

A FOOD HABITS STUDY OF DUCKS WINTERING ON THE LOWER PEE DEE AND WACCAMAW RIVERS, GEORGETOWN, SOUTH CAROLINA¹

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INTRODUCTION

In discussing the future of waterfowl, Janzen (1964) makes the following points: (1) we cannot expect to return to the good old days in waterfowl management; (2) we can and should strive to manage for a population comparable to that of the mid-1950's; and (3) habitat destruction is the chief cause of the reduced waterfowl population. He also points out the potential wildlife habitat made available by land taken out of agricultural production and then says, "Reasons for the changed agricultural outlook can be laid directly at the door of research. Research in agriculture has found, literally, how to grow two bushels of grain where one grew before. In a similar manner, I believe, research should show us how to produce two ducks where one was produced before."

Likewise, research in marsh management should show us how to feed two ducks where one was fed before. After ascertaining which plants in a given area are preferred as food by ducks, the results of further research will show us how to produce more of these plants per acre of land, thereby increasing efficiency of management.

There have been many studies concerned with the food habits of waterfowl. Among the first and most notable are those by Martin and Uhler (1939) and Cottam (1939). The material for these studies was collected in a period of years and included data collected from many places in the United States and Canada without special reference to availability of various foods. The results of these studies have been valuable to the waterfowl managers generally, but have not been directly applicable to local situations. In the work reported in this paper, an area of coastal marsh that had been managed for waterfowl for several years was selected and details of availability and use of duck foods were studied. It was thought that by this approach management practices could be evaluated for the local area.

McGilvrey (1964) used a somewhat similar method in studying food habits of ducks on a hydroelectric impoundment, Lake Marion, in South Carolina. There have been few other waterfowl food studies in the Southeastern United States, and none from the lower Pee Dee and Waccamaw rivers—an important waterfowl wintering area.

The study was made principally on the Pee Dee Management Area, South Carolina Wildlife Resources Department, but it also included some surrounding privately owned lands on the lower Pee Dee and Waccamaw rivers in Georgetown County, approximately 15 miles northeast of Georgetown. The topography of Georgetown County is that of an old ocean floor plain, little dissected, and poorly drained. The Pee Dee and Waccamaw rivers are little affected in the area by local streams and meander through broad overflow plains. These bottomlands are overflowed by the tide, which factor has been important in the history of land use of the area, since most of the study area was at one time in rice culture (McLendon *et al.*, 1912).

Much of the Pee Dee Management Area is composed of abandoned rice fields. Since 1963, it has been subjected to management measures, mainly controlled burning and water level control, intended to suppress vegetation of low value and increase duck food plants. This food

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utilization study was done in the fall and winter of 1964-65, and used in a thesis by the author (Conrad, 1965).

Objectives

It was with more effective marsh management in mind that this study was undertaken. The first objective was to determine the food habits of ducks in relation to availability of food plants in an area managed intensively for waterfowl. A second objective was to determine the value of *Aneilema*, *Aneilema Keisak* Hassk., as a food for ducks. Other food habit studies have indicated that many of the plants present in this area may be valuable as duck foods, but little information is available concerning utilization of *Aneilema*, which is abundant in the study area.

PROCEDURE

Plant Survey

A plant survey was conducted in September and October, 1964. Each field was slowly covered on foot. Plants present were recorded, and unidentified species were collected for later identification. The fields were covered a second time, and each plant species was rated according to availability by the following designations: abundant, large amount, medium amount, small amount, and scarce. The purpose of these designations was to record a general rating of plant abundance so that availability could be considered in determining preference as food by ducks.

Food Habits Study

From November 24, 1964, until February 4, 1965, 244 ducks of 12 species were collected including 100 Mallards, *Anas platyrhynchos* *Platyrhynchos* L., 53 Green-winged Teals, *Anas carolinensis* Gmelin, 26 Pintails, *Anas acuta* L., 23 Black Ducks, *Anas rubripes* Brewster, 18 Wood Ducks, *Aix sponsa* (L.), 9 Ring-necked Ducks, *Aythya collaris* (Donovan), 5 Blue-winged Teals, *Anas discors discors* L., 4 American Widgeons, *Mareca americana* (Gmelin), 3 Gadwalls, *Anas strepera* L., 1 Canvasback, *Aythya valisineria* (Wilson), 1 Shoveler, *Spatula clypeata* (L.), and 1 Lesser Scaup, *Aythya affinis* (Eyton). Twenty-five full crops and 243 gizzards were obtained and analyzed.

