THE COMPARATIVE ECOLOGY OF TWO SPECIES OF PIPEFISH (SYNGNATHIDAE) IN THE YORK RIVER, VIRGINIA

A Thesis

Presented to

The Faculty of the School of Marine Science

The College of William and Mary in Virginia

In Partial Fulfillment

Of the Requirements for the Degree of

Master of Arts

By

Linda Pushee Mercer

1973

APPROVAL SHEET

This thesis is submitted in partial fulfillment of the requirements for the degree of

Master of Arts

Linda Pushee Mercer

Linda Pushee Mercer

Approved, August 1973

John A. Musick

John A. Musick

John V. Merriner

John V. Merriner

George C. Grant

George C. Grant

TABLE OF CONTENTS

ACKNOWLEDGMENTS

The author wishes to express her sincere appreciation to John A. Musick, under whose guidance this investigation was conducted, for his criticism throughout the study. For their careful reading and criticism of the manuscript I thank John V. Merriner and George C. Grant. Thanks are extended to my fellow graduate students and workers who assisted me during the study. I thank Kay Stubblefield and Ken Thornberry for the figures. For his patience and encouragement I thank my husband, Jim.

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Syngnathus fuscus and *S. floridae* are differentially distributed relative to depth, salinity and season in the York River estuary. Both species inhabit eelgrass beds with *S. fuscus* being more abundant than *S. floridae* in water shallower than about 1.5 m. *S. floridae* is most abundant at salinities between 17 and 22 ppt, whereas *S. fuscus* is most abundant between 13 and 20 ppt. *S. fuscus* occurs at salinities as low as 4 ppt, whereas *S. floridae* occurs at salinities no lower than 15 ppt. *S. fuscus* is most abundant in mid-June and leaves the shallows by late August. *S. floridae*, however, is most abundant in August and remains in shallow water through November. Both species apparently overwinter in the channel in a torpid state until spring. The presence of juveniles from June through October indicates a prolonged spawning season for both species. Analysis of stomach contents indicates that *S. fuscus* and *S. floridae* feed predominantly on amphipods, isopods, and mysids, but in slightly different proportions.

THE COMPARATIVE ECOLOGY OF TWO SPECIES OF PIPEFISH (SYNGNATHIDAE) IN THE YORK RIVER, VIRGINIA

INTRODUCTION

Two species of pipefish, *Syngnathus fuscus* and *S. floridae* occur in the York River, Virginia. *S. fuscus*, the northern pipefish, occurs from Nova Scotia to northern Florida. *S. floridae*, the dusky pipefish, is polytypic and has a discontinuous distribution from Chesapeake Bay to Panama (Herald, 1965). The form which occurs from Chesapeake Bay to South Carolina is *S. f. floridae*. In the York River *S. fuscus* and *S. floridae* are collected together in eelgrass beds, their reproductive seasons overlap, and their diets are similar. Their morphological differences, including snout length, fin rays, dorsal fin position, coloration, size of brood pouch, and size, do not indicate different ecological preferences but may aid in conspecific recognition in reproduction.

The objectives of this study were to examine factors which might control the distribution and abundance of *S. fuscus* and *S. floridae*, to determine whether they compete ecologically, to determine the degree to which the two species co-occurred, and to determine whether the two species might be avoiding direct competition by niche segregation.

METHODS AND MATERIALS

The study area included the lower 16 kilometers of the York River (Figure 1). This area was divided into a numbered grid system (400 m x 400 m) and sampled monthly from April, 1971 through March, 1972. Twenty-five stations were chosen from a table of random numbers each month and were allocated to two strata: shallows (1-5 m), including both north and south shores; and channel (6-27 m). More stations were allocated to the shallows during summer and to the channel during winter to provide more intensive sampling in areas where fishes were concentrated. A 5 m semi-balloon otter trawl with 1 cm stretch mesh in the cod end was towed for five minutes against the tide at each station. Hydrographic data were collected at each station and included surface and bottom temperatures, water samples for salinity and dissolved oxygen determination, turbidity measurements, tidal stage and general weather conditions.

Thirteen seine stations were located along both sides of the river from the mouth to West Point (45 km) (Figure 1) to sample the near shore zone to a depth of 1 meter. The seven stations furthest downstream were located in areas of eelgrass. Eelgrass becomes sparse and patchy upstream from these stations as the lower salinity limit of *Zostera* is approaches (approximately 14 ppt). Sampling was conducted monthly from April through December at low tide when possible. One seine haul with a 9 m x 1 m seine having 6 mm stretch mesh was made at each station for 10 m parallel to the shore. Temperature, salinity and oxygen data were collected at each station.

Samples were preserved in 10% formalin. Bottom type, types of vegetation and invertebrates, and total length and sex of all pipefish were recorded at each station. A subsample of pipefish from each month was saved for gonad examination and stomach content analysis.

DESCRIPTION OF THE STUDY AREA

The lower York River contains a variety of bottom types and associated floras and faunas. Near shore the bottom is generally sand, grading into silts as the channel is approached. The bottom is composed of silts where tidal creeks enter the river. Locally, dense beds of eelgrass extend from below mean low water to approximately 3 m during summer. The channel bottom is composed of silts and clays. The bottom fauna includes hydrozoans, bryozoans, tunicates, sponges, alcyonarian coral, mantis shrimp, sea stars, anemones, and xanthid crabs (Wass et al, 1972).

The upstream distribution of eelgrass in the York River is limited by salinity. On the north shore it extends upstream to Clay Bank but on the south shore only to Sandy Point (Figure 1). Numerous amphipods, isopods, gastropods, polychaetes and decapods occur as macrofauna and epizoans of eelgrass (Marsh, 1970). Oyster bars are scattered throughout the shallows and are colonized mainly by sponges and xanthid crabs (Wass et al, 1972).

HYDROGRAPHY

Physical-chemical conditions in the York River fluctuate with each tidal cycle. The average range of salinity in the study area was 14-21 ppt (Figure 2). Salinities on the south shore were lower than the north shore. Temperatures at trawl stations averaged 27°C in late July and 5°C in January (Figure 2). Temperatures at beach seine stations ranged from 31°C in late July to 8°C in December (Figure 2). Dissolved oxygen was lowest during summer and increased during fall and winter (Figure 2).

RESULTS

Habitat

S. fuscus and S. floridae occur most commonly and abundantly in eelgrass beds in which they resemble blades of grass in their color, body shape and posture. Briggs and O'Connor (1971) compared shore-zone fishes over naturally vegetated and sand-filled bottom and found a significant preference of S. fuscus for naturally vegetated bottom. Similar comparisons cannot be made with these data since seine stations were selected for maximum likelihood of capture of pipefishes. However, few pipefish of either species were collected in the York River where vegetation was sparse. Both species of syngnathids were occasionally collected in patches of Ulva and Agardhiella.

