SPRING MIGRATION OF SPECTACLED EIDERS AT CAPE ROMANZOF, ALASKA

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The Spectacled Eider, *Somateria fischeri*, was described for science from St. Michael, Alaska, over 150 years ago. Its nonbreeding range remained unknown until recently, however, when concentrations of molting and wintering eiders in the Bering and Chukchi seas were finally revealed by satellite telemetry (Petersen et al. 1995, 1999). Because most of the satellite transmitters used to date failed by late winter (Petersen et al. 1995), the areas used by Spectacled Eiders in the early spring just prior to breeding and the routes used by migrant eiders en route to their breeding grounds in the Yukon–Kuskokwim delta remain unknown. Specifically, it is not known whether spring migrants fly directly to the delta from the area occupied in late winter or from an undiscovered spring staging area.

Unlike virtually all other waterfowl species breeding in the central Yukon–Kuskokwim delta, Spectacled Eiders arrive in the spring from the north or northwest (Conover 1926, Dau and Kistchinski 1977). Because of this direction of arrival, Dau and Kistchinski (1977) hypothesized that Spectacled Eiders stage in the northern Bering Sea or Bering Strait prior to departure for the breeding grounds in the delta. The recent discovery of wintering concentrations southwest of St. Lawrence Island (Petersen et al. 1995, 1999) neither supports nor refutes this hypothesis. Theoretically, spring migrants could fly directly from the vicinity of St. Lawrence Island to the delta or they could depart from a more northern staging area, fly down the Bering Sea coastline, then turn inland once they arrive at the delta (Figure 1). In both cases, observers away from the immediate coast in the central delta would detect them arriving from the northwest.

To investigate these alternatives, we monitored the spring migration of Spectacled Eiders at Cape Romanzof, which lies immediately to the north of the main breeding grounds in the Yukon–Kuskokwim delta. Because the cape is only slightly south of the wintering area, spring migrants could fly almost directly southeastward from the wintering area to the breeding grounds without passing it (Figure 1). If the eiders were migrating south along the coast from a staging area farther north, however, they would pass near Cape Romanzof en route to the breeding grounds.

STUDY SITE

Cape Romanzof (61° 49' N, 166° 5' W) projects into the Bering Sea at the western end of the Askinuk Mountains between Scammon and Kokechik bays (Figure 1). The Askinuk Mountains rise to more than 700 m elevation at Towak Mountain, 9 km east of the cape, and lie just north of the main breeding grounds of the Spectacled Eider in the Yukon–Kuskokwim delta (U.S. Fish and Wildlife Service 1996).

