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Central and Arctic Region

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Project Title: Eastern Canadian Arctic killer whale research

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Summary:

Recent increases in sightings of killer whales, *Orcinus orca*, in the eastern Canadian Arctic have raised concern over their effects to marine mammal prey populations in the region. However, with little information known about the number of killer whales seasonally visiting the eastern Arctic, as well as their distribution and extent of prey specialization, their predatory impacts are difficult to quantify. 2013 marked expansion of the killer whale research program to train and equip northerners to conduct research independent of southerner support. Ongoing research in 2014 will continue this expansion to increase coverage of the killer whale research program throughout the eastern Canadian Arctic. By building community-based monitoring teams for killer whales, there is great potential for increased data collection that can improve population estimates, discern killer whales' degree of prey specialization, and elucidate their summer and winter ranges. With a better understanding of biological and ecological information about these predators, estimates of how killer whales are affecting marine mammal populations in the eastern Canadian Arctic can be improved.

Introduction:

With recent increases in sightings of killer whales, *Orcinus orca*, in the eastern Canadian Arctic (ECA) (Higdon 2007), there is raising concern over their effect to potential prey populations. Currently, it is unclear whether ECA killer whales specialize in certain prey types similar to killer whales in other geographic regions (e.g. Ford et al. 1998), so making predictions about how specific prey populations may be affected remains difficult. Observations of predation events and Inuit traditional ecological knowledge (TEK) suggest Arctic killer whales prefer marine mammals, including: beluga (*Delphinapterus leucas*), narwhal (*Monodon monoceros*), bowhead (*Balaena mysticetus*), and seals (Finley 1990; Laidre et al. 2006; Ferguson et al. 2012a). Determining how marine mammal populations may be affected by killer whales is important given their ecological and sociocultural importance in the ECA.

The ability to quantify killer whale predation effects to marine mammal populations remains limited with unknown information about the biology and ecology of Arctic killer whales. For example, with only a minimum population estimate for killer whales in the ECA (Young et al.

2011), it is difficult to determine their energy requirements and subsequent number of marine mammals seasonally consumed to meet these requirements. Because the extent of their dietary specialization remains unknown, the strategies killer whales use during feeding in the ECA may also affect how marine mammal populations are affected (Ferguson et al. 2012b). In addition to the consumptive effects of killer whale predation, intimidation effects of killer whale presence can also adversely affect prey (Peckarsky et al. 2008). Disruption to behaviours, such as feeding, mating, and/or communication, can have negative consequences for overall prey population fitness and survival. In the ECA, anti-predator behaviour by marine mammal prey have been reported in the presence of killer whales, such as swimming close to shore and the cessation of calling in narwhal (Laidre et al. 2006).

Project Objectives:

Ongoing objectives for killer whale research in the ECA concern acquiring more data on their biology and ecology. Some examples include a population size estimate, whether certain groups exist, extent of prey specialization, and killer whales distribution within and outside of the ECA. Overall project objectives include:

1. Estimate population size using photo-identification.
2. Determine killer whales' distribution using satellite telemetry and photo-identification.
3. Determine spatial and temporal separation of ECA killer whales to other North Atlantic killer whales by comparing photo-identification catalogues.
4. Determine the extent of dietary specialization in ECA killer whales through stable isotope (SI) and fatty acid (FA) analysis of tissue biopsies (skin and blubber).
5. Build community-based monitoring teams comprised of Northerners in several communities to increase spatial and temporal coverage of killer whale monitoring in the ECA. Teams will be trained and equipped to deploy satellite transmitters, acquire tissue biopsies, and take photographs of killer whales for photo-identification.

Methods:

Photo-identification: Natural markings, including the unique shape and size of each killer whale's dorsal fin, as well as their left and right saddle patches and eye patches can be used to distinguish between individuals (Ford et al. 2000). Other markings, such as scars, may remain permanent over an individual's lifetime can also be used. For example, many killer whales have nicks in the trailing edge of their dorsal fin as well as scars that can be used for re-identification. When individual killer whales are identified in photographs, they are compared to the Arctic killer whale photo-identification catalogue. The newly identified whale is either added as a re-sighting of an individual (i.e. it was already present in the catalogue from a previous encounter) or as a new individual (i.e. it was not already present in the catalogue). Re-sightings provide insight into the individual killer whale's movements throughout the ECA either within the same year or between years. Comparison of the Arctic killer whale photo-identification catalogue to similar catalogues created for killer whales present in other regions of the North Atlantic (e.g. Newfoundland/Labrador, West Greenland, Azores, Iceland) will identify if Arctic killer whales are also present in these regions if matches between catalogues are made.

