1 Introduction
Relatively little is known about killer whales (Orcinus orca) in the eastern Canadian Arctic. Summarized accounts indicate killer whales are distributed along the north and east coasts of Baffin Island and within Hudson Bay, where occurrence during late summer coincides with reduced sea ice. These killer whales are thought to come from the northwest Atlantic, where they may overwinter in offshore portions of the Labrador Sea, the open Atlantic east of Newfoundland, or further south along the North American coast. Eastern Arctic killer whales have been documented feeding on narwhal, beluga, bowhead whales, and seals. However, knowledge of their overall distribution remains limited, and their seasonal movements and feeding ecology in the Arctic are largely unknown. Recent increases in killer whale sightings in the eastern Arctic, along with range expansions associated with decreasing ice cover, have raised concerns about impacts of increasing killer whale presence on Arctic ecosystems.

In August 2010, researchers returned to Admiralty Inlet to continue killer whale research initiated in 2009. The field team comprised Gretchen Freund (FN 08, Research Photographer, St. Louis, Missouri), Cory Matthews (PhD student, University of Manitoba), Stephen Petersen (Visiting Fellow, DFO), and boat captain Nataq Levi (Arctic Bay, NU) (Figure 1). Researchers were joined by a BBC film crew consisting of Matt Swarbrick (director), Max Hug Williams (cameraman), and local observer Randy Oyukuluk. Research objectives included 1) studying movement and distribution using photo identification and satellite telemetry, 2) determining diet using chemical analysis of biopsied skin (stable isotopes analysis, SIA) and blubber (fatty acids analysis, FAA), and 3) studying group and population structure using genetics analysis of biopsied skin. Specified fieldwork objectives included:

- photographing dorsal fin, saddle patch, and eye patch areas of observed whales.
- remote deployment of satellite transmitters (SPOT 5, Wildlife Computers, Seattle, USA) onto dorsal fins of killer whales (using crossbows).
- collection of skin and blubber biopsies (using crossbows).
- recording calls of killer whales and their prey using an underwater acoustic device (CPOD).

BBC objectives were to collect footage of killer whale research and foraging behavior for the upcoming series ‘Frozen Planet’.

2 Methods
Photography: Photographs are taken using a Canon EOS-1 D Mark IV camera fitted with either a 400 mm fixed lens, 70-200 mm lens, or 16-35 mm zoom lens. Photographs will be added to an eastern Arctic killer whale photo database, which is being used to determine movement patterns within and across years and spatial regions (e.g., Hudson Bay versus Baffin Bay).
Satellite transmitter deployment: A crossbow is used to shoot satellite tags surface-mounted with metal barbs at the base of the dorsal fin. Upon contact, the crossbow bolt housing the tag falls away to expose the transmitter antenna. Transmitters are programmed to send data up to 300 times throughout the day as the whale surfaces, and polar-orbiting satellites pick up signals within their field of reception. Movement information can be used to determine seasonal distribution of killer whales in the eastern Arctic and where they overwinter, and clarify temporal and spatial overlaps in killer whale distribution with that of prey.

Tissue biopsy: Tissue cores are obtained using a crossbow to fire a biopsy dart fitted with a tubular sterile stainless steel tip (40 mm x 5 mm). Biopsied tissue is excised immediately after collection using sterile forceps. Blubber is separated from skin and wrapped in an aluminum foil sleeve, and both skin and blubber are placed in a cryoshipper with liquid nitrogen onshore. Stable isotopes and fatty acids analyses of skin and blubber can be used to assess diet, while genetics analyses of skin can be used to determine relatedness among individuals within a group, population structure, and metapopulation structure of the species (e.g., similarity of eastern Arctic whales to others in the North Atlantic and elsewhere).

Acoustic recordings: A CPOD will be used to record sounds continuously while deployed at the seafloor. CPODs record echolocation clicks produced by toothed whales (killer whales, narwhal, and beluga) for navigation and prey detection, and can be used to monitor location and foraging events.

3 Field Research Summary
C. Matthews and S. Petersen arrived in Arctic Bay on July 31, and M. Swarbrick and M. Hug Williams arrived in Arctic Bay on August 2. Killer whale research and filming plans were presented to the Arctic Bay Hunters & Trappers Organization (HTO) on August 3. The presentation outlined results from fieldwork conducted in 2009, discussed a killer whale stranding in Repulse Bay in late 2009, and provided an overview of research plans in 2010. The BBC presented several clips of footage taken in other locations to give the HTO board an idea of what they would be filming in Admiralty Inlet, and confirmed their intent to film only killer whale research. Arrangements for boats, guides, and an observer of filming activities were finalized with the HTO.

Ice conditions and problems with boat motors prevented departure from Arctic Bay on planned dates (August 4 or 5). On August 6, G. Freund was flown from Cunningham Inlet to Arctic Bay on a twin otter flight from PCSP Resolute. Two research boats departed Arctic Bay at approximately 22h00 on August 6, arriving at the field site at Kakiak Point just after midnight. Photographs of bearded seals and several bowhead whales were taken enroute, and BBC footage was taken during the trip. General camp set-up was completed on August 7 (Figure 2). All personal tents and gear were set up just after arrival and later the same day a twin otter flight from PCSP Resolute brought remaining equipment (longhouse tent, tables and chairs, remainder of fuel) (Figure 3).

