Hydrologic Conditions, Habitat Characteristics, and Occurrence of Fishes in the Apalachicola River Floodplain, Florida: Second Annual Report of Progress, October 1993–September 1994

By Helen M. Light, Melanie R. Darst, *and* J.W. Grubbs

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U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director

For additional information
write to:

District Chief
U.S. Geological Survey
Suite 3015
227 N. Bronough Street
Tallahassee, FL 32301

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CONVERSION FACTORS, VERTICAL DATUM, AND ABBREVIATIONS

Multiply	By	To obtain
inch (in.)	2.54	centimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
acre	0.4047	hectare
cubic feet per second (ft^3/s)	0.02832	cubic meters per second

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)--a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Additional abbreviations

FGFWFC = Florida Game and Fresh Water Fish Commission
GIS = Geographic Information System
NWS = National Weather Service
RP = reference point
USGS = U.S. Geological Survey

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Abstract

This report describes progress and interim results of the second year of a 4-year study. The purpose of the 4-year study is to describe aquatic habitat types in the Apalachicola River floodplain and quantify the amount of habitat inundated by the river at various stages. Final results will be used to determine possible effects of altered flows on floodplain habitats and their associated fish communities. The study is being conducted by the U.S. Geological Survey in cooperation with the Northwest Florida Water Management District as part of a comprehensive study of water needs throughout two large river basins in Florida, Georgia, and Alabama.

By the end of the second year, approximately 80 to 90 percent of field data collection was completed. Water levels at 56 floodplain and main channel locations at study sites were read numerous times during low water and once or twice during high water. Rating curves estimating the relation between stage at a floodplain site and flow of the Apalachicola River at Chattahoochee are presented for three sites in the upper river. Elevation, substrate type, and amount of vegetative structure were described at 27 cross sections representing 8 different floodplain tributary types at upper, middle, and lower river study sites. A summary of substrate and structure information from all cross sections is presented. Substrate and structure characteristics of floodplain habitats inundated when riverflow was at record low flow, mean annual low flow, and mean flow are described for three cross sections in the upper river. Digital coverage of high-altitude infrared aerial photography was processed for use in a Geographic Information System which will be used to map aquatic habitats in the third year of the study. A summary of the literature on fish utilization of floodplain habitats is described. Eighty-one percent of the species collected in the main channel of the Apalachicola River are known to occur in floodplain habitats of eastern rivers.

INTRODUCTION

The fluctuating hydrologic conditions of the river and the extensive bottomland hardwood forests of the floodplain are integrated components of the Apalachicola River system. During annual flooding, diverse and abundant freshwater fish communities, as well as other aquatic organisms, utilize the inundated floodplain forests for habitat, food, protective cover, spawning sites and nursery grounds. Floodplain sloughs, ponds, tributaries and backwater lakes provide a refuge for fish and macroinvertebrate assemblages during drought conditions. The relation between biological diversity and productivity and the hydrologic conditions of the system are complex, with floral and faunal distributions varying spatially, seasonally, and annually.

Descriptions of aquatic habitat types and associated biological communities within the Apalachicola River floodplain are limited. Florida Game and Freshwater Fish Commission (FGFWFC) made a number of fish collections in several floodplain tributaries in 1985 (Hill and others, 1990). Most other work by the FGFWFC has focused primarily on the main river channel, where major habitats were mapped, fish communities associated with each habitat were described, and dredging effects on the system were assessed (Ager and others, 1986). Floodplain tree communities were correlated with elevations and hydrologic conditions by the U.S. Geological Survey (USGS) in the early 1980's (Leitman and others, 1983). More recent work by the USGS on the Ochlockonee River and floodplain (which is adjacent to the Apalachicola River to the east) described relations between hydrologic conditions, floodplain habitats, and fish assemblages (Leitman and others, 1991). Information on hydrologic conditions associated with biological communities is needed for aquatic habitats in the floodplain of the Apalachicola River. This information is necessary to evaluate potential effects from increased upstream water withdrawals or modified water delivery schedules from storage reservoirs.

The purpose of this report is to summarize the study progress in the second year of a 4-year investigation. The objectives of the 4-year study are to describe aquatic habitat types in the Apalachicola River floodplain and quantify the amount of habitat inundated by the river at various stages. Final results will be used to determine possible effects of altered flows on floodplain habitats and their associated fish communities.

Some aquatic habitats in the floodplain are connected to the main channel of the river during low water and remain connected most or all of the year, whereas others are connected only during medium- or high-water periods. In this study, particular emphasis will be given to aquatic habitats that are connected during low flow, because water management during drought periods has become increasingly difficult. Changes in flow during low-water periods can decrease availability of floodplain habitats at a time when the area of these habitats is already at a minimum. Aquatic habitats connected to the river during medium and high flows will be described in less detail, but will also be addressed in the study. Critical habitat for fishes can be affected by altered flows at all river levels.

The format and contents of this annual progress report are organized to follow the work agreed to be done in fiscal year 1994. The ordered topics summarized in this report are as follows:

1. Description of methodologies.
2. Description of measured and estimated flow and stage records at Chattahoochee gage, stage only at Blountstown, Wewahitchka, and Sumatra gages, and stage only at study sites for complete period of record.
3. Preliminary statistical analyses of hydrologic records at gages and study sites.
4. Preliminary categories of aquatic habitats to be used in mapping, with general descriptions of hydrologic, topographic, vegetative, and substrate characteristics of those habitats.
5. Description of preliminary mapping efforts at selected floodplain locations showing changes in estimated acreage of habitats with changing stages.
6. Summary of the literature on Apalachicola River fish species that use aquatic habitats in the floodplain.

This project, jointly funded by Northwest Florida Water Management District and U.S. Geological Survey, is part of the Apalachicola River and Bay Freshwater Needs Assessment as developed by the States of Florida, Alabama, and Georgia, and by the U.S. Army Corps of Engineers for the Alabama-Coosa-Tallapoosa/Apalachicola-Chattahoochee-Flint Comprehensive Study. The authors wish to acknowledge F. Graham Lewis, III, Northwest Florida Water Management District, for essential technical and administrative guidance throughout the project. Appreciation is also extended to Michael J. Hill and D. Gray Bass, Jr., Florida Game and Fresh Water Fish Commission, for assistance in assembling and interpreting Apalachicola River fish collection data. Lamar Batts, U.S. Geological Survey, is acknowledged for his invaluable support with field work.

DESCRIPTION OF METHODOLOGIES

The study area consists of the upper, middle, and nontidal lower reaches of the Apalachicola River and floodplain (fig. 1). The tidal reach of the lower river is not studied in this project but may be mentioned in some of the discussion. In this report, "lower river" is intended to mean the nontidal part of the lower river. The study sites are Flat Creek and Johnson Creek in the upper river, Iamonia Lake in the middle river, and River Styx in the lower river.

