LABORATORY MAINTENANCE OF TREE SPARROWS

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Wild birds have increasingly become the subject of laboratory investigations by scientists. The recently discovered relationship between birds and arborviruses and the increased use of birds in the study of bioenergetics have resulted in increased attempts to maintain these animals in captivity for experimental purposes. Stamm (1966) expressed the need for more information on methods of maintaining wild birds in the laboratory. Farrar (1966) states that there is still little information on several of the species of birds widely used in the study of bioenergetics.

The main objective of this investigation was to determine the foods on which the Tree Sparrow, *Spizella arborea,* could best maintain its weight while in captivity in a laboratory environment. Information concerning the amount of food and water consumed, weight of excreta, and body weight fluctuations was recorded from December, 1967 to April, 1968 at the Rice Creek Biological Field Station, State University College, Oswego, New York.

METHODS

Trapping of the Tree Sparrows began in early December, 1967 and continued until 20 birds were captured early in January, 1968. The trap consisted of a rectangular wooden frame of six square meters covered by a nylon mist net which fell over the birds attracted to feed under the net.

Twenty cages (16″ × 9½″ × 7″ high) were used and divided by cardboard into three rectangular compartments to minimize scattering of feed and water. The larger middle compartment contained a perch, and the side compartments contained the feed and water. The bottom of the cage was covered by cardboard in order to further reduce scattering and contain the loss. The front of the food compartment was covered with clear plastic and the bottom cardboard was cut out under the feeder. The plastic prevented food from being thrown out the front and removal of the cardboard directly below the feeder allowed dropped food to fall out of the cage and into a collecting pan below. The interior bottom of the cage was lined with aluminum foil as recommended by Martin (1967) to facilitate the separation of feed and feces.

Several types of feeders were tested and the simplest proved to be the most satisfactory. A 250 ml beaker with the top half covered by tape was used. This type of feeder contained enough food to last a week and reduced scattering to a minimum.

The water container was a junior baby food jar, which held 250 ml of water, inverted over an oversized cap with a stick tipping the jar which allowed water to seep into the cap. The jars were filled under water so that all air was eliminated from the system.

According to West (1960) there was no difference between the energy requirements of male and female Tree Sparrows even though the males weighed slightly more. Because of this, the sex of the bird was not considered and all data for both sexes were combined.

Twenty birds were divided into four groups of five birds each. Group 1, consisted of birds 1A, 2A, 3A, 4A, and 5A, and were fed a commercial mix called Feathered Friend packaged by Agway, Inc. of Syracuse, New York. This mix contained millet, wheat, sunflower seeds, milo and peanut hearts. Group 2, consisted of birds 6A, 7A, 8A, 9A, 10A and were fed millet. Group 3, consisted of birds 11A, 12A, 13A, 14A, 15A and were fed finely cracked corn. Group 4, consisted of birds 16A, 17A, 18A, 19A, 20A and were fed sunflower seeds removed from their shells. The investigation was carried out for twelve weeks and each group of birds was always fed the same type of food.

As recommended by West (1960) a period of days was allowed for the birds to adjust to captivity before the experiments were conducted. Also climatic adjustment was necessary as the birds were taken from a winter environment and placed in a room at 24°C and with 16 hours of daylight maintained by an automatic time switch.

The experimental procedure during the 12 week period remained consistent and was as follows: The aluminum foil bottom was weighed to the nearest 0.01 gram and placed in the bottom of the cage. The feeder jar was filled with the appropriate food and weighed to the nearest 0.01 gram. The water jar was filled under water to eliminate all air, the volume for each jar having been previously determined. Finally, the birds were weighed to the nearest 0.1 gram and one bird placed in each cage.

At the end of each week, the bird was removed and weighed. The food spilled on the aluminum foil was separated from the feces and weighed along with the remaining feed left at the end of the week in the feeder jar. Subtraction of this weight from the original weight of the feed at the beginning of the week gave the amount of feed consumed by the bird per week. The aluminum foil containing the feces was folded and dried. The foil was then weighed to obtain the dry weight of the feces.

Because of loss of water by evaporation, controls were necessary to determine the amount of water consumed. Each group had a control water bottle near their cages from which evaporation loss was measured. Thus the amount of water consumed by each bird per week was obtained.

