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RESEARCH NOTE

Polar bear depredation of a thick-billed murre fledgling in open water at Prince Leopold Island, Nunavut

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Abstract

Sea-ice distribution and duration are declining across the circumpolar range of the polar bear (*Ursus maritimus*), resulting in a reduced access to ice-obligate seals, its primary prey. Consequently, polar bears may have increased reliance on alternative food sources in the future. Foraging on land is well documented but foraging in open water is less understood. We report the successful depredation of a thick-billed murre (*Uria lomvia*) in open water near Prince Leopold Island, Nunavut, and discuss implications for understanding the behavioural plasticity of polar bears and their opportunistic foraging patterns.

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Introduction

Polar bears (*Ursus maritimus*) feed primarily on ringed seals (*Pusa hispida*) and bearded seals (*Erignathus barbatus*) when Arctic and Subarctic waters are ice covered (Stirling & Archibald 1977; Smith 1980). In those areas of the Canadian Arctic where the ice melts completely each year in summer, that is, the seasonal sea-ice ecoregion (Amstrup et al. 2008), polar bears are forced ashore for many months during which they largely live off stored fat reserves. The ice-free season for polar bear subpopulations in the seasonal ice ecoregion—Western Hudson Bay, Southern Hudson Bay, Foxe Basin, Baffin Bay and Davis Strait (Fig. 1)—increased by 6.6–16.6 days/decade between 1979 and 2014 (Stern & Laidre 2016). Although body condition and abundance of polar bears are declining in some subpopulations in the seasonal sea-ice ecoregion (Lunn et al. 2016; Obbard et al. 2016; Obbard et al. 2018), correlated with observed reduction in sea-ice duration and presumed access to seals, polar bears are expected to persist into the next century in the Canadian archipelagic ecoregion subpopulations of M'Clintock Channel, Gulf of Boothia, Lancaster Sound, Viscount Melville and Norwegian Bay (Fig. 1) in the face of loss of sea ice elsewhere (Amstrup et al. 2008). Nevertheless, the length of the ice-free season in these areas increased by 5.5–16.2 days/decade between 1979 and 2014 (Stern & Laidre 2016). Climate warming is already changing some regions of the eastern Canadian Arctic from a multi-year ice environment to an annual ice environment (Laidre et al. 2020). This will likely reduce hunting opportunities for polar bears in some subpopulations and increase pressure on them to exploit alternative food sources.

It has long been recognized that polar bears opportunistically exploit a wide variety of food sources, ranging from marine algae and grasses to birds (primarily Anatidae) while on land during the ice-free season (Russell 1975). Recent studies have further emphasized the potential importance of terrestrial food sources for polar bears that are on land during the ice-free season (Gormezano & Rockwell 2013, 2015). Recently, greatly increased depredation pressure by polar bears on bird eggs and young (Table 1) was explained as a response to a shortening of the ice-covered season, when bears have access to seals (Stirling & Parkinson 2006; Stern & Laidre 2016).

Prince Leopold Island Migratory Bird Sanctuary is in Lancaster Sound in the eastern Canadian Arctic, approximately 13 km off the north-eastern tip of Cape Clarence, Somerset Island, in Nunavut. The area lies within the recently created Tallurutiup Imanga National Marine Conservation Area (Parks Canada 2019). This sanctuary is one of the most important multi-species seabird colonies in the Canadian Arctic as it supports large numbers of nesting thick-billed murres (*Uria lomvia*), northern fulmars (*Fulmarus glacialis*), black-legged kittiwakes

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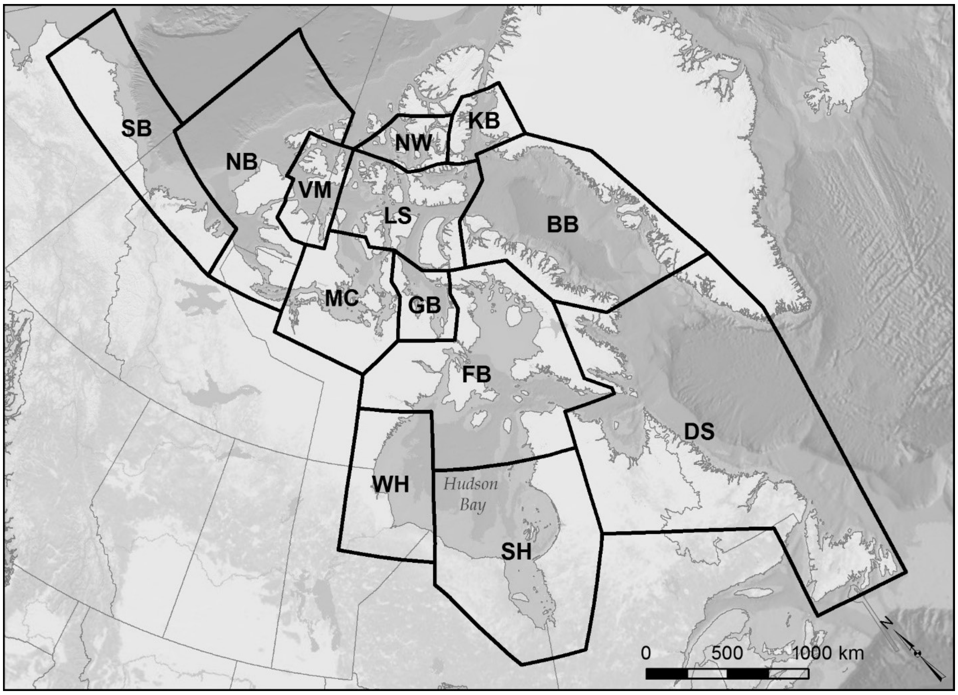