Distribution

There were considerable differences in the numbers of pipefish caught by the two types of gear, at different locations and at different seasons, although the total number of both species was nearly equal. A total of 2,015 S. floridae and 1,905 S. fuscus were collected.

Comparison of trawl and seine abundances of pipefishes suggests a preference of S. floridae for slightly deeper eelgrass beds. Seine hauls yielded 1,598 S. fuscus (84%), whereas trawl stations resulted in only 307 specimens (16%). In comparison, 1,206 *S. floridae* (60%) were taken in the seine and 809 specimens (40%) in trawl collections.

Distribution of *S. fuscus* and *S. floridae* by depth, season and salinity was analyzed after transforming each catch (X) by Y = log (X + 1). Fishes are contagiously distributed and the log transformation tends to reduce bias from occasional large catches (Taylor, 1953; Moyle and Lound, 1960; and Roessler, 1965).

Transformed mean number of individuals of *S. fuscus* and *S. floridae* captured per meter reveal a seasonal change in depth distribution (Figure 3). *S. fuscus* and *S. floridae* were distributed from the channel to the shallows from April through June. *S. fuscus* was more abundant in the shallows during these months than was *S. floridae*. *S. fuscus* was more abundant than *S. floridae* in early July at all depths except 1.5 m, the shallowest trawl depth. In late July *S. fuscus* was only slightly more abundant at 1 m with *S. floridae* being more abundant at all other depths. *S. floridae* outnumbered *S. fuscus* at all depths in August. *S. floridae* continued to outnumber *S. fuscus* at depths less than 3 m in September and October collections. In November *S. fuscus* was again found at all depths, but *S. floridae* was collected only in the shallows. In December *S. floridae* was collected at all depths and *S. fuscus* was collected only in the channel. Both species were collected only in the channel during January. Only *S. fuscus* was collected in February. Both species were again collected in the shallows during March.

S. floridae in the York River appeared to prefer higher salinity than *S. fuscus* (Figures 4 and 5). *S. floridae* was most abundant at salinities between 17 and 22 ppt. S. fuscus was most abundant at salinities of 13 to 20 ppt. S. fuscus occurred at salinities as low as 4 ppt and S. floridae occurred as low as 14 ppt in the York River.

No S. floridae were collected on the south shore upstream from Yorktown (Figure 1), probably because the salinity is lower on that shore. However, this species was collected in large numbers at Mumfort Islands (Figure 1) on the north shore where there are extensive eelgrass beds. S. floridae was collected as far upstream as Clay Bank on the north shore but was less abundant than S. fuscus. S. fuscus was more abundant at Gloucester Point and Yorktown seine stations (Figure 1). S. floridae outnumbered S. fuscus at all other downstream stations.

Reproduction

Catches of pipefish increased in spring because they migrated inshore and spawned. Spawning individuals of both species move into the shallows first. Most specimens of S. fuscus in May seine collections are greater than 100 mm total length (Figure 6). This mode in seine collections disappears by early July. Most males of this size group have pouches filled with eggs and larvae (Table 1). These fish are probably two years of age and spawn and die after brooding larvae.

Early in June the first juveniles of S. fuscus appear in seine collections (Figure 6). Later in June two prominent length modes are present. The first mode represents juveniles spawned earlier in the season and the second mode represents immature yearling fish. Fish of the second group apparently do not spawn until the following spring.

The peak of spawning for *S. fuscus* is in May and early June, based on the percent of males with egg- and larvae- filled pouches (Table 1). Spawning probably begins early in March since juveniles in early June had grown to 48 mm total length. *S. fuscus* generally leaves the shallows in mid-August with yearlings leaving first followed by young-of-the-year. Two 40-50 mm individuals were collected at the end of October indicating scattered spawning as late as August, perhaps by mature yearlings.

S. floridae follows the same pattern as *S. fuscus* but begins spawning about a month later. Juveniles are 10-20 mm smaller in June than juveniles of *S. fuscus* (Figure 6). The spawning peak occurs in late July and August based on the number of males with pouches filled with eggs and larvae (Table 1). As with *S. fuscus*, juveniles remain in the shallows later in the season than do older fish.

Males of *S. fuscus* outnumbered females in seine collections during the peak of the breeding season. Females became more abundant thereafter (Table 2). The sex ratio in trawl samples was more nearly equal from April through June after which females predominated. The sex ratio of *S. floridae* was approximately 1 : 1 in both seine and trawl collections (Table 2).

Association

Hurlbert's (1969) coefficient of interspecific association, C_8, was calculated to determine whether *S. fuscus* occurred with

S. floridae more or less frequently than could be expected by chance, where:

$$C_8 = \frac{ad - bc}{ad - bc} \sqrt{\frac{\text{Obs } X^2 - \text{Max } X^2}{\text{Obs } X^2 - \text{Min } X^2}}$$

and a is the number of joint occurrences, d is the number of simultaneous absences, b is the number of times species A alone is present and c is the number of times species B alone is present. The statistical significance of C_8 is tested by $X^2 = t^2$ where, $t = C_8/\sigma_c$ (σ_c = standard error of the coefficient of interspecific association). The coefficient was calculated separately for trawl and seine collections by month (Table 3).

The values for C_8 based on trawl samples are high in April and July and decrease to September. No joint occurrences were found in June, October, or November, only one in December, and none from January through March. Significant values of C_8 for seine collections were obtained in June, September and October. Although there were six co-occurrences out of eleven in August, the C_8 value is very close to zero and X^2 is nonsignificant. Pooling the data for the entire year resulted in significant C_8 values of .63 and .71 for trawl and beach seine collections respectively.

Food Habits

The types and sizes of food organisms taken by pipefish are related to the jaw specialization of syngnathids. The tube-shaped snout and small mouth limit them to feeding by suction on small free-swimming and epifaunal crustacea of eelgrass. Analysis of stomach contents indicates that both species feed predominantly on mysids, isopods, and amphipods (Table 4). Food items were identified to species when possible and the number of each counted.

Index of Affinity (Sanders, 1961) is a measure of the percentage of fauna common to a pair of samples and is obtained by summing smaller percentages of those species present in both samples. A value of .99 was obtained, indicating that the diets of the two species are very similar. A value of .70 was obtained for Morisita's (1959) Index of Similarity which also indicates similar diets.

Comparison of *S. fuscus* and *S. floridae* by each species of food in contingency tables yielded significant X^2 values at the .05 level for the isopod, *Edotea triloba* and the amphipod, *Elasmopus levis*, and at the .01 level for *Mysidopsis bigelowi*, *Ampithoe longimana*, and *Gammarus mucronatus*.

DISCUSSION

S. fuscus and *S. floridae* co-occur in eelgrass beds but their apparent cohabitation is shown here to be spurious. There is heterogeneity in the habitat in space and time allowing the species to coexist (Harper et al, 1961). At stations where both species were present, one or the other was more abundant, depending on season, depth and salinity.

