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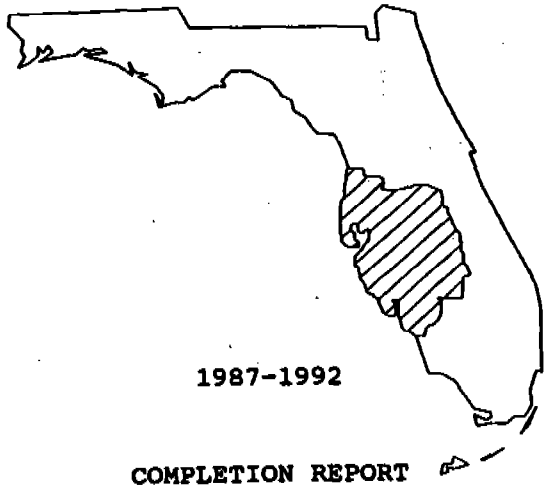
STATE OF FLORIDA

GAME AND FRESH WATER FISH COMMISSION



1987-1992

COMPLETION REPORT

SOUTH REGION FISHERIES MANAGEMENT

NOVEMBER 1992

Study Title: REGIONAL SERVICES

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ACKNOWLEDGMENTS

We sincerely thank all personnel with the Florida Game and Fresh Water Fish Commission who provided valuable assistance with this study. Special appreciation is extended to Lt. Col. J. O. Brown, Regional Director-South Region; Mr. William (Buck) Wegener, Section Leader-Regional Fisheries, and Mr. Tom Vaughn, Bureau Chief-Fisheries Management.

LIST OF TABLES

STATE: Florida PROJECT NO.: 6210

PROJECT TYPE: Management STUDY NO.: 6215

PROJECT TITLE: South Region Fisheries Management

PERIOD COVERED: 1 July 1987 through 30 June 1992

STUDY TITLE: Regional Services

STUDY OBJECTIVES: To provide through various means the information or services required to meet the needs of fishery resources management.

ABSTRACT

This on-going study provided fishery management, public assistance, technical input, environmental protection, and educational programs to a 13-county region with 3.5 million residents, 30% of whom are anglers. Formal presentations were provided to 80 groups. Over 300 media contacts were made through print, radio, and television. Coordination with other projects of the Florida Game and Fresh Water Fish Commission (GFC) and local, regional, state, and federal agencies was done to protect, enhance, and provide public access to freshwater fishery resources. Field surveys were conducted on 190 public waterbodies and various management programs were implemented. Results from two investigations were published in technical journals. Owners of private ponds were assisted in management of recreational fisheries, and a detailed brochure was developed to facilitate the educational process. Fish kills occurred on 60 occasions that were investigated, documenting a total loss of 20,331,018 fish. Mercury tissue analysis was conducted on fish from 13 lakes and rivers, of which 10 had levels that warranted issuance of a public health advisory.

INTRODUCTION

The South Region of the Florida Game and Fresh Water Fish Commission is composed of 13 counties (Table 1), populated by 3.5 million residents, of which 30% enjoy freshwater fishing (U.S. Fish and Wildlife Service 1989). More fishing stamps are issued from Polk County than any other county in the state. Freshwater angling opportunities are abundant with 1,645 natural lakes over 4 ha in size, thousands of smaller public and private ponds, 12 major streams, and six major reservoirs. Most natural lake systems are located in the eastern portion of the region; while most people live along the west coast. Urban centers include: Tampa/St. Petersburg, Bradenton/Sarasota, and Ft. Myers. As is the case with other areas of the state, the South Region has experienced rapid growth; and the population has increased over the past decade by 33% (Florida Statistical Abstracts 1991). Providing freshwater angling access to this populace, especially coastal residents, is a primary objective of the Regional Services Study.

Strip-mining operations in Polk, Hardee, Manatee, and Hillsborough counties have had significant environmental impacts that need to be further documented. A positive effect of this industry has been the creation of thousands of hectares of additional angling opportunities. Gaining public access to these phosphate "pits" is another study goal to increase angling opportunities within the region. Evaluation of management programs implemented on these waters is needed to understand how to maintain quality-angling and develop lake design criteria for reclamation.

Management of natural lakes is a major challenge in the face of many pressures such as; cultural eutrophication, exotic aquatic plant and animal

invasions, lake shoreline development with resulting loss of littoral habitat, and declining lake levels that result from deficit rainfall and groundwater withdrawals. Rapid population growth has resulted in degradation of fisheries habitat as well as significant increases in fishing pressure that togather, threaten to degrade fish population structures and fishing quality.

This study provides on-going services to the general public that addresses all the diverse challenges mentioned above by integrating various activities such as public education, technical assistance, inter/intra-agency coordination, fish population evaluation and management, lake management and restoration, environmental impact documentation, and angler access. The objective of this study is to conserve fisheries resources within the region while meeting increasing needs of the public, as well as the desires and expectations of fishermen.

MATERIALS AND METHODS

Educational and technical information was disseminated through telephone contacts, lectures, public meetings, news media, written correspondence, brochures, exhibitions, and intra/inter-agency coordination. Field surveys to evaluate fish populations and aquatic habitat were made of various waterbodies upon request from the public and applicable recommendations were provided. Various sampling equipment and procedures were utilized to determine status of selected public lakes and rivers. Management programs such as fish stocking, fish feeders and attractors, habitat manipulation (e.g., vegetation transplanting and control, water level fluctuation, and fertilization), commercial haul seine operations, angler access, and regulations were

implemented as needed. Fish kills, pollution spills, and other environmental impacts were investigated.

Black crappie (Pomoxis nigromaculatus) populations from 10 lakes were sampled with a 4.6-m otter trawl. Various lake parameters (e.g., trophic state, macrophyte abundance, fish stocking history, and community balance) were evaluated to determine relative association with crappie population dynamics.

FINDINGS AND DISCUSSION

Public education and intra/inter-agency coordination

Regular contact with the public occurred by telephone and written correspondence, meetings, talks and presentations to various groups, proactive and reactive contact with the print, radio and television media, and interaction during field work. Prepared presentations were provided on over 80 occasions. Each year, the Florida State Fair exhibit was prepared and staffed. The exhibit underwent extensive improvement in 1988 when a 5,700 liter display tank was constructed. In addition to making over 300 media contacts, 30 news releases were distributed and assistance was provided to two public broadcasting stations filming documentaries on the Peace and Myakka rivers. A brochure was developed to assist private pond owners with managing their waters for recreational fishing. Mass production of this brochure for distribution state-wide should be completed in 1993 as funding allows. Fish kill causes and prevention was the theme of another publication that was developed and sent to individuals reporting fish kills.

Many local, regional, state, and federal agencies requested technical assistance and input. Examples included: planning agencies developing comprehensive plans, phosphate mine permitting and reclamation, development of management plans for specific waterbodies, adoption of lake fluctuation schedules by water management districts, review of Development of Regional Impact applications. Enactment of the Surface Water Improvement and Management Act in 1987 required extensive involvement in priority list development, input to technical advisory committees, and plan review. Review of aquatic plant control work plans and permits was done to ensure that weed control projects administered by the Department of Natural Resources (DNR) did not negatively-impact fish habitat in public lakes.

