to associate certain clues at the surface (see for example Shaffer, Specializations in the feeding behaviour of gulls and other birds, D. Phil. Thesis, Oxford Univ., 1971) with hidden food. However, not all of the adults' digging efforts were rewarded.

Although I have not shown that a gull who digs finds more food than one who does not dig, I think it is safe to assume that digging is profitable. My data (tables 1 and 2) show a strong correlation between increased digging and the number of food items found. As the frequency of successful stealing does not seem to improve with age, but digging does, stealing becomes an occasional activity, rather than a way of life. Most adults find their own food, but all of them probably try to steal when the opportunity arises.

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MATE ATTRACTION FUNCTION OF SONG IN THE WHITE-THROATED SPARROW

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It is postulated that male advertising song in passerines functions sexually to attract the female and maintain the pair bond, and/or functions aggressively as a threat to rival males. The degree to which song serves both functions concurrently is dependent upon the stage in the breeding cycle and the presence or absence of such external stimuli as an intruding male, the absence of a female, or a conspecific song.

Falls (in R. A. Hinde [ed.] Bird vocalizations, Cambridge Univ. Press, Cambridge, 1969) proposed that the song of the White-throated Sparrow (Zonotrichia albicollis) serves three functions: (1) to attract mates (2) coordinate breeding activities and (3) exclude rivals from a home area. This study investigates the possibility that unmated male White-throated Sparrows use song to attract females.

Under natural conditions I investigated the daily singing activity of six males. I observed singing before and after pair formation (table 1). After a female paired with male One for seven days and another female paired with male Two for thirteen days, I removed the females and compared singing activity before and after removal (table 2). Male Two, after two days, formed a pair bond with a new female and I studied his singing activity before and after the second pairing (table 2).

The study took place in northern coniferous forest at two locations in New Hampshire. I observed one White-throated Sparrow (Wilmot Co.) from 5 May to 31 July 1974 and the five other individuals (Danbury Co.) from 9 May to 24 June 1975. Observations began when males established territories. At the Danbury study site I recognized the color-banded sparrows by their song alone and I monitored all five birds simultaneously from one place. For the six birds, I recorded the number of minutes a male sang for three 30-min periods each day. If a male sang at least once during the one-minute interval

I recorded him as singing for that minute. I collected singing data between two and four hours after sunrise and observed males daily to determine whether pairing occurred.

I used the Student-Newman-Keuls test to examine the differences between all possible pairs of daily means when a one-way analysis of variance indicated a difference in daily singing activity.

Considering all six sparrows as a group, males sang significantly more before they paired with females than afterward. Daily singing behavior differed significantly over the nine-day period (see table 1, $F = 53.10$, $df = 8,120$, $P < 0.001$). Comparison of individual daily means of singing frequency, taken two at a time, revealed no significant differences in singing frequency between days either before or after pairing ($P > 0.05$). Singing frequency during the four days before pairing, however, was significantly different from singing frequency on each of the five days after pairing ($P < 0.05$). Thus, the arrival of a female corresponds to a significant decrease in the male's singing behavior.

For both birds in the removal experiments, the four days examined (day −1 to day +2, female removed on day 0, see table 2), had significantly different daily singing frequency means ($F = 26.86$, $df = 3, 8$, $P < 0.001$, for bird One; $F = 6.55$, $df = 3, 8$, $P < 0.05$, for bird Two). In both cases, singing behavior for the two days before female removal did not vary, nor did that of the two days after removal ($P > 0.05$). The days before removal, however, differed significantly from each of the days after removal ($P < 0.05$). After female removal, singing increased significantly.

After bird Two paired again, his singing decreased significantly. Considering the two observations immediately before and after pairing (day +1 to +4, see table 2), the daily singing frequency means differed significantly ($F = 19.61$, $df = 3, 8$, $P < 0.001$). There was no significant difference between the two daily means before or between the two daily means after pairing ($P > 0.05$). When the days before pairing were compared to the days after pairing there was a significant difference ($P < 0.05$). Thus, before pairing, in the absence of the

TABLE 1. Singing behavior of White-throated Sparrows in New Hampshire. Each datum corresponds to the number of minutes out of thirty that the bird was singing. Day zero was the day of the first reading taken with the male and female paired.

	DAY								
BIRD	−4	−3	−2	−1	0	+1	+2	+3	+4
Danbury Co.									
	13	17	13	10	5	6	10	5	5
One	17	12	22	18	2	4	8	4	5
	15	20	20	14	4	5	3	2	8
		15	16	14	6	3	4	1	8
Two		20	15	11	2	2	2	2	2
		9	15	15	0	3	4	4	4
		16	15	23	4	0	3	3	4
Three		15	10	14	9	0	7	2	4
		10	20	17	4	1	1	0	9
			13	10	1	0	1	2	4
Four			11	10	2	3	0	6	4
			10	15	6	9	1	0	0
	16	15	16	15	5	3	2	3	3
Five	17	9	9	13	8	0	1	0	0
	16	7	6	14	0	0	1	0	6
Wilmot Co.									
	17		26			2	7	5	1
One	16		19			2	5	3	7
	17		17			0	8	4	2
x̄ ± S.E.	16.00	13.75	15.17	14.20	3.87	2.39	3.78	2.56	4.22
	± 0.44	± 1.25	± 1.19	± 0.89	± 0.70	± 0.58	± 0.72	± 0.44	± 0.63

female, singing was significantly higher than after pairing.

