Canvasback Food Habits in Chesapeake Bay

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ABSTRACT

Food habits analyses were conducted on the gullet and gizzards of 153 canvasbacks (Aythya valisineria) collected at night from eight major wintering areas in Chesapeake Bay. The Baltic clam (Macoma balthica) was the predominant gullet and gizzard food material for all areas except the Choptank River where corn (Zea mays) predominated. Corn constituted the second greatest volume of food found in the gullet and gizzards of all canvasbacks. The diversity of food was greatest in the gizzard where 42 species were recorded compared to only 14 from the gullet. Wild-celery (Vallisneria americana) was not found in any of the 1975 birds and constituted only a trace in birds from 1976. No significant difference was detected between the volumes or frequency of occurrence of the major foods between the two years. The diversity of food, however, decreased from 35 to 24 species from 1975 to 1976.

During the last 10 years sportsmen and biologists have been aware of a change in the diet of canvasbacks (Aythya valisineria) wintering in Chesapeake Bay. Sportsmen noted that the species no longer was the table delicacy it once was, and biologists noticed that canvasbacks were no longer feeding in traditional vegetated areas such as Susquehanna Flats. Stewart (1962) found that in fresh estuarine bays the principal

foods of canvasbacks were leaves, stems, and rootstalks of wild-celery (Vallisneria americana) and other plants. In brackish estuarine bays principal foods were molluscs, mud crabs, and aquatic vegetation. Stewart's study was the last major food habits study of diving ducks in Chesapeake Bay. Since this study was conducted many changes have occurred in the quality, quantity, and distribution of the biota of the Bay. It has been observed that several waterfowl species, including canvasbacks, have changed their diets from a mixed plant and invertebrate food diet to one of predominantly invertebrate foods. Concurrent with this change has been a deterioration of the water quality of the Bay causing a decrease in vegetation and an increase in certain invertebrates. One invertebrate species that has become very common in Chesapeake Bay.. is the brackish water clam, Rangia cuneata. This mollusc, which has extended its range from the Gulf of Mexico, was not reported in Stewart's study.

The objective of this study was to determine the current food habits of canvasbacks wintering in Chesapeake Bay and to compare this data with previous food habits data. Numerous hours were expended on this study under very adverse conditions. The assistance of the following is greatly appreciated: Ronald Anglin, Joseph Artmann, Walter Cottrell, David Dolton, Bradford Dorff, Bruce Dunn, Larry Hindman, Lloyd Griffith, Charles Grosch, Robert Leigh, Elwood Martin, Thomas Mathews, Robert McGee, James Minuchi, Robert Munro, Frank Percival, Walter Quist, Lonnie Schroeder, George Shegogue, Robert Smith, John Tautin, and Byron Wates.

METHODS

Several means are available to obtain canvasbacks for food habits analyses. Hunters have traditionally assisted in these studies by providing gizzards from birds they have killed. In recent years, however, canvasback hunting has been illegal on the Atlantic coast, and therefore no birds were available from this source. Canvasbacks illegally shot by hunters are often available from State and Federal game enforcement personnel and have been of great value in the past. This source, however, is unpredictable and not always from the desired areas or time of day. To counteract these problems it was necessary to collect canvasbacks by shooting them from a boat during the winters of 1974-75 and 1975-76. Nighttime collection was conducted because previous studies indicated that this was an important feeding period for canvasbacks. Collected birds were aged, sexed, weighed and bagged for future analyses. Water depth and exact location were recorded for each sample. Collecting was conducted in known canvasback feeding areas and at various hours of the night to determine hours of most active feeding. Shooting was done with a shotgun from the bow of a slowly-moving 16-ft. Boston Whaler[1/] equipped with floodlights.

Analyses of the gullet (esophagus and proventriculus) and gizzard were conducted at Patuxent Wildlife Research Center. Food material was separated by species and volumetric measurements were made for each group. The average percent volume and frequency of occurrence was tabulated for each food item for the various locations where birds were collected. Food

1/ Trade names referred to in this article do not imply Government endorsement of commercial products.

material in the gullet was kept separate from gizzard food material to determine if the grinding action of the gizzard biased the findings.

