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Feeding Habits of Young-of-Year Striped Bass, *Morone saxatilis*, and White Perch, *Morone americana*, in lower James River, VA

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ABSTRACT

A total of 188 young-of-year (YOY) striped bass, *Morone saxatilis*, and 199 YOY white perch, *Morone americana*, were collected by pushnet, seine and trawl during 24-hour periods from June through August, 1992 in lower James River, Virginia. The purpose was to identify prey and temporal and spatial feeding habits. Copepods were the most numerous prey of both species. Fishes and mysids comprised the largest volumetric percentage of diets of striped bass and white perch, respectively. Using an index of relative importance, leptodorids and copepods were the most important prey of striped bass and white perch, respectively. Both species shifted from planktonic to epibenthic foods with increasing length. Diets of striped bass and white perch captured by seine were significantly more diverse than those captured by trawl. No temporal or spatial differences in feeding success were found for striped bass. White perch captured at twilight and by pushnet fed more successfully than conspecifics captured at day, or by seine or trawl, respectively. Spearman correlation coefficient, Horn's index and Shannon-Weaver index indicated that diets between striped bass and white perch were significantly correlated, highly overlapping and equally diverse, respectively. With the exception of one temporal and one spatial comparison, interspecific comparisons of feeding success were not significantly different. Results indicate that young of both species feed opportunistically. Abiotic factors appear to have little direct relationship with YOY striped bass and YOY white perch feeding success.

INTRODUCTION

The striped bass, *Morone saxatilis* (Walbaum), and white perch, *Morone americana* (Gmelin), are recreationally, commercially and ecologically important species that use lower reaches of Chesapeake Bay tributaries as spawning and nursery grounds. Striped bass occur sympatrically with white perch over part of the range of white perch (Woolcott, 1962) with juveniles of both species utilizing similar estuarine habitats and niches (Rinaldo, 1971). White perch constitute a large part of the resident ichthyofauna of Chesapeake Bay tributaries (St. Pierre, 1971) and, as such, are important for cycling nutrients within estuarine food webs and contributing to the diet of larger fishes such as striped bass (Bath and O'Conner, 1982).

A low abundance of striped bass in the past has been partially attributed to habitat loss and declining in food production, which reduces survivability (Kelley, 1982). Feeding analyses on these two species are important because inadequate quantity and

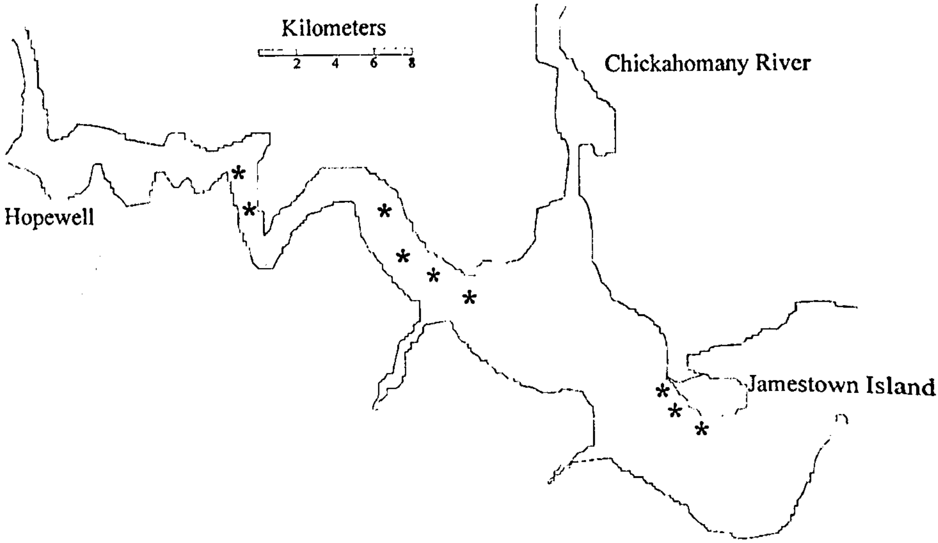

FIGURE 1. James River sampling sites.

quality of food may be contributing factors to year-class variability and poor year-class success (Rulifson, 1985). Additionally, feeding studies of fingerlings may be more accurate than similar studies on ichthyoplankton because the former assessment is conducted at a life history stage closer to that of the fishable stock (Boynton et al., 1977).

