# FOOD HABITS OF WATERFOWL MIGRATING THROUGH PAYNE COUNTY, OKLAHOMA

By

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## INTRODUCTION

Extensive research into the food habits of waterfowl has resulted in the acquisition of valuable and comprehensive knowledge covering the subject on a national and continental scale. No matter how thoroughly accomplished, however, studies embracing so wide a scope could definitely mask the value of important plant foods of local areas (Stallberg, 1950).

The long migrations, after all, are made from locality to locality and the migrants subject to the varying ecological factors encountered in each. By the same token they are the recipients of the fruits of conservation practices, good, bad or none, characterizing the localities wherein they must pause and feed before moving on.

For that reason it is felt that further advancement of food habits investigation can best be served by limiting this study to a supplemental rather than an originative endeavor.

The decision to confine the survey within local bounds was further stimulated by perusal of certain maps indicating geographical locations from which specimens utilized in wide-scale surveys were collected. For example, the classical study made by Martin and Uhler (1939) indicated that only ten stomachs represented the entire State of Oklahoma, and that these ten were all collected near Turpin, Buffalo County, Oklahoma,

situated in the "Panhandle" region. Obviously, it is felt that the present work will contribute substantially not only to our knowledge of foods of this particular locality, but will help to fill an important space in that ecological "jigsaw puzzle" that is called the Central Flyway.

A determination of the major natural foods utilized by waterfowl migrating through Payne County, Oklahoma, along with a consideration of the ecological factors most vitally affecting them, is the over-all objective of this study. Its accomplishment is attempted through the development of these four minor objectives: (1) Determination of the foods taken by waterfowl in general while migrating through this particular section of the State of Oklahoma, listing them in order of importance; (2) determination of the foods taken by different species of waterfowl while migrating through this area, listing them in order of importance; (3) comparison of the foods taken by waterfowl on Lake Carl Blackwell during the 1949-50 migrations with those taken during the migrations of 1940-41, when ecological factors were different; and (4) comparison of the foods taken by waterfowl on clear ponds and impoundments of the county with those taken on turbid ponds and impoundments.

It must be borne constantly in mind that food habits investigation is not an exact science. Martin (1949) points out explicitly that the results of even the most meticulously conducted studies can be considered as giving only approximate indications of the actual food habits of the animals concerned. This does not, perhaps, too much impair the value of this survey,

because the over-all objective is the determination of the major natural foods of the vicinity that are most acceptable to waterfowl, with the ultimate aim of propagating them to the best advantage of bird and man. This objective can be definitely gained through the proper exploitation of accepted techniques and principles of food habits analysis.

## PROCEDURE

A total of 204 stomachs of various species of Anatidae was examined throughout the course of the investigation. Of this number, Dr. F. M. Baumgartner, Department of Zoology, presented 131 specimens which had been carefully preserved and stored during the 1940-41 migrations. The remaining 73 specimens were procured from three sources: (1) Collection of birds from the field following receipt of Federal and State permits to take waterfowl for scientific purposes; (2) contributions of accurately identified specimens by faculty members and students of wildlife conservation; and (3) contributions from other interested people made cognizant of the effort through announcement at gatherings of sportsmen, newspaper publicity, and personal contacts.

Analyses were performed in accordance with methods recommended by the Fish and Wildlife Service at the Patuxent Wildlife Research Refuge (Martin, op. cit.). Minor techniques were originated as the work progressed.

Results designated in all tables were computed by averaging (to the nearest 5 percent) proportionate volumes of individual food items found in each stomach. Also indicated, is the frequency of occurrence of individual items.

Grit and debris were entirely excluded from volumetric evaluation as only organic materials are concerned in food habits investigations. Particular note, however, was given to the presence of shot, due to the tremendous influence of lead poisoning on the welfare of waterfowl (Kortright, 1942). In only

one instance was more than one shot found in a single stomach. Contrary to procedure employed by Stollberg (op. cit.), shell fragments of Mollusca (Physa sp. and Helisoma sp.) were included in computations.

Stomachs were excluded from consideration if the entire organic content measured less than one-tenth of a cubic centimeter or, as suggested by Martin and Uhler (op. cit.), if the extent of pulverization or enzymic reaction precluded accurate identification. Pursuant to this procedure, five stomachs were rejected from the 1940-41 series, and 12 from the 1949-50 series. One hundred and eighty-seven stomachs were actually employed in the compilation of the data.

Inasmuch as animal foods do not constitute a propagative problem, taxonomic identity of animal matter was limited to Class. However, numerous, more precisely determined specimens have been placed in the reference collection in the event that a need for detailed studies should arise in the future.

Plant foods, on the other hand, were systematized as accurately as recognizability would permit. In many cases they were designated no farther than genera because, in agreement with Martin (op. cit.), it was felt that absolute correctness to this category was more desirable than more explicit nomenclature based on unsupportable supposition.

# METHODS AND TECHNIQUES

## Preparatory Training

Methods and techniques employed in food habits investigations were studied at Patuxent Wildlife Research Refuge, Laurel, Maryland, over a period of five weeks during the summer of 1949, for the purpose of establishing a more secure background for the work to be undertaken. Training under the direction of Alexander C. Martin, Francis M. Uhler, Neil Hotchkiss, and other personnel of the Refuge resulted in a more comprehensive understanding of all phases of procedure than could possibly have been gained in unsupervised endeavor.

## Reference Collection

A permanent reference collection of seeds and other items utilized by waterfowl has been carefully established by collections in the field and extraction of particular specimens from the stomachs examined. This was done, not only to facilitate the present study, but with a view of ultimately presenting to Oklahoma A. and M. College an accurate and workable implement for use in future research.

The reference collection was stored in uniformly partitioned boxes, each containing 21 vials. Taxonomic identification of each vial was designated at a corresponding position on the top of the container so that any particular item could be quickly removed or replaced from and to its proper position by using the removed top as a guide. The boxes were arranged according to

Fig. 1. Some Materials Used in Food Habits Analyses. (Patuxent Wildlife Research Refuge, Laurel, Maryland. Photograph by Roy A. Grizzell.)

Families and given corresponding numbers as designated in Gray's New Manual of Botany. As an added precaution, the scientific name of the species was written with eternal ink on a label placed within each vial.

## Preliminary Storage Methods

The first phase of stomach analyses involved the proper treatment of materials prior to investigation. Using eternal ink, information concerning identification, location, time and date of kill, as well as identity of the contributor, was written on a museum tag and wrapped with the stomach in an individual gauze packet. The packets were stored in 5 percent formalin solution. This procedure, not only safely preserved the stomach contents until time of making analyses, but converted them into excellent condition for ultimate permanent storage.

## Preparation for Analysis

Stomachs removed from storage for analyses were first soaked in water to relieve the hardened condition caused by the formalin, and to prevent tendency of the gizzard lining to splinter during dissection. After removal from its gauze packet, each stomach was placed in a white enamel pan, taking care to preserve the identifying tag with which it will eventually be placed in permanent storage. Each stomach was then cut in halves and the contents emptied carefully into the pan. The contents of the pan were then decanted onto silk bolting cloth drawn

tightly across the mouth of a wide glass funnel, and primed with alcohol. The silk permitted the water to pass through freely but retained even the minutest of materials. The flow of water through a rubber tube could be regulated in such a way that the grit was entirely separated from the other items and deposited separately on the bolting cloth. Both food material and grit were scraped from the bolting cloth by use of a scalpel and placed in separate piles on paper toweling and allowed to dry. The museum tag was placed with the materials, and a petri dish inverted over all to prevent collection of dust, attraction of insects, or other contamination. The careful separation of food items from grit was important in view of the fact that organic material alone is considered in analysis.

Separation and Analysis

After the materials were thoroughly dried, the grit was placed in a Syracuse watchglass. The grit and the food material were then deposited in the bottom of a petri dish and covered. Usually several stomachs were accumulated in this manner before actual analysis was instigated.

In analyzing the contents of one of the petri dishes, the first step was to recheck the grit in order to remove all organic material not separated in the decanting process. The actual food material was then measured in cubic centimeters and the results noted (with eternal ink) on the accompanying museum tag. The contents then were placed on graph paper that was firmly attached to a dissecting board. Procedure from this point depended upon the amount and condition of the material to be analyzed.

Fig. 2. Some Materials and Techniques Used in Food Habits Analyses. (Patuxent Wildlife Research Refuge, Laurel, Maryland. Photograph by Roy A. Grizzell.)

If the bird had been killed shortly after feeding and much recognizable material remained in both the proventriculus and gizzard, the entire stomach content was easily separated into individual items and the volumetric proportion determined by one or a combination of the following methods: (1) Each individual item was measured separately and the percentage (to the nearest 5 percent) determined by its proportion to the whole amount. (2) The number of squares covered by each item on the graph paper was noted and its proportion to the whole determined to the nearest 5 percent. (3) Individual items were segregated into heaps and a visual estimate employed. In this case, several people were asked to make percentage estimates, and an average, to the nearest 5 percent, was accepted.

If considerable time had lapsed between the time of feeding and the time of kill, it was found that the organic material would invariably be crushed, finely ground, or pulverized by the muscular action of the gizzard and the contained grit material. It was found that the items taken most recently and those of harder and tougher construction were in the best condition for identification, while those of softer and more brittle constitution ranged from barely recognizable fragments to hardly more than dust. When materials of this nature were encountered, the entire stomach content was shaped by scalpel into a neat, evenly distributed square, from which one-half, one-fourth, one-eighth, one-sixteenth, or even smaller portions could be cut out for consideration. Either the visual estimate or graph paper method of evaluation was then employed.

## Materials

Materials employed were again determined by the types and condition of the food items. Many items could be separated at the time of decanting on the silk bolting cloth by exploitation of their specific gravities through skillful manipulation of the hose. Graduated sieves and strainers were advantageously employed in separating items of various sizes. Tilting of the material so that round items would roll while others remained stationary was another method used with pronounced success.

## Determinations

During the process of separation, specimens of unknown items were removed and placed in vials along with the unknown number and stomach reference number. The vial was then placed in the "unknown" box, the spaces of which were arranged in numerical sequence. The unknowns were first checked with specimens in the expanding wildlife reference collection before further aid was sought. After checking with faculty members of Oklahoma A. and M. College, if identification could not be made by matching the item was sent to the Patuxent Wildlife Research Refuge for consideration by Dr. Alexander C. Martin, F. M. Uhler, or Neil Hotchkiss. It was the practice to accumulate a box of unknowns before submitting them to the Refuge.

