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The occurrence and behavior of non-breeding Horned Puffins at Black Guillemot colonies in northern Alaska.—The Black Guillemot (*Cepphus grylle*) and Horned Puffin (*Fratercula corniculata*) are cavity nesting alcids that typically breed in talus. In Alaska both species breed in rock cavities as far north as Cape Lisburne (D. Roseneau, pers. comm.). No talus or rock cliffs are present north of Cape Lisburne but the Black Guillemot has extended its breeding range to the northern Chukchi and Beaufort seas by breeding in man-made debris (Divoky et al., Condor 76:339–343, 1974). Censuses north of Cape Lisburne from 1972–1981 show the following number of Black Guillemot breeding pairs at the major colonies (Fig. 1): 5—Seahorse Island, 5—Point Barrow, 20—Deadman Island, 100—Cooper Island, and 5—Igalik Island. Bailey (Birds of Arctic Alaska, Pop. Ser. 8, Colorado Museum of Nat. Hist., 1948) considered the Horned Puffin a rare vagrant north of Cape Lisburne. During extensive pelagic and inshore censusing of the northern Chukchi and Beaufort seas Horned Puffins were seen in fewer than 1% of all observation periods (Divoky, pers. obs.). This note documents the regular occurrence of Horned Puffins at Black Guillemot colonies in northern Alaska and describes previously unrecorded behaviors of non-breeding puffins at guillemot nest-sites. These behaviors include the displacement of guillemot eggs, and the feeding, brooding and killing of guillemot chicks.

Two- to 3-h censuses of Black Guillemot colonies have produced sightings of Horned Puffins. At Seahorse Island two were seen on 6 and 30 July 1972, one on 5 August 1976 and two on 25 July 1981. The puffins were associated with a sand dune that had burrows with alcid footprints leading into them. The burrows were too deep to be completely examined for the presence of eggs or young. Black Guillemot nests at Seahorse Island were primarily in a natural driftwood pile. At Deadman Island a single Horned Puffin was seen on 15 and 20 August and 6 September 1976, and 4 September 1977. Two were present on 14 August 1979 and 18 August 1980, and four on 3 July and 13 August 1981. All sightings of puffins at Deadman are of birds circling the barge containing guillemot nests.

The most systematic observations of Horned Puffins have been at Cooper Island where Black Guillemots breed in boxes and other man-made debris. Periods of observation were 16 June–16 September 1976, 21 June–20 August 1977, 1 July–12 September 1978, 26 June–5 September 1979, 9 June–7 September 1980, and 4 June–7 September 1981. Horned Puffins were seen mostly from mid- to late summer until early September when observations ceased. Dates of first sightings were 4 August 1976, 2 August 1977, 7 July 1978, 16 July 1979, 24 June 1980, and 16 June 1981. Because all behavioral information was gathered at Cooper Island it it important to note that the number of puffins encountered was small. Sightings were usually of a single bird, although two were seen frequently in 1979 and 1980, and four were seen on one instance in 1979. All of our observations of puffins at nest-sites may have been of the same bird. A puffin banded at a guillemot nest-site in 1978 returned to Cooper Island the next 3 years.

Few puffin-guillemot interactions were observed away from nest-sites. Guillemots occasionally chased a puffin in the air. Single puffins frequently sat next to guillemot flocks, both on land and water. While Drent (Ardea 53:99–160, 1965) observed Pigeon Guillemots (*C. columba*) giving a communal alarm call at the approach of a Tufted Puffin (*Lunda cirrhata*), We observed no similar behavior.

Horned Puffins entered Black Guillemot nest-sites on Cooper Island. With the exception of observations in 1980, Horned Puffins entered only nest-sites with chicks. In 1980 a single puffin entered a nest shortly after eggs were laid.

We have primarily circumstantial evidence of puffin activities in nest-sites. In 1980 eggs in six guillemot nests were pushed out of their depressions 1–7 days after laying. All nests

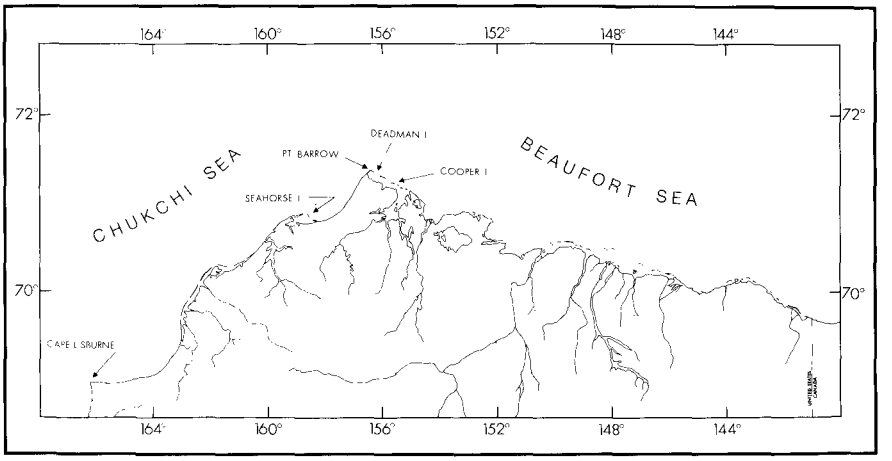

FIG. 1. The location of Black Guillemot colonies in northern Alaska mentioned in the text.

affected were next to a pond frequented by a puffin and a puffin was seen entering a nest where eggs were later found to be displaced. No egg displacement occurred in other areas of the colony.

