple and easy. MST showed us our spaces at embarkation. We cleared out gear and washed our sheets the day we left.

d) Other

Shared spaces were a problem. There was too little room to work. In fact, because the science library was mainly used for recreation there was no other space to work. This was especially difficult on down days, when weather or transit precluded conducting science mission. Not to have space to work in for such an extended period was a problem and likely will be more acute with larger science parties.

Added during debrief: Robin Muench: in some measure, that's just the way the ship was designed.
Merav Ben-David: There were no quiet spots to work.
CG: This may have been more of a problem for your cruise because it was long and we had a lot of weather days. I believe that the scientists did find some places to work.

Another problem was the laundry facility. There weren't enough machines and although the science party was allocated to Sunday each week, other crew members encroached on our time because they were unable to do laundry on the days allocated to their department. Please buy new machines!

Added during debrief: Captain: we have new laundry machines being installed.

18) Medical

a) Were needs, if any, met?

We had few and minor medical needs and they were fully addressed.

b) Medical history questionnaires
i) Could the forms be improved?
ii) How did the submission process go? (timing, acknowledgement of receipt, etc.)

The form was rather repetitious and could be improved. Submission was easy and efficient

19) Any other comments?

See preliminary reports from all science operations below.

Added during debrief: Phil McGillivary: Polar bear people fell through the ice. How did this happen?
Merav Ben-David: A scientist stepped off the helo and went into the water up to their hips. The Helo landed on a solid spot but in the middle of poor ice. The sedated bear was moved. The ice conditions were just very poor. Helo operations were far from the Polar Sea. Both helos were working together. Had to rely on Helos for rescue, if needed
Robin Muench: Did helos bump the ice before landing to check to see if it was ok for landing.
Merav Ben-David: Yes.
Renee Crain: Eiders were encountered. Where?
Merav Ben-David: N. Chukchi, I think. Alex Rose who worked with Dr. Kuletz was aboard recording the data. U.S. Fish and Wildlife Service has the data. Wildlife has the data.
We saw lots of polar bears but very few seal kills. The ice dynamics were very different this year.

Appendix – Additional Questions for Specific Activities or Instruments. Do not answer unless appropriate for your cruise.

1) Multibeam

a) How much real-time watchstander effort was required?

b) How much onboard ping editing was done in the post-processing?

c) In both cases, who provided the people? Who was responsible for training the people?

d) Other Multi -Beam issues?

2) Diving

If you conducted scientific diving on your cruise, how did it go?

Excellent as far as the diving operations are concerned. Not as efficient as could have been because of ship maneuvering issues (see above).

Polar bear project

Adaptive long-term fasting in land- and ice-bound polar bears: coping with ice loss in the Arctic?

Lead: Hank Harlow and Merav Ben-David
Department of Zoology and Physiology
University of Wyoming
Laramie, WY 82071
Tel: 307-766-5307
Cell: 307-214-0510
Fax: 307-766-5625
Email: bendavid@uwyo.edu

Team members: George Durner (USGS), Eric Regehr (USFWS), John Whiteman (University of Wyoming).

Summary:
The largest segment of the world's polar bear (*Ursus maritimus*) population follow the retreating sea ice northward and spend much of the summer and early fall on the deep water pack ice. These individuals likely contend with different conditions than those experienced by land-bound bears that experience lengthened periods of summer inactivity and food deprivation (i.e., "walking hibernation"). The cooler temperatures on the pack ice and potential opportunistic predation of ringed seals (*Phoca hispida*) may result in a higher activity profile and food intake which may lead to lower skeletal muscle atrophy, reduced risk of heart disease by ingestion of omega-3 fatty acids, and maintenance of fat and protein reserves that could be allocated to reproduction. Because the capacity of polar bears to withstand extended periods of fasting is finite, it is possible that the ability of polar bears to remain on the pack ice year round minimizes the negative effects of reduced foraging opportunities associated with declines in annual sea ice and may buffer polar bears from the ill effects of climate change. Nonetheless, thinning of multiyear ice and continued ice loss in the Arctic may eventually force all bears onto land and this physiological buffer may be lost, thus rendering population projections based on current conditions incorrect. In this project we assess the capacity of land-bound and ice-bound polar bears to withstand extended periods of fasting by repeated sampling of breath, blood, fat and muscle from individuals captured at the beginning and towards the end of the ice free period in the Beaufort Sea.

Table 1. Capture information for polar bears captured during PSEA 0902.

