

# Notes

## Sea Ice Crossing by Migrating Caribou, *Rangifer tarandus*, in Northwestern Alaska

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Long movements across sea ice by Caribou (*Rangifer tarandus*) in Alaska are relatively uncommon and are not well documented. With rapidly diminishing sea ice cover in arctic waters, these movements may cease altogether. On 26 May 2012, a Caribou crossed a long span (57 km) of sea ice off the coast of Alaska. The cow successfully crossed after traveling 66 km on the sea ice and eventually reached the calving grounds. The highly dynamic nature of sea ice, which is driven by oceanic currents and wind during spring break-up, presents inherent hazards different from lake ice. Based on three years of Global Positioning System (GPS) radio-collar data, Caribou routinely crossed long expanses (30 km) of ice covering the brackish Selawik Lake and shorter stretches (<13 km) on Inland Lake during their spring migration north. There was also a single crossing on the ice covering Selawik Lake during the fall migration south to the wintering grounds that took place in early November 2010. Five GPS-collared Caribou crossed the short frozen span (14 km) of Kotzebue Sound between Cape Krusenstern National Monument and the Baldwin Peninsula in the fall of 2011.

Key Words: Caribou, *Rangifer tarandus*, climate change, migration, sea ice, Western Arctic Herd, Alaska.

In 2009, the Arctic Inventory and Monitoring Network of the U.S. National Park Service launched a program to monitor Caribou (*Rangifer tarandus*). One of the goals of this monitoring is to detect changes in the phenology and distribution of Caribou migrations. Although long-distance movements across sea ice are relatively common and are well documented in the Canadian Arctic Archipelago (e.g., Miller et al. 2005; Poole et al. 2010) and Eurasia (Klein and Kuzyakin 1982; Klein 1999), such movements are uncommon, but not unprecedented, and heretofore, to my knowledge, undocumented in Alaska.

### Study Area and Methods

My study area was along the northwestern coast of Alaska, where Western Arctic Herd Caribou have the potential to undertake relatively large ice crossings (Figure 1). The region is dominated by low tundra but shrublands and boreal forest habitats are common along the major waterways. The terrain is rugged in many places but elevations are generally <1100 m. In order to monitor Caribou, 68 cows of the Western Arctic Herd were fitted with satellite Global Positioning System (GPS) radio-collars (Telonics, TGW-4680, Mesa, Arizona, United States) from 2009 to 2011 that reported locations every 8 hours throughout the year. All animal handling followed Animal Welfare Policy guidelines and were approved by the Animal Care and Use Committee of the State of Alaska Division of Wildlife Conservation.

### Results

A GPS-collared Caribou left the shore of Cape Espenberg on 25 May 2012 and crossed the sea ice of Kotzebue Sound to reach Cape Krusenstern (Cow A) (Figure 1). The cow covered about 66 km of sea ice in approximately 28 hours. The straight-line distance between the two locations is about 57 km. The hills (elevation 500 m) in Cape Krusenstern National Monument were likely visible from high ground (elevation 20 m) near Cape Espenberg (see Miller et al. 2005).

The cow began her northbound migration on 15 May, after wintering within Bering Land Bridge National Preserve. Upon reaching the coast, where she found contiguous sea ice, she twice balked at crossing and worked her way east and reached land's end at Cape Espenberg before attempting the crossing of Kotzebue Sound (Figure 1). She traveled at an average speed of 0.54 km/hr (SD 0.25) until she reached the edge of the sea ice. The cow's average rate of travel during the crossing was about 2.33 km/hr (SD 0.88). Her pace slowed again, to 1.21 km/hr (SD 0.41), when she reached land at Cape Krusenstern National Monument. Although the ice pack was solid and covered nearly all of Kotzebue Sound (Figures 1 and 2), the cow's increased speed on it may have indicated a change in the urgency in her movement north. The Caribou continued north after reaching land and eventually made her way to the calving grounds on 9 June 2012 (Figure 3).