RESULTS

A total of 89 canvasbacks was collected during the period 7 January - 22 March 1975, and 64 additional birds were collected during the period 29 January - 22 March 1976. The combined results of all areas for both years are presented in Table 1. The diversity of food decreased from 35 to 24 species from 1975 to 1976. The Baltic clam (Macoma balthica) was the predominant food item in the gullet and gizzard for both years. This thin-shelled clam was found in the gullet of 25 and 13 percent of the canvasbacks where it accounted for 74 and 73 percent of the total food volume for 1975 and 1976, respectively. In the gizzard the frequency of occurrence was 97 percent for both years where it made up 89 and 91 percent of the volume (Table 1). The soft-shelled clam (Mya arenaria) accounted for 13 percent of the gullet food and 2 percent of the gizzard food in 1975, but was not recorded in 1976. Macoma mitchelli made up 1 percent of the food in the gullet and gizzard in 1975 and a trace in 1976. Other quantifiable invertebrate food materials in the gizzard were clam worms (Nereis sp.), barnacles (Balanus sp.), and the brackish water clam (Rangia cuneata). Twelve other invertebrate species were found in the birds, but only in trace amounts. Fish bones were found in two birds in trace amounts. The eating of fish by canvasbacks has been observed on numerous occasions in Chesapeake Bay. Among the plant food, only corn (Zea mays), milo (Sorghum vulgare), and redhead grass (Potomogeton perfoliatus) were found in measurable quantities. Twenty-three species of plants were

represented in the food of the canvasbacks in trace amounts. The volume of plant food in the birds was of very small quantities except for the few birds that had fed on corn and milo. Birds with corn and milo were mainly from an area on the Choptank River where feeding has traditionally been conducted. Wild-celery was not found in any of the birds in 1975 but subterranean buds of wild-celery were found in one bird in 1976.

Table 2 presents findings from the Gibson Island area which is in the northwest part of the Bay near Baltimore. In 1975 and 1976 Macoma balthica made up 72 and 78 percent of the gizzard food and Rangia cuneata accounted for 12 and 11 percent of the food, respectively. Birds from the Gibson Island area had the greatest quantities of Rangia. This was expected because the area has the lowest salinity of all areas sampled. These birds also had the greatest quantities of aquatic plants in their food tracts.

In the South River (Table 3) Macoma balthica was the predominant food in all birds. In 1975, Mya arenaria was the only other important food, accounting for 14 percent of the food in the gullet of South River birds. Aquatic vegetation was not recorded from birds in this area. In 1976, corn and barley (Hordeum vulgare) constituted a significant amount of food.

All birds from Chester River and Eastern Bay had fed on Macoma balthica and in these birds it accounted for 100 percent of the gullet and gizzard food (Tables 4 and 5). Widgeon-grass (Ruppia maritima) was found in trace amounts in birds sampled from these two areas in 1975.

In the Patuxent River, Macoma balthica was the predominant food for 1975 and 1976. Mya arenaria constituted 24 percent of the gizzard food in 1975, but was not recorded in 1976. A total of 11 food items was recorded in 1975, whereas only one, Macoma balthica was recorded in 1976.

Canvasbacks collected from the Potomac River had the greatest diversity of food items. Twenty-six organisms were recorded from these birds although Macoma balthica, as in other areas, predominated in the gullet and gizzard. One bird from the Potomac River had fed on buds of wild-celery. This is the only recorded utilization of this once important aquatic plant in all the birds that were sampled.

Birds from the Choptank River had fed on large quantities of commercial feed during 1975 and 1976 (Table 8). This feed which consisted of corn, milo, and wheat (Triticum aestivum) is regularly given to canvasbacks throughout the winter by residents in Cambridge, Maryland. The most important food in the gullet in both years was corn, although Macoma balthica predominated in the gizzard.

No food was found in the gullets of any of the Nanticoke River birds (Table 9). Macoma balthica constituted over 97 percent of the food in the gizzard. In 1975, Mya arenaria was the only other quantifiable organism, and in 1976 an amphipod Leptocheirus plumulosus was found in 25 percent of the birds where it constituted 2 percent of the volume.

DISCUSSION

The findings from this preliminary food habits study indicate that Macoma balthica is extremely important in the diet of canvasbacks from all sampled areas of the Bay. Stewart (1962) found that this species was also very important and had the highest frequency of occurrence of any of the invertebrates eaten by canvasbacks in most areas. In the Susquehanna Flats and the Gunpowder and Sassafras Rivers, Macoma balthica was not recorded by Stewart. These areas, however, are fresh water estuaries and not in the salinity range of Macoma balthica. Vegetation was the predominant food material from these areas. During this recent food habits study no canvasbacks were collected from this area due to the complete absence of canvasbacks in these historic feeding areas. This lack of use can most likely be attributed to the significant decline in vegetation in Chesapeake Bay due to a multiple of environmental problems.

