FOOD AND FEEDING HABITS OF THE SCAUPS IN CONNECTICUT WATERS

BY JOHN M. CRONAN, JR.

As part of a general investigation of scaup in Connecticut waters during the period from October, 1952 to May, 1954, data were obtained on the food and feeding habits of the Greater Scaup Duck (*Aythya marila*) and the Lesser Scaup Duck (*Aythya affinis*). The data pertaining to the food habits concern the particular species, but because of the difficulty of distinguishing the two species of scaups in the field, the feeding habits data pertain to either or both species. Hunter bag checks and scaup trapping have indicated that the Lesser Scaup comprise less than twenty per cent of the wintering population.

All except two of the ducks examined in the food habit study were collected in October, November, and December. One Lesser Scaup was collected in February and one Greater Scaup in March. However, as the birds winter in the area only seven months of the year, samples taken during three months of the year represent a good percentage of the time that the ducks are in Connecticut waters. Observations have shown that many of the feeding areas are used throughout the wintering season. This may indicate that the same foods were taken during the entire stay of the birds. Also, large food items such as the blue mussel (*Mytilus edulis*) and sea lettuce (*Ulva lacunata*), which can actually be seen in the birds' bills, were observed being taken during the entire stay of the ducks.

No records were found that indicated that the scaups had been previously collected in Connecticut for food habit study. Cottam (1939) summarized the food habit studies of scaup up to that time. A large number of birds that were covered in Cottam's summary were taken in fresh waters. The one large group of Greater Scaup that was collected in salt water was taken on or near Pacific Coast oyster beds (Kubichek, 1933) in a study to determine what, if any, damage scaup did to oyster beds. Thus, these data are not applicable to the coastal waters of Long Island Sound. Foley and Taber (1952) collected forty-three Greater and seven Lesser scaup in the Long Island region in 1949–50 and gave data on twenty Greater and five Lesser scaup collected in earlier years.

All of the common and scientific names of the mollusca used in this paper are after Abbott (1954). The authority for the plant names is Fernald (1950).

Most of the scaup stomachs were collected by the author from

hunters, but some stomachs were also obtained from birds collected by the author and by members of the Connecticut State Board of Fisheries and Game.

The term "stomach," as used in this paper, includes the gullet, proventriculus, and gizzard. The gullet and proventriculus were examined in the field and preserved only if they contained food.

I am indebted to Mr. James Bishop, Mr. Mason Belden, and Miss Ruth Billard of the Connecticut State Board of Fisheries and Game for their assistance during the study. Thanks are also due Dr. Russell P. Hunter of the University of Connecticut and Dr. Jacob Shapiro and Mr. B. F. McCamey, formerly of the University of Connecticut.

The facilities of the Bingham Oceanographic Laboratory in New Haven were made available for the food habits study through the courtesy of the director, Dr. Daniel Merriman.

Dr. John Rankin of the University of Connecticut and Mr. Howard Saunders of the Bingham Oceanographic Laboratory were of great assistance in identifying the invertebrate foods of the scaup.

Mr. George Bakelin of Fairfield, Connecticut, generously donated the launch with which a great deal of the study was made.

Portions of the data are taken from a thesis submitted by the author in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Management, University of Connecticut. Funds for the study were supplied by Connecticut State Board of Fisheries and Game under Federal Aid Project W-7-R.

Food Habits of Greater Scaup.—Animal food made up 93.4 per cent of the total food volume and occurred in 96.6 per cent of the 119 Greater Scaup stomachs analyzed (Table 1). Animal food was more predominant in the above stomachs than in the Greater Scaup discussed by Cottam (1939) and Foley and Taber (1950), probably owing to the fact that all of the birds used in this study were taken from coastal waters. The blue mussel was the most important animal food by volume, making up 20.6 per cent of the total food volume and occurring in 25.2 per cent of the stomachs examined. The channeled barrel-bubble (*Retusa canaliculata*) was the most important animal food by frequency, occurring in 34.5 per cent of the stomachs, but because of its small size it made up only 0.7 per cent of the total food volume. The dwarf surf clam (*Mulinia lateralis*) was second in importance both by volume (16.0 per cent) and by frequency of occurrence (33.6 per cent). The fragile spoon clam (*Periploma fragile*) occurred in 30.3 per cent of the stomachs but contributed only 4.8 per cent of the total food volume.