Most of the food habits material was obtained from ducks killed by hunters in the course of 10 managed hunts in December, 1964, and early January, 1965. Additional material was obtained from 31 ducks collected in November, 1964, and 39 ducks collected after the hunting season in January and February, 1965.

FOOD HABITS OF DUCKS IN RELATION TO AVAILABILITY OF FOODS

The plant survey revealed that in the diked and managed fields plant species rated as abundant or occurring in large or medium amounts were: *Aneilema*; giant cutgrass, *Zizaniopsis miliacea* (Michx.); various smartweeds and tearthumbs, *Polygonum* sp.; arrow arum, *Peltandra virginica* (L.); soft-stemmed bulrush, *Scirpus validus* Vahl.; and square stemmed spikerush, *Eleocharis quadrangulata* (Michx.). In the unmanaged marshes the most common plants were: various tree and shrub species; giant cutgrass; beggar ticks, *Bidens* sp.; *Aster* sp.; water hemlock, *Cicuta* sp.; water parsnip, *Sium suave* Walt.; and golden culb, *Orontium aquaticum* (L.).

Plants Rated as Abundant

Smartweeds and tearthumbs.— Various species of *Polygonum* probably comprised the most abundant single genus present in the diked fields. They occurred in 78.7 per cent of all ducks collected and accounted for 29.33 per cent of total diet. *Polygonum* accounted for the largest volume of foods taken by Mallards (40.25 per cent); Black Ducks (39.93 per cent); and Ring-necked Ducks (47.66 per cent). These plants respond favorably to management, are highly preferred by ducks, and are therefore rated as excellent duck foods in this area.

Aneilema.— *Aneilema* was probably the most abundant single

species of plant found within the diked fields, and accounted for a larger volume of foods eaten than any other single plant species. It occurred in 42.6 per cent of all ducks collected and accounted for 18.35 per cent of food found in the 244 ducks. It was especially preferred by Green-Winged Teals (63.59 per cent of total volume). It also made up an important part of the foods of Mallards (12.59 per cent) and Black Ducks (16.73 per cent of total volume). Growth of aneilema is stimulated by proper management practices and this plant was abundant within all diked fields. Because of its heavy mat-like growth, seed that shatter and fall to the ground may be unavailable without a good fall cover burn. During the fall of 1964, a good burn was not accomplished because of heavy rains and warm weather that kept the plant somewhat green. It is probable that aneilema would have been even more heavily used by ducks after a good burn. Aneilema is rated as an excellent duck food in this area.

Giant cutgrass. — The seeds of giant cutgrass were found as traces in only 20 ducks, although the plant was among those rated as abundant. It is considered as a pest plant even though in certain locations it may be used as protective cover around the edges of ponds. Other plants that produce more food also serve as cover.

Plants Rated as Occurring in Large Amount

Swamp smartweed, Polygonum hydropiperoides Michx. — Swamp smartweed occurred in more ducks (73.4 per cent) than any other single plant species and accounted for the second largest total volume (13.58 per cent). It was especially important to Mallards (11.68 per cent), Black Ducks (33.33 per cent), and Ring-necked Ducks (36.45 per cent of total volume). The high occurrence of swamp smartweed was probably because of its small seed and wide distribution throughout the fields. This plant responds favorably to management and is considered an excellent duck food in the study area.

Big leaf tearthumb, Polygonum arifolium L. — Big leaf tearthumb occurred in 25.4 per cent of all ducks and accounts for 11.28 per cent of total volume of foods eaten. It occurred most commonly in Mallards in November and December. It accounted for the largest volume of all species of foods taken by Mallards (22.78 per cent). Big leaf tearthumb burns especially well and, therefore, the seeds are made more available after a burn. Its low occurrence and high volume taken in the early fall denote high preference for this plant. Therefore, it is classified as an excellent food plant for this area.