One surprising finding from these collections was the small quantities of Rangia cuneata eaten by the canvasbacks. Analyses of gizzards from the previous three years from several locations in Chesapeake Bay indicated that this hard-shell clam was a very significant food organism. Benthic sampling during the last three years has shown an increase in the average size of Rangia cuneata. Many of the clams during the past two winters may have been too large for canvasbacks to eat. Rangia is dependent on proper salinity conditions for spawning and if these conditions do not exist no small clams will be available as food. The maximum size Rangia eaten by canvasbacks is approximately 25 mm long, whereas maximum length of Rangia is almost 70 mm.

The quantities of food material in the gullet and gizzard were tabulated separately to detect any bias that might occur due to differential digestive rates of organisms in the gizzard. Numerous researchers (including Swanson and Bartonek 1970), have stated that reliable data cannot be obtained from gizzard analysis due to differential digestive rates of food organisms in the gizzard. This study indicated that a fairly close relationship existed between food found in the gullet and in the gizzard although the major clam species constituted a greater percentage in the gizzard than in the gullet. Much more data, however, are necessary to determine the differences that occur between the gullet and gizzard food material. A significant difference in the diversity of organisms was noted, with 42 species recorded from the gizzard and only 14 species from the gullet.

Future Studies

The findings to date are preliminary and there is a need to expand the food habits studies to answer some of the questions that still exist. Some of the objectives of future studies should be:

1. To determine if there are annual or seasonal differences in the food eaten by canvasbacks.
2. To determine the areas of Chesapeake Bay where vegetation is an important food organism for canvasbacks.
3. To determine the diel feeding pattern of canvasbacks.

4. To determine if canvasbacks are feeding on the adventive Asiatic fresh-water clam (Corbicula manilensis).
5. To determine bias associated with gizzard analysis due to differential digestive rates.

It is important in food habits research that birds be actively feeding when collection takes place so that food material is not partially digested. This is only possible when biologists obtain samples by shooting actively feeding birds or by obtaining birds that have been caught in fish nets while actively feeding. The latter approach has been unsuccessful although birds are known to die in Chesapeake Bay fishing nets. The shooting technique of collecting birds for food habits research enables biologists to obtain the best data from the preferred areas. This technique also has been the most random means of obtaining birds for tissue and bone analyses of pollutant residues. The data obtained in this study will give researchers and managers a better appreciation of the feeding ecology of the canvasback in its most important wintering area in North America.

LITERATURE CITED

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Table 1. Food of 153 canvasbacks collected at night from Chesapeake Bay, January-March 1975 and 1976[1/]

	1975		1976	
Animal Food	Gullet	Gizzard	Gullet	Gizzard
Macoma balthica	74(25)	89(97)	73(13)	91(97)
Rangia cuneata		2(16)		2(8)
Nereis sp.	Tr.(1)	2(19)		Tr.(8)
Mya arenaria	13(8)	2(8)		
Macoma mitchelli	1(3)	1(6)		Tr.(3)
Balamus sp.		Tr.(1)		1(5)
Leptocheirus plumulosus	Tr.(6)	Tr.(10)		Tr.(5)
Mulinia lateralis	Tr.(2)	Tr.(6)		
Brachidontes recurvus		Tr.(4)		
Rhithropanopeus harrisii	Tr.(1)	Tr.(4)		
Congeria lencophaeta		Tr.(3)		Tr.(3)
Gammarus tigrinus	Tr.(2)	Tr.(3)		Tr.(2)
Cyathura polita	Tr.(3)	Tr.(3)		
Odostomia sp.		Tr.(1)		
Vespa sp.		Tr.(1)		
Chalepus dorsalis		Tr.(1)		
HYDROIDA		Tr.(2)		
PORIFERA				Tr.(2)
Fish bones		Tr.(2)		
Plant Food				
Zea mays	7(2)	3(4)	19(5)	2(3)
Sorghum vulgare			8(3)	
Hordeum vulgare			Tr.(2)	
Triticum aestivum			Tr.(2)	
Potomogeton perfoliatus	4(1)	1(6)		1(5)
Potomogeton pectinatus				Tr.(2)
Myriophyllum spicatum				Tr.(2)
Ruppia maritima		Tr.(6)		Tr.(2)
Vallisneria americana				Tr.(2)
Nyssa sylvatica		Tr.(3)		
Scirpus americanus		Tr.(3)		Tr.(2)
Scirpus olneyi		Tr.(1)		
Scirpus robustus		Tr.(1)		
Carex lurida				Tr.(2)
Polygonum hydropiper		Tr.(1)		
Polygonum punctatum				Tr.(2)
Cladium mariscoides				Tr.(2)
Tripsacum dactyloides		Tr.(1)		
Geranium sp.		Tr.(1)		
Galium sp.		Tr.(1)		
Vitis sp.		Tr.(2)		Tr.(2)
Pinus taeda		Tr.(1)		Tr.(2)
Ilex decidua		Tr.(1)		
Ilex opaca		Tr.(1)		Tr.(2)
Rhus capallina		Tr.(1)		Tr.(2)
Myrica cerifera		Tr.(1)		Tr.(2)
No. Samples	18	89	11	64
Ave. Volume (cc)	9.2	7.1	17.6	6.1