The mollusca comprised the most important food of Greater Scaup

TABLE 1

FOOD EATEN BY 119 GREATER SCAUP DUCK COLLECTED IN 1952–53 ALONG THE CONNECTICUT COAST OF LONG ISLAND SOUND

Species	*Volume*		*Occurrence*	
	Cubic centimeters	*Per cent*	*Number*	*Per cent*
Plant Food				
Sea lettuce (*Ulva lacunata*)	11.2	3.6	6	5.0
Bulrush (*Scirpus* sp.)	tr.	tr.	5	4.2
Sago pondweed (*Potamogeton pectinatus*)	0.1	tr.	1	0.8
Pondweed (*Potamogeton pusillus*)	tr.	tr.	1	0.8
Floating-leaf pondweed (*Potamogeton natans*)	tr.	tr.	1	0.8
Pondweed (*Potamogeton* sp.)	tr.	tr.	1	0.8
Bayberry (*Myrica pennsylvanica*)	tr.	tr.	1	0.8
Undetermined Plant Food	9.4	3.0	34	28.6
Sub-total, Plant Food	20.6	6.6	46	38.7
Animal Food—Mollusca				
Blue mussel (*Mytilus edulis*)	64.5	20.6	30	25.2
Dwarf surf clam (*Mulinia lateralis*)	50.0	16.0	40	33.6
Fragile spoon clam (*Periploma fragile*)	15.0	4.8	36	30.3
Amethyst gem clam (*Gemma gemma*)	6.8	2.2	4	3.4
Atlantic nut clam (*Nucula proxima*)	2.5	0.8	33	27.7
Transverse ark (*Anadara transversa*)	tr.	tr.	3	2.5
Eastern oyster (*Crassostrea virginica*)	tr.	tr.	1	0.8
Undetermined pelecypoda	37.6	12.0	19	15.0
Common periwinkle (*Littorina littorea*)	11.6	3.7	12	10.1
Channeled barrel-bubble (*Retusa canaliculata*)	2.3	0.7	41	34.5
Northern yellow periwinkle (*Littorina obtusata*)	2.3	0.7	7	5.9
Eastern mud nassa (*Nassarius obsoletus*)	2.2	0.7	14	11.8
Periwinkle (*Littorina* sp.)	0.3	0.1	4	3.4
New England nassa (*Nassarius trivittatus*)	0.2	0.1	9	7.6
Three-lined odostome (*Odostomia trifida*)	0.1	0.1	3	2.5
Atlantic oyster drill (*Urosalpinx cinerea*)	0.0	tr.	4	3.4
Lunar dove-shell (*Mitrella lunata*)	0.0	tr.	12	10.1
Well-ribbed dove-shell (*Anachis translirata*)	tr.	tr.	4	3.4
Alternate bittium (*Bittium alternatum*)	tr.	tr.	2	1.7
Knobbed whelk (*Busycon carica*)	tr.	tr.	1	0.8
Adam's baby-bubble (*Acteon punctostriatus*)	tr.	tr.	3	2.5
Green's miniature cerith (*Cerithiopis greeni*)	tr.	tr.	1	0.8
Double-sutured odostome (*Odostomia bisuturalis*)	tr.	tr.	1	0.8
Odostome (*Odostomia seminuda*)	tr.	tr.	1	0.8
Common northern lacuna (*Lacuna vincta*)	tr.	tr.	1	0.8
Undetermined Mollusca	76.0	24.3	39	32.8
Animal Food—Crustacea				
Rock crab (*Cancer* sp.)	9.9	3.1	2	1.7
Mud crab (*Panopeus herbsti*)	4.0	1.3	3	2.5
Small hermit crab (*Pagurus longiocarpus*)	tr.	tr.	1	0.8
Undetermined Decapoda	tr.	tr.	4	3.4
Amphipod (*Ampelisca compressa*)	tr.	tr.	1	0.8
Animal Food—Animal Detritus	7.3	2.3	30	25.2
Sub-total, Animal Food	292.4	93.4	115	96.6
Total, All Food	313.0	100.0	119	100.0
Gravel	34.0	9.8[1]	66	55.5
Shot	0.1	tr.	2	1.7
Sponge rubber	tr.	tr.	2	1.7
Coal	tr.	tr.	1	0.8
Total Contents	347.1	—	—	—