RESULTS

After capture, the body weight of the birds in all four groups declined and remained at a level below their original weight. Each group

showed different body weight changes during the 12 week experimental period as seen in Figure 1 and Table 1. The first group, which was fed mixed grain, and were selective in their consumption of the various components of that mix, was the most stable throughout the experimental period. There was a decline during the first week, but then there was a stable period lasting for seven weeks. Although weakened by their period of captivity, none of the birds died and all were able to fly well when released.

The millet fed second group varied quite erratically in weight with slight weight increases interrupting a gradual decline. Although their weight did not drop as low as the corn group, the millet group suffered the greatest number of casualties. Three of the original five birds died

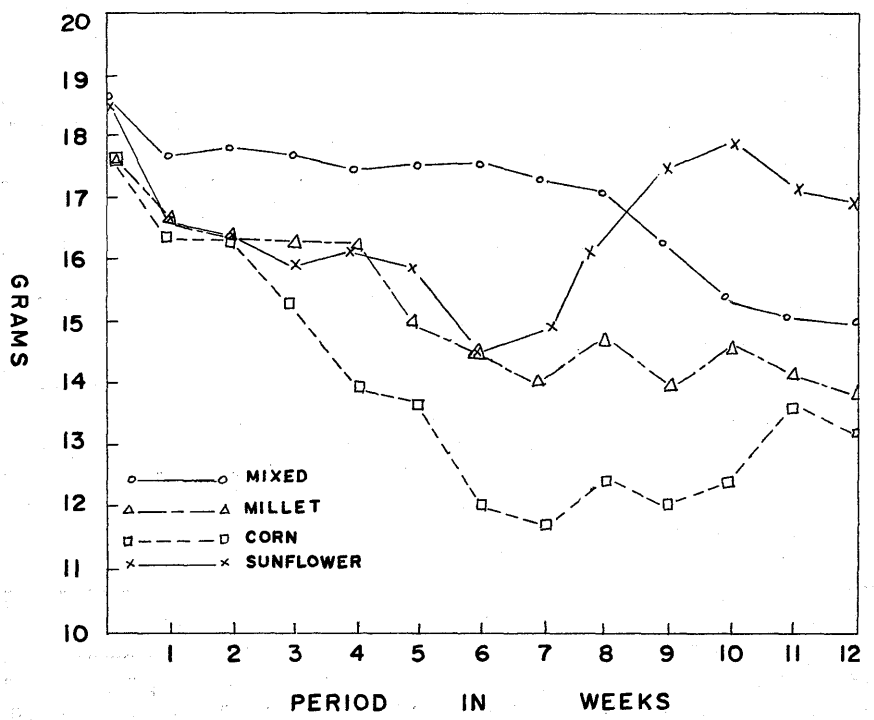

Figure 1. Average weight of Tree Sparrows fed four feed types for 12 weeks. Five birds were in each group.

toward the end of the twelve week study. The remaining two birds were so weakened that they could only fly poorly when released.

The corn fed group dropped to very low weights during the first six weeks and then remained low the rest of the experimental period. They were in extremely poor condition and could not fly at the time of release but only one bird died at the end of the experiment.

The fourth group, which was fed sunflower seed, experienced more body weight fluctuation than the first group and one of the birds died. They maintained the highest average weights and were only slightly below their normal weight when the study ended. They were slightly weakened by their experience but easily flew away when released.

A summary of the weekly measurements of food consumption, water consumption, and feces weights is presented in Table 2. Statistical analysis was used to determine if equal amounts of the four feeds were consumed, if equal quantities of feces were produced by birds in the four groups, and if weight fluctuation of birds fed on the four feeds was similar. The analysis of variance was evaluated by an F-test to determine if the above parameters were true.

TABLE 1

Weight Loss of Laboratory Maintained Tree Sparrows

Period (days of captivity)	*Mean Loss at End of Period (Percent of Normal)*[1]			
	Feed Groups[2]			
	Mixed	*Millet*	*Corn*	*Sunflower*
Normal Mean Weight	18.7 gms	17.8 gms	17.4 gms	18.4 gms
1–7	5.9%	6.2%	6.3%	9.2%
8–14	4.8	7.9	6.3	10.9
15–21	6.4	7.9	12.1	14.1
22–28	8.6	7.3	20.1	12.0
29–35	6.4	15.7	21.3	13.6
36–42	5.9	18.0	29.9	21.7
43–49	7.5	20.8	32.2	18.5
50–57	8.0	15.2	27.6	10.3
58–64	13.4	18.0	30.5	6.5
65–71	17.6	15.7	28.2	5.4
72–78	19.3	18.0	20.1	7.6
79–85	19.8	20.8	24.7	9.8

[1] Normal refers to the mean weight of each group at beginning of experiment period.
[2] There were 5 experimental birds in each feed group.

