

A MASS POST-BREEDING MOVEMENT OF CRESTED AUKLETS *AETHIA CRISTATELLA* IN THE CHUKCHI SEA

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SUMMARY

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The Crested Auklet *Aethia cristatella* is a highly pelagic alcid for which non-breeding movements and distribution remain poorly understood. On 18 August 2013, in the vicinity of Cape Kekurnyi at the eastern end of the Chukotski Peninsula (66°9.2'N, 169°43.6'W), we observed an uninterrupted passage of an estimated 10 560 000 Crested Auklets over a period of four hours. At the peak of the movement, birds were passing at a rate exceeding 1 000 individuals per second. While the northward movement of Crested Auklets into the Chukchi Sea is well known, our observations indicate that birds from multiple breeding colonies congregate during the post-breeding season and travel in huge numbers to locally productive foraging areas. It also seems likely either that the global population of Crested Auklets has been previously underestimated, or that recent population increases have gone undetected.

Key words: Chukchi Sea, Chukotski Peninsula, Crested Auklet, post-breeding movement, world population

INTRODUCTION

In August and September of 2013, the ship *Professor Khromov* was engaged under private charter in an exploration of the northeastern coast of Chukotka. On the morning of 18 August, while approaching the village of Uelen (66°9.6'N, 169°48.5'W), we noted large rafts of Crested Auklets *Aethia cristatella* actively feeding in the shallow waters off Uelen Spit. We estimated that 450 000 individuals were present in an area of about 6 km² just offshore the village (Fig. 1). As we neared Cape Kekurnyi, we observed a clearly defined band of auklets flying in a steady stream about 1 m above the water with little or no deviation in course or speed. The birds were flying on a heading of 310°N into a mild cross wind of 5 knots (9.26 km/h) from 220°. The birds we observed flying were restricted to a tight band roughly 400 m wide and were flying approximately 2 km north of the main concentration of feeding birds in the bay. The rate at which the flying auklets were passing varied, but the birds formed one continuous, uninterrupted flock throughout the entire observation period (4 h 6 min). Although over the course of our observations a small number of feeding birds appeared to join the migrating birds and vice versa, there was a very clear distinction between the two groups and an obvious gap of open water between them.

METHODS AND RESULTS

We estimated the size of the flock of feeding Crested Auklets by averaging multiple counts of birds observed from the approximate center of the flock in a known field of view through binoculars, and then multiplying to obtain an estimate for a full 360°. Both authors independently made over a dozen counts each over an hour-long period. Estimates ranged from 360 000 to 500 000 individuals, and multiple counts averaged 450 000 individuals for the hour.

Estimates of the number of flying birds were made both visually and by extrapolating from high-resolution photographs obtained

from the bridge and main deck of the ship. From our position at anchor approximately 1.5 km offshore of Uelen, virtually all of the migrating auklets were visible in one vertical field of view. Both visual observations and photographs indicated an average rate of passage of between 300 and 1 000 birds per second. Observations were made continuously between 09h54 and 12h34 and for several minutes every quarter of an hour between 12h34 and 14h00 (Table 1). Observations were made by both authors, and birds were counted by hundreds or thousands as conditions dictated. Since the number of birds precluded any attempt to obtain an ongoing tally, the purpose of our counts was to determine an accurate rate of passage throughout the observation period. The rate of passage

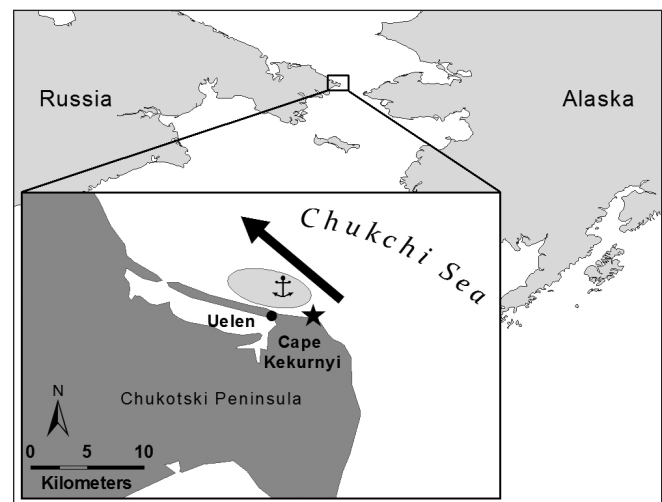


Fig. 1. Overview of Cape Kekurnyi and vicinity. Anchor indicates approximate location of ship during observations; shaded oval represents approximate extent of feeding auklets; black arrow indicates approximate relative position and flight path of flying auklets.