Satellite telemetry: The study of killer whales in the Arctic is difficult as killer whales are highly mobile predators (Andrews et al. 2008; Matthews et al. 2011) and accessibility to Arctic regions is logistically challenging. The remote tracking of wildlife through biotelemetry and biologging provides researchers with a means to study the activities and behaviours of wildlife at remote distances without disturbance (Bogard et al. 2010). This is particularly advantageous when studying marine mammals because they spend the majority of their lives at-sea and below the water surface (Bogard et al. 2010), areas relatively inaccessible to researchers. In 2009, two satellite transmitters were attached to a killer whale in Admiralty Inlet, and this was the first time killer whales were tracked using telemetry in the Arctic (Matthews et al. 2011). In 2013, five satellite transmitters were attached to killer whales in Milne Inlet and Tremblay Sound (near Pond Inlet). Continuation of remotely tracking killer whales in the ECA using satellite telemetry is beneficial to document their movement within and outside of the ECA.

Tissue biopsies: The chemical composition of the predator's tissue reflects the chemical composition of their prey; chemical analysis of nitrogen and carbon stable isotopes can provide insight of a predator's diet and regions where foraging takes place (Newsome et al. 2010). As highlighted above, the extent of prey specialization remains unknown for Arctic killer whales. In some regions, killer whales show a highly specialized diet (e.g. eastern Pacific resident killer whales consume only fish; Ford et al. 1998), but whether this is the case for Arctic killer whales remains unknown. Knowledge of whether Arctic killer whales consume solely marine mammal prey, or also consume fish species would be beneficially incorporated into estimates of their impact to marine mammal populations important for Inuit subsistence hunting. In addition, genetic analysis of biopsied tissue can determine how similar Arctic killer whales are to other killer whale groups, especially those present in regions of the north Atlantic. This type of analysis can also elucidate the sex of the killer whale from which the biopsy was collected, allowing for improved estimates of sex compositions of ECA killer whale groups.

Preliminary Results/Discussion:

Recent publications that summarize research about Arctic killer whales include: Matthews and Ferguson (2013), Higdon et al. (2013). Reinhart et al. (2012), and Westdal (2013). Current work being conducted includes individual killer whale identification from photographs obtained during 2013 fieldwork and submitted as sightings throughout 2013 for comparison to the Arctic photo-identification catalogue. Projected work includes analyzing telemetry data from 2009 and 2013 in which both killer whales and potential prey species [bowhead (2009 and 2013), and narwhal (2009)] were equipped with satellite transmitters in the Gulf of Boothia and Prince Regent Inlet. Transmissions from predator and prey species overlap in time and space, and research will focus on describing predator-prey movement patterns in relation to each other's presence.

In August of 2013, with the help of two local Pond Inlet Inuit, five satellite transmitters were attached to killer whales in Milne Inlet and Tremblay Sound. In addition, seven biopsies were obtained and thousands of photographs for photo-identification. Preliminary results suggest that at least some of the identified killer whales during fieldwork are re-sightings of killer whales in the Arctic killer whale photo-identification catalogue. The time duration of each satellite transmitter differed. Two transmitters terminated transmissions on 20 August, the third on 30

August, the fourth on 11 September, and the final tag continued to transmit locations until 11 October. The summary track for the final tag is shown in Figure 1.

