WINTER FOODS OF *ANAS PLATYRHYNCHOS* AT BARKLEY WATERFOWL AREA, STEWART COUNTY, TENNESSEE

BY

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WINTER FOODS OF *ANAS PLATYRHYNCHOS* AT BARKLEY WATERFOWL AREA, STEWART COUNTY, TENNESSEE

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Master of Science

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by
John William Sexton
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To the Graduate Council:

I am submitting herewith a Research Paper written by John William Sexton entitled "Winter Foods of *Anas platyrhynchos* at Barkley Waterfowl Area, Stewart County, Tennessee." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Biology.

Floyd M. Ford
Major Professor

Accepted for the Council:

Wayne E. Stamey
Dean of the Graduate School

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CHAPTER I

INTRODUCTION

The importance of game management in relation to our natural resources is increasing each year. Through man's quest for increased farm land as well as increased urbanization, many of the natural habitats for game animals have been destroyed. This is especially true of waterfowl. Man has destroyed a large percentage of the breeding grounds and in many cases the feeding grounds of waterfowl. This trend of over-exploitation is now changing as a result of game management and the establishment of national wildlife refuges.

One of the most important facets of game management is a knowledge of food habits. The game manager must know the preference for selected foods in order to produce and maintain a proper waterfowl habitat.

The main purpose of this research is to determine food preferences of waterfowl migrating through Middle Tennessee. The area selected for this study is located on Barkley Lake near Dover, Tennessee. The Tennessee Game and Fish Commission in association with the United States Corps of Engineers presently manages this hunting area.

The Barkley Lake hunting area lends itself to an investigation of food habits. Each hunter is required to check out at a central point to determine his kill for that particular day. The material needed for a food habits analysis can be collected with the cooperation of the hunter. The gizzard and one wing was taken from each of all ducks examined. The contents of the gizzard were used to evaluate food preferences and the wing used to determine age and sex ratios.

It is hoped that the information obtained from the study may be used by the Tennessee Game and Fish Commission to improve waterfowl management in the Barkley Lake hunting area.

CHAPTER II

LOCATION AND DESCRIPTION OF COLLECTION AREA

The Barkley Waterfowl Management Area is located in Stewart County, Tennessee, near Dover, on the Cumberland River. The area is twenty-seven miles west of Clarksville and seventy-seven miles northwest of Nashville. The management area is bordered by Highway 79 on the south, the Cumberland River and The Land Between the Lakes Recreation Area on the west, Bumpus Mills Road on the east, and various graveled county roads on the north. The area is approximately two miles northwest of Cross Creeks National Wildlife Refuge.

The area is maintained by the Tennessee Game and Fish Commission in cooperation with local farmers. Approximately 1,000 acres of the area are cultivated each year by sharecroppers. Of this acreage approximately 30 percent is left for wildlife food. Most of the acreage is planted in soybeans, browntop, millet, and milo. According to a report by Gore, 1969, approximately twenty acres of smartweed grow naturally in the area.

The area is maintained by seasonal flooding and draining. Each fall the hunting area is flooded by the use of a large water pump located on the west side of the area. After the hunting season the area is drained and allowed to dry so that cultivation can begin.

CHAPTER III

METHODS AND MATERIALS

Field Collection

The collection period for this study began on December 6, 1969 and ended on January 4, 1970. Collections were made on all hunting days during this period except two. Collections for these two days were impossible because water covered the access road to the collection area.

The majority of the hunting blinds are located in the southwest corner of the area. These blinds are easily accessible by a small graveled road just east of the Sidney C. Lewis Bridge on Highway 79. The road leads to the pump station area. Many of the hunters use this location to load and unload their boats. This spot was chosen as my collection point.

A wing was taken from each duck which was used to obtain sex and age data. The wings were removed by cutting through the joint connecting the humerus and the pectoral girdle. Care was taken in collecting wings which were not damaged. A label was attached to each wing with the collecting date, sex, and reference number. This was done by the use of a short piece of wire which was pushed through the tissue between the ulna and radius.