Regional Services also aided many Commission projects of all Divisions and Offices. Assistance with the production of Morone species was provided every spring both in brood stock collection and hatchery activities. Coordination and initial development of the Tampa Bay Urban Pond Project (6660) was accomplished from 1987 through 1991. Assistance to this project continues with field operations and project administration. Coordination of boat ramp repairs and acquisition of new sites has required additional manpower during the past three years. The region lists a total of 36 boat ramps as of the end of this study. Besides transfer of 0.6 man-years for direct coordination, administration over the boat ramp project takes significant time. Progress reports for the boat ramp project are contained in South Region Annual Reports from 1987 through 1990. Reporting after 1991 is accomplished by the Statewide Boat Ramp Project (6333).

Private pond assistance

The service of providing fingerling game fish to private ponds ended in 1989. This program was designed to assist pond owners in developing recreational fishing ponds so total angler pressure subjected to public waters could possibly be reduced. Considering the number of private ponds scattered within the region, this was a meritorious objective. Evaluation of the effectiveness of the program was investigated as part of a statewide study reported by Young and Crew (1988). Twenty ponds stocked in the South Region during the mid-1980's were selected and surveyed. Most ponds did not produce satisfactory fisheries, and it was concluded that this was due to the pond owner's failure to follow advice provided by the biologist. When fish were available free of cost, pond owners did not care to expend necessary effort to manage the pond correctly. They mistakenly believed when fishing declined, they could simply get more fish from the Commission. Many ponds in the South Region were being stocked at the request of large development companies, who did not pass on any of the recommendations to the management organizations. For these reasons and the increased availablity of sportfishes provided by private hatcheries, it was decided that the original objective would remain; however, our approach would concentrate on education of the pond owner and not include stocking private ponds. Technical assistance would be provided as requested and field surveys would be made as time allowed. A detailed pond management brochure was developed that will help educate pond owners. Since this brochure was completed, over 400 have been distributed in the South Region. By elimination of the stocking program, it is hoped that pond owners will be more inclined to follow management recommendations, since they have invested their own money in the fish. This approach may result in a higher

percentage of private ponds supporting quality sportfisheries.

Public Lake Management

Management of public lakes encompassed many activities such as: fish stocking (Table 2), construction of 41 brush attractors at 23 lakes by the Fish Attractor Project; (6290; Table 3), transplanting bulrush into 8 lakes (Table 3), haul seine harvest of nongame fishes from 12 lakes (Table 4), placing automatic fish feeders in lakes to increase angling success, and conducting routine sampling to evaluate status of the fishery and provide information and recommendations. A total of 190 waterbodies were surveyed during this study, and resulting data or documentation is on file at the South Region office. Fish population sampling of the Weeki Wachee River is reported in detail in Appendix 1. Significant findings concerning specific management techniques and waterbodies are discussed below.

Haul Seine Program

The haul seine program was started in the South Region in 1972 to develop commercial fisheries in public lakes for the harvest of blue tilapia (Oreochromis aurea), catfish (Ictaluridae), and other nongame species. As a management tool, early operations also harvested bream from hypereutrophic lakes in an effort to restore population balance. Commercialization of the bream (Lepomis sp.) catch was not allowed, however. Currently, five permits are issued and haul seines are allowed under specific guidelines on 12 public lakes. Most effort is exerted on six of these lakes. Effective operations occur on those lakes with the highest trophic state, with even bottoms overlaid by thick organic sediments. Table 4 shows annual harvest reported by the operators from 1985 through 1991. Average harvest over this period was

239,620 kg with a market value of $109,270 (Table 4). Comparison with harvest data from 1972 through 1977 shows that annual harvest has declined by 27% (Langford et al. 1978). Market price has remained stable at $0.25/pound for nearly 20 years, and economics of tilapia is market limited. If market demand increases in the future, effort and harvest of tilapia will also increase. It appears the tilapia market is frequently flooded by castnet catch, and haul seine operations are used to fill large orders. These operations are small, family-owned and are unable to expand the market.

Fish Feeder Program

The South Region fish feeder program includes five parks, with a total of 12 feeders in operation (Table 3). The program is a cooperative effort with county parks to increase bank angling success by concentrating fish around feeders. Feeders are purchased by the GFC and after installation, cooperating agencies are responsible for maintaining feeders with feed and batteries. Periodic inspections are done to ensure proper operation and cooperator compliance. Most cooperators have done a good job maintaining their feeders, and they quickly notify regional personnel when major repairs are required.

Limited supplemental stocking of catfish and corrective stocking of largemouth bass (Micropterus salmoides) has occurred at some sites to enhance fisheries. Signs and brochures with fishing tips were placed at all sites to inform anglers about feeders and aid fishing success.

Public utilization has been high at most sites. As part of an angler survey at Medard Park, 52% of all bream and catfish anglers who were asked if they knew about feeders indicated they did and knew of their purpose. Similar

results were documented at Saddle Creek Park (Champeau et al. 1991b). These findings indicate the importance and need for continued public education.

Fish feeder brochures were revised and continue to be distributed to the public. Educational information is an important aspect in the success of the feeder program. With continued public awareness and cooperator assistance, this program will be expanded to other sites. Additional effort will be directed to document levels of utilization and effects of feeders on success rates.

Black Crappie Investigations

Factors affecting black crappie recruitment and growth are poorly understood. Twelve lakes, chosen for differences in biotic and abiotic conditions, were sampled by otter trawl in fall 1991 in the South Region. Nine lakes within the region were sampled in fall 1990. A large data base (3,500 crappie collected) is being analyzed to assess the importance of various habitat components affecting black crappie recruitment and growth rates. Lake size, conductance, pH, turbidity, and nutrients are being evaluated as abiotic limiting factors. Primary productivity, aquatic macrophyte coverage, and presence of stocked sunshine bass are being evaluated as possible biotic limiting factors. Knowledge of the importance of these components may allow managers to predict long-term population dynamics and impliment appropriate management strategies to better utilize this resource.

Otter trawl catch rates ranged from 0 to 269 crappie per tow (Table 5), and appear to provide a reasonable indication of relative abundance. Most size ranges were collected with reasonable efficiency. Large numbers of young-of-year crappie were captured in some lakes along with good numbers of

large crappie (up to 375 mm).

Age structure analysis of various populations is incomplete, but when available will be used to develop an index of relative quality of crappie populations with regard to sport fishing interests. The index will closely parallel one developed by Colvin and Vasey (1986) to assess white crappie (Pomoxis annularis) population dynamics using trap nets as sampling gear. The trawl used in this study collects the same type of data as obtained by the trap nets. Trawl sampling may, however, be more effective in capturing young-of-year black crappie. This index when generated will yield a single value that will allow a simplified comparison of a wide range of population dynamics to individual habitat components.