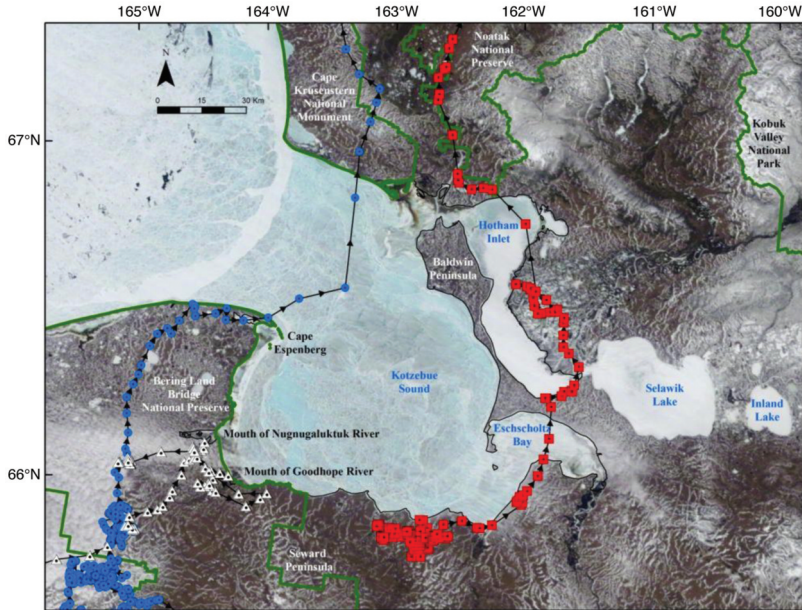


FIGURE 1. Northward spring migration of three radio-collared Caribou (*Rangifer tarandus*) of the Western Arctic Herd, May–June 2012. The background is a MODIS satellite image taken day 1 of the Caribou crossing of the Kotzebue Sound sea ice (26 May 2012). Markers represent GPS locations, collected every 8 hours, and lines show the route and direction of movement. Cow A (circles) headed north, crossed the frozen waters of Kotzebue Sound, and reached the calving grounds. Cow B (squares) migrated east round Kotzebue Sound and crossed its eastern reaches. Cow C (triangles) migrated northeast and reached Kotzebue Sound, where there were poor ice conditions (darker colors). She turned east to go around Kotzebue Sound but doubled back on 31 May 2012 and spent the calving and summer seasons in Bering Land Bridge National Preserve. MODIS satellite image: Geographic Information Network of Alaska. [www.gina.alaska.edu](http://www.gina.alaska.edu). (Accessed 25 June 2012).

Members of the Western Arctic Herd that overwinter on the central Seward Peninsula, which is on the western edge of the herd's winter range, typically migrate east around Kotzebue Sound before heading north (Figure 3). Eighteen other cows with GPS collars overwintered with Cow A on the Seward Peninsula, including 11 that were within 50 km of her. Seventeen of the 18 (94%) migrated east around Kotzebue Sound before heading north and making the >500 km journey to the calving grounds—adding >100 km on to their spring migration route versus the direct-line distance (Figure 3).

One of the cows that overwintered on the Seward Peninsula (Cow B) cut across 13.8 km of Eschscholtz Bay (which was ice covered) at the base of the Baldwin Peninsula (a straight-line distance of 13.3 km) as she migrated east around Kotzebue Sound in 2012 (Figure 1). Her rate of travel was 0.38 km/hr (SD 0.39) prior to the crossing, 1.12 km/hr (SD 0.22) during the crossing, and 0.25 km/hr (SD 0.21) after the crossing. Continuing north, she crossed 20 km of sea ice (straight-line distance of 19 km) on Hotham Inlet, northeast of Baldwin Peninsula (Figure 1). Again, her rate of travel across the ice (2.45 km/hr, SD 0.44) was greater than her rate prior to (0.43 km/hr, SD 0.30) or after (0.56 km/hr, SD 0.55) the crossing. She reached



FIGURE 2. Photograph from a fixed-wing aircraft of Kotzebue Sound sea ice on 6 June 2012, 11 days after Cow A made the crossing. Photo: Marci Johnson, U.S. National Park Service.

the calving grounds by 30 May 2012. GPS-collared Caribou crossed the 30 km of brackish, frozen water of Selawik Lake, the state's third largest lake, during each spring migration of the project (2010–2012). At least 9 GPS-collared Caribou also traversed the approximately 12 km of ice in May on Inland Lake, which lies just east of Selawik Lake (Figure 1).