Food availability plays an important role in regulating juvenile striped bass growth (Dey, 1981). Additionally, food availability and foraging success may be major factors in habitat preference and movement of young-of-the-year moronids within nursery areas (Boynton et al., 1977).

Food and feeding patterns of YOY striped bass and YOY white perch are important in analyzing how natural or artificial changes in an estuary may affect year-class success and stock abundance. Food availability as measured by average stomach fullness is thought to play a major role in controlling both growth and mortality of YOY striped bass (Kline, 1990). The same may be true for YOY white perch.

Objectives of this study were to: identify prey items of striped bass and white perch; measure intra- and interspecific diet similarity, correlation and overlap; compare and contrast intra- and interspecific spatial and temporal feeding patterns; and determine the relationship between feeding success of each species and physical parameters that included light, temperature, salinity, and current speed.

METHODS

Field sampling took place over nine 24 hr periods between 20-21 June and 19-20 August, 1992 in James River, VA. Sample sites ranged from 56-90 km above the river mouth (Figure 1). Samples were taken within the same river km during each 24 hr period. Each 24-hr period consisted of either eight or nine 3 hr sampling blocks, depending on weather conditions. Although little information is available on residence times of foods in stomachs of juvenile moronids, digestion appears to be rapid in larval striped bass stomachs, with some foods entering the intestine ½ hr post-feeding (Chu and Ozkizilcik, 1999). Young (ages 0 and 1) largemouth bass (*Micropterus salmoides*) had an average of 31.6 % of their meal remaining 2.5 hours after being fed 2% of their body weight in live minnows at 26°C (Hayward and Bushmann, 1994). We felt that a 3 hr interval between sampling blocks was sufficient enough to allow feeding activity to be partitioned between three times of day but short enough in duration to help increase sample size.

At the beginning of each block, samples were taken in a randomly selected order, by three gears deployed in four habitats to detect temporal and spatial feeding patterns. A 15.2 m long, 1.2 m deep seine with 6.4 mm mesh was deployed in the nearshore zone perpendicularly to shore and swung down-current back to the beach. A 2.25 m^2 pushnet (Kriete and Loesch, 1980) that had 20 mm mesh at the mouth and 12 mm mesh at the cod end was affixed to the front end of a twenty-one foot skiff and used to sample channel near-surface and shoal near-surface habitats. A 4 m semi-balloon otter trawl with 30 mm mesh at the mouth and 13 mm mesh at the cod end was also affixed to the boat for bottom sampling in the river channel. Vessel-deployed gear was fished countercurrent for five minutes at a speed of roughly 3.5 km/hr. Seventy-seven samples each were collected with the beach seine, shoal pushnet and otter trawl. Sixty-nine samples were collected with the channel pushnet.

Physical parameters were recorded with each sampling block. Current was visually estimated as fast, medium, slow or zero for each collection. Surface temperature and salinity were recorded for each sampling block. Light readings at 0.5 m below the surface were recorded for each sampling block. Daytime collections were considered those when light exceeded 25.0 $\mu E/m^2/sec$; twilight between 0.1 $\mu E/m^2/sec$ and 25.0 $\mu E/m^2/sec$; and night less than 0.1 $\mu E/m^2/sec$.

Captured YOY striped bass and white perch were fixed in a 5 % buffered formalin solution for 48 hr after capture and then transferred to a 70 percent ethanol solution. Fork length (FL) and total length (TL)of each specimen were measured to the nearest mm.

For this study, stomach contents were removed from the base of the esophagus to the first major curve of the small intestine. Stomach contents were identified to the lowest practical taxon and enumerated. An ocular micrometer was used to measure the volume of each food item by first measuring the item's length and width, and then turning the food item on its side to measure its depth.