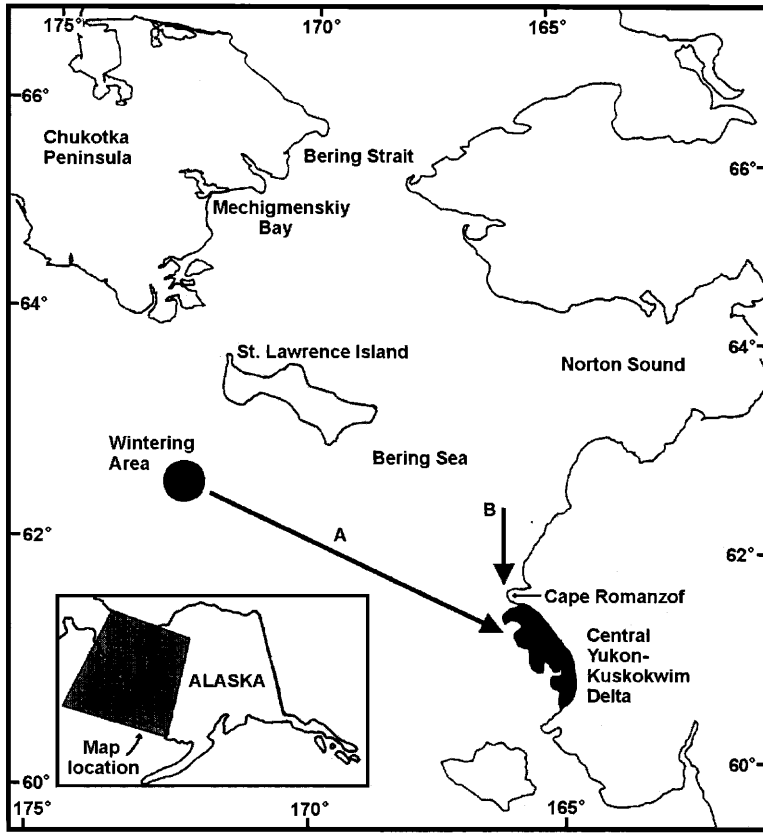

Figure 1. The northern Bering Sea, showing the major localities mentioned in the text, including the 1997 wintering area (adapted from Petersen et al. 1999). (A) Hypothetical spring migration route if Spectacled Eiders fly directly from the wintering area to the central Yukon–Kuskokwim delta. (B) Observed orientation of Spectacled Eiders approaching Cape Romanzof during spring migration.

METHODS

We counted migrating Spectacled Eiders at Cape Romanzof from 25 April to 15 May 1997. Two observers made observations with 10 × 40 binoculars and/or zoom spotting scopes from sites 75–125 m above sea level with northern or northwestern exposures. We chose observation sites daily in response to local weather conditions; most were located in the lee of exposed tors and outcroppings. We conducted formal counts between 0600 and 2230 Alaska Standard Time. This 16.5-hr period equaled the average period of daylight during the study. Previous studies of migrating sea ducks indicate that day-to-day variation in numbers of migrants exceeds variation

within a day (Herter et al. 1989, Suydam et al. 1997). To minimize the effects of day-to-day variation on the precision of estimates, we used a stratified random design for scheduling observations, with 90-min intervals as the sample units and days as the strata. For each day, we randomly selected for sampling six of the eleven 90-min intervals between 0600 and 2230. Data recorded for each flock included flock size, species composition, sex composition, direction of flight, and distance from shore. From 6 to 15 May, we also noted the sex of the bird leading the flock. We also collected comparable data for all flocks prior to and between sampling intervals. At all times, we recorded flocks detected only within 1.5 km of shore (estimated by reference to landmarks of known distance) because we could not confidently distinguish the Spectacled from the Common Eider (*S. mollissima*) at greater distances. Finally, during each sampling interval, we noted whether visibility was complete for the entire interval (i.e., not obscured by fog or precipitation out to a distance of 1.5 km) or incomplete (partially obscured during some portion of the period).

We were at Cape Romanzof for 103 90-min sampling intervals on 20 days from 25 April to 15 May; severe weather prevented us from reaching the cape safely on 14 May. Because of dense fog surrounding the cape, however, we could collect data during only 94 of the 103 sampling intervals. We had complete visibility during 63 sampling intervals.

For each day, we calculated the mean number of Spectacled Eiders migrating per 90-min interval by averaging the six samples; we estimated the daily total by multiplying this mean migration rate by a factor of 11 (the number of sampling periods in a day). We then estimated the total number of eiders passing Cape Romanzof over all days with formal sampling by summing the daily estimates. We generated estimates (with 95% confidence limits) for data collected during periods of incomplete visibility separately from periods of complete visibility. We also report a total count of migrants detected (with no error term), calculated by summing all observations made both during and outside of formal sampling intervals, representing a minimum estimate of the number of Spectacled Eiders passing Cape Romanzof.

RESULTS

The first flocks of Spectacled Eiders were seen on 27 April, the next flocks were not seen until 5 May, and the peak passage occurred on 6 May. Eiders were still migrating past Cape Romanzof on 15 May, our last day in the field.

We recorded 80 flocks of Spectacled Eiders during the study. Fifty-three flocks (66% of all) approached Cape Romanzof from the north, and 27 (34%) approached from the northeast. The mean flock size was 10.6, the median flock size was 6.0, and the modal flock size (29% of all flocks) was 2. We determined the sex of all birds in 79 of the 80 flocks, resulting in a total count of 420 males and 399 females (sex ratio 1.05). The first flock seen on 27 April had the most skewed sex ratio of the study, with 42 males and 21 females. That flock excluded, the overall sex ratio during the rest of the study was exactly 1.0. This result did not derive simply from flocks with skewed sex ratios canceling each other out over the course of the migration. Instead, 60 of the 79 sexed flocks (76%) had an even sex ratio, and 12 more (15%)

varied from an even sex ratio by only a single bird. Between 6 and 15 May, 48 of 49 flocks (98%) were led exclusively by a female; the lead alternated between the male and the female at the head of the other flock. In most linear flocks, females and males alternated regularly from the front of the flock to the rear.