## Final Storage

Upon the completion of an analysis of a stomach, the museum slip was inserted within a final storage vial with the side containing taxonomic identification of the bird, catalog stomach

number, and designation of the cubic centimeter content on the outside. The organic material was then placed in the vial, over which a padding of cotton was tamped, followed by insertion of the grit material. The specimen was then sealed and placed in its numerical position in a final storage box. Toward the end of the investigation, grit and organic material were kept separate by using No. 00 capsules instead of the cotton wad. All specimens have been placed in final storage at Oklahoma A. and M. College at the request of the United States Fish and Wildlife Service, and official data cards, containing the results of each analysis, have been sent to the Patuxent Wildlife Research Refuge, Laurel, Maryland.

# DISCUSSION

## Food Habits of Waterfowl in General

Factors tending to detract from the absolute accuracy of this survey are here presented in order to insure a more comprehensive evaluation of the results obtained. It must be emphasized that the majority of stomachs examined were collected during hunting seasons when shooting pressure could easily have interfered with the normal selectivity of foods. Moreover, the food habits of waterfowl vary with the changing seasons and, thus, this report actually deals with only about one-fourth of the year-round diet. Still another depreciating feature of a local study lies in the probability that some of the food items found in stomachs taken locally were consumed in a distant locality and are, in reality, alien to the biota of the region under consideration. This, however, is alleviated proportionately as the number of stomachs is increased, by reason of the fact that a large series will minimize the influence of a few atypical specimens (Martin, op. cit.).

Even more complicating to the accurate appraisal of the true significance of percentage ratios in stomach analyses is the fact that some items are easily digested, quickly becoming indistinguishable, and passing from the stomach to the intestine. While others, due to hardness or other resistant qualities, remain in the stomach in recognizable condition for long periods of time (Hartley, 1948). Difficulties encountered in the assessment of value concerning such foods as *Chara spp.*, *Najas*, and insect materials illustrate the point.

Six hundred fruiting bodies (oogonia) of Chara disclosed by opening a stomach may collectively measure less than one-tenth of a cubic centimeter and thus relegate the plant to a position of minor importance when resultant data ARE recorded. Mouth parts of waterfowl are constructed in a manner that would seem to preclude any possibility of the detachment of oogonia from vegetative material while feeding. This leads to the conclusion that all components of the plant are eaten simultaneously and that the vegetation, being fragile, passes quickly through the gizzard while the more resistant oogonia remain behind. Therefore, it seems that several hundred oogonia enjoying little or no percentage value are indicative of a far greater amount of Chara actually consumed. Whether or not detached oogonia can be strained from bottom mud of a pond or lake in such quantities is another point to consider.

By the same token, the determinations of percentage values of Najas guadalupensis actually taken based upon the presence of seed alone was equally as baffling to the writer.

Of similar nature was the problem of determining the amounts of insect material consumed on the basis of the hard fragments that had resisted the grinding of gizzard and grit. If all of the less resistant parts of insects that had passed through could have been evaluated with the mandibles, leg fragments, and chitinous plates that bore evidence of their passing, these, in many cases, would have been major items of high percentage value rather than minor ones.

As no adequate solutions to these problems concerning Chara, Najas, Insecta and similar materials were effected, it seems evident that future research into this particular phase of food habits investigation would be highly desirable.

The findings of the general survey (comparisons of 1940-41 and 1949-50 series) corraborate the thesis that certain submerged aquatic plants are truly the preferred foods of waterfowl migrating through Payne County, Oklahoma. The birds turn to other foods in quantity only when such factors as turbidity of water and hunting pressure limit the availability of these preferred foods. Not only is this borne out by evidence presented in Table 1 of this report, but by almost every table and graph contained herein. For example, southern naiad, muskgrasses, and grass-leaved pondweed constituted more than half (51.93 percent) of the gross volume of all specimens considered in this investigation. The same three plants constituted 58.13 percent of all foods contained in stomachs (147) used in the Lake Carl Blackwell survey (Table 18) and enjoyed similar percentages in most of the surveys of individual species.

The fact that some local waters have reached a condition precarious to the existence of these valuable food plants was graphically indicated in the results of practically every phase of the investigation. Lake Carl Blackwell, for example, has changed from a clear to a muddy condition during the years of its existence (Leonard, 1950). Increasing turbidity undoubtedly resulted in the diminution of light rays vital to the photosynthetic activities of submerged aquatic plants. Consequently,

the waterfowl have been subjected to drastic changes in feeding habits between the 1940-41 migrations, when these waters were clear, and the 1949-50 migrations, when they had become turbid. This is supported by evidence presented in Table 18.

Data contained in the comparative columns of the combined survey show that the same three top ranking food plants plummeted from a collective percentage evaluation of 67.39 in the 1940-41 survey to that of 20.00 in the 1949-50 survey--a loss of 47.39 percent. It will be noted that a decrease in the utilization of submerged aquatic food plants is almost invariable accompanied by a marked increase in the utilization of the margin loving smartweeds. This same trend was reiterated time and again throughout the investigation.

## Food Habits of Various Species of Waterfowl

Although the collection contained more stomachs of some species of waterfowl than of others, an attempt was made to determine the foods taken by as many species as were available and to list them in order of importance. Obviously, greater significance is attributed to studies based on larger numbers of stomachs examined than to those involving fewer or single stomachs. The results are contained in Tables 2 through 17.

Foods contained in specimens of each species collected during the 1940-41 migrations were compared with those collected during the 1949-50 migrations in an effort to determine the extent to which feeding habits might have been altered during the ten-year interval. In some cases the specimens collected

during one migratory period far outnumbered those collected during another (Pintail and Green-winged Teal), while in others the numbers were more evenly balanced (Mallard, Redhead, and Lesser Scaup duck). To obtain an even clearer view of the results indicated by the individual surveys, a comparison was made between the foods taken, first, by all dabbling ducks collected during the two migration periods, and second, by all the diving ducks. In order to facilitate comparisons and avoid repetitious discussion, the trends exposed by these surveys are depicted by the use of bar graphs in Figure 3 of this report.

It will be noted that large amounts of submerged aquatic plant foods (Najas guadalupensis (southern naiad); Potamogeton spp. (pondweed); Chara spp. (muskgrasses); and Myriophyllum spp. (watermilfoil)) associated with smaller amounts of smartweeds characterized the 1940-41 migrations, while larger amounts of smartweeds associated with smaller amounts of submerged aquatics were characteristic of the 1949-50 migrations.

The surveys of individual species presented several features of unusual interest. For example, stomachs of the Baldpate series characteristically contained large quantities of submerged aquatic vegetative material with seeds conspicuously absent. Inasmuch as comparative studies showed an increase in utilization of submerged aquatic plants during the 1949-50 migrations, results of this survey were not in keeping with trends indicated by most of the others.

Surprisingly large percentages of minnows were found in a few stomachs during the analyses of the Blue-winged Teal series.

Although the impoundment on which they were taken had been formerly used as a rearing pond for minnows, the percentages (25 percent in one case) seemed excessive for waterfowl of this type, especially in view of the fact that an abundance of other foods was available.

An interesting feature of the Shoveller series was the overwhelming percentage of snail shells (Helisoma sp. and Physa sp.) encountered during analyses of the stomachs. The writer could not avoid a suspicion that the high rating of these gastropods (Table 9) could be minimized by the fact that whenever shells and shell fragments were present in abundance, sand and gravel were in correspondingly meager quantity. It might seem that the preponderance of shell fragments could indicate that not all the material represented living gastropods when consumed, but were the remains of deceased animals picked up in the form of grit. The possibility of selectivity of shell fragments over grit could be considered in the light of a need for calcium.

The finding of a gold nugget during analyses of the Pintail series provided one of the most interesting sidelights of the entire investigation. The nugget, slightly larger than the head of an ordinary pin and weighing .0128 grams, was verified by the Geology Department of Oklahoma A. and M. College.

Comparison of the Foods Taken by Waterfowl on Lake Carl Blackwell During the 1949-50 Migrations with Those Taken During the Migrations of 1940-41

An opportunity to determine the extent to which waterfowl alter their feeding habits in keeping with changing ecological conditions was afforded by the availability of 126 stomachs collected by Dr. F. M. Baumgartner on Lake Carl Blackwell during the 1940-41 migration periods. At that time the lake was comparatively new, and the water was clear except for brief periods immediately following heavy rains. As previously stated, the waters of this impoundment have become progressively more turbid within the intervening near-decade. It is unfortunate that only 26 stomachs were collected during the 1949-50 migrations to more evenly balance the earlier series of 126 stomachs. Nevertheless, it is believed that irrefutable evidences pertaining to the extent and cause of changes in waterfowl feeding habits within a ten-year period were derived from this survey (Table 18. For example, the startling change in the rating of Chara sp. from its primary position (25.28 percent) in the 1940-41 survey to complete disappearance in the 1949-50 survey illustrates the drastic effects of muddy waters upon submerged aquatic plants, and qualifies the muskgrasses to be considered as definite indicators of clear water. Further evidence is derived from the fact that the three top ranking plant foods of the 1940-41 series (all dependent on clear water) declined from a combined percentage volume of 68.38 to that of 2.38, while the marginal plant, Polygonum lapathifolium, advanced from fourth position (1.94

