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FOOD HABITS AND FEEDING SELECTIVITY OF STRIPED BASS FINGERLINGS IN CULTURE PONDS

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ABSTRACT

Stomach content analyses were performed on 213 striped bass (11.4-80.0 mm TL) collected from culture ponds at the Front Royal Fish Cultural Station, Virginia, during the 1969 and 1970 rearing seasons. Cladocerans (families Sididae, Daphnidae and Bosminidae) constituted the major portion of the diet of these fish with copepods (family Cyclopidae) and insects (family Chironomidae) also being important food organisms. Cladoceran abundance in the stomachs increased after the bass were 30-40 mm long, while copepod abundance decreased and insect abundance remained relatively stable. The fish negatively selected Brachionidae (rotifers) and copepod nauplii. Daphnidae and Bosminidae were positively selected and Cyclopidae was eaten in relation to its abundance in the ponds. Sididae was positively selected when present in small numbers, but eaten in proportion to its abundance when present in large numbers.

INTRODUCTION

Development of techniques for propagating and transporting millions of striped bass fry resulted in attempts in various states to establish striped bass populations in reervoirs, but fry stocking usually failed since larval mortality was high even under the best conditions. Attempts to establish this fish in inland waters in several states by stocking adults in spawning condition were also unsuccessful. One solution is to rear the fry to fingerling size before stocking. This should increase survival by introducing fish that can better compete with smaller fish and escape excessive predation from large carnivores.

Several agencies have attempted to rear fingerling striped bass in hatchery ponds but success has been highly variable. Food habits of these fish have been determined at some facilities in an attempt to improve culture methods. Young striped bass in hatchery ponds at Edenton, N. C., in 1964 consumed *Daphnia pulex*, rotifers and chironomid larvae (Anderson 1966). Postlarval bass in Oklahoma selected early instars of cladocerans and copepods (Sandoz and Johnston 1965). Food of striped bass ranging from 10 to 110 mm standard length in hatchery ponds in Oklahoma was determined during the summer of 1967 (Harper et al. 1968). The culicid, *Chaoborus*, was a significant food item of small fish (10-19 mm). The diet of fish in the 10-30 mm size class consisted mainly of copepods supplemented with some cladocerans and insects. Important crustaceans in the diet included *Diaphanosoma, Diaptomus* and *Daphnia.*

Striped bass larvae from four hatchery ponds at Edenton, N. C., in 1967 preferred *Cyclops* and consistently selected against *Bosmina. Ceriodaphnia* was the second preferred genus and *Daphnia* had varying degrees of acceptance (Regan et al. 1968). Striped bass fingerlings in six ponds at Edenton in 1968 consistently chose to eat zooplankton although bottom fauna were more plentiful (Bowker et al. 1969). Meshaw (1969) determined that these fingerlings were highly selective for *Cyclops* while they selected against *Bosmina, Ceriodaphnia, Daphnia,* nauplii and rotifers. Large numbers of chironomid larvae and ostracods were occasionally consumed by the fish.

The present study was initiated to determine food habits and feeding selectivity of striped bass fingerlings in culture ponds at the Front Royal Fish Cultural Station in Virginia during the 1969 and 1970 rearing seasons.

METHODS AND MATERIALS

In 1969, four one-acre ponds (nos. 19, 20, 22 and 23) were sampled once a week from 17 June to 22 July and 159 striped bass (23.0-80.0 mm TL) were collected. In 1970, three ¼-acre ponds (nos. 1, 2 and 7) and a one-acre pond (no. 19) were sampled once a week from 4 June to 24 June and 54 striped bass (11.4-53.4 mm TL) were collected. The one-acre ponds were dried each year and sown to rye grass which grew over winter. The ponds were flooded with water from Passage Creek in April of each year, at that time, 600 pounds of hay and 200 pounds of cow manure per acre were added to enhance zooplankton production. These ponds were stocked with striped bass fry (120,000 per acre) from the Brookneal hatchery in May of each year. The three ¼-acre ponds were filled with water from Passage Creek in May 1970 when approximately 50 pounds of cow manure were added to each pond to enhance zooplankton production. Approximately 4,000 striped bass fry (5 days old) were stocked in each pond on 27 May.

Sampling procedures were identical each season and all samples were taken in the early afternoon on each collection date. Plankton samples were obtained by taking two vertical tows of 1.2 meters in each pond using a Wisconsin plankton net having 200 meshes per inch and a mouth opening of 12 cm. One tow was taken at the upper spillway and the other at the lower spillway of each pond. Each sample represented a filtrate of 27.6 liters of water. In the laboratory the samples were concentrated in a specific volume of preservative depending on the volume of organisms present. From each sample, a one ml subsample was placed in a Sedgwick-Rafter counting cell and examined microscopically (100x) to determine the numbers and types of organisms present. From these data the percentage occurrence of various plankters in each pond was calculated.

Young striped bass in the ponds were sampled with a 3.2 mm mesh nylon seine (7.6 m long, 1.8 m deep). In the laboratory the stomach (portion of the digestive tract between the esophagus and pyloric valve) of each fish was removed. The stomach contents were removed with dissecting needles, placed on a glass slide and examined microscopically (100x). The organisms were classified in taxonomic groups, usually families. Empty stomachs (5 in 1969 and 7 in 1970) were not included in the data analyses.