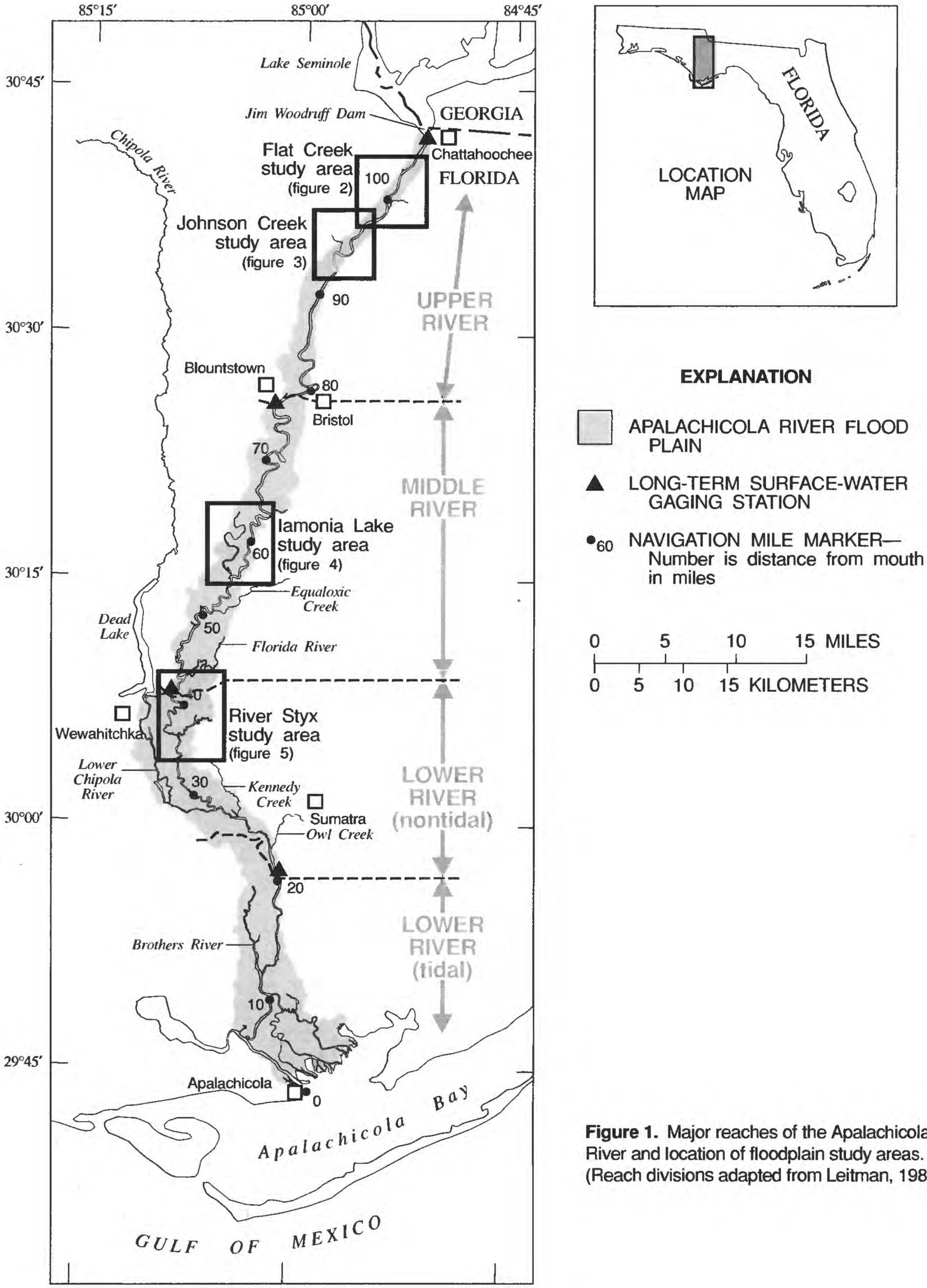

Figure 1. Major reaches of the Apalachicola River and location of floodplain study areas. (Reach divisions adapted from Leitman, 1984.)

The final products anticipated from the 4-year study are a series of flow-area curves relating the amount of aquatic habitat in the floodplain to flow at the Chattahoochee gage. Different flow-area curves will be developed for many different habitat types in each of the three major reaches of the river (upper, middle, and nontidal lower). Long-term records at Chattahoochee will be analyzed to describe historic conditions in the various floodplain habitats. Information in the literature about species of fishes that are likely to be using those habitats will be summarized. General tasks required to produce the flow-area curves are (1) relating water-level measurements at selected floodplain study sites to flows at Chattahoochee, (2) characterizing general habitat substrate and structure at study sites, (3) using aerial photos and maps to estimate amount of each type of habitat throughout the floodplain, (4) using conditions at study sites, field observations, and previous studies to estimate habitat conditions and elevations throughout the floodplain, and (5) relating amount of area, habitat conditions, and water levels throughout the floodplain to flow at Chattahoochee. Some of this work was completed in the first year, some is addressed in this report, and some will be completed in the third and fourth years. Methodologies described below are associated with tasks completed in the second year of the study.

The purpose of the hydrologic analyses is tocharacterize the long-term frequency and duration that aquatic habitats in the floodplain are inundated and connected to the Apalachicola River. All statistical analyses of long-term hydrologic conditions are based on flow at the Chattahoochee gage, representing the flow at the head of the Apalachicola River. The 72-year period defined by water years 1922-93 is referred to as the baseline period. Long-term stage information was developed at selected floodplain sites through ratings that relate stage at the floodplain site to flow at Chattahoochee. These ratings were based on observations made at water-level reference points (RPs) at the sites.

RPs were established at numerous locations at the study sites, primarily on the banks of floodplain tributaries, but also in the adjacent main channel and in a few isolated floodplain ponds. Nails in trees were used as the fixed point from which water levels were measured with a tape and weight. Nails in trees remain stable over time because tree growth is lateral along the trunks (vertical growth is limited to the growing tips of the branches). In order to measure water levels that varied vertically as much as 20 ft, many RP sites required three or four nails at different heights on the same tree or on a nearby tree. Most of the RP measurements were made during low flow; however, a few high-flow measurements were needed to establish an elevation relative to mean sea level for each RP.

Three floodplain RP sites were selected as examples to develop ratings relating stage at the sites to flow at Chattahoochee. All three sites were located in the same type of upper river tributary, classified as 4B (4 being the smallest size class and B indicating that the adjacent forest type was bottomland hardwoods). The ratings represent stages at the sites that can be expected with present channel conditions in the river. Stages in the upper river during low and medium flows are lower now than in the pre-dam period because of riverbed degradation resulting from construction of Jim Woodruff Dam in the 1950's. In the final report, additional ratings for upper river sites will be developed to represent stages that would be expected if the channel had not been degraded.

Cross sections were surveyed at numerous locations on floodplain tributaries at the study sites. Line transects were established from bank-to-bank, perpendicular to the channel of the tributary. Homogeneous segments were delineated primarily by changes in slope along the line transect. Segment width, substrate type (sand, silt/clay, or organic mud), amount of vegetative structure (in percent cover intersecting the line), and elevation were measured for each segment of the line transect. Measurements of percent coverage of vegetative structure were grouped into five classes: very low (less than 15 percent), low (15-34.9 percent), medium (35-65 percent), high (65.1-85 percent), and very high (greater than 85 percent).

Three upper river 4B cross sections (adjacent to the three selected RP sites mentioned above) were selected as examples for habitat area computations. Ratings at the three RP sites were used to determine stages at the cross sections when the Chattahoochee gage is measuring record low, mean annual low, mean annual, and mean annual high flows. Average segment widths of each habitat type at the cross sections were multiplied by length of 4B stream reaches at the study sites to produce estimates of surface area of habitats. This resulted in estimated areas of various habitat types that would be expected in 4B reaches of the upper river when the river was at those long-term flow levels.

Estimated areas of various habitats in all types of upper, middle, and lower river floodplain tributaries found at the study sites will be presented in future reports. Those areas will be used in conjunction with floodplain-mapping to extend the information determined at the study sites to habitats throughout the entire non-tidal floodplain. Work to prepare digitally scanned infrared aerial photography and other Geographic Information System (GIS) coverages for mapping streams and other aquatic habitats in the floodplain is nearly completed.

A literature review was conducted to determine the occurrence of Apalachicola River fishes in floodplain habitats of eastern rivers. Species were grouped into four categories: (1) common or abundant in Apalachicola floodplain collections, (2) collected in low numbers in Apalachicola floodplain, (3) present in other eastern floodplains, whereas presence in Apalachicola floodplain probable, and (4) no documented occurrences in eastern floodplains, whereas presence in Apalachicola floodplain uncertain.

DESCRIPTION OF MEASURED AND ESTIMATED FLOW AND STAGE RECORDS

Daily stage and flow data for the Apalachicola River have been collected at the Chattahoochee gage by the USGS beginning in water year 1929 and continuing to the present. From October, 1919, until the beginning of water year 1929, daily stage data were collected by the National Weather Service (NWS). Nearly continuous daily stage data were available from the NWS at this gage beginning in water year 1922. These data were used to develop a long-term, baseline flow data set for the period 1922-93, using methods to estimate missing record as described by Light and others (1993, p. 5).

At the time the study began, it was anticipated that long-term stage data sets would need to be developed for the Chattahoochee, Blountstown, Wewahitchka, and Sumatra gages on the Apalachicola River Subsequently, it was determined that project objectives could be more efficiently met by estimating river stage as needed using stage-discharge ratings without developing separate stage data sets for each site. The methods used to develop these ratings are similar to those described by Light and others (1993, p. 5-6). Preliminary ratings relating stage at the Chattahoochee, Blountstown and Wewahitchka gages to flow at Chattahoochee have been developed. A rating will not be prepared for the Sumatra gage because the most downstream study site is relatively close (2-7 mi downstream) to the Wewahitchka gage and an additional gage at river mile 36 is within the study site area (Corps of Engineers gage 023587547, Apalachicola River at mile 36 near Wewahitchka). A rating for the river mile 36 gage will be developed as soon as gage data for water year 1994 are processed.

