Utilization of Mayflies and Caddis Flies by Some Mississippi River Fishes[1]

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ABSTRACT

At sampling stations in the Mississippi River near Keokuk, Iowa, during 1958 mayfly naiads, *Hexagenia* spp., comprised over 50 percent by volume of the food of channel catfish *(Ictalurus punctatus)*, freshwater drum *(Aplodinotus grunniens)*, mooneyes *(Hiodon tergisus)*, goldeyes *(Hiodon alosoides)*, and white bass *(Roccus chrysops)*, and over 40 percent of the food of paddlefish *(Polyodon spathula)* and white crappies *(Pomoxis annularis)*. These naiads were also eaten by shovelnose sturgeon *(Scaphirhynchus platorynchus)*. Larval caddis flies, *Potamyia flava*, comprised over 60 percent of the food of the shovelnose sturgeon and between 10 and 20 percent of the food of mooneyes, goldeyes, and white crappies. The *Hexagenia* naiads found in the stomachs are the same kinds that ordinarily create a problem in the river communities but the nuisance species of caddis flies *(Cheumatopsyche campyla* and *Hydropsyche orris)* are not usually significant in the diets of the fish studied.

INTRODUCTION

Large emergences of caddis flies and mayflies occur at many places along the impounded waters of the upper Mississippi River during the summer months. At times of peak emergence hordes of winged adults invade many of the river towns, creating health, transportation, economic, and nuisance problems. Many of the river towns are planning to develop programs designed to either eliminate these insects or to control their numbers. The initiation of any program which might alter the numbers and distribution of the aquatic immature forms should be seriously considered only after a thorough investigation of their present distribution, ecological importance, and biology. Such a study was initiated at Keokuk, Iowa, in 1957 assisted by a grant from the National Science Foundation. This paper reports the degree to which mayfly and caddis fly aquatic stages were utilized as food by several species of fish as determined by the collection, examination, and analysis of stomach-content material.

[1]Journal Paper No. J-3685 of the Iowa Agricultural and Home Economics Experiment Station, Ames, Iowa. Project No. 1373, Iowa Cooperative Fisheries Research Unit, sponsored by the Iowa State Conservation Commission and Iowa State University of Science and Technology, with the cooperation of the U. S. Fish and Wildlife Service. This phase of the project was aided by a grant from the National Science Foundation.

METHODS OF INVESTIGATION

The fish examined during this study were collected in Pool 19 of the Mississippi River in the vicinity of Burlington and Keokuk, Iowa, and in the tailwaters immediately below Lock and Dam 19, Keokuk, Iowa (Table 1). The problem of acquiring the large numbers of fresh samples necessary for this study was overcome by enlisting the aid of several commercial fishermen and fish markets in the vicinity of Keokuk and Burlington. The quantities, in percentage, of each food organism with relation to the total stomach contents of each fish species may be presented in a radial diagram where each of the five radii is 100 percent and the points on these radii are connected to form a characteristic figure (Figure 1). Although a number of species of mayflies and caddis flies were identified during the stomach-analysis work, only relatively few were important in the diets of the fish examined. A comparison of all analyses made for each fish species collected showed that little seasonal variation in food habits occurred relative to the utilization of caddis and mayfly immatures.

UTILIZATION OF MAYFLIES AND CADDIS FLIES

Mayflies of the genus *Hexagenia* form an important source of food for the paddlefish during the winter, spring, and early summer months. Naiads of *Hexagenia* comprised 46 percent of the total food content of the 64 paddlefish examined. Cladocerans, copepods,

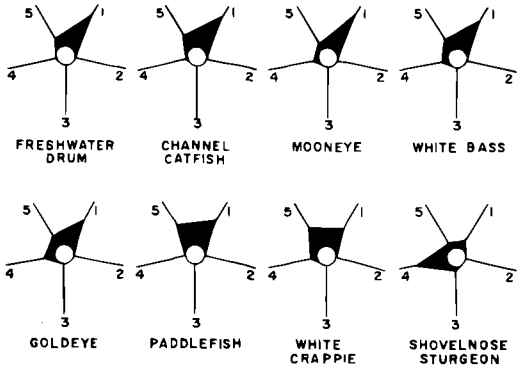

FIGURE 1.—Utilization of mayflies, *Hexagenia* spp. (1); caddisworms, *Hydropsyche orris* (2); *Cheumatopsyche campyla* (3); *Potamyia flava* (4); and other organisms (5); as food by fish, Mississippi River, near Keokuk and Burlington, Iowa, January 1958 to November 1958.