[1] Per cent of total contents.

in the study area, making up 86.7 per cent of the total food contents of the stomachs and 92.8 per cent of the animal food. The pelecypoda composed 56.4 per cent of the total food, the gastropoda 6.0 per cent of the total food and undetermined mollusca made up 24.3 per cent of the total food. Mollusca occurred in 97.5 per cent of all the Greater Scaup stomachs analyzed. The remainder of the animal food consisted of rock crab (*Cancer* sp.), representing 3.1 per cent of the total food volume and occurring in 1.7 per cent of the stomachs; mud crab (*Panopeus herbsti*), representing 1.3 per cent of the total food volume and occurring in 2.5 per cent of the stomachs; the small hermit crab (*Pagurus longiocarpus*), occurring in one stomach; and an amphipod (*Ampelisca compressa*), occurring in one stomach.

Plant food comprised only 6.6 per cent of the total food volume, but occurred in 38.7 per cent of the stomachs. The only important Greater Scaup plant food in the area is sea lettuce (*Ulva lacunata*), which made up 3.6 per cent of the total food volume and occurred in 5.0 per cent of the stomachs. Bulrush (*Scirpus* sp.) occurred in 4.2 per cent of the stomachs, but its volume was insignificant. Undetermined plant food occurred in 28.6 per cent of the stomachs and made up 3.0 per cent of the total food volume.

It is probable that plant food, primarily the marine algae such as sea lettuce, make up a much larger percentage of the total food taken than can be shown by stomach analysis. The fast rate at which soft materials such as plant food must pass through the anterior portion of the digestive tract makes it very difficult to obtain a true picture of their value. A record was kept of the number of Greater Scaup gizzards that were stained green on their inside walls, as it was thought that this might give further indications of feeding on plant materials. The number of green-stained gizzards amounted to 63, or 53.0 per cent of all gizzards taken. 17 of the 63 green-stained gizzards had no trace of plant food in them.

Inanimate material made up 9.8 per cent of the volume of the total contents. Gravel occurred in 55.5 per cent of the stomachs and was the predominant inanimate material. Shot and sponge rubber were found in two stomachs and a piece of coal in one stomach.

Food Habits of Lesser Scaup.—Of 129 scaup collected for stomach analysis, 10, or 8.4 per cent, were Lesser Scaup.

In its food habits, even in coastal waters, the Lesser Scaup appears to feed more on plant material than the Greater Scaup; animal and plant foods occur with equal frequency (Table 2). Plant food constituted 38.3 per cent of the total food volume and animal food the remaining 61.7 per cent.

The Lesser Scaup from Connecticut waters utilized more animal food than those studied by Cottam (1939), but the Lesser Scaup discussed by Foley and Taber (1952) had food habits similar to those of the Connecticut birds.