The importance of each taxonomic group in the striped bass diet was determined by the following methods: (a) from the percentage of stomachs examined that contained organisms of the group (frequency of occurrence method), (b) from the percentage that each group or organisms formed of the total number of organims (numerical or abundance method) and (c) from the percentage that each group of organisms formed of the estimated total volume of stomach contents (volumetric method). Regarding the latter method, a sample (usually 10 organisms) of each group of organisms in each stomach was measured with an ocular micrometer and the length units were used as indices to estimate the volume percentages.

Data for each season were analyzed separately since there were several differences including pond sizes, stocking rates, fertilization rates, sample sizes and fish sizes. Pooled stomach content analyses by the three methods described above were performed to determine general trends in striped bass food habits. Data from each pond were compared to determine between ponds variation in food habits. The bass were also grouped in size classes of 10 mm intervals to determine variation in food habits with fish length.

Feeding selectivity of striped bass for various organisms in ponds was determined by using a quantitative index (Ivlev, 1961). This index was termed "electivity" (E) and was calculated by the equation:

$$E = \frac{r_i - p_i}{r_i + p_i}$$

where r_i is the occurrence of an item in the fish diet expressed as a percentage of total number and p_i is the relative quantity of the same item in the ponds expressed as a percentage. The limiting values of E are −1.0 (indicating complete selection against an item) and +1.0 (indicating exclusive selection for an item). An E value of 0.0 indicates no selection (an item eaten in proportion to its occurrence in the ponds). Electivity values for six groups of organisms (Brachionidaee, Sididae, Daphnidae, Bosminidae, Cyclopidae and copepod nauplii) were calculated. Insects, ostracods and other groups were not considered since sampling methods did not allow estimates of their abundance in the ponds.

RESULTS

Pooled Data of Stomach Contents

Artificial food plus 22 different categories representing four classes (Chlorophyceae, Monogonata Crustacea and Insecta) and 10 orders were found in the stomachs. The four major categories of food organisms are divided into families of organisms except the orders Ephemeroptera and Odonata, the copepod nauplii, the unidentified group and the artificial food (Table 1).

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TABLE 1. Percentage abundance, estimated volume and frequency of occurrence of food organisms in 201 striped bass stomach samples (154 in 1969, 47 in 1970) from Front Royal ponds.

Category of Organism	Abundance (A)[1] 1969 (%)	Abundance (A)[1] 1970 (%)	Volume (V)[2] 1969 (%)	Volume (V)[2] 1970 (%)	Occurrence (F)[3] 1969 (%)	Occurrence (F)[3] 1970 (%)
Cladocerans						
Sididae	67.01	17.07	50.11	17.87	51.95	51.06
Chydoridae	0.28	1.25	0.15	0.72	17.53	6.38
Daphnidae	20.17	5.27	20.70	11.08	56.49	46.81
Bosminidae	2.10	64.36	1.05	43.21	21.43	44.68
Macrothricidae	0.01	....	0.02	....	1.30	....
Copepods						
Diaptomidae	0.28	1.81	0.46	1.79	4.55	8.51
Cyclopidae	4.97	7.34	6.03	8.74	64.94	57.45
Nauplii	0.21	0.17	0.10	0.08	8.44	8.51
Insects						
Ephemeroptera	0.08	0.78	0.38	4.68	7.14	23.40
Odonata	0.17	....	1.05	....	19.48	....
Notonectidae	0.01	....	0.01	....	0.65	....
Corixidae	0.01	....	0.03	....	1.30	....
Dytiscidae	0.10	0.14	0.81	1.21	12.34	8.51
Tipulidae	0.01	....	0.13	....	1.95	....
Culicidae	0.14	0.68	0.64	2.52	6.49	19.15
Simuliidae	0.31	0.11	1.90	0.75	8.44	4.26
Chironomidae	3.71	0.96	14.78	7.33	73.38	29.79
Ceratopogonidae	0.02	....	0.18	....	4.55	....
Miscellaneous						
Desmidiaceae	0.05	....	0.03	....	0.65	....
Brachionidae	0.01	....	0.01	....	1.30	....
Cypridae	0.33	....	0.31	....	9.09	....
Unidentified	0.01	0.06	0.12	0.02	9.74	4.26
Artificial food	0.01	....	1.00	....	9.09	....

[1] $A = \frac{\text{no. organisms of each type}}{\text{total no. of organisms}}$

[2] $V = \frac{\text{vol. of organisms of each type}}{\text{total vol. of organisms}}$

[3] $F = \frac{\text{no. stomachs containing organisms of each type}}{\text{total no. of stomachs}}$

Generally, cladocerans constituted a major portion of the fish diet with copepods and insects also being important. More food categories were found in 1969 than in 1970, but major differences between seasons were in the insect and miscellaneuos groups which were of minor importance as food organisms. These were usually relatively large organisms and the fish collected in 1970 were probably not large enough to eat them.

By percentage abundance and by percentage volume, cladocerans were the most important food organisms in all ponds (Fig. 1). Cladoceran abundance percentages ranged from 62.1 in pond 2 in 1970 to 97.7 in pond 19 in 1970, while estimated volume percentages ranged from 41.7 in pond 19 in 1969 to 90.5 in pond 19 in 1970. Copepods outnumbered insects in the striped bass diet in two ponds (19 and 23) in 1969 and in all ponds in 1970. This was probably related to fish size differences