Fig. 1 Recognized boundaries of Canadian polar bear subpopulations: South Beaufort (SB), North Beaufort (NB), Viscount Melville (VM), Norwegian Bay (NW), Lancaster Sound (LS), M'Clintock Channel (MC), Gulf of Boothia (GB), Baffin Bay (BB), Davis Strait (DS), Foxe Basin (FB), Western Hudson Bay (WH) and Southern Hudson Bay (SH) (see Lunn et al. (2010) for more information on Canadian subpopulations).

Table 1 Examples of polar bear depredation of birds.

Species	Eggs	Young	Adults
Canada goose (*Branta canadensis*)	Smith & Hill 1996		
Snow goose (*Chen caerulescens*)	Rockwell & Gormezano 2009; Smith et al. 2010		
Pink-footed goose (*Anser brachyrhynchus*)	Prop et al. 2013		
Barnacle goose (*Branta leucopsis*)	Prop et al. 2015		Stempniewicz 2006[a]
Dovekie (*Alle alle*)	Stempniewicz 1993	Stempniewicz 1993	Stempniewicz 1993
Thick-billed murre (*Uria lomvia*)	Smith et al. 2010	Smith et al. 2010	
Black guillemot (*Cepphus grylle*)	Bourque et al. 2020	Bourque et al. 2020	Stempniewicz et al. 2014
Common eider (*Somateria mollissima*)	Iverson et al. 2014; Prop et al. 2015		
Glaucous gull (*Larus hyperboreus*)	Prop et al. 2015	Prop et al. 2015	
Arctic tern (*Sterna paradisia*)		Stempniewicz et al. 2014	

[a]Attempted depredation.

(*Rissa tridactyla*) and black guillemots (*Cepphus grylle mandtii)* that nest on its 250-m high cliffs. It is estimated that 6% of Canada's thick-billed murre population, approximately 100 000 pairs of birds, nest on the sea cliffs of Prince Leopold Island (Environment and Climate Change Canada 2019). At the end of the breeding season, accompanied by their fathers, large numbers of flightless juvenile murres swim from Prince Leopold Island through Lancaster Sound and move southwards, to winter off the west Greenland coast and in the Labrador Sea (Environment and Climate Change Canada 2019).

Following a 32-day incubation period, thick-billed murre chicks at Prince Leopold Island leave the nest ledge at 18–24 days after hatching (Gaston & Hipfner 2020). Departure from the nest usually involves interaction between the chick giving the 'departure' call and the adult male (father) giving the 'chick-contact call,' which apparently encourages the chick to jump from the nest ledge (Gaston & Hipfner 2020). Adults are seemingly able to identify their own chicks by their vocalizations prior to the nest departure (Lefevre et al. 1998). Chicks landing on the beach below nesting cliffs, rather than on the sea, may be injured or killed and subsequently scavenged, although most chicks land safely in the water and re-unite with the male parent (Gaston & Hipfner 2020). Here, we describe the successful depredation of a juvenile thick-billed murre in deep open water by a subadult male polar bear at Prince Leopold Island, Nunavut.