The mollusca made up all of the animal material in the stomachs, with the pelecypoda composing 52.7 per cent of the total contents and 85.4 per cent of the animal food. Gastropods were insignificant

TABLE 2

FOOD EATEN BY 10 LESSER SCAUP DUCK COLLECTED IN 1952–53 ALONG THE CONNECTICUT COAST OF LONG ISLAND SOUND[1]

Species	Volume		Occurrence	
	Cubic centimeters	Per cent	Number	Per cent
Plant Food				
Sea lettuce (*Ulva lacunata*)	7.1	35.8	1	11.1
Saltmarsh bulrush (*Scirpus robustus*)	0.5	2.5	2	22.2
Undetermined Plant Remains	tr.	tr.	3	33.3
Sub-total, Plant Food	7.6	38.3	5	55.6
Animal Food—Mollusca				
Dwarf surf clam (*Mulinia lateralis*)	4.4	22.4	4	44.4
Atlantic nut clam (*Nucula proxima*)	0.3	1.3	2	22.2
Fragile spoon clam (*Periploma fragile*)	tr.	tr.	1	11.1
Undetermined Pelecypoda	5.8	29.0	2	22.2
New England nassa (*Nassarius trivittatus*)	0.0	0.4	1	11.1
Channeled barrel-bubble (*Retusa canaliculata*)	tr.	tr.	1	11.1
Undetermined Mollusca	1.6	8.1	1	11.1
Animal Food—Animal Detritus	0.1	0.6	3	33.3
Sub-total, Animal Food	12.3	61.7	5	55.6
Total, All Food	19.9	100.0	9[2]	100.0
Gravel	5.3	21.1[3]	6	66.7
Total Contents	25.2	—	—	—

[1] One bird was collected from Trustroms Pond, Rhode Island.
[2] One gizzard contained gravel only.
[3] Per cent of total contents.

in volume. Undetermined mollusca made up 8.1 per cent of the total volume.

Sea lettuce was the most important plant food by volume, but occurred in only one stomach. Saltmarsh bulrush (*Scirpus robustus*) was present in two, or 22.2 per cent, of the stomachs that contained food but only amounted to 2.5 per cent of the total food volume.

Gravel was found in 66.7 per cent of the Lesser Scaup stomachs and made up 21.1 per cent of the total stomach contents.

Availability of Scaup Foods.—128 scaup of both species were collected in Connecticut. 30 were collected between New Haven and Stratford and 98 between New Haven and Saybrook. There was a

great difference in the importance of the various food items in the two areas mentioned.

Table 3 illustrates the differences between the two areas. Percentages are based on the number of stomachs taken in each area, and both species of scaup are included. The area titled "New Haven to Saybrook" includes New Haven Harbor.

It can be seen that there is a large difference in the most important foods in the different areas. The reason for this appears to be availability.

In an effort to determine the availability of various duck food organisms along the section of the coast in which stomachs were obtained, a series of bottom samples was taken in areas where scaup

TABLE 3

PLACE AND OCCURRENCE OF IMPORTANT SCAUP ANIMAL FOODS

Species of Animal Food in Stomach Contents	*New Haven to Saybrook*	*New Haven to Stratford*
	Per cent occurrence	*Per cent occurrence*
Atlantic nut shell (*Nucula proxima*)	35.7	0.0
Dwarf surf clam (*Mulinia lateralis*)	41.8	10.0
Channeled barrel-bubble (*Retusa canaliculata*)	40.8	6.6
Blue mussel (*Mytilus edulis*)	8.2	73.3

were observed feeding and in areas where no feeding was observed. In most cases the feeding areas contained a high percentage of the same organisms that were found in the scaup stomachs obtained in that area. The non-feeding areas that were sampled did not at any time contain duck food organisms in any large quantity.

It appears from the scaup stomach analysis and the sampling of the feeding areas that the most important animal foods of the scaup in Connecticut's coastal waters are the dwarf surf clam and the blue mussel, and that the most important plant food is sea lettuce.

The blue mussel, whenever common, appears to be a favorite scaup food. Foley and Taber (1952) found it first both in frequency of occurrence and percentage of volume in the Long Island area, and Cottam (1939) also listed it as the most important individual animal food for scaup. The remainder of the animal foods as individual species appear to be only locally important.