The amount of food consumed by each bird fed on the four feeds and the analysis of variance is presented in Table 3. The F test for Table 3 shows a null hypothesis probability of more than 1%. Therefore, the null hypothesis cannot be rejected. This means that on the average the four feeds are equal in the amount consumed.

The amount of feces voided by birds fed on the four feeds and the analysis of variance is presented in Table 4. The F test for Table 4 shows a null hypothesis probability of less than 1%. This means that the null hypothesis must be rejected and that the four feeds do not result in the same amount of feces voided.

A summary of weight fluctuation of birds fed on the four feed types and the analysis of variance is presented in Table 5. The F test shows a

TABLE 2

Average Food and Water Consumption and Feces Excreted in Laboratory Maintained Tree Sparrows for 12 Weeks.

	Bird #	*Grams of Feed Consumed per Week*	*Milliliters of Water Consumed per Week*	*Grams of Feces Excreted per Week*
Mixed	1A	24.55	38.9	3.66
	2A	23.98	33.6	4.12
	3A	25.14	30.1	3.42
	4A	23.51	28.4	2.77
	5A	23.08	51.6	3.08
Millet	6A	22.77	27.7	7.48
	7A	21.64	51.3	4.17
	8A	29.21	31.3	9.41
	9A	28.99	26.0	9.96
	10A	20.85	3.3	9.97
Corn	11A	20.82	37.0	2.85
	12A	24.12	40.7	2.41
	13A	17.32	32.1	2.65
	14A	20.58	59.1	2.49
	15A	20.29	18.9	2.89
Sunflower	16A	21.07	66.4	9.12
	17A	16.55	84.3	6.13
	18A	20.71	57.4	10.63
	19A	20.33	37.6	8.64
	20A	18.81	44.1	7.61

null hypothesis probability of less than 1%. Therefore, the null hypothesis must be rejected which means the four feeds do not produce the same gain in weight. Further support for this hypothesis can be seen in Figure 1 where a decided difference can be noted in the curves of these graphs showing variations in bird weights in the four groups.

DISCUSSION

When wild birds are placed in captivity, there tends to follow a period of weight loss lasting from a few days to weeks. In his investigation with Slate-colored Juncos, Farrar (1960) reported an immediate decrease in weight, followed by an increase to some stabilized position below normal weight. He suggested that the rate of change, maximum loss, timing and final stabilization point may or may not be dependent upon environmental conditions and that the decreases may be a result of some psychological effect, a change in diet, or most probably inactivity resulting in muscle atrophy accompanied by a shift in water content to restore normal water balance. West (1960) also reported a decline in body weights after capture in his study with Tree Sparrows. West, however, maintained that the birds returned to their original levels of body weight after a few days of captivity.

In this study none of the Tree Sparrows returned to their original weights. Weight losses were fairly continuous in all groups with the exception of the sunflower seed fed group, which was able to nearly regain the weight initially lost and the mixed feed group which was able to maintain a fairly stable weight for seven weeks before it declined at the end of the experimental period. The birds maintained on sunflower seeds appeard to be healthier and were stronger when released. Loss of strength was partly due to the lack of exercise space due to the small size of the cage, although the feed probably was primarily responsible for the weakening of the birds.

The fact that the birds survived best on the mixed grain and sunflower seeds is indicated by the sample variances for these groups which were much lower than those for the millet and corn (Table 3). The birds on the more nutritional diet showed less individual variation of feed consumed and showed less weight fluctuation during the period than did those birds on the other feeds, which probably indicated some stability in the better fed groups.

The birds consumed, on the average, equal amounts of each of the four feed types in spite of the advantage to the bird of two of the feeds. This phenomenon appears to be consistent with the observation that many vertebrates will eat available food to fill their stomachs even if that food is of low nutritional value. The fact that each feed type did not produce equal amounts of feces probably indicates that some of the feeds are more readily digested than others and thus produce less fecal material.

