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CHICK DIET AND DAILY ACTIVITY PATTERN OF COMMON MURRES AND BLACK-LEGGED KITTIWAKES AT BLUFF SEABIRD COLONY, NORTON SOUND, ALASKA

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Abstract: At Bluff seabird colony, Norton Sound, Alaska, Common Murres (*Uria aalge*) fed their chicks with mostly blennies in the afternoon. Parents of Black-legged Kittiwakes (*Rissa tridactyla*) shifted chick guarding duties at any time of day Foraging trip time of the murres at Bluff (3 6 hr) was about 1.4–3.3 times longer than other colonies in boreal areas

1. Introduction

Murres (*Uria* spp) and kittiwakes (*Rissa* spp) are abundant seabirds in the northern North Pacific and Atlantic Ocean. Their feeding and breeding ecology have been studied at several colonies in boreal and low arctic areas (TUCK, 1961; BIRKHEAD, 1977a, b; BIRKHEAD and NETTLESHIP, 1981; HEDGREN. 1981; GASTON *et al.*, 1983; COULSON and THOMAS, 1985; COULSON and PORTER, 1985; GALBRAITH, 1983; MIKHTARYANTZ, 1986)

In the arctic and subarctic area of the North Pacific, their distribution and adult diets have been studied (BRADSTREET, 1979, 1980, HUNT *et al* , 1981a, b; SPRINGER *et al.*, 1984, 1987; OGI *et al.*, 1985; MURPHY *et al* , 1986). However, the diet of their chicks and daily activity patterns have received less attention

We describe here the diets for chicks of Common Murres (*U aalge*) and daily patterns of feeding chicks by Common Murres and Black-legged Kittiwakes (*R tridactyla*) at Bluff in subarctic Alaska

2. Study Area and Methods

2 1 Study area

The study was conducted at Bluff (64°40′N, 164°25′W), in Norton Sound, Alaska between late July and early August, 1988 The Bluff seabird colony consists of about 3.5 km of coastal cliffs rising from 15 to 175 m above sea level. About 30000 Common Murres and 15000 Black-legged Kittiwakes breed in this colony (HUNT *et al.*, 1981a; MURPHY *et al* , 1986). Common Murres and Black-legged Kittiwakes started hatching in mid and early July, respectively, in the study year.

The study plot was on the cliff ledges about 15 m below 'stake 8' (Fig. 1 in MURPHY *et al.*, 1986). Twenty-one pairs of Common Murres and sixteen pairs of Black-legged Kittiwakes bred on the ledges. In addition, ten pairs of unsuccessful or non-breeders of Common Murres visited the ledges.

2.2. Direct observation

YW observed 12–15 and 12–13 pairs with chicks of the murres and the kittiwakes, respectively, from 'stake 8' with 10×40 binoculars on six clear days: July 21, 1200–July 22, 0300 (Beaufort scale 0–1); July 23, 1200–July 24, 0800 (0–1); July 28, 0500–2000 (0–1); July 29, 0600–1800 (0–3); July 31, 2000–2400 (0–3); August 1, 0900–2100 (0–3). In this period, sun set around 2330 and rose around 0400, and it was crepuscular during the night. Time of day is shown by Alaska Daylight Time (ADT).

Presence or absence of the murre and kittiwake parents with chicks was recorded at 15 min intervals, and total number of the murres was recorded at 30 min intervals. Food deliveries by the murres, shifts of chick guarding duties by the kittiwakes and food deliveries by murres without chicks (non-breeders or unsuccessful breeders) were also recorded. It took from several seconds to one minute to feed chicks by the murres and several seconds to shift chick guarding by the kittiwakes, respectively. Murres brought always one individual fish at a time. Fish that was delivered to the murre chicks could be divided into several types; blennies, sandlance, salmon, saffron cod, capelin and others.

2.3. Diet collection

Fish that were abandoned by the murres on the ledges or at the foot of the cliffs where the murres bred were collected, preserved in 5% formaldehyde solution and identified to species. Their fork-length was measured.

All the values are shown as mean±SD with sample size in parentheses.

3. Results

3.1. Chick diet

Common Murres brought mostly blennies (probably *Lumpenus* and *Stichaeus*; 74%) for their chicks (Table 1). Unsuccessful or non-breeders brought similar fish species (Table 1) to the ledges also with the frequency of 0.05 per pair-hour. They assumed a posture of feeding chicks as if they had chicks. Then, they ate the fish by themselves, fed it to their mate, or dropped it.

