the weight loss is impressive, particularly since these caged birds had access to a superabundant food supply.

Ricklefs (1968) analyzed the relationship between maximum nestling weight and average adult weight for individual species. For this he constructed a ratio (R) of the asymptote from the growth curve to the average adult weight. Ratios greater than 1.10 were most common in aerial feeders, while ratios less than 0.90 were most common for ground feeders. Also, species with high R values tended to have long nestling periods. The ratio for Monk Parakeets was 1.28. This was somewhat higher than the intermediate levels that might be expected of an arboreal and ground feeder such as this species. However, the high R value of Monk Parakeets is in accord with what would be expected in species with similarly long nestling periods.

Since the energy requirements for nestlings is the sum of maintenance energy and energy for growth, a low growth rate would tend to decrease the rate of energy demand for a nestling. If the number of surviving offspring is limited by the rate at which the parents can deliver energy to the young, then changes in the factors tending to lower the rate of energy demand of the nestlings could increase the number of potential offspring reared by the parents. One way to effect such a change is to lower the growth rate. However a low growth rate also increases the chances for predation and other nest losses by increasing the time in the nest. Monk Parakeets lay large clutches (5–9 eggs) and with their sizable stick-nests which are often built in clusters, this species would seemingly have a relatively secure nest environment. Thus it would seem that this safe nest environment could allow for the extended period of incubation (31 days) and the very low growth rate without a substantial increase in mortality. Therefore the low rate of development may be an adaptation for maximizing the production of young by maximizing clutch size.—DONALD F. CACCAMISE, *Dept. of Entomology and Economic Zoology*, and PETER J. ALEXANDRO, *Dept. of Zoology, Rutgers, State Univ. of New Jersey, New Brunswick, 08903.* *Accepted 1 July 1975.*

Foraging methods of the Song Thrush.—A recent review by Clark (Wilson Bull. 83:66–73, 1971) of bill sweeping in foraging behavior includes his personal observations on the Wood Thrush (*Hylocichla mustelina*), the American Robin (*Turdus migratorius*) and the European Blackbird (*Turdus merula*). Some time ago I was able to make incidental observations at close range of foraging behavior in the Song Thrush (*Turdus philomelos*) and these add some detail and expand the context of Clark's observations. These notes concern the coordination of bill sweeping and foot movements, the occurrence of a distinct form of foraging also using the bill, intra- and inter-individual differences, and the relative use of the 2 types of behavior on different substrates.

All my observations were made between August 1960 and June 1962 on hand-reared birds kept in a large aviary (15 × 5 m). Up to 7 birds lived in one-half of the aviary and were tested singly or in pairs in experiments on camouflage that were set up in the other half. This section contained 3 circular experimental plots about 150 cm in diameter. Two plots were formed from woodwool (a commonly used animal bedding material similar or identical to excelsior) which had been torn up into shorter pieces averaging 5 cm long by 0.2 cm wide. The third plot was formed from wood shavings, each about 1.5 × 0.75 cm, to simulate leaf litter. Each substrate was 2 to 4 cm in depth over a concrete floor. Also in the aviary was a large stack of untorn woodwool and a shallow gutter filled with a wind-blown loose detritus of decayed leaves, dust, small pieces from the experimental plots, etc. The birds regularly found maggots and mealworms in all substrates and also snails in the experimental plots.

TABLE 1

RELATIVE USE OF BILL SWEEPING AND PULLING IN DIFFERENT SUBSTRATES

	Woodwool stacks	Woodwool plots	Floor detritus	Shavings plots
% bill sweeps	25	59	95	100
% lateral pulling	75	41	5	0
Total responses	245	155	519	694
Number of individuals	4	7	10	7

The constant feature of bill sweeping by the Song Thrush is a rapid and usually repeated lateral sweep of the head; at the start the bill is partly buried in the substrate so that typically the movement results in substrate material being thrown to one side. Usually there are 3 to 8 sweeps in quick succession before the bird switches to another activity but occasionally almost continuous sweeping occupies up to 1½ min, as, e.g., when 88 sweeps occurred with the bird pausing only briefly and moving only a few steps during this period.

Sometimes there is a simultaneous scratching movement of one foot acting close to where the bill is sweeping so that both actions disturb the substrate. This foot movement is very rapid and of small amplitude and can only be seen with a close and completely unobscured view. Thus, even though the aviary gave excellent observation conditions, on only a few of the occasions when bill sweeping was observed could the presence or absence of a foot scratch component be determined. I have never noted a foot scratch in the absence of a simultaneous bill sweep and, as I recall it, a scratch of the left foot occurs with a bill sweep to the left and vice versa.