TABLE 3

Maximum-Minimum and Mean Amounts of Food Consumed per Week in Grams by Laboratory Maintained Tree Sparrows During 12 Weeks.

	Bird #	*Max-Min*	*Sample Mean*	*Sample Variance*	*95% Confidence Interval*
Mixed	1A	26.95-20.37	24.55	1.19	$23.86 < \mu < 25.24$
	2A	28.83-20.30	23.98	2.33	$22.51 < \mu < 25.45$
	3A	27.18-20.93	25.14	2.96	$23.84 < \mu < 26.44$
	4A	26.25-19.25	23.51	2.03	$22.23 < \mu < 24.79$
	5A	26.53-18.45	23.08	2.76	$21.33 < \mu < 24.83$
Millet	6A	24.87-21.49	22.77	1.32	$21.89 < \mu < 23.65$
	7A	30.90-16.99	21.64	4.79	$18.60 < \mu < 25.10$
	8A	34.87-20.75	29.21	4.05	$25.90 < \mu < 32.52$
	9A	36.77-20.16	28.99	5.08	$25.09 < \mu < 32.89$
	10A	26.84-14.73	20.85	3.73	$18.49 < \mu < 23.21$
Corn	11A	28.14-14.63	20.82	4.53	$17.94 < \mu < 23.70$
	12A	35.77-16.37	24.12	6.89	$19.74 < \mu < 28.50$
	13A	25.83-13.16	17.32	3.90	$14.51 < \mu < 20.13$
	14A	32.06-13.39	20.58	5.47	$17.11 < \mu < 24.05$
	15A	25.38-16.10	20.29	3.47	$18.09 < \mu < 22.49$
Sunflower	16A	24.92-18.55	21.07	2.02	$19.79 < \mu < 22.35$
	17A	22.75-13.59	16.55	2.42	$15.02 < \mu < 18.08$
	18A	23.17-17.64	20.71	1.83	$19.55 < \mu < 21.87$
	19A	21.56-18.59	20.33	1.22	$19.06 < \mu < 21.60$
	20A	22.89-15.41	18.81	2.36	$17.31 < \mu < 20.31$

μ mean

Analysis of Variance of Table 3

Source of Variation	*Degrees of Freedom*	*Sum of Squares*	*Mean Squares*	*F*
Between Samples	3	97.19	32.39	4.87*
Error	16	106.34	6.64	
Total	19	203.53	—	

* $F.01$ = significant for $F < 5.29$

TABLE 4

Maximum-Minimum and Mean Amounts of Feces Excreted per Week in Grams by Laboratory Maintained Tree Sparrows During 12 Weeks.

	Bird #	*Max-Min*	*Sample Mean*	*Sample Variance*	*95% Confidence Interval*
Mixed	1A	4.55-3.03	3.66	0.47	$3.30 < \mu < 4.02$
	2A	4.67-3.35	4.06	0.48	$3.70 < \mu < 4.42$
	3A	4.51-2.38	3.30	0.71	$2.76 < \mu < 3.84$
	4A	3.50-2.19	2.81	0.51	$2.42 < \mu < 3.20$
	5A	4.64-2.03	3.07	0.74	$2.51 < \mu < 3.63$
Millet	6A	9.06-5.04	7.48	1.10	$6.74 < \mu < 8.21$
	7A	6.37-2.24	4.17	1.22	$3.40 < \mu < 4.94$
	8A	12.42–5.53	8.41	2.43	$6.38 < \mu < 10.44$
	9A	15.33-4.32	9.96	4.29	$6.67 < \mu < 13.25$
	10A	6.58-2.95	3.97	1.16	$3.24 < \mu < 4.70$
Corn	11A	3.92-1.23	2.85	0.80	$2.35 < \mu < 3.25$
	12A	3.08-1.68	2.40	0.56	$1.98 < \mu < 2.82$
	13A	3.57-1.82	2.64	0.56	$2.25 < \mu < 3.03$
	14A	3.53-1.47	2.50	0.76	$2.02 < \mu < 2.98$
	15A	4.27-1.41	2.89	1.09	$2.20 < \mu < 3.58$
Sunflower	16A	14.21-5.25	9.56	2.17	$8.91 < \mu < 10.21$
	17A	11.41-3.57	6.53	1.92	$5.24 < \mu < 7.82$
	18A	15.33-8.59	11.25	3.75	$8.73 < \mu < 13.77$
	19A	10.57-7.91	5.91	1.81	$3.66 < \mu < 8.16$
	20A	10.05-5.46	7.92	1.51	$6.91 < \mu < 8.93$