Stages at study sites were measured at 56 floodplain and main channel RP locations. Figures 2, 3, 4, and 5 show 44 of the 56 RP locations; the remaining 12 were located very close to RP sites that are shown on the figures and could not be separately depicted on maps of that scale. A total of 471 water-level measurements were made during a 15-month period from June 1993 to September 1994, with the majority of the measurements made in the fall of 1993.

Stage-discharge ratings relating the stage at RP sites to discharge at the Chattahoochee gage were developed at selected sites. These ratings were prepared from water-level measurements made at the RP sites, Chattahoochee discharge data, thalweg data collected at and downstream of the RP site, and rating curves from the closest upstream and downstream gaging stations. Stage-discharge data points were developed by: (1) determining the elevations of the RPs by estimating the stage (relative to sea level) at the RPs during high-water conditions when a level water surface can be assumed from the main channel, (2) calculating the stage for all other points in time when RP to water surface measurements were made, and (3) determining the "effective" discharge at the Chattahoochee gage for each stage observation by adjusting for travel time from the gage to the RP. Preliminary ratings for selected RP sites were prepared by estimating stage at the sites from rating curves for the closest upstream and downstream gages. Final ratings were then developed by adjusting these preliminary ratings using the stage-discharge data points from the RP sites and thalweg data.

Stage-discharge ratings for three RP sites on Flat Creek and Johnson Creek appear in appendix I. Similar ratings will be prepared for additional upper river sites, and selected middle and lower river study sites as water year 1994 data are processed for the Wewahitchka and river mile 36 gages. The flat parts of the RP site ratings at very low flows represent conditions that occur when stage in the main channel is at or below estimated minimum stage at the RP site. In the case of Flat Creek, which has a steady source of flow originating from its upland drainage basin, the stream maintains a minimum stage even when river stage near the mouth of the

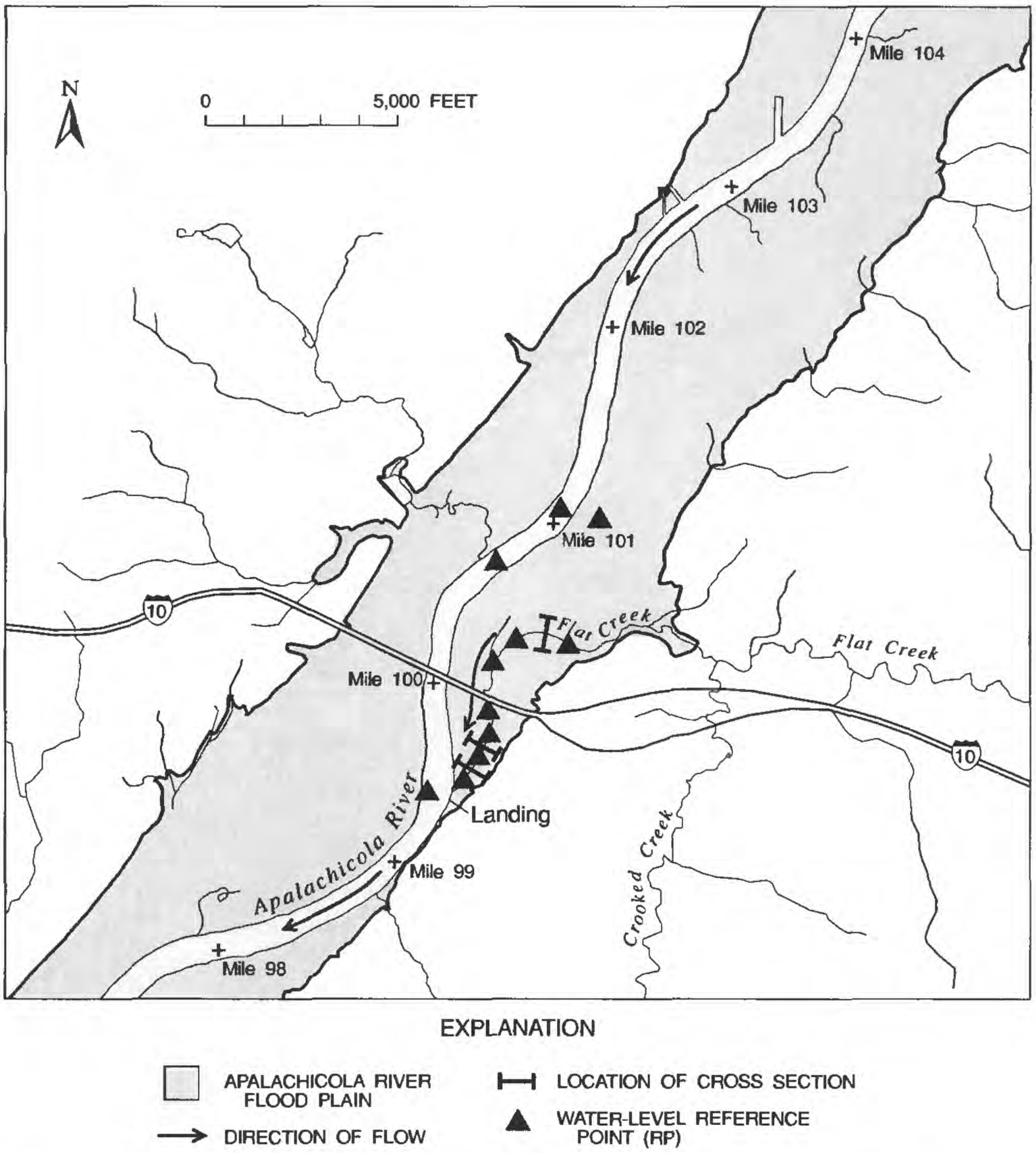

Figure 2. Location of Flat Creek cross sections and water-level reference points.

creek is lower than the streambed at the RP site. Johnson Creek does not have a significant source of base flow to maintain a minimum stage when the river is very low. However, a minimum stage is maintained through ponding by a controlling sill at its mouth. Johnson Creek is isolated from the main channel whenever river stage is at or below the elevation of the sill and water in the creek remains pooled at that elevation.

In a later section of this report, cross-sectional data are used to estimate the type and amount of aquatic habitat existing at different flow levels. Stage-discharge ratings from the RP sites are used to estimate stages at the cross sections. The three cross sections described in this report were located at the three RP sites in appendix I; therefore, the final stage-discharge ratings for the RP sites could be used for the cross sections without any adjustment. Some of the other cross sections are not located at RP sites and will require interpolation or extrapolation of cross-sectional stages from the ratings of nearby RPs.

STATISTICAL ANALYSES OF HYDROLOGIC RECORDS

The lowest mean daily flow in 72 years of record from 1922-93 at the Chattahoochee gage was 3,900 ft^3/s on November 15, 1987. Annual low mean daily flows below 5,200 ft^3/s occurred eight times between 1922-93: once in the early 1930's, twice in the mid 1950's, and five times in the last 12 years (in the 1982, 1986, 1987, 1988, and 1993 water years). The mean annual low (based on mean daily flows) for the entire 72 years of record was 7,750 ft^3/s.

