WESTERN BIRDS

Volume 44, Number 3, 2013

SEABIRDS NEW TO THE EASTERN CHUKCHI AND BEAUFORT SEAS, ALASKA: RESPONSE TO A CHANGING CLIMATE?

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ABSTRACT: Seabirds at high latitudes may respond to climate change in a variety of ways, including range contractions or expansions and/or seasonal or annual shifts in distribution. Since 2006, three species of seabirds have been reported in the eastern Chukchi Sea for the first time: the Short-tailed Albatross (*Phoebastria albatrus*), Northern Gannet (*Morus bassanus*), and Rhinoceros Auklet (*Cerorhinca monocerata*). Sometime prior to 2006, the Ancient Murrelet (*Synthliboramphus antiquus*) expanded its usual maritime range north into the eastern Chukchi and now has reached the Beaufort Sea. The gannet appears to have entered the Pacific via the Northwest Passage, whereas the other three species have moved north from the Pacific. Whales, other seabirds, and diatoms have been recorded moving between the Atlantic and Pacific via the Northwest Passage in the past 15 years as sea ice has retreated and the passage has opened. Because of broad-scale changes to the Chukchi ecosystem and because of increased sampling of the region, we anticipate that additional seabirds will be recorded in the Chukchi and Beaufort seas from the North Pacific and possibly the North Atlantic.

The Pacific arctic marine region is undergoing rapid physical and biological change as a result of climate change (Grebmeier et al. 2006a, b, Overland

and Wang 2011, Sigler et al. 2011, Grebmeier 2012). Climate-change models suggest that the increases in air and water temperatures are greatest at high latitudes (IPCC 2007), influencing biological change at multiple trophic levels. For example, the part of the northern Bering Sea south of St. Lawrence Island has changed from an arctic to a subarctic environment in recent years: the cover of sea ice has decreased, blooms of phytoplankton within the ice are diminished, and the abundance and biomass of communities of benthic organisms have been reduced, leading to reduced use by benthic-feeding marine mammals and an increase in populations of pelagic fishes in that region (Grebmeier et al. 2006b). Because of warming and the northward advection of water from the Bering Sea, boreal and subarctic benthic invertebrates also have expanded their distributions northward into the Chukchi Sea, as have the gray whales (*Eschrichtius robustus*) that feed on them (Grebmeier 2012). Climate change also is expected to alter distributions of species such as ice-pupping seals and marine fishes in the Pacific Arctic (Sigler et al. 2011), and there is evidence that, in the Okhotsk Sea (eastern Russia), the productivity of both planktivorous and piscivorous seabirds is changing with climate-associated changes in the marine ecosystem (Kitaysky and Golubova 2000).

Seabirds, which are highly mobile, may be expected to be prominent bellwethers of change in arctic marine ecosystems. One facet of changes in these ecosystems is range contractions or expansions and/or seasonal or annual shifts in seabirds' distributions. In this paper, we detail recent records of species new to the marine avifauna of the Chukchi and Beaufort seas, species that may be responding to climate change. Here, we report and interpret these observations with respect to changing environmental conditions in arctic Alaska.

RECORDS

Short-tailed Albatross

A Short-tailed Albatross was observed by Watts and photographed by S. Nelson (Denver, CO) in the northeastern Chukchi Sea at 71.3°N, 163.22°W on 6 August 2012. What presumably was the same bird was seen and photographed by C. Pham (U.S. Fish and Wildlife Service [USFWS]) nearly 200 km to the southwest at 70.03° N, 166.99° W on 17 August 2012. It was identifiable as a juvenile by its plumage that was evenly dark gray over the entire body and wings; the large bubblegum-pink beak also is clearly visible in the photographs. This is the first record of this species in the eastern, and probably the entire, Chukchi Sea. Photos documenting both sightings have been deposited with the Alaska Checklist Committee at the University of Alaska Museum.

