Temperature-dependent reduction of individual distance in captive House-Sparrows.— Alerted to variation in animal spacing by Hediger's (1950) concept of contact and distance species, researchers have noted the correlation between decreased social distance in a variety of avian species and increased climatic stress. Under cold stress, species such as the Tree Swallow (*Iridoprocne bicolor*; Leck 1972, Grubb 1973) and Bushtit (*Psaltriparus minimus*, Smith 1972) that normally maintain a minimum individual distance from conspecifics (*sensu* Hediger) forego that tendency and clump together.

To test for this clumping response under controlled conditions, I captured 10 male House Sparrows (*Passer domesticus*) in and around Columbus, Ohio in January and February, 1975. I kept the birds in a Sherer environmental chamber at light/dark 11/13 and ambient temperatures from −10 to 5°C. A 61 × 91 × 122 cm hardware-cloth cage, placed inside the environmental chamber, was fitted with one bowed 90-cm perch graduated in mm. The curvature of the perch allowed a view along the anterior-posterior axis of each perched bird through the glass window at the front of the environmental chamber. To prevent birds from clinging to the sides of the cage during the night, three walls of the cage were lined with opaque brown paper and the fourth (facing the chamber window) was fitted with a sheet of glass.

A mock sunset was controlled automatically by a series of rheostats that gradually decreased the wattage of the light in the chamber from 100 to 0 over a 45-min period each evening, during which time the birds went to roost.

The ambient daytime temperature in the chamber was 5°C, but the nighttime experimental temperature was varied randomly among −10, −5, and 0°C, each in 3-night series. The birds were exposed four times to each of the 3-night series of temperatures. Thus, the design called for 12 nights, four at each temperature. While the change from day to night temperature was complete by the onset of the mock sunset, the change from night to day temperature began 30 min after morning light.

Observations were made through the chamber window using an infra-red viewer ("Metascope," Varo, Inc., Garland, Texas) 1.5 to 3 h after darkness. Distance was defined and measured as the span between the mid-points of adjacent birds. The nearest neighbor, the closest of each bird's neighbors, was used to find the median nearest neighbor at each experimental temperature. In addition, each perched bird was scored nightly as either in contact or not in contact with a neighbor, from which I calculated percent birds in contact for each experimental temperature.

Median distances between adjacent male House Sparrows decreased significantly with decreasing temperature ($\underline{\alpha} = 0.0375$; Jonckheere test for ordered alternatives; Hollander and Wolfe 1973). Percent contact increased with decreasing temperature ($\underline{\alpha} = 0.0153$; Jonckheere test). These relationships are illustrated by Fig. 1A and 1B respectively.

These results confirm the field workers' interpretation that cold stress obviates individual distance and causes clumping behavior. The physiological advantages of moving close together in House Sparrows are still undemonstrated, but Brenner (1965) reported that close proximity to conspecifics in the Starling (*Sturnis vulgaris*) afforded the birds a metabolic saving in cold temperatures. It seems reasonable to expect even greater energetic advantages from clumping during cold stress.

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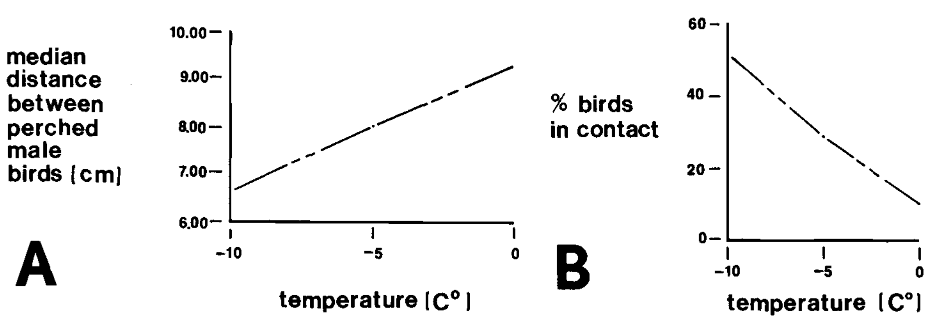

Fig. 1. A. Relation between ambient temperature and spacing of male House Sparrows roosting at night. B. Relation between ambient temperature and instances of contact between House Sparrows roosting at night.

the Zoology Department, Ohio State University, and served as partial fulfillment of requirements for a Master of Science degree.

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KATHLEEN GRABASKAS BEAL, *Department of Zoology, Ohio State University, Columbus, Ohio 43210.*
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Imprinting of a Ring-billed Gull

MARCELLA M. BISHOP
212 Second Avenue E., Polson, Montana 59860 USA

Most studies of imprinting or fixation behavior are, of necessity, conducted with hand-reared or captive birds (Hess 1959, Lorenz 1952, Thorpe 1956), and I have found few references to abnormal attachments in wild birds. During the fall and winter of 1973–1974, I made daily observations of winter populations of diving ducks on Flathead Lake, in western Montana. During this study I observed an immature-plumage Ring-billed Gull (*Larus delawarensis*) in the constant company of a flock of four female and two male Common Mergansers (*Mergus merganser*). The males were in almost complete winter plumage, with some vestiges of molt.

Gulls frequently feed in proximity to other fish-eating birds in this area, probably because of a common food source. There is also some parasitic feeding advantage for the gulls. I have observed gulls taking fish from mergansers surfacing from depths lower than the gulls could reach. However, it was readily apparent that this particular gull was not such a casual feeder. When first observed on 11 November 1973, the gull was engaged in a curious attempt to submerge. It put its head into the water and flapped its wings and splashed its feet. It flew up about 1 m and dove into the water with only momentary success. This behavior occurred repeatedly and only when the mergansers were under the water. When they surfaced the gull swam to join them. Even when this required covering some distance, the gull did not fly to the new location as gulls usually do, but swam in a labored fashion, with much pumping of the head in the sagittal plane. When the mergansers dove again the gull resumed the attempts to follow. This occurred on more than 15 successive dives during the first observation period of about an hour. After this the birds were seen almost daily. During this period the gull fed very little. It spent most of its time just keeping up with its adopted "family." The mergansers seemed neither to accept nor reject the gull. They swam to join each other but all maintenance of contact between them and the gull was strictly up to the gull. This the gull did with difficulty because of its reluctance to fly and the mergansers' superior swimming ability.

Over a period of a month the attempts to dive after the mergansers diminished and by mid-December the gull only swam erratically about until the mergansers surfaced, with its neck arched so that the bill was pointed straight down. This was possibly an attempt to observe the mergansers' progress under water. The gull was capable of flight, with gull-like maneuvers in landing and taking off, but flew only when the mergansers did and only with direct flapping flight, low over the water, as they did. In feeding it dabbled phalarope fashion. It appeared to have considerably less bulk and presented a much slimmer profile than the gulls that landed nearby, so its feeding habits up to this point may not have been totally effective.

I was able to observe these birds almost daily and this behavior continued until 1 January 1974 when the lake froze over and the birds were forced to move downriver to open water. With the return of open water