Hinde (1969) and Catchpole (Behaviour 46:300–320, 1973) proposed that to determine the function of a behavior we must observe the result of the performance of that particular behavior. If the outcome is consistent and "beneficial," we conclude that the function of the behavior is to achieve the final outcome. A consequence of singing is the procurement of a mate, which is beneficial to a sing-

ing male. Following this line of reasoning, a function or adaptive value of the advertising song of *Zonotrichia albicollis* is to attract a female.

The possibility still exists, however, that acquiring a mate merely interferes with a male's singing. If this is the case, song might function only in the aggressive context. The briefer time of male singing that occurs after pairing could be solely a consequence of new time budget demands on the male. After pairing, a male may be forced to spend more

TABLE 2. Singing behavior of birds One and Two before and after the female was removed. On the afternoon of day zero the female was removed. On day plus three bird number Two was paired again. Each datum corresponds to the number of minutes out of thirty that the bird was singing.

	DAY							
BIRD	−1	0	+1	+2	+3	+4	+5	+6
	4	2	18	15	13	26	18	20
One	6	6	16	23	17	12	13	25
	7	5	15	20	16	14	8	22
x̄ ± S.E.	5.67	4.33	16.33	19.33	15.33	17.33	13.00	22.33
	± 0.88	± 1.20	± 0.88	± 2.33	± 1.20	± 4.37	± 2.88	± 1.45
	11	7	16	18	8	10	6	13
Two	13	13	19	14	11	9	4	7
	8	10	16	15	8	9	6	8
x̄ ± S.E.	10.67	10.00	17.00	15.67	9.00	9.33	5.33	9.33
	± 1.45	± 1.73	± 1.00	± 1.20	± 1.00	± 0.34	± 0.87	± 1.85

time in activities associated with his mate and have less time for aggressive singing.

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FOOD CACHING IN THE SCREECH OWL

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Instances of food storing or caching in raptors have been reported (Pierce, Condor 39:140, 1937; Tordoff, Wilson Bull. 67:138, 1955; Stendell and Waian, Condor 70:187, 1968). Food storage may be appropriate when a food resource is periodic and/or unpredictable. It has been proposed that this behavior is adaptive for avian predators such as shrikes (Lanius) (Cade, Living Bird 6:43–86, 1967) and Snowy Owls (Nyctea scandiaca) (Pitelka et al., Ecol. Monogr. 25:85, 1955).

In April 1974, on Amherst Island, near Kingston, Ontario, Canada, I found a Screech Owl (Otus asio) storing meadow voles (Microtus pennsylvanicus) on a rafter inside an old shack. Three visits were made to the site. At each visit, a Screech Owl was flushed from the shack. Numerous regurgitated pellets were found in the shack, indicating that the owl had been using it for a long period.

On April 12, seven voles were found on the rafters. Each vole was weighed and eartagged for subsequent identification. Two days later, there were only five voles, all with eartags. A week later, I found six voles, four of them eartagged. The size of the voles in the cache was between 13 and 26 g (mean 20.1 g; N = 9). I could find no apparent signs of external injury on the voles in the cache. The owl appeared to be storing vole carcasses it had picked up nearby.

At the time of my observations, the vole population on the island was declining in density, from approximately 165 voles/ha to about 33/ha. Vole carcasses were abundant in the vicinity of the shack.

My findings show turnover in the cache. However, some stored items remained longer than those observed by Stendell and Waian (1968). During forty days of observation of a kestrel (Falco sparverius) cache, prey items were stored for seven days at most. The storage of prey by raptors must be brief because decay may often be rapid. Decay is probably the chief factor limiting the usefulness of a cache. When decay is slow, as in winter, or the turnover rate of the cache is high, as while feeding young, decay is less limiting.

Food caching is probably adaptive in many situations, providing a readily accessible food supply. In shrikes, this behavior is necessitated by the similarity in size of the predator and the prey. In the Snowy Owl, the accumulation of prey items is probably in response to the great demand for prey by the female and young during the nesting period. It is possible that the caching behavior in this instance was also related to breeding as Screech Owls in this locality begin nesting in mid-April. However, there was no evidence that the owl in question was nesting.

As a result of caching behavior, foraging time may be reduced, permitting more time for other activities (e.g. breeding). It seems possible that caching could occur before actual breeding activity commences if physiological changes themselves are adequate to elicit this behavior at the onset of the breeding season. Thus, caching could provide a margin of safety in the provision of food, while substantially reducing the time and energy costs normally associated with foraging.

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HEAD-SCRATCHING BY A ONE-LEGGED CHAFFINCH

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R. B. Waide and J. P. Hailman described head-scratching attempts by one-legged birds (Condor 77:350) and concluded that the behavior is functionally important. This note supports their view.

In late March 1956 a female Chaffinch (Fringilla coelebs) with a broken right leg started coming to my garden, and subsequently to window ledges, for artificial food. By 11 April 1956 the bird's toes and section of the tarsus below the break had withered and dropped off leaving a tarsal stump < 1 cm in length. The bird continued to come for food until the late summer of 1960 and amongst my sporadic notes made about its behavior there are several con-