and Longsworth stated that between 2 and 4 April many sick and dead murres washed ashore. Strong winds and snow blew from the southeast the previous 3 days. They related that, according to residents, dead birds appear every spring, and in some years the beaches are black with birds.

Stormy weather undoubtedly disrupts feeding and probably blows pelagic birds away from concentrations of food they are utilizing. Assuming starvation caused by severe weather perpetrated the die-off, it is especially perplexing why only one species was affected. Of the hundreds of birds we examined on the beaches, all were Common Murres with the exception of two decomposed Crested Auklets (*Aethia cristatella*). Probably by late April, Thick-billed Murres (*Uria lomvia*) are migrating toward their more northerly breeding colonies and are not in this region. Besides differential distribution and abundance, disparate food spectra may account partly for the lack of mortality of other species.

Visits to the Shumagin Islands and Amak Island in June and July divulged saturated breeding colonies of Common Murres. Evidently the die-off was inconsequential with respect to the overall population in this area. In the future, the Alaska Peninsula and Aleutian Islands hopefully will receive additional aerial surveillance, especially after protracted severe weather. This should better illustrate the significance of weather-related mortality and further the scanty knowledge of the distribution and ecology of pelagic birds.

SUMMARY

Stormy weather prevailed in the Aleutian Islands and southern part of the Alaska Peninsula between 19 and 23 April 1970, climaxed by an intense disturbance with winds reaching 84 mph at Cold Bay on 22 April. Two days later reports from an aircraft north of Cold Bay indicated hundreds of dead and dying sea birds on the Bering Sea beach.

On 25 April, airborne observers from Cold Bay surveyed beaches northward up the peninsula while another aircraft from Kodiak Island flew southward to Cold Bay. Thousands of dead and distressed murres were observed along the beaches between Ilnik Lake and Moffet Point. Aerial reconnaissance widened, and for 5 days, counts were conducted, sampling roughly 450 miles of coastline. Mortality was restricted to Common Murres, and dead birds were sighted from Egegik Bay at the north end of the Alaska Peninsula to the western end of Unimak Island. Maximum concentrations of dead murres existed in the Port Moller area. Total mortality probably exceeded 100,000 murres. Contrary to early reports, we found no evidence of oil spills, or evidence that any other species of bird or mammal suffered during the period of mortality in murres.

No hydrocarbons were detected in murres or sand and water samples by six different laboratories. Tests for other toxins proved inconclusive, and there was no evidence of disease. All murre specimens were emaciated and considerably underweight. Although paradoxical that only Common Murres were affected, the die-off most likely resulted from starvation precipitated by severe weather.

ACKNOWLEDGMENTS

This investigation was a joint federal and state effort involving many individuals from several agencies: the U.S. Fish & Wildlife Service, Federal Water Quality Administration, Alaska Department of Fish & Game, Alaska Department of Health, and U.S. Coast Guard. We were assisted in obtaining field data at Cold Bay by Harvey Yoshihara, Alaska Fish & Game; Palmer Sekora, Bureau of Sport Fisheries & Wildlife; and Robert DeVol, Alaska Department of Health. James Bartonek, Bureau of Sport Fisheries and Wildlife Research Biologist in Fairbanks, furnished results from the six laboratories previously mentioned and provided pertinent literature and reports unavailable in Cold Bay. Valuable information and coordination were also received from Raymond Trembley, U.S. Game Management Agent in Anchorage.

Accepted for publication 7 July 1971.

HOVERING BEHAVIOR BY HOUSE FINCHES

PATRIA M. TAYLOR[1]

13506 Boca Raton Drive
Houston, Texas 77040

This paper is concerned with an unusual situation in which House Finches (*Carpodacus mexicanus*) regularly drank from a standard hummingbird nectar bottle by hovering and inserting their bills into the spout. To my knowledge, this hovering behavior has not previously been reported. The study was carried out in Palos Verdes Peninsula, 30 miles SW of Los Angeles, California, and involved a total of 38 House Finches. Observations were usually made from 08:00 to 17:00 on a daily basis, from a blind or covered veranda, at a distance of 4 m from the feeder, with the aid of binoculars. The finches were observed from February to July 1969.