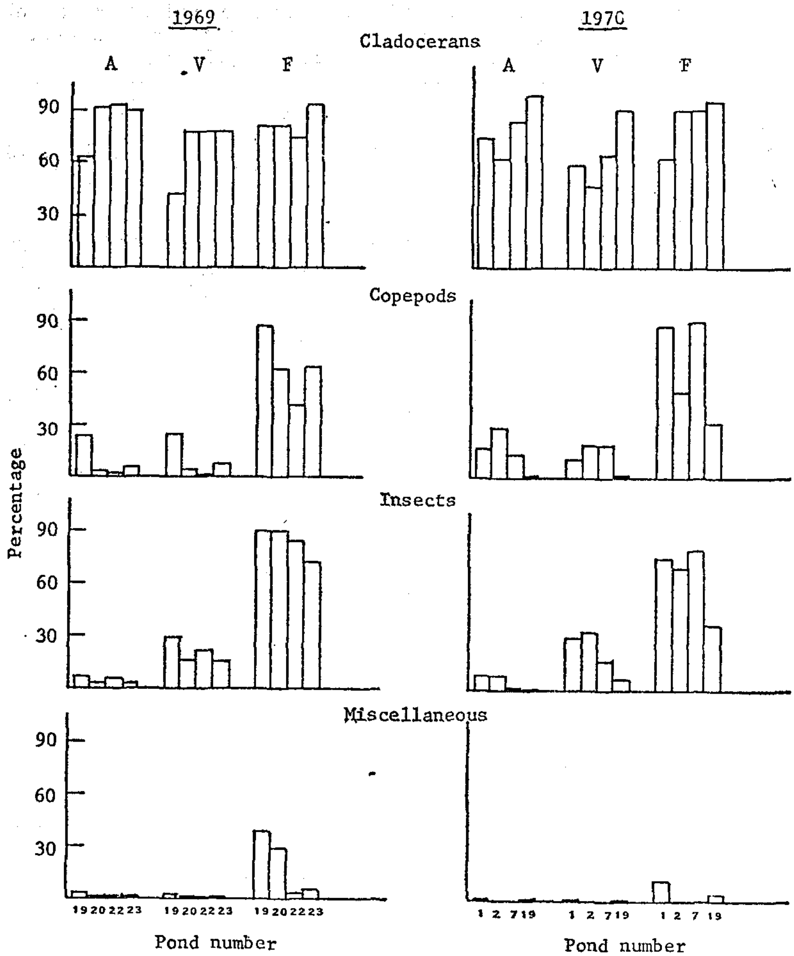

FIG. 1. Variation among ponds in percentage abundance (A), estimated volume (V) and frequency of occurrence (F) of four food categories in the striped bass diet at Front Royal, 1969 and 1970.

which are discussed later. But estimated volumes of insects were greater than those of copepods (except in pond 7) since most of the insects were larger than the copepods.

All three major food categories were well represented by frequency of occurrence. Cladocerans occurred in over half the stomachs in all ponds, copepods occurred in over half the stomachs except in pond 22 (42.1%) and pond 19 in 1970 (31.6%), and insects occurred in over half the stomachs except in pond 19 in 1970 (36.8%). The high frequency of occurrence of copepods and insects relative to their low abundance is obvious from Fig. 1.

The miscellaneous category in Fig. 1 included all organisms other than cladocerans, copepods and insects. The specific groups in this category are listed in Table 1. Desmids were found in only one fish from pond 23 on 24 June 1969; this was the only fish collected on that date which also contained artificial food. Brachionidae (rotifers) were found in two striped bass from pond 19 on 1 July 1969. Since rotifers were the major group of organisms by percentage occurrence (83) in the zooplankton from pond 19 on that date, they were probably ingested incidentally with other food. Cypridae (ostracods) were found in 14 stomachs of fish in 1969. The largest number of ostracods in an individual fish was 38. Artificial food (salmon chow) was broadcast around the pond edges on an irregular schedule in 1969. This food was found in 12 stomachs of fish from pond 20 and in 2 stomachs of fish from pond 23.

The three major food categories (cladocerans, copepods and insects) accounted for most of the organisms in the striped bass diet. Further data analyses indicated that five families of organisms made up the bulk of the diet. Cladocerans were represented by families Sididae, Daphnidae and Bosminidae; copepods were represented by family Cyclopidae; and insects were represented by family Chironomidae. In 1969, Sididae and Daphnidae were the most important families by abundance and volume in ponds 20, 22 and 23, while Bosminidae was of minor importance (Fig. 2).

