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Biology Department, West Virginia University, Morgantown, West Virginia 26505.

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WEIGHT CHANGES AND FEEDING BEHAVIOR OF A CAPTIVE-REARED BALD EAGLE

By PAUL A. STEWART

On 15 June 1962, when I was stationed at Petersburg, Alaska, a nestling Bald Eagle (*Haliaetus leucocephalus*) was brought to me by fishermen. The eaglet was reported to have been found on the bare ground of the shore of Wrangell Narrows near an area of intensive logging operations. The fishermen thought that the eaglet had been removed from its nest by the logging crew before they felled its nesting tree and that it had been left on the ground with the expectation that the parent birds would find and care for it. There was an unidentified dead bird with the eaglet, presumably left as food for the eaglet by either the logging crew or the parent birds. The eaglet appeared to be in perfect health and thus was assumed to be of approximately normal weight. As I was at the time employed by the U. S. Fish and Wildlife Service on a research project involving the effects of DDT exposure on Bald Eagles, I was prepared to care for the eaglet and to collect data on its feeding behavior and growth rate. The eaglet was later transported to the Patuxent Wildlife Research Center, Laurel, Maryland where research on it was continued. This paper reports some of the results of the research conducted on this bird in Alaska and at the Patuxent Wildlife Research Center. Various phases of this study extended through about the first year of the eagle's life.

METHODS AND EQUIPMENT

When at Petersburg, Alaska, during the period 15 June to 2 July, the eaglet was kept in a cardboard box where it was fed on ground flounders, liver meal, and multiple vitamins, the same diet as was used by Chura and Stewart (1967), except that Terramycin was not used. At the Patuxent Wildlife Research Center, until growth was completed, the bird was fed whole whitings and ground horse meat, purchased at a local store. During the 16 days in Alaska the eagle was fed twice daily; later it was fed once daily except when feeding experiments were in progress.

Figure 1 Combination roosting and weighing perch for Bald Eagle. The hand of the balance has made one revolution for 5 pounds which is not shown on the photograph.

After the bird attained full growth and its plumage became relatively well developed, it was confined in a cage, 10 ft by 10 ft by 8 ft, containing a rain-proof roof, a wind-proof side, three wire sides, and a wire floor. Its diet was experimentally varied to include various road-killed animals, commercial dog food, cooked rolled oats, grass, ground horse meat, whole whitings, and smelts. A metal pan, 36 in. by 30 in. by 6 in., was kept on the floor of the cage, always holding several inches of water, intended for both drinking and bathing. During the winter the water was frozen and snow was left on top of the ice for variable periods of time.

To provide the eagle with an elevated roosting and resting place and to provide a means for weighing it without undue disturbance, a horizontal perching bar was installed near the center of the rear of the cage. This perching bar was suspended from a Chatillon spring balance (Fig. 1), graduated to ounces, with a weighing capacity of about 6.5 kg. The bar moved freely up and down in channels at both of its ends. In the channels below the perching bar was a second bar which could be raised or lowered by pulling or releasing a rope extending from the bar through pulleys to the outside of the cage, thus either holding the perch up and the hand of the balance at zero or being entirely out of contact with the eagle-loaded perch. Above both ends of the perching bar were inward and downward projecting arms, wider apart above than below, enabling the eagle to spread its wings when leaving or approaching the perch but forcing it, when sitting on the perch, to sit at about the center of the perch (Fig. 1). The eagle used this perch much of the time; thus its weight usually was readily obtained. During food deprivation tests, however, the eagle left its perch more quickly on the approach of an attendant than at other times, and it was then necessary to make some of the weight readings at night with use of a flashlight. Weights were taken daily during the period 15 June to 2 July; thereafter weights were taken less frequently and at 1-3 day intervals.