Syngnathids and several resident fish species migrate seasonally within the estuary, inshore in spring and offshore to the channel in fall. Hildebrand and Schroeder (1928) reported *S. fuscus* in comparatively large numbers from April until October in seine collections. None were collected by them in trawls during the summer but in late October several were taken in 7 m and one was taken in 16 m. These captures indicated migration of *S. fuscus* from the shore area had already begun in October. They collected *S. fuscus* throughout the winter in trawls but not *S. floridae*. They suggested a winter migration of *S. floridae* from the Bay to warmer waters.

Both species apparently spend the winter months in the channel where they become inaccessible to a trawl. Although no *S. floridae* were collected in February, this was more likely a result of sampling error rather than evidence of migration to warmer waters. Water temperatures in February averaged the same as in January when *S. floridae* was collected. Wicklund et al (1968) reported observations of *S. fuscus* and *Hippocampus erectus* off Long Island in November at 14 to 16 m and water temperature of 10.6°C. The pipefish appeared to be in a torpid state. Some were partially buried in the sand and others were curled around sand dollars or just lying motionless on the bottom. Both species probably move into the deeper waters to avoid the extremely low temperatures which may occur in the shallows during winter.

Differences between *S. fuscus* and *S. floridae* in time of appearance and disappearance from the shallows were observed in this study. *S. fuscus* migrated to the shallows earlier in the spring when shallow water temperatures averaged 14°C, whereas *S. floridae* was not collected in the shallows until early June when water temperatures averaged 22.5°C. *S. fuscus* reached a peak of abundance in mid-June and then became rare in the shallows by late August. *S. floridae* reached a peak of abundance in late July and early August and remained abundant in the shallows until late October.

Differences in spawning time would account for the differences in peaks of abundance since juveniles represent the greatest percentage of individuals present during the summer. The first juveniles to appear were *S. fuscus* in early June. Juveniles of *S. floridae* appeared later in June but they were 10-20 mm smaller than *S. fuscus* indicating that the latter begins to spawn earlier. Dovel (1971) collected *S. fuscus* larvae 10-12 mm in upper Chesapeake Bay during mid-May and found two spawning peaks, early May and late July. He reported more rapid growth of larvae and juveniles following the second spawning. The spawning season for both species in the York River is prolonged but not separated into two peaks.

The difference in sex ratios of S. fuscus is correlated with breeding season. Males were abundant early in spring and summer during the peak of the breeding season. Strawn (1958) suggested a correlation between sex ratio of dwarf seahorses in Florida and season or types of vegetation. He cited females outnumbering males at both shallow and deep stations during summer. During other seasons the sex ratio was even at deep stations but females remained more abundant at shallow stations. Joseph (1957) found a majority of males of S. scovelli in Florida in spring, coinciding with the spring peak of reproduction, with an increase in females through fall and winter. He suggested that the incubation of young might result in an increased mortality rate in males causing a reduction in the number of males with a subsequent increase in the percentage of females. Larger individuals of S. fuscus and S. floridae are not collected after June and August, respectively, which suggests that individuals die soon after spawning. Males must survive long enough to incubate the broods which may partially account for the skewed sex ratio.

The depth and salinity distributions of the two species are slightly different. S. floridae outnumbered S. fuscus at shallow-water trawl stations while more S. fuscus were collected by seine near shore. In the Gulf of Mexico near Cedar Key, Florida, S. floridae was slightly more common on deep flats and approaches to shallow flats than on the shallow flats (Reid, 1954).

S. floridae prefers higher salinities (17-22 ppt) while *S. fuscus* was collected at 4 ppt and was most abundant between 13 and 20 ppt. *S. fuscus* has been reported in upper Chesapeake Bay in salinities ranging from 2 to 22 ppt, although they were most abundant between 11 and 19 ppt (Dovel, 1971).

The two species were positively associated based on C_8 values. The decreasing values for trawl collections through the summer coincide with the departure of *S. fuscus* from the shallows and the different depth distribution of the two species. The highly significant values for seine collections are somewhat misleading because they are strongly effected when one species does not occur in the absence of the other.

Although the diets of *S. fuscus* and *S. floridae* are similar, the prey species are both common and abundant epibiota of eelgrass (Marsh, 1970). If food items become abundant, as they probably do in the summer months when many of these species reproduce (Feeley and Wass, 1971), the diets could overlap without any competition between *S. fuscus* and *S. floridae* (Lack, 1945).

The seasonal, depth and salinity differences between the two species probably reduce competition for food as well as space. The capture of nearly equal numbers of *S. fuscus* and *S. floridae* over the entire sampling period suggests that neither species is succeeding at the expense of the other within the study area.

LITERATURE CITED

Briggs, Philip T., and Joel S. O'Connor. 1971. Comparison of shore-zone fishes over naturally vegetated and sand-filled bottoms in Great South Bay. N. Y. Fish and Game Jour. 18(1): 15-41.

Cole, LaMont C. 1949. The measurement of interspecific association. Ecology 30(4): 411-424.

Dovel, William L. 1971. Fish eggs and larvae of the upper Chesapeake Bay. Nat. Res. Inst. Spec. Rep. No. 4, 71 pp.

Feeley, James B., and Marvin L. Wass. 1971. The distribution and ecology of the Gammaridea (Crustacea: Amphipoda) of the lower Chesapeake estuaries. Va. Inst. Mar. Sci. Spec. Pap. Mar. Sci. No. 2, 58 pp.

Harper, J. L., J. N. Clatworthy, I. H. McNaughton, and G. R. Sayer. 1961. The evolution and ecology of closely related species living in the same area. Evolution 15: 209-227.

Herald, Earl S. 1965. Studies on the Atlantic American pipefishes with descriptions of new species. Proc. Calif. Acad. Sci. 32(2): 363-375.

Hildebrand, Samuel F., and William C. Schroeder. 1928. Fishes of Chesapeake Bay. U. S. Fish. and Wildlife Serv. Fish. Bull. 53(Pt. I).

Hurlbert, Stuart H. 1969. A coefficient of interspecific association. Ecology 50(1): 1-9.

Joseph, Edwin B. 1957. A study of the systematics and life history of the Gulf pipefish, Syngnathus scovelli (Evermann and Kendall). Doctoral dissertation, Florida State Univ., 105 pp.

Lack, David. 1946. Competition for food by birds of prey. J. Anim. Ecol. 15(2): 123-129.

Marsh, G. A. 1970. A seasonal study of Zostera epibiota in the York River, Virginia. Doctoral dissertation, Va. Inst. Mar. Sci., 156 pp.

Morisita, Masaaki. 1959. Measuring of interspecific association and similarity between communities. Kyoshu Univ. Memoirs Faculty of Sci. 3(1): 65-80.

Moyle, J. B., and R. Lound. 1960. Confidence limits associated with means and medians of series of net catches. Trans. Am. Fish. Soc. 89(1): 53-58.