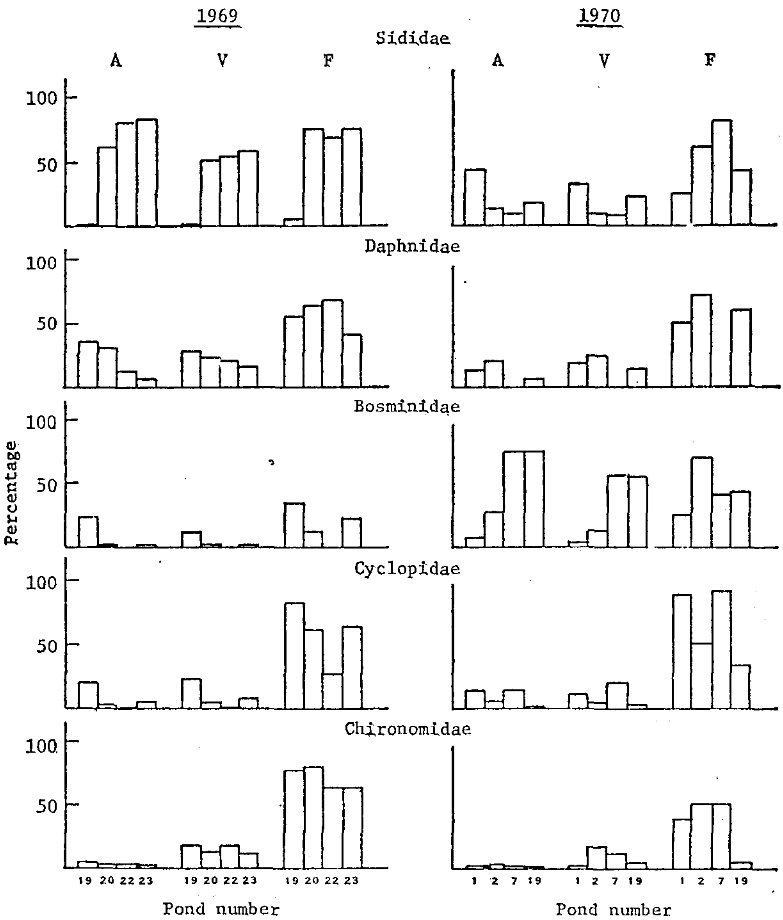

FIG. 2. Variation among ponds in percentage abundance (A), estimated volume (V) and frequency of occurrence (F) of five families of organisms in the striped bass diet at Front Royal, 1969 and 1970.

The minor abundance and volume of Sididae and the relative importance of Bosminidae in pond 19 was notable. These variations were reflected in plankton samples from this pond in which Sididae was present in very low concentrations compared to Bosminidae.

In 1970, Sididae was the most abundant family in pond 1, while Bosminidae was most abundant in ponds 2, 7 and 19. Generally, members of families Cyclopidae and Chironomidae appeared in a large number of stomachs (high frequency of occurrence), but these families showed much variability by abundance and volume both between ponds and between seasons.

Variation in Food Habits with Striped Bass Length

In 1969, cladocerans composed the major portion (78.3% to 95.8%) of the diet of bass in all size classes (Fig. 3). Generally, cladoceran abundance increased with fish size after the bass were in the 30-40 mm size class. The increase in cladoceran abundance was reflected by a decrease in copepod abundance. Insect abundance remained relatively stable at about 5% throughout the size range of fish sampled. The 1970 data showed these same general trends over the limited range of size classes.

In 1969 Daphnidae was the major food family for fish in the 20-30 mm and 30-40 mm size classes, making up 51.6% and 57.2% of the total number of organisms, respectively (Fig. 4). Bosminidae was also an important family in stomachs of these fish, making up 27.7% and 16.7% of the organisms, respectively. Bosminidae decreased in abundance to

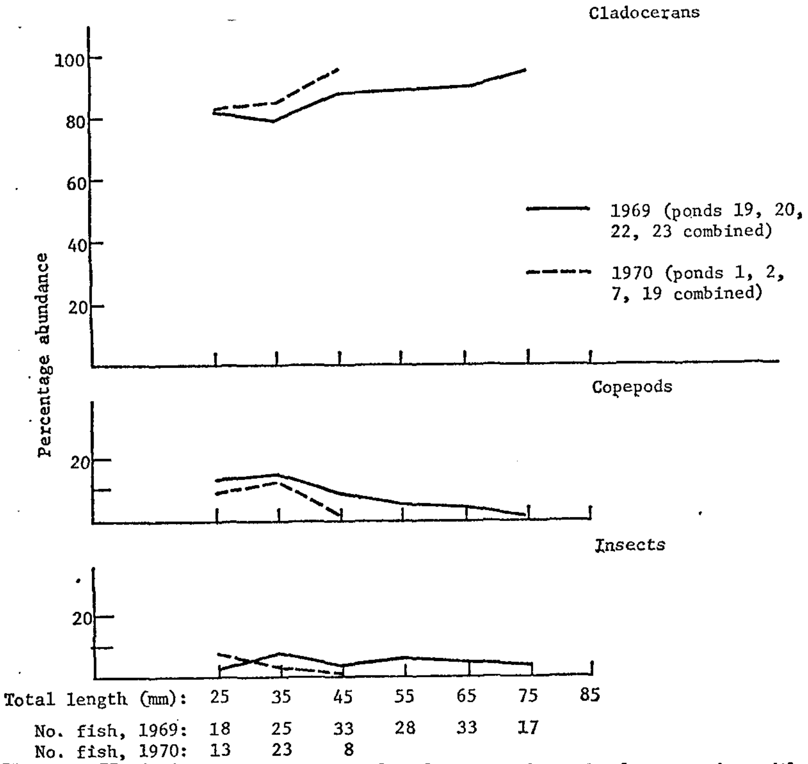

FIG. 3. Variation in percentage abundance of three food categories with striped bass length at Front Royal, 1969 and 1970.