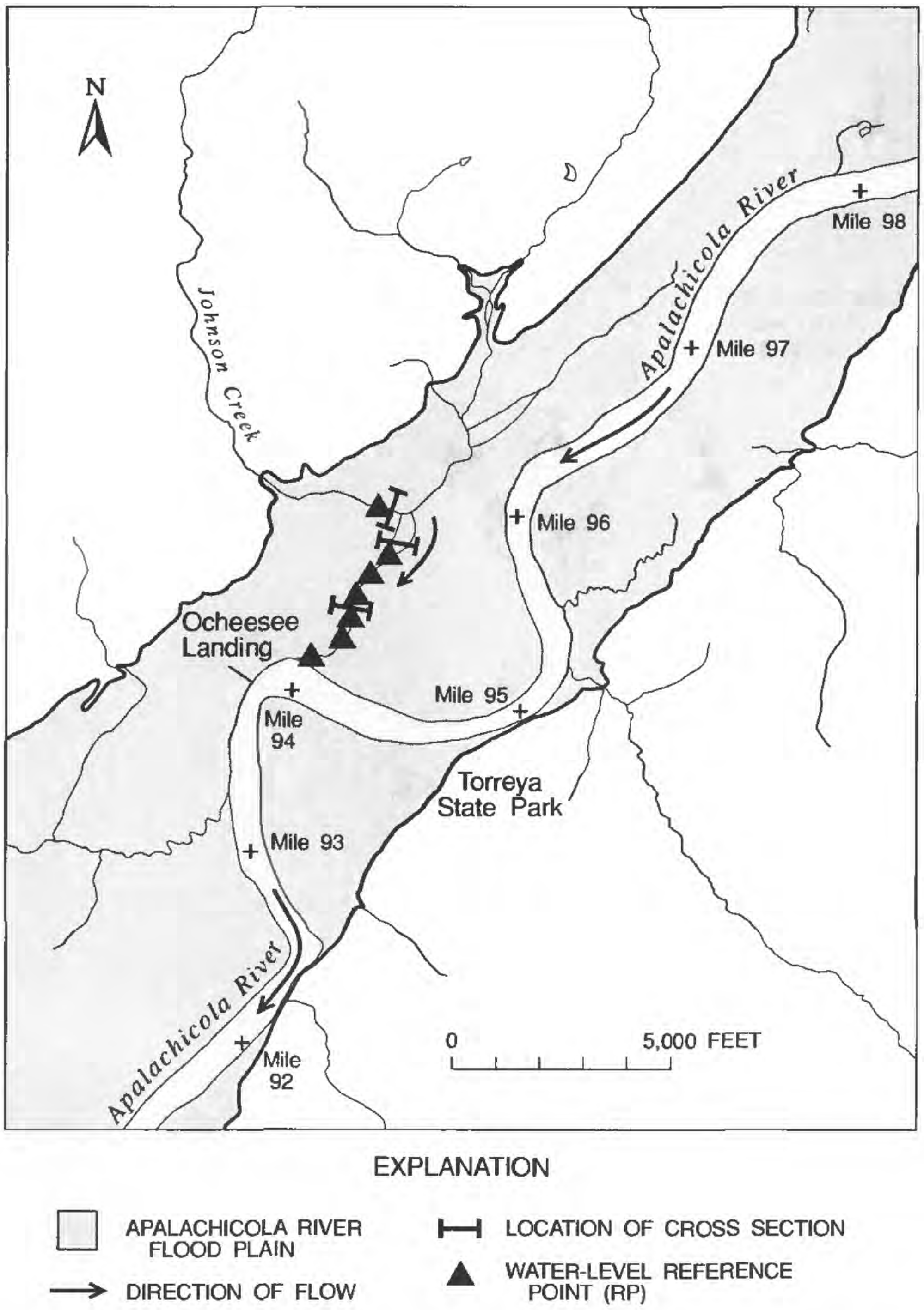

Figure 3. Location of Johnson Creek cross sections and water-level reference points.

Mean annual flow (based on mean daily flows) for the period 1922-93 was 22,165 ft^3/s; mean annual high (based on mean daily flows) was 94,913 ft^3/s. Under present channel conditions, the stage corresponding to mean annual high flow is approximately 16.6 ft higher than the stage corresponding to mean annual flow and 23.7 ft higher than the stage corresponding to mean annual low flow at the Chattahoochee gage.

The highest mean daily flow on record was 291,000 ft^3/s in 1929 and the second highest was 256,000 ft^3/s in 1925. The 1994 water year is not yet included in the period of record for the Chattahoochee gage in this report; however, the third highest mean daily flow occurred during the summer floods of 1994 (206,000 ft^3/s on July 10).

Stages at the study sites when the Chattahoochee gage is at mean annual high flow, mean annual flow, mean annual low flow, and record low flow were determined at three cross section sites using the closest RP rating in appendix I.

PRELIMINARY CATEGORIES OF AQUATIC HABITATS

Cross sections were surveyed at 27 sites to characterize floodplain tributary habitats (figs. 2, 3, 4, and 5; table 1). Cross-section lengths varied from 55 to 1,313 ft. Most of the cross sections started and ended at a recognizable top-of-bank elevation on either side of

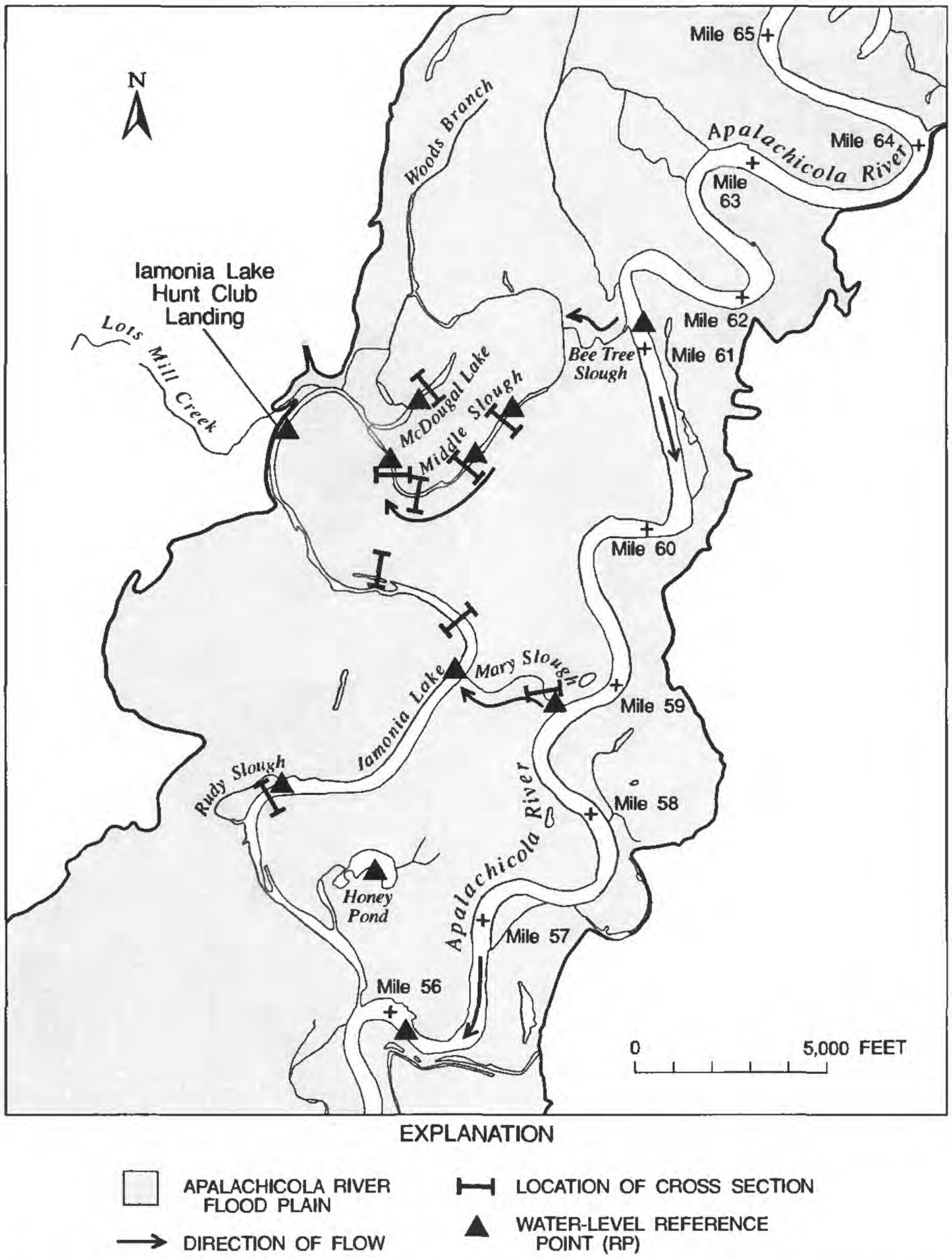

Figure 4. Location of Iamonia Lake cross sections and water-level reference points.

the tributary. These cross sections represented 15 floodplainwide-mapping categories determined from color infrared aerial photographs and USGS quadrangle maps (Light and others, 1993). Mapping categories consisted of four possible stream-size classes in combination with three possible adjacent forest types for each of the three river reaches (upper, middle, and lower). Stream-size classes are numbered 1 through 4, with 1 being the widest and 4 the narrowest channel width. Forest types were: B, bottomland hardwoods; M, mixtures of bottomland hardwoods and tupelo-cypress; and T, tupelo-cypress. The number of mapping categories present in each reach increased with proximity to the river mouth. In the upper reach, only three types occurred on streams at the study sites, all of which were in the narrowest channel-width category (class 4). All four channel-width classes occurred at study sites in the middle and lower river, with a total of five mapping categories occurring at middle river sites, and seven categories at lower river sites.