Reid, George K. 1954. An ecological study of the Gulf of Mexico fishes in the vicinity of Cedar Key, Florida. Bull. Mar. Sci. Gulf and Carib. 4(1): 1-94.

Roessler, M. 1965. An analysis of variability of fish populations taken by otter trawl in Biscayne Bay, Florida. Trans. Am. Fish. Soc. 94(4): 311-318.

Sanders, Howard L. 1960. Benthic studies in Buzzards Bay. III. The structure of soft-bottom communities. Limnol. and Oceanogr. 5: 138-

Strawn, Kirk. 1958. Life history of the pigmy seahorse, Hippocampus zosterae Jordan and Gilbert, at Cedar Key, Florida. Copeia (1): 16-22.

Taylor, Clyde C. 1953. Nature of variability in trawl catches. U. S. Fish and Wildlife Serv. Fish. Bull. 54(83): 145-166.

Wass, Marvin L., et al. 1972. A check list of the biota of lower Chesapeake Bay. Va. Inst. Mar. Sci. Spec. Sci. Rep. No. 65.

Wicklund, Robert I., Stuart J. Wilk, and Larry Ogren. 1968. Observations on wintering locations of the northern pipefish and spotted seahorse. Underwater Naturalist 5(2): 26-28.

Figure 1. Location of seine stations and trawl areas in the York River.

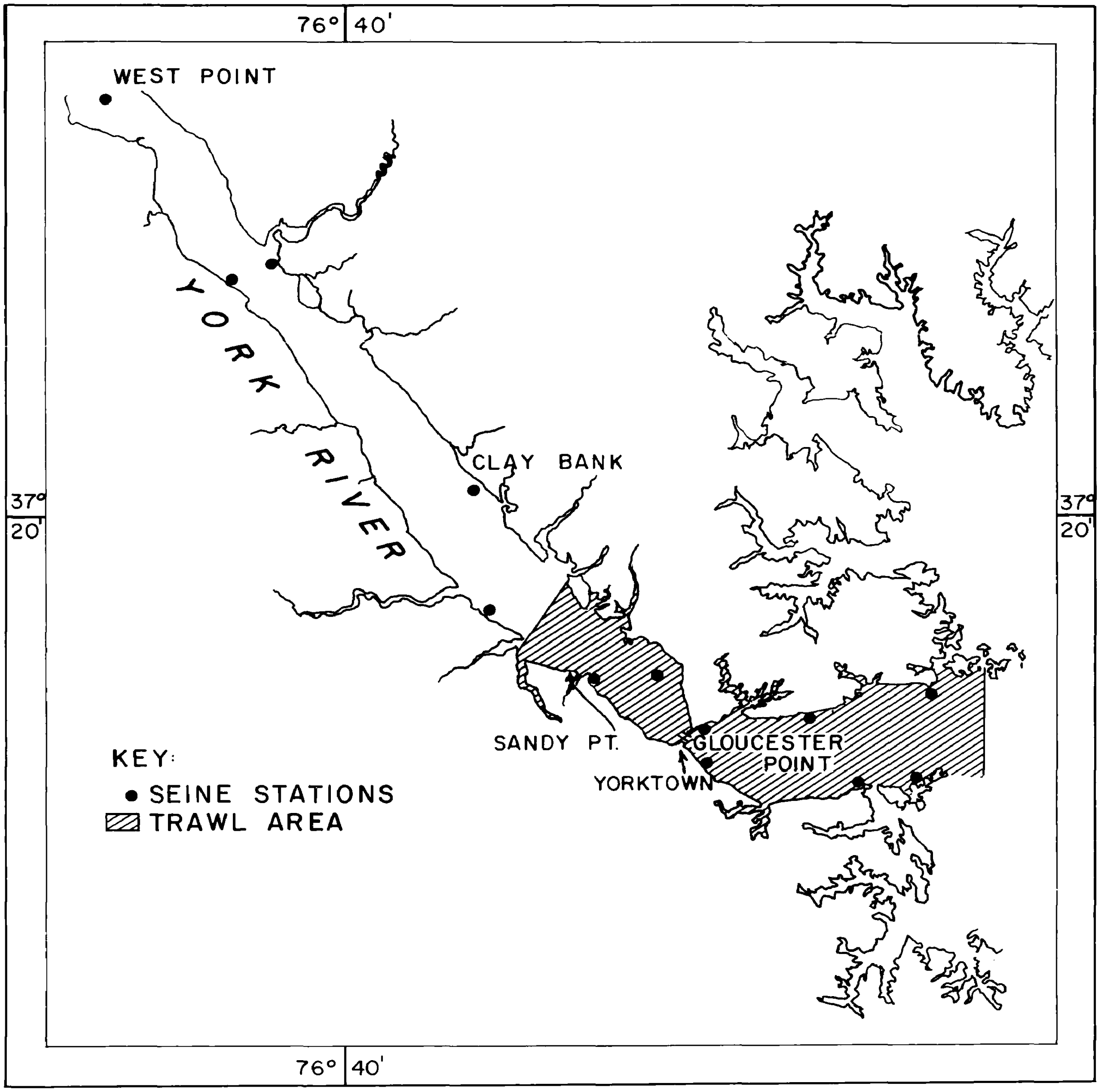

76° 40'
WEST POINT
YORK RIVER
CLAY BANK
37° 20'
SANDY PT.
GLOUCESTER POINT
YORKTOWN
KEY:
SEINE STATIONS
TRAWL AREA
76° 40'

Figure 2. Hydrographic data.