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 2. Food of canvasbacks from Gibson Island Area, Maryland[1/].

Animal Food	1975 Gullet	1975 Gizzard	1976 Gullet	1976 Gizzard
Macoma balthica	65(20)	72(80)		78(80)
Nereis sp.		9(60)		Tr.(20)
Rangia cuneata		12(40)		11(40)
Macoma mitchelli		1(10)		
Brachidontes recurvus		Tr.(20)		
Rhithropanopeus harrisii		Tr.(20)		
Congeria leucophaeta		2(20)		2(20)
Gammarus tigrinus	1(10)	1(20)		
Odostomia sp.		Tr.(10)		
Balamus sp.		Tr.(10)		
Vespa sp.		Tr.(10)		
Chalepus dorsalis		Tr.(10)		
PORIFERA				1(20)
Plant Food				
Zea mays		Tr.(10)		
Potomogeton perfoliatus	33(10)	4(20)		6(20)
Ruppia maritima		Tr.(10)		2(20)
Nyssa sylvatica		Tr.(10)		
Scirpus olneyi		Tr.(10)		
Geranium sp.		Tr.(10)		
Ilex decidua		Tr.(10)		
Prunus serotina	1(10)			
No. Samples	3	10	0	5
Ave. Volume (cc)	5.0	6.9	0	3.4

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 3. Food of canvasbacks from South River, Maryland[1/].

	1975		1976	
Animal Food	Gullet	Gizzard	Gullet	Gizzard
Macoma balthica	85(50)	100(100)	50(20)	71(80)
Macoma mitchelli				Tr.(20)
Nereis sp.		Tr.(7)		
Rangia cuneata		Tr.(7)		9(40)
Mya arenaria	14(21)	Tr.(7)		
Leptocheirus plumulosus	1(14)	Tr.(7)		
Rhithropanopeus harrisii		Tr.(7)		
Cyathura polita	Tr.(7)			
Balamus sp.				Tr.(20)
Plant Food				
Zea mays			50(20)	20(20)
Hordeum vulgare			Tr.(20)	
No. Samples	8	14	2	5
Ave. Volume (cc)	6.6	9.7	4.1	5.0

[1/] Quantities represent percent of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 4. Food of canvasbacks from Chester River, Maryland[1/].

	1975		1976	
Animal Food	Gullet	Gizzard	Gullet	Gizzard
Macoma balthica	100(20)	100(100)		100(100)
Nereis sp.				Tr.(25)
Mya arenaria	Tr.(10)			
Macoma mitchelli		Tr.(10)		
Leptocheirus plumulosus	Tr.(10)	Tr.(10)		
Plant Food				
Ruppia maritima		Tr.(20)		
No. Samples	2	10	0	4
Ave. Volume (cc)	4.0	8.6	0	3.6

1/ Quantities represent percent of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 5. Food of canvasbacks from Eastern Bay, Maryland[1/].

Animal Food	1975 Gullet	1975 Gizzard	1976 Gullet	1976 Gizzard
Macoma balthica		100(100)	100(10)	100(100)
Nereis sp.		Tr.(38)		
Leptocheirus plumulosus		Tr.(25)		
Mulinia lateralis		Tr.(12)		
Plant Food				
Ruppia maritima		Tr.(12)		
No. Samples	0	8	1	10
Ave. Volume (cc)	0	3.1	15	5.1

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 6. Food of canvasbacks from Patuxent River, Maryland[1/].