Substrates of cross sections were classified as silt/clay, sand, or organic mud. Eighty-seven percent of the total length of all cross sections consisted of silt/clay and 12 percent consisted of sand (table 2). Both

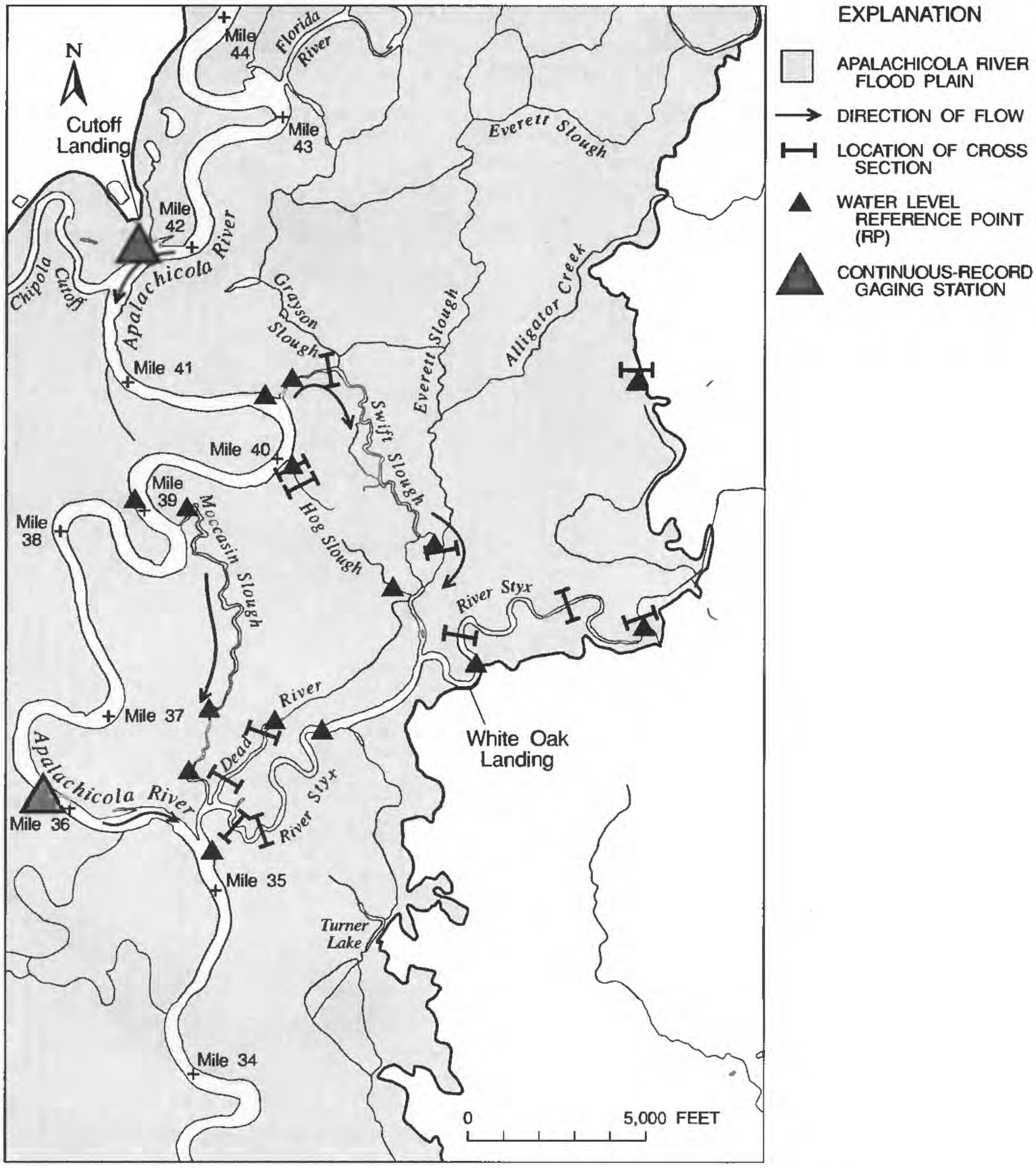

Figure 5. Location of River Styx cross sections and water-level reference points.

substrates were present in nearly the same proportion in all reaches. Sand substrates were the most common in areas submerged less than 6 ft at the time of survey. (Most of the surveys were conducted at stages within 6 ft of extreme low water.) Organic mud was the least common substrate, occurring on less than 1 percent of the total length of surveyed cross sections.

Average lengths of cross sections (bank-to-bank width), substrates, and structure varied with forest types (table 3). Average cross-section length on streams bordered by tupelo-cypress forest (type T) was more than three times the length of type B cross sections. Type B cross sections had much more sand substrate than the other two forest types. Organic mud substrates occurred only on type T cross sections. Structure was highest on cross sections through tupelo-cypress forests, averaging 52 percent of total length with high to very high structure compared to 37 percent in type M and 16 percent on cross sections in type B. Type T cross sections had less variation in land-surface elevation than M or B types and did not contain any deeply submerged parts (greater than 6 ft deep) at the time of survey.

Table 1. Location, date, and length of cross sections surveyed on the Apalachicola River floodplain

[Mapping categories described by Light and others (1993) are based on characteristics visible on infrared aerial photographs and consist of 4 stream-size classes (1 through 4, with 1 being the widest channel-width class) in combination with three adjacent forest types (B, bottomland hardwoods; T, tupelo-cypress; and M, mixtures of bottomland hardwoods and tupelo-cypress). est., estimated]

River reach	Mapping category	Tributary	Distance upstream of mouth (in feet)	Date surveyed	River stage at Chattahoochee gage	Cross-section length (in feet)
UPPER	4B	Johnson Creek	1,450	11-19-93	42.36	76.4
	4B	Flat Creek	120	6-29-93	41.77	96.8
	4B	Flat Creek	900	6-29-93	41.77	79.7
	4M	Flat Creek	6,600	11-23-93	41.71	308.4
	4T	Johnson Creek	3,600	10-14-93	43.12	529.9
	4T	Johnson Creek	4,300	11-19-93	42.36	298.9
MIDDLE	1B	Iamonia Lake	7,200	10-19-93	43.05	331.7
	1B	Iamonia Lake	15,000	10-19-93	43.05	443.3
	1B	McDougal Lake	1,800	10-6-93	43.23	208.7
	2B	Middle Slough	1,425	10-21-93	43.08	132.6
	2B	Middle Slough	5,075	11-17-93	42.34	184.7
	3B	Middle Slough	3,500	10-21-93	43.07	269.4
	3B	Middle Slough	2,500	11-17-93	42.34	211.6
	4B	Marys Slough	2,600	10-22-93	42.95	54.8
	4T	Iamonia Lake	16,700	10-22-93	42.95	274.6
LOWER	1B	River Styx	3,100	10-29-93	39.7 (est.)	170.6
	1B	River Styx	2,500	10-29-93	39.7 (est.)	157.2
	1M	River Styx	15,600	11-18-93	42.32	244.4
	2B	Dead River	1,200	11-1-93	42.49	137.5
	2B	Dead River	2,500	11-1-93	42.49	127.0
	3B	Swift Slough	3,400	7-20-93	41.60	73.8
	3B	Swift Slough	11,000	11-9-93	44.80	88.3
	3T	River Styx	19,600	10-25-93	41.69	719.5
	4B	Hog Slough	4,600	11-9-93	44.80	68.6
	4B	Hog Slough	4,500	11-9-93	44.80	57.4
	4T	River Styx	23,650	6-11-93 11-16-93	45.66 42.51	245.0
	4T	River Styx	37,400	11-10-93	44.56	1,313.1
Total						6,904.5

Table 2. Substrate types in cross sections of floodplain tributaries of the upper, middle, and lower Apalachicola River