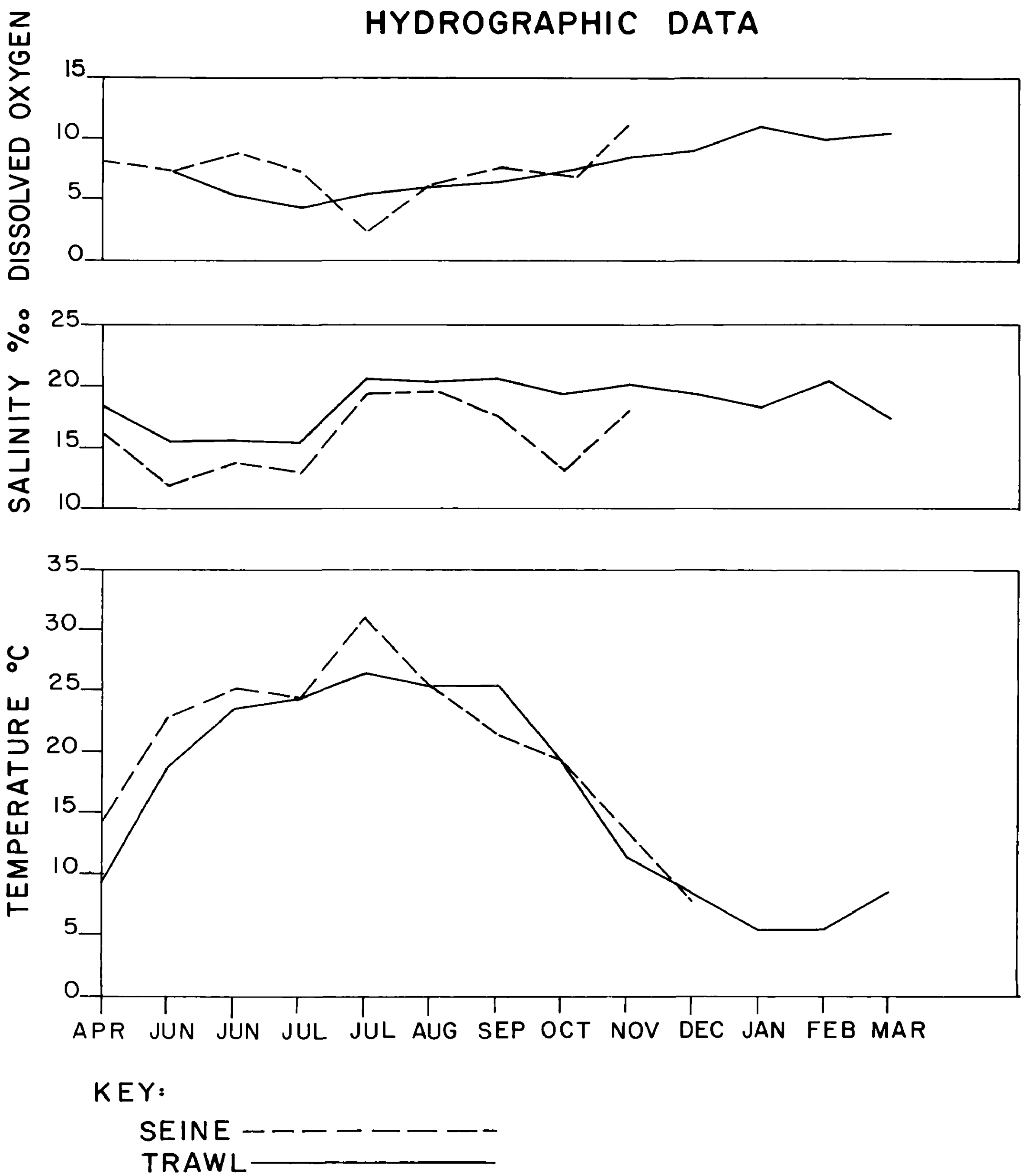
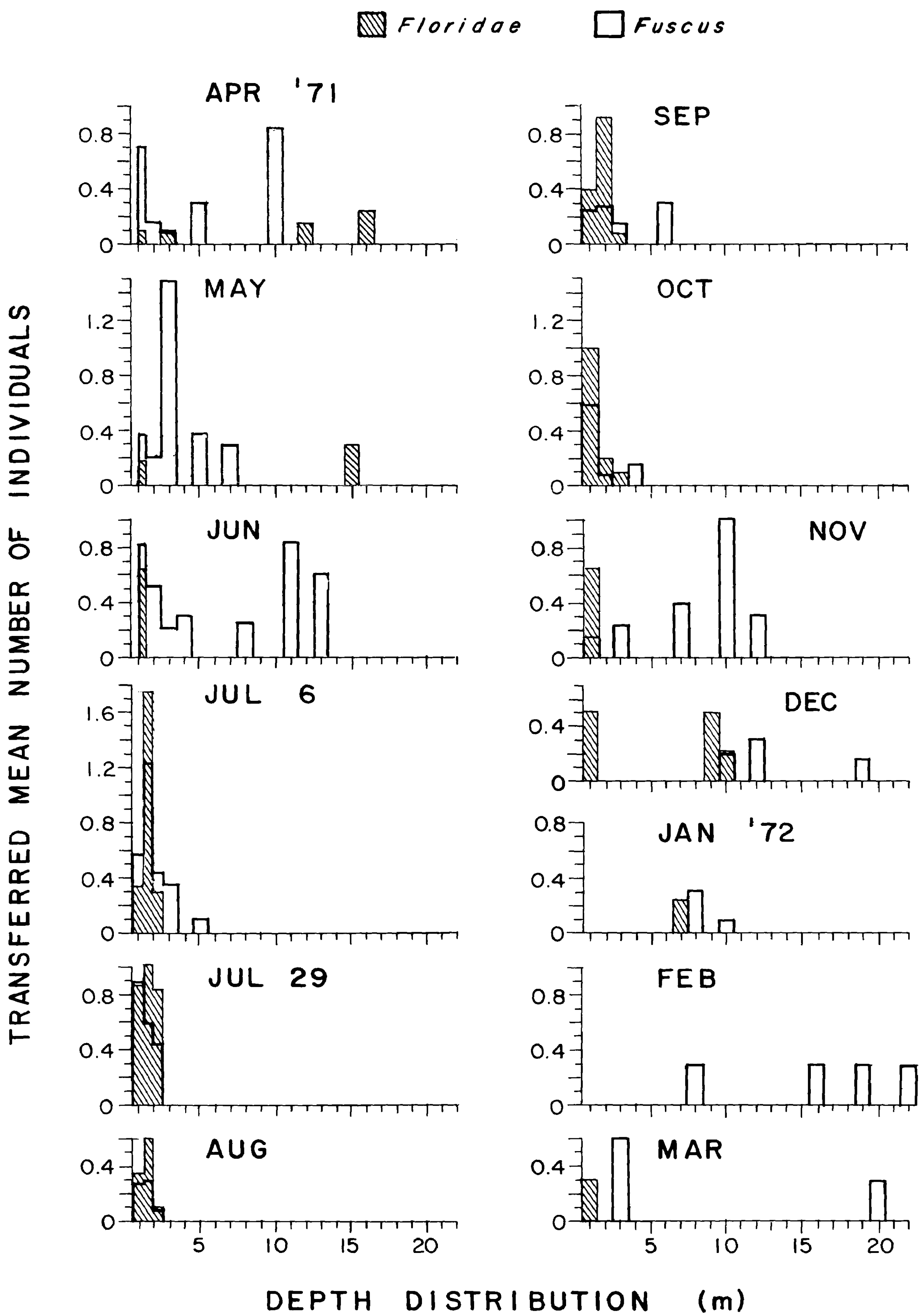
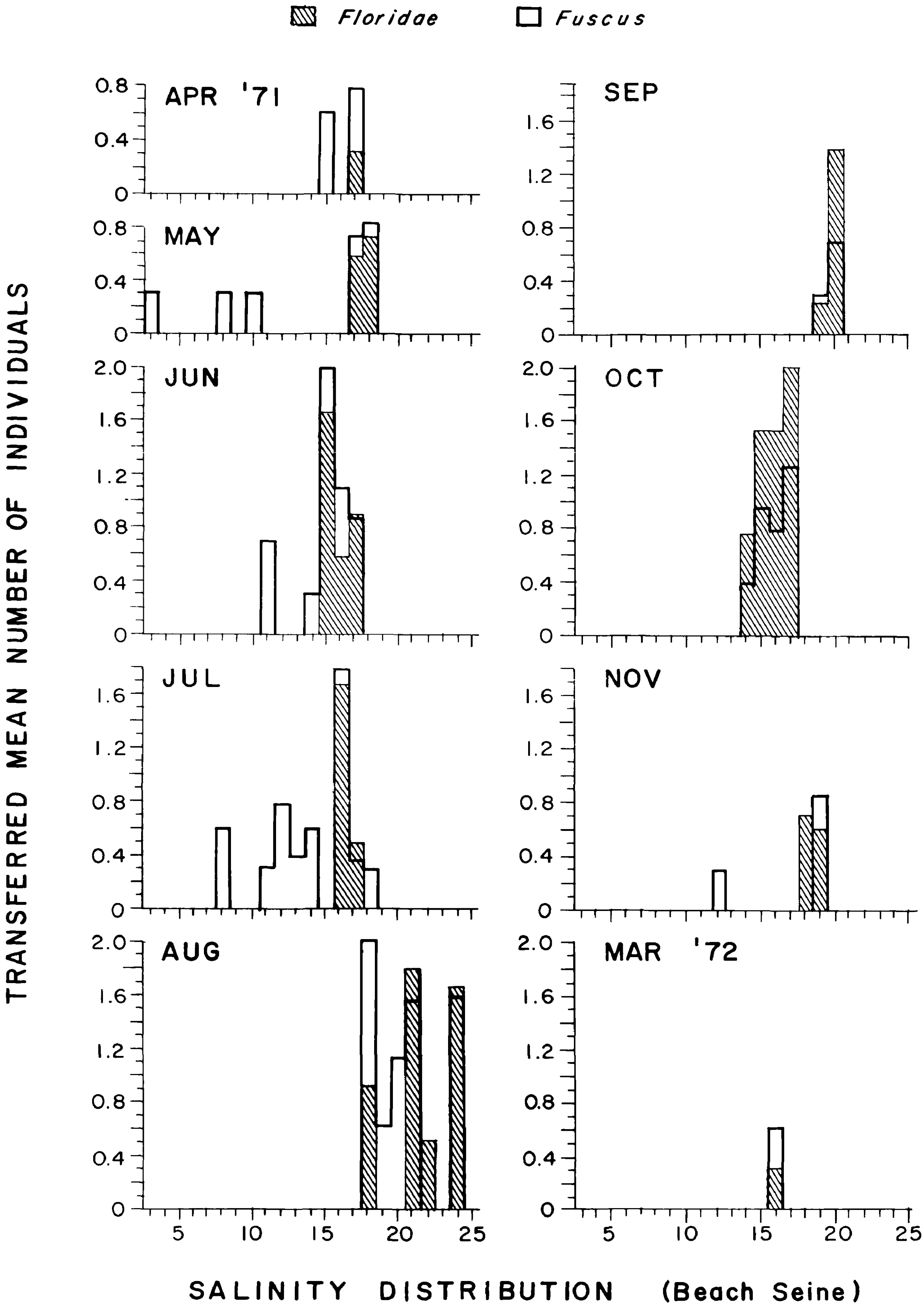