Plants Rated as Occurring in Medium Amount

Arrow arum. — Arrow arum accounted for 11.84 per cent of the total foods eaten and was highly important to the Wood Duck (60.92 per cent of total volume) during the early fall. Arrow arum responds favorably to management; however, the plants associated with an increase in arrow arum are mostly undersirable. In most cases no more than a medium amount of arrow arum would be desired since it is important to but one duck species. Arrow arum is rated as an excellent food for Wood Ducks. It is rated as a poor to fair food for Mallards (1.13 per cent) and Black Ducks (6.24 per cent). Arrow arum did not occur in other ducks collected; therefore, it could be considered a pest since it replaced more useful food plants.

Square stem spikerush. — Square stem spikerush accounted for 10.93 per cent of total volume and occurred in 65.2 per cent of all ducks. It was most important to Mallards in January and February, accounting for 18.11 per cent of total volume. A higher occurrence and volume of square stem spikerush in the last half of the wintering period indicates a slightly lower preference for this plant than for some of the others reported in this paper. It is rated as good duck food in this area.

Soft-stem bulrush. — Soft-stem bulrush occurred in 59.4 per cent of all ducks collected and accounted for 7.61 per cent of all food present. It was most important to Mallards (12.22 per cent) and Black Ducks (nine per cent of total volume) and occurred mostly in January. It is rated as a fair to good duck food in this area.

Plants Rated as Occurring in Small Amounts

Pennsylvania smartweed, Polygonum pennsylvanicum L.—Pennsylvania smartweed was one of the few plants rated as available in small amounts, accounting for as much as one per cent of total volume. It occurred in 40.6 per cent of all ducks collected and accounted for 3.21 per cent of total volume. It was most important in Mallards (4.29 per cent of total volume) and occurred mostly in December. Pennsylvania smartweed has a seed somewhat larger than that of swamp smartweed, and because of its high preference in relation to low availability, it is classified as an excellent duck food in this area. Any increase in the amount of Pennsylvania smartweed within diked fields would be desired.

Wild rice, Zizania aquatica L.—Wild rice occurred in nine of 244 ducks collected and made up 1.51 per cent of total volume and was most important to Black Ducks (5.77 per cent of total volume). It is rated as a fair duck food in this area. The biggest objection to wild rice is that it is eaten heavily by blackbirds before it ripens.

Water grass, Hydrochloa caroliniensis Beauv.—Water grass was present mostly in the upper one-fourth of one diked field. Few ducks used this area during the duck season. This area, however, was used heavily in January after the duck season, and water grass occurred in 14.3 per cent of all ducks and accounted for 2.19 per cent of total volume. It is most important in Mallards in January.

Water grass apparently grows best in several inches of water. This reduces the abundance of good seed-producing plants, such as aneilema and smartweeds. Therefore, water grass is somewhat undesirable in this area. Based on total volume and availability, this plant would be rated as a good duck food. Considering other factors, however, water grass would be rated as a poor duck food for this area; therefore, management normally would be directed toward a reduction of this plant.

No other plant species available in small amounts accounted for as much as one per cent of total volume. These plants would be rated at best as poor duck foods for this area. Plants that did not occur in any ducks could be considered as pest plants, but not abundant enough to cause any management problems at time of the study.

Plants Rated as Scarce

American Water Lily, Nymphaea odorata Ait.—Of the plants whose availability was scarce, American water lily was the only one that accounted for as much as one-half of one per cent of total volume. The total volume of this plant occurred in the Ring-necked Duck which is unimportant to this area. Management practices to increase this plant would decrease other highly preferred plants. American water lily is rated as a poor food plant for ducks in the study area.

All others rated as scarce in availability are rated as poor food plants if occurring at all in the samples. Plants that occurred in no ducks could be considered pest plants but not abundant enough to cause any management problems.

Litter or finely ground vegetative matter accounted for 3.77 per cent of the total volume of foods eaten, but no identification was made on these fragments and no rating is included.

Oak (acorns) and corn made up 5.30 and 2.37 per cent of total volume, respectively, and these were not rated as duck foods since they were brought into the diked fields from other locations.

DISCUSSION

A limitation of this type of investigation is that much of the material available for study is stomach (gizzard) contents rather than crop contents. Only 25 of the 244 ducks used in this study contained full crops, and both crop and gizzard contents were analyzed.

When food items of varying hardness reach the gizzard, the harder seeds presumably remain longer than the softer foods. Thus, at any given time a gizzard may contain an amount of hard food items disproportionate to the amount consumed.