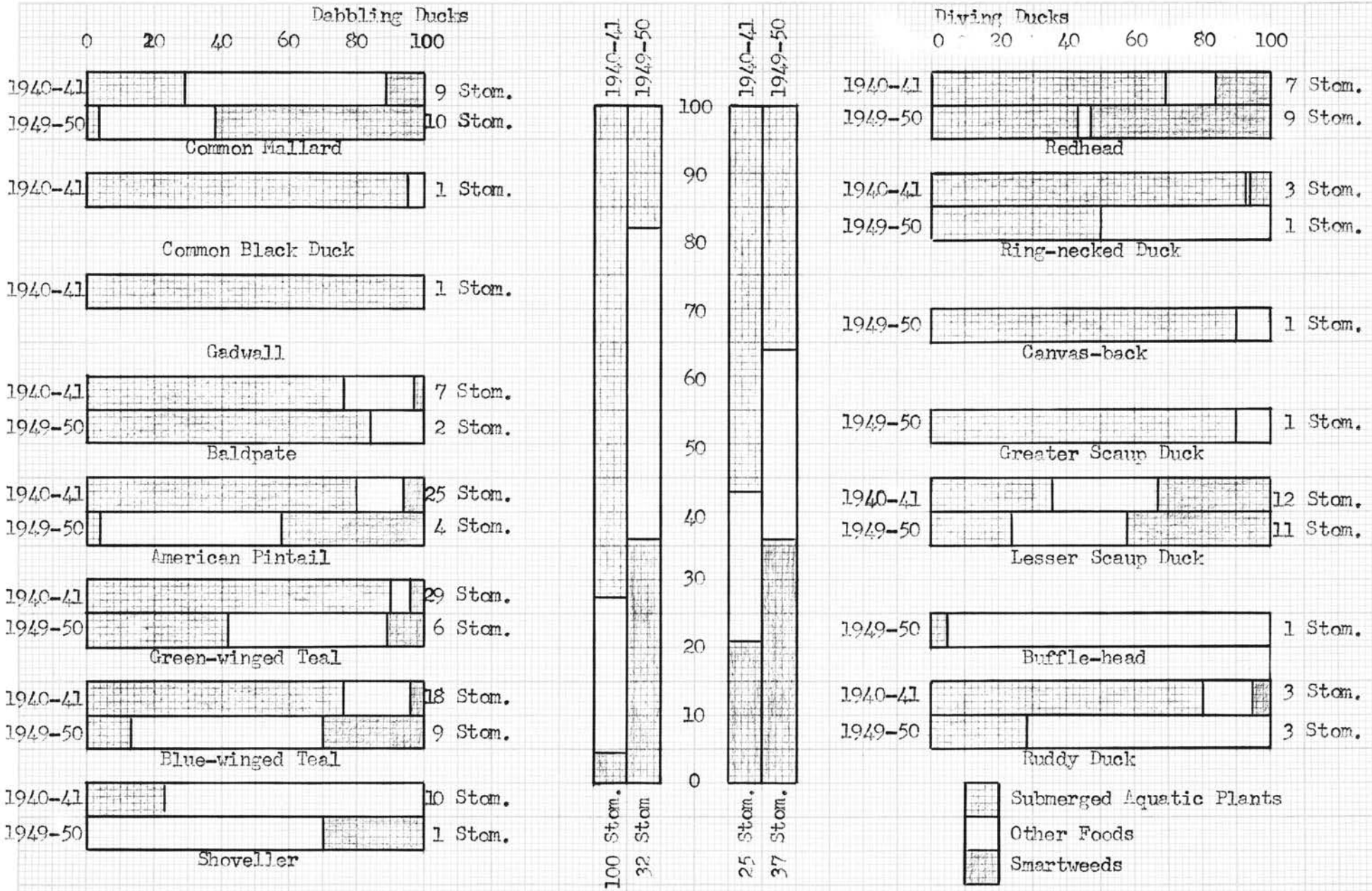


Fig. 3. Comparisons of Submerged Aquatic Plants, Smartweeds and Other Foods Eaten by Various Species of Waterfowl.

percent) to that of first (69.05). Frequency of occurrences support the premise that a definite trend is here indicated and not merely coincidence due to inadequate numbers of specimens examined.

Results arising from the Lake Carl Blackwell study are entirely in line with the findings of Chamberlain (1948), whose investigations on the Back Bay National Refuge led to the conclusion that turbidity of water was the factor most responsible for the limited growth of submerged waterfowl food plants. It should be remembered that turbidity can cause the destruction of valuable submerged waterfowl food plants by the precipitation of silt upon the leaves as well as the exclusion of light rays from the water.

A far greater variety of food items appeared in the 1940-41 survey than were present in the later series. This situation was due in all probability to the fact that unusually heavy rains had swollen the lake and inundated marginal fields just prior to the dates when many of the specimens were collected. A great abundance of seeds of upland plants were thus made available in the water and accounted for the large amounts of ragweed, spurge, thistle, and other items not usually associated with the feeding habits of waterfowl. It is believed that the principle, thus implied, should be fully exploited in future waterfowl management plans wherever fluctuations of water levels are possible. This is supported by Morse (1948), who, in describing experiments with controlled fluctuations of water levels, pointed out in a quarterly report of Western Kentucky Waterfowl Management Investigations that ducks appeared in vast numbers wherever

fields were inundated, and as quickly departed when the water returned to its normal level. The practice of deliberately raising and lowering water levels to coincide with migrations of waterfowl, especially in areas characterized by a scarcity of food, should be adopted as a waterfowl management measure wherever possible. Needless to say, little benefit can be derived from rises in water level, controlled or uncontrolled, over areas where cattle have been permitted to graze and trample to the water line.

Comparative Survey of Foods Taken on Large and Small Impoundments

This study was designed to compare the foods contained in the stomachs of waterfowl collected on some of the large turbid impoundments with those contained in stomachs collected on smaller and clearer bodies of water. Specimens from the 1949-50 series were used with a view of determining to what extent, if any, such a contrast embracing the same migratory periods would support the trends indicated by the preceding surveys.

Boomer Lake, two miles north of Stillwater, Oklahoma, and Lake Carl Blackwell, approximately 12 miles west, were the large impoundments from which specimens were collected for studying the influence of ecological conditions involving turbidity. Boomer Lake is the smaller and by far the muddier of the two lakes. Carberry Pond, the minnow ponds near Lake Carl Blackwell, and one farm pond collectively provided the series representing small, clear water situations for contrasting study. Carberry Pond, one of the clearest in Payne County, is situated

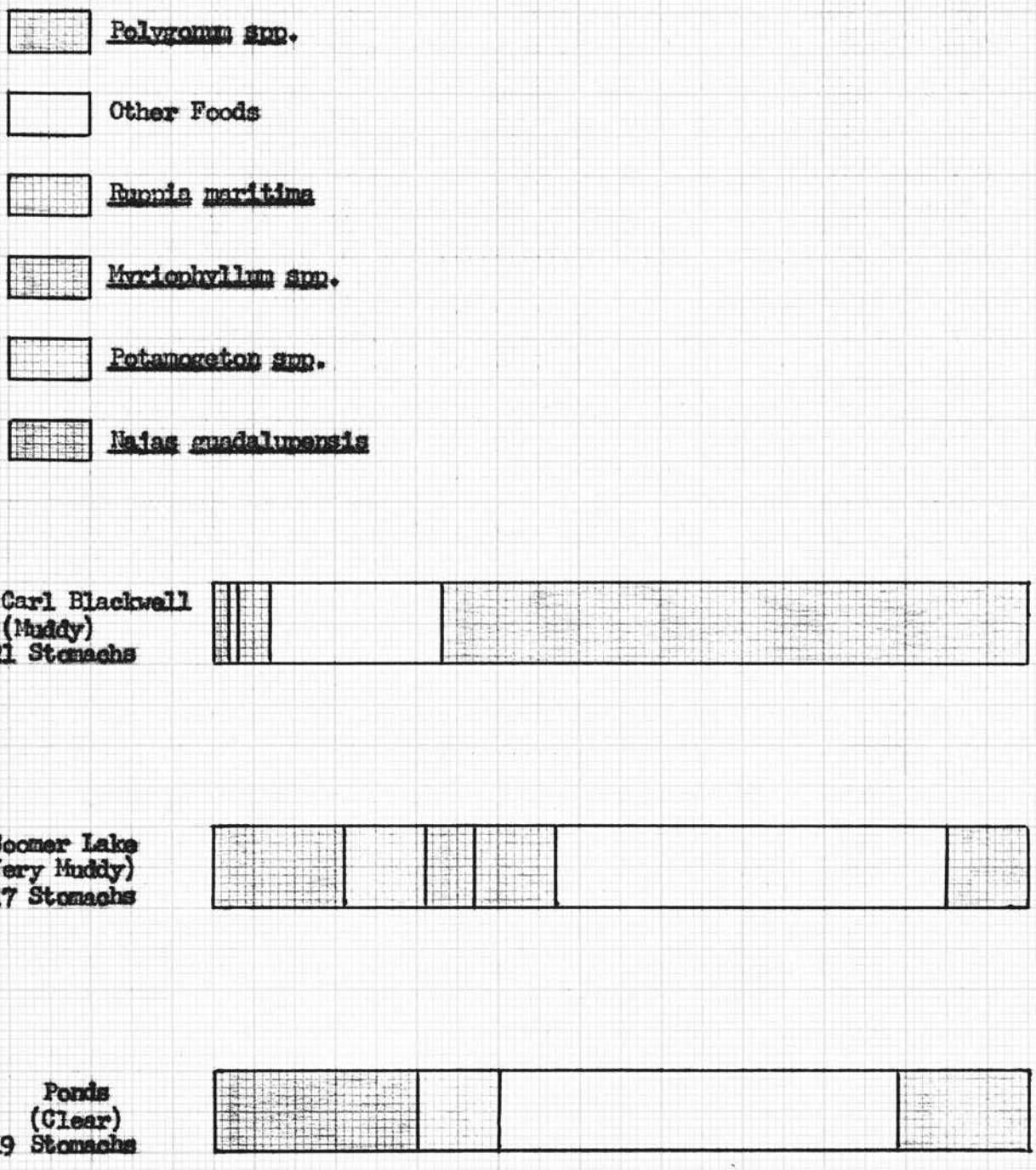


Fig. 4. Comparisons of Foods Contained in Stomachs of Waterfowl (Anatidae) Collected on Large Turbid Impoundments with Those Contained in Stomachs Taken on Small Clear Ponds. (1949-50 Series.)

on an east-west line approximately halfway between the two larger impoundments. Detailed results of this survey are contained in Table 19 of this report.

Analyses of the Lake Carl Blackwell series and the clear pond series produced findings which, although not striking, were still in keeping with trends indicated by previous surveys (Fig. 4). Small percentages of submerged aquatic plant foods associated with larger percentages of Polygonum spp. characterized the stomachs collected from turbid water situations, while large percentages of submerged aquatic plant foods associated with smaller percentages of Polygonum spp. characterized the stomachs collected from clear water situations.

Survey of the Boomer Lake series, however, produced results which at first seemed to be at variance with expected results. This muddy impoundment harbored waterfowl, the stomachs of which contained higher percentages of submerged aquatic plant foods and smaller percentages of smartweed than those representing either Lake Carl Blackwell or the clear ponds collectively.

