

# Fish Populations In Dense Submersed Plant Communities

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## ABSTRACT

Fish populations of dense submersed aquatic plant communities were studied in several locations in central Florida. Killifish, livebearers, and juvenile centrarchids were the dominant groups of 35 species collected. Extrapolated population parameters ranged from 83 to 619 kg per hectare and from 86,833 to 2,503,693 fishes per hectare. The Margalef species diversity index varied from 2.87 to 6.65.

## INTRODUCTION

Most of Florida's waterways are vegetated with a profusion of aquatic plants. This lush growth flourishes in these shallow, warm waters with low turbidity, readily available nutrients, and a long growing season.

The submersed aquatic macrophytes commonly exhibit a growth pattern of tangled stems and leaves which form a seemingly impenetrable mass of herbage from surface to substrate. The most abundant submersed plant in Florida is the exotic hydrilla, (*Hydrilla verticillata* Royle), which is second only to the waterhyacinth (*Eichhornia crassipes* (Mart.) Solms) as problem plants requiring weed control efforts. Hydrilla was first discovered in the early 1960's in the Tampa Bay and Crystal River areas, and now covers over 50,000 acres in the southern two-thirds of the peninsula. Many other submersed species have a similar dense growth pattern in Florida waters. The most common of these are egeria (*Egeria densa* Planch.), southern naiad (*Najas quadalupensis* (Spreng.) Magnus), coontail, (*Ceratophyllum demersum* L.), cabomba (*Cabomba caroliniana* Gray), bladderwort (*Utricularia vulgaris* L.), broadleaf

watermilfoil (*Myriophyllum heterophyllum* Michx.), and chara (*Chara* spp.). Occasionally eelgrass (*Vallisneria americana* Michx.) also will form extremely dense beds.

Anyone who has passed a dipnet through dense submersed vegetation is aware of the multitude and variety of forage fishes and invertebrates which inhabit this community. However, effective sampling of the fish population is impossible if traditional techniques are utilized. This study was designed to survey the fishes of dense submersed plant communities in Florida using a technique especially designed for that purpose.

## METHODS AND MATERIALS

Fish population samples were taken only from shallow areas where submersed plant communities exhibited dense growth throughout the water column and usually surface matting. Suitable sample areas were further restricted by accessibility and substrate firmness.

The sampling technique employed a miniature modification of the four sided block-off net (2). The net was constructed of fiber glass screen material and 1.9-cm diameter pipe supports. It was designed to encompass an area of 30.4 sq m at a maximum depth of 1.1 m. A detailed discussion of this sampling method is described by Barnett (1). Three 3.04 by 3.04 m samples were collected from 13 different communities in central Florida.

Sampling localities, dates, and plant communities were as follows: Lake Rousseau, October 19 and 20, 1971, hydrilla; Rodman Reservoir, November 5 and 8, 1971, coontail, and August 2, 1972, egeria; Little Lake Conway, January 6 and 7, and August 28, 1972, hydrilla; Hillsborough River, May 10, 1972, egeria; Crystal River, August 9, 1972, hydrilla; Lake George, August 16, 1972, eelgrass; East Lake Tohopekaliga, September 27, 1972, hydrilla; Lake Barton, October 3, 1973, hydrilla; and Lake Pierce, October 25, 1972, eelgrass, coontail and southern naiad.

Fishes were preserved in the field in 10% formalin and transferred to 40% isopropanol in the laboratory. Each sample was separated by species, and for each species the number, total length range in mm and blotted wet weight in grams was recorded. Maragle's species diversity index (3) was computed for each set of three samples.

## RESULTS

The fish populations of these dense aquatic plant communities were comprised of 35 species which were highly variable in their frequency of occurrence (Table 1). Killifish, livebearers, and juvenile centrarchids were the dominant groups. Rarely was a fish larger than 150 mm T.L. (total length) captured, although the largest specimen was a largemouth bass (*Micropterus salmoides* (Lacépède)) 238 mm in length.