The Short-tailed Albatross is a subarctic–boreal Pacific species known to occur in the Bering Sea since the 19th century. For example, Nelson (1887) "found them common about Bering Straits in summer," seeing "a number" near Big and Little Diomede islands in 1881. However, he did not see any albatrosses during his subsequent cruise through nearly the entire Chukchi Sea, including visits to Kotzebue Sound and Barrow in Alaska, North Cape

(now Cape Schmidt) in Siberia, and Wrangel Island from July to September 1881. Although this species was still abundant at that time, it was not seen north of Bering Strait, suggesting that it somehow was limited in its northward distribution in those days., During an extensive cruise throughout the Chukchi Sea in the late 1920s, Jacques (1930) did not record the Short-tailed Albatross; although its numbers were declining at that time, they still were in the thousands (Hasegawa and DeGange 1982). Likewise, surveys in the eastern Chukchi Sea in the 1960s (Swartz 1967) and extensive surveys there in the 1970s and 1980s (Watson and Divoky 1972, Divoky 1987) found none. Finally, in a compilation of 2463 incidental sightings of the Short-tailed Albatross from 1988 to 2004, Piatt et al. (2006) recorded only two even as far north as the Chirikov Basin (between St. Lawrence Island and Bering Strait) but suggested that the Anadyr Current, flowing north, could attract shelf-edge specialists such as this albatross to the region. On the other hand, Portenko (1972) assumed that eight albatrosses observed by M. M. Sleptsov off Cape Serdtse-Kamen (northern Chukchi Peninsula) on 4 September 1939 were Short-tailed, although the species by then was on the verge of extinction (Murie 1959, Hasegawa and DeGange 1982). Therefore, we believe it more probable that these birds instead were Laysan Albatrosses (*P. immutabilis*), a species that Murie (1959) realized in the 1930s he was mistaking for the Short-tailed in the Aleutian Islands.

Northern Gannet

Rose and M. Akpik (Wainwright, AK) identified a Northern Gannet at 71.85° N, 161.80° W, 190 km west-northwest of Barrow, on 16 August 2010, but the observation was brief and no photos were taken. The mostly white plumage with a golden wash on the head and black distal parts of the wings indicated that the bird was an adult. This is the first report of this species in the Pacific sector of the Arctic Ocean. On the basis of this observation and one of presumably the same bird the next day off Barrow (*North American Birds* 65:143), the Alaska Checklist Committee added the species to the Alaska unsubstantiated list in 2010 (Gibson et al. 2013). Because the Northwest Passage was not open in the intervening period (see below), we assume that an adult Northern Gannet found 21 months later at Southeast Farallon Island on 25 April 2012 (*North American Birds* 66:551, *Western Birds* 44[1]: cover) was either the same bird or another that had arrived the same season and subsequently reached California waters via Bering Strait, Bering Sea, and the eastern North Pacific.

Ancient Murrelet

The Ancient Murrelet first was recorded in the Chukchi Sea on 14 September 1976, with one bird seen just north of Bering Strait (North Pacific Pelagic Seabird Database, U.S. Geological Survey, Anchorage, AK; see Kessel 1989). Kessel (1989) also mentioned Day's numerous records in and near Bering Strait in late September 1985 and reported two birds near Cape Lisburne on 26 August 1987. The first record of substantial numbers is by Fenneman, who saw a total of ~50–100 birds scattered in small groups of two to six throughout the eastern Chukchi Sea from the last week of