Bear number	Age	Sex	Date	Collar retrieved	Temperature logger retrieved	Samples collected
20764	Ad	F	10/3/2009	yes	yes	Breath, blood, fat, hair, muscle
21029	COY	M	10/3/2009	na	na	Breath, blood, fat, hair
21128	SA	F	10/3/2009	na	na	Breath, blood, fat, hair, muscle
21129	Ad	F	10/5/2009	na	na	Breath, blood, fat, hair, muscle
21130	COY	F	10/5/2009	na	na	Breath, blood, fat, hair
21024	Ad	F	10/12/2009	yes	yes	Breath, blood, fat, hair
21025	COY	M	10/12/2009	na	na	Breath, blood, fat, hair
21045	Ad	F	10/12/2009	yes	yes	Breath, blood, fat, hair, muscle
21046	COY	M	10/12/2009	na	na	Breath, blood, fat, hair
20817	Ad	F	10/14/2009	na	na	Breath, blood, fat, hair, muscle
21131	COY	F	10/14/2009	na	na	Breath, blood, fat, hair
21132	COY	F	10/14/2009	na	na	Breath, blood, fat, hair
32777	Ad	F	10/19/2009	yes	yes	Breath, blood, fat, hair, muscle
20905	Ad	F	10/19/2009	yes	na	Breath, blood, fat, hair
20910	Ad	F	10/26/2009	yes	na	Breath, blood, fat, hair
21133	COY	M	10/26/2009	na	na	na
21134	COY	F	10/26/2009	na	na	na

Diversity of life in Arctic pack ice
Cruise report, PSEA 0902, 26 September – 1 November 2009

Katrin Iken, University of Alaska Fairbanks
Participating group members: Heloise Chenelot, Mette Kaufman, Brenna McConnell, Shawn Harper

Additional dive team member: Richard Morris, R.E.M. Films, freelance videographer

***Background*:**
The focus of this study was an analysis of eukaryotic life (from algae to metazoans) living in association with select sea ice structures in the Beaufort and Chukchi Seas in late summer, early fall. Climate change-related warming trends lead to increased summer melt and a relatively greater abundance of thicker, ridged ice compared to thinner, level ice. In addition, summer melt may create low-salinity conditions under level ice in the summer unfavorable for marine life, while pressure ridges might act as refuge for the typical sea ice communities, as they reach well below the reduced salinity surface layer. A combination of core sampling on level ice and dive-assisted ice sampling from ridges allows us to evaluate the state of the ice biota in this region of maximum summer sea ice retreat in the Arctic Ocean. These biological diversity analyses are augmented with detailed investigations of the physical properties of the sea ice-water interface region, primary production investigations, and food-web studies.

The objectives of the project were to:
- analyze meiofauna in level and ridged sea ice
- quantify macrofauna associated with sea ice structures
- conduct physical measurements (temperature, salinity, light) of the ice-water interface
- measure primary production in sea ice and the underlying water column
- analyze trophic position of select macrofauna using stable isotope analysis

***Accomplishments*:**
A total of 11 stations were sampled for sea ice to accomplish most of the objectives (Tables 1 and 2). Occasionally, some samples could not be taken because of equipment failure or adverse environmental conditions.

On-ice sampling (Table 1):
Regular activities during on-ice included a hand-held CTD cast equipped with an additional PAR sensor through an auger hole down to 20 m depth. A 2π-sensor surface measurement was taken as reference for the underwater light measurements. Then, water was collected from 5 m depth through the same hole using a Kemmerer water sampler. Some of the water was later filtered onto GF/F filters for POC, PON and chl *a* analysis. Some of the water was used for primary production measurements in 500 ml bottles suspended at 5 m and at the ice-water interface for at least 2 h. Ice shavings from the bottom of an ice core (to add ice algae) were added to the incubation bottles and the ice-

water interface. All primary production bottles were spiked with isotopically labeled precursors to determine the ice algal nutrient uptake kinetics ($^{15}NH_4$, $K^{15}N0_3$) and carbon assimilation ($NaH^{13}CO_3$).

Ice cores were taken at each station; one core was used to measure total core length and core temperature every 10 cm. Six other cores were taken and sliced into the following sections: 0-1 cm, 1-2 cm, 2-5 cm, 5-10 cm, 10-20 cm, 20-30 cm, additional 10 or 20 cm sections for one full core. Sections of three cores were melted individually at 5-10°C and filtered onto GF/F filters for later chl *a*, POC, PON and stable carbon and nitrogen measurements. Sections of the three other cores were individually melted with the addition of 100 ml filtered seawater (0.8 μm) per 1-cm core section. Melted cores were concentrated over 20 μm gauze and meiofauna counted, separated and preserved. Most common meiofauna were turbellarians, nematods, harpacticoid copepods, nauplii, ciliates, and occasionally cyclopoid and calanoid copepods, amphipods and rotifers. The dinoflagellate *Ceratium arcticum* was frequently found in ice samples, which is uncommon for Arctic sea ice. Other uncommon findings include veliger bivalve larvae and hydroids.