Samples from lakes Gibson and Mattie documented excellent black crappie populations. High abundance with wide size ranges are indicative of good reproduction, survival, growth, and recruitment. Both lakes are tannin-stained, of moderate size, and receive high fishing pressure for crappie. Lakes with the largest sample size, Lake Hollingsworth and Lake Thonotosassa, are hypereutrophic and are being studied for possible restoration. Both appear to have one or two year classes dominating the population, indicating periodic recruitment problems. Lake Thonotosassa had a high Proportional Stock Density (PSD = 73) in 1990; however, this result is based on a small number of crappie longer than 13 cm (n = 43). The remaining 77% of the sample was comprised of fish shorter than 13 cm. Both lakes are currently characterized by low PSD, but may periodically produce quality crappie fisheries for short periods of time. Lakes where few crappie were collected by trawl were characterized by tannin-stained water with continued low water levels due to recent drought conditions. One exception is Lake Julianna,

which is very eutrophic and has relatively stable water levels. These lakes had high PSD values indicating poor recruitment over a substantial period of time.

This evaluation appears to have potential to indicate specific factors with management implications that limit black crappie recruitment and growth rates. An additional benefit of this project is to provide basic population data to interested anglers, a product not available prior to this effort.

Saddle Creek Park Fish Management Area

Complaints about poor fishing success for largemouth bass and bream resulted in detailed evaluation of the fishery, and development and implementation of a management program designed to improve fishing quality. Reduction in bass harvest was necessary to improve population structure and standing stock. Increased predation pressure would then improve stunted bream populations. A slot length limit was implemented in 1987 that protected bass between 330 and 508 mm in length. Brush attractors, fish feeders and bulrush transplants were used to concentrate bream, thereby increasing vulnerability of bream to bank angling. Channel catfish (Ictalurus punctatus) were stocked to provide an additional recreational species, and all harvest methods exclusive of hook-and-line were prohibited. Bass population structure improved dramatically (Table 6), and bass biomass increased by an estimated 46%. Angler success almost doubled and average length of the catch increased. Bream success and harvest also increased; however, no change in bream population structure was documented. Anglers favored the regulation before and after implementation. A negative finding was the decrease in trophy-size bass in Saddle Creek. Abundance of bass greater that 20 inches steadily

declined after the regulation went into effect, and fishing mortality was not believed to be the cause. It was speculated that a decrease in forage caused by the change in bass population structure and density slowed growth rates of slot-size bass and reduced recruitment to trophy sizes. Beginning in July 1992, the slot limit will be modified to protect bass between 355 and 457 mm. This will hopefully result in higher harvest of sub-slot bass and enough larger bass, to allow an increase in growth rates. The effects of the management program at Saddle Creek were evaluated from 1984 through 1991 (Champeau et al. 1991b) and follow-up sampling will continue under the Regional Services Study to document effects of the modified regulation.

Myakka River

Evaluations of fish populations and aquatic plant communities in upper and lower Myakka lakes documented the need for annual herbicide treatments to control hydrilla. During the past two decades, hydrilla often totally covered these lakes. Since 1988, springtime applications of floridone has resulted in excellent control. This river system drains a large area, and these treatments must be made when flows are lowest. The lakes flush quickly early in the summer. Length-frequency data for largemouth bass, bluegill, and redear sunfish showed favorable improvement in 1990, one year after hydrilla control was achieved. By working closely with DNR, Southwest Florida Water Management District (SWFWMD), and the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida, a cost-effective aquatic plant control program was developed that has improved boater access and fishery quality in this system. Detailed reports of these evaluations are in the 1987-88 and 1989-90 annual reports (Champeau et al. 1988b, 1990).

Peace River

Detailed evaluations of the fish community in Peace River were conducted from 1982 through 1987 (Champeau et al. 1988a). Portions of this study were published in the Florida Scientist (Champeau 1990). Since 1987, annual sampling continued as part of the Statewide Streams Study. Trends observed during this period were similar to those documented during the earlier study. Inputs from degraded lakes and tributaries upstream have a significant negative impact on the ecology of the system, evidenced by lower species diversity and dominance of pollution-tolerant species. Dilution from higher-quality streams downstream allowed conditions to improve, and increased species diversity (Table 7). Abundance of sport fishes increased downstream and supported a good fishery. Heavy rainfall during spring and summer of 1991 maintained high river stages for the longest period experienced since 1982. During most of the study period, the region experienced low water conditions. Increased river stage during 1991 allowed prolonged inundation of the floodplain and restoration of flow from many higher order streams to the main channel. The fish community responded in dramatic fashion, with high production resulting in record abundance in fall 1991 (Table 7). Drought conditions returned after the 1991 rainy season, and effects of this will be evaluated next fall. While high river levels are needed to maintain a healthy ecosystem, improving quality of upstream tributaries through lake restoration, wetland filtration, and phosphate reclamation is needed to reduce pollutant loads to the river and areas downstream to Charlotte Harbor. Protection of higher-quality streams in Hardee and Desoto counties from the effects of urban and agricultural development and phosphate mining must be accomplished to

allow continued dilution that enables a more functional ecosystem to exist downstream.

Lake Maggiore

The city of St. Petersburg and the SWFWMD requested our input to a technical committee and assistance with a diagnostic/feasibility study funded by the Pinellas/Anclote Basin Board. The goal of the study was to initiate development of a management plan to improve water quality, aquatic habitats, and fish and wildlife resources in this 153 ha urban lake. During fall 1990, four, 0.4 ha blocknet samples were taken to document the status of the fishery. This hypereutrophic lake has received considerable attention from the Regional Fisheries Project for many years, and this was the first occasion that city and SWFWMD officials assumed an aggressive posture to improve the lake. Fish community structure was similar to previous data, with an unique assemblage of exotic, marine, and freshwater species. The lake's advanced trophic condition favored omnivorous fishes, and sport fish populations were of poor quality. More young bass were collected than ever before, and this may have been due to a brief abundance of hydrilla at the time of sampling. Hydrilla disappeared soon after, perhaps as a result of high winds and resulting turbidity. Since then, hydrilla has not returned to the lake in any significant abundance. Findings and recommendations were reported to the Lake Maggiore Technical Committee (Champeau et al. 1990). This lake requires extensive in-lake restoration to remove organic sediment and rehabilitate the littoral shelf. Stormwater inputs must also be reduced to improve water quality. The city has initiated several minor projects to reduce cattail growth; however, no required improvements can be made until significant

funding is provided. The city has approached SWFWMD for SWIM funds and the Environmental Protection Agency for federal funds. The Regional Project recommended Lake Maggiore to the Lake Restoration Section in 1991 and 1992.