Scheduled watches for killer whales and other marine mammals, as well as polar bears near the campsite, began on August 8. Shore-based searches were conducted continuously by one to three observers working in 3-hr shifts. Detailed notes of marine mammal sightings, as well as general weather conditions and other occurrences (e.g., polar bear sightings) were recorded during watches. During August 9-13, dense pack ice extending at least several kilometers drifted against the shore at Kakiak Point and within Kakiak Bay (Figures 4 & 5).
There were reports of similar conditions at a narwhal hunting camp approximately 20 km south of Kakiak Point. Bowhead whales and narwhals were often observed traveling within the ice close to (50-200 m) shore. Polar bears were also observed daily and frequently had to be scared off by chasing and/or firing bear bangers or birdshot (Figure 6). No killer whales were observed during this period.

Around August 13, ice conditions improved as a strong north/northwest wind moved remaining ice south of Kakiak Point. On August 14 at 8h00, killer whales were sighted offshore (>1 km). Several onshore observers independently counted 4-7 individuals, including three mature males identified by their large dorsal fins. Unfortunately, strong winds and rough seas prevented deployment of research vessels to approach killer whales. Sightings reports received by radio (August 14-18) indicated killer whales were present near hunting camps south of Kakiak Point in the following days. Unfortunately, strong winds and rough seas prevented any boat-based work, so searches for sighted killer whales were not conducted.

On August 16, a DFO research team consisting of Bernard LeBlanc, Levi Qaunaq, Rick Oyukuluk, Isaiah Oyukuluk, and Martin Caron arrived at Kakiak Point, which was to be used as a base while conducting satellite tagging of bowhead whales. Polar bears were sighted daily near camp throughout the second week, while narwhal and bowhead whale sightings decreased. Poor weather and rough seas persisted until August 21, when it was decided to break camp and depart for Arctic Bay. Scheduled watches were stopped that morning, and most PCSP gear was packed and left for pick-up by twin otter the following day. Due to heavy ice during the first week and poor weather conditions during the second, researchers were unable to deploy the CPOD at any point during fieldwork.

M. Swarbrick and M. Hug Williams departed Arctic Bay on August 24 via commercial flights from Nanisivik Airport, followed by C. Matthews and S. Petersen on August 25. G. Freund made arrangements to remain in Arctic Bay until September 1, enlisting local boat guide, Samson Ejiangiaq, to search for killer whales. They arrived at Kakiak on August 28 and sighted killer whales near Kakiak Bay on August 29. Rough waves prevented approaching the whales by boat. However, 8-10 whales were sighted in the same area again on August 30 when calmer conditions allowed photographs of the whales to be taken from a boat (Figures 7 & 8). Initial analysis suggests the photographed whales were not those encountered in the area in August 2009.

4 Summary

During August 2010, researchers were based at Kakiak Point, Admiralty Inlet to conduct research on killer whales. Objectives included deploying satellite transmitters, collecting biopsies and photographs, and recording killer whale sounds using CPOD. Killer whales were sighted once from shore by researchers at Kakiak Point, and several times by local hunters within 20 km of the campsite. Unfortunately, weather conditions prevented any boat-based work (with the exception of photo identification) from being conducted so most research objectives were not met. However, killer whale sightings during mid to late August indicate Admiralty Inlet continues to be a reliable location for future killer whale research.

Figure 1: Killer whale researchers from left to right: Stephen Petersen, Gretchen Freund, Cory Matthews, Nataq Levi. (Photo: Unknown)
Figure 2: Admiralty Inlet from Kakiak Point campsite where researchers were based. (Photo: G. Freund)

Figure 3: PCSP Twin Otter airplane arriving with remaining supplies for camp. (Photo: G. Freund)

Figures 4 & 5: Admiralty Inlet from Kakiak Point. High winds, rough seas and pack ice persisted during the second week of fieldwork, and prevented the research team from searching for killer whales sighted on August 14. (Photos: G. Freund)

Figure 6: Many polar bears were sighted during the expedition and had to be scared off by firing bear bangers and/or birdshot. (Photo: G. Freund)

Figures 7 & 8: Photo identification images of Orca taken on August 30, 2010. (Photos: G. Freund)
Figure 1: Stephen Peterson, Gretchen Freund (FN 08), Cory Matthews, Nataq Levi

Figure 2: Admiralty Inlet from Kakiak Point campsite
Figure 3: PCSP Twin Otter arriving with supplies

Figure 4: High winds and pack ice persisted during the second week of fieldwork
Figure 5: High winds and pack ice persisted during the second week of fieldwork

Figure 6: Many polar bears were sighted during the expedition
Figure 7: Photo Identification image of Orca taken on August 30, 2010

Figure 8: Photo Identification image of Orca taken on August 30, 2010