Substrate type	Condition at time of survey	Percent of total cross-section length			
		River reach			All reaches
		Upper	Middle	Lower	
SAND	Exposed	4.7	5.7	2.3	3.8
	Submerged less than 6 feet	8.2	6.1	7.9	7.4
	Submerged 6 feet of more	0	0	2.0	1.0
SILT/ CLAY	Exposed	72.9	44.7	65.9	60.8
	Submerged less than 6 feet	14.2	18.0	15.3	15.9
	Submerged 6 feet of more	0	23.7	6.1	10.3
ORGANIC MUD	Exposed	0	1.8	0	.5
	Submerged less than 6 feet	0	0	.5	.3
	Submerged 6 feet of more	0	0	0	0
Totals		100	100	100	100
Total sand		12.9	11.8	12.2	12.2
Total silt/clay		87.1	86.4	87.3	87.0
Total organic mud		0	1.8	0.5	0.8

Table 3. Substrate and vegetative structure in cross sections of Apalachicola River floodplain tributaries with three different adjacent forest types

[Measurements of percent coverage of vegetative structure are grouped into three classes: very low to low (less than 34.9 percent), medium (35-65 percent), and high to very high (greater than 65 percent)]

Adjacent forest type	Average cross-section length (in feet)	Amount of habitat of each substrate type (in percent of total length of cross sections)				Amount of habitat in each vegetative structure class (in percent of total length of cross sections)			
		Sand	Silt/ clay	Organic mud	Total	Very low to low	Medium	High to very high	Total
B -- Bottomland hardwoods	156	25.3	74.7	0	100.0	77.3	6.4	16.3	100.0
M -- Mixtures of bottomland hardwoods and tupelo-cypress	277	7.0	93.0	0	100.0	48.4	14.2	37.4	100.0
T -- Tupelo-cypress	564	1.5	96.8	1.7	100.0	31.5	16.7	51.8	100.0

DESCRIPTION OF PRELIMINARY MAPPING EFFORTS

In this section, changes in estimated surface area of aquatic habitats existing at selected floodplain locations under certain long-term flow conditions are described. This provides an example of the preliminary information that will be needed to map all aquatic habitats existing under various long-term flow conditions.

Stages at three 4B cross sections in the upper river when the Chattahoochee gage is at mean annual high, mean annual, and mean annual low flow are shown in figure 6. Record high stages are not shown, but would be 14 or 15 ft higher than those at mean annual high. Stage at the Chattahoochee gage at record low is 1.8 ft lower than it is at mean annual low. However, stages at the cross sections when Chattahoochee is at mean annual low flow are the same as when the gage is at record low flow. This is because at mean annual low flow and lower, river stage is lower than the streambed at the cross sections of these two creeks.

Average segment widths of each habitat type at these three cross-sections were multiplied by length of 4B stream reaches at the study sites to produce estimates of surface area of habitats. When the Chattahoochee gage is at or below mean annual low flow, an estimated 3.9 acres of aquatic habitat are present in 4B reaches of upper river study sites (table 4). This is less than half the total amount of aquatic habitat present (8.4 acres) when the Chattahoochee gage is at mean annual flow (table 4). At mean annual low flow most of the aquatic habitats have sand substrates, are less than 1 ft deep, and have very low vegetative structure. When the Chattahoochee gage is at mean annual flow, 45 percent of aquatic habitats are over 6 ft deep and substrates are approximately 50 percent sand and 50 percent silt/clay. Vegetative structure is significantly greater at mean annual flow, with almost one-third of the area having more than 15 percent coverage.

When mapping is conducted in a later phase of the project, the area of aquatic habitat in all 4B reaches of the upper river will be estimated using the cross sections shown in figure 6 and determinations from GIS coverages of the total length of 4B reaches in the upper river. Area of aquatic habitat in other floodplain tributary types will be calculated from cross sections, RP ratings, and map lengths using similar methods.

The elevation of top-of-bank features at the beginning and end of the cross sections vary with respect to the flow at Chattahoochee at which they will be overtopped. At the three cross sections shown in figure 6, cross-sections begin and end at bank elevations that are between mean annual flow and mean annual high flow. In the final report, substrate, structure, and elevation information about areas of the floodplain forest beyond the tributary banks that are inundated at high flows will be estimated from transects and observations made in a previous study (Leitman and others, 1983). Estimates of area inundated will be made for flows up to and including mean annual high flow, although estimates made for high flows will be made at fewer flow intervals and with less detailed elevation and habitat data than those made for low flows.

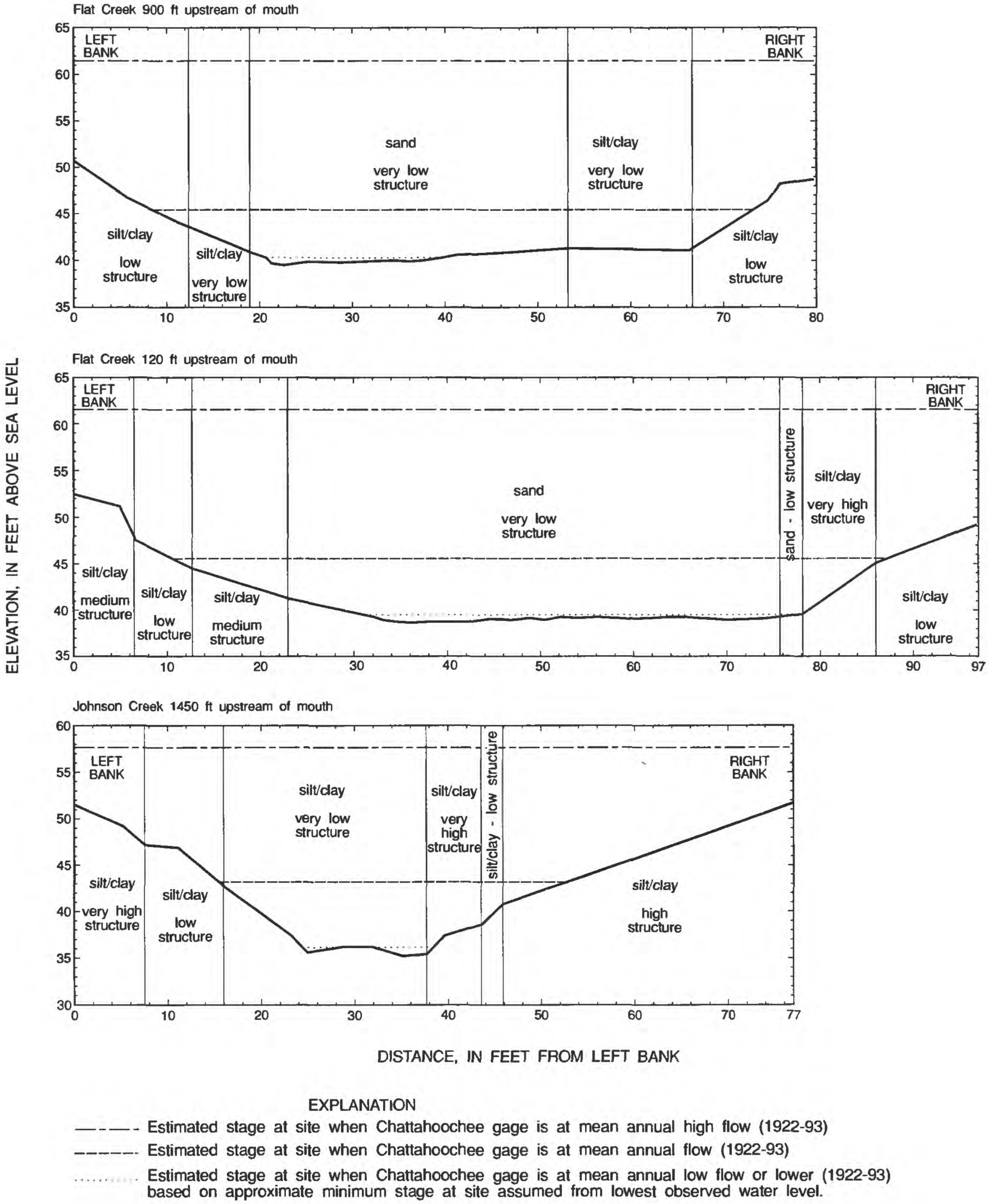

Figure 6. Cross sections of Flat Creek and Johnson Creek showing substrate type, coverage of vegetative structure, and estimated long-term water levels.