RESULTS AND DISCUSSION

Growth Rate, Weight Maintenance, and Amount of Food Used

When first obtained on 15 June 1962, the eaglet weighed 347 gms. Herrick (1934: 119) reported that a Bald Eagle chick weighed 88.8 gms. at hatching; thus, backward extrapolation of the later growth curve (Fig. 2) indicated that the eaglet was about six days old when obtained and it had hatched on about 9 June. As was indicated by a cessation in weight increase, growth was completed when the eagle was 70-74 days of age. Herrick (1924) noted that young eagles remained 72-74 days in an Ohio nest; thus growth continued until about the age at which the birds normally leave the nest. The slight slump in the weight-growth curve when the eagle was 10-50 days old may have been associated with feather development. Brown and Amadon (1968: 114) reported a somewhat similar slump in the rate of weight increase of Wahlberg's Eagles (*Aquila wahlbergi*) and Golden Eagles (*Aquila chrysaetos*), indicating that it was probably correlated with feather development.

In the first week after the bird was obtained, when it was 7-14 days old and was being fed twice daily, it consumed 70-105 gms of food per meal or 150-200 gms per day, approximately 48 percent of its body weight. During this period the average daily weight gain was 33.4 gms, or about 1 gm of gain per 5 gms of food. After transfer to the Patuxent Wildlife Research Center when the eaglet was approximately 21 days of age, once-daily feeding was started. Then the daily food consumption gradually increased until a maximum of 672 gms was consumed in one daily meal. When no

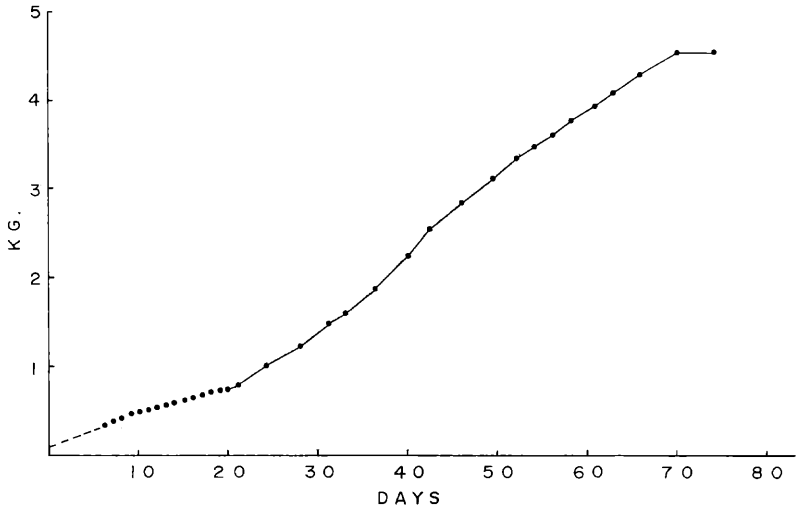

Figure 2. Growth Curve for a Bald Eagle. The broken line at the beginning of the curve involves an extrapolation.

feeding test was being made, 336 gms of food was daily offered by the attendant and consumed by the eagle. This seemed to be adequate for a maintenance diet, and it was about 8.0 percent of the eagle's body weight. Brown and Amadon (1968) reported 188 gms of food or 5.26 percent of the body weight to be enough to maintain an inactive Golden Eagle, and these two species are of about the same size (Imler and Kalmbach, 1955: 10).

A food deprivation test was conducted to get some information on the length of time the bird could survive without food. A loss by the bird of one-fourth to one-half of its weight was arbitrarily chosen as a safe goal. I saw no indications of permanent harm to the bird resulting from the test. I suspect that ability to survive relatively long periods without food may be characteristic of most or all birds and mammals wintering in the far north.

The eagle was given no food during the period 22 August to 7 September 1962, and during those 16 days it lost 1,260 gms of its original 4,508 gms, or 27.9 percent of its body weight. The loss was 60 to 89 gms per day or slightly less than 2 percent per day. The rate of weight loss decreased slightly with continued food deprivation (Table 1).