Lake Seminole Fish Management Area

Pinellas County and SWFWMD requested the Regional Fisheries Project to assist with data collection and management plan development for this 283 ha hypereutrophic lake. Funding was provided by the Pinellas/Anclote Basin Board. The Regional Project received funds to conduct a recreational use survey. Fish population sampling was provide by in-house funds. Concern over this lake is not new; however, funding to address the lake's problem is new and provided an opportunity to improve fishery quality, which has degraded in recent years. The bass population was fair, although angling success was not good. Population structures, angling effort and success for panfish species was poor (Champeau et al. 1991c). Besides hypertrophy, Lake Seminole lacks quality aquatic macrophyte communities. Dense cattail monocultures dominate the littoral shelf. Although hydrilla was abundant enough to provide some fisheries habitat, bass recruitment was low. It is possible that poor quality habitat resulted in inadequate spawning success. A significant change occurred in the macrophyte community during 1991 after stocking triploid grass carp at 17 fish/ha (62 fish/vegetated ha). Hydrilla coverage went from 90 ha in 1990 to zero by 1992. This loss was offset by a rapid expansion of Vallisneria americana from 5 ha in 1990 to 100 ha in 1992. It is hoped that eelgrass will continue to thrive and provide superior habitat to replace hydrilla. Input to the Lake Seminole Management Committee as a voting member continues. The diagnostic/feasibility study has been completed, and a

consultant will be hired to develop a comprehensive management plan for the lake and surrounding watershed. The Regional Fisheries Project recommended a lake level drawdown to facilitate removal of organic sediments, scrape cattail monocultures, and rehabilitate the littoral shelf. This lake was submitted to the Lake Restoration Section for consideration in 1992. Additional work needs to be done to develop a drawdown project and will require support from the Lake Seminole Management Committee. The scope of work to be accomplished by the consultant does not involve any tasks necessary to develop a drawdown/ revegetation project.

Studies involving other waterbodies initiated under this study included: Lake Tarpon Fish Management Area Evaluation (Champeau et al. 1991a); Medard Park Evaluation and Management (Champeau et al. 1992); and, Webb Lake Fish Management Area Drawdown Evaluation (Champeau et al. 1992). Results from angler survey data for Lake Tarpon were incorporated in a manuscript entitled "Voluntary release of largemouth bass by Florida anglers" that was presented at the 45th Conference of Southeastern Association of Fish and Wildlife Agencies in 1991 and will be published in the proceedings of the conference (Champeau and Thomas in press).

Environmental Impact Investigations

The Regional Services Study was involved in many investigations of activities involving environmental impact. Coordination with the Environmental Enforcement Section of the Division of Law Enforcement, as well as various local, regional, state, and federal agencies involved technical input, field inspections, support documentation, and expert testimony at legal proceedings. While types of environmental impacts were very diverse, major

investigations under this study included fish kill documentation (Tables 8 and 9) and evaluation of mercury contamination in fishes (Table 10). Fish kills reported during 1991-92 are listed in Table 8 and most were caused by low dissolved oxygen. Levels of mercury in largemouth bass from 10 out of 13 waterbodies tested had levels within the limited consumption range from 0.5 to 1.5 mg/kg established by the Department of Health and Rehabilitative Services, and public health advisories were issued (Table 10).

CONCLUSIONS AND RECOMMENDATIONS

The Regional Services study is an extremely valuable program to manage fisheries within the South Region and to serve and educate the general public. This study provides the "first-line" of service and benefits many anglers and non-anglers receive. Many problems, goals, and strategies specified in the Commission Strategic Plan are addressed under this study.

Recommendation: The Regional Services study should be continued indefinitely.

Manpower demand for this study is increasing as the region grows. Since 1980, an additional 870,000 people live in the region which relates to 260,000 more fishermen utilizing the same (if not less through degradation) amount of fishery resource. Administration and intra/inter-agency coordination have increased significantly as well. However, during the same period, manpower provided to the South Region Management Project has gone from 6.0 man-years to 4.1 man-years. It is expected that additional manpower for boat ramp coordination will take an additional 0.4 man-years, leaving the project with 43% less manpower than 10 years ago. Intensive management of specific

waterbodies or evaluations of specific problems or management techniques must be sacrificed to satisfy demands currently under Regional Services. This threatens to reduce the effectiveness of the Regional Management Project.

Recommendation: An additional 2 man-years should be provided to the South Region Management Project. One of these positions should be classified at the Biological Scientist IV level to assist the Regional Administrator with supervision of field operations and project personnel, development of work plans and preparation of reports.

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TABLE 1. South Region counties, number of natural lakes (>4 ha), total area of named la (ha) and population size.

County	Total Number of Natural Lakes[a]	Total Area of Named Lakes (ha)[a]	Population[b]
Charlotte	145	87	100,959
Desoto	41	56	23,865
Glades	13	163	7,591
Hardee	3	2	19,499
Hernando	130	1633	101,115
Highlands	95	19,603	68,432
Hillsborough	238	2,606	834,054
Lee	88	264	335,113
Manatee	19	401	211,707
Pasco	300	2,883	281,131
Pinellas	38	1,448	851,659
Polk	550	32,763	405,382
Sarasota	15	569	277,776
Total:	1,675	62,478	3,518,283

[a] From Gazatteer of Florida Lakes (Shafer et al. 1986)
[b] From Florida Statistical Abstracts (1992)

TABLE 2. South Region public lake fish stocking record, 1988-1992.

County	Lake	Size (ha)	Species	Number of Fish Stocked Per Year				
				88	89	90	91	92
Char.	Gulf Cove	132	Sunshine Bass*					3250
High.	Francis	121	Sunshine Bass*	1500				
High.	June-in-Winter	1418	Sunshine Bass*					35040
Hill.	Dover Park	6	Sunshine Bass*			320		
Hill.	Horizon Park	2	Sunshine Bass*				100	
Hill.	Medard Park	243	Sunshine Bass*		6000		6000	6000
Hill.	Tampa-By-Pass	73	Sunshine Bass*	2000	2000	2000		6000
Hill.	Thonotosassa	324	Sunshine Bass*		8000		8000	
Mana.	Evers	162	Sunshine Bass*	2000	2000	4000	2000	4000
Mana.	Manatee	1012	Sunshine Bass*	25000		25000	10000	10000
Pine.	Alligator	31	Sunshine Bass*		2630			800
Pine.	Belleview	40	Sunshine Bass*				400	
Pine.	Crescent	8	Sunshine Bass*	800			400	2000
Pine.	Mirror	5	Sunshine Bass*	500				
Pine.	Seminole	405	Sunshine Bass*	10000	5000	3500		
Polk	Bonny	143	Sunshine Bass*		5300			
Polk	Buffum	437	Sunshine Bass*		5400			
Polk	Christina Park	25	Sunshine Bass*			2000	600	500
Polk	Elbert	70	Sunshine Bass*			1730		
Polk	Ft. Meade Pits	40	Sunshine Bass*				1000	
Polk	John	51	Sunshine Bass*	700	3250		1200	
Polk	Littleton	12	Sunshine Bass*					1000
Polk	Mary Hollen	20	Sunshine Bass*		1250			300
Polk	Mulberry DOT	5	Sunshine Bass*			300		22720
Polk	Parker	919	Sunshine Bass*		22720			
Polk	Saddle Cr. Pk.	131	Sunshine Bass*	100	1600			
Polk	Tenoroc Lk. 2	20	Sunshine Bass*			500	1800	
Polk	Tenoroc Lk. D	24	Sunshine Bass*		2000		600	
Polk	Winter Haven	2428	Sunshine Bass*		30000	30000	30000	
Polk	Wales	132	Sunshine Bass*			3260		3000
Sara.	Ackerman Park	8	Sunshine Bass*			400		400
Sara.	East Twin Lake	2	Sunshine Bass*			150		720
Sara.	West Twin Lake	2	Sunshine Bass*			150		
Total:				44100	97150	73310	62100	95710

Cont'd

TABLE 2 Cont'd.