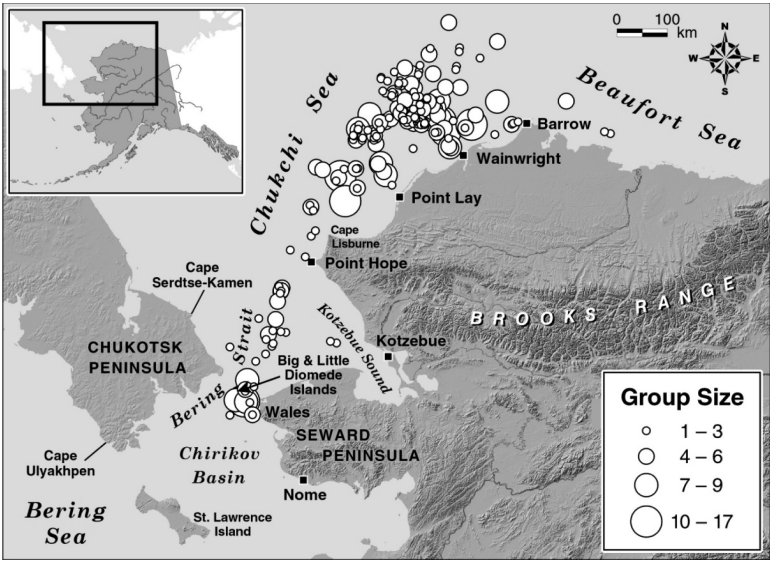

Figure 1. Locations of Ancient Murrelets in the Chukchi and Beaufort seas of Alaska, 1976–2012. Size of circle indicates number recorded during 10-minute transects.

September to mid-October 2006. Subsequently, in 4 of the last 6 years, ornithologists with ABR, Inc., and the USFWS recorded hundreds of Ancient Murrelets in the Chukchi (Figure 1, Table 1). Photos documenting one of the sightings have been deposited at the University of Alaska Museum with the Alaska Checklist Committee.

In addition to these records from the Chukchi Sea, Plissner and Sanzenbacher saw two at 71.15° N, 152.59° W, and a group of three at 71.12° N, 152.28° W, ~80 km northwest of Cape Halkett, in the western Beaufort Sea, on 21 September 2010. Also in the Beaufort, A. Bankert (USFWS) recorded a group of four at 71.71° N, 154.66° W, ~80 km northeast of Bar-

Table 1 Summary of Records of the Ancient Murrelet in the Chukchi Sea, 2006–2012

Year	Total number of birds	Range of dates
2006	~50–100	late September to mid-October
2007	68	5 September–6 October
2008	0	
2009	0	
2010	289	31 August–8 October
2011	110	25 August–24 October
2012	198	10 August–22 October

row, on 28 August 2012. In addition, J. C. George (Department of Wildlife Management, North Slope Borough, Barrow, AK, in litt.) saw "a few pairs" of Ancient Murrelets ~25 km north of Cooper Island at 71.42° N, 155.60° W on 10 September 2012; neither he nor the Iñupiat whalers he was with had ever seen them before. Photos documenting one of the Beaufort sightings have also been deposited at the University of Alaska Museum. These observations represent the first records of this species for the Beaufort Sea.

The Ancient Murrelet is a boreal Pacific species that has been known from the northern Bering Sea only since 1976; earlier workers in the region did not record it, in spite of many extensive surveys (Nelson 1887, Jacques 1930, Swartz 1967, Portenko 1973, Watson and Divoky 1972, Divoky 1987). Its nearest breeding colonies are located in the Aleutian Islands, ~1300 km south of Bering Strait (Gibson and Byrd 2007), except for one record of probable breeding on the Pribilofs (Lehman 2005). In September 1985, substantial numbers occurred near St. Lawrence Island and as far north as Bering Strait, where birds were seen flying north into the southern Chukchi (Kessel 1989, Day 1992). The species was not recorded in the Chukchi Sea again until 2006, however, suggesting that whatever environmental conditions may have been limiting its northward distribution in the intervening period had disappeared or been ameliorated. The Chukchi Sea was surveyed little during the intervening period, but seabird biologists working in the northern Bering during this period did not record the Ancient Murrelet either. However, land-based observers in the northern Bering Sea, at Gambell, St. Lawrence Island, recorded small numbers each fall from 2001 to 2007, then a substantial increase to over 100 annually from 2008 through 2012 (Lehman 2005, P. E. Lehman in litt.). The Ancient Murrelet has been noted in the Chukchi in 5 of the 7 years from 2006 to 2012, and sometimes in substantial numbers, suggesting the exploitation of new postbreeding habitat and/or a true range expansion. In addition, the recent records from the Beaufort Sea imply a further northward/eastward expansion of the range. Currently, the Ancient Murrelet is rare to uncommon in the eastern Chukchi Sea between early August and late October and casual to very rare in the Beaufort Sea from late August to late September.