In the majority of the feeding areas sampled, either the dwarf surf clam or the blue mussel was the predominant animal species. It might be assumed that the feeding areas were selected because either one of these two favorite food items was present. However, it appears from this and other studies that although mollusks in general are a favorite scaup food in coastal regions, the most important food for scaup in a given area is the most prevalent mollusk species in that area. Norton (1909) examined one scaup in Maine and found the stomach filled with the balthic macoma (*Macoma balthica*), and Lynch (1939) in Rhode Island found that the Atlantic surf clam (*Spisula solidissima*) was the predominant food item in the few scaup stomachs he examined. Munro (1941) stated that the foods of scaup in the coastal waters of British Columbia were gastropods, sea lettuce, crustaceans, and the eggs of herring (*Clupea pallasii*), in the order of their importance. It can be seen that in different areas, different mollusks are the predominant scaup food. Apparently, mollusks, at least in coastal waters, are a very important scaup food, but the particular molluscan species utilized for food is determined by availability.

Feeding Habits.—A total of 338 different observations of feeding scaup were obtained during the study. At the time of observation the following data were recorded: hour of day, wind direction, weather, water condition (i.e. calm, rough, etc.), stage of tide, and water and air temperature. Data were obtained for the same day from the local weather bureau as to the average and maximum wind velocity and the average, maximum, and minimum air temperatures.

It was apparent during the observations and upon compilation of the data that the factors recorded had little, if any, effect on scaup feeding.

Scaup were observed feeding during all periods of the daylight hours from dawn to dusk. No effort was made to obtain data on night feeding. The stage of the tide affected scaup feeding only in certain areas. For example, in areas where mussels were the main food item and the mussel beds were exposed at low tide there was little or no scaup feeding at low tide, since the birds normally will not feed out of water. In localities where the mussel beds were submerged at all tidal stages, the birds were observed feeding during all stages of the tide. Only the most severe weather and water conditions affected the scaup feeding. Rain, snow, and sleet did not appear to affect it. On occasion scaup were observed feeding when the waves were as high as three feet. The birds were also observed feeding in the breaking surf.

The strongest water current in the study area, over three knots at the mouth of the Housatonic River at certain stages of the tide, did not affect scaup feeding; the birds were observed many times feeding in the midst of the current.

The winter range of water and air temperatures in the area studied had no apparent effect on scaup feeding, nor did the wind direction or sky cover.

Scaup were observed feeding without any evidence of active competition with Old-squaws (*Clangula hyemalis*), American Golden-eyes (*Bucephala clangula*), White-winged Scoters (*Melanitta deglandi*), Mallards (*Anas platyrhynchos*), Black Ducks (*Anas rubripes*) and Red-breasted Mergansers (*Mergus serrator*). Herring Gulls (*Larus argentatus*) often robbed scaup of their food, but this would never force more than a few birds to stop feeding.

The greatest known depth to which scaup were observed feeding during the study was 23 feet. Most of the feeding was done in less than five feet of water. Scaup in the study area appeared to prefer feeding in shallow waters, but most of the feeding observations were made in areas where the blue mussel was the most abundant food; thus the preference for shallow water feeding may be due to the fact that the blue mussel is a shallow-water species.

Human activity did have a strong effect on scaup feeding. Areas that were heavily hunted were not subject to scaup feeding during the hunting season. During the fall and spring many of the feeding areas were not utilized when fishing and boating activities were going on. Even during mid-winter when a comparatively balmy Saturday or Sunday encouraged human activity along the shore, the scaup would not be present in their normal feeding areas.