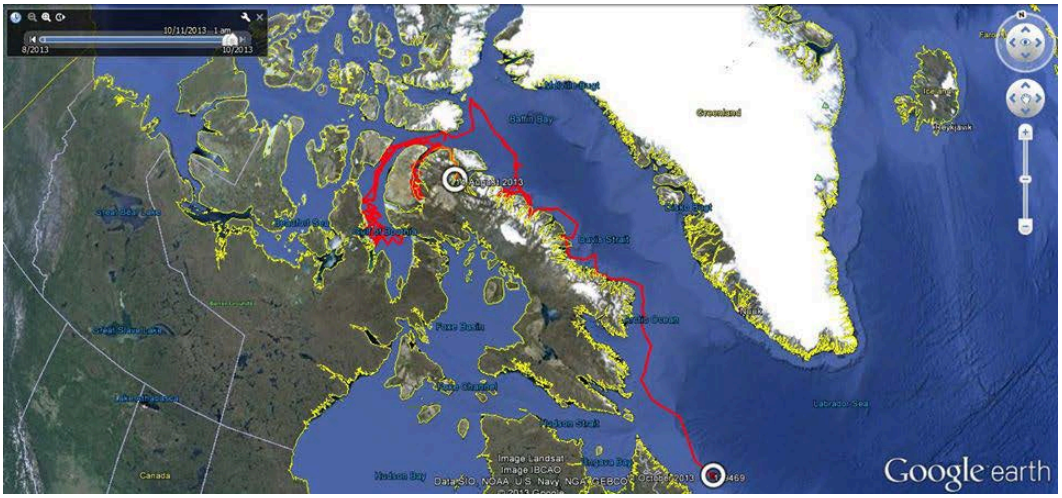

Figure 1: Summary track for one killer whale equiped with a satellite transmitter from 12 August to 11 October, 2013. The track begins in Milne Inlet, northern Baffin Island and terminates just north of Labrador.

Reporting to Communities/Resource Users:

The spring 2013 newsletter (Aarluk News; Figure 2) was released summarizing recent research on ECA killer whales. Work is currently underway to release a fall 2014 edition of the newsletter that will summarize fieldwork from 2013. The newsletters are made available on the Orcas of the Canadian Arctic website (http://www.naturenorth.com/OCA/index.htm) that was launched in 2009. In 2013, the website moved to a new domain (NatureNorth.com) in an attempt to increase exposure and was updated to include information about the Inukjuak entrapment of killer whales that took place in January 2013, as well as to summarize successes of the 2013 field season (http://www.naturenorth.com/OCA/OCAresearch.html). A Facebook group was also created, entitled Canadian Arctic Killer Whales – Orcas of the Canadian Arctic (https://www.facebook.com/?ref=logo#!/groups/416205555156446/), in which individuals on Facebook could request membership in order to receive updates about killer whale research in the ECA. Initial updates were primarily focused on the movements of the killer whales that were tagged in August 2013 (Figure 1). Ongoing updates also include information on killer whale prey items, including bowhead whales equipped with satellite transmitters.

Figure 2. Spring 2013 Aarluk newsletter. Available at http://www.naturenorth.com /OCA/index.htm

A summary letter of 2013 fieldwork was provided to Hunters and Trappers Organizations at several communities in the ECA in October 2013. The letter was presented both in English and Inuktitut. Community reporting in 2014 included oral presentations to Hunters and Trappers Organizations/Associations about killer whale research in Pangnirtung (May), and Pond Inlet (June). Presentations highlighted past fieldwork success, plans for future fieldwork and plans for training Northerners to carryout data collection independently.

Comment [D1]: Steve, did you discus KW fieldwork when you visited Pang?

Plans for 2014:

An application to NWRT to fund ongoing research of killer whales in the eastern Arctic has been submitted. It includes plans to deploy satellite transmitters, take photographs for identification, and collect tissue biopsies, with an overall objective to estimate how killer whale predation is affecting marine mammal populations in the Arctic. After the successful field season of 2013 in Pond Inlet and previous success in 2009 in Admiralty Inlet, 2014 fieldwork plans include visiting three communities in the eastern Arctic to continue the training of northerners to conduct killer whale fieldwork independent of researcher support. Researchers will make a return visit to Pond Inlet to work with the same field team to continue their training in biopsy and photograph collection, and satellite transmitter deployment. Researchers will also visit Repulse Bay and Arctic Bay to initiate training in both of these communities. Finally, a second field team consisting of Northerners in Pangnirtung will operate independently in 2014 to carry out fieldwork in Cumberland Sound when killer whales are sighted.

After the 2014 field season, killer whale sampling kits will have been sent to four communities in the eastern Arctic (Pangnirtung [2013], Pond Inlet [2014], Arctic Bay [2014], Repulse Bay [2014]) and two communities will have received two years' worth of training appropriate for killer whale fieldwork and the use of killer whale sampling kits (Pangnirtung and Pond Inlet). Planned fieldwork for 2015 will include a second training season in Repulse and Arctic Bays.

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