Rhinoceros Auklet

Fenneman identified a single Rhinoceros Auklet ~30 km west-northwest of Kotzebue in Kotzebue Sound, southeastern Chukchi Sea, in August 2006 (exact date unavailable). He saw the bird at close range for several minutes but was unable to photograph it. On the basis of the dull plumage and the dull bill with no horn evident, it was either a fresh juvenile or a non- or post-breeder. It differed from a Tufted Puffin in that it had a long, sloping forehead and lacked any sign of the puffin's facial pattern, which would have been evident in a bird at least 1 year old at this time. This is the first report of this species in the Chukchi Sea.

The Rhinoceros Auklet is an amphipacific species, breeding on both the eastern and western coasts of the North Pacific Ocean with only a few small colonies along the intervening north coast (AOU 1998, Gibson and Byrd 2007). The records nearest Kotzebue Sound are of one bird recorded at Cape

Ulyakhpen (just west of Sireniki, Chukotka, Russia), in the northwestern Bering Sea, on 11 July 1988 (Konyukhov et al. 1998) and one seen at western St. Lawrence Island on 28 August 2008 (*North American Birds* 63:140).

RESPONSE TO A CHANGING ENVIRONMENT

The Northern Gannet presumably was able to move west into the Chukchi Sea as climate change opened the Northwest Passage, greatly reducing the extent of summer sea ice in the Arctic Ocean in recent years. The passage was open enough for unaided travel by ships in 1998, 2007, 2010, and 2012 (Corbyn 2007; http://en.wikipedia.org/wiki/Northwest_Passage, accessed 17 April 2013; http://earthobservatory.nasa.gov/IOTD/view.php?id=78797, accessed 17 April 2013), suggesting that the gannet may be the vanguard of new species arriving from the Atlantic. During the past 15 years, movements presumed to be through the Northwest Passage also have been recorded for Bowhead Whales (*Balaena mysticetus*) from Alaska and Greenland traveling both directions in 2010 (Heide-Jørgensen et al. 2012); Gray Whales seen in the Mediterranean Sea in 2011 (http://en.wikipedia.org/wiki/Northwest_Passage; accessed 15 March 2013) and in Namibia in 2013 (www.guardian.co.uk/environment/blog/2013/may/14/grey-whale-walvis-bay-namibia#; accessed 10 June 2013); and a North Pacific diatom (*Neodenticula seminae*) recorded in the northwestern North Atlantic in 1998—the first record in the North Atlantic in 800,000 years (Corbyn 2007, Reid et al. 2007). In addition, a juvenile Great Black-backed Gull (*Larus marinus*) photographed at Barrow 8–10 October 2010 presumably came through the Northwest Passage (*North American Birds* 65:143), and the proportionately large bill of an adult Atlantic Puffin (*Fratercula arctica*) on 20 June 2008 in the Okhotsk Sea, eastern Russia, pointed to subspecies *F. a. naumanni*, which occurs from Greenland to Svalbard, so Kharitonov (2009) inferred the bird to have arrived in the Russian Far East via the Northwest Passage. Hence the gannet we report might not have been the first seabird to transit the Northwest Passage in recent years. Kharitonov (2009) cited records of other Atlantic alcids in the Russian Far East but suggested that they instead reached the Pacific via the Northeast Passage (i.e., across the ocean north of Asia), which also has been open recently.