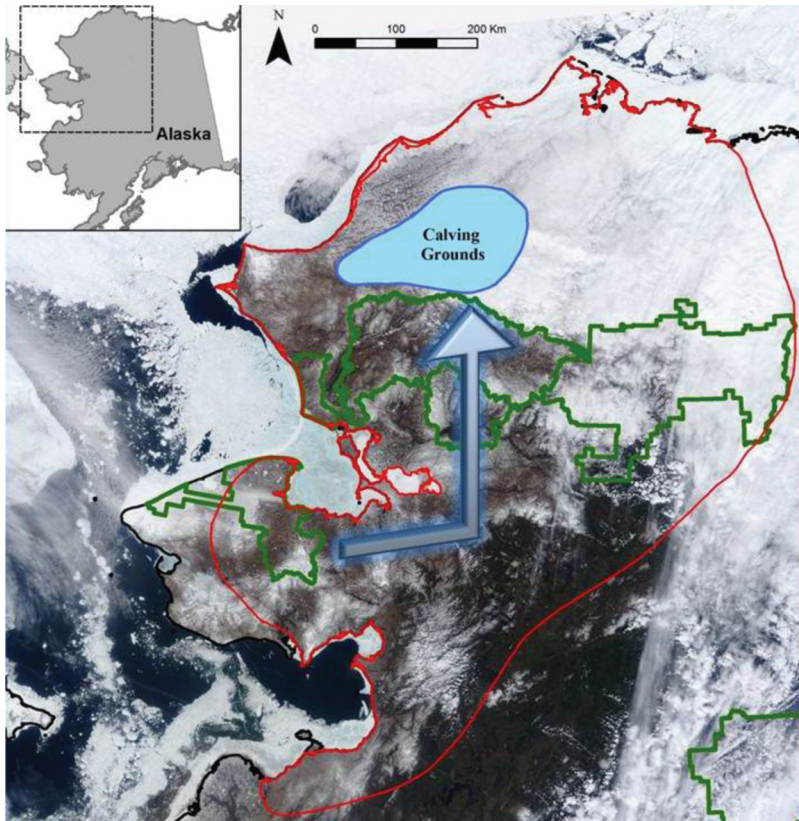


FIGURE 3. Range (red perimeter) and calving grounds of the Western Arctic Herd and the typical northbound spring migration route of Caribou (*Rangifer tarandus*) cows that overwinter on the Seward Peninsula (large arrow). The background is a MODIS satellite image (courtesy of Geographic Information Network of Alaska, [www.gina.alaska.edu](http://www.gina.alaska.edu), accessed 25 June 2012) taken 26 May 2012. Polygons are U.S. National Park units. Herd Range: Alaska Department of Fish and Game.

On the southbound fall migration, only one cow crossed the frozen Selawik Lake—on 1 November 2010. No GPS-collared cow definitely crossed Inland Lake on the fall migration. Five GPS-collared Caribou crossed the short frozen span (14 km) of Kotzebue Sound between the southern tip of Cape Krusenstern National Monument and the northern tip of the Baldwin Peninsula in November of 2011. Congruent with spring observations, fall travel rates were greater during the crossings of sea ice (2.72 km/hr, SD 0.61) than either before (1.20 km/hr, SD 1.09) or after (0.79 km/hr, SD 0.66) the crossings. The over-ice distance crossed by Caribou of the Western Arctic Herd falls within the range of distances traveled by Caribou in the Canadian Arctic Archipelago (e.g., Miller et al. 2005; Poole et al. 2010).

### Discussion

Given a warming Arctic and rapidly declining sea ice cover (Hinzman et al. 2005; Cosimo 2006), long-distance migrations over ice may become more infre-

quent and/or dangerous and could possibly cease altogether (Miller et al. 2005). Kotzebue Sound had extensive ice-free areas in May 2011 and has often (>33% of years) had open channels of water in May during the last decade (Geographic Information Network of Alaska 2012).

Pelagic water crossings are much more energetically demanding and are typically much shorter (<3 km) (Miller 1995; Ricca et al. 2012) than ice crossings. Unlike in the Canadian Arctic Archipelago, the loss of sea ice in Kotzebue Sound would not precipitate a functional loss of habitat because Caribou can and do migrate around Kotzebue Sound (Miller et al. 2005; this study). However, I posit that this potential change could have an impact on the number of Caribou that spend the summer on the Seward Peninsula in the future. Indeed, one GPS-collared cow that overwintered on the Seward Peninsula began to trek north in May 2012. She reached Kotzebue Sound near the mouth of the Nugnugaluktuk River on 23 May 2012 and approached Kotzebue Sound again on 27 May near



the mouth of the Goodhope River (Figure 1). Encountering ice conditions that were poor (dark areas in Figure 1), she started migrating east around Kotzebue Sound. After only a brief eastward movement, she doubled back the way she had come and was on the Seward Peninsula during the calving period and remained there for the duration of the summer. During a reconnaissance flight in July 2012, I was unable to determine whether she had a calf, as she was in a very tightly aggregated group of 300 that had about 30 calves. The ecological, nutritional and demographic impacts of summering on the Seward Peninsula on caribou are unclear at this time, however the region supported over 100,000 reindeer (*Rangifer tarandus*) less century ago (Stern et al. 1980).

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