Table 1: Station locations and sampling conducted for level ice. X indicates that samples were taken.

Level ice sampling							
Station	**Lat (N)**	**Long (W)**	**Date**	***CTD***	***Prim Prod***	***5m Water***	***Core samples***
Stn 2	76 34.421	170 58.536	2-Oct-09	X	No	X	X
Stn 3	77 20.766	168 20.640	3-Oct-09	X	No	X	X
Stn 4	77 23.449	167 11.407	5-Oct-09	X	X	X	X
Stn 5	77 22.4	166 58.2	6-Oct-09	X	X	X	X
Stn 6	76 32.8	169 54.6	7-Oct-09	X	X	X	X
Stn 9	73 07.862	153 34.583	12-Oct-09	X	X	X	X
Stn 12	72 01.499	132 48.924	18-Oct-09	X	X	X	X
Stn 13	72 00.459	132 51.796	19-Oct-09	No	No	No	No
Stn 14	72 20.039	146 00.095	25-Oct-09	X	X	X	X
Stn 15	72 20.8	146 23.9	26-Oct-09	X	X	X	X
Stn 16	72 23.3	146 51.1	27-Oct-09	X	No	X	X

Under-ice sampling (Table 2):
Sampling under the ice at ridge structure was accomplished using SCUBA diving. In some cases no real, weathered pressure ridges were encountered but the ice structures were rather very thick floes, recently or newly conglomerated ridges (Table 2). Quantitative assessments of macrofauna, specifically under-ice amphipods, were not done because of the overall scarcity of amphipods in the study region. Instead, overall numbers of amphipod observations were noted for each dive. The most common was *Gammarus wilkitzkii*, followed by few observations of *Onisimus* sp. *Apherusa glacialis* was rarely seen and one *Gammaracanthus* sp. was collected. A new finding from ridged ice includes a polynoid polychaete associated with the underside of the ice. Arctic cod (*Boreogadus saida*) was observed at most stations and approximate numbers and habitat features noted. They were particularly abundant at St. 6. Physical parameters were

measured using a small, hand-held CTD to measure salinity, temperature and light intensity from an externally attached HOBO light tidbit at bottom ridges/floes, the side of ridges, upward-facing ridge portions and under level ice. In addition, water samples directly from the ice-water interface were taken with syringes and salinity later determined using a YSI conductivity sonde. While CTD measurements revealed little differences in salinity by ice structure, syringe samples showed a tendency towards higher salinity under level ice than at other ice types, which we attribute to the mostly freezing conditions and brine expulsion under newly-forming level ice.
Duplicate ice samples were chiseled from the same ice structures as measured for physical parameters and individually enclosed in ziplock bags under water. Any ambient water was drained from the samples immediately after surfacing. Occasionally, replicate sample pairs were taken from bottom ridges or sides of ridges. Ice samples were the processed as described above for core sections: One sample per ice structure was melted to measure chl *a*, POC, PON and stable carbon and nitrogen ratios. The paired ice sample of each structure was melted with the addition of filtered seawater, concentrated over 20 µm gauze and meiofauna counted, separated and preserved. Meiofauna composition was similar to that encountered at level ice; quantitative differences between level and ridges ice will be analyzed later. A yet unidentified worm-shaped meiofauna organism in an ice sample from an upward-facing ridge structure may be a new finding.
Still photography (S. Harper) was used to document macrofauna and ridge ice structures at each site. At most stations, underwater video (R. Morris) was taken to document macrofauna, ice structures and ice sampling techniques.

Table 2: Sampling conducted for ridged ice. X indicates that samples were taken.