Initially, the House Finches were regularly seen feeding on a profusely bearing fig tree. The fruit supply was finally exhausted. Over a period of several months, the feeder regularly used by the resident population of Anna's (*Calypte anna*) and Allen's (*Selasphorus sasin*) Hummingbirds began to need more frequent refilling. It was then noticed that three finches were drinking from the feeder, one by perching on the spout (fig. 1) and the other two by actually hovering beneath the spout and inserting their bills into the nectar (fig. 2). As more finches became attracted to the nectar, it was apparent that the hovering finches were dominant over the perchers, as the latter would fly off the feeder at the approach of a hoverer. To determine whether perching finches could be made to hover, the feeder spout was greased with margarine to make perching more difficult. Finches that had previously perched and ones that first entered the area during the time when the spout was greased, learned to drink by hovering. One exception was a male which persevered in perching after repeatedly landing on the spout, thereby scraping off most of the grease.

The entire sequence of steps in the learning process was witnessed in four finches (one male, two females, and an immature). Eight other adult finches were observed in various stages of the learning process, prior to actually hovering. All finches followed virtually the same pattern in learning, typical of which is the

[1] Present address: Shell Chemical Co., Plastics and Resins Technical Center, P.O. Box 700, Woodbury, New Jersey 08096.

FIGURE 1. A female House Finch in typical perching posture on the spout of the feeder.

FIGURE 2. A male House Finch hovering beneath the feeder spout.

case of the male, "Y". "Y" had been drinking for 3 days by perching, before the spout of the feeder was greased. Unable to balance and drink on the greased spout, he spent a further 3 days in the feeder tree and neighboring ones. During this time, he passed through the intermediate stage in the learning process as all finches that have subsequently learned have been observed to do. The finch stood with one foot on the top of the feeder and the second foot either holding onto the branch above him or onto the wire holder which suspends the feeder, in such a way that his legs were nearly perpendicular to each other. In this position he bent and peered over the feeder and pecked the sides and top. Finally, he took off very cautiously from a position directly above the feeder. Usually, the first two flights are either too high or too low to allow him to sip, but they serve to acquaint him with the area. On the third flight he invariably bumped his head on the spout, but actually managed to sip while doing an awkward hover. Future flights polished his style until he was quite adept and could take multiple drinks on the same hover. In "Y"'s case, unlike most, he always approached the feeder from the same limb position. In all cases for adults, learning took place within a 2-week span and the performance was initially awkward but effective.

The study was continued past the nesting season (April/May) to see if the nestlings would also learn to hover. The learning process for these immature birds was longer than that for adults (6 weeks rather than 2) for several reasons. First, the young were not highly motivated to learn as they could still obtain the nectar by begging from adults who would regurgitate after several sips of nectar. Second, the attempts on the part of the young to learn were not easily tolerated by adults. Whereas adult finches usually took turns at the feeder, and only one instance of physical aggression among adults was observed throughout the study, there was utter confusion and loud vocalization on the part of adults when any young attempted to perch or hover. Three or four adults would fly toward the feeder, as if to hover, and the immature bird would flee.

The drinking technique of the hoverers varied slightly from one finch to another but kept a fairly consistent and reproducible pattern. Females were never observed to take more than one sip with each hover. Males appeared to be far more "athletic" and all males (including an immature) could take multiple drinks, as shown by the number of bubbles rising in the feeder spout (fig. 3), usually up to a maximum of five sips on a single hover. While multiple drinks among hoverers were observed only in males, their ability or inclination to do so varied, as some males would take multiple sips only 30% of the time, while others would take multiples over 90% of the time.

The average time of actual hovering (i.e., time virtually motionless beneath the feeder spout) was approximately one second for females and ranged from 2 to 5 sec for males. (Hummingbirds averaged 5 sec but could easily remain 20 sec if necessary.)

A total of 38 finches were involved in the study; 59% of these were males. Of these finches, 20 eventually learned to hover: again, 60% of these were males. This implies that males and females were equally disposed to learning to hover.

