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Invertebrates Consumed by Dabbling Ducks (Anatinae) on the Breeding Grounds

GEORGE A. SWANSON*

ABSTRACT — Foods consumed by dabbling ducks on the breeding grounds of south-central North Dakota were investigated during the spring and summer of 1967-80. Invertebrates dominated the diet of laying females. Animal foods comprised 99%, 72%, and 77% of the diet of laying blue-winged teal and northern shovelers, gadwalls, and mallards, and northern pintails, respectively. Factors that influence food selection include morphological adaptations for feeding, current physiological demands, the nutritional value of food items, and food availability. Preservation of waterfowl production habitat requires that the value of the wetland complex be recognized. Temporary, seasonal, and semipermanent wetlands provide abundant and highly available invertebrate foods for reneating females and broods successively throughout the breeding season.

Introduction

To maintain waterfowl populations, there must be a certain proportion of breeding females that successfully hatch a clutch of eggs and a certain proportion of hatched young that survive to flight stage. Maintenance of the quantity and quality of wetlands that traditionally support breeding females and their broods is a high-priority objective in waterfowl management.

Investigations of dabbling duck feeding ecology show that the foods selected vary with season, age, sex, and reproductive condition of laying females (1-8). Bird-related factors that influence food selection include species-specific morphological adaptations and current physiological demands. Food-related factors that influence diet selection include the nutritional value and availability (8).

Breeding females can respond to loss of a clutch by reneating and are physiologically capable of reneating up to four times during the breeding season if foods that can satisfy their nutritional demands for laying are highly available (8). Adequate food is required to support both a strong reneating effort and duckling growth during the downy stage when they require brooding, have restricted feeding modes, and are highly susceptible to mortality (9).

This paper describes non-target invertebrates that may be inadvertently influenced by mosquito control and are consumed by laying female dabbling ducks and their broods. This paper summarizes the feeding ecology of breeding dabbling ducks studied by researchers of the Northern Prairie Wildlife Research Center during 1967-80.

Materials and Methods

Actively feeding dabbling ducks were collected on wetlands in south central North Dakota. Males paired with females were collected on the same feeding site. The contents of the esophagus were removed, processed, and tabulated as

described by Swanson et al. (3). Females were classified as laying if they contained an egg in the oviduct or a fully developed follicle and large, recently ruptured follicles. Feeding birds were collected on wetlands in the Drift Prairie and Missouri Coteau in proportion to their use of cultivated, grazed, and idle wetlands. Gadwalls (*Anas strepera*) feeding on both saline lakes and on ephemeral, temporary, seasonal, and semipermanent wetlands, lower in salt content (10), were collected.

Results

Animal material comprised 99% (11), 99% (6), 72% (5,6), 77% (4), and 72% (8) of the diet of laying blue-winged teal (*A. discors*), northern shovelers (*A. clypeata*), gadwalls, northern pintails (*A. acuta*), and mallards (*A. platyrhynchos*), respectively, in south central North Dakota (Table 1). Snails (Gastropoda) accounted for 38% and 40% of the blue-winged teal and northern shoveler diet, respectively, but were a smaller portion of the diet of northern pintails (15%) and mallards (16%) and were rarely consumed by gadwalls. Insects were important in the diet of blue-winged teal (44%), gadwalls that fed on saline lakes (52%) and fresh wetlands (36%), northern pintails (37%), and mallards (27%). Insects were of minor importance in the diet of northern shovelers, accounting for only 5% of the diet. Midges (Chironomidae) were the dominant insect consumed by blue-winged teal (20%), northern pintails (20%), and gadwalls that fed on saline lakes (26%) and fresh wetlands (17%). Crustacea were a major food item in the diet of northern shovelers (54%). They were also an important item in the diet of gadwalls that fed on saline lakes (20%) and fresh wetlands (32%). Cladocera were the dominant crustacean consumed by northern shovelers (33%) and gadwalls (10%). Animal matter comprised 90% of the diets of immature blue-winged teal compared to 50% of the adults' diet (Table 2).

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Table 1. Invertebrates consumed by laying female Anatidae collected during 1967-80 in south-central North Dakota (number of birds examined shown in parentheses). Data expressed as aggregate percent by volume. Table modified from Swanson et al. (6).

Food item	Blue-winged teal ^a (20)	Northern shoveler ^b (15)	Gadwall (saline) ^c (20)	Gadwall (fresh) ^b (35)	Mallard ^d (37)	Northern pintail ^e (31)
Gastropoda	38	40	—	4	16	15
Insecta	44	5	52	36	27	37
Trichoptera	7	t ^f	1	8	9	1
Coleoptera	3	2	16	4	5	3
Diptera	32	2	26	18	6	33
Chironomidae	20	1	26	17	4	20
Miscellaneous	2	1	9	6	7	—
Crustacea	14	54	20	32	13	14
Anostraca	5	6	t	—	4	14
Conchostraca	t	7	—	14	6	t
Cladocera	—	33	10	10	3	t
Amphipoda	8	—	—	1	t	t
Miscellaneous	1	8	10	7	t	—
Annelida	1	—	—	t	13	11
Miscellaneous	2	—	—	—	3	—
Total	99	99	72	72	72	77

^aSwanson and Meyer (11).