On 16 August 2017, at approximately 10:00, eight Zodiac® inflatable boats from the small expedition ship *Akademik Sergey Vavilov,* operated on behalf of One Ocean Expeditions and Worldwide Quest, approached Prince Leopold Island and began to cruise along the coast about 200 m offshore. At about 11:15, a subadult male polar bear was observed lying on the shingle beach at the base of the cliff used as a nesting site by the large colony of thick-billed murres. At about 11:30, the bear arose and slowly walked about 200 m to the south end of the beach and entered the water. There were many pairs of thick-billed murre fledglings and fathers floating in the near-shore area. The bear then swam slowly to the south, just offshore. At about 11:45, the bear swam behind a small ice floe, rose partially out of the water and fed on the remains of a dead bird, possibly a glaucous gull (*Larus hyperboreus*). The bear then continued to swim slowly in a southerly direction towards a number of thick-billed murres. As the bear approached an adult male and juvenile thick-billed murre pair, the parent dove out of sight while the juvenile remained on the surface. The juvenile then dove and at about 12:00 surfaced within about 3 m of the bear (Fig. 2a). The bear then changed direction and approached the murre, which dove a second time. Two seconds later the bear dove (Fig. 2b), and after an additional five seconds re-emerged with the juvenile murre in its mouth (Fig. 2c). The bear took the bird under water twice after capturing it, perhaps to drown it. The bear then manipulated the murre with its front paws and proceeded to feed on the recently dead murre while floating in the water (Fig. 2d). The sequence was captured in still photographs (Fig. 2) and in a supplementary video.

Discussion

Given that both the distribution and duration of Arctic sea ice are expected to decrease further in the future due to climate warming (Stroeve & Notz 2018; Crawford et al. 2021), polar bears in this region of the eastern Canadian Arctic and elsewhere may become more reliant on alternative food sources. Although such alternative foods are unlikely to compensate for the loss of seals (Rode et al. 2015; Dey et al. 2017), they may play some role in slowing declines in body condition and reducing the negative effects of a longer fasting period on survival and reproductive success (Molnár et al. 2020).

Adult thick-billed murres are depredated by Arctic foxes (*Alopex lagopus*) and by gyrfalcons (*Falco rusticolus*), and eggs and chicks are depredated by Arctic foxes, glaucous gulls, Iceland gulls (*Larus glaucoides*) and common ravens (*Corvus corax*) (Donaldson et al. 1995). Polar bears are not typically considered to be predators of thick-billed murre adults or chicks. However, at Coats Island, in northern Hudson Bay, a polar bear was seen to dive under a raft of thick-billed murres in mid-August 1991 and to surface with a single murre in its mouth, which it took to a nearby island to consume (Donaldson et al. 1995). In July 1992, a female polar bear accompanied by two yearling cubs approached the Coats Island colony on the land-fast ice. Subsequently, she was seen to deliver a murre to the cubs; however, it was unknown whether she had killed or scavenged the murre (Donaldson et al. 1995).

Adult thick-billed murres are highly manoeuvrable when swimming under water (Gaston & Hipfner 2020). Based on time–depth recorders, they are capable of reaching a speed of 3.5 m s^{-1} under water with an average rate of descent of 0.94 m s^{-1} and an average ascent of 0.86 m s^{-1} (Croll et al. 1992). When foraging, thick-billed murres make numerous shallow short-duration dives (Croll et al. 1992). The maximum dive depth recorded was 210 m; however, dives averaged 18 m depth and 55 s in duration and most time at depth was spent between 21 and 40 m (Croll et al. 1992). It would seem that capturing an adult thick-billed murre underwater would be a challenge for a polar bear because adult murres are adept swimmers. However, it is likely that juvenile murres are less adept swimmers and divers, especially if they only recently jumped from the nesting cliff, as was the likely case here, which could explain why the polar bear was able to capture the bird so easily.

There is additional evidence that polar bears can catch avian prey in open water. In a study of polar bear scats from islands in James Bay, 34% contained remains of long-tailed duck (*Clangula hyemalis*), and a further 9% contained remains of common eider (Russell 1975). Russell (1975: 123) concluded that "some bears have apparently learned to capture sea ducks on the open sea, probably during the moult." The sheaths of moulting feathers were found in 50% of scats, which contained the remains of birds (Russell 1975).