County	Lake	Size (ha)	Species	Number of Fish Stocked Per Year 88	89	90	91	92
Char.	Webb Pond 1(SW)	2	Largemouth Bass[b]					348
Char.	Webb Pond 2(N)	3	Largemouth Bass[b]					378
Char.	Webb Pond 3(W)	2	Largrmouth Bass[b]					377
Hill.	Dover	6	Largemouth Bass[a]				3000	
Lee	Twins Park	5	Largemouth Bass[a]					1200
Pine.	Pownall	2	Largemouth Bass[a]				800	
Pine.	Seminole Pk.	6	Largemouth Bass[b]					842
Pine.	Taylor	16	Largemouth Bass[b]					2185
Sara.	East Twin	2	Largemouth Bass				1300[a]	806[b]
Sara.	West Twin	2	Largemouth Bass				1300[a]	605[b]
Total:							6400	7346
Hill.	Dover	6	Channel Catfish[b]				1500	
Hill.	Horizon	2	Channel Catfish[b]				500	
Hill.	Starvation Lk.	8	Channel Catfish[b]				1000	
Lee	Lake Park	40	Channel Catfish[b]			600	1000	
Pine.	Freedom	2	Channel Catfish[b]				500	
Polk	Lake John	48	Channel Catfish[b]			3000		
Polk	Saddle Cr. Pk.	131	Channel Catfish[b]	3500	26000			
Sara.	Ackerman	8	Channel Catfish[b]			1400	2000	
Sara.	West Twin	2	Channel Catfish[b]			600		
Total:				3500	26000	5600	6500	

[a] Fingerling fish
[b] Sub-adult fish

TABLE 3. Fish attractors located in the South Region, 1987-1992.

County	Lake	Number	Type	Date Installed/ Refurbished
Charlotte	Webb	3	Concrete Pipe	1991
Highlands	Francis	3	Bulrush Plots	1990
Highlands	Francis	1	Brush Pile	1988
Highlands	Jackson	3	Bulrush Plots	1990
Highlands	Jackson	3	Brush Piles	1991
Highlands	June-in-Winter	3	Bulrush Plots	1990
Highlands	Placid	3	Bulrush Plots	1990
Highlands	Red Beach	3	Bulrush Plots	1990
Highlands	Red Beach	2	Brush Piles	1991
Hillsborough	Medard	2	Fish Feeders	1991
Hillsborough	Park	4	Brush Piles	1991
Hillsborough	Rogers Lake	1	Fish Feeder	1989[a]
Hillsborough	Rogers Lake	5	Bulrush Plots	1989[a]
Hillsborough	Starvation Lake	1	Fish Feeder	1989[a]
Hillsborough	Thonotosassa	2	Brush Piles	1991
Lee	Lakes Park	1	Fish Feeder	1989
Manatee	Evers	2	Brush Piles	1991
Pinellas	Tarpon	4	Brush Piles	1989
Polk	Agnes	1	Brush Pile	1990
Polk	Crooked Lake	5	Bulrush Plots	1990
Polk	Gibson	2	Brush Piles	1988
Polk	Peterson Park	2	Fish Feeders	1989
Polk	Reedy	2	Brush Piles	1990
Polk	Rosalie	2	Brush Piles	1991
Polk	Saddle Creek Park	2	Brush Piles	1987
Polk	Saddle Creek Park	2	Fish Feeders	1987
Polk	Saddle Creek Park	2	Fish Feeders	1990
Polk	Saddle Creek Park	2	Fish Feeders	1992
Polk	Saddle Creek Park	5	Bulrush Plots	1987
Polk	Smart	1	Brush Pile	1989
Polk	Summit	1	Brush Pile	1989
Polk	Tenoroc A	2	Brush Piles	1987
Polk	Tenoroc B	4	Brush Piles	1988
Polk	Tenoroc C	1	Brush Pile	1988
Polk	Wales	1	Brush Pile	1989
Polk	Walk-in-Water	2	Brush Piles	1989
Sarasota	Ackerman	2	Brush Piles	1990
Sarasota	Ackerman	2	Fish Feeders	1988
Sarasota	East Twin	1	Fish Feeder	1988[a]
Sarasota	West Twin	1	Fish Feeder	1988

[a] Discontinued

TABLE 4. Commercial harvest (kg) and market value from haul seine operations in the South Region, 1985-1991.

Year	Total Harvest (kg)	Market Value($)
1985	217,422	166,669
1986	173,066	96,775
1987	385,074	128,100
1988	303,181	131,394
1989	357,249	118,139
1990[a]	77,856	40,460
1991	163,490	83,354
Averages:	239,620	109,270

[a] Incomplete data - 2 operators went out of business and failed to report.

TABLE 5. Catch results and population statistics from otter trawl samples for black crappie. Thirteen different lakes were sampled in the South Region in 1990 and 1991.

Total Crappie	Size	Average Length	PSD[b]	RSD_{25}[c]

TABLE 5. Catch results and population statistics from otter trawl samples for black crappie. Thirteen different lakes were sampled in the South Region in 1990 and 1991.

Lake Name	Size (ha)	Year	Total Crappie Sampled	CPUE[a]	Size Range (mm)	Average Length (mm)	PSD[b]	RSD_{26}[c]
Crooked	2241	1990						
		1991	48	4.8	65 - 346	236	87	65
Garfield	265	1990	1	<1	246	246		
		1991	0					
Gibson	192	1990						
		1991	188	38	66 - 345	157	64	39
Hollingsworth	144	1990	90	30	71 - 246	108	17	0
		1991	129	32	104 - 286	188	31	1
Julianna	375	1990	0					
		1991	0					
Lulu	122	1990	152	19	92 - 270	141	16	2
		1991	293	37	87 - 256	153	20	2
Mattie	436	1990	158	53	79 - 375	176	43	28
		1991	304	76	70 - 371	115	49	30
Moody	158	1990	88	15	81 - 260	130	31	3
		1991						
Reedy	1411	1990	192	38	74 - 323	138	49	26
		1991	729	243	74 - 305	138	25	5
Rosalie	1860	1990						
		1991	213	26.7	62 - 344	135	36	11
Shipp	114	1990	60	20	78 - 160	117	0	0
		1991	386	96	80 - 259	147	18	0
Thonotosassa	331	1990	185	62	83 - 225	130	73	0
		1991	268	269	76 - 240	172	16	0
Walk-in-water	3048	1990						
		1991	15	1.5	73 - 301	162	83	83

[a] fish-per-tow (15 min.)