After 16 days of food deprivation and after weighing on 7 September, the eagle was returned to a full feeding schedule, and the first meal contained 924 gms of food. Presumably resulting partly from the restoration of food in the alimentary tract, there was a daily increase during the next two days of 280 gms or 7.9 percent of the eagle's body weight. After the initial weight increase, continued return to the pre-starvation weight was slightly slower than

TABLE 1. CHANGES IN BODY WEIGHTS IN RELATION TO FEEDING OF CAGED BALD EAGLE

Dates	Weights of bird (gms)*	Average gain or loss/day (gms)	Average percent gain or loss/day
22 Aug.	4,508		
27 Aug.	4,060	−89	−2.1
1 Sept.	3,668	−78	−2.0
7 Sept.	3,248	−60	−1.7
9 Sept.	3,808	+280	+7.9
13 Sept.	4,004	+49	+1.0
20 Sept.	4,333	+47	+1.1
27 Sept.	4,604	+39	+0.8

*Bird was given no food between 22 August and 7 September; it was fed all it would eat once daily between 7 and 27 September. All weights were taken within three hours before feeding.

the rate at which the weight had been lost, or about 1 instead of 2 percent of the body weight per day.

In eight days on a diet of cooked rolled oats, the eagle lost 21.1 percent of its body weight. In eight days with no food, it lost 20.4 percent of its body weight. Thus, the weight loss was about the same with no food as with rolled oats, and the rolled oats obviously was not utilized as food.

Selection of Food

Twice when two each of smelts, Brown-headed Cowbirds (*Molothrus ater*), and halfgrown laboratory rats were offered in a mixed pile, the eagle selected and ate first the smelts, then the cowbirds, and finally the rats. Twice with a similar offering, the cowbirds were eaten first, then the smelts, and finally the rats. All of the various animals were of approximately the same size. Thus, fishes and birds were chosen over rats, but there was no indicated preference between birds and fishes. According to Imler and Kalmbach (1955), the food of Bald Eagles in southeastern Alaska is chiefly fish and birds. Although mammals other than rats were not offered in choice situations, opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), woodchucks (*Marmota monax*), chipmunks (*Tamias striatus*), gray squirrels (*Sciurus carolinensis*), muskrats (*Ondatra zibethica*), cottontails (*Sylvilagus floridanus*), and laboratory mice all were eaten when available.

However, one mammal, the house cat, was definitely rejected. A dead house cat was left three days on the floor of the eagle's cage without visible signs of the eagle having even tried to eat it, although no other food was available. Snakes also were rejected. A dead black snake (*Coluber constrictor*), about four feet long, was left four days in the eagle's cage without being eaten or disturbed. A dead water snake (*Natrix* sp.), about two feet long, was

offered to the eagle by putting the snake's head through the wire of the cage while the remainder of the snake's body was concealed in a paper bag. The eagle quickly grabbed the snake and pulled it about half way through the wire of the cage only to then drop it and rush to the opposite side of the cage, as if frightened. The snake was left hanging in the wire and was not disturbed by the eagle in the following two days. One of Bent's (1937: 327) correspondents reported that he had never found a snake among the animals gathered for food in nests of Bald Eagles he had examined. This failure of Bald Eagles to eat snakes is a contrast with the Golden Eagle, which, according to Bent (1937: 304), kills many snakes.

Several trials were made with use of commercial dog foods to feed the eagle. One brand of dog food which was soft enough to be easily segmented and swallowed was sticky so that the eagle obviously had difficulty in swallowing it. Another brand was relatively firm and hard, and the eagle picked up and dropped this food without trying to swallow it. Two commercial dog foods thus appeared to be unsuitable for eagle food because of their physical characteristics of stickiness and hardness, respectively.

Cooked rolled oats was eaten alone only when flesh foods were not available, and eating was with some hesitancy as compared with eating of foods such as ground horse meat. It was possible to get the eagle to eat grass only by mixing it with ground flesh. When the eaglet was confined in a cardboard box, it pecked at and ate some of the box material, my only observation of the eagle seeming to choose to eat indigestible material. The eaglet at that time was well-filled with suitable food, and it was certainly not a lack of nutritious food in its alimentary tract that caused it to eat the several pieces of cardboard material. Reed (1925: 20) reported that a captive Great Horned Owl (*Bubo virginianus*), "devoured feathers from a plucked chicken in considerable quantities" when being fed an exclusive diet of raw meat from the butcher shop, thus suggesting that the Great Horned Owl may need or desire non-food roughage material.