An index of relative importance (Pinkas et al., 1971) was used to estimate contributions of major food groups to diets of both species. Index of relative importance (IRI) is defined as: IRI = F(N+V) where F is percent frequency of occurrence of a food group, N is numerical percentage of the food group and V is volumetric percentage of the food group. Frequency of occurrence of food items was determined relative to total number of stomachs, regardless of whether they were full or empty. IRIs were computed for all specimens and 5 size classes (TL) of each species: 30 mm or less; 31-40 mm; 41-50 mm; 51-60 mm; and 61 mm and above.

Measure of intra- and interspecific similarity were calculated by applying Spearman rank correlation coefficients to percent frequency of occurrence of food groups. This is done by calculating the percent frequency of occurrence of each food group, ranking the food groups in descending order of their frequency of occurrence, and then applying the Spearman rank correlation coefficient, r_s. Unlike the parametric correlation coefficient, the Spearman coefficient is distribution-free, a condition that was not met for either species for the data on frequency of occurrence.

Comparisons of intra- and interspecific diet overlap were made with Horn's index (R) of overlap (Horn, 1966), where R ranges from 0 (no overlap) to 1 (complete overlap). Intra- and interspecific comparisons of dietary diversity of striped bass and white perch were performed using Shannon-Weaver diversity index (Shannon, 1948).

A gravimetric index of relative fullness (IRF) was measured for each specimen and used to test for temporal and spatial differences in feeding success (food consumption). IRF is defined as the quotient of dry weight of stomach contents of a specimen divided by dry weight of a specimen after its stomach has been removed, multiplied by 100 (Smyly, 1952). Parametric tests could not be used to test for differences in mean fullness because assumptions were violated before and after the data was transformed. Subsequently, the Wilcoxon signed-rank test (Wilcoxon, 1945) was used to make pairwise tests for differences in mean fullness. Intraspecific temporal comparisons of feeding success were performed using only specimens captured by seine and using only specimens captured by trawl. For each species, channel pushnet and shoal pushnet catches were combined due to low catches in the channel pushnet. Intraspecific spatial comparisons of feeding success were performed between: pushnet and seine specimens; pushnet and trawl specimens; and seine and trawl specimens.

Feeding success of striped bass and white perch was examined for interspecific differences between: all striped bass and white perch; specimens captured at day, twilight, and night, respectively; seine specimens; trawl specimens; and specimens captured by both pushnets. Interspecific feeding comparisons were also performed for: seine catches at day, twilight and night; and trawl catches at day, twilight and night.

For each species, linear multiple regression was performed to examine relationships between abiotic factors and striped bass and white perch feeding success. A regression model for feeding success was developed using light, temperature, salinity and current speed as independent variables. For the model, dummy variables were used by assigning a value of one to the current speed at which the specimen was caught, and zero values to the other three estimates of current speed. The dependent variable, feeding success, was measured with IRFs. Each regression model was run with a minimum tolerance of 0.10.

RESULTS AND DISCUSSION

A total of 188 striped bass and 199 white perch were captured in 300 collections (Table 1).

Striped bass and white perch captured by seine were significantly longer than those captured by trawl ($t=15.04$; $p<0.0005$ and $t=19.94$; $p<0.0005$, respectively).

A total of 6,402 food items were found in striped bass stomachs. Adult copepods were the most numerous food item found in striped bass. Fish comprised the largest volumetric percentage of striped bass food items. Leptodorid cladocerans (leptodorids) were found in the greatest percentage of striped bass. Five striped bass stomachs were empty. Using an index of relative importance, the five most important striped bass food groups, in descending order of importance, were leptodorids, copepods, insect pupae, fish and insect larvae. The percent frequency of occurrence,

TABLE 1. Catches of striped bass and white perch by gear and time of day.