[b] Proportional Stock Density - stock-size = 13 cm, quality-size = 20 cm

[c] Relative Stock Density - preferred-size = 25 cm

PL81

TABLE 6. Largemouth bass size group proportions and biomass estimates before and after implementation of a 330-508 mm slot limit regulation at Saddle Creek Park, 1987-1992.

Year	% Below Slot (254-329 mm)	% Within Slot (330-508 mm)	% Above Slot (>508 mm)	Biomass (kg/ha)
1986	47	42	11	40
1987	54	37	9	51
----------REGULATIONIMPLEMENTED----------				
1988	24	66	10	75
1989	24	66	10	65
1990	40	54	6	65
1991	43	54	3	60
1992	38	61	1	--

TABLE 7

Station

Homelar
Abundar
Biomass
Diversi

Wauchu
Abunda
Biomas
Diversi

Gardne
Abunda
Biomas
Diversi

Nocate
Abundi
Biomas
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Ft. O
Abund
Bioma
Diver

a Low
b Sta

TABLE 7. Peace River fish community evaluations 1983-1991.

Station	Year				
	83-88	88	89	90	91
Homeland					
Abundance (#/min)	5.8	9.4	11.0	4.0	--[a]
Biomass (kg/min)	1.4	2.3	3.7	2.0	--[a]
Diversity (H')	2.05	2.25	2.18	1.13	--
Wauchula					
Abundance (#/min)	3.2	2.9	4.4	1.8	15.0
Biomass (kg/min)	1.0	0.7	1.7	0.9	2.3
Diversity (H')	2.20	2.22	2.13	2.15	1.95
Gardner					
Abundance (#/min)	2.1	3.7	3.4	3.0	18.1
Biomass (kg/min)	0.7	0.7	1.8	1.0	2.5
Diversity (H')	2.28	2.27	2.27	2.08	2.18
Nocatee					
Abundance (#/min)	2.9	2.3	2.0	4.6	18.4
Biomass (kg/min)	1.0	0.9	1.0	0.5	2.0
Diversity (H')	2.18	2.01	2.08	1.94	2.17
Ft. Ogden					
Abundance (#/min)	1.6	3.8	--	--	--[b]
Biomass (kg/min)	1.1	0.7	--[b]	--[b]	
Diversity (H')	1.99	1.19	--	--	--

[a] Low water
[b] Station Eliminated

TABLE 8. Summary of fish kill investigations in the South Region, 1991-92.

Date	County	Waterbody	Species	Probable Cause
7/10/91	Polk	Lake Parker	150 Largemouth Bass, 550 Bluegill, 100 Redear Sunfish, 1 Brown Bullhead, 1000 Threadfin Shad	Low D.O.
8/2/91	Sarasota	Ackerman Park	150 Largemouth Bass, 200 Bluegill, 100 Redear Sunfish, 1 Sunshine Bass, 120,000 Threadfin Shad, 1 Tilapia, 1 Lake Chubsucker, 200 Gizzard Shad	Low D.O.
9/28/91	Sarasota	Ackerman Park	150 Largemouth Bass, 250 Bluegill, 150 Redear Sunfish, 8 Black Crappie, 4 Sunshine Bass, 10 Warmouth, 2500 Threadfin Shad, 50 Gizzard Shad, 3 Lake Chubsuckers	Low D.O.
10/22/91	Polk	Lake Parker	50 Bluegill, 300 Threadfin Shad	Haul Seine Stress
3/30/92	Hills.	Tampa Bypass Canal	100 Tilapia (more reported but not observed)	Spawning Stress
4/12/92	Manatee	Gilleys Creek	12 Largemouth Bass	Undetermined
4/22/92	Polk	Christina Lakes	100 Tilapia	Spawning Stress
4/24/92	Polk	Lake Reedy	50 Black Crappie	Sewage
4/29/92	Polk	Lake Bonnet	100 Tilapia	Spawning Stress
5/26/92	Highlands	Lake Istokpoga	Thousands of Threadfin Shad	Low D.O.
6/7/92	Pinellas	Cross Bayou Canal	1 Snook, 22 Stripped Mullet, 3 Florida Spotted Gar, 100 Tilapia	Siltation

Species Breakdown

Largemouth Bass	462	Florida Spotted Gar	3
Bluegill	1050	Threadfin Shad	123,800
Redear Sunfish	350	Gizzard Shad	250
Black Crappie	58	Stripped Mullet	22
Snook	1	Brown Bullhead	1
Sunshine Bass	5		
Warmouth	10	Grand Total:	126,410
Tilapia	401		

TABLE 9.

Year	
1987-88	
1988-89	
1989-90	
1990-91	
1991-92	
Totals:	

TABLE 9. Fish kills reported within the South Region, 1987-92.

Year	Total Fish Kills Reported	Kills Investigated	Documented Fish Losses
1987-88	150	20	90,702
1988-89	130	13	20,040,973
1989-90	130	8	49,655
1990-91	100	8	23,278
1991-92	94	11	126,410
Totals:	604	60	20,331,018

TABLE 10. South Region waterbodies tested for mercury concentrations in largem bass, 1984-1992.

Waterbody - Date Tested	No. Sampled	Mean Mercury Concentrat (mg/kg)
Alafia River - 1988	3	0.59
(Hillsborough) 1992	11	0.43
Anclote River - 1988	3	0.34
(Pasco) 1992	14	1.28
Lake Annie - 1984	1	0.86
(Highlands) 1987	3	1.57
Caloosahatchee River - 1987 (Glades)	3	0.48
Crooked Lake - 1991 (Polk)	12	0.52
Hillsborough River - 1984	2	0.55
(Hillsborough) 1987	3	1.10
1988	23	1.01
1989	73	1.07
Lake Istokpoga - 1988	3	0.74
(Highlands) 1989	12	0.56
Lake Josephine - 1991 (Highlands)	12	0.73
Lakes Park - 1991[a] (Lee)	12	0.65
Little Manatee River - 1992 (Hillsborough)	12	0.19
Myakka River - 1988	3	0.57
(Sarasota) 1992	12	0.45
Lake Parker - 1987 (Polk)	3	0.05
Peace River - 1984	1	0.82
(Desoto) 1987	3	1.57
Peace River - 1992 (Hardee)	12	0.64
Lake Placid - 1987	3	0.80
(Highlands) 1991	15	0.55
Lake Tarpon - 1990 (Pinellas)	12	0.52

[a]Reported by HRS.