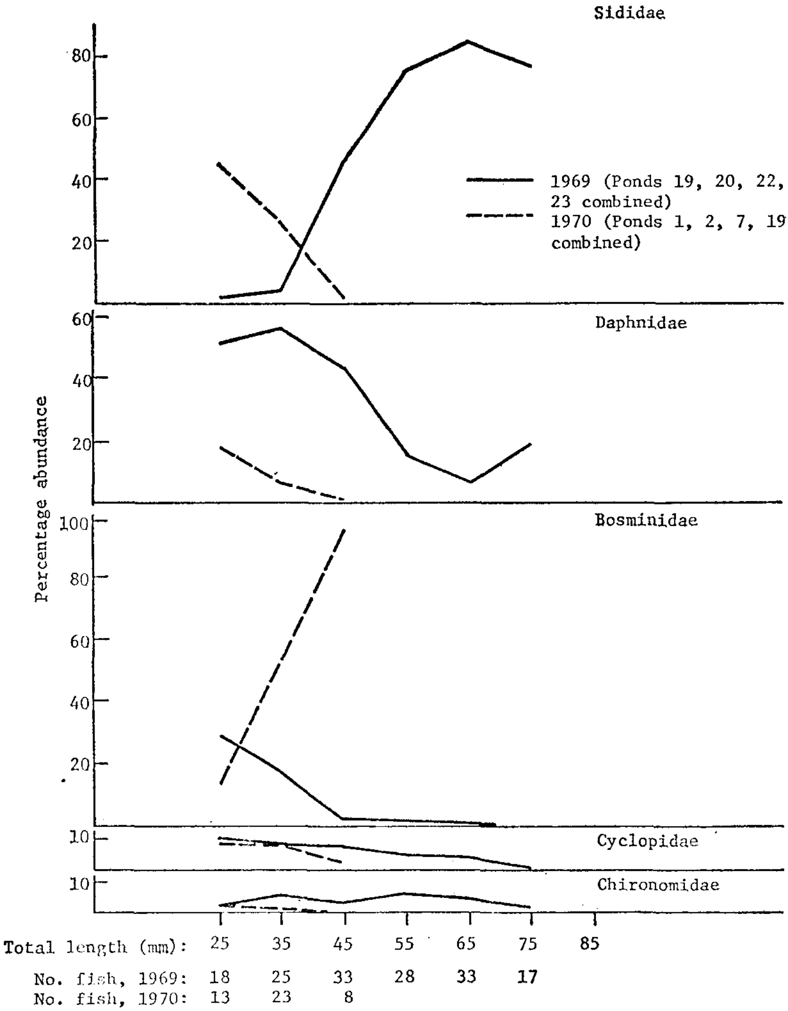

FIG. 4. Variation in percentage abundance of five families of food organisms with striped bass length at Front Royal, 1969 and 1970.

less than 1% in the 40-80 mm fish. Sididae (43.7%) and Daphnidae (43.3%) were the major food families in the 40-50 mm fish. Generally, in larger fish Sididae increased in abundance as Daphnidae decreased. The data for smaller size classes of fish may be misleading since all fish in the 20-30 mm class and all except 3 fish in the 30-40 mm class came from pond 19. Plankton samples from this pond indicated relatively high concentrations of Daphnidae and Bosminidae and notably small concentrations of Sididae. Thus, differences in plankton composition in ponds may account for much of the variation. The trends for Cyclopidae and Chironomidae are similar to those noted in Fig. 3 for the copepod and insect groups.

The 1970 data for cladocerans were highly variable. Small fish sizes and small sample sizes probably caused much variability. The families Sididae and Daphnidae decreased in abundance as fish size increased, while Bosminidae was most abundant in 30-40 mm fish. This was reflected in plankton samples from the ponds in which Bosminidae constituted an average of 36% of the zooplankters.

Food Selection by Young Striped Bass

Average electivity indices indicated that during both seasons the fish exhibited highly negative selection for Brachionidae (rotifers) and copepod nauplii (Table 2). Selection for Cyclopidae was slightly negative (−0.04) in 1969 and slightly positive (+0.08) in 1970. Generally, this family was eaten in relation to its abundance in the ponds (Fig. 5). Daphnidae and Bosminidae were positively selected by fish during both seasons.

TABLE 2. Average electivity indices for six taxonomic groups of organisms eaten by striped bass during the 1969 and 1970 seasons at Front Royal.

Category of organism	Abundance in plankton, p_i (%)	Abundance in fish, r_i (%)	Electivity index, E[1]
1969: Ponds 19, 20, 22 and 23 combined			
Brachionidae	11.07	0.01	−0.99
Sididae	67.73	67.01	−0.01
Daphnidae	5.07	20.17	+0.60
Bosminidae	1.56	2.10	+0.15
Cyclopidae	5.34	4.97	−0.04
Nauplii	5.87	0.27	−0.93
1970: Ponds 1, 2, 7 and 19 combined			
Brachionidae	38.57	0.00	−1.00
Sididae	0.93	17.07	+0.90
Daphnidae	4.19	5.27	+0.11
Bosminidae	35.82	64.36	+0.29
Cyclopidae	6.23	7.34	+0.08
Nauplii	13.10	0.17	−0.97

[1] $E = \frac{r_i - p_i}{r_i + p_i}$

Selectivity for Sididae was slightly negative (−0.01) in 1969 but highly positive (+0.90) in 1970. A major difference between seasons was in the percentage occurrence of Sididae in the plankton (67.7% in 1969 and 0.9% in 1970). Thus, these organisms were positively selected when present in small numbers, but they were eaten in proportion to their occurrence when present in large numbers. These data indicated that members of this family (particularly *Diaphanosoma*) were preferred food organisms of striped bass.

In both years selectivity for Brachionidae and nauplii was highly negative in all ponds (Table 3). In 1969, Daphnidae was positively selected in ponds 20, 22 and 23 where it was present in very small concentrations in the plankton (Fig. 6). Selection for Cyclopidae was slightly negative in pond 20, slightly positive in pond 23 and highly negative in pond 22. But selection for Bosminidae and Cyclopidae was highly positive in pond 19. Generally, Sididae was the most abundant family in fish and plankton in ponds 20, 22 and 23, but this family was nearly absent in pond 19. Thus, fish in pond 19 fed on other organisms which probably resulted in the high selection for Bosminidae and Cyclopidae. The size of fish from pond 22 (greater than 60 mm TL)