(in birds per second) was estimated at least once every few minutes between 09h54 and 12h34 and averaged over the observation period. Between 12h34 and 14h00 estimates were made over a few minutes every quarter hour and then averaged.

A series of photographs was obtained throughout the observation period using a Canon 40D DSLR with a Canon 100-400 mm telephoto zoom lens. Images were recorded in RAW format and imported into Adobe Photoshop Lightroom (Adobe Systems, San Jose, CA), where they were converted to black and white, cropped, and enhanced to maximize contrast and sharpness (Fig. 2). These images allowed us to count individual birds, and based on our observations of how long it took individual birds to cross a known field of view, we were then able to calculate the number of birds per second in each image.

Estimates obtained during visual observations were consistent with counts obtained from the enhanced photographs ($\pm\sim 20\%$ difference). The numbers presented in Table 1 represent estimates obtained by rounding down the average of all visual estimates and counts obtained from photographs for each observation period. We cannot account for birds passing before or after our observation period, and we have no indication as to how many additional birds may have been involved in this movement.

TABLE 1
Estimated numbers of Crested Auklets
recorded on 18 August 2013

Observation start	Observation end	Rate of passage (birds/s)	Total estimated birds (000 000)
09:54	11:24	1 000	5.4
11:24	12:34	800	3.36
12:34	12:55	500	0.63
12:55	14:00	300	1.17
Total	4:06		10.56

DISCUSSION

Crested Auklets breed across a wide range in the north Pacific, primarily on rocky islands in the Bering Sea. No breeding colonies are known north of the Bering Strait. Their abundance and density at breeding colonies, combined with their tendency to nest with other similar (and similarly abundant) congeners in crevices, make estimates of breeding populations at colony sites highly uncertain. Birds seen on the surface at colony sites may account for only 10%–25% of the actual total number of breeding birds (Jones 1998), and estimates of colonies based solely on unextrapolated numbers may be unrealistically low (Piatt *et al.* 1990). As a result, estimates of the size of the global population of Crested Auklets are highly imprecise, but contemporary assessments from both Alaska (Jones 1998, North Pacific Seabird Colony Database 2013) and Russia (Konyukhov & Bogoslovskaya 1998, Nettleship *et al.* 2000, Zubakin *et al.* 2010) agree on a figure of at least 6 000 000 breeding individuals, while del Hoyo *et al.* (1996) estimate 8 200 000 individuals. Of 101 Crested Auklet colonies surveyed across the range of the species, the largest known colonies contain a maximum of 1 000 000 individuals, e.g., 1 000 000 on Talan Island; 814 389 on Mt. Ivekan on St. Lawrence Island; 600 000 on Matykil' Island; and 360 000 at Sirius Point on Kiska Island (North Pacific Seabird Colony Database 2013). Although these data are presumed accurate, they reflect counts that in some cases are many decades old.

On the basis of our observation of over 10 000 000 birds in a single flock well north of the breeding colonies, during the time when nestlings are still being provisioned at northern colonies (Jones 1998), we suggest that the global population of the species may be severely underestimated. Even with the limitations of our observations, we are confident that our estimates are accurate to within $\pm\sim 20\%$ and account for at least 8 500 000 individuals.

It seems improbable that any significant colonies of such an obvious and gregarious species have been overlooked, and it follows that the discrepancy between our observations and current population