Fourteen *Lumpenus fabricii* (fork-length, 14.2±1.6 (5) cm), two *Stichaeus punctatus* (9.6 (1) cm), four *Ammodytes hexapterus* (8.5 (2) cm) and two *Oncorhynchus nerka* (8.5 (2) cm) were collected on the ledges or at the foot of the cliffs where murres bred.

3.2. Daily activity patterns

Although the total number of Common Murres on the ledges decreased around noon and increased in the afternoon, the number of breeding adults did not change (Fig. 1a). This indicates that attendance of unsuccessful or non-breeders was high between late afternoon and early morning.

Table 1. Diet of Common Murre chicks as shown by the number of fish delivered to chicks by parents and that brought by unsuccessful breeders or non-breeders to the breeding site. Fish type was determined by direct observation.

Fish type	No. of fish for chicks	No. of fish brought by unsuccessful breeders
Blennina[1]	122	18
Sandlance	13	2
Capelin type[2]	10	5
Salmon type	18	4
Saffron cod type[3]	2	2
Unidentified	47	1
Total	212	32

[1] probably *Lumpenus* and *Stichaeus*
[2] may be *Mallotus villosus.*
[3] probably *Eleginus gracilis.*

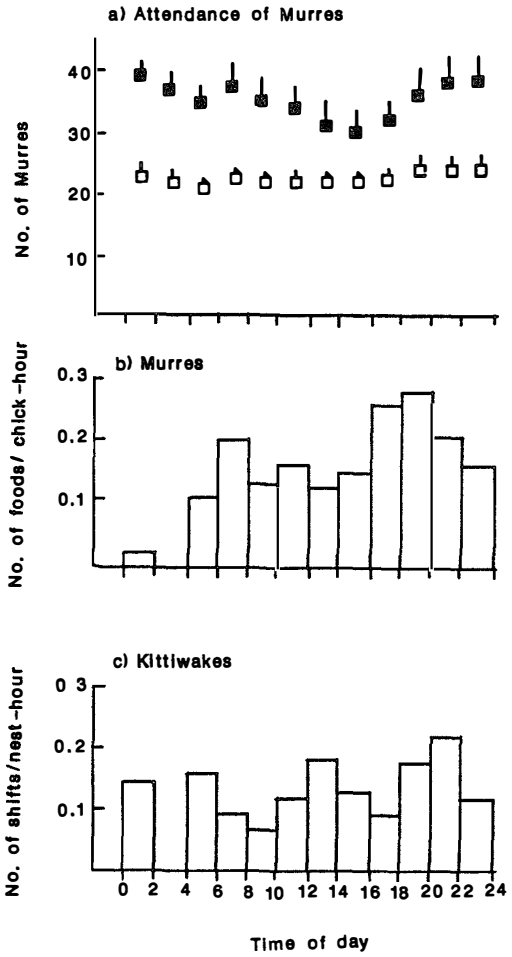

Fig. 1. Daily patterns of a) mean of total number of Common Murres (closed squares) and that of the breeding murres (open squares) and 1SD on one side, b) feeding frequency (number of meals per chick-hour) of Common Murres and c) shift rate of chick guarding (number of shifts per nest-hour) in Kittiwakes

Common Murres delivered food to chicks most frequently between 1600 and 2000 but they did not between 0000 and 0500 (Fig. 1b). Black-legged Kittiwakes shifted chick guarding at any time of day, excluding nighttime and early morning (0200–0400) (Fig. 1c). Common Murres brought 18% of blennies, 53% of sandlance type and 65% of salmon type between 2100 and 0800; indicating that they foraged sandlance and salmon types during night and early morning but blennies in the daytime.

3.3. Absence duration

Common Murres and Black-legged Kittiwakes usually left the ledges for about 1–2 hours and 3–5 hours, respectively, preceding chick feeding or shift of chick guarding (Fig. 2). Excluding more than 10-hour absence durations since they might include long resting time, absence duration of the murres (3.6 ± 2.9 (109) hours) was shorter than that of kittiwakes (5.0 ± 1.9 (61) hours, Mann-Whitney U-test, $z=4.71$, $P<0.01$).