There are several reasons why we believe that these birds arrived via the Northwest Passage rather than the Northeast Passage (also called the Northeast Sea Route) across northern Russia. First, the straight-line distance along 73° N from central Davis Strait (between Canada and Greenland) to the central Chukchi Sea is only ~3800 km, whereas the distance along 73° N from the northern tip of Norway to the central Chukchi Sea is ~5900 km—over 50% longer. Second, in Europe, wandering Northern Gannets wander west, not east, from western Russia (Cramp and Simmons 1980); likewise, those in eastern North America wander west and have been recorded across the continent to central Canada and even Victoria Island (AOU 1998), which is not far from the Canadian sector of the Beaufort Sea and abuts the Northwest Passage. Third, if correct, the identification of the Atlantic Puffin to the subspecies from the northernmost Atlantic implies that it would have a much shorter journey to the Chukchi Sea and North Pacific via the Northwest Passage than it would via the

Northeast Passage. Finally, in Europe, Great Black-backed Gulls also wander west and south from western Russia (Cramp and Simmons1983), whereas in eastern North America, nonbreeding Great Black-backed Gulls occasionally summer as far north and west as Baffin Bay, Hudson Bay, and the Canadian Prairie provinces (AOU 1998), all of which are much closer to the Chukchi Sea than is their nearest breeding site in the northwestern corner of Russia.

The expansion of the Ancient Murrelet's range into the Chukchi Sea, and even the Beaufort Sea, appears to represent post-breeding dispersal. In the Aleutian Islands, which are the species' nearest breeding grounds, the peak of fledging of chicks is the second week of July, with all fledging completed by the end of July (Byrd and Day 1986). The range of records from 10 August to 24 October, most of which are from late August to mid-October, is ~1–3 months after chicks have fledged. Hence it is not yet clear whether these records are of nonbreeding adults, postbreeding adults, and/or juveniles; many of the sightings at Gambell in late August and early September, at least, have been of adults in alternate plumage (P. E. Lehman in litt.).

The Short-tailed Albatross, Ancient Murrelet, and Rhinoceros Auklet all are North Pacific species that reached the Chukchi Sea presumably in response to lessened ice and warmer temperatures. The composition of the seabirds of the Chukchi Sea has changed dramatically in the past 37 years, reflecting the effects of climate change on the community as a whole: formerly composed primarily of piscivorous seabirds and benthic-feeding seaducks, the community has changed to one composed primarily of planktivorous seabirds (Gall et al., unpubl. data). (Surprisingly in the face of this ecological change, of these three new species from farther south. only the Ancient Murrelet is a planktivore.) These changes to the structure of the seabird community have been accompanied by dramatic changes in the timing of sea ice and the reduction of its extent, and the abundance and/or biomass of zooplankton have increased because of the warmer temperatures (Lane et al. 2008, Matsuno et al. 2011). Because of this broad-scale change to the Chukchi ecosystem and because of increased study at sea, we may expect that additional species of seabirds will be recorded in the Chukchi and Beaufort seas from the North Pacific and possibly the North Atlantic.

ACKNOWLEDGMENTS

The research by ABR, Inc., was funded by ConocoPhillips Company, Shell Exploration and Production Company, and Statoil USA E&P, Inc., as part of the Chukchi Sea Environmental Studies Program (CSESP). Research by the USFWS was funded in part by the North Pacific Research Board (projects 637 and B64) and the Bureau of Ocean Energy Management (Interagency Agreement M10PG00050). The conclusions do not necessarily represent the views of the funding companies or agencies. We particularly thank scientists Caryn Rea (ConocoPhillips), Michael Macrander (Shell), Steinar Eldøy (Statoil), and Sheyna Wisdom (Fairweather Science) for support and feedback during all phases of the CSESP. We also thank personnel of ABR, Inc., for collecting data from 2008 to 2012, Elizabeth Labunski (USFWS) for collecting and processing data, and the many contributors to the North Pacific Pelagic Seabird Database over the past four decades. We also thank J. Craighead George of the North Slope Borough for providing the unpublished photos of Ancient Murrelets off of Barrow. The manuscript was improved greatly by the reviews of D. D. Gibson, S. C. Heinl, and M. L. Kissling.

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Accepted 18 June 2013