	Day	Twilight	Night
Striped bass			
haul seine	45	15	14
channel pushnet	1	1	2
shoal pushnet	13	13	2
otter trawl	38	22	22
White perch			
haul seine	43	6	17
channel pushnet	0	1	0
shoal pushnet	1	60	0
otter trawl	30	25	16

numerical percentage, volumetric percentage, and indices of relative importance of major striped bass food groups are presented in Table 2.

A total of 11,278 food items were found in white perch stomachs. Adult copepods were the most numerous food item found in white perch. Mysids comprised the largest volumetric percentage of white perch food items. Adult copepods were found in the greatest percentage of white perch. Four white perch stomachs were empty. The five most important white perch food groups, in descending order of relative importance, were copepods, leptodorids, insect larvae, bosminids and insect pupae. The percent frequency of occurrence, numerical percentage, volumetric percentage and indices of relative importance of major white perch food groups are presented in Table 3.

Diets of larger striped bass and white perch shifted to larger food items. Tables 2 and 3 summarize the shifts in dietary preferences (as measured by indices of relative importance) of striped bass and white perch, respectively.

The Spearman rank correlation coefficient, R_s, between striped bass and white perch diets was 0.86 and highly significant ($p<0.001$). Horn's index of overlap, R_o, between striped bass and white perch diets was 0.77. To perform the Shannon-Weaver analysis, food items of both striped bass and white perch were divided into twelve categories. The diversity of striped bass diets was not significantly different from the diversity of white perch diets ($t=1.24$; $0.2<p<0.5$).

Diets of striped bass captured by the two most successful gears, seine and trawl, were compared. Using the Spearman rank correlation coefficient for tied ranks, they were not significantly correlated with each other ($R_s=0.47$; $0.1<p<0.2$). Horn's index of overlap, R_o, between these two groups of striped bass was 0.64, although this relatively high value is attributable to the consumption of fish by two trawl striped bass. Had these two specimens not consumed fish, R_o would have been 0.151. The diets of striped bass captured by seine were significantly more diverse than the diets of striped bass captured by trawl ($t=8.90$; $p<0.0005$).

Diets of white perch captured by seine and trawl were also compared. The Spearman coefficient found that the diets of white perch captured by seine and trawl

TABLE 2. Percent frequency of occurrence (F), numerical percentage (N), volumetric percentage (V), and relative importance (IRI) of major food groups for five size classes of striped bass.

Striped bass ≤ 30mm

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	50	1175	18.73	83.3	71.6	36.7	9021.4
leptodorids	50	242	29.87	83.3	14.8	58.6	6114.2
bosminids	17	153	1.32	28.3	9.3	2.6	336.8
copepod nauplii	17	45	0.33	28.3	2.7	0.7	94.8

Striped bass 31-40mm

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
leptodorids	37	653	71.90	74.0	40.4	62.1	7585.0
copepods	29	660	9.42	58.0	40.8	8.1	2836.2
insect pupae	6	19	14.42	12.0	1.2	12.5	164.4
insect larvae	7	62	7.04	14.0	3.8	6.1	138.6

Striped bass 41-50mm

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
leptodorids	23	1262	149.98	57.5	65.5	73.1	7965.5
copepods	23	295	4.68	57.5	15.3	2.3	1012.0
insect larvae	13	126	20.49	32.5	16.5	10.0	536.3
insect pupae	7	65	13.49	17.5	3.4	6.6	175.0

Striped bass 51-60mm

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	7	385	6.67	33.3	40.8	1.8	1418.6
mysids	5	142	151.35	23.8	15.0	40.2	1314.3
fish	4	8	151.18	19.1	0.8	40.2	781.1
insect larvae	11	44	21.42	52.4	4.7	5.7	544.8

Striped bass > 60mm

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
insect pupae	9	162	56.52	52.9	59.6	14.2	3907.0
fish	6	7	266.74	35.3	2.6	67.2	2463.9
insect larvae	5	39	20.29	29.4	14.3	5.1	570.4
mysids	1	31	32.85	5.9	11.4	8.3	115.8