STATE OF FLORIDA

GAME AND FRESH WATER FISH COMMISSION

SOUTH REGIONAL FISHERIES MANAGEMENT

REGIONAL SERVICES STUDY

COMPLETION REPORT

APPENDIX I

WEEKI WACHEE RIVER FISHERIES EVALUATION

NOVEMBER 1992

Project Leader: T. R. Champeau

Project Assistants: K. W. Denson

M. J. Mounce

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Executive Director

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Division of Fisheries

Robert J. Wattendorf, Assistant Director
Division of Fisheries

Thomas L. Vaughn, Chief
Bureau of Fish Management

187e

STATE: Florida PROJECT NO. 6210

PROJECT TYPE: Management STUDY NO. 6215 (2)

PROJECT TITLE: South Regional Fisheries Management

PERIOD COVERED: 1 July 1991 through 30 June 1992

JOB TITLE: Lake and Stream Survey and Management-Weeki Wachee River

JOB OBJECTIVE: To document the status of the fish community of Weeki Wachee River.

ABSTRACT

The Weeki Wachee is a spring-fed river located in western Hernando county. The river is a major site for recreation including boating, fishing and swimming. Recent concerns about declining water quality have led to the development of the Weeki Wachee study plan by the Southwest Florida Water Management District, 1990. The plan is designed to address water quality issues and provide additional information regarding the biology of the system. The Florida Game and Fresh Water Fish Commission (GFC) conducted sampling in 1991 to document the status of the fish community. Spotted sunfish (Lepomis punctatus), bluegill (L. macrochirus) and largemouth bass (Micropterus salmoides) were the most abundant species in the river. The river appears to have a well balanced fish community. Changes in the fish community since the last assessment in 1984 were not indicated.

INTRODUCTION

Florida contains 27 of the 77 first magnitude springs in the United States, as well as scores of smaller discharges (Rosenau et al. 1977). Spring runs are very productive ecosystems because of high concentrations of dissolved phosphates (Bass 1983). Leaching of phosphates into the water elevates basic biological production and typically allows spring-fed streams

to possess greater standing crops of both fish and benthic invertebrates, than non spring-fed streams (Bass 1983). Located in western Hernando county, the 12 km Weeki Wachee river discharges to the Gulf of Mexico, draining a 54 km^2 watershed. The Weeki Wachee river spring is a first magnitude spring with an average discharge of 5.0 m^2/s (Bass 1983). Clear water and constant annual temperatures make springs popular as tourist attractions and recreational areas. As a result of increasing population and human activity, the Weeki Wachee River has become a major site for recreational use. The Weeki Wachee River is best known for the tourist resort and mermaid shows at the spring head. Other river activities include boating, fishing and swimming at Rodgers Park beach.

Past involvement in the Weeki Wachee River by the GFC dates back nearly 40 years. In the 1950's the primary public concern was stocking sportfish in the river. This practice quickly became obsolete when studies revealed most established fish communities sufficiently reproduce to sustain populations without supplemental stocking. In 1968, the GFC completed a pollution report about canal construction on the Weeki Wachee River. The report found canal construction caused major water quality degradation and habitat destruction (Buntz 1968). The last fisheries data was collected and placed on file at the GFC South Region office in 1984.

As development and human activity increases around the river, concerns of degrading water quality and pollution are increasing. As a result, the Southwest Florida Water Management District (SWFWMD) developed the Weeki Wachee River study plan to address problems facing this resource (SWFWMD 1990). An objective of the study, to characterize the fish population was undertaken by the GFC Regional Fisheries Project and is accomplished by this report.

MATERIALS AND METHODS

During November 1991, fish population sampling was conducted using an electrofishing boat equipped with a Smith-Root model VI-A electrofishing unit. The Smith-Root unit regulates electrical output at six to seven amperes of pulsed direct current. Bow mounted electrodes suspended in the water act as anodes, while the boat hull works as the cathode. Fish were netted from the front of the boat after being stunned by electrical current. Data collected consisted of size, weight, and numbers of each fish species. Data was recorded at the end of each sample, and fish were released. Habitat utilized during electrofishing samples consisted of river banks containing brush, snags and macrophytes, as most fish species orient to available cover.

Working upstream, four 10-minute transects were sampled. The distance between each 300 meter transect was approximately one km. The first transect (#1) was a residential canal constructed off the main river. Remaining samples were taken in less developed sections of the river proper. Transect locations are marked on aerial photographs on file at South Region Fisheries Office.

FINDINGS

Sampling effort of four electrofishing transects yielded 13 species. Spotted sunfish (Lepomis punctatus) were most abundant, making up 56.5% of the sample, followed by bluegill (L. macrochirus) and largemouth bass (Micropterus salmoides), 11.6% and 10.6%, respectively (Table 1). Total catch-per-unit effort (CPUE) of combined transects was 7.2 fish per minute (Table 2). Spotted sunfish had the highest combined CPUE of 4.1 followed by largemouth bass and bluegill both being 0.8 fish per minute (Table 2). Of the four samples, sample-1 had the highest abundance of largemouth bass, species richness and diversity (Table 2).

Largemouth bass combined sample size range was 90 to 475 mm with an average size of 227 mm (Table 3). Combined proportional stock density (PSD) for largemouth bass was 41 and average relative weight (Wr) was 96 (Table 3). Low total numbers of miscellaneous species were observed in all four sample transects (Table 4).

DISCUSSION

Habitat in the Weeki Wachee River is good providing ample cover for forage and predatory fish. Electrofishing samples revealed good species richness with a total of 13 different species collected. Population balance appears good with a diverse group of forage species and largemouth bass as the dominant predator. From limited available data, changes in the fishery, since the last assessment in 1984, are not significant.

Spotted sunfish were the most abundant species in 1991 samples, which is consistent with 1984 data. Data indicates an increase in relative abundance of total combined species and in most individual species since 1984; however, several factors can influence relative abundance and drawing a conclusion from such limited data is not advised. Species composition compared well with 1984 data indicating that spotted sunfish, largemouth bass and bluegill are dominant species.

Increased largemouth bass abundance and species richness in the residential canal (sample-1) can be attributed to distinct habitat differences. When these canals were built, natural river habitat was altered. As a result, the canals resemble a lentic environment. The canals provide a deep, slow flowing habitat with an organic substrate. Hydrilla verticillata and other macrophytes were abundant, and this provides habitat very different from the river proper. Different habitat in the canal affects fish distribution and production. Most of the fish found in the river are species

that do well in this type of habitat. Although the canals provide human benefit and some degree of habitat diversity, they alter natural riverine conditions and can be problematic.

A wide size range of largemouth bass indicates good reproduction and recruitment. Combined largemouth bass PSD and average Wr were within desired ranges, indicating population balance.

Low abundance non-game fish in the samples is further evidence of a well-balanced fish community. Non-game fish such as gar (Lepisosteus platyrhincus) and chubsucker (Erimyzon sucetta) were most abundant in the residential canal (sample 1).

CONCLUSIONS AND RECOMMENDATIONS

The Weeki Wachee River has a well-balanced fish community. Species richness, diversity, fish abundance, and community structure appear to be typical of a swift, spring-fed stream. No ecological problems with this riverine system are currently expressed in fish population data.

To document changes in the fish community, assessments should be conducted every five years. Night sampling should also be conducted in the next assessment to compare with day results.

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Rosenau, J. C., G. L. Faulkner, C. W. Henrys, Jr., and R. W. Hull. 1977. Springs of Florida. U.S. Geological Survey, Bulletin Number 21. Tallahassee, FL.