The dives of 69 feeding scaup were timed and the average dive was found to be 20.4 seconds in duration, with a range of nine to 33 seconds. Bent (1923) states that Greater Scaup dives vary from 20 to 29 seconds and Phillips (1925) doubts if Lesser Scaup stayed under water more than 35 seconds, although 50 to 60 seconds had been reported for the Greater Scaup. Cottam (1933) says the time between dives for Lesser Scaup is slightly longer than the time under water. This was not the case with the scaup observed feeding in the present study area; the time between dives was slightly less than the time under, except when a bird obtained an exceptionally large mussel or large piece of sea lettuce. By comparison with scaup, the average length of time for dives of other waterfowl in the study area were: fifteen White-winged Scoter dives, 32.7 seconds; three American Golden-eye dives, 30.3 seconds; seven Buffle-head dives,

24.1 seconds; three King Eider (*Somateria spectabilis*) dives, 13.0 seconds; and two Red-breasted Merganser dives, 19.5 seconds.

Bent (1923) states that scaup swim under water with their wings tightly closed. This was borne out by the present study; scaup observed from above used only their feet for underwater swimming. When feeding on large, heavy substances such as blue mussels they would "chew" their food at the surface with their bills in the water; however, when "chewing" lighter food, such as sea lettuce, their heads were kept out of the water.

Scaup in rafts often do not all feed at the same time. Birds at one end of the raft may be feeding while those at the other end may be resting. Occasionally, feeding and non-feeding birds will be interspersed. When rafts of scaup are feeding in a current they often "drift feed." That is, the raft will be strung out in a line in the current, and as the birds go by a feeding area they feed as they drift. After they have drifted a certain distance beyond the feeding area, they fly to the other end of the raft and again drift by the feeding area. In many cases when large groups are "drift feeding," there are always birds flying up-current, and an appearance of perpetual motion often prevails for two or three hours at a time. Drift feeding is not necessarily due to the strong current, since scaup were often seen feeding in place in the same current that they "drift fed" in, with no apparent difficulty in holding their positions.

SUMMARY

Animal food comprised 93.4 per cent of the contents of the Greater Scaup stomachs examined and the most important animal foods were mollusks. Sea lettuce was the only important plant food of the Greater Scaup. The Lesser Scaup stomachs examined indicated that animal food makes up 61.7 per cent of their diet, and as in the Greater Scaup the most important animal foods were mollusks and the most important plant food sea lettuce.

Scaup feeding areas were sampled and most of the areas had quantities of the same food items that were found in the scaup stomachs. None of the non-feeding areas examined had scaup food items present in any quantity.

Mollusks were unquestionably the favorite scaup food, but the particular molluscan species taken appeared to depend upon availability.

Scaup feeding did not appear to be affected by any factor except human activity.

LITERATURE CITED

ABBOTT, R. T. 1954. American seashells. New York, D. VanNostrand Co., Inc., 541 pp.

BENT, A. C. 1951. Life histories of North American waterfowl (Order Anseres). New York, Dover Publications, Inc., 1: 207–224.

COTTAM, C. 1933. Feeding habits of the Lesser Scaup Duck. Condor, 35: 118–119.

COTTAM, C. 1939. Food habits of North American diving ducks. U. S. D. A. Tech. Bull. 643, 140 pp.

FERNALD, M. L., ed. 1950. Gray's manual of botany. 8th ed. New York, American Book Co., 1632 pp.

FOLEY, D. D., and W. R. TABER. 1952. Long Island waterfowl investigations. P. R. Proj. 52-R, Final Report. New York, Cons. Dept., 296 pp.

KUBICHEK, W. F. 1933. Report of the food of five of our most important game ducks. Iowa St. Coll. Jour. Sci., 8: 107–126.

LYNCH, J. J. 1939. Marine algae in food of Rhode Island waterfowl. Auk, **56**: 374–380.

MUNRO, J. A. 1941. Studies of waterfowl in British Columbia. Greater Scaup Duck, Lesser Scaup Duck. Can. Jour. Res. (Sect. D), 19: 113–138.

NORTON, A. H. 1909. The food of several Maine water birds. Auk, **26**: 438–440.

PHILLIPS, J. C. 1925. A natural history of the ducks. 3. Boston, Houghton Mifflin Co.

Dept. of Agriculture and Conservation, Division of Fish and Game, Providence, Rhode Island, August 6, 1956.