All striped bass

Food group	#bass	#eaten	vol.(mm^3)	F	N	V	IRI
leptodorids	119	2186	255.18	63.3	34.1	22.3	3570.1
copepods	113	2526	39.68	60.1	39.5	3.5	2584.3
insect pupae	36	271	104.43	19.1	4.2	9.1	254.0
fish	11	16	424.57	5.9	0.2	37.1	220.1
insect larvae	37	272	69.36	19.7	4.2	6.1	202.9

TABLE 3. Percent frequency of occurrence (F), numerical percentage (N), volumetric percentage (V), and relative importance (IRI) of major food groups for five size classes of white perch.

White perch ≤ 30mm

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	75	3295	53.80	90.4	81.5	47.6	11670.6
leptodorids	67	404	52.80	80.7	1.0	46.8	4583.8
copepod nauplii	34	167	1.07	41.0	4.1	1.0	206.8
bosmonids	23	117	1.01	27.7	2.9	0.9	105.0

White perch 31-40mm

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	31	1975	34.30	67.4	83.7	35.8	8054.3
leptodorids	18	219	31.12	39.1	9.2	32.5	1630.5
insect larvae	6	15	7.66	13.0	0.6	8.0	112.7
copepod nauplii	17	61	0.36	37.0	2.6	0.4	110.1

White perch 41-50mm

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	21	1478	22.28	70.0	68.6	15.4	5876.5
leptodorids	11	254	24.63	36.6	11.8	17.0	1053.3
mysids	5	53	58.16	16.6	2.5	40.2	708.2
insect larvae	12	35	10.38	40.0	1.6	7.2	352.0

White perch 51-60mm

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
insect larvae	24	243	101.74	77.4	13.5	40.8	4202.0
insect pupae	21	138	65.81	67.7	7.7	26.4	2308.6
copepods	22	431	6.60	71.0	23.9	2.6	1881.5
bosminids	12	644	4.51	38.7	35.8	1.8	1455.5

White perch >60mm

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
mysids	3	82	62.89	33.3	8.9	72.1	2697.3
bosminids	2	680	4.88	22.2	74.1	5.6	1769.3
insect larvae	5	30	7.59	55.5	3.3	8.7	666.0
ostracods	2	9	0.29	22.2	1.0	0.3	29.1

All white perch

Food group	#perch	#eaten	vol.(mm^3)	F	N	V	IRI
copepods	151	7183	117.03	75.9	63.7	17.0	6125.1
leptodorids	109	1024	113.22	54.8	9.1	16.4	1397.4
insect larvae	50	326	127.89	25.1	2.9	18.5	537.1
bosminids	48	1458	10.57	24.1	12.9	1.5	347.0
insect pupae	32	161	79.39	16.1	1.4	11.5	207.7

were not significantly correlated with each other (R_s=0.08; 0.5<p). Horn's index of overlap, R_0, between these two groups of white perch was 0.27. The diets of white perch captured by seine were significantly more diverse than the diets of white perch captured by trawl (t=12.51; p<0.0005).

Striped bass and white perch captured by trawl had diets that largely consisted of zooplankton, with copepods, leptodorids, and bosminids the three most important foods. These three groups of zooplankton comprised 98.1% and 98.5% of the sum of IRIs across all food groups of striped bass and white perch respectively, captured by traw. The importance of zooplankton to striped bass and white perch captured by seine decreased as insect larvae, insect pupae, mysids and fish became substantial dietary components. For moronids captured by seine, the same three groups of zooplankton comprised 55.0% and 46.6% of the sum of IRIs for striped bass and white perch respectively, captured by seine.

Feeding success (as measured by IRFs) was independent of time or location of capture for striped bass (Table 4).

Feeding success was associated with time of capture for white perch. White perch captured at twilight had a significantly greater mean IRF than those captured at day (Z=2.093; p=0.036). Feeding success of white perch was also associated with location of capture, as white perch captured by pushnet had a significantly greater mean IRF than those captured by seine (Z=2.492; p=0.013) or by trawl (Z=2.251; p=0.024). Temporal and spatial comparisons of feeding for white perch are presented in Table 5.