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ABLE 1. Percent composition, by number, of Weeki Wachee River electrofishing samples, fall 1991.

	Sample 1	Sample 2	Sample 3	Sample 4	Combined
argemouth bass *icropterus salmoides*	22.0	6.0	12.2	5.3	10.6
luegill *epomis macrochirus*	15.2	18.1	6.7	6.6	11.6
edear sunfish *epomis microlophus*	8.4	0.0	0.0	6.6	3.4
potted sunfish *epomis punctatus*	23.7	61.4	66.2	67.1	56.5
lorida spotted gar *episosteus platyrhincus*	8.4	0.0	0.0	0.0	1.7
ake chubsucker *rimyzon sucetta*	10.2	2.4	4.0	5.3	5.1
rown bullhead *meiurus punctatus*	5.1	0.0	0.0	0.0	1.0
tlantic needlefish *trongylura marina*	1.7	0.0	0.0	1.3	0.7
ojjara sp. *erreidae sp.*	5.1	0.0	0.0	0.0	1.0
armouth *Lepomis gulosus*	0.0	3.6	4.0	3.9	3.1
eminole killifish *Fundulus seminolis*	0.0	1.2	6.7	3.9	3.1
triped mullet *Mugil cephalus*	0.0	3.6	0.0	0.0	1.0
ellow bullhead *Ameiurus natalis*	0.0	2.4	0.0	0.0	0.7

Sample 1 Developed canal.
Samples 2-4 Undeveloped river areas.

TABLE 2. Catch-per-unit-effort (fish/minute) of Weeki Wachee River electrofishing samples, fall 1991.

	Sample 1	Sample 2	Sample 3	Sample 4	Combined
Largemouth bass *Micropterus salmoides*	1.3	0.5	0.9	0.4	0.8
Bluegill *Lepomis macrochirus*	0.9	1.5	0.5	0.5	0.8
Redear sunfish *Lepomis microlophus*	0.5	0.0	0.0	0.5	0.25
Spotted sunfish *Lepomis punctatus*	1.4	5.1	4.9	5.1	4.1
Florida spotted gar *Lepisosteus platyrhincus*	0.5	0.0	0.0	0.0	0.1
Lake chubsucker *Erimyzon sucetta*	0.6	0.2	0.3	0.4	0.4
Brown bullhead *Ameiurus punctatus*	0.3	0.0	0.0	0.0	0.07
Atlantic needlefish *Strongylura marina*	0.1	0.0	0.0	0.1	0.05
Mojjara sp. *Gerreidae sp.*	0.3	0.0	0.0	0.0	0.07
Warmouth *Lepomis gulosus*	0.0	0.3	0.3	0.3	0.22
Seminole killifish *Fundulus seminolis*	0.0	0.1	0.5	0.3	0.22
Striped mullet *Mugil cephalus*	0.0	0.3	0.0	0.0	0.07
Yellow bullhead *Ameiurus natalis*	0.0	0.2	0.0	0.0	0.05
Total fish / minute	5.9	8.3	7.4	7.6	7.22
# Different species	9	8	6	8	

Sample 1 Developed canal,
Samples 2-4 Undeveloped river areas.

TABLE 3. Population data for largemouth bass, bluegill, redear and spotted sunfish from Weeki Wachee River electrofishing samples, fall 1991.

	Sample 1	Sample 2	Sample 3	Sample 4	Combined
Largemouth bass					
*PSD	100	40	0	50	41
**Avg. Wr (grams)	100.4	86.4	109.9	58.4	96.4
Avg. length (mm)	222.6	301.2	208.3	195.5	227.6
Size range (mm)	116 475	260 378	90 290	105 315	90 475
Total #	13	5	9	4	31
Bluegill					
*PSD	11	7	20	75	19
Avg. length (mm)	111.1	104.7	126.0	136.0	114.1
Size range (mm)	80 150	70 150	90 170	50 180	50 180
Total #	9	15	5	5	34
Redear sunfish					
*PSD	40	0	0	0	20
Avg. length (mm)	134.0	0	0	150.0	142.0
Size range (mm)	100 190	0	0	110 160	100 190
Total #	5	0	0	5	10
Spotted sunfish					
*PSD	21	27	14	16	21
Avg. length (mm)	93.6	108.0	95.1	100.0	100.0
Size range (mm)	60 170	70 160	60 150	50 150	50 170
Total #	14	51	49	51	165

Sample 1 Developed canal.

Samples 2-4 Undeveloped river areas.

* PSD = Largemouth bass $\frac{\#\ >\ 300\ mm}{\#\ \geq\ 200\ mm} \times 100$

Bluegill $\frac{\#\ >\ 150\ mm}{\#\ \geq\ 80\ mm} \times 100$

Redear Sunfish $\frac{\#\ >\ 180\ mm}{\#\ \geq\ 100\ mm} \times 100$

Spotted Sunfish $\frac{\#\ >\ 130\ mm}{\#\ \geq\ 60\ mm} \times 100$

** $Wr = \frac{W}{Ws} \times 100$ W is the weight of an individual and Ws is a lenght-specific standard weight.

TABLE 4. Population data of miscellaneous species from Weeki Wachee River electrofishing samples, fall 1991.

	Sample 1	Sample 2	Sample 3	Sample 4	Combined
Florida spotted gar					
Avg. length (mm)	458.0	0	0	0	458.0
Size range (mm)	350 520	0	0	0	350 520
Total #	5	0	0	0	5
Lake chubsucker					
Avg. length (mm)	341.7	160.0	230.0	207.5	234.8
Size range (mm)	240 380	140 180	160 270	160 250	140 380
Total #	6	2	3	4	15
Brown bullhead					
Avg. length (mm)	300.0	0	0	0	300.0
Size range (mm)	290 310	0	0	0	290 310
Total #	3	0	0	0	3
Atlantic needlefish					
Avg. length (mm)	200.0	0	0	270.0	235.0
Size range (mm)	200.0	0	0	270.0	200 270
Total #	1	0	0	1	2
Mojiara					
Avg. length (mm)	96.7	0	0	0	96.7
Size range (mm)	90 100	0	0	0	90 100
Total #	3	0	0	0	3
Warmouth					
Avg. length (mm)	0	113.3	103.3	153.3	123.3
Size range (mm)	0	50 150	50 170	140 170	50 170
Total #	0	1	5	3	9
Seminole killifish					
Avg. length (mm)	0	90.0	130.0	113.3	11.1
Size range (mm)	0	90	100 160	70 150	70 160
Total #	0	1	5	3	9
Sriped mullet					
Avg. length (mm)	0	440.0	0	0	440.0
Size range (mm)	0	410 470	0	0	410 470
Total #	0	3	0	0	3
Yellow bullhead					
Avg. length (mm)	0	195.0	0	0	195.0
Size range (mm)	0	170 220	0	0	170 220
Total #	0	2	0	0	2

Sample 1 Developed canal.
Samples 2-4 Undeveloped river areas.