Other species of sea ducks observed during our study, including the Common Eider, Oldsquaw (*Clangula hyemalis*), and White-winged Scoter (*Melanitta fusca*), regularly courted, loafed, and fed in the nearshore waters surrounding the cape; most Spectacled Eiders, however, flew past without stopping. Only 9% of Spectacled Eider flocks (including only 5% of individuals) landed on the waters around the cape.

We recorded 844 Spectacled Eiders during the study. Of these, 573 (68%) were recorded during sampling intervals. For all sampling intervals with some visibility, we estimate that 1327 ± 425 Spectacled Eiders flew south within 1.5 km of Cape Romanzof. For intervals with complete visibility only, the estimated total was 1677 ± 365 Spectacled Eiders.

DISCUSSION

We suspect that the Spectacled Eiders flying south past Cape Romanzof were directly en route to breeding sites in the central Yukon–Kuskokwim delta. Four lines of evidence support this conclusion. First, the sex-ratio data indicate that the vast majority of birds were paired. Second, we saw no subadult-plumaged birds, which are extremely rare on the breeding grounds (Dau and Kistchinski 1977) but probably would be common in flocks of nonbreeders. Third, one of the females retained a nasal disk that had been attached to her while nesting in the delta in a previous year. Finally, the peak passage of Spectacled Eiders past the cape (6 May) preceded the peak arrival at breeding sites 60–125 km to the southeast by only one day (P. L. Flint and C. L. Moran pers. comm.), suggesting that the eiders passing the cape were en route directly to those areas.

Between 1993 and 1997, approximately 3400 pairs of Spectacled Eiders nested annually in the Yukon–Kuskokwim delta (T. D. Bowman and R. A. Stehn pers. comm.). If we assume that the migrant eiders we detected were breeding pairs, we actually saw >12% of the delta's eiders during daylight hours as they passed Cape Romanzof from 25 April to 15 May, and the estimated passage (based on sampling) represented 20–25% of the entire delta population. For several reasons, these estimates are probably minimal. We did not sample on 14 May because of a severe storm with strong southeast winds. Although migration of Common and King eiders (*S. spectabilis*) at Barrow, Alaska, can be virtually stopped by strong headwinds (R. H. Day pers. comm.), we regularly observed migrant Spectacled Eiders flying south into headwinds, including sustained winds of up to 50 km/hr, with gusts to 80 km/hr. We suspect, therefore, that some Spectacled Eiders may have migrated past the cape on 14 May, despite the storm. We also suspect that we simply failed to detect some of the eiders passing by during sampling intervals. Among all of the species of sea duck at Cape Romanzof, the Spectacled Eider was the most difficult to detect, primarily because of its tendency to fly directly and low over the water. This behavior was markedly

different from the vertical undulations we frequently observed in flying flocks of other sea ducks, including other eiders and the Oldsquaw. In addition, flocks of the most frequent sizes (one or two pairs) were more difficult to detect than larger flocks. Furthermore, additional eiders could have passed the cape outside of the 3-week sampling window because birds were still migrating on 15 May. Other birds may have migrated at night or even overland across the western Askinuk Mountains, east of our observation point. Still others may have migrated south past the cape but beyond the range of visual detection. Finally, if any birds were migrating directly from the wintering areas south of St. Lawrence to the Yukon–Kuskokwim delta, they would have reached the coast beyond our visual range well to the south of Cape Romanzof.

We can conclude that a significant percentage of the Spectacled Eiders breeding in the delta migrate south past Cape Romanzof. If the Spectacled is like the Common Eider, females rely heavily on stored energy reserves for egg production, then fast during laying and incubation (Parker and Holm 1990). If so, females should attempt to increase caloric intake and/or reduce caloric expenditure immediately prior to breeding. A direct flight from the wintering area to the breeding area might be part of the latter strategy. In 1997, Spectacled Eiders wintered at 62–63° N, to the southwest of St. Lawrence Island (Petersen et al. 1999). As noted previously, however, a straight flight from the wintering grounds to the breeding grounds in the Yukon–Kuskokwim delta would pass south of Cape Romanzof (Figure 1). Similarly, if migrant eiders were attempting to minimize the distance flown between the wintering grounds and the Alaska coastline before reorienting toward the breeding grounds, a direct flight to (but not north of) the cape is the shortest distance. Birds arriving at the cape from the north and northeast, however, were following neither of these routes.