Preparation of Food for Eating

When hair could be relatively easily separated from the flesh being eaten, it was not eaten by the eagle, and when bunches of hair were offered with fish or ground horsemeat, they were picked out with the bill and thrown aside. Likewise, the skins of larger animals were torn so feeding was done inside of the skin, and the skin as well as the hair was largely left uneaten. Hair and feathers were eaten chiefly when they were on small animals eaten entire, and a choice against eating the hair could have been made only with some special difficulty.

When mice were offered alive to the eagle, they were usually killed before being eaten, but 2 of 38 mice were swallowed alive. The eagle usually killed the mice by pulling off their heads with its bill when their bodies were being held in its talons. Once, however,

a rear leg was removed from a mouse before its position was changed in the talons and its head removed.

When dead mice or other small animals up to the size of chipmunks, cowbirds, and smelts were fed to the eagle, they were usually swallowed headfirst and entire. In 50 observations involving 24 smelts, 14 laboratory rats, and 12 cowbirds, all were swallowed entire and all were swallowed headfirst, except 2 rats and 1 smelt were swallowed tail first. Obviously, some fish, such as those included in the families Centrarchidae and Ameiuridae, could present a particularly serious hazard to birds swallowing them tail first. However, the one smelt was swallowed tail first by the eagle without apparent difficulty.

Pellet Formation

Bent (1937: 328) commented that, "Eagles, like most hawks and owls, cast up in the form of pellets the indigestible portions of their food, such as bones, fur, and feathers." However, Herrick (1934: 101) noted that, "The large bones of fowl and mammals were completely dissolved in the digestive juices of the eagle's stomach in twenty-six hours." In this study, the bones were found to be completely digested, but 32-34 hrs passed after ingestion of the indigestible material before pellets were regurgitated. Chitty (1938) reported that Great Horned Owls regurgitated pellets 12 hrs after feeding and Barn Owls (*Tyro alba*) regurgitated pellets 9-11 hrs after feeding. Reasonably intact bones are normally contained in the pellets of these two species. The eagle appeared to be able to digest only flesh and bones. Rolled oats was later discarded in pellets, as was the grass which had been eaten, mixed with ground horse meat.

Sumner (1933: 288) reported irregularity in egestion of pellets by a Golden Eagle and indicated that indigestible material may not have been ejected until a fairly large mass was accumulated. The Bald Eagle in this study egested indigestible material 32-34 hrs after ingestion regardless of the amount of indigestible material involved. One pellet consisted of only a short piece of grass.

SUMMARY

A captive-reared Bald Eagle, 7-14 days of age, consumed 150-200 gms of food per day, or about 48 percent of its body weight. The average daily weight gain at 7-14 days of age was 33.4 gms or about 1 gm of gain per 5 gms of food. When mature and on a maintenance diet, 336 gms of food daily appeared to be ample, but after a period of food deprivation the eagle ate 924 gms of food at one meal. In 16 days of food deprivation, the eagle lost 27.9 percent of its body weight; after food was restored it regained the lost weight almost as quickly as losing it. Weight was lost at about the same rate on a rolled oats diet as under food deprivation.

The eagle showed preference for smelts and cowbirds over laboratory rats. Most animals were eaten by the eagle, but a house cat and

two snakes were rejected. Most but not all small animals were killed before eating, and most but not all were swallowed headfirst. Hair, feathers, grass, paper, and rolled oats were ejected in pellets, but unlike most hawks and owls, the eagle digested bones. The interval of time elapsing between ingestion and egestion of indigestible material was 32-34 hrs.

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Entomology Research Division, Agr. Res. Serv., USDA, Oxford, North Carolina 27565.

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