Table 4. Type and amount of aquatic habitats in 4B reaches of upper river study sites when Chattahoochee gage is at or below mean annual low flow and at mean annual flow

[Represents area of 4B habitats at Flat Creek and Johnson Creek study sites only. Based on long-term 1922-93 records that were converted to stage by using a rating that reflects present channel conditions. Measurements of percent coverage of vegetative structure are grouped into five classes: very low (less than 15 percent), low (15-34.9 percent), medium (35-65 percent), high (65.1-85 percent), and very high (greater than 85 percent). <, less than; >, greater than]

Depth of water (in feet)	Substrate type	Area of habitat in each vegetative structure class (in acres)					Totals
		Very low	Low	Medium	High	Very high	
At or below mean annual low flow							
<1.0	Sand	2.91	0.11	---	---	---	3.02
	Silt/clay	.45	---	---	---	---	.45
1.0-2.99	Sand	.45	---	---	---	---	.45
	Silt/clay	---	---	---	---	---	---
3.0-6.0	Sand	---	---	---	---	---	---
	Silt/clay	---	---	---	---	---	---
>6.0	Sand	---	---	---	---	---	---
	Silt/clay	---	---	---	---	---	---
Totals		3.82	0.11	---	---	---	3.93
Mean annual flow							
<1.0	Sand	---	---	---	---	---	---
	Silt/clay	---	0.25	---	0.55	---	0.80
1.0-2.99	Sand	---	---	---	---	---	---
	Silt/clay	.33	.50	0.47	---	---	1.30
3.0-6.0	Sand	1.06	---	---	---	---	1.06
	Silt/clay	.95	---	---	---	0.55	1.50
>6.0	Sand	2.93	.11	---	---	---	3.04
	Silt/clay	.66	---	---	---	.08	.74
Totals		5.93	0.86	0.47	0.55	0.63	8.44

SUMMARY OF THE LITERATURE ON APALACHICOLA RIVER FISH SPECIES THAT USE FLOODPLAIN HABITATS

Ninety-one species of fishes are known to inhabit the main channel of the Apalachicola River throughout its 107-mile length. Most of these 91 species are freshwater fishes, but a few coastal and estuarine species that are known to exist throughout the river are included in this group. An additional 40 coastal and estuarine species have been found in the freshwater tidal reach of the lower Apalachicola River and its distributaries; these will not be addressed in this report. Literature sources documenting the occurrence of the 131 freshwater, coastal, and estuarine species in the freshwaters of the Apalachicola River are summarized in appendix VI of Light and others (1993).

Eighty-one percent, or 74 of the 91 species collected in the main channel of the Apalachicola River, are known to occur in floodplain habitats of eastern rivers (table 5). Fifty-one of these species have been collected in the Apalachicola River floodplain (22 common or abundant, 29 collected in low numbers). Twenty-three additional species present in other eastern floodplains would probably be found in the Apalachicola floodplain with expanded collection efforts (based on a review in appendix III of 13 studies, one of which (Baker and others, 1991) summarized floodplain collections in the lower Mississippi River from more than 70 sources of information).

Apalachicola River floodplain collections have been conducted almost entirely by the electrofishing method (app. II). Some species are collected more effectively with a variety of sampling methods. White catfish were collected in relatively large numbers with fyke nets in the nearby Ochlockonee River floodplain. Three species of madtoms (black, tadpole, and speckled), and small centrarchids, such as banded pygmy sunfish and bluespotted sunfish, were also frequently collected with seines, dip nets, traps, and rotenone in other eastern floodplains (app. III).

Apalachicola River floodplain collections were made primarily in one habitat (sluggish tributaries) with minimal or no effort expended in other habitats

Table 5. Occurrence of Apalachicola River fish species in floodplain habitats

[This table summarizes the information in appendix III which lists the 91 fish species known to inhabit the main channel of the Apalachicola River and gives their relative abundance in floodplain habitats (sloughs, tributaries, isolated ponds, and flooded woods) of the Apalachicola and other eastern rivers. Excluded are species restricted to the lower Chipola River and coastal and estuarine species restricted to the tidal floodplain habitats of the lower Apalachicola and other eastern rivers]

Occurrence in floodplain of Apalachicola or other eastern rivers	Fish species known to inhabit main channel of Apalachicola River			Number of fish species
Common or abundant in Apalachicola floodplain collections	Spotted gar Bowfin American eel Gizzard shad Threadfin shad Carp Golden shiner Bluestripe shiner	Taillight shiner Blacktail shiner Spotted sucker Pirate perch Mosquitofish Brook silverside Okefenokee pygmy sunfish	Redbreast sunfish Warmouth Bluegill Redear sunfish Spotted sunfish Largemouth bass Black crappie	22
Collected in low numbers in Apalachicola floodplain	Longnose gar Skipjack herring Redfin pickerel Chain pickerel Pugnose minnow Redeye chub Coastal shiner Weed shiner Bandfin shiner Lake chubsucker Grayfin redhorse	Snail bullhead Yellow bullhead Brown bullhead Channel catfish Spotted bullhead Atlantic needlefish Eastern starhead topminnow Blackspotted topminnow	Bluefin killifish Least killifish Sunshine bass Flier Everglades pygmy sunfish Orangespotted sunfish Dollar sunfish Blackbanded darter Striped mullet Hogchoker	29
Present in other eastern floodplains; presence in Apalachicola floodplain probable	Silverjaw minnow Bannerfin shiner Bluenose shiner Creek chub Quillback White catfish Black madtom Tadpole madtom	Speckled madtom Flathead catfish Golden topminnow Pygmy killifish White bass Striped bass Banded pygmy sunfish	Bluespotted sunfish Banded sunfish Green sunfish Spotted bass Brown darter Swamp darter Gulf darter Sauger	23
No documented occurrences in eastern flood-plains; presence in Apalachicola floodplain uncertain	Southern brook lamprey Gulf of Mexico sturgeon Alabama shad Clear chub Ironcolor shiner	Dusky shiner Sailfin shiner Longnose shiner Flagfin shiner Banded topminow Shadow bass	Shoal bass Florida sand darter Goldstripe darter Yellow perch Mountain mullet Southern flounder	17
Total number of species known to inhabit main channel of Apalachicola River				91

(app. II). The alluvial river floodplains of eastern rivers contain a variety of aquatic habitats that occur outside the main channel of the river but within the annual flood zone. Baker and others (1991) identified seven habitats in the floodplain of the lower Mississippi (and an additional six in the main channel of the river). In this report, aquatic floodplain habitats are grouped into three major types.

The first type, "isolated floodplain ponds and sloughs during low water" includes depressional tupelo-cypress swamps (ranging in size from less than an acre to several hundred acres) that hold water at levels that are independent of the main channel stage except during annual floods, ponds of various sizes (not forested) that are isolated except during annual floods, and small pools in sloughs that are isolated only during low water (and are connected and flowing at medium and high water). Because these areas are mostly shallow, still-water habitats, they usually contain fish communities that are distinctly different from flowing waters of the main channel. Direct information about the fish communities of this habitat in the Apalachicola River floodplain is limited due to incomplete collections (app. II). A total of 32 species are known to inhabit isolated ponds and sloughs of eastern rivers, the most common being redfin pickerel, golden shiner, taillight shiner, yellow bullhead, pirate perch, mosquitofish, least killifish, flier, banded pygmy sunfish, warmouth, bluegill, and black crappie (app. III).

The second type, "connected floodplain backwaters, oxbows, and tributaries during low water" includes both sluggish and swiftly flowing habitats. Sluggish tributaries are common in the Apalachicola floodplain, especially in the middle and lower reaches of the river. They are usually under backwater influence from the river, or are slowly flowing into the river (with a velocity less than 0.5 ft/s) during most of the year. They vary greatly in size; one of the larger examples is Iamonia Lake which exceeds 8 mi in length (including its headwater sloughs) and is nearly as wide and deep as the main river channel in some places. Connected oxbow lakes are also still-water habitats; however, they are rare in the Apalachicola River floodplain. The fish communities of sluggish tributaries in the Apalachicola River floodplain have been relatively well documented by the Florida Game and Fresh Water Fish Commission (app. II). Forty-four species were collected in six floodplain tributary systems of the middle and lower river. The most frequently collected species (in order from most to least common) were bluegill, brook silverside, bowfin, largemouth bass, spotted gar, redear sunfish, spotted sucker, warmouth, American eel, and redbreast sunfish.

