

# THE USE OF ROOFS BY AMERICAN GOLDEN PLOVERS *PLUVIALIS DOMINICA FULVA* WINTERING ON OAHU, HAWAIIAN ISLANDS

by Oscar W. Johnson and Robert M. Nakamura

Portions of the wintering range of American Golden Plovers on the island of Oahu coincide with urbanised areas. In these locations, plovers often use flat roofs for nocturnal roosting and various diurnal activities such as loafing and preening. Although such behaviour may be relatively common in some parts of the Pacific, documentation is restricted to brief sight records.

Observations of from one to ten golden plovers on roofs in Hawaii were published by Ichijo (1974), Wilson (1974a, b) and Pyle (1977a, b). With the exception of one bird seen silhouetted just after sunset, these were all daytime sightings. Jenkins and Sibson (1979) reported three instances of plovers on roofs (from two to three birds in each case) in Honolulu (December 1971) and Pago Pago, American Samoa (December 1971 and November 1976). The Jenkins-Sibson paper prompted Burton (1979) to report that he had observed golden plovers "which regularly roosted at night on the roofs of suburban houses in groups of up to a dozen or so" in Kuching, Sarawak, during the winter of 1976. Burton went on to point out that similar behaviour has not been found in the other taxa of golden plovers (*P.d. dominica*, *P. apricaria* and *P.a. altifrons*), and that it probably is of recent origin on the Pacific wintering grounds.

Since extensive urbanization on Oahu is a product of the last two to three decades, it is apparent that the responses described below have occurred during a relatively brief span of time. Attendant wetland drainage and coastal development suggest that the plovers using roofs have been displaced from natural habitats. The phenomenon demonstrates significant behavioural adaptability in this subspecies, with probable survival value during a period of human encroachment and pressure from introduced mammalian predators.

## Nocturnal roosting

A large roosting aggregation of plovers occurs at the Pacific Palisades Elementary School in Honolulu. The roost has been in regular use each winter since at least 1973, when it was discovered by the second author. The school consists of several flat-roofed buildings arranged in a stair-step fashion on the side of a hill. Since the roost is located on the roofs of the middle buildings, observers positioned on the roof of the upper buildings can view the birds from above at relatively close range.

We visited the site on 17 and 24 April 1980. On the 17th, no birds were present at 18:52 (sunset); by 19:18 about 20 plovers had arrived. At this time we temporarily left the site, returning again at 20:30 to find approximately 125 plovers on the roost. We observed these birds until 22:00 and the number did not appear to increase further. It was evident that the majority of birds roosting here had arrived after dark. On the 24th, plovers began arriving shortly after 19:00; by 20:15 about 75 were present and this number seemed constant until our departure at 21:15. A major northward migration of plovers from Oahu occurred on 25-26 April 1980, and the lessened population at the roost on the 24th was perhaps related to migratory movements.

We found a second roosting site on the roof of the Kailua Intermediate School in Kailua on the windward coast of Oahu. Relative to the Pacific Palisades area, the Kailua site is on the opposite side of the Koolau Mountain range which bisects the island of Oahu, and the plovers there probably represent a different wintering population. Observations, using a spotting scope, were made weekly over the period from 18 September 1979 through 18 April 1980 from the 13th floor of a nearby apartment building. The roof was observed from 30 minutes before to approximately 15 minutes after sunset, by which time it became too dark to see the birds clearly. The number of plovers present at the end of each observation period varied from 9 to 27. While a few birds appeared earlier, most of them began to arrive about 10 minutes before sunset and continued arriving to the limits of our visibility. They came alone or in small groups. Since some fraction of the roosting aggregation probably arrived after dark (based on our observations at Pacific Palisades), we were unable to determine exactly the size of the flock using the Kailua Intermediate School roof. It is reasonable to project a total of around 50 birds.

Compared to other types of structures, schools are likely to be particularly attractive as roosting sites. Low, flat-roofed buildings surrounded by a campus provide relative seclusion from nocturnal human activity in heavily urbanized areas of Oahu. On the evening of 18 April 1980, we visited two additional schools (both in Kailua) to determine if plovers were present. Since direct viewing of the roofs was not possible, we simply listened for the sounds made by roosting birds. Many calls were heard at the Kailua High School at 19:30, implying a large aggregation similar to the Pacific Palisades roost. Only a few calls were heard at the Kalaheo High School at 20:15.

The Pacific Palisades Elementary School was completed in 1966, and provides a specific example of rapid utilization of a new roosting area. The date when plovers first roosted there is unknown, but an aggregation similar in size to that reported above was already established when the site was first observed in 1973. Dates of construction for the other schools mentioned are Kailua Intermediate - 1954, Kailua High School - 1958 and Kalaheo High School - 1966.

Under normal weather conditions, the plovers used open areas all across the surface of the roof. On windy evenings, they modified their behaviour and selectively occupied zones in the lee of ventilators and other structural appurtenances. This response was particularly dramatic at the Kailua Intermediate School on the evenings of 8 and 9 January 1980 at which time an unusually severe tropical storm with heavy rains and gale force winds gusting to about 126 kph was in progress. Several plovers, each in a crouched posture, were observed immediately behind various "windbreaks". Despite the protection afforded by the latter, the birds appeared to be having difficulty maintaining their positions. It was impossible to determine whether they were unable to remain on the roof during these extremely windy nights. No storm-caused mortality was evident since our counts remained comparable throughout the study period.