TABLE 1. TOTAL LENGTH RANGE AND FREQUENCY OF OCCURRENCE FOR FISHES FROM SUBMERSED AQUATIC PLANT COMMUNITIES IN FLORIDA

Species	Total length range for all samples (mm)	Frequency of occurrence for all samples (%)
Florida gar, <i>Lepisosteus platyrhincus</i> DeKay	174	7.7
Chain pickerel, <i>Esox niger</i> Lesueur	168-264	15.4
Redfin pickerel, <i>Esox americanus</i> Gmelin	136-211	30.8
Golden shiner, <i>Notemigonus crysoleucas</i> (Mitchill)	59-73	7.7
Pugnose minnow, <i>Notropis emiliae</i> (Hay)	30	7.7
Lake chubsucker, <i>Erimyzon sucetta</i> (Lacépède)	17-141	53.9
White catfish, <i>Ictalurus catus</i> (Linnaeus)	40	7.7
Yellow bullhead, <i>Ictalurus natalis</i> (Lesueur)	20-146	38.5
Brown bullhead, <i>Ictalurus nebulosus</i> (Lesueur)	30-123	30.8
Tadpole madtom, <i>Noturus gyrinus</i> (Mitchill)	35-55	15.4
Bluefin killifish, <i>Lucania goodei</i> Jordan	8-44	92.3
Rainwater killifish, <i>Lucania parva</i> (Baird)	11-32	15.4
Golden topminnow, <i>Fundulus chrysotus</i> (Günther)	7-72	77.0
Seminole killifish, <i>Fundulus seminolis</i> Girard	35-94	77.0
Marsh killifish, <i>Fundulus confluentus</i> Goode and Bean	32	7.7
Flagfish, <i>Jordanella floridae</i> Goode and Bean	15-48	15.4
Mosquitofish, <i>Gambusia affinis</i> (Baird and Girard)	5-51	92.3
Least killifish, <i>Heterandria formosa</i> Agassiz	7-31	92.3
Sailfin molly, <i>Poecilia latipinna</i> (Lesueur)	14-78	53.9
Pirateperch, <i>Aphredoderus sayanus</i> (Gilliams)	23-62	7.7
Gulf pipefish, <i>Syngnathus scovelli</i> (Evermann and Kendall)	16-103	7.7
Largemouth bass, <i>Micropterus salmoides</i> (Lacépède)	20-238	84.7
Black crappie, <i>Pomoxis nigromaculatus</i> (Lesueur)	113	7.7
Warmouth, <i>Lepomis gulosus</i> (Cuvier)	25-195	92.3
Dollar sunfish, <i>Lepomis marginatus</i> (Holbrook)	29-81	53.9
Bluegill, <i>Lepomis macrochirus</i> Rafinesque	13-141	77.0
Spotted sunfish, <i>Lepomis punctatus</i> (Valenciennes)	34-160	46.2
Redear sunfish, <i>Lepomis microlophus</i> (Günther)	9-113	61.6
Rebreast sunfish, <i>Lepomis auritus</i> (Linnaeus)	15-83	23.1
Bluespotted sunfish, <i>Enneacanthus gloriosus</i> (Holbrook)	7-61	84.7
Everglades pigmy sunfish, <i>Elassoma evergladei</i> Jordan	16-29	15.4
Okefenokee pigmy sunfish, <i>Elassoma okefenokee</i> Böhlke	11-26	23.1
Swamp darter, <i>Etheostoma fusiforme</i> (Girard)	22-53	69.3
Naked goby, <i>Gobiosoma boscii</i> (Lacépède)	15-38	15.4
Clown goby, <i>Microgobius gulosus</i> (Girard)	13-57	7.7

The average weight for a set of three samples varied from 78 to 586 g which extrapolates to 83 to 619 kg per hectare (Table 2). The average number of fishes per sample set ranged from 85 to 2,327. The latter figure extrapolates to a phenomenal 2,503,693 fishes per hectare. The Margalef species diversity index varied from 2.87 to 6.65.