Swiftly flowing tributaries (with velocities greater than 1.5 ft/s) are usually draining large swamps, are fed by upland streams that flow through the floodplain before reaching the main river channel, or are relatively steeply sloped connecting streams which divert flow from the main river channel and deliver it back to the river or to a larger floodplain tributary. Fishes of the small, swiftly-flowing tributaries of the Apalachicola River are unknown. Those areas probably support the more common species such as bluegill, bowfin, largemouth bass, redear and redbreast sunfish that thrive in either flowing or still waters, as well as more specialized fishes such as darters and other small stream fishes that prefer flowing water. Blackbanded darters and Gulf darters were commonly collected in a small, swiftly flowing tributary in the floodplain of the Ochlockonee River (unpublished data in the files of U.S. Geological Survey).

The lower reaches of larger tributaries, such as the Chipola River, that pass through the floodplain before entering the main channel were not considered floodplain habitats in this report, because their fish communities include species characteristic of the origin tributary. This treatment differs from that of Baker and others (1991), who included as one of their floodplain habitats the lower reaches of larger tributaries flowing across the Mississippi River floodplain that are influenced by backwater flooding from the Mississippi River on a regular basis. Floodplain species reported only in their "tributary" habitats were not included in appendix III in this report.

The third type, "inundated floodplain during high water" includes all areas inundated during the annual flood season. This includes temporarily flooded bottomland forest that is dry for the greater part of the year, as well as the year-round aquatic habitats described above (ponds, depressional swamps, sloughs, and tributaries) that are deeply inundated and fully connected to the main river channel by overbank flooding. Velocities in the floodplain during a flood can be very sluggish in some areas and quite swift in others depending upon the surrounding topography and the river stage. Twenty-seven species were collected in the Apalachicola River floodplain during a flood (app. II); however, these collection efforts were incomplete and other studies indicate that many more Apalachicola River species probably exploit flooded woods during high water. Seventy percent (64) of the species known to inhabit the main channel of the Apalachicola River have been collected in the inundated floodplains of eastern rivers during high water (app. III). The extent of flood exploitation was similar on the Ochlockonee River, where 75 percent of the known main channel species were collected in the floodplain during floods (Leitman and others, 1991).

Fishes use floodplains to fulfill their basic needs for food, shelter from predators, and reproduction (Guillory, 1979; Wharton and others, 1981, 1982; Baker and others, 1991; and Leitman and others, 1991). Four of the studies summarized in appendix III noted evidence of reproduction indicating that at least 28 Apalachicola River species use floodplain habitats for spawning or nursery grounds. Several studies of southeastern rivers reviewed by Wharton and others (1981) have documented feeding on floodplains as evidenced by terrestrial invertebrates in the stomachs of fishes on inundated floodplains. The abundant vegetative structure in floodplain habitats such as snags, stumps, debris, grasses, and shrubs provide excellent shelter from predators (Aggus and Elliot, 1975; Savino and Stein, 1982; Benke and others, 1985; and Harmon and others, 1986).

The degree to which fishes depend on floodplain habitats varies with species or species guilds. Floodplains are critical habitats for backwater species such as redfin pickerel, taillight shiner, flier, and warmouth that typically reside year-round in still-water habitats of the floodplain and are rarely found in the flowing waters of the main channel. These species probably depend on the floodplain for all of their basic needs. Species such as gizzard shad, spotted sucker, redbreast sunfish, bluegill, and largemouth bass are common in both the floodplain and the main channel, and may fulfill basic needs in either habitat. Abundance of these more opportunistic species may be dependent upon availability of floodplain habitats. Still others such as bannerfin shiner and white bass exploit the floodplain primarily during floods, benefiting from the increased space and food available during the high-water season when flood waters are flowing through forest communities. Use of the floodplain during floods for spawning or intensive feeding may meet critical needs in the life cycle of these fishes, despite the relatively short time they are using these habitats.

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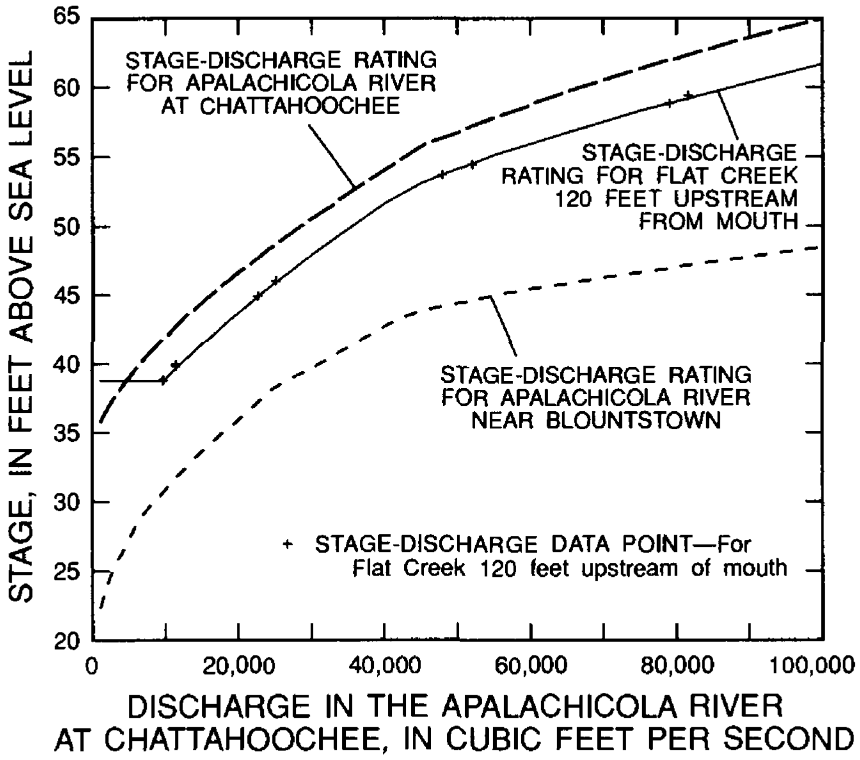
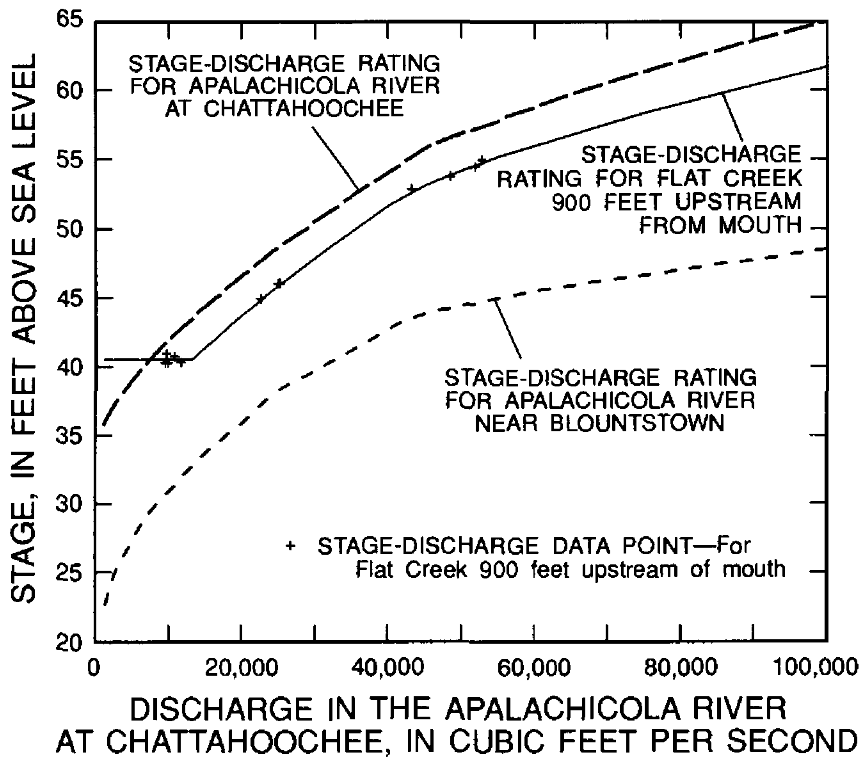
(page 19 follows)

Appendix I