The viscera were taken from each duck by making a slit just under the rib cage and inserting two fingers into the opening to an area just above the heart. The viscera were then pulled from the duck with little effort. The material was then placed in a plastic bag along with a label corresponding to the label attached to the wing. The wing was then attached to the plastic bag by a small piece of wire. All of the viscera were taken because of a study of the endoparasites being done on the same material.

The material was then taken back to the laboratory at Austin Peay State University. The gizzards were separated from the rest of the viscera. The material from each gizzard was placed in a small jar containing a mixture of alcohol, acetic acid, and formalin. A label was attached to the jar with corresponding reference number and collecting date for that particular specimen.

The wings were removed from the bag and placed in a freezer for future reference.

Gizzard Analysis

The contents of each jar were placed into a petri dish bottom. The contents were then separated into either organic or inorganic material. The organic material was then put aside for later identification. The inorganic material was then measured to determine the volume that it occupied. This was done by the use of a ten millileter Fisher graduate cylinder. The volume was measured by the

displacement of water. The plant and animal material was measured by the same method as described by Larimer (1960). An average volume per unit was determined by placing a certain number of seeds into the cylinder. A reading was made before and after the seeds were added. The difference in the two readings was then divided by the number of seeds used and an average for each seed was determined. The volume for each seed was determined by this method except when only a few seeds of one species were found. This was done by a size relationship with calculated seeds. After this was done the number of seeds was multiplied by the calculated volume for one seed.

The plant and animal material was classified to the lowest possible taxonomic level. The seed identification was made with the aid of Martin and Barkley's Seed Identification Manual (1961). The 1961 Yearbook of Agriculture entitled Seeds was also of some help. A two-set series of photographs of drawings of common "weed seeds," which is published by the Division of Photography, Office of Information, United States Department of Agriculture, Washington, D. C., was also used. The final plant classification was made with the use of Fernald (1950).

The animal material was classified with the use of Storer and Usinger (1957).

The volume for a particular species was recorded if the volume was over .01 milliliter. Anything less than this was recorded as a trace. Each time a seed was found

in a gizzard represented an occurrence. This was used in determining percent occurrence.

Sex Determination

The sex of the mallard is easily determined by external appearance. This observation was made in the field at the time of the collection.

The winter plumage of the male shows the head and neck with a purplish gloss if observed at certain angles. This coloration terminates at the base of the neck in a narrow white collar in the front. The head of the female is buff colored streaked with brown. The chin and throat are also buffy colored. Peterson (1934), Robbins (1966), and Kortright (1942), bring these points out.

Age Determination

The age of the mallard can be determined by the examination of certain parts of the wing. Four parts are generally used. These are the tertial coverts, tertials, primary coverts, and middle coverts.

The tertial coverts proved to be the most helpful in aging the wings. Any pronounced fraying of the edge of the tertial coverts, particularly the last two, was characteristic of juvenile birds. If this fraying was absent the bird was considered as an adult (Carney and Geis, 1960).

The next wing area to be checked was the tertials. The tertials of juvenile birds were faded and frayed at the

tip. According to Carney and Geis (1960), these are remnants of juvenile plumage. These feathers were absent on the adult.

The juveniles showed a light edging on the inner web of the primary coverts. The adults showed no light edging in this area.

The juveniles had narrower middle coverts that were less rounded and more trapezoidal than those of adults. This character was not used to any extent.

According to Carney and Geis (1960), these factors proved to be 95 percent reliable. A key to the age of mallard wings by the above authors was used.

Lead Shot Ingestion

The presence of lead shot that was ingested was determined by a method described by Anderson (1959). If the lining of the gizzard was dark green in color, this indicated that the shot had been ingested. If the lead shot was fairly smooth and rounded without any shiny areas the shot was assumed to be ingested.

CHAPTER IV

RESULTS

Sex and Age Ratios

A total of fifty mallards was collected during the study. Twenty-four were males and twenty-six were females. The juveniles accounted for twenty-eight of the total while adults numbered twenty. Two could not be aged and were counted as undetermined (Table I).