^bSwanson et al. (6).

^cSerie and Swanson (5). "Saline" gadwalls are those that fed in saline lakes.

^dSwanson et al. (8).

^eKrapu (4).

^f<1%.

Discussion

Breeding Birds

Dirschl (12) documented a high incidence of invertebrates in the diet of blue-winged teal during the breeding season and Perret (1) pointed out that female mallards consumed a greater proportion of invertebrates than did males. Perret (1) examined the esophageal contents of 96 mallards in south central Manitoba during the breeding seasons of 1957-59. Manitoba birds selected a diet that contained 54% animal foods. The animal diet of Manitoba mallards consisted of Diptera (25%), Trichoptera (18%), Odonata (6%), and Coleoptera (3%). Larval chironomids accounted for 20% of the diet. Mollusks, crustaceans, and annelids were of a minor importance.

Street (7) described seasonal changes in the diet of mallards collected in eastern England. Cereal grains accounted for 92% of the diet in August, September, and October. In February, March, and April, the invertebrate content of the diet increased to 39%. Invertebrates made up 73% of the summer diet, reaching a maximum of 85% in June. The invertebrates selected included crustaceans, mollusks, insects, and annelids.

Laying female anatids examined within and outside of the prairie pothole region demonstrated high consumption of animal foods (Figure 1). Diets of laying female American black ducks (*A. rubripes*) in Maine and wood ducks (*Aix sponsa*) in Missouri contained 91% (13) and 79% (14), respectively, animal material. Studies indicated that mallard diets contained about the same proportion of animal material as gadwalls, northern pintails, and wood ducks. Gadwalls consume plant material in the same proportion that seed components are consumed by the other three species. Diets of blue-winged teal, northern shovelers, and American black ducks contained more than 90% animal material.

Laying females select animal foods to satisfy their demand for a high-protein diet during egg production (15). The demand for high-protein foods that can replenish body reserves lost during previous nesting attempts increases with each re-nesting attempt. From pre-nesting to laying, female mallards increased the amount of time spent feeding from 18% to 55% and spent 45% of the time foraging while in seasonal wetlands (16).

Ducklings

Foods consumed by anatid ducklings have been described by Chura (17), Perret (1), and Sugden (2). Invertebrates associated with the water surface dominated the diet of recently hatched northern pintail, gadwall, American wigeon (*A. americana*), and mallard ducklings examined by Chura (17) and Sugden (2). Invertebrates dominated the diet of all ducklings less than 15 days old. Gadwall and American wigeon ducklings examined by Sugden (2) and mallard ducklings examined by Chura (17) contained a diet dominated by plant parts and seeds, respectively, after 15 days of age. Northern pintail ducklings continued to consume a diet high in invertebrates up to 40 days of age (2), as did mallard ducklings examined by Perret (1). Flying immature mallards examined by Perret (1) contained 71% animal foods and flying immature blue-winged teal examined by Swanson and Nelson (18) contained 90% animal foods (Table 2).

Food Availability

Food availability in the wetland environment is controlled by the abundance and distribution of food items within feeding zones defined by the physical capabilities of the bird. Dabbling ducks are morphologically adapted to filter-feed in shallow water or close to the water surface. Hydrologic changes and invertebrate migration in and out of the feeding zones alter food availability (8). Emerging insects; mollusks,