For interspecific comparisons of feeding, white perch captured at twilight had a significantly greater mean IRF than striped bass captured at twilight (Z= 2.325; p=0.020). Additionally, white perch captured by pushnet had a significantly greater mean IRF than striped bass captured by pushnet (Z=3.216; p=0.001). Interspecific feeding comparisons are presented in Table 6.

For the regression examining striped bass feeding success, salinity and fast current speed were found to be significantly and positively related to feeding success at α =0.05 with an r^2=0.164. The fitted equation was Y = 0.183 + 0.294 S + 0.276 FCS where Y was the fitted IRF value, 0.183 was the constant α, and 0.294 and 0.276 were the regression coefficients, β_i's, for salinity, S, and fast current speed, FCS, respectively. The values for the t-statistic were 0.340, 4.948 and 2.468 for α, β_1 and β_2, respectively.

For the regression examining white perch feeding success, a fast current speed had a significant, positive relationship with feeding success at α =0.05. The r^2 was 0.284. The fitted equation was Y = -0.487 + 0.805 FCS where Y was the fitted IRF value, -0.487 was the constant α, and 0.805 was the partial regression coefficient, β, for fast current speed, FCS. The values for the t-statistic were -0.784 and 7.809 for α and β, respectively.

The low catches of YOY striped bass in James River in this study are consistent with YOY striped bass population data collected by Colvocoresses et al. (1993), who caught fewer than the average numbers of striped bass in James River in 1992. Additionally, steadily decreasing catches of striped bass throughout the summer in this study parallels typical seasonal findings by the Virginia Institute of Marine Science juvenile striped bass seining survey (Colvocoresses, 1990).

TABLE 4. Temporal and spatial index of relative fullness (IRF) comparisons for striped bass.

comparison	mean IRF	Z	p
day	0.378	0.572	0.567
twilight	0.481		
day	0.378	-1.256	0.209
night	0.312		
twilight	0.481	-1.559	0.119
night	0.312		
pushnets	0.348	-1.309	0.191
seine	0.455		
pushnets	0.348	-0.075	0.940
trawl	0.350		
seine	0.455	-0.916	0.360
trawl	0.350		
day seine	0.414	1.533	0.125
twilight seine	0.656		
day seine	0.414	-0.282	0.778
night seine	0.374		
twilight seine	0.656	-1.161	0.245
night seine	0.374		
day trawl	0.382	0.406	0.685
twilight trawl	0.368		
day trawl	0.382	-0.438	0.661
night trawl	0.275		
twilight trawl	0.368	-0.698	0.485
night trawl	0.275		

A combination of several factors may have led to relatively low catches of striped bass and white perch in this study (and others) in James River in 1992. These factors include patchiness (McGovern and Olney, 1988), gear avoidance, downstream drift or dispersal from the sampling area (Raney, 1952; Calhoun, 1953; Sasaki, 1966; Markle and Grant, 1970; Rinaldo, 1971; Turner and Chadwick, 1972; Boynton et al., 1977; Kernehan et al.

The most plausible explanation of low catches of striped bass is relatively poor year-class success in James River in 1992. Potential patchiness may have been rectified at least for striped bass if sampling had been expanded outside of the historical center of YOY striped bass abundance in James River. Although patchiness may have

TABLE 5. Temporal and spatial index of relative fullness (IRF) comparisons for white perch.