Of the 18 birds which never learned to hover, 13 were transients, staying in the area only 1–10 days, feeding on the millet seed. Four other finches established residence during a time when the feeder spout was ungreased (to encourage the nestlings to drink) and drank by perching, having little incentive to hover. Only one male persisted in perching in spite of the greased spout. By landing on the spout and slipping off repeatedly, he would wear off enough of the margarine to be able to perch precariously on the spout and drink. All other finches began to investigate hovering after slipping off the spout once or twice. Once having learned to hover, the finches did not revert to perching to feed.

FIGURE 3. A male House Finch completing a multiple drink on a single hover.

A total period of at least 458 hr was spent recording observations. During 205 of these hours, a count of drinks taken totaled 8971, or an overall average of 44 drinks per hr. The peak of the drinking activity occurred at the onset of nesting (mid-March) when the number of drinks per finch per day was 140. The finches at this time were ingesting an average of 12% of their body weight in sugar. The total average number of birds drinking per day increased during the nesting season, making competition higher and decreasing the number of drinks per bird per day.

How the finches first began hovering for the nectar remains an unsolved question. One assumes the finches would ordinarily drink by perching rather than hovering. Unlike hummingbirds, they are not well equipped for hovering, as they can get support only on the downstroke. While finches were completely intolerant of other species of birds in the feeder tree, they never showed any aggression toward hummingbirds. These were common in the area and drank regularly at the feeder, alternating drinks with the finches. The initial gradual increase in nectar consumption before the study began indicates that the finches learned to drink the nectar from the feeder and had ample opportunity to observe the hummingbirds daily. It is interesting to speculate that the finches may have learned to hover by imitating the hummingbirds.

Whether this hovering behavior is a local adaptation is not known. To the author's knowledge, hovering behavior on the part of finches has not been reported in other parts of California.

SUMMARY

This is a report of a behavioral study on House Finches (*Carpodacus mexicanus*) in the Palos Verdes Peninsula area of California. The finches were quite normal in courting and nesting pattern, but regularly fed by hovering at a hummingbird nectar bottle as a chief source of their nourishment. The unusual feature of the study is that each finch actually had to learn how to hover in order to obtain the liquid. The learning process was observed for several finches and it followed an extremely consistent pattern. The hovering performance is very proficient and can be sustained virtually motionless for a maximum of 5 sec. This behavior can be learned by adults of both sexes and by the immature offspring. The learning process occurs over a 2–6-week period. The study was conducted during the daylight hours from February to July 1969, and observations were recorded during a total of at least 458 hr. During 205 of these hours, 8971 drinks, by House Finches, were noted.

Accepted for publication 4 August 1971.

ZONE-TAILED HAWK AND TURKEY VULTURE: MIMICRY OR AERODYNAMICS?

HELMUT C. MUELLER

Department of Zoology
University of North Carolina
Chapel Hill, North Carolina 27514

Willis (Condor 65:313, 1963) has shown that the Zone-tailed Hawk (*Buteo albonotatus*) differs from related hawks and closely resembles the Turkey Vulture (*Cathartes aura*) in color, shape, and manner of soaring. Willis suggests that *B. albonotatus* is an aggressive mimic of *Cathartes* and that this mimicry may permit the hawk to approach closely potential prey which have become habituated to the vulture. Willis mentions that the resemblance in wing shape and dihedral might be due to similarities in the manner of soaring; I believe this is the major reason for the resemblance. The best aerodynamic "design" for a bird that habitually soars near the substrate includes rather long and narrow wings that are held at a pronounced dihedral. To my knowledge, all raptorial birds that habitually soar near the substrate share this design, including *C. aura*, *B. albonotatus*, and the harriers (*Circus* sp.).

A bird that holds its wings horizontal is quite unstable in soaring flight; if the lift on one wing exceeds that on the other, the bird will begin to roll. Since the lift generated by a wing is perpendicular to the wing axis, the vertical lift component will decrease and a lateral component will develop. This lateral component will pull the bird to the side and the loss of vertical lift will cause the bird to lose altitude; the combination results in a side-slip. Thus a bird that soars with the wings held horizontal is very unstable and will roll, lose altitude, change direction, and even completely lose control unless immediate changes are made in the wings to adjust for the differences in lift. Such a bird soaring near the substrate will encounter frequent fluctuations in wind velocity and will have to adjust its wings almost constantly. A bird soaring with its wings held at a dihedral is considerably more stable. When a roll occurs, the vertical