Why, then, do Spectacled Eiders arrive at Cape Romanzof from the north? We consider two classes of hypotheses, accidental displacements and adaptive, if atypical, migrations. Perhaps most birds en route to the delta did fly directly to the breeding grounds. Under this scenario, the fraction of birds we detected at Cape Romanzof might have been displaced to the northeast of the regular migration route by orientation errors or spring winds. We cannot evaluate the efficacy of Spectacled Eider orientation directly, but the species' use of small traditional areas at sea during the nonbreeding season (Petersen et al. 1995, U.S. Fish and Wildlife Service 1996) and its tendency to return to specific nesting areas (Grand et al. 1998), even the immediate vicinity of former nests (C. L. Moran pers. comm.), suggest a capacity for very effective homing to final destinations. We do not know, however, whether such precise homing is a function of accurate orientation from point to point or the result of repeated adjustments en route. Displacement by winds seems unlikely because nearshore wind speeds and directions at Cape Romanzof in 1997 were not obviously correlated with either pulses or interruptions of eider migration (unpubl. data). We therefore do not believe that up to 25% of the delta's breeding population was accidentally displaced to the north of its traditional migration route.

Instead, we suspect that a prebreeding movement from the wintering grounds to still unknown areas in the northern Bering Sea is a regular part

of the annual cycle for Spectacled Eiders nesting in the Yukon–Kuskokwim delta. Such a movement could result from either a circuitous migration route or the use of a spring staging area. As the ice moves north in the spring, Spectacled Eiders departing from the wintering area southwest of St. Lawrence Island might follow the ice edge generally eastward until they hit shoreline leads or shorefast ice, then correct their flight direction by turning south to reach the delta. Ice edges might provide foraging opportunities or, if predictable from year to year, orientation cues. We consider this unlikely, however, for two reasons. Ice conditions in the northern Bering Sea at the time of spring migration in 1997 did not produce ice edges that would have guided the birds toward the delta's coastline (R. Page unpubl. data), and, more generally, the location of ice in the Bering Sea can be extremely variable over a range of temporal scales (Niebauer and Day 1989). Because of such variation, retreating ice edges are unlikely to provide reliable orientation cues from year to year.

Several species of sea ducks use spring staging areas in the Bering Sea (Larned 1998), and we suspect that Spectacled Eiders do as well. Over 300,000 Spectacled Eiders winter in the pack ice southwest of St. Lawrence Island (Petersen et al. 1999). For the vast majority of these birds, movement to a spring staging area in the northern Bering Sea would be en route to arctic breeding grounds in Russia or northern Alaska. Spectacled Eiders nesting in the Yukon–Kuskokwim delta, however, would be unique in flying north to a spring staging area (presumably with the rest of the global population), then returning south to breed.

Two areas in the Bering Sea north of St. Lawrence Island are occupied at other times of the year by Spectacled Eiders. Eastern Norton Sound and Mechigmenskiy Bay (Figure 1) are used during the postbreeding molt by the delta's females and males, respectively (Petersen et al. 1999). Further satellite telemetry, with longer-lasting transmitters, could confirm if prebreeding Spectacled Eiders stage to the north of their wintering area at these or other sites in the northern Bering Sea prior to spring arrival in the Yukon–Kuskokwim delta.

SUMMARY

From 25 April to 15 May 1997, we monitored the spring migration of Spectacled Eiders at Cape Romanzof, Alaska. We recorded 844 birds in 80 flocks as they migrated south past the cape en route to nesting habitat in the central Yukon–Kuskokwim delta. On the basis of systematic sampling, we estimate that 1327–1677 Spectacled Eiders passed south within 1.5 km of the cape during our study, 20–25% of the estimated breeding population in the delta. The birds' overall sex ratio, the sex ratio within individual flocks, and the alternation of males and females within flocks suggest that they were already paired when they passed Cape Romanzof. Because all of the eiders arrived from either the north or the northeast, we suspect that a spring staging area exists in the northern Bering Sea, north of the species' main wintering area, which lies to the southwest of St. Lawrence Island.

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