Results of the analyses of the 25 full crops indicate this may have

been true in this study. Notably hard seeds, such as square stem spike-rush and soft-stem bulrush, were relatively less common in the crops, whereas aneilema and soft fruited species, such as arrow arum, were relatively more abundant in the crops. The difference in each instance was around seven per cent. Accordingly, aneilema may have been even more important than was indicated by the food analyses. The volume of other important foods was not notably different in crop and gizzard contents.

The importance of aneilema, as revealed in this study, is of particular interest. Martin and Uhler (1939) reported aneilema from only one duck of 1,213 examined from the Atlantic Coast Region. They wrote, "A plant of the Commelinaceae, which appears to be an *Aneilema*, grows abundantly in the marshes near Charleston, S. C., and its seeds have been consumed by ducks."

Robinson and Fernald (1908) do not list aneilema, whereas Small (1933) lists it as a native of the East Indies, occurring in the Coastal Plain from Florida to Georgia. According to Radford *et al.* (1964) aneilema occurs throughout the Carolinas in marshes and along stream-banks. It would seem that sometime during the period when the Martin and Uhler (1939) food habits materials were collected aneilema appeared in the coastal marshes of the Southeast and has since become established; it is an important duck food plant in favorable sites.

It is evident from the plant survey and food habits study that the better duck food plant species occurred most commonly in the diked and managed marshes. Chabreck (1960) reported that a detailed ecological study done on Rockefeller Refuge, Louisiana, revealed species considered good duck food-producing plants made up more than 50 per cent of the vegetation within diked impoundments as compared with less than five per cent in the adjacent undiked control areas. He also reported that during peak duck populations, 80 per cent of the ducks present on Rockefeller Refuge were using the impoundments that made up 21.7 per cent of the total refuge area. The remaining 20 per cent of the ducks present used ponds, lakes, and flooded marshes outside the impoundments.

From the study of Chabreck (*loc. cit.*) and the results of management on the Pee Dee Management Area, it appears that it is possible to manipulate the composition of tidal marshes to produce food for two ducks where not enough for one was produced before. Where marshes are diked and water levels manipulated properly, pronounced changes occur in the plant composition, which favor good duck foods. Prescribed burning has proved beneficial in eliciting further beneficial changes in the ecology of the marshes and in making seeds more readily available to ducks.

CONCLUSIONS

1. The most important ducks wintering along the lower Pee Dee and Waccamaw rivers were Mallards, Green-winged Teals, Pintails, Black Ducks, and Wood Ducks.
2. The foods most preferred by ducks in this area were aneilema, big leaf tearthumb, swamp smartweed, arrow arum berries, square stem spikerush, and soft-stem bulrush.
3. Aneilema was found to be an excellent duck food in this area. Further investigation of the importance of aneilema as a waterfowl food should be made to determine (1) nutritional value (2) usage in other locations and (3) possibilities of introduction into waterfowl areas where absent.
4. Plant surveys revealed that good duck food plants were much more abundant in managed impoundments than in tidal marshes.
5. Ducks were found to use diked impoundments more extensively than undiked marshes.
6. Diking, water manipulation, and prescribed burning of tidal marshes will result in increased production of duck foods.
7. This study illustrates the value of local food habits studies in contrast to national or continental studies.

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TECHNIQUES AND METHODS USED TO CAPTURE AND TAG ALLIGATORS IN FLORIDA

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INTRODUCTION

This paper by its very nature will compliment and in some cases contradict the findings of Mr. Robert H. Chabreck as reported in "Methods of Capturing, Marking and Sexing Alligators," presented at the Seventeenth Annual Conference (October 1963). It is not the intention of this paper to question the findings of Mr. Chabreck but to report techniques developed in Florida since 1959.

The study was conducted on the J. W. Corbett and Everglades Wildlife Management Areas in South Florida and the St. Marks National Refuge in North Florida. The primary objective was to develop basic and sound management techniques. In order to accomplish this, life history data must be collected. Of prime interest is information on movement, growth rates, and breeding habits. A reliable method of capturing alligators and tagging them for identification was needed. A practical use of the tags was to assist in the control of the large number of exhibit alligators in the state. These exhibits have proven to be a valuable aid in testing the durability of the various tagging methods.

The purpose of this paper is to report some of the capturing methods that have proven to be most satisfactory and report the success of the tagging techniques. The tags are by and large modifica-