HYDROGRAPHIC DATA
DISSOLVED OXYGEN
15
10
5
0
SALINITY ‰
25
20
15
10
TEMPERATURE °C
35
30
25
20
15
10
5
0
APR JUN JUN JUL JUL AUG SEP OCT NOV DEC JAN FEB MAR
KEY:
SEINE
TRAWL

Figure 3. Depth distribution of S. fuscus and S. floridae by month.



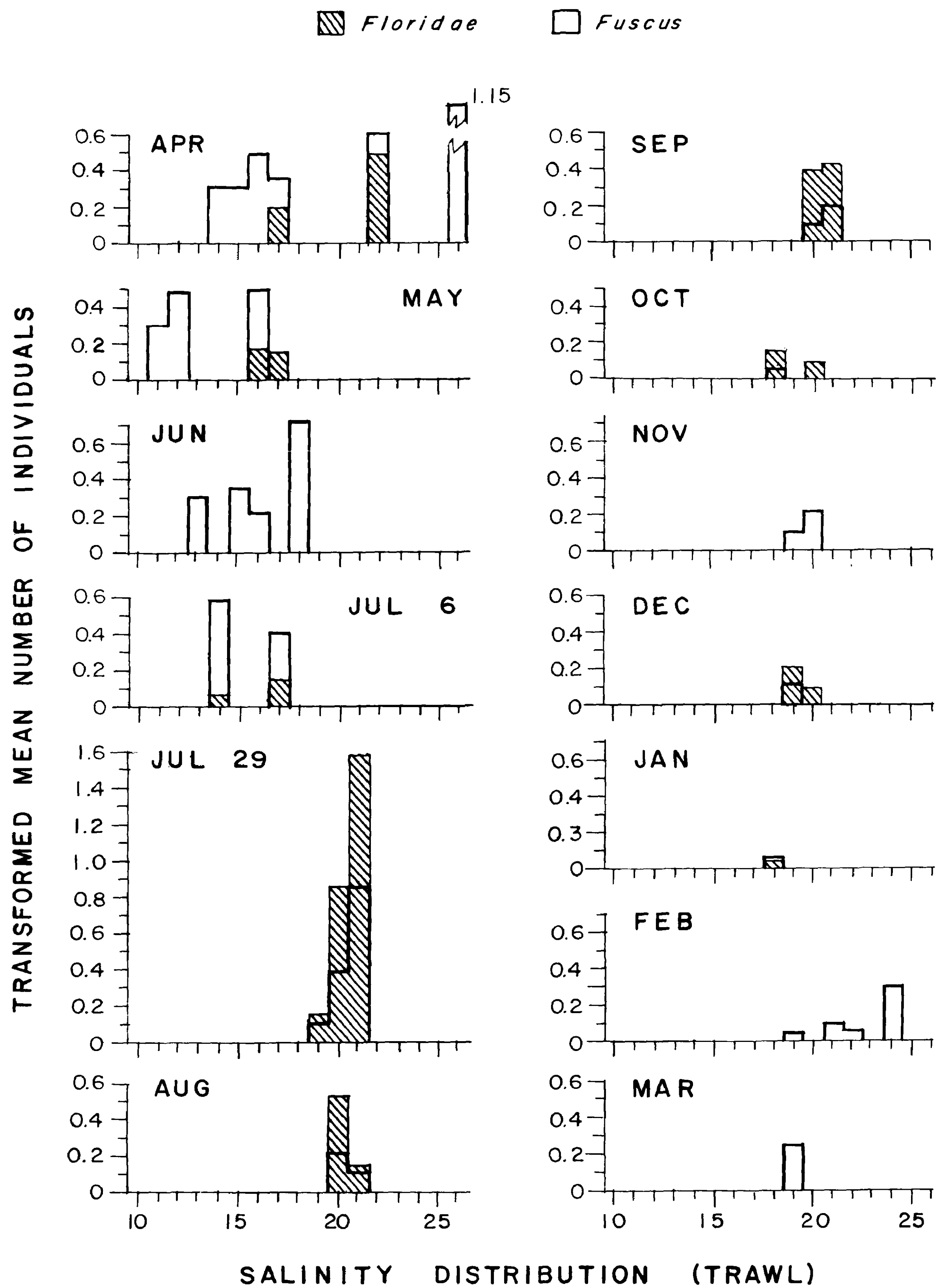
Floridae
Fuscus
APR '71
MAY
JUN
JUL 6
JUL 29
AUG
SEP
OCT
NOV
DEC
JAN '72
FEB
MAR
TRANSFERRED MEAN NUMBER OF INDIVIDUALS
DEPTH DISTRIBUTION (m)