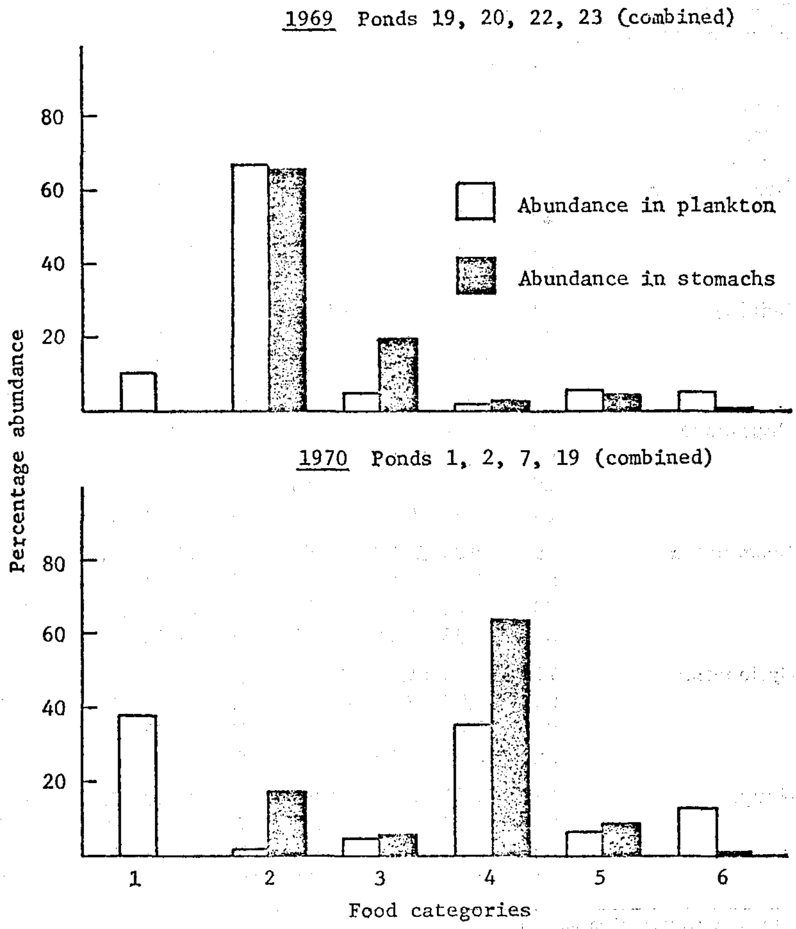

FIG. 5. Comparison by seasons of percentage abundance of six categories of organisms in the striped bass diet and in plankton samples at Front Royal, 1969 and 1970. Food categories: (1) Brachionidae (2) Sididae (3) Daphnidae (4) Bosminidae (5) Cyclopidae (6) Nauplii.

probably accounted for the negative selection of Cyclopidae since Harper et al. (1968) found that bass in the 60-100 mm size class utilized fewer copepods (including Cyclopidae) than smaller fish.

In 1970, selection for Sididae was highly positive in all ponds even though percentage abundance in the plankton was low. Selection for Bosminidae was positive in ponds 2, 7 and 19, but negative in pond 1. Cyclopidae was negatively selected in ponds 1, 2 and 19, but selection was highly positive in pond 7. One difference in the ponds was the low abundance of Daphnidae in plankton from pond 7. Thus, fish in this pond probably selected Cyclopidae to compensate for this deficiency. Selection for Daphnidae was highly variable ranging from +0.82 in pond 2 to −1.00 in pond 7.

TABLE 3. Average electivity indices for six taxonomic groups of organisms eaten by striped bass in ponds 19, 20, 22, 23 (1969) and ponds 1, 2, 7, 19 (1970) at Front Royal.

Category of Organism	Pond No.	p_i[1]	r_i[2]	E[3]	Pond No.	p_i	r_i	E
Brachionidae	19	47.51	0.13	−0.99	1	8.07	0.00	−1.00
	20	14.23	0.00	−1.00	2	5.27	0.00	−1.00
	22	0.25	0.00	−1.00	7	47.07	0.00	−1.00
	23	10.26	0.00	−1.00	19	29.55	0.00	−1.00
Sididae	19	0.40	0.17	−0.40	1	1.65	42.86	+0.93
	20	67.41	61.10	−0.05	2	2.34	14.34	+0.72
	22	88.88	80.48	−0.05	7	0.65	8.57	+0.86
	23	52.79	82.52	+0.22	19	1.39	17.97	+0.86
Daphnidae	19	11.24	36.32	+0.53	1	13.43	12.61	−0.03
	20	5.22	30.83	+0.71	2	1.87	19.49	+0.82
	22	4.80	12.53	+0.45	7	0.47	0.00	−1.00
	23	2.73	7.48	+0.47	19	33.34	5.12	−0.73
Bosminidae	19	6.97	24.26	+0.55	1	33.60	7.28	−0.64
	20	1.61	0.09	−0.89	2	16.74	28.31	+0.26
	22	0.25	0.00	−1.00	7	39.78	74.96	+0.31
	23	1.86	0.14	−0.86	19	14.90	74.65	+0.67
Cyclopidae	19	1.08	21.45	+0.90	1	18.34	14.57	−0.11
	20	5.85	3.60	−0.24	2	37.82	5.51	−0.75
	22	5.42	0.54	−0.82	7	1.63	14.09	+0.79
	23	5.75	6.09	+0.03	19	4.04	1.51	−0.46
Nauplii	19	24.63	2.38	−0.82	1	19.00	1.40	−0.86
	20	4.24	0.02	−0.99	2	32.44	0.00	−1.00
	22	0.00	0.00	0.00	7	10.19	0.08	−0.98
	23	14.32	0.00	−1.00	19	15.40	0.00	−1.00