μ = mean

Analysis of Variance of Table 4

Source of Variation	*Degrees of Freedom*	*Sum of Squares*	*Mean Squares*	*F*
Between Samples	3	116.0	38.7	13.82*
Error	16	44	2.80	
Total	19	160.0	—	

* F.01 = not significant for $F > 5.29$

TABLE 5

Maximum-Minimum and Mean Weight Fluctuations per Week in Grams by Laboratory Maintained Tree Sparrows During 12 Weeks.

	Bird #	*Max-Min*	*Sample Mean*	*Sample Variance*	*95% Confidence Interval*
Mixed	1A	17.5-15.2	16.60	.71	$16.18 < \mu < 17.02$
	2A	19.3-15.8	17.98	1.09	$17.33 < \mu < 18.63$
	3A	20.1-17.0	18.73	.97	$18.15 < \mu < 19.31$
	4A	18.2-12.6	15.41	1.78	$14.34 < \mu < 16.48$
	5A	19.2-13.6	16.06	1.70	$15.04 < \mu < 17.08$
Millet	6A	16.1-12.4	14.12	1.16	$13.39 < \mu < 14.85$
	7A	18.2-13.0	14.96	1.28	$14.19 < \mu < 15.73$
	8A	17.7-13.1	16.52	.99	$15.76 < \mu < 17.28$
	9A	18.2-13.7	14.96	1.42	$13.96 < \mu < 15.97$
	10A	20.2-14.9	17.00	2.05	$15.77 < \mu < 18.23$
Corn	11A	16.2-11.5	13.40	1.80	$12.32 < \mu < 14.48$
	12A	21.1-12.6	15.32	2.76	$13.66 < \mu < 16.98$
	13A	18.7-10.2	13.10	2.75	$11.26 < \mu < 19.94$
	14A	17.2-12.3	13.89	1.59	$12.93 < \mu < 14.85$
	15A	15.7-11.7	13.17	1.23	$12.43 < \mu < 13.91$
Sunflower	16A	18.4-14.6	17.00	1.01	$16.39 < \mu < 17.61$
	17A	18.4-13.1	15.86	1.30	$15.08 < \mu < 16.64$
	18A	19.3-14.9	16.95	1.08	$16.30 < \mu < 17.60$
	19A	18.7-13.2	15.04	1.10	$14.03 < \mu < 16.05$
	20A	20.0-14.5	17.00	1.61	$16.03 < \mu < 17.97$

μ = mean

Analysis of Variance of Table 5

Source of Variation	*Degrees of Freedom*	*Sum of Squares*	*Mean Squares*	*F*
Between Samples	3	97.19	32.39	8.44*
Error	16	106.34	6.64	
Total	19	203.53	—	

* F.01 = not significant for $F > 5.29$

SUMMARY

This study was conducted from December, 1967 to April, 1968 at the Rice Creek Biological Field Station, State University College, Oswego, New York for the purpose of obtaining information on the maintenance of a selected fringillid in the laboratory.

In the study, twenty Tree Sparrows were divided into four groups of five birds each. The groups were fed commercial mixed feed (Agway Feathered Friend), millet, corn, and sunflower seed respectively. Data concerning bird weights, food and water consumed and feces voided were collected once a week over a twelve week period. The findings are as follows:

1. The Tree Sparrows were most successful in maintaining their body weight when fed the mixed grain or sunflower seed. Of the two feeds, the sunflower seed appeared to be slightly better.

2. The Tree Sparrows could not maintain their weight on millet or corn. Of the two grains, however, corn was better than the millet.

3. In this study Tree Sparrows consumed approximately the same amounts of food per day irrespective of the type of grain.

4. The amount of feces voided by the birds was dependent upon the type of feed.

5. If fed a mixed grain, the birds were selective in their consumption of the various components of that mix.

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