Observations of waterfowl on this lake as well as survey of vegetation around its margin had led to an opinion that it contained foods of little or no value to waterfowl, and that it was used by them primarily as a resting area. Moreover, 23 percent of the stomachs taken from this impoundment were rejected because of insufficient food content. Consequently, it is believed that the quantity and variety (Fig. 4) of submerged aquatic foods contained in these stomachs can be interpreted as lending support

to the probability that birds taken on Boomer Lake had fed on other ponds and impoundments and were shot after returning for resting purposes only.

Perhaps the most important result of this survey from a propagative standpoint was the discovery that two very valuable waterfowl food plants (Potamogeton pectinatus and Ruppia maritima) appeared in sizeable quantities in the stomachs of a few birds shot on Boomer Lake. These plant foods had been scarce or completely absent from the findings of previous surveys. Potamogeton pectinatus (sago pondweed), designated by Martin and Uhler (op. cit.) as perhaps the most important single waterfowl food plant on the continent, constituted 5 percent (gross volume) of the 17 stomachs comprising the Boomer Lake series. As previously stated, this was surprising in view of the turbid condition of these waters, but the seed were in good condition and obviously recently consumed. This leads to the conclusion that this highly desirable food plant is thriving somewhere in the vicinity if not in the shallows of Boomer Lake itself. Ruppia maritima (wigeongrass), which ranked fourth in order of importance of all waterfowl foods of the United States and Canada, ranked second in importance (10 percent) of foods consumed by the Boomer Lake specimens. These seed were also in good condition and apparently very recently taken.

Since it is quite apparent that these valuable waterfowl foods are thriving in at least a few local environments, it seems that serious attention should be given to their propagation and distribution, for their presence would contribute most

substantially toward improvement of waterfowl feeding conditions in Payne County.

Wigeongrass is characteristic of brackish coastal waters and alkaline lakes in the West, and its principal range, as designated by Martin and Uhler (op. cit.) does not include this region of the state.

# CONCLUSIONS

1. Plant foods most important to waterfowl migrating through Payne County, Oklahoma, are Najas guadalupensis (southern naiad), Chara spp. (muskgrass), Potamogeton foliosus (grass-leaved pondweed), Polygonum lapathifolium (nodding smartweed), Echinochloa crusgalli (wild millet), Polygonum longistylum (long-styled persicaria), Myriophyllum spp. (watermilfoil), Polygonum pensylvanicum (largeseed smartweed), Scirpus spp. (bulrush), and Sorghum vulgare (grain sorghum). These foods comprised 72.95 percent (gross volume) of the food found in 187 stomachs.

2. The submerged aquatic plant foods, Najas guadalupensis (southern naiad), Chara spp. (muskgrass), and Potamogeton foliosus (grass-leaved pondweed) constituted a greater combined percentage (by gross volume) than all other foods combined.

3. These aquatic plants, along with Polygonum lapathifolium, are the preferred foods of waterfowl in migrating through Payne County, and they turn to other foods in great quantity only when the availability of these is limited.

4. Food habits of waterfowl on Lake Carl Blackwell have undergone drastic changes within the past decade due to increasing turbidity of the water. The change has been from the submerged aquatics to the shore-line and upland plants.

5. Chara spp. (muskgrasses) are plant indicators of this change.

6. Two very important waterfowl food plants (sago pondweed and wigeongrass) were found to be present in one of the 1949-50

surveys. It would be highly desirable to attempt to propagate and increase the distribution of these species.

7. The development and maintenance of clear water or controlled fluctuation of water levels on muddy lakes and ponds will materially increase the food supply for waterfowl.

TABLE 1. Foods of Waterfowl Migrating Through Payne County, Oklahoma As Indicated by Analyses Based on 187 Stomachs. (Column 1 presents the combined series listed in order of percentages; column 2 and 3, the 1940-41 and 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Najas guadalupensis (Southern naiad) | 19.47 | 99 | 21.79 | 81 | 14.67 | 18 |
| Chara spp. (Muskgrass) | 17.25 | 109 | 25.28 | 100 | .66 | 9 |
| Potamogeton foliosus (Grass-leaved pondweed) | 15.21 | 140 | 20.32 | 117 | 4.67 | 23 |
| Polygonum lapathifolium (Nodding smartweed) | 11.28 | 67 | 1.94 | 29 | 30.57 | 39 |
| Echinochloa crusgalli (Wild millet) | 2.25 | 31 | 1.94 | 16 | 2.87 | 15 |
| Polygonum longistylum (Long-styled persicaria) | 1.66 | 25 | 2.46 | 21 | | 4 |
| Myriophyllum spp. (Watermilfoil) | 1.23 | 6 | .32 | 4 | 3.11 | 3 |
| Polygonum pensylvanicum (Largeseed smartweed) | 1.20 | 16 | 1.11 | 7 | 1.39 | 9 |
| Polygonum spp. (Smartweed) | 1.18 | 52 | 1.31 | 46 | .90 | 6 |
| Scirpus spp. (Bulrush) | 1.12 | 7 | | 2 | 3.44 | 5 |
| Sorghum vulgare (Sorghum) | 1.10 | 3 | 1.63 | 3 | | |
| Helianthus spp. (Sunflower) | .96 | 18 | | 13 | 2.95 | 5 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Ruppia maritima (Wigeongrass) | .96 | 5 | .04 | 2 | 2.87 | 3 |
| Leptoloma cognatum (Chase fall witchgrass) | .83 | 16 | | 10 | 2.54 | 6 |
| Algae (Algae) | .80 | 3 | 1.19 | 2 | | 1 |
| Potamogeton spp. (Pondweed) | .80 | 6 | 1.19 | 4 | | 2 |
| Eleocharis palustris (Common spikerush) | .70 | 8 | .91 | 3 | .25 | 5 |
| Ambrosia aptera (Blood ragweed) | .67 | 7 | .99 | 5 | | 2 |
| Sorghum halepense (Johnson grass) | .64 | 3 | .91 | 2 | .08 | 1 |
| Zea mays (Corn) | .64 | 3 | | | 1.97 | 3 |
| Potamogeton pectinatus (Sago pondweed) | .61 | 14 | .20 | 5 | 1.47 | 9 |
| Digitaria villosa (Shaggy fingergrass) | .51 | 10 | | 2 | 1.56 | 9 |
| Polygonum persicaria (Ladysthumb) | .45 | 15 | .24 | 9 | .90 | 6 |
| Panicum spp. (Panicum) | .37 | 18 | .56 | 15 | | 3 |
| Cirsium spp. (Thistle) | .35 | 33 | .52 | 30 | | 3 |
| Chloris spp. (Windmillgrass) | .33 | 9 | | 8 | .98 | 1 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Eupharbia corollata (Flowering spurge) | .32 | 1 | .48 | 1 | | |
| Oenothera laciniata (Evening primrose) | .30 | 52 | .44 | 52 | | |
| Panicum virgatum (Switchgrass) | .24 | 2 | | | .74 | 2 |
| Triodia flava (Purpletop) | .24 | 3 | .67 | 3 | | |
| Eleocharis spp. (Spikerush) | .22 | 13 | | 6 | .66 | 7 |
| Polygonum muhlenbergii (Marsh smartweed) | .21 | 8 | | 1 | .66 | 7 |
| Panicum dichotomiflorum (Fall panicum) | .19 | 1 | | | .57 | 1 |
| Scirpus paludosus (Alkali bulrush) | .19 | 1 | | | .57 | 1 |
| Polygonum hydropiperoides (Swamp smartweed) | .16 | 16 | .24 | 12 | | 4 |
| Scirpus validus (Softstem bulrush) | .14 | 6 | .08 | 4 | .25 | 2 |
| Scirpus fluviatilis (River bulrush) | .11 | 4 | .04 | 1 | .25 | 3 |
| Croton spp. (Croton) | .09 | 3 | .19 | 2 | | 1 |
| Cyperus spp. (Cyperus) | .08 | 12 | .08 | 4 | .08 | 8 |
| Carex spp. (Sedge) | .06 | 6 | .08 | 5 | | 1 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Chamaesyce sp. (Euphorbia) | .05 | 1 | .08 | 1 | | |
| Hordeum spp. (Little barley) | .04 | 5 | .04 | 5 | | |
| Lemna minor (Small duckweed) | .04 | 1 | | | .08 | 1 |
| Mollugo verticillata (Carpetweed) | .04 | 13 | .04 | 13 | | |
| Potamogeton natans (Floatingleaf pondweed) | .04 | 4 | | 1 | .08 | 3 |
| Scirpus acutus (Hardstem bulrush) | .04 | 5 | | 2 | .08 | 3 |
| Sparganium sp. (Burreed) | .03 | 1 | .04 | 1 | | |
| Solanum rostratum (Buffalo bur) | .03 | 1 | .04 | | | |
| Ditaxis sp. (Ditaxis) | .03 | 1 | .04 | 1 | | |
| Miscellaneous | 3.56 | | 2.58 | | 5.43 | |
| Arachnida (Spiders) | | 1 | | 1 | | |
| Insecta (Insects) | 3.77 | 127 | 2.76 | 96 | 5.66 | 31 |
| Crustacea (Ostracods) | | 10 | | 7 | | 3 |
| Gastropoda (Snails) | 6.99 | 45 | 7.19 | 30 | 6.48 | 15 |
| Pisces (Minnows, etc.) | .22 | 6 | .04 | 1 | .57 | 5 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Geranium carolinianum* (Geranium) | | 17 | | 16 | | 1 |
| *Amaranthus spp.* (Pigweed) | | 16 | | 10 | | 6 |
| *Ambrosia spp.* (Ragweed) | | 12 | | 10 | | 2 |
| *Paspalum spp.* (Paspalum) | | 11 | | 10 | | 1 |
| *Chenopodium spp.* (Goosefoot) | | 8 | | 7 | | 1 |
| *Prionopsis ciliata* (Prionopsis) | | 5 | | 5 | | |
| *Galium spp.* (Bedstraw) | | 4 | | 4 | | |
| *Bromus spp.* (Brome grass) | | 3 | | 3 | | |
| *Commelina spp.* (Day flower) | | 3 | | 3 | | |
| *Digitaria sanguinalis* (Crabgrass) | | 3 | | 3 | | |
| *Diodia teres* (Buttonweed) | | 3 | | 3 | | |
| *Muhlenbergia spp.* (Muhlenbergia) | | 3 | | 3 | | |
| *Smilax sp.* (Green brier) | | 3 | | 1 | | 2 |
| *Symphoricarpos orbiculatus* (Coral-berry) | | 3 | | 2 | | 1 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Ambrosia psilostachya (Ragweed) | | 2 | | 2 | | |
| Andropogon saccharoides (Silvery beardgrass) | | 2 | | 2 | | |
| Brasenia schreberi (Watershield) | | 2 | | 1 | | 1 |
| Chloris verticillata (Windmillgrass) | | 2 | | 2 | | |
| Cynodon dactylon (Bermudagrass) | | 2 | | 2 | | |
| Geranium sp. (Geranium) | | 2 | | 1 | | 1 |
| Polygonum hydropiper (Waterpepper) | | 2 | | | | 2 |
| Polygonum punctatum (Dotted smartweed) | | 2 | | 1 | | 1 |
| Rumex sp. (Dock) | | 2 | | 1 | | 1 |
| Sisyrinchium spp. (Blue-eyed grass) | | 2 | | | | 2 |
| Acalypha sp. (Copper leaf, mercury) | | 1 | | 1 | | |
| Andropogon furcatus (Big bluestem) | | 1 | | | | 1 |
| Brachiaria sp. (Brachiaria) | | 1 | | 1 | | |
| Cornus sp. (Dogwood) | | 1 | | | | 1 |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Desmodium sp. (Tickclover) | | 1 | | | | 1 |
| Eragrostis sp. (Lovegrass) | | 1 | | 1 | | |
| Fimbristylis carolinianus (Fimbristylis) | | 1 | | | | 1 |
| Iva sp. (Iva) | | 1 | | 1 | | |
| Jussiaea sp. (Waterprimrose) | | 1 | | | | 1 |
| Mollugo sp. (Indian chickweed) | | 1 | | 1 | | |
| Oxalis sp. (Wood sorrel) | | 1 | | 1 | | |
| Rennex sp. (Rennex) | | 1 | | | | 1 |
| Rhus sp. (Sumac) | | 1 | | | | 1 |
| Setaria sp. (Pigeongrass) | | 1 | | | | 1 |
| Sidalcea sp. (Sidalcea) | | 1 | | | | 1 |
| Silene antirrhina (Sleepy catchfly) | | 1 | | 1 | | |
| Solanum sp. (Nightshade) | | 1 | | 1 | | |
| Taxodium distichum (Baldcypress) | | 1 | | 1 | | |