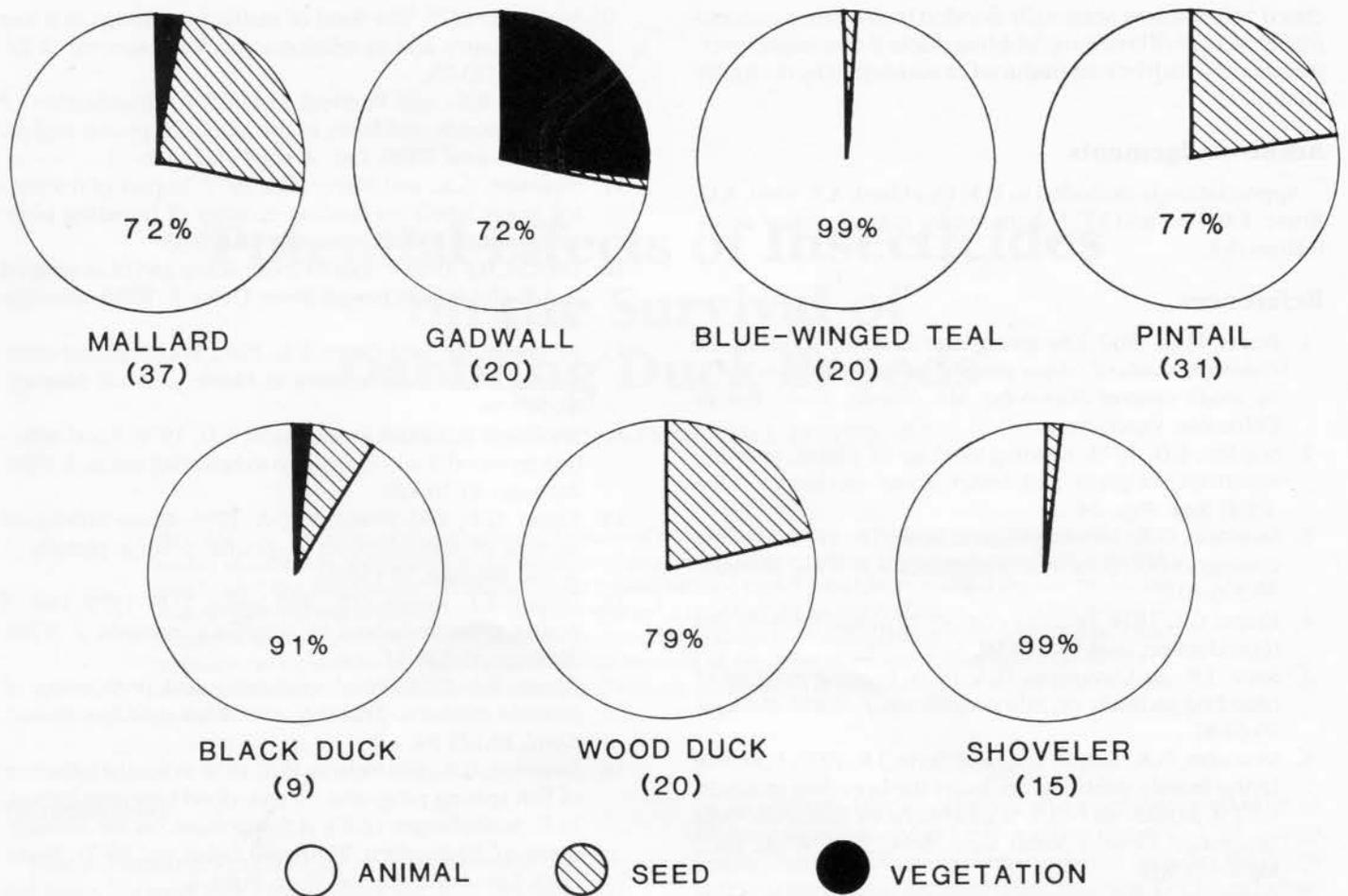


Figure 1. Proportions of invertebrates, seeds, and vegetation consumed by laying mallards (8), gadwalls (5,6), blue-winged teal (3), northern pintails (4), American black ducks (13), wood ducks (14), and northern shovelers (6). The diet of American black ducks and wood ducks is expressed as percent by dry weight. Number of birds examined shown in parentheses.

crustaceans, and insects attached to aquatic substrates near the water surface; and pelagic crustaceans and insects that migrate to the water surface are available to dabbling ducks. Surface invertebrates are influenced by changes in climatic conditions (19).

Hydrology influences the salinity and permanence of wetlands which in turn determine the species composition of plant and animal communities of wetlands. Invertebrate species are controlled by drawdown chronology within the current year and hydrologic regimes that have persisted for a number of years. Ephemeral, temporary, and seasonal wetlands and wet meadow and shallow marsh zones of semipermanent lakes that were dry the previous summer fill with water from snowmelt in early spring. Early-developing invertebrate species become available as wetland basins fill in early spring. The total food base available to breeding dabbling ducks in the prairie pothole region in any given year is influenced by the proportion of shallow wetlands that are available during the breeding season.

Wetland Use

Steward and Kantrud (20) examined breeding-pair use of wetlands and found that dabbling duck pairs made frequent use of temporary, seasonal, and semipermanent wetlands. Ephemeral, temporary, seasonal, and semipermanent wetlands accounted for 12%, 20%, 44%, and 24%, respectively, of the wetland classes utilized by mallards during the breeding

Table 2. Proportion of animal foods consumed by blue-winged teal during the spring, summer, and fall of 1967-71 in south-central North Dakota.^a Number of birds examined shown in parentheses.

Food item	Breeding birds ^b		Fall-flying birds ^c	
	Female (61)	Male (46)	Adult (39)	Immature (61)
Mollusca	36	25	31	41
Crustacea	16	23	12	8
Insecta	36	33	6	40
Miscellaneous	3	4	1	1
Total	91	85	50	90

^aData expressed as percentage by volume.

^bSwanson et al. (3).

^cSwanson and Nelson (18).

season (8). Forty-one percent of the blue-winged teal observed by Swanson et al. (3) fed on seasonal wetlands, 30% on semipermanent wetlands, 13% on temporary wetlands, and 16% on other areas. This pattern of wetland use by breeding blue-winged teal was similar throughout the prairie pothole region of North Dakota as determined by Stewart and Kantrud (20).

Dabbling ducks' high consumption of invertebrates during the breeding season and dependence on invertebrates asso-

ciated with shallow seasonally flooded basins raises concern for the welfare of breeding dabbling ducks if non-target invertebrates are inadvertently reduced or eliminated by mosquito control.

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