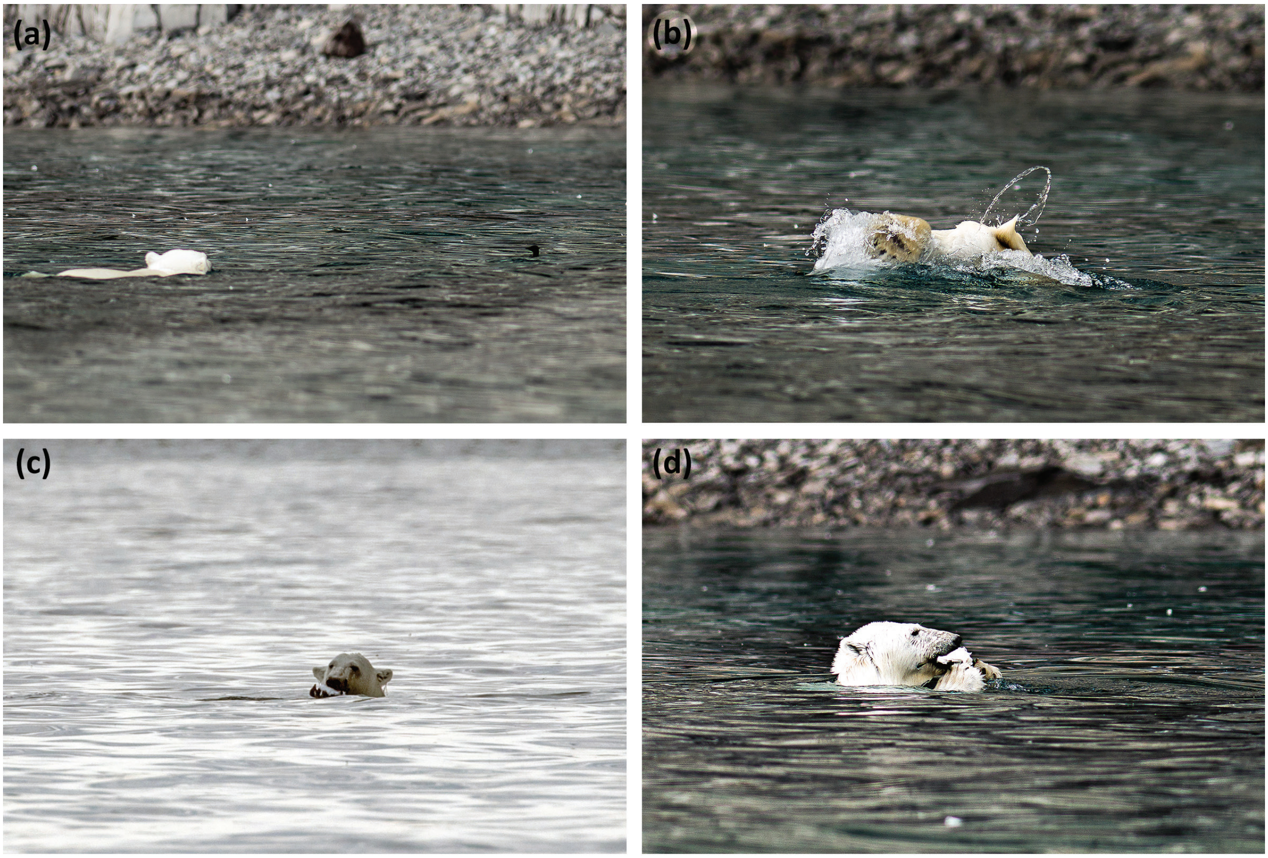

Fig. 2 (a) Juvenile thick-billed murre (*Uria lomvia*) surfaces close to subadult male polar bear (*Ursus maritimus*). (b) The polar bear dives in pursuit of the bird. (c) The polar bear surfaces with the murre and (d) manipulates its prey with its forepaws while consuming it (photographs by B. Wise, except for [c], by R. Pimenta.).

The maximum reported dive time for a polar bear was recorded during an aquatic stalk of three bearded seals when the bear dove for 3 min 10 s and swam about 50 m without surfacing (Stirling & van Meurs 2015). Shorter dives of 34–72 s were recorded when bears were feeding on kelp (*Laminaria* spp.; Stirling 1974), and of 3–29 s when a polar bear was catching Arctic charr (*Salvelinus alpinus*) and fourhorn sculpin (*Myoxocephalus quadricornis*; Dyck & Romberg 2007). The dive length of our observation (five seconds) was similar to those of a bear attempting to catch Arctic charr in shallow water, although the water offshore from Prince Leopold Island is much deeper.

Capturing and eating a juvenile thick-billed murre may be a small energetic reward for an animal as large as a polar bear; however, it seemed that the bear exerted little effort to capture the murre, implying that there was a net gain to the bear's annual energy budget. Arctic charr are active swimmers (Beamish 1980), as are thick-billed murres, which suggests that polar bears, at least young bears, are agile under water at least for short periods in order to catch such prey. We do not know whether the bear fed on other murres, but about 100 000 pairs nest on the cliffs of Prince Leopold Island (Environment and Climate Change Canada 2019), so juvenile murres are abundant in the water once they jump from the nest—a substantial potential food source. Perhaps, the bear in our observation was attracted to the beach at the cliff base, where it might expect to find dead fledglings (Gaston & Hipfner 2020). In a similar situation, polar bears were observed searching for dead dovekies at the base of a cliff in Franz Josef Land (Stempniewicz 1993).

This observation adds to our understanding of the ecological plasticity of polar bears and of the opportunistic foraging behaviour of polar bears even where there is only a small energetic reward.

Disclosure statement

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