TABLE 1. (Continued)

| Scientific Name (Common Name) | Combined Series 660.6 cc 187 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 265.4 cc 61 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Triodia* sp. (Triodia) | | 1 | | 1 | | |
| *Verbena* sp. (Verbena) | | 1 | | | | 1 |
| *Vicia* sp. (Vetch) | | 1 | | 1 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |
| Lead shot | | 7 | | 3 | | 4 |

| *Common mallard | 19 |
|---|---|
| Common black duck | 1 |
| Gadwall | 1 |
| Baldpate | 9 |
| American pintail | 29 |
| Green-winged teal | 35 |
| Blue-winged teal | 27 |
| Shoveller | 11 |
| Redhead | 16 |
| Ring-necked duck | 4 |
| Canvas-back | 1 |
| Greater scaup duck | 1 |
| Lesser scaup duck | 23 |
| Buffle-head | 1 |
| Ruddy duck | 6 |
| Hutchins's goose | 1 |
| Total - - - - | 187 |

| **Common mallard | 9 |
|---|---|
| Common black duck | 1 |
| Gadwall | 1 |
| Baldpate | 7 |
| American pintail | 25 |
| Green-winged teal | 29 |
| Blue-winged teal | 18 |
| Shoveller | 10 |
| Redhead | 7 |
| Ring-necked duck | 3 |
| Lesser scaup duck | 12 |
| Ruddy duck | 3 |
| Hutchins's goose | 1 |
| Total - - - - | 126 |

| ***Common mallard | 10 |
|---|---|
| Baldpate | 2 |
| American pintail | 4 |
| Green-winged teal | 6 |
| Blue-winged teal | 9 |
| Shoveller | 1 |
| Redhead | 9 |
| Ring-necked duck | 1 |
| Canvas-back | 1 |
| Greater scaup duck | 1 |
| Lesser scaup duck | 11 |
| Buffle-head | 1 |
| Ruddy duck | 3 |
| Undetermined | 2 |
| Total - - - - | 61 |

Common Mallard
(*Anas platyrhynchos platyrhynchos*)

TABLE 2. Foods of the Common Mallard Based on Analyses of 19 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 219.1 cc 19 Stomachs* | | 1940-41 Series 185.6 cc 9 Stomachs | | 1949-50 Series 30.3 cc 10 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Polygonum lapathifolium* (Nodding smartweed) | 35.78 | 12 | 6.67 | 3 | 62.00 | 9 |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 12.40 | 6 | 26.11 | 6 | | |
| *Sorghum vulgare* (Sorghum) | 10.78 | 3 | 22.78 | 3 | | |
| *Echinochloa crusgalli* (Wild millet) | 6.32 | 6 | 13.33 | 4 | | 2 |
| *Zea mays* (Corn) | 6.32 | 3 | | | 12.00 | 3 |
| *Ambrosia aptera* (Blood ragweed) | 3.42 | 3 | 7.22 | 3 | | |
| *Euphorbia corollata* (Flowering spurge) | 3.16 | 1 | 6.67 | 1 | | |
| *Najas guadalupensis* (Southern naiad) | 3.16 | 4 | 2.78 | 3 | 3.50 | 1 |
| *Digitaria villosa* (Shaggy fingergrass) | 2.37 | 3 | | 1 | 4.50 | 2 |
| *Triodia flava* (Purpletop) | 2.37 | 2 | 5.00 | 2 | | |
| *Scirpus paludosus* (Alkali bulrush) | 1.84 | 1 | | | 3.50 | 1 |
| *Polygonum pensylvanicum* (Largeseed smartweed) | 1.57 | 2 | 3.33 | 1 | | 1 |

TABLE 2. (Continued)

| Scientific Name (Common Name) | Combined Series 219.1 cc 19 Stomachs* | | 1940-41 Series 185.6 cc 9 Stomachs | | 1949-50 Series 30.3 cc 10 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Cirsium spp. (Thistle) | .53 | 2 | 1.11 | 2 | | |
| Polygonum longistylum (Long-styled persicaria) | .53 | 4 | 1.11 | 3 | | 1 |
| Cyperus sp. (Cyperus) | .53 | 1 | 1.11 | 1 | | |
| Potamogeton pectinatus (Sago pondweed) | .26 | 3 | | | .50 | 3 |
| Scirpus spp. (Bulrush) | .26 | 2 | | | .50 | 2 |
| Miscellaneous | 5.24 | | 2.78 | | 7.50 | |
| Insecta (Insects) | 3.16 | 6 | | 5 | 6.00 | 1 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Taken:

November 1940 - 2
December 1940 - 6
November 1941 - 1
October 1949 - 1
November 1949 - 6
December 1949 - 3

Total - 19

Common Black Duck
(*Anas rubripes rubripes*)

TABLE 3. Foods of the Common Black Duck Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 4.5 cc 1 Stomach* | | 1940-41 Series 4.5 cc 1 Stomach | | 1949-50 Series | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 95.00 | 1 | 95.00 | 1 | | |
| *Sparganium sp.* (Burreed) | 5.00 | 1 | 5.00 | 1 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | | |

*Stomach Collected:
November 1940

Gadwall
(*Chaulelasmus streperus*)

TABLE 4. Foods of the Gadwall Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 3 cc 1 Stomach* | | 1940-41 Series 3 cc 1 Stomach | | 1949-50 Series | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 100.00 | 1 | 100.00 | 1 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | | |

*Stomach Collected:
November 1940

Baldpate
(*Mareca americana*)

TABLE 5. Foods of the Baldpate Based on Analyses of 9 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 16.5 cc 9 Stomachs* | | 1940-41 Series 12.7 cc 7 Stomachs | | 1949-50 Series 3.8 cc 2 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Najas guadalupensis* (Southern naiad) | 60.56 | 6 | 64.29 | 5 | 47.50 | 1 |
| *Potamogeton sp.* (Pondweed) | 7.79 | 1 | 10.00 | 1 | | |
| *Ruppia maritima* (Wigeongrass) | 7.79 | 1 | | | 35.00 | 1 |
| *Eleocharis crusgalli* (Wild millet) | 6.11 | 2 | 7.86 | 2 | | |
| *Sorghum halepense* (Johnson grass) | 3.89 | 1 | 5.00 | 1 | | |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 2.78 | 8 | 2.86 | 7 | 2.50 | 1 |
| *Eleocharis palustris* (Common spikerush) | 1.68 | 2 | 2.14 | 1 | | 1 |
| *Polygonum lapathifolium* (Nodding smartweed) | 1.11 | 1 | 1.43 | 1 | | |
| Miscellaneous | 3.29 | | | | 15.00 | |
| *Insecta* (Insects) | 5.00 | 3 | 6.42 | 3 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |
| Lead shot | | 1 | | 1 | | |

*Specimens Collected: October 1940 - 5
November 1940 - 1
December 1940 - 1
October 1949 - 1
November 1949 - 1
Total - 9

American Pintail
(Dafila acuta tzitzihoa)

TABLE 6. Foods of the American Pintail Based on Analyses of 29 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 76.5 cc 29 Stomachs* | | 1940-41 Series 48.8 cc 25 Stomachs | | 1949-50 Series 27.7 cc 4 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Chara spp. (Muskgrass) | 32.93 | 23 | 38.20 | 23 | | |
| Potamogeton foliosus (Grass-leaved pondweed) | 17.76 | 25 | 20.60 | 25 | | |
| Najas guadalupensis (Southern naiad) | 15.17 | 19 | 16.60 | 18 | 6.25 | 1 |
| Polygonum lapathifolium (Nodding smartweed) | 6.72 | 8 | 1.00 | 6 | 42.50 | 2 |
| Helianthus spp. (Sunflower) | 6.21 | 5 | | 3 | 45.00 | 2 |
| Eleocharis palustris (Common spikerush) | 3.45 | 2 | 4.00 | 2 | | |
| Potamogeton spp. (Pondweed) | 2.59 | 2 | 3.00 | 1 | | 1 |
| Panicum spp. (Panicum) | 2.42 | 2 | 2.80 | 1 | | 1 |
| Polygonum spp. (Smartweed) | 2.42 | 13 | 2.80 | 13 | | |
| Cirsium spp. (Thistle) | 1.03 | 6 | 1.20 | 5 | | 1 |
| Potamogeton pectinatus (Sago pondweed) | .86 | 3 | 1.00 | 3 | | |