Figure 4. Salinity distribution of S. *fuscus* and S. *floridae* by month for seine stations.



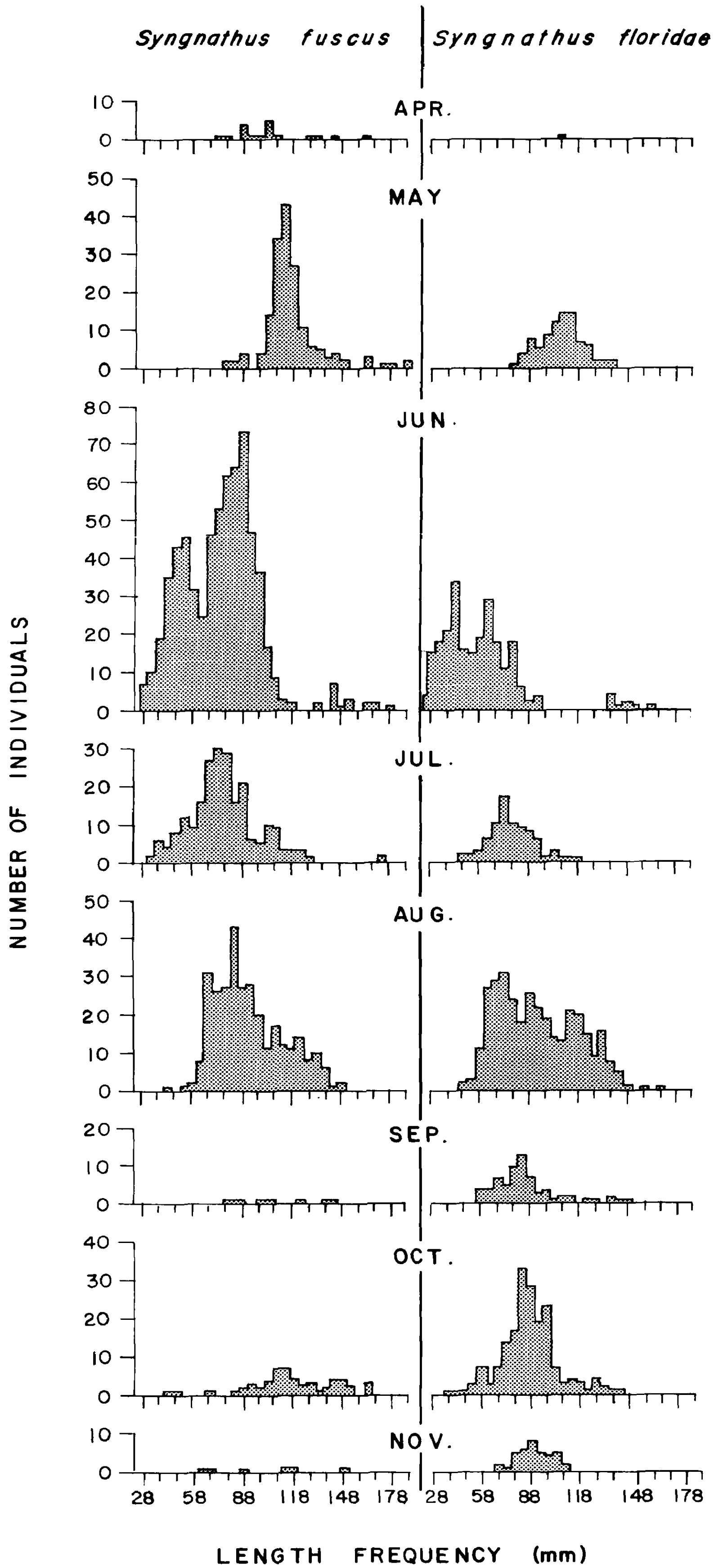
Floridae
Fuscus
TRANSFERRED MEAN NUMBER OF INDIVIDUALS
APR '71
MAY
JUN
JUL
AUG
SEP
OCT
NOV
MAR '72
0
0.4
0.8
1.2
1.6
2.0
5
10
15
20
25
SALINITY DISTRIBUTION (Beach Seine)

Figure 5. Salinity distribution of *S. fuscus* and *S. floridae* by month for trawl stations.



Floridae
Fuscus
APR
1.15
MAY
JUN
JUL 6
JUL 29
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
TRANSFORMED MEAN NUMBER OF INDIVIDUALS
0
0.2
0.3
0.4
0.6
0.8
1.0
1.2
1.4
1.6
10
15
20
25
SALINITY DISTRIBUTION (TRAWL)

Figure 6. Length frequencies of _S_. _fuscus_ and _S_. _floridae_ by month for seine stations.



Syngnathus fuscus
Syngnathus floridae
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
NUMBER OF INDIVIDUALS
28 58 88 118 148 178
LENGTH FREQUENCY (mm)

Figure 7. Length frequencies of *S. fuscus* and *S. floridae* by month for trawl stations.