[1] p_i = percentage abundance in plankton

[2] r_i = percentage abundance in stomachs

[3] E = electivity index = $\frac{r_i - p_i}{r_i + p_i}$

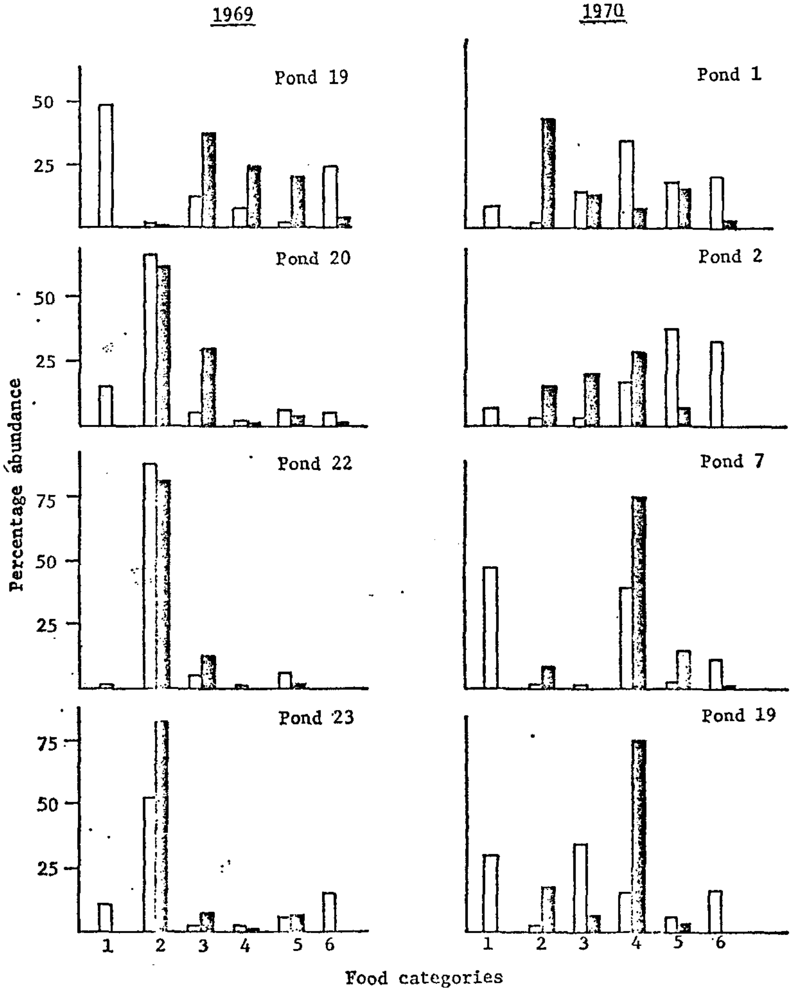

FIG. 6. Comparison by ponds of percentage abundance of six categories of organisms in the striped bass diet and in plankton samples at Front Royal, 1969 and 1970. Clear bars indicate abundance in plankton, opaque bars indicate abundance in stomachs. Food categories (1) Brachionidae (2) Sididae (3) Daphnidae (4) Bosminidae (5) Cyclopidae (6) Nauplii.

DISCUSSION

The food habits study showed that young striped bass were versatile, highly carnivorous feeders. Other studies indicate that this is characteristic of the species. The fish ate a wide variety of pelagic and benthic organisms available in the ponds. Cladocerans (families Sididae, Daphnidae and Bosminidae) made up the bulk of the diet with copepods (family Cyclopidae) and insects (family Chironomidae) also being important. Generally, the families Sididae, Bosminidae and Cyclopidae were each represented by one major genus; *Diaphanosoma*, *Bosmina* and *Cyclops*, respectively. Family Daphnidae was mainly represented by the genera *Daphnia, Ceriodaphnia* and *Scapholeberis*. No attempt was made to classify chironomids past family. Similar results were found in other studies in which young striped bass ate cladocerans, particularly *Diaphanosoma, Daphnia* and *Ceriodaphnia;* copepods, particularly *Diaptomus* and *Cyclops;* and insect larvae, particularly chironomids and *Chaoborus* (Heubach et al. 1963; Sandoz and Johnston, 1965; Anderson 1966; Bogdanov et al. 1967; Harper et al. 1968; Regan et al. 1968; Bowker et al. 1969).

The high frequency of occurrence of copepods and insects relative to their low abundance in the bass stomachs was notable (Figs. 2 and 3). Generally, the relatively large sizes of insects limited their abundance in individual stomachs, but many fish ate small numbers of these organisms. Harper et al. (1968) also found that insects were important by volume and frequency of occurrence in young striped bass even though percentage abundance was low. The high frequency of occurrence of copepods could not be explained by their size, but Meshaw (1969) found that copepods were highly selected by young striped bass. Thus, most fish in the present study probably sought these organisms but ingested few since copepod abundance in the ponds was relatively low.

Ostracods (Cypridae) and artificial food made up most of the miscellaneous category in the striped bass diet. One fish stomach contained 38 ostracods. Meshaw (1969) also found that young striped bass in culture ponds often ate many ostracods. Apparently artificial food was of little value to the fish in the present study since hatchery personnel noted little feeding activity when it was introduced. Harper et al. (1968) concluded that addition of prepared diets to striped bass ponds without visual observations of feeding activity was apparently not helpful. Regan et al. (1968) found that striped bass in culture ponds used artificial food little, if at all, during the first 60 days after stocking.