Food Analysis

Since the mallard is primarily a dabbler, one would expect the major percentage of the diet to be plant material. This proved to be the case. The total volume of plant material was 95.87 percent. The total animal material was only 4.13 percent.

The total volume of the fifty gizzards, including organic and inorganic material, came to 206.22 cc. Of this amount, 146.34 was inorganic material, while 58.64 was organic in nature. Of the organic material 56.22 cc. was plant material and 2.42 cc. animal material. The smallest amount of material in any gizzard was 0.22 cc. The largest amount was 15.31 cc. The average amount of material per gizzard was 4.12 cc.

The buckwheat family (Polygonaceae) accounted for the highest percent occurrence. Various species of this

TABLE I

Sex and Age Ratios of Fifty Mallards (*Anas platyrhnchos*) Collected at Barkley Waterfowl Area

	Number	Percent
Males	24	48
Females	26	52
Juveniles	28	56
Adults	20	40
Undetermined	2	4

family were found in thirty-six of the gizzards for a percent occurrence of seventy-two. Polygonum proved to be the most common, being counted thirty-five times for 70 percent occurrence (Table II).

The grass family (Gramineae) was second in percent occurrence with 36 percent. Various species were found in this family. The most common were manna-grass (Glyceria spp.), feathergrass (Leptochloa spp.), and wheat (Triticum aestivum). These three made up 20 percent of the 36 percent.

The sedge family (Cyperaceae) was third in percent occurrence with 34 percent being counted seventeen times. Spike Rush (Eleocharis spp.) was the most common, being counted nine times for 18 percent occurrence. Various species of sedge (Carex) were counted four times.

The pondweed family (Zosteraceae) was fourth in percent occurrence, being counted fourteen times for 28 percent. Pondweed (Potamogeton spp.) accounted for all of this family.

The madder family (Rubiaceae) was counted nine times for an 18 percent occurrence. Buttonbush (Cephalanthus occidentalis) was the only species counted in this family.

The pulse family (Leguminosae) was sixth, being counted seven times for 14 percent occurrence. Soy-beans (Glycine Max) accounted for all seven counts.

TABLE II

Percent Occurrence and Classification of Plant Material

Classification	Times Counted	Percent Occurrence
Polygonaceae - Buckwheat Family	36	72
Polygonum - Smartweed	35	70
P. pensylvanicum - Pinkweed	4	8
P. lapathifolium - Smartweed	1	2
P. spp. - Smartweed	30	60
Fagopyrum sagittatum - Buckwheat	1	2
Cyperaceae - Sedge Family	17	34
Eleocharis spp. - Spike-Rush	9	18
Carex spp. - Sedge	4	8
Scirpus - Bulrush	4	8
Scirpus fluviatilis - Bulrush	3	6
Scirpus spp. - Sedge	1	2
Gramineae - Grass Family	18	36
Zizania aquatica - Wild-Rice	1	2
Zizaniopsis milliacea - Water-Millett	2	4
Glyceria - Manna-Grass	4	8
G. striata - Manna-Grass	3	6
G. spp.	1	2
Pancium spp. - Panic-Grass	1	2
Leptochloa spp. - Feathergrass	3	6
Phleum pratense - Timothy	1	2
Sorgum halepense - Sorghum	2	4
Triticum aestivum - Wheat	3	6
Echinochloa spp. - Barnyard-Grass	1	2
Zosteraceae - Pondweed Family	14	28
Potamogeton - Pondweed	14	28
P. pusillus - Pondweed	3	6
P. spp. - Pondweed	11	22
Sparganiaceae - Bur-Reed Family	3	6
Sparganium eurycarpum - Bur-Reed	3	6
Leguminosae - Pulse Family	7	14
Glycine Max - Soy-Beans	7	14
Amaranthaceae - Amaranth Family	3	6
Amaranthus spp. - Amaranth	3	6

TABLE II (CONTINUED)