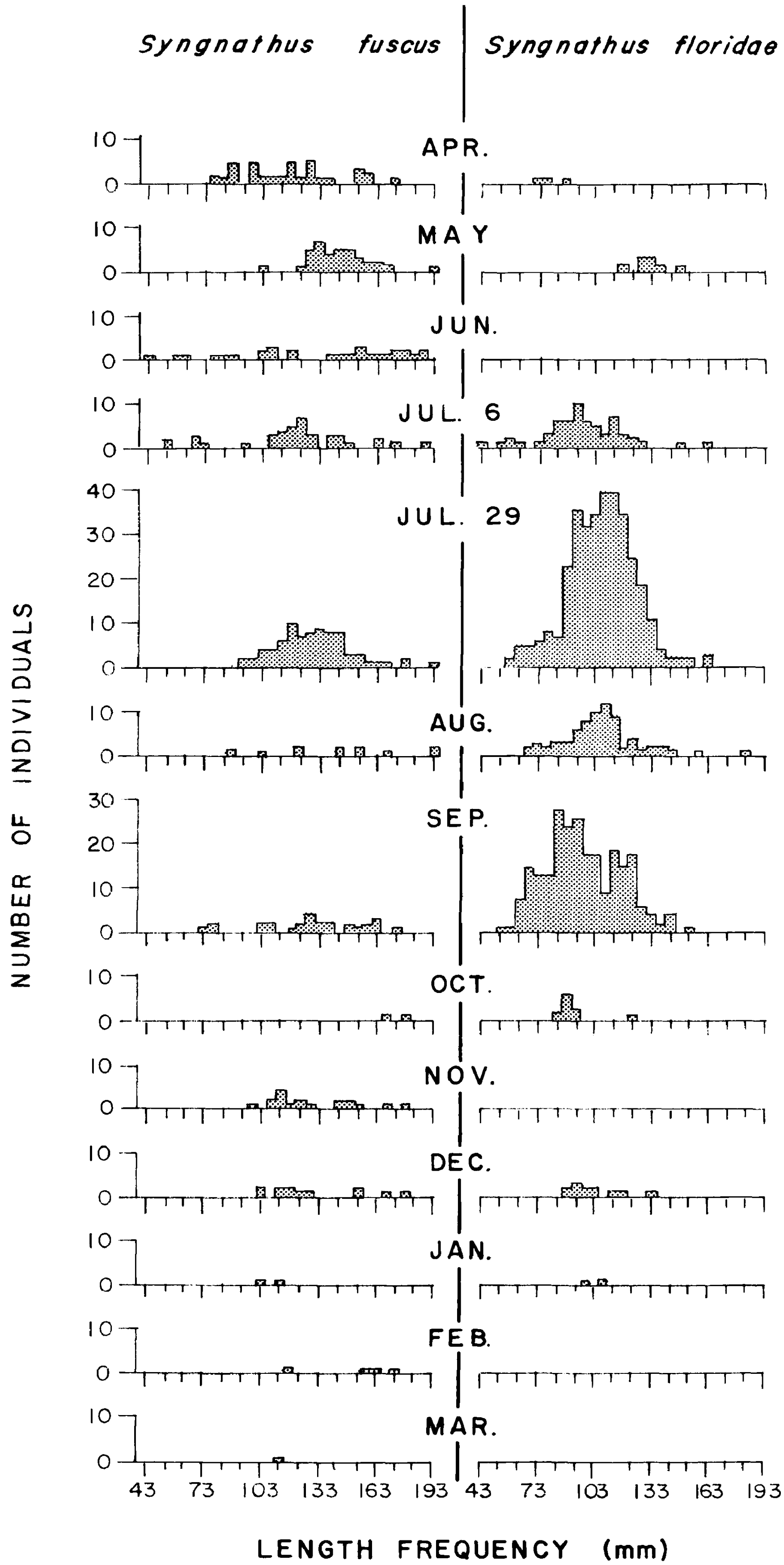

Syngnathus fuscus
Syngnathus floridae
APR.
MAY
JUN.
JUL. 6
JUL. 29
AUG.
SEP.
OCT.
NOV.
DEC.
JAN.
FEB.
MAR.
NUMBER OF INDIVIDUALS
0
10
20
30
40
43
73
103
133
163
193
LENGTH FREQUENCY (mm)

Table 1

The number of male pipefish with and without eggs and larvae in pouch.

	Syngnathus fuscus		*Syngnathus floridae*	
	With	Without	With	Without
May 19	85	6	19	4
June 3	43	1	4	0
June 19	12	7	4	0
July 29	10	0	52	12
August 3	12	2	42	2
August 23	2	0	12	0

Table 2

Sex distribution of _S_. _fuscus_ and _S_. _floridae_ at seine and trawl stations.

	Syngnathus fuscus Seine Number	*S. fuscus* Seine Percent ♂♂	*S. fuscus* Seine Percent ♀♀	*S. fuscus* Trawl Number	*S. fuscus* Trawl Percent ♂♂	*S. fuscus* Trawl Percent ♀♀	*Syngnathus floridae* Seine Number	*S. floridae* Seine Percent ♂♂	*S. floridae* Seine Percent ♀♀	*S. floridae* Trawl Number	*S. floridae* Trawl Percent ♂♂	*S. floridae* Trawl Percent ♀♀
April	16	81	19	44	45	55	1		100	3	33	67
May	166	70	30	-	-	-	88	41	59	-	-	-
June 3	53	83	17	37	59	41	7	43	57	10	60	40
June 19	25	40	60	25	44	56	10	40	60	-	-	-
July	104	9	91	23	22	78	22	27	73	48	31	69
August 3	153	14	86	80	41	59	170	46	54	476	52	48
August 23	18	11	89	12	17	83	17	71	29	72	51	49
September	6	67	33	13	38	62	14	43	57	123	34	66
October	14	21	79	3		100	22	41	59	9		100

Table 3

C_8 values for co-occurrences of _S. fuscus_ with _S. floridae_

Month	Trawl	Seine
April	NS	NS
June	NS	1**
July 6	1*	NS
July 29	.8**	NS
August	.69**	NS
September	.55**	1**
October	NS	1**

* significant at .05 level

** significant at .01 level

NS not significant

Table 4

Stomach contents of *S. fuscus* and *S. floridae*.

Food Item	Frequency	
	S. fuscus	*S. floridae*
Isopods		
Erichsonella attenuata	36	27
Edotea triloba	7	13
Mysids		
Neomysis americana	14	14
Mysidopsis bigelowi	20	49
Amphipods		
Caprella penantis	35	23
C. equilibra	2	1
Paracaprella tenuis	5	2
Cymadusa compta	19	8
Ampithoe longimana	31	1
Jassa falcata	1	0
Elasmopus levis	13	3
Gammarus mucronatus	36	3
Melita appendiculata	10	3
Ampelisca verrili	2	8
Stenothoe minuta	1	1
Sympleustes glaber	1	1
Batea catharenensis	3	0
Cerapus tubularis	1	0
Corophium tuberculatum	1	0
Ampelisca vadorum	4	1
Miscellaneous		
Bittium varium	3	5
Acartia tonsa	9	10
Paleomonetes sp. eggs	0	2
Syngnathus sp.	0	2

VITA

Linda Pushee Mercer

Born in Worcester, Massachusetts, November 17, 1947. Graduated from Narragansett Regional High School in Templeton, Massachusetts, June 1965, B. A. Colby College, June 1969. Employed as an Assistant Marine Fisheries Biologist by the Massachusetts Division of Marine Fisheries from September 1969 to September 1970. Entered the College of William and Mary, School of Marine Science, September 1970 and held a graduate assistantship from that date to the present. Married James L. Mercer in September 1972.