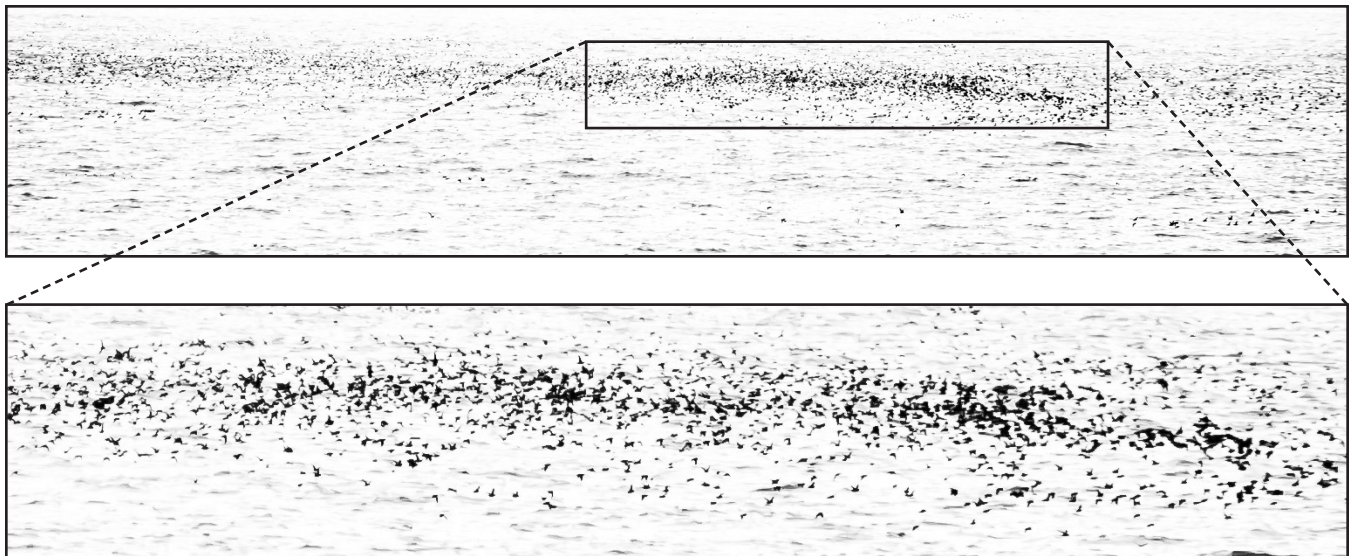


Fig. 2. An enhanced photograph of part of the continuous flock of Crested Auklets we observed (the lower image is magnified to show detail). This particular photograph shows 3 611 birds and represents approximately 4 s of observation; i.e., it would have taken a bird 4 s to cross the field of view depicted in the upper image.

estimates can be attributed to underestimates of colony sizes, or to an increase in the global population of this species that has gone undetected because of infrequent and incomplete surveys at a number of major colony sites. Population trends for Crested Auklets are difficult to track even at annually monitored sites, and the creation and degradation of the crevice habitats on which this species relies can influence local populations on a decadal scale (Gaston & Jones 1998, Byrd *et al.* 2005). Most Crested Auklet breeding colonies are on extremely remote rocky islands, visited only intermittently, and census efforts and accuracy vary greatly (Byrd *et al.* 2005; North Pacific Seabird Colony Database 2013). It is conceivable that current populations may have surpassed historical estimates. Similarly, a recent IUCN assessment by BirdLife International, which indicates that populations are suspected to be in decline owing to predation by invasive species, disturbance and pollution (BirdLife International 2014), is probably incorrect. Localized declines at some better-studied colonies probably belie an increase in the global population.

From an ecological perspective, our observations shed some light on the still poorly understood distribution and behavior of Crested Auklets outside of the breeding season. Crested Auklets are known to congregate in waters supporting high concentrations of their preferred prey, primarily euphausiid shrimp and large oceanic copepods (Hunt *et al.* 1998, Jones 1998, Piatt & Springer 2003). The area in which we made our observations, where the northward-flowing Anadyr Water is restricted and accelerated through the narrowest extent of the Bering Strait, has been identified as a hotspot used by planktivorous alcids in both the breeding and post-breeding seasons (Springer & Roseman 1985; Hunt *et al.* 1993, 1998). In August 2013, this particular area was roughly 2°C warmer than normal, and temperatures were even higher in the preceding month (NOAA 2014), a factor that may have contributed to unusually high local productivity. Previous records of large congregations of Crested Auklets away from major breeding areas indicate that breeding populations may move from depleted or only seasonally productive waters around large breeding colonies to richer foraging grounds elsewhere (Renner *et al.* 2008). Our observations indicate that such movements can occur *en masse*.

A mass-flocking strategy may be beneficial to birds that regularly encounter highly localized and/or ephemeral patches of superabundant resources (e.g. Hoffman *et al.* 1981). The 450 000 birds we observed foraging near Cape Kekurnyi certainly represent an extraordinary concentration of a single species, and local densities of zooplankton must have been very high. In fact, our attention was initially drawn to the area in which the auklets were foraging by a large aggregation of at least 300 Humpback Whales *Megaptera novaeangliae* within the same general area, also apparently feeding on zooplankton. The association between foraging whales and pursuit-diving seabirds is widely recognized (albeit poorly studied). The vast majority of both birds and whales that we observed were foraging within the 20 m depth contour extending out from shore, while the band of flying auklets was travelling considerably further out to sea. This reinforced our supposition that the feeding and flying birds constituted two fairly distinct groups of birds.

The *Professor Khromov* was also present in the same location near Cape Kekurnyi on two other days in 2013 (10 August and 1 September). Although the same approximate number of whales

was seen on both occasions, only a few thousand Crested Auklets were observed in each case, further indicating that the passage of Crested Auklets we observed on 18 August was a discrete movement of migrating birds.

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