comparison	mean IRF	Z	p
day	0.359	2.093	0.036
twilight	0.582		
day	0.359	-0.393	0.694
night	0.190		
twilight	0.582	-1.831	0.067
night	0.190		
pushnets	0.727	2.492	0.013
seine	0.314		
pushnets	0.727	2.251	0.024
trawl	0.292		
seine	0.314	-0.144	0.886
trawl	0.292		
day seine	0.367	-1.153	0.249
twilight seine	0.174		
day seine	0.367	0.284	0.776
night seine	0.228		
twilight seine	0.174	-0.734	0.463
night seine	0.228		
day trawl	0.352	-0.283	0.778
twilight trawl	0.311		
day trawl	0.352	0.284	0.776
night trawl	0.154		
twilight trawl	0.311	-0.734	0.463
night trawl	0.154		

contributed to low catches, the intensity of this study's sampling (300 collections) over a nine week period should have minimized the effects of patchiness. Gear avoidance by larger YOY striped bass and white perch as well as downstream drift by both species may have contributed to reduced catch rates, particularly as summer progressed.

Although striped bass and white perch captured by seine were significantly longer, respectively, than those captured by trawl, it is not clear whether these intraspecific size differences were due to a true shoreward migration, avoidance of the trawl, or a combination of these factors. As larvae, striped bass and white perch are planktonic and appear to exhibit a shoreward migration as they become nektonic juveniles (Boynton et al., 1977). In the Potomac River, Boynton et al. (1977) found that YOY

TABLE 6. Interspecific index of relative fullness (IRF) comparisons.

comparison	mean IRF	Z	p
all striped bass	0.391	0.497	0.619
all white perch	0.435		
day bass	0.378	-0.199	0.842
day perch	0.359		
twilight bass	0.481	2.325	0.020
twilight perch	0.582		
night bass	0.312	-0.509	0.611
night perch	0.190		
trawl bass	0.350	-0.464	0.643
trawl perch	0.292		
seine bass	0.455	-1.747	0.081
seine perch	0.314		
pushnet bass	0.348	3.216	0.001
pushnet perch	0.727		
day trawl bass	0.382	-0.751	0.453
day trawl perch	0.352		
twilight trawl bass	0.368	-0.666	0.506
twilight trawl perch	0.311		
night trawl bass	0.275	0.724	0.469
night trawl perch	0.154		
day seine bass	0.414	-0.350	0.726
day seine perch	0.367		
twilight seine bass	0.656	-1.572	0.116
twilight seine perch	0.174		
night seine bass	0.374	-0.910	0.363
night seine perch	0.228		

striped bass were more abundant at nearshore sights and had higher feeding success (weight of food items per individual) at these nearshore sights. Additionally, Dey (1981) found in the Hudson River that post-larval and juvenile striped bass moved shoreward and onto shoal areas. Kernehan et al. (1981) found that progressively larger striped bass were taken closer to shore in upper Chesapeake Bay nursery areas. White perch may use nearshore areas for similar reasons as striped bass.

The Shannon-Weaver index found that striped bass and white perch captured by seine had significantly more diverse diets, respectively, than those captured by trawl. Older, more mobile striped bass and white perch begin to consume larger prey presumably to more efficiently meet greater nutritional requirements (Elrod et al., 1981). The finding that striped bass and white perch fed to a large extent on epibenthic prey is consistent with other research on YOY striped bass feeding (Markle and Grant 1970,; Bason, 1971) and YOY white perch feeding (Hildebrand and Schroeder, 1928; Elrod et al., 1981; Bath and O'Conner, 1985; Weisberg and Janicki, 1990). These dietary changes may have also been related to seasonal abundance and availability of specific food items (Calhoun, 1953; Thomas, 1967).

While no significant differences in mean IRFs were found among groups of striped bass, two significant differences were found among white perch. Only four collections yielded all 61 white perch captured at twilight by pushnet. The much greater average IRF (0.728) for white perch captured at twilight by pushnet than the average IRF (0.435) for all other white perch accounts for the only siginificant differences in IRFs among conspecifics and congenerics in this study. Consistent with this study, Webster (1942) found that young white perch taken from freshwater fed most heavily early in the evening and much less later into the night or early in the morning. Although our findings suggest that young white perch feed heavily prior to sunset, further inquiry is needed before a definitive conclusion may be reached.