Roosting plovers did not distribute themselves evenly over available roof surface, but instead formed aggregations on one or more areas of a single roof or of several roofs. A few individuals tended to remain at varying distances peripheral to the aggregation(s). Since there was much aggression within the group, close crowding of roosting birds was seldom observed. They tolerated each other only within certain spatial limits; usually if two birds were closer than about 1.5 m there was an aggressive encounter. The intensity and pattern of these encounters varied. Typically, one bird assumed a crouching posture with head pulled low to the shoulders, and in this threatening position rapidly chased the other bird over a short distance so as to displace it from the immediate vicinity. Chases generally involved running, but this sometimes erupted into brief fluttering flights wherein the attacker attempted to peck and/or buffet (with its wings) the bird being chased. Newcomers alighting amidst or adjacent to birds already on the roof elicited substantial aggressive responses from them. Other studies (Johnson et al. 1981) disclosed a high degree of constancy in daytime behaviour with specific (colour-banded) individuals occupying the same feeding territories daily throughout the wintering period. Perhaps similar behaviour also occurs on the roost with given birds defending the same spaces nightly, and the flock assuming a structured organization comparable to that reported for Redshanks *Tringa totanus* (Furness and Galbraith 1980). Extremely windy weather depressed aggressive behaviour but did not eliminate it; agonistic interactions were observed even during periods of high winds when the birds could scarcely maintain their footing.

Varying degrees of aggressive interaction occurred at the Pacific Palisades site to the limits of our observations at 22:00. During aggressive encounters the birds call repetitively, emitting sounds which can be likened to: "psweer", "psweer wit", "sweerit" and "pseer". The sounds are relatively high-pitched, and have a melodious whistled quality. From his residence nearby, Johnson heard these aggression-related calls coming from the Kailua Intermediate School roost at various hours throughout the night over the entire wintering period.

#### Diurnal activities

Several hundred golden plovers winter on the Kaneohe Marine Corps Air Station (KMCAS) near Kaneohe on the windward coast of Oahu. The base contains attractive plover habitats, including large lawns, grassy runway borders and medians, and saline marshes. KMCAS has numerous flat-roofed buildings but we were unable to locate any nocturnal roosts on them. Instead, we found extensive diurnal use of roofs with large flocks of plovers engaged in loafing, sleeping and preening. One site (consisting of the roofs of four adjacent buildings) was particularly attractive to the birds, and approximate counts for eight dates in December, January, March and April ranged between 50 and 150 plovers on these roofs simultaneously. On various occasions we saw groups of plovers departing from the roofs in the late afternoon and flying in the direction of the Nuupia Ponds (saline marshes managed as bird sanctuaries) where there appear to be important roosting sites. This suggests that roofs are not preferred for roosting when natural habitats are available.

In contrast to the nocturnal behaviour described earlier, little aggression was observed in the diurnal aggregations. Loafing, preening and sleeping birds tolerated each other in close proximity (often 0.5 m or less) without agonistic responses. We made several observations of plovers occupying feeding territories in a small park in a residential area of Kailua. When disturbed by people using the park, the birds generally flew to the safety afforded by the roofs of adjacent houses. After preening and loafing for varying periods of time, they returned to their territories well after the disturbance had passed. Whether the birds were also using these residential roofs as nocturnal roosts was not determined. Since the Kailua High School was nearby, these plovers may have been members of the roosting contingent there.

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O.W. Johnson, Department of Biology, Moorhead State University, Moorhead, Minnesota 56560, U.S.A., and R.M. Nakamura, Department of Animal Sciences, University of Hawaii, Honolulu, Hawaii 96822, U.S.A.

## SOME NOTES ON SEASONAL FLUCTUATIONS IN THE WEIGHT OF DUNLIN *CALIDRIS ALPINA* ON THE FRASER RIVER DELTA, BRITISH COLUMBIA

by G. W. Kaiser and M. Gillingham

#### Introduction

While one would expect fluctuations in the mean weight of a population to follow various environmental stresses, this may not in fact always be the case. For instance, fluctuations in weight of populations of Dunlin in the British Isles cannot consistently be related to periods of bad weather, and Pienkowski et al. (1979) have proposed two theories to account for the pattern of weight changes observed during the winter:

1. Food abundance is high in early winter and the birds store surplus energy intake as fat. As winter progresses, invertebrates become less active and burrow deeper, the daylight period becomes shorter and night feeding is probably less efficient. The accumulated fat reserve is used to compensate for inadequate feeding and the bird loses weight until the weather improves in March.
2. The fat reserves are a form of insurance against difficulties in meeting food requirements. High reserves are maintained through December and January, but may become a disadvantage when the probability of poor weather is reduced in February and March, so fat reserves are reduced.

The purpose of this paper is to show how contrasting conditions in the Fraser River Delta and Britain can be used to support one of these hypotheses.

#### Methods

From December 1976 to May 1980, 2806 Dunlin were banded in the Fraser River Delta, British Columbia, Canada (49°01'N 123°00'W). The birds were mist-netted at high tide, banded, weighed and measured to assist in sex determination. The plumage characteristics for age determination have been described by Prater et al. (1977). In at least two thirds of the population, the length of the exposed culmen identifies the sex (Page 1974).