Rubiaceae - Madder Family	9	18
Cephalanthus occidentalis - Buttonbush	9	18
Convolvulaceae - Convolvulus Family	2	4
Ipomoea lacunosa - Morning Glory	2	4
Solanaceae - Nightshade Family	1	2
Solanum carolinense - Horse-Nettle	1	2
Compositae - Composite Family	3	6
Ambrosia trifida - Ragweed	1	2
Bidens spp. - Bar-Marigold	1	2
Xanthium spp. - Cockleburr	1	2

All other families had less than a 10 percent occurrence rate. These included Sparganiaceae, Amaranthaceae, Convolvulaceae, Solanaceae, and Compositae.

The Phylum Bryozoa was the most commonly found animal material. The fresh water bryozoan, Plumatella, was counted three times for six percent occurrence (Table III).

The volume of plant material was easily led by various species of Polygonum. A total of 20.50 cc. of Polygonum was taken from the gizzards. This accounted for 34.96 percent of the total volume. P. pensylvanicum accounted for 4.84 percent of the total (Table IV).

Soy-Beans (Glycine Max) ranked second in percent volume accounting for 5.79 percent of the total. A total of 3.40 cc. of Soy-Beans was taken in the study.

Various species of pondweed (Potamogeton) ranked third in percent volume accounting for 4.94 percent of the total.

Feathergrass (Leptochloa fasicularis) ranked fourth in percent volume with 4.79 percent of the total. A total of 2.80 cc. of this species was found.

Buttonbush (Cephalanthus occidentalis) ranked fifth with a percent volume of 3.94. A total of 2.31 cc. of this species was taken in the study.

Bulrushes (Scirpus) ranked sixth with a volume of 2.07 cc. for 3.53 percent of the total.

Other important plant food items included milo, 3.24 percent; cockleburs (Xanthium spp.), 3.09 percent;

TABLE III

Percent Occurrence and Classification of Animal Material

Classification	Times Counted	Percent Occurrence
Phylum Bryozoa	3	6
Plumatella spp. - Freshwater Bryozoan	3	6
Phylum Mollusca	2	4
Class Gastropoda	1	2
Snail	1	2
Class Pelecypoda	1	2
Margaritifera spp. - Mussel	1	2
Phylum Annelida	1	2
Phylum Insecta	6	12
Class Diptera	6	12

TABLE IV

Total Volume and Percent Volume of Plant Material

Plant Material	Total Volume in cc.	Percent Volume
Plant Material	56.22	95.87
Polygonum	20.50	34.95
P. pensylvanicum	2.84	4.84
P. lapathifolium	0.16	0.28
P. spp.	17.50	29.84
Glycine Max	3.40	5.79
Potamogeton	2.90	4.94
P. pusillus	0.12	0.20
P. spp.	2.78	4.74
Leptochloa fasicularis	2.80	4.79
Cephalanthus occidentalis	2.31	3.94
Scirpus	2.07	3.53
S. fluviatilis	0.27	0.46
S. spp.	1.80	3.09
Milo	1.91	3.24
Xanthium spp.	1.80	3.09
Eleocharis spp.	1.77	3.03
Zizaniopsis miliacea	1.75	2.98
Ipomoea lacunosa	1.44	2.46
Carex spp.	1.24	2.14
Sparganium eurycarpum	1.22	2.08
Fagopyrum sagittatum	0.90	1.53
Echinochloa spp.	0.89	1.52
Amaranthus	0.82	1.39
A. tamariscumus	0.81	1.38
A. cannbinus	trace	trace
Triticum aestivum	0.50	0.85
Glyceria	0.47	0.80
G. striata	0.42	0.73
G. spp.	0.05	0.08
Sorgum halepense	0.39	0.66
Pancium spp.	0.25	0.43
Ambrosia trifida	0.20	0.34
Solanum carolinense	0.10	0.18
Bidens spp.	0.04	0.07
Phleum pratense	0.03	0.05
Sparganium eurycarpum	0.03	0.05
Zizania aquatica	trace	trace
Unidentified plant material	6.46	11.01

spike-rush (Eleocharis spp.), 3.03 percent; water millet (Zizaniopsis miliaceae), 2.98 percent; and morning glory (Ipomoea lacunosa) 2.46 percent.