and algae were also significant food items, primarily in the late summer and fall months. Shovelnose sturgeon depend largely upon caddis larvae throughout the year. In the 74 sturgeon examined the total content was 68 percent *Potamyia flava* larvae, 7 percent *Cheumatopsyche campyla* larvae, 17 percent *Hexagenia* naiads, and 8 percent other material which included immature Plecoptera, Diptera, and Odonata. The total stomach content of 136 mooneyes included 66 percent *Hexagenia* naiads and 17 percent *Potamyia flava* larvae. Immature Plecoptera, Diptera, and Odonata comprised the remainder. The food habits of the goldeye are almost identical to those of its more abundant relative, the mooneye. *Hexagenia* naiads comprised 56 percent of the contents of the 44 goldeye stomachs collected; *Potamyia flava* larvae made up 19 percent. Immature Zygoptera and Odonata and fish formed the bulk of the remaining contents. The stomach contents of 143 channel catfish contained 68 percent *Hexagenia* naiads and subimagos but only 3 percent *Potamyia flava* larvae. Mayfly subimagos appeared only in channel catfish stomachs collected between June 24 and July 16 and their presence always coincided with periods of peak mayfly emergence. The remainder included immature Plecoptera and Diptera, clams, snails, and algae. *Hexagenia* naiads comprised 54 percent of the total stomach content of the 56 white bass collected. The larvae of *Potamyia flava* formed 9 percent of the content and immature Odonata and Zygoptera, Hemiptera, amphipods, crayfish, and fish were also present. The food of 83 white crappies included 42 percent *Hexagenia* naiads and 11 percent *Po-*

TABLE 1.—*Fish collected in the Mississippi River at Burlington and Keokuk, Iowa, in 1958 for food-habits study*

Species	Collection dates	Numbers with food	Gear	Total lengths of fish in inches[1]
Paddlefish	January and February	17	Gillnet	29.0-54.5
	April	24	Seine	
	July and August	10	Seine	
	October and November	12	Seine	
Shovelnose sturgeon	April	44	Trammel net	17.5-24.0
	June and July	10	Hoop net	
	October	20	Trammel net	
Mooneyes	April	36	Seine	8.5-14.5
	July and August	33	Seine	
	October and November	67	Seine	
Goldeyes	July and August	39	Seine	10.0-15.5
	October	4	Seine	
Channel catfish	April	14	Seine	9.5-21.5
	June	39	Trot line	
	July and August	68	Trot line	
	October	9	Seine	
White bass	April	8	Seine	8.0-14.5
	July and August	35	Seine	
	October and November	14	Seine	
White crappie	April	4	Seine	6.6-12.3
	July and August	76	Seine	
	October	2	Seine	
Freshwater drum	April	4	Seine	8.5-14.5
	July and August	18	Seine	
	October and November	11	Seine	

[1]Shovelnose sturgeon were measured in standard lengths. Paddlefish were measured from the tip of the bill to the end of the dorsal portion of the caudal fin. Total lengths of all other fish were measured from the anterior of the head (mouth closed) to the longest ray of the caudal fin (lobes compressed) while the fish lay on its right side.

tamyia flava larvae. The remainder of the content was composed chiefly of immature Diptera, Odonata and Zygoptera, Hemiptera, and fish. Seventy-five percent of the total stomach content of the 33 freshwater drum examined was comprised of *Hexagenia* naiads. Immature Coleoptera and Odonata, snails, and fish constituted the bulk of the remaining 25 percent.

The stomach analyses show that, with respect to mayflies, the nuisance species are the same as those which are important as fish food in their immature stages. With regard to caddis flies, however, the problem species *(Cheumatopsyche campyla* and *Hydropsyche orris)* are apparently not significant as food organisms in the fish examined. In this case another caddis fly, *Potamyia flava*, closely related to *H. orris* and *C. campyla* both biologically and taxonomically, has little importance as a nuisance species because it does not enter cities or residential areas in large numbers but is relatively significant as a source of food for many of the fish, especially the shovelnose sturgeon.

ACKNOWLEDGMENTS

The author wishes to extend his appreciation to the many commercial fishermen and fish-house operators, whose interest and assistance made this study possible. Thanks are due the personnel of Lock and Dam 19 and the Corps of Engineers, U. S. Army, for providing laboratory space and assistance and to the City of Keokuk for lodging during the periods of field investigation. The author is indebted to Dr. Kenneth D. Carlander for guidance and critical comment in preparation of the paper and to Calvin R. Fremling for field assistance.