Animal Food	1975 Gullet	1975 Gizzard	1976 Gullet	1976 Gizzard
Macoma balthica	78(62)	75(100)		100(100)
Nereis sp.	Tr.(12)			
Mya arenaria	19(12)	24(38)		
Macoma mitchelli	Tr.(12)			
Leptocheirus plumulosus	1(12)	1(12)		
Mulinia lateralis	Tr.(12)	Tr.(38)		
Brachidontes recurvus		Tr.(12)		
Rhithropanopeus harrisii	Tr.(12)	Tr.(12)		
Gammarus tigrinus	Tr.(12)	Tr.(12)		
Cyathura polita	Tr.(12)	Tr.(12)		
Plant Food				
Nyssa sylvatica		Tr.(12)		
No. Samples	5	8	0	6
Ave. Volume (cc)	10.1	10.7	0	5.8

1/ Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 7. Food of canvasbacks from Potomac River, Maryland[1/].

Animal Food	1975 Gullet	1975 Gizzard	1976 Gullet	1976 Gizzard
Macoma balthica	80(21)	87(96)	100(14)	86(100)
Nereis sp.		2(12)		
Rangia cuneata		3(29)		Tr.(14)
Mya arenaria	20(20)	4(4)		
Macoma mitchelli	Tr.(20)	Tr.(4)		
Leptocheirus plumulosus	Tr.(20)	Tr.(4)		
Mulinia lateralis		Tr.(4)		
Congeria leucophaeta		Tr.(4)		
Balamus sp.				7(14)
Fish Bones		Tr.(4)		
HYDROIDA		Tr.(4)		
Plant Food				
Vallisneria americana				3(14)
Potomogeton perfoliatus		Tr.(12)		Tr.(14)
Ruppia maritima				1(14)
Nyssa sylvatica		Tr.(4)		
Scirpus americanus		Tr.(12)		1(14)
Carex lurida				Tr.(14)
Vitis sp.		Tr.(8)		Tr.(14)
Polygonum hydropiper		Tr.(4)		
Polygonum punctatum				Tr.(14)
Tripsacum dactyloides		Tr.(4)		
Galium sp.		Tr.(4)		
Pinus taeda		Tr.(4)		
Rhus capallina		Tr.(4)		Tr.(14)
Myrica cerifera		Tr.(4)		Tr.(14)
Ilex opaca				Tr.(14)
No. Samples	5	24	1	7
Ave. Volume (cc)	10.9	5.4	6.0	5.5

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 8. Food of canvasbacks from Choptank River, Maryland[1/].

Animal Food	1975 Gullet	1975 Gizzard	1976 Gullet	1976 Gizzard
Macoma balthica	31(20)	85(100)	33(33)	63(100)
Nereis sp.		Tr.(10)		
Mya arenaria	10(10)	Tr.(20)		
Macoma mitchelli	6(10)	Tr.(20)		
Mulinia lateralis	Tr.(10)			
Cyathura polita	2(10)	1(20)		
Balamus sp.				Tr.(20)
Plant Food				
Zea mays	50(20)	19(20)	37(66)	1(20)
Sorghum vulgare			29(66)	36(40)
Triticum aestivum			Tr.(33)	
Ruppia maritima		Tr.(10)		
No. Samples	4	10	3	5
Ave. Volume (cc)	17.1	8.0	45.3	11.4

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.

Table 9. Food of canvasbacks from Nanticoke River, Maryland[1/].

Animal Food	1975		1976	
	Gullet	Gizzard	Gullet	Gizzard
Macoma balthica		97(100)		98(100)
Nereis sp.		Tr.(40)		Tr.(8)
Rangia cuneata		Tr.(40)		
Mya arenaria		2(20)		
Brachidontes recurvus		Tr.(20)		
Leptocheirus plumulosus				2(25)
HYDROIDA		Tr.(20)		
Plant Food				
Scirpus robustus		Tr.(20)		
Pinus taeda				Tr.(8)
No. Samples	0	5	0	12
Ave. Volume (cc)	0	4.9	0	5.7

[1/] Quantities represent percent by volume of food material. Percent by occurrence given in parentheses. Volume of less than 0.5 percent represented as Tr.