The phylum Mollusca ranked first in percent volume of the animal foods. A total of 1.32 cc. of this phylum was taken accounting for 2.25 percent volume. The class Pelecypoda accounted for 2.21 percent of the amount.

The phylum Bryozoa ranked second in animal material with 0.79 cc. amounting to 1.32 percent volume (Table V).

Lead Shot Ingestion

A total of three lead shot or pellets was found. Two of these were ingested accounting for a four percent occurrence while one shot was a result of hunter's fire.

TABLE V

Total Volume and Percent Volume of Animal Material

Animal Material	Total Volume in cc.	Percent Volume
Animal Material	2.42	4.13
Phylum Mollusca	1.32	2.25
Class Gastropoda	0.02	0.03
Class Pelecypoda	1.30	2.21
Phylum Bryozoa	0.79	1.32
Plumatella spp.	0.79	1.32
Phylum Insecta	0.25	0.43
Class Diptera	0.25	0.43
Phylum Annelida	0.06	0.13

CHAPTER V

DISCUSSION

Comparison With Other Studies

In a study by McGilvrey (1966), various species of Polygonum ranked first in percent occurrence and fifth in percent volume. Buttonbush, Cephalanthus occidentalis ranked second in percent occurrence and fourth in percent volume. Spike-rush, Eleocharis spp. ranked third in percent occurrence and eighth in percent volume. See Table VI for a comparison of this study with the present study.

According to Korschgen (1952), Polygonum also ranked first in percent occurrence and ranked second in percent volume. Corn, Zea Mays, ranked first in percent volume. Potamogeton ranked sixth in percent occurrence and tenth by percent volume (Table VI).

In another study by Korschgen (1955), Polygonum again ranked first in percent occurrence and second in percent volume. Potamogeton ranked fifth in percent occurrence and ninth in percent volume (Table VI).

Anderson (1959), found Polygonum to rank first in percent occurrence and fourth in percent volume. Potamogeton ranked third in percent occurrence and eighth in percent volume (Table VI).

These results closely follow the results of my study in relation to various species of Polygonum and Potamogeton.

TABLE VI

A Comparison of the Percentages of Certain Plant Foods of the Mallard (Anas platyrhynchos) by Volume and Occurrence With Previous Studies in Relation to Rank

	Polygonum		Potamogeton		Cephalanthus		Eleocharis	
	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.	Vol.	Occ.
Present Study Tennessee	1	1	3	2	5	3	9	4
McGilvrey, F. B. South Carolina	5	1	-	-	4	2	8	3
Korschgen, L. J. Missouri 1952	2	1	10	6	18	9	14	10
Korschgen, L. J. Missouri 1955	2	1	9	5	15	10	13	12
Anderson, H. B. Illinois	4	1	8	3	11	5	-	-

Sex and Age Ratios

In various studies by Bellrose and others (1961), the males accounted for 51.0 percent to approximately 73 percent of the specimens collected. The ratio of young to adults was 1.2:1. The low number of specimens in this study make it impossible to evaluate the status of the population. This data was taken purely for the methods involved. The same holds true in relation to lead shot ingestion.

CHAPTER VI

SUMMARY

The purpose of this study was to determine the winter food habits of the common mallard, Anas platyrhynchos, on Barkley Lake Waterfowl Management Area. Age and sex ratios and the incidence of lead shot ingestion were also studied.

Plant material was found to occupy approximately 95 percent of the total volume of the organic material while animal material occupied only five percent.

This study showed that various species of Polygonum accounted for a major percentage of the diet of the mallard. Other species which proved to be important included Potamogeton, Cephalanthus, Eleocharis, and Carex.

The relatively small number of birds collected made it impossible to draw any conclusions as to the status of the population in relation to age and sex ratios.

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