## DISCUSSION

The dense, submersed aquatic vegetation in the shallows of Florida's lakes and rivers provides habitat for large populations of forage and juvenile gamefish species. In our study areas, livebearers and killifish usually comprised more than 80% of the population by number, with mosquitofish (*Gambusia affinis* (Baird and Girard)), least killifish (*Heterandria formosa* Agassiz), and bluefin killifish (*Lucania goodei* Jordan) being the most abundant species. Piscivorous fishes were rarely numerous within the plant beds, although groups of largemouth bass were frequently observed at the periphery of dense vegetation.

Fish biomass in these areas usually averaged between 160 and 315 kg per hectare, and this parameter exhibited considerably less variation than the average number of fish per sample. These figures can be compared to common sampling results in which 1.0 acre block-net collections from littoral areas in Lake Tohopekaliga, Florida yielded 1,000 to 10,000 fishes (approximately 2,500 to 25,000 per hectare) and between 150 and 200 lb per sample (165 to 220 kg per hectare) (4). Thus, total fish production in dense vegetation is comparable to, or in some instances exceeds production in more sparsely vegetated lake habitats.

Sampled plant communities had similar fish populations with the exception of the two eelgrass samples. Eelgrass communities supported fewer fishes, especially killi-

fish and livebearer species, and they had a higher species diversity index. The eelgrass beds were less dense than those of other plant species, consequently forage fishes were more vulnerable to predation.

In central Florida, most submersed aquatic plants often form dense, surface-matted beds from late July to early January when cooler temperatures usually kill the plants back to the substrate. Between July and January, forage fishes within these beds are relatively inaccessible to predators, allowing them to greatly expand their population. When the dense vegetation dies in winter, tremendous populations of forage fishes become available for predation. This phenomenon is undoubtedly significant in the fish population dynamics in waters where submersed vegetation is abundant.

This study indicates that dense submersed aquatic plant communities contain greater numbers and biomass per unit area than most of Florida's other aquatic habitats. Recommended topics for further research include: intensive ecological surveys of these communities, the contribution of these communities to piscivorous gamefish production, and the management of submersed vegetation to maximize the fishery harvest.

## LITERATURE CITED

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TABLE 2. POPULATION PARAMETERS FOR FISHERIES FROM SUBMERSED AQUATIC PLANT COMMUNITIES.

Sample location	Plant community	Weight per sample (g)	Extrapolated kg per hectare	Average number per sample	Extrapolated number per hectare	% composition of killifish and livebearers by number	Species diversity index
Lake Rousseau	hydrilla	296	312	1,368	1,471,552	90.0	4.15
Little Lake Conway	hydrilla <sup>a</sup>	185	196	1,017	1,094,546	98.6	2.87
	hydrilla <sup>b</sup>	151	158	297	297,712	86.0	4.41
	coontail	196	207	1,110	1,194,559	92.1	4.54
Rodman Reservoir	egeria	189	199	598	643,729	83.8	4.30
	egeria	417	441	2,327	2,503,693	94.6	3.64
Hillsborough River	hydrilla	586	619	1,909	2,053,632	96.1	4.26
Crystal River	hydrilla	109	116	117	126,207	49.8	5.89
Lake George	eelgrass	78	83	240	258,547	50.4	3.85
East Lake Tohopekaliga	hydrilla	270	285	426	458,348	95.3	3.22
Lake Barton	hydrilla	187	198	85	86,833	45.4	6.65
	coontail	269	284	409	439,734	86.3	3.24
	naiad	237	251	838	901,307	77.8	3.82

<sup>a</sup>Samples collected in January, 1972.

<sup>b</sup>Samples collected in August, 1972.