In 1978, 1979, and 1980, Horned Puffins were observed brooding guillemot chicks. One instance was recorded in 1978 when a puffin was found brooding two chicks. In 1979 two chicks in one nest-site were brooded by a puffin between 14 and 27 August for 16 of 46 h of observation. On two occasions a puffin brooded the chicks continuously for at least 4.5 h while the parents fed the chicks. Feeding occurred at the nest-site entrance without the parents entering, a not unusual method of feeding. In 1980 there were two instances of a puffin brooding two chicks at one nest-site.

On six occasions in 1979 a puffin circled the colony with a fish in its bill. In four instances the puffin entered a nest-site with a fish and brooded the chicks. It could not be determined if the fish were consumed by the chicks or the puffin. Fish were brought only to the site where chicks were regularly brooded by a puffin and presumably all brooding and "feeding" involved the same puffin.

There is some evidence that Horned Puffins may kill or injure adult and nestling guillemots in or near nest-sites. A total of 11 deaths (nine chicks and two adults) were recorded from 1976–1980: three chicks in one nest (1976); two chicks and one adult in the same site (1977); one adult in a nest-site (1978); two chicks on one nest-site and one in another (1979); one chick (1980). Puffins were observed at nest-sites where deaths subsequently occurred. Dead chicks had either crushed skulls, or head and neck wounds. No puffin-related mortality occurred at the sites where a puffin regularly brooded in 1979 and 1980. However, one of the two chicks brooded in 1979 had holes bitten or torn in the webs of its feet and both chicks brooded in 1980 had wounds in the nape region.

Nest-building by puffins occurred in 1979 and 1980 at sites where a puffin regularly brooded. In 1979 six feathers were placed in the site. In 1980 the guillemot eggs were displaced in the same site and the gravel floor excavated to create a larger cavity. The site regularly visited in 1980 had over 40 feathers placed in it in a 2-day period in late August.

This is the first reported instance of an alcid displacing the eggs or killing the young of a

species with which it competes for nest-sites. It is also the first record of interspecific chick brooding and feeding in alcids. Intraspecific brooding and feeding of chicks has been observed in murres (*Uria* sp.) (Perry, Lundy: Isle of Puffins, Lindsay Drummond, London, England, 1946).

(*Addendum 1982.*—On 8 July 1982, a pair of Horned Puffins arrived at Cooper Island and courted at Black Guillemot nest-sites where later eggs of the latter species were found to have been pushed out of nest depressions. No observations of puffin courtship activities have previously been made at the islands discussed herein.)

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Body temperature and growth of Bonin Petrel chicks.—Body temperature and timing of endothermy in several altricial and semi-altricial species have been related to the length of the nestling period (Dawson and Evans, Physiol. Zool. 30:315–327, 1957), the growth rate constant k (Ricklefs and Hainsworth, Condor 70:121–127, 1968; Dunn, Condor 77:286–291, 1975), feeding history of the chick (Wheelwright and Boersma, Physiol. Zool. 52:231–239, 1979), and the mass of the nestling (Marsh, Physiol. Zool. 52:340–353, 1979). Data for small procellariiforms are meager but they suggest that the semi-altricial chicks are able to maintain adult body temperatures within a few days of hatching (Farner and Serventy, Condor 61:426–433, 1959; Wheelwright and Boersma 1979). Growth among procellariiform chicks is characterized by slow development, a long and flexible fledging period, large deposits of lipid reserves, and achievement of pre-fledging weights well above the adult's body weight, followed by a pre-fledging weight loss. These growth characteristics are considered to be adaptations to meager, distant, or fluctuating food resources (Lack, Ecological Adaptations for Breeding in Birds, Methuen, London, England, 1968). In addition, procellariiform birds have prolonged incubation periods and slow embryonic growth rates which may be related to slow growth of the chick after hatching (Ackerman et al., Physiol. Zool. 53:210–221, 1980; Whittow, Am. Zool. 20:427–437, 1980). A recent visit to Midway Islands in the northwestern Hawaiian Islands presented us with an opportunity to measure the growth and fledging period of Bonin Petrel (*Pterodroma hypoleuca*) chicks, the thermal environment of their nest-burrows, and development of body temperature regulation.

Methods.—Chicks were weighed twice daily at 07:00 and 17:00 with a torsion balance (±0.1 g) up to 2 weeks of age and then with Pesola spring scales (±1 g) until fledging. At 2 weeks of age chicks were banded for subsequent identification and measurement. Growth data from 1980 and 1981 have been pooled and a logistic growth equation fitted to the data (Ricklefs, Ecology 48:978–983, 1967). Data are presented as means ± 1 SD.

The Bonin Petrel nests in a deep burrow (Grant et al., Auk 99:236–242, 1982); a pre-constructed shaft provided access to the nest-chamber. The temperatures of both incubating adults and chicks were obtained by inserting a sheathed thermocouple into the proventriculus. Temperatures were measured with a Kane-May Ltd. Dependatherm. Ambient temperatures of burrows were recorded continuously over several days on a linear recorder, with the thermocouple placed about 10 cm from the incubating petrel.