TABLE 6. (Continued)

| Scientific Name (Common Name) | Combined Series 76.5 cc 29 Stomachs* | | 1940-41 Series 48.8 cc 25 Stomachs | | 1949-50 Series 27.7 cc 4 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Myriophyllum* spp. (Watermilfoil) | .69 | 2 | .80 | 2 | | |
| *Polygonum longistylum* (Long-styled persicaria) | .69 | 3 | .80 | 3 | | |
| *Croton* sp. (Croton) | .52 | 1 | .60 | 1 | | |
| *Oenothera laciniata* (Evening primrose) | .52 | 15 | .60 | 15 | | |
| *Carex* sp. (Sedge) | .35 | 1 | .40 | 1 | | |
| *Echinochloa crusgalli* (Wild millet) | .35 | 2 | | | 2.50 | 2 |
| *Chamaesyce* sp. (Euphorbia) | .35 | 1 | .40 | 1 | | |
| *Mollugo verticillata* (Carpetweed) | .17 | 6 | .20 | 6 | | |
| *Panicum virgatum* (Switchgrass) | .17 | 1 | | | 1.25 | 1 |
| *Scirpus fluviatilis* (River bulrush) | .17 | 1 | .20 | 1 | | |
| *Scirpus validus* (Softstem bulrush) | .17 | 2 | .20 | 2 | | |
| *Solanum rostratum* (Buffalo bur) | .17 | 1 | .20 | 1 | | |
| *Sorghum halepense* (Johnson grass) | .17 | 1 | | | 1.25 | 1 |
| *Ditaxis* sp. (Ditaxis) | .16 | 1 | .19 | 1 | | |

TABLE 6. (Continued)

| Scientific Name (Common Name) | Combined Series 76.5 cc 29 Stomachs* | | 1940-41 Series 48.8 cc 25 Stomachs | | 1949-50 Series 27.7 cc 4 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Miscellaneous | 2.76 | | 3.01 | | 1.25 | |
| Gastropoda (Snails) | .86 | 16 | 1.00 | 14 | | 2 |
| Pisces (Minnows, etc.) | .17 | 1 | .20 | 1 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Collected:

| | | |
|---|---|---|
| October | 1940 - | 18 |
| November | 1940 - | 6 |
| December | 1940 - | 1 |
| November | 1949 - | 3 |
| March | 1950 - | 1 |
| Total | - | 29 |

Green-winged Teal
(*Nettion carolinense*)

TABLE 7. Foods of the Green-winged Teal Based on Analyses of 35 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 37.1 cc 35 Stomachs* | | 1940-41 Series 26.5 cc 29 Stomachs | | 1949-50 Series 10.6 cc 6 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Najas guadalupensis* (Southern naiad) | 32.29 | 26 | 35.35 | 23 | 17.50 | 3 |
| *Chara spp.* (Muskgrass) | 31.26 | 30 | 36.38 | 28 | 6.67 | 2 |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 16.00 | 30 | 18.97 | 28 | 1.67 | 2 |
| *Leptoloma cognatum* (Chase fall witchgrass) | 3.57 | 4 | | 2 | 20.83 | 2 |
| *Polygonum lapathifolium* (Nodding smartweed) | 3.57 | 7 | 2.07 | 4 | 10.83 | 3 |
| *Myriophyllum sp.* (Watermilfoil) | 2.71 | 1 | | | 15.83 | 1 |
| *Scirpus spp.* (Bulrush) | 2.57 | 2 | | 1 | 15.00 | 1 |
| *Eleocharis crusgalli* (Wild millet) | 1.43 | 8 | 1.38 | 5 | 1.67 | 3 |
| *Cirsium spp.* (Thistle) | .57 | 10 | .69 | 10 | | |
| *Oenothera laciniata* (Evening primrose) | .43 | 15 | .52 | 15 | | |
| *Polygonum spp.* (Smartweed) | .43 | 19 | .52 | 16 | | 3 |

TABLE 7. (Continued)

| Scientific Name (Common Name) | Combined Series 37.1 cc 35 Stomachs* | | 1940-41 Series 26.5 cc 29 Stomachs | | 1949-50 Series 10.6 cc 6 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Polygonum hydropiperoides (Swamp smartweed) | .43 | 2 | .52 | 2 | | |
| Polygonum pensylvanicum (Largeseed smartweed) | .29 | 4 | .35 | 1 | | 3 |
| Polygonum persicaria (Ladysthumb) | .29 | 2 | .35 | 1 | | 1 |
| Miscellaneous | 1.00 | | 1.03 | | .83 | |
| Insecta (Insects) | 1.57 | 33 | 1.87 | 28 | | 5 |
| Gastropoda (Snails) | 1.59 | 2 | | | 9.17 | 2 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Collected:
October 1940 -26
November 1940 - 3
October 1949 - 3
November 1949 - 3

Total - 35

Blue-winged Teal
(*Querquedula discors*)

TABLE 8. Foods of the Blue-winged Teal Based on Analyses of 27 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 49.1 cc 27 Stomachs* | | 1940-41 Series 25.6 cc 18 Stomachs | | 1949-50 Series 23.5 cc 9 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Chara spp.* (Muskgrass) | 27.96 | 21 | 41.94 | 17 | | 4 |
| *Najas guadalupensis* (Southern naiad) | 14.26 | 11 | 16.94 | 9 | 8.89 | 2 |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 11.30 | 20 | 15.00 | 15 | 3.89 | 5 |
| *Eleocharis crusgalli* (Wild millet) | 5.74 | 7 | | 1 | 17.22 | 6 |
| *Algae* (Algae) | 5.56 | 3 | 8.33 | 2 | | 1 |
| *Polygonum lapathifolium* (Nodding smartweed) | 4.82 | 10 | .56 | 3 | 13.33 | 7 |
| *Sorghum halepense* (Johnson grass) | 2.96 | 1 | 4.44 | 1 | | |
| *Polygonum persicaria* (Ladysthumb) | 2.78 | 4 | 1.11 | 2 | 6.11 | 2 |
| *Chloris verticillata* (Windmillgrass) | 2.22 | 4 | | 3 | 6.67 | 1 |
| *Polygonum spp.* (Smartweed) | 2.22 | 7 | .28 | 6 | 6.11 | 1 |
| *Eleocharis spp.* (Spikerush) | 1.48 | 4 | | | 4.44 | 4 |

TABLE 8. (Continued)

| Scientific Name (Common Name) | Combined Series 49.1 cc 27 Stomachs* | | 1940-41 Series 25.6 cc 18 Stomachs | | 1949-50 Series 23.5 cc 9 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Panicum virgatum (Switchgrass) | 1.48 | 1 | | | 4.44 | 1 |
| Panicum dichotomiflorum (Fall panicum) | 1.30 | 1 | | | 3.89 | 1 |
| Polygonum pensylvanicum (Largeseed smartweed) | 1.11 | 3 | | | 3.33 | 3 |
| Leptoloma cognatum (Chase fall witchgrass) | .93 | 3 | | 2 | 2.78 | 1 |
| Myriophyllum sp. (Watermilfoil) | .74 | 1 | 1.11 | 1 | | |
| Scirpus validus (Softstem bulrush) | .74 | 4 | .28 | 2 | 1.68 | 2 |
| Polygonum hydropiperoides (Swamp smartweed) | .37 | 2 | .56 | 1 | | 1 |
| Ruppia maritima (Wigeongrass) | .37 | 3 | .28 | 2 | .56 | 1 |
| Oenothera laciniata (Evening primrose) | .19 | 9 | .28 | 9 | | |
| Polygonum longistylum (Long-styled persicaria) | .19 | 3 | .29 | 2 | | 1 |
| Potamogeton sp. (Pondweed) | .19 | 1 | .28 | 1 | | |
| Miscellaneous | 1.46 | | 1.37 | | 1.66 | |

TABLE 8. (Continued)

| Scientific Name (Common Name) | Combined Series 49.1 cc 27 Stomachs* | | 1940-41 Series 25.6 cc 18 Stomachs | | 1949-50 Series 23.5 cc 9 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Insecta (Insects) | 4.44 | 21 | 4.17 | 16 | 5.00 | 5 |
| Gastropoda (Snails) | 3.89 | 17 | 2.78 | 10 | 6.11 | 7 |
| Pisces (Minnows, etc. | 1.30 | 4 | | | 3.89 | 4 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Collected:

| | | |
|---|---|---|
| October | 1940 - | 14 |
| November | 1940 - | 1 |
| April | 1941 - | 2 |
| December | 1941 - | 1 |
| April | 1949 - | 1 |
| September | 1949 - | 4 |
| October | 1949 - | 3 |
| April | 1950 - | 1 |
| Total | - | 27 |

Shoveller
(Spatula clypeata)

TABLE 9. Foods of the Shoveller Based on Analyses of 11 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 26.6 cc 11 Stomachs* | | 1940-41 Series 25.9 cc 10 Stomachs | | 1949-50 Series .7 cc 1 Stomach | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Chara spp. (Muskgrass) | 12.73 | 10 | 14.00 | 9 | | 1 |
| Potamogeton foliosus (Grass-leaved pondweed) | 7.27 | 10 | 8.00 | 10 | | |
| Polygonum hydropiperoides (Swamp smartweed) | 2.73 | 3 | | 2 | 30.00 | 1 |
| Najas guadalupensis (Southern naiad) | .91 | 7 | 1.00 | 7 | | |
| Miscellaneous | 6.82 | | 5.00 | | 25.00 | |
| Insecta (Insects) | 3.18 | 9 | 3.00 | 8 | 5.00 | 1 |
| Gastropoda (Snails) | 66.36 | 10 | 69.00 | 9 | 40.00 | 1 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Collected:
October 1940 - 10
April 1950 - 1

Total - 11

Redhead
(*Nyroca americana*)

TABLE 10. Foods of the Redhead Based on Analyses of 16 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 148.4 cc 16 Stomachs* | | 1940-41 Series 24.6 cc 7 Stomachs | | 1949-50 Series 123.8 cc 9 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Najas guadalupensis* (Southern naiad) | 34.69 | 9 | 43.57 | 5 | 27.78 | 4 |
| *Polygonum lapathifolium* (Nodding smartweed) | 30.00 | 5 | | | 53.33 | 5 |
| *Chara spp.* (Muskgrass) | 10.31 | 6 | 23.57 | 6 | | |
| *Polygonum longistylum* (Long-styled persicaria) | 6.25 | 3 | 14.29 | 2 | | 1 |
| *Ruppia maritima* (Wigeongrass) | 6.25 | 1 | | | 11.11 | 1 |
| *Ambrosia aptera* (Blood ragweed) | 3.75 | 1 | 8.57 | 1 | | |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 3.44 | 9 | 1.43 | 6 | 5.00 | 3 |
| *Triodia flava* (Purpletop) | 2.50 | 1 | 5.71 | 1 | | |
| *Polygonum spp.* (Smartweed) | .94 | 5 | 2.14 | 4 | | 1 |
| Miscellaneous | 1.87 | | .72 | | 2.78 | |
| Total - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Stomachs Collected:
October 1940 - 5
November 1940 - 2
October 1949 - 1
November 1949 - 8
Total - 16

Ring-necked Duck
(*Nyroca collaris*)

TABLE 11. Foods of the Ring-necked Duck Based on Analyses of 4 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 13 cc 4 Stomachs* | | 1940-41 Series 11.9 cc 3 Stomachs | | 1949-50 Series 1.1 cc 1 Stomach | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 55.00 | 4 | 65.00 | 3 | 25.00 | 1 |
| *Chara sp.* (Muskgrass) | 20.00 | 1 | 26.67 | 1 | | |
| *Najas guadalupensis* (Southern naiad) | 7.50 | 2 | 1.67 | 1 | 25.00 | 1 |
| *Polygonum longistylum* (Long-styled persicaria) | 2.50 | 1 | 3.33 | 1 | | |
| *Polygonum pensylvanicum* (Largeseed smartweed) | 2.50 | 1 | 3.33 | 1 | | |
| *Gastropoda* (Snails) | 12.50 | 1 | | | 50.00 | 1 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Specimens Collected:
October 1940 - 2
November 1940 - 1
March 1950 - 1

Total - 4

Canvas-back
(*Nyroca valisineria*)

TABLE 12. Foods of the Canvas-back Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 1.1 cc 1 Stomach* | | 1940-41 Series | | 1949-50 Series 1.1 cc 1 Stomach | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Najas guadalupensis* (Southern naiad) | 90.00 | 1 | | | 90.00 | 1 |
| *Leptoloma cognatum* (Chase fall witchgrass) | 5.00 | 1 | | | 5.00 | 1 |
| *Insecta* (Insects) | 5.00 | 1 | | | 5.00 | 1 |
| Total - - - - - - - - - | 100.00 | | | | 100.00 | |

*Stomach Collected:
November 1949

Greater Scaup Duck
(*Nyroca marila*)

TABLE 13. Foods of the Greater Scaup Duck Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 1.9 cc 1 Stomach* | | 1940-41 Series | | 1949-50 Series 1.9 cc 1 Stomach | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Myriophyllum sp.* (Watermilfoil) | 90.00 | 1 | | | 90.00 | 1 |
| Miscellaneous | 10.00 | | | | 10.00 | |
| Total - - - - - - - - - | 100.00 | | | | 100.00 | |

*Stomach Collected:
November 1949

Lesser Scaup Duck
(*Nyroca affinis*)

TABLE 14. Foods of the Lesser Scaup Duck Based on Analyses of 23 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 53.1 cc 23 Stomachs* | | 1940-41 Series 22.8 cc 12 Stomachs | | 1949-50 Series 30.3 cc 11 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Polygonum lapathifolium* (Nodding smartweed) | 18.91 | 15 | 5.83 | 7 | 33.18 | 8 |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 13.91 | 17 | 20.00 | 11 | 7.27 | 6 |
| *Najas guadalupensis* (Southern naiad) | 10.65 | 7 | 12.92 | 5 | 8.18 | 2 |
| *Polygonum longistylum* (Long-styled persicaria) | 6.96 | 9 | 13.33 | 8 | | 1 |
| *Polygonum pensylvanicum* (Largeseed smartweed) | 6.30 | 6 | 7.50 | 4 | 5.00 | 2 |
| *Potamogeton pectinatus* (Sago pondweed) | 3.48 | 3 | | | 7.27 | 3 |
| *Polygonum* spp. (Smartweed) | 2.61 | 3 | 5.00 | 2 | | 1 |
| *Polygonum muhlenbergii* (Marsh smartweed) | 1.74 | 4 | | | 3.64 | 4 |
| *Chara* spp. (Muskgrass) | 1.52 | 8 | 2.92 | 8 | | |
| *Echinochloa crusgalli* (Wild millet) | 1.30 | 4 | 2.50 | 2 | | 2 |
| *Oenothera laciniata* (Evening primrose) | .87 | 6 | 1.67 | 6 | | |
| *Eleocharis palustris* (Common spikerush) | .65 | 2 | | | 1.36 | 2 |

TABLE 14. (Continued)

| Scientific Name (Common Name) | Combined Series 53.1 cc 23 Stomachs* | | 1940-41 Series 22.8 cc 12 Stomachs | | 1949-50 Series 30.3 cc 11 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Cirsium spp. (Thistle) | .22 | 7 | .42 | 5 | | 2 |
| Cyperus spp. (Cyperus) | .22 | 2 | | | .46 | 2 |
| Hordeum spp. (Little barley) | .22 | 2 | .42 | 2 | | |
| Myriophyllum spp. (Watermilfoil) | .22 | 2 | | 1 | .46 | 1 |
| Polygonum hydropiperoides (Swamp smartweed) | .22 | 5 | .42 | 3 | | 2 |
| Potamogeton natans (Floatingleaf pondweed) | .22 | 1 | | | .46 | 1 |
| Scirpus acutus (Hardstem bulrush) | .22 | 2 | | | .46 | 2 |
| Miscellaneous | 4.78 | | 4.15 | | 5.44 | |
| Insecta (Insects) | 8.91 | 20 | 8.75 | 12 | 9.09 | 8 |
| Gastropoda (Snails) | 15.87 | 12 | 14.17 | 9 | 17.73 | 3 |
| Total - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |
| Lead shot | | 5 | | 2 | | 3 |

*Stomachs Collected:

| | |
|---|---|
| October 1940 - | 2 |
| November 1940 - | 4 |
| December 1940 - | 5 |
| April 1941 - | 1 |
| November 1949 - | 11 |
| Total - | 23 |

Buffle-head
(*Charitonetta islandica*)

TABLE 15. Foods of the Buffle-head Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 1.5 cc 1 Stomach | | 1940-41 Series | | 1949-50 Series 1.5 cc 1 Stomach | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 5.00 | 1 | | | 5.00 | 1 |
| Insecta (Insects) | 95.00 | 1 | | | 95.00 | 1 |
| Total - - - - - - - - - | 100.00 | | | | 100.00 | |

*Stomach Collected:
April 1949

Ruddy Duck
(*Erismatura jamaicensis rubida*)

TABLE 16. Foods of the Ruddy Duck Based on Analyses of 6 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 6.1 cc 6 Stomachs* | | 1940-41 Series 3.7 cc 3 Stomachs | | 1949-50 Series 2.4 cc 3 Stomachs | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 45.83 | 5 | 65.00 | 3 | 26.67 | 2 |
| *Scirpus spp.* (Bulrush) | 19.17 | 2 | | | 38.32 | 2 |
| *Najas guadalupensis* (Southern naiad) | 7.50 | 4 | 15.00 | 3 | | 1 |
| *Scirpus fluviatilis* (River bulrush) | 2.50 | 1 | | | 5.00 | 1 |
| *Polygonum lapathifolium* (Nodding smartweed) | 1.67 | 3 | 3.33 | 2 | | 1 |
| *Lemna minor* (Small duckweed) | .83 | 1 | | | 1.67 | 1 |
| *Polygonum longistylum* (Long-styled persicaria) | .83 | 1 | 1.67 | 1 | | |
| *Potamogeton pectinatus* (Sago pondweed) | .83 | 1 | | | 1.67 | 1 |
| Miscellaneous | 18.34 | | 10.00 | | 26.67 | |
| *Insecta* (Insects) | 2.50 | 3 | 5.00 | 3 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |
| Lead shot | | 1 | | | | 1 |

*Stomachs Collected: October 1940 - 2
December 1940 - 1
April 1949 - 1
November 1949 - 2
Total - 6

Hutchins's Goose
(*Branta canadensis hutchinsi*)

TABLE 17. Foods of the Hutchins's Goose Based on Analysis of One Stomach. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 4.1 cc 1 Stomach | | 1940-41 Series 4.1 cc 1 Stomach | | 1949-50 Series | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 55.00 | 1 | 55.00 | 1 | | |
| *Najas guadalupensis* (Southern naiad) | 5.00 | 1 | 5.00 | 1 | | |
| Miscellaneous | 40.00 | | 40.00 | | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | | |

*Stomach Collected:
October 1940

TABLE 18. Foods of Waterfowl Taken on Lake Carl Blackwell, Payne County, Oklahoma, Based on Analyses of 147 Stomachs. (Column 1 presents the combined series in order of percentages; columns 2 and 3, the 1940-41 vs. 1949-50 series for comparative study.)

| Scientific Name (Common Name) | Combined Series 525.2 cc 147 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 135.5 cc 21 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| *Chara spp.* (Muskgrass) | 21.67 | 100 | 25.28 | 100 | | |
| *Najas guadalupensis* (Southern naiad) | 18.91 | 83 | 21.79 | 81 | 1.67 | 2 |
| *Potamogeton foliosus* (Grass-leaved pondweed) | 17.55 | 119 | 20.32 | 117 | .71 | 2 |
| *Polygonum lapathifolium* (Nodding smartweed) | 11.53 | 49 | 1.94 | 29 | 69.05 | 20 |
| *Polygonum longistylum* (Long-styled persicaria) | 2.11 | 24 | 2.46 | 21 | | 3 |
| *Echinochloa crusgalli* (Wild millet) | 1.67 | 20 | 1.94 | 16 | | 4 |
| *Sorghum vulgare* (Grain sorghum) | 1.39 | 3 | 1.63 | 3 | | |
| *Polygonum spp.* (Smartweed) | 1.12 | 47 | 1.31 | 46 | | 1 |
| *Polygonum pensylvanicum* (Largeseed smartweed) | 1.05 | 9 | 1.11 | 7 | .71 | 2 |
| *Algae* (Algae) | 1.02 | 2 | 1.19 | 2 | | |
| *Potamogeton spp.* (Pondweed) | 1.02 | 4 | 1.19 | 4 | | |
| *Myriophyllum spp.* (Watermilfoil) | .88 | 5 | .32 | 4 | 4.29 | 1 |

TABLE 18. (Continued)

| Scientific Name (Common Name) | Combined Series 525.2 cc 147 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 135.5 cc 21 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Ambrosia aptera (Blood ragweed) | .85 | 5 | .99 | 5 | | |
| Eleocharis palustris (Common spikerush) | .78 | 4 | .91 | 3 | | 1 |
| Sorghum halepense (Johnson grass) | .78 | 2 | .91 | 2 | | |
| Scirpus spp. (Bulrush) | .65 | 5 | | 2 | 4.52 | 3 |
| Triodia flava (Purpletop) | .59 | 3 | .66 | 3 | | |
| Panicum spp. (Panicum) | .48 | 17 | .56 | 15 | | 2 |
| Cirsium spp. (Thistle) | .44 | 32 | .52 | 30 | | 2 |
| Euphorbia corollata (Flowering spurge) | .41 | 1 | .48 | 1 | | |
| Oenothera laciniata (Evening primrose) | .37 | 52 | .44 | 52 | | |
| Digitaria villosa (Shaggy fingergrass) | .31 | 5 | | 2 | 2.14 | 3 |
| Polygonum muhlenbergii (Marsh smartweed) | .27 | 4 | | 1 | 1.90 | 3 |
| Scirpus paludosus (Alkali bulrush) | .24 | 1 | | | 1.67 | 1 |
| Polygonum hydropiperoides (Swamp smartweed) | .20 | 15 | .24 | 12 | | 3 |
| Polygonum persicaria (Ladysthumb) | .20 | 10 | .24 | 9 | | 1 |

TABLE 18. (Continued)

| Scientific Name (Common Name) | Combined Series 525.2 cc 147 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 135.5 cc 21 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Potamogeton pectinatus (Sago pondweed) | .20 | 10 | .20 | 5 | .24 | 5 |
| Zea mays (Corn) | .14 | 2 | | | .95 | 2 |
| Croton spp. (Croton) | .10 | 3 | .19 | 2 | | 1 |
| Carex spp. (Sedge) | .07 | 5 | .08 | 5 | | |
| Chamaesyce sp. (Euphorbia) | .07 | 1 | .08 | 1 | | |
| Cyperus spp. (Cyperus) | .07 | 4 | .08 | 4 | | |
| Scirpus validus (Softstem bulrush) | .07 | 4 | .08 | 4 | | |
| Ditaxis sp. (Ditaxis) | .03 | 1 | .04 | 1 | | |
| Hordeum spp. (Little barley) | .03 | 5 | .04 | 5 | | |
| Mollugo verticillata (Carpetweed) | .03 | 13 | .04 | 13 | | |
| Ruppia maritima (Wigeongrass) | .03 | 2 | .04 | 2 | | |
| Scirpus fluviatilis (River bulrush) | .03 | 2 | .04 | 1 | | 1 |
| Solanum rostratum (Buffalo bur) | .03 | 1 | .04 | 1 | | |
| Sparganium sp. (Burreed) | .03 | 1 | .04 | 1 | | |

TABLE 18. (Continued)

| Scientific Name (Common Name) | Combined Series 525.2 cc 147 Stomachs* | | 1940-41 Series 399.7 cc 126 Stomachs** | | 1949-50 Series 135.5 cc 21 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Miscellaneous | 2.99 | | 2.58 | | 5.01 | |
| Gastropoda (Snails) | 6.39 | 31 | 7.22 | 30 | 1.43 | 1 |
| Insecta (Insects) | 3.20 | 104 | 2.78 | 96 | 5.71 | 8 |
| Crustacea (Ostracods) | | 7 | | 7 | | |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |
| Lead shot | | 4 | | 3 | | 1 |

| *Common mallard | 18 |
|---|---|
| Common black duck | 1 |
| Gadwall | 1 |
| Baldpate | 7 |
| American pintail | 25 |
| Green-winged teal | 30 |
| Blue-winged teal | 18 |
| Shoveller | 10 |
| Redhead | 12 |
| Ring-necked duck | 3 |
| Greater scaup duck | 1 |
| Lesser scaup duck | 17 |
| Ruddy duck | 3 |
| Hutchins's goose | 1 |
| Total - - - - | 147 |

| **Common mallard | 9 |
|---|---|
| Common black duck | 1 |
| Gadwall | 1 |
| Baldpate | 7 |
| American pintail | 25 |
| Green-winged teal | 29 |
| Blue-winged teal | 18 |
| Shoveller | 10 |
| Redhead | 7 |
| Ring-necked duck | 3 |
| Lesser scaup duck | 12 |
| Ruddy duck | 3 |
| Hutchins's goose | 1 |
| Total - - - - | 126 |

| ***Common mallard | 9 |
|---|---|
| Green-winged teal | 1 |
| Redhead | 5 |
| Greater scaup duck | 1 |
| Lesser scaup duck | 5 |
| Total - - - - | 21 |

TABLE 19. Comparative Survey of Foods Taken by Waterfowl During the 1949-50 Migrations on Large Turbid Impoundments with Those Taken on Smaller and Clearer Impoundments Based on Analyses of 57 Stomachs.

| Scientific Name (Common Name) | Muddy Lake Carl Blackwell 135.5 cc 21 Stomachs* | | Muddy Boomer Lake 21.4 cc 17 Stomachs** | | Clear Small Impoundments 98.2 cc 19 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Polygonum lapathifolium (Nodding smartweed) | 69.05 | 20 | 7.65 | 4 | 11.58 | 11 |
| Najas guadalupensis (Southern naiad) | 1.67 | 2 | 16.47 | 5 | 25.00 | 8 |
| Potamogeton foliosus (Grass-leaved pondweed) | .71 | 2 | 5.00 | 8 | 8.68 | 11 |
| Scirpus spp. (Bulrush) | 4.52 | 3 | 6.77 | 2 | | |
| Myriophyllum spp. (Watermilfoil) | 4.29 | 1 | 5.88 | 2 | | |
| Ruppia maritima (Wigeongrass) | | | 10.00 | 2 | | |
| Helianthus spp. (Sunflower) | | 1 | | | 9.40 | 3 |
| Echinochloa crusgalli (Wild millet) | | 4 | | | 8.68 | 7 |
| Leptoloma cognatum (Chase fall witchgrass) | | 1 | 6.18 | 2 | 1.32 | 2 |
| Zea mays (Corn) | .95 | 2 | 5.88 | 1 | | |
| Potamogeton pectinatus (Sago pondweed) | .24 | 5 | 5.00 | 3 | | |
| Digitaria villosa (Shaggy fingergrass) | 2.14 | 3 | 2.94 | 2 | | 3 |
| Polygonum pensylvanicum (Largeseed smartweed) | .71 | 2 | 2.35 | 2 | 1.58 | 1 |

TABLE 19. (Continued)

| Scientific Name (Common Name) | Muddy Lake Carl Blackwell 135.5 cc 21 Stomachs* | | Muddy Boomer Lake 21.4 cc 17 Stomachs** | | Clear Small Impoundments 98.2 cc 19 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Chloris sp. (Windmillgrass) | | | 3.53 | 1 | | |
| Polygonum spp. (Smartweed) | | 1 | | 3 | 2.90 | 2 |
| Panicum virgatum (Switchgrass) | | | | | 2.37 | 2 |
| Eleocharis spp. (Spikerush) | | 2 | | 1 | 2.11 | 3 |
| Polygonum muhlenbergii (Marsh smartweed) | 1.91 | 3 | | 2 | | 1 |
| Panicum dichotomiflorum (Fall panicum) | | | | | 1.84 | 1 |
| Scirpus paludosus (Alkali bulrush) | 1.67 | 1 | | | | |
| Eleocharis palustris (Common spikerush) | | 1 | .88 | 2 | | |
| Scirpus fluviatalis (River bulrush) | | 1 | .88 | 2 | | |
| Scirpus validus (Softstem bulrush) | | | | | .79 | 1 |
| Cyperus spp. (Cyperus) | | | .29 | 4 | | 1 |
| Lemna minor (Small duckweed) | | | .29 | 1 | | |
| Potamogeton natans (Floatingleaf pondweed) | | 1 | .29 | 1 | | |
| Scirpus acutus (Hardstem bulrush) | | | .29 | 2 | | |

TABLE 19. (Continued)

| Scientific Name (Common Name) | Muddy Lake Carl Blackwell 135.5 cc 21 Stomachs* | | Muddy Boomer Lake 21.4 cc 17 Stomachs** | | Clear Small Impoundments 98.2 cc 19 Stomachs*** | |
|---|---|---|---|---|---|---|
| | Vol. Percentage | Times Used | Vol. Percentage | Times Used | Vol. Percentage | Times Used |
| Sorghum halepense (Johnson grass) | | | | | .26 | 1 |
| Miscellaneous | 5.00 | | 9.12 | | 3.42 | |
| Gastropoda (Snails) | 1.43 | 1 | 5.02 | 2 | 11.91 | 10 |
| Insecta (Insects) | 5.71 | 8 | 5.29 | 9 | 6.32 | 9 |
| Pisces (Minnows, etc.) | | | | 1 | 1.84 | 4 |
| Total - - - - - - - - - | 100.00 | | 100.00 | | 100.00 | |

*Common mallard 9
Green-winged teal 1
Redhead 5
Greater scaup duck 1
Lesser scaup duck 5

Total - - - - 21

**Common mallard 1
Baldpate 1
American pintail 1
Green-winged teal 2
Blue-winged teal 1
Redhead 1
Canvas-back 1
Lesser scaup duck 5
Ruddy duck 2
Undetermined 2

Total - - - - 17

***Baldpate 1
American pintail 3
Blue-winged teal 7
Shoveller 1
Redhead 3
Ring-necked duck 1
Lesser scaup duck 1
Buffle-head 1
Ruddy duck 1

Total - - - - 19

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