Ridged ice sampling

Station	**floe type**	***Ice samples***	***I-W CTD***	***I-W Salinity***	***Macrofauna (isotopes)***	***Imagery***
Stn 2	thick floe	X	No	No	No	X (S)
Stn 3	thick floe	X	No	No	No	X (S)
Stn 4	pressure ridge	X	X	X	X	X (S,V)
Stn 5	pressure ridge	X	X	X	X	X (S,V)
Stn 6	thick floe	X	X	X	X	X (S,V)
Stn 9	thick floe	X	X	No	X	X (S,V)
Stn 12	new ridge	X	X	X	X	X (S,V)
Stn 13	pressure ridge	X	No	X	X	X (S,V)
Stn 14	thick floe	X	X	X	X	X (S)
Stn 15	pressure ridge	X	(X)	X	No	X (S)
Stn 16	thick floe	X	No	X	X	X (S)

[I-W = ice-water interface; Imagery S = still photography, V = videography; For lat, long and date see Table 1]

Acknowledgements:

We would like to express our deepest thanks to Lt. Kellee M. Nolan who served as the liaison between the science divers and the Polar Sea Command. We appreciate all the support, encouragement and improvement she has provided for our work and we believe that our science diving mission was greatly improved by her input. We also are grateful to Kaiti Ott for her tireless help with the dive team and her knowledgeable handling of

samples and sampling gear. We also appreciate the support of the Polar Sea, especially of the deck-force in getting us on the ice. Last but not least, we are grateful to Drs. Merav Ben-David and Hank Harlow for the opportunity to participate in this cruise and their support for our work. This project was supported by NOAA Ocean Exploration, and contributes to the Census of Marine Life Acrtic Ocean Diversity (ArcOD) project.

PSEA-0902 Cruise Report

Dr. Marjorie Brooks, assistant professor
Biogeochemistry Laboratory
Department of Zoology, MC 6501
Carbondale, IL 62901
Email: mlbrooks@siu.edu
Tel: 618-453-4121
Cell: 307-399-0576

SIU Crew: Dawn Sechler, Daniel Whiting

Summary of Data Collection:

- Eleven off-side deployments of the conductivity, temperature, and depth (CTD) apparatus casts with water sampling collected at 2 meters, 50 meters, 100 meter depths.
- From CTD casts at each respective depth, water was filtered for particulate organic matter, chlorophyll *a*, fatty acids, stable isotopes, dissolved organic carbon.
- At nine stations a light meter (radiometer) was deployed to collect ultra-violet (UV) and visible light profiles.
- Four flow-through incubation experiments were conducted on the deck of the fo'c'sle, examining the effects of UV light on the spectral qualities of seawater as mediated by colored dissolved organic matter (CDOM).

Assessment of Support for the Scientific Mission

Pros

- The Marine Science Technicians (MSTs) were extremely helpful, accommodating our research needs rapidly and efficiently. For example, when problems arose with our fluorometer the MSTs offered parts from a defunct fluorometer in storage. They skillfully maneuvered and deployed the CTD from the J-frame and were extremely helpful when deploying the radiometer by hand.
- Once permission was given to conduct a CTD cast, coordination among the MSTs and the bridge was efficient.
- Communication among the scientists and MSTs was excellent.
- Interactions with Ensign Christopher Verlinden were incredibly productive. His conduct was always professional, efficient, and insightful, based on obvious forethought about how best to optimize the science mission while maintaining high standards of safety.
- Coast Guard electricians efficiently accommodated our electrical needs on the fo'c'sle for flow-through incubation experiments. Their installation of a ground-fault interruption outlet was very helpful during the searches for a ground on the ship and isolating a faulty electrical cord.
- David Hassilev made sure that email and information technology needs were met by the Coast Guard science server. He also compiled CTD data for the science team.
- Lab space, storage of samples, and other facilities (sink access) were adequate for our research.

- The berthing on the ship was adequate.
- The food was delicious and there was always a nice variety of foods to choose from at each meal.
- The employees from Barrow Arctic Science Consortium (BASC), particularly Mike Stotts, Lewis Brower, and Bryan Thomas were very helpful during on-load and off-load of personnel and equipment to the Polar Sea. In addition, they were supportive of travel and shipping needs, purchasing ice packs and freezing them for our use during travel. Mike Stotts also took the lead on shipping a piece of equipment from Barrow to an equipment company in California despite poor communication about postage costs from the equipment company.
- The Maritime pilots were very organized and efficient with helping on load and off load gear and personnel.