Few stomachs of either species were either gorged or empty. The majority of striped bass and white perch stomachs were partially full, which suggests that a moderate level of feeding had taken place prior to capture, and that young of both species forage and feed in widely varying habitats and light levels. The ability of juvenile striped bass and white perch to feed at night suggests that senses other than light are important for prey detection.

Once striped bass become nektonic they predominantly inhabit nearshore areas rather than move shoreward on a daily basis (Boynton et al., 1981; Dey, 1981; Kernehan et al., 1981). The lack of a daily movement would increase the importance of analyzing within-gear catches to detect temporal feeding patterns. Yet striped bass and white perch captured by seine and trawl showed no significant intraspecific within-gear feeding trends. These findings support the widely held view that YOY striped bass and white perch feed whenever food becomes available (Bigelow and Welsh, 1925; Scofield, 1931; Raney, 1952; Boynton et al., 1981; Elrod et al., 1981).

The similarity in feeding niches between young striped bass and white perch is shown by a high Horn's index, a highly significant Spearman rank coefficient, and similar Shannon-Weaver indices. Although Rinaldo (1971) found that striped bass greater than 19 mm in the Pamunkey River had more diverse diets than similarly sized white perch, the Shannon-Weaver index indicated no significant interspecific differences in dietary diversity in this study. Additionally, with exception of specimens capture at twilight, or by pushnet, there were no significant interspecific differences in feeding success. The similarity in feeding niches, feeding success and habitats of YOY striped bass and white perch indicates that interspecific competition may occur, which could be critical should food items become limited (Rinaldo, 1971). However, YOY white perch exhibit less downstream drift than YOY striped bass (Rinaldo, 1971), which may help to reduce interspecific niche overlap and competition for food as summer progresses.

An inverse relationship has been found between first year growth and cohort abundance for both striped bass (Chadwick, 1964) and white perch (Mansueti, 1961). The findings of an inverse relationship between growth and abundance underscore the ramifications of intra- and iterspecific competition for food when large numbers of young of one or both species are produced. It has been suggested that fish community density rather than population density of any one species is most important to the growth of individuals of any particular species (Boisclair and Leggett, 1989). A pertinent topic of future research would be to compare feeding success and condition factors of striped bass and white perch between years of high and low abundances.

Greater salinity being positively related to striped bass feeding success is attributed to mysids in the diets of striped bass collected at higher salinities. Mysids were 66.9% of the total volume of food items consumed by striped bass at the four stations with measurable salinities. Striped bass that had eaten mysids had an average IRF of 1.176, compared to the average IRF for all striped bass of 0.391.

Although a positive relationship was found between fast current speed and white perch feeding success, the low adjusted r^2 for striped bass and white perch regressions indicates that using a linear regression model, only a small percentage of the total variation in striped bass and white perch IRFs can be accounted for. It would appear that striped bass and white perch feeding success is directly due to the availability of food (Calhoun, 1953; Thomas, 1967), which is indirectly determined by a combination of abiotic environmental factors (Boynton et al., 1981).

Both species shifted towards consumption of mysids with greater salinity. Similarly, Markle and Grant (1970) found in the James River that due to the unavailability of mysids at low salinity sites, insect larvae became the most frequent food item of striped bass 25-100 mm in length. Mysids and decapods would have likely comprised a much larger numeric and volumetric percentage of prey of both species in this study if more sampling was conducted at higher salinities.

The wide array of food items consumed by juvenile striped bass and white perch suggests that an unselective, opportunistic feeding strategy is employed. Such a feeding strategy by juvenile striped bass has been suggested by other authors (Bigelow and Welsh, 1925; Scofield, 1931; Raney, 1952; Boynton et al., 1981; Elrod et al., 1981). Such a strategy likely allows juvenile striped bass and white perch to adjust to variable environmental conditions (Boynton et al., 1981).

Striped bass were captured in only 64 of 300 collections and white perch were captured in only 52 of 300 collections. Greater catches would have increased the power of statistical tests and may have led to the detection of movements and feeding patterns that were otherwise undetected in this study.

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