During 12 observation sessions involving 5 birds, sequences of bill sweeping were observed closely enough to examine the bill and foot coordination in a semi-quantitative way. Only 1 bird regularly used the foot scratch. In 3 tests about 75% of 228 sweeps coincided with a foot scratch; in another test (15 sweeps) the foot scratch occurred in fewer than half the responses. A second bird produced foot scratches in 1 out of 2 tests that gave a total of 28 bill sweeps whilst the final 3 birds demonstrated in 6 tests only 2 scratches in 190 bill sweeps.

Variation also occurs in the general incidence of bill sweeping. The length of an observation session depended on the success of a bird in snail hunting and hence was usually between 10 and 20 min. The probability of recording any sweeping during a test varied among individual birds from 0.13 to 0.60. On a sample of 6 birds this variation is highly significant (chi-square; $p < 0.01$). The variation is not simply due to different test lengths since the 3 birds with the lowest probabilities of sweeping were observed over more and longer tests.

Quite often my Song Thrushes showed a distinct additional foraging behavior; a bird would grasp material firmly in the bill and pull it backwards and laterally with a combined head and body movement with the overall position of the bird shifting little or not at all. The use of this pulling response is strongly connected with the type of substrate. Table 1 shows that pulling is a common response when a bird forages at the edge of a stack of tangled, untorn woodwool and fairly common on the plots of torn-up woodwool. Bill sweeping is the dominant response on the plots of wood shavings and in floor detri-

tus; in both these cases long fibers are scarce. The pulling behavior is very similar to that shown by recently fledged birds that grip and pull back the paper lining of a cage floor but in that context the lateral component is absent.

The overall frequency of sweeping plus pulling varies among birds by a factor of $\times 5$. The relative frequency of pulling (out of the 2 foraging behaviors combined) varies among birds from 0 to 35% due to different frequencies of foraging in different substrates and to differences in behavior on a single substrate. These data are distributed rather erratically among birds and substrates so that an overall formal analysis is not possible.

The sweeping behavior of Song Thrushes in aviaries seems similar to that of the species in the wild and to that of the closely related European Blackbird. Thus Snow (A Study of Blackbirds, George Allen and Unwin, London, 1958) writes of *Turdus merula*: "as the bill comes down to flick, . . . , one foot comes forward to the level of the head and scratches vigorously backward." I have also observed this species pick up and throw aside individual leaves of Sycamore (*Acer pseudoplatanus*) which besides being large had become sodden and heavy. It would be interesting to examine other species of *Turdus* to determine if they share the range of foraging behaviors reported here and whether species of different body size use different behaviors in the same substrate.

In my aviary situation Song Thrushes found most of their food without sweeping and pulling and in many observation sessions these behaviors did not occur. Inspection of my original notes suggests that, when they did occur, sweeping and pulling could not be correlated with any change in environmental stimuli or placed at particular times in a sequence of hunting and resting. It is possible that field observations would reveal a more systematic organization of foraging and a lesser degree of individual variation. It would be of interest to examine in controlled operant situations how the frequency of these natural patterns of foraging behavior could be influenced by making the discovery of food more or less contingent on performance.

These observations were made during the course of work for a D. Phil. supervised by Professor N. Tinbergen and using the facilities of the Department of Zoology, University of Oxford, by permission of Professor Sir A. C. Hardy.—C. J. HENTY, *Dept. of Psychology, Univ. of Stirling, Stirling, Scotland. Accepted 18 July 1975.*

A late nesting attempt by Clark's Nutcracker.—On 1 June 1974 I observed a pair of Clark's Nutcrackers (*Nucifraga columbiana*) during an early stage of nest construction. The nest platform had patches of sky showing through and resembled the first-day structure described by Mewaldt (Condor 58:3–23, 1956). Placed approximately two-thirds up in a 20 m lodgepole pine (*Pinus murrayana*), the nest was located on an east-facing slope above Tioga Lake, elevation 2970 m, latitude 38°, in Inyo National Forest, Mono Co., California.

Between 12:40 and 13:30, the birds made 9 trips to the nest. Twigs were brought and set in place on 3 visits. Forty-five min after the last nest visit both nutcrackers returned to the vicinity of the nesting tree, one bird landing near the nest and the other perching in an adjacent lodgepole pine, each giving the soft, "musical" nesting call described by Mewaldt (1956). Although the intensity of nest-building activity did not match the rate observed by Mewaldt (1956) of one trip with nesting material per bird every 3 or 4 min, the use of territorial perches and nesting calls followed his description.

I observed the nest again on 20 June, 12:00, at which time the structure was a complete bowl with no holes in the bottom. After two hours of observation, there were no signs of an incubating nutcracker on the nest, nor were any nutcrackers seen in the vicinity. Again on 26 June, I saw no nutcrackers; and, I assume the nesting attempt was aborted.