Cons

- We struggled to gain clear communication and coordination with the Operations Officer for off-side deployments of the CTD and radiometer. Deployment of these instruments to 100 m depth requires 30 to 40 minutes.
- Of 17 potential stations, CTD casts were conducted at 11 stations—64% of potential data collection—and radiometer deployments were conducted at 9 stations—53% of potential data collection. Because light characteristics are paired with findings from the CTD, our data analyses from the sites lacking radiometer casts are limited.
- Radiometer and CTD casts were often rushed by an immediate departure of the ship despite daylight conditions, which is why another radiometer deployment was cancelled.
- Deployments of the CTD and radiometer were delayed until after dive operations making it difficult to obtain radiometer profiles prior to dusk and obtain a variety of light profiles during different light conditions. Because of this delay, radiometer data were not obtained at one station.
- On two occasions, separate from dive operations, we were given clearance to perform a CTD cast and after preparing for the cast were denied further approval without logical explanation.
- It appeared that despite the desire of the lead scientist, measurements of the dynamic optical properties of the sea were not ranked as part of the science mission by the Operations Officer and apparently by Captain Vaughn.

Suggestions for Improvement of Future Science Missions:

- Had coordination of operations improved, data collection would have improved. An alternative sequence of data collection was suggested by the science party but rejected by the Operations Officer. Following initiation of bear operations, radiometer and CTD casts could have been conducted at all of the ice stations during the dive briefings.
- Given costs of data collection on an ice-breaker cruise, we recommend greater communication with the chief scientist to avoid partial compromise of the science mission and failure to achieve optimal data collection.

Marine mammals/seabird surveys

Seabird and Marine Mammal Observations / North Pacific Pelagic Seabird Observer Program

Lead: Kathy J. Kuletz, Ph.D.
U.S. Fish and Wildlife Service
1011 E. Tudor Rd
Anchorage, AK 99503
Tel: 907-786-3453
Cell: 907-360-5998
FAX: 907-786-3641
Email: Kathy_kuletz@fws.gov

Observer on PSEA0902 Cruise: Dr. Alexandra Rose

I. BRIEF SCIENCE OBJECTIVE

This project will examine seabird and marine mammal distribution relative to oceanographic and biological features in the Beaufort Sea. Our goal is to examine the current influence of oceanographic and prey dynamics on the distribution and abundance of top predators. By using multiple years of data to examine seabird and mammal response to these variables, we aim to predict how changes in the marine ecosystem will alter the distribution of apex predators.

Table 1. Marine and land bird observations during the Polar Sea Arctic West 2009 Cruise (September 26 to November 1).

Common Name	Latin Name	N	% of Total Birds	% of Identified Bird Spp.
Short-tailed shearwater	*Puffinus tenuirostris*	215	0.32	0.31
Black guillemot	*Cepphus cepphus*	87	0.13	0.12
Common murre	*Uria aalge*	1	<0.01	<0.01
Kitlitz's murrelet	*Brachyramphus brevirostris*	1	<0.01	<0.01
Crested auklet	*Aethia cristatella*	5	0.01	0.01
Black-legged kittiwake	*Rissa tridactyla*	7	0.01	0.01
Glaucous gull	*Larus hyperboreus*	59	0.09	0.08
Ivory gull	*Pagophila eburnea*	42	0.06	0.06
Ross's gull	*Rhodostethia rosea*	209	0.31	0.30
Pacific loon	*Gavia pacifica*	5	0.01	0.01
Yellow-billed loon	*Gavia adamsii*	1	<0.01	<0.01
Spectacled eider	*Somateria fischeri*	60	0.09	0.09
Snow bunting	*Plectrophenax nivalis*	3	<0.01	<0.01
Snowy owl	*Bubo scandiacus*	7	0.01	0.01
Unidentified Alcid	Family *Alcidae*	5	0.01	0.01
Unidentified Auklet	*Aethia* spp.	1	<0.01	<0.01
Unidentified bird	Class *Aves*	12	0.02	0.02
Unidentified eider	*Somateria* spp.	1	<0.01	<0.01
Unidentified gull	Family *Laridae*	21	0.03	0.03
Grand Total (All orgs)		878		
Total birds		675		
Total identified birds		702		
Total mammals		277		
Total identified mammals		72		

Table 2. Marine mammal observations during the Polar Sea Arctic West 2009 Cruise (September 26 to November 1). Off transect observations were >300m from the ship's center line.

Common Name	Latin Name	N	N off Transect
Bearded seal	*Erignathus barbatus*	6	6
Ringed seal	*Phoca hispida*	11	4
Walrus	*Odobenus rosmarus*	1	1
Unidentified seals		40	25
Arctic Fox Tracks	*Alopex lagopus*	8	N/A
Polar Bear (Animals and Tracks)	*Ursus maritimus*	46	N/A
Seal "Push Up"		171	N/A
Beluga whale	*Delphinapterus leucas*	24	24