Generally, cladoceran abundance in the stomachs increased with fish size after the bass were 30-40 mm long, while copepod abundance decreased and insect abundance remained relatively stable. These results are in general agreement with Harper et al. (1968) who found that striped bass after reaching 30 mm length ate fewer copepods but more cladocerans and insects.

Electivity indices indicated that during both seasons striped bass exhibited high negative selection for Brachionidae (rotifers) and copepod nauplii. Several investigators have also noted an avoidance of rotifers by young striped bass (Bogdanov et al. 1967; Harper et al. 1968; Meshaw 1969). Copepod nauplii have been cited as a preferred food of larval and postlarval striped bass in which mouth parts are too small to capture adult copepods or cladocerans (Sandoz and Johnston 1965; Bogdanov et al. 1967). But fish in the present study were more advanced thus, selection against nauplii was expected due to their small size in relation to the fish.

Daphnidae and Bosminidae were positively selected by fish during both seasons while Cyclopidae was generally eaten in relation to its abundance in the ponds. These data are contrary to results of Meshaw (1969) who found that young striped bass exhibited high positive selection for *Cyclops* and negative selection for *Daphnia* and *Bosminia*. But average lengths of most of his fish were less than 30 mm, whereas fish in the present study were larger. Thus, fish size apparently had a significant effect on selectivity for certain organisms.

The results on food selection by striped bass must be viewed with caution. Apparent differences in selectivity might have been caused by several predator-prey interrelationships which are discussed in detail by Ivlev (1961). These include population densities, mobility, relative, sizes and distribution of the predators and prey. Also, the reliability of the plankton sampling method in this study as a means of indexing is not known since it did not indicate the particular distribution of various plankters in the ponds. For example, Ivlev (1961) found that evenly distributed food was consumed at a low rate by fish. The more patchily the same quantity of food was distributed, the higher the rate of ingestion.

Schooling of fish was noted in most ponds, especially in 1969 when the fish concentrated at the upper spillways during periods of water flow. All samples were taken in the early afternoon on a particular date and fish from each pond usually came from a single school. Stomach content analyses of fish from each pond usually showed the food in similar states of digestion indicating that members of a school fed simultaneously. But stomach contents often varied greatly between fish in a single sample. There were instances in which a food item occurred in large numbers in a few fish, but not in others. For example, one fish from pond 19 on 17 June 1969 contained 411 *Scapholeberis*, while this was a food item of minor occurrence in other fish caught at the same time in the same area. Thus, the exact importance of any group of food organisms was difficult to determine.

SUMMARY AND CONCLUSIONS

1. Cladocerans (families Sididae, Daphnidae and Bosminidae) constituted a major portion of the striped bass diet with copepods (family Cyclopidae) and insects (family Chironomidae) also being important.
2. Cladoceran abundance increased with fish size after the bass were 30 to 40 mm long, while copepod abundance decreased and insect abundance remained relatively stable.
3. Striped bass negatively slected Brachionidae (rotifers) and copepod nauplii.
4. Daphnidae and Bosminidae were positively selected by the bass and Cyclopidae was eaten in proportion to its abundance in the ponds.
5. Sididae was positively selected by the fish when its abundance in the ponds was low, but this family was eaten in proportion to its abundance when present in large numbers.

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PRELIMINARY FECUNDITY STUDIES OF THE HYBRID (STRIPED BASS X WHITE BASS) IN TWO SOUTH CAROLINA RESERVOIRS *

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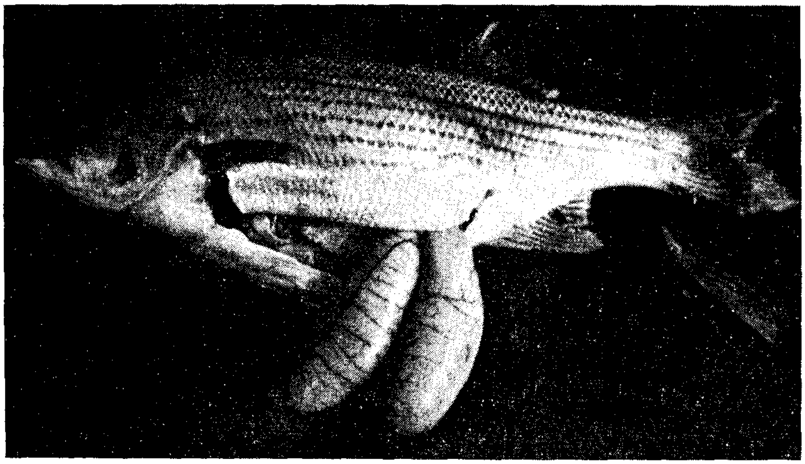

ABSTRACT

The ovaries of 28 mature female hybrids, striped bass *Morone saxatilis* (Walbaum) X white bass *Morone chrysops* (Rafinesque) from Lakes Hartwell and Clark Hill were utilized in determining fecundity in this oviparous species.

These data were collected from all year classes present that were sexually mature, which included year classes I, II, and III. No females of year class O were captured during these studies.

Many hybrid males one year of age were caught at the spawning grounds and specimens as small as 269 mm in total length appeared to be sexually mature.

Female hybrids as small as 409 mm in total length and some weighing as little as 917 grams were found to be sexually mature. Mean ova production although increasing in direct proportion to age, total length and body weight remained rather constant as to average number of eggs per pound of body weight.

Total ova production ranged from a minimum of 185,000 in a 2.9 pound two year old fish to a maximum of 1,152,000 in a 6.3 pound four

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