3.4. Feeding frequency

Among the pairs that could be observed on days with longer than 12-hour watch periods, mean feeding frequency of Common Murres was 0.19 ± 0.05 (12 pairs) per chick-hour and mean shift rate of Black-legged Kittiwakes was 0.16 ± 0.03 (12 pairs) per nest-hour.

Common Murres fed chicks more frequently on days with wind 0–1 (Beaufort scale) (0.20 ± 0.08 (36 chick-days)) than days with wind 0–3 (0.15 ± 0.11 (24 chick-days), U-test, $z=2.33$, $P<0.01$). Black-legged Kittiwakes also shifted chick guarding more frequently on days with wind 0–1 (0.19 ± 0.06 (35 nest-days)) than on days with wind

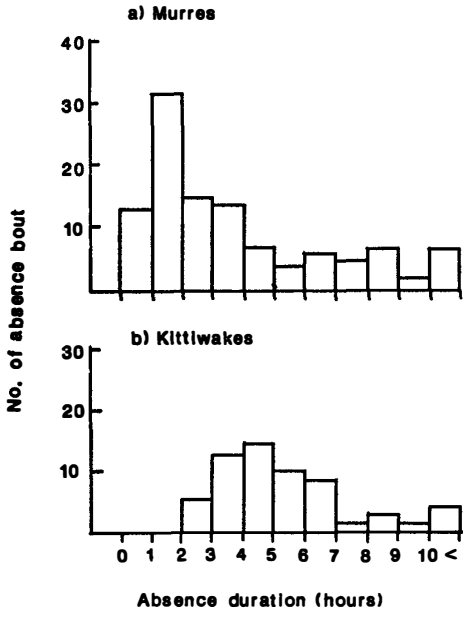

Fig. 2. Frequency distribution of absence duration defined as time between departure and arrival of the birds in the study plot. Absence durations during night time (2400–0500) were excluded because these were longer than 10 hours and birds did not feed chicks during night time (see Fig. 1).

0–3 (0.10 ± 0.05 (24 nest-days), U-test, $z=4.56$, $P<0.01$).

4. Discussion

Common Murres at Bluff fed the chicks mostly with blennies in the afternoon, while SPRINGER *et al.* (1987) showed stomach contents of the murre adults collected 2–3 km off Bluff consisted mainly of saffron cod and sandlance. In boreal and low arctic areas (England, Wales, Gotland, and Newfoundland, ranged from 47–57° N) the murres feed chicks with capelin, sandlance and herring mostly in the early morning (BIRKHEAD, 1977b; HEDGREN and LINNMAN, 1979; MAHONEY, 1979). Assuming that the one way trip time between foraging area and the colonies was around one or two hours (half of the absence duration), the murres at Bluff foraged food for chicks around noon and those in the boreal area around dawn or in the early morning.

At Tyuleny Island, Sakhalin in boreal area, however, Common Murres feed blennies *Leptoclinus maculatus* to their chicks in the daytime and capeline *M. villosus* and sandlance *A. hexapterus* in the early morning and late evening (MIKHTARYANTZ, 1986). Our limited data also indicate the murres fed sandlance and salmon types in the night and early morning and blennies in the daytime. These suggest that availabilities of sandlance and capeline are high in the evening and early morning, while that of blennies is high in the daytime. Therefore, the reason why the murre food delivery rate at Bluff was high in the daytime might be that they fed mainly blennies, while those in the colonies, where sandlance and capeline are the main diet, are high in the early morning.

Absence duration indicates the maximum estimate of foraging trip time. In boreal areas, absence duration of Common Murres was 1 1–2.6 hr (BIRKHEAD, 1977b; BRADSTREET and BROWN, 1985; WANLESS *et al.*, 1988). Hence, maximum estimate of foraging trip time of Common Murres at Bluff was about 1.4–3.3 times longer than in boreal areas suggesting that the murres at Bluff foraged farther from the colony or needed more time to search for food.

Sandlance probably is the main food of Black-legged Kittiwake chicks at Bluff (MURPHY *et al.*, 1991). Diet and daily activity pattern of the kittiwakes at Bluff are comparable to those of other colonies in boreal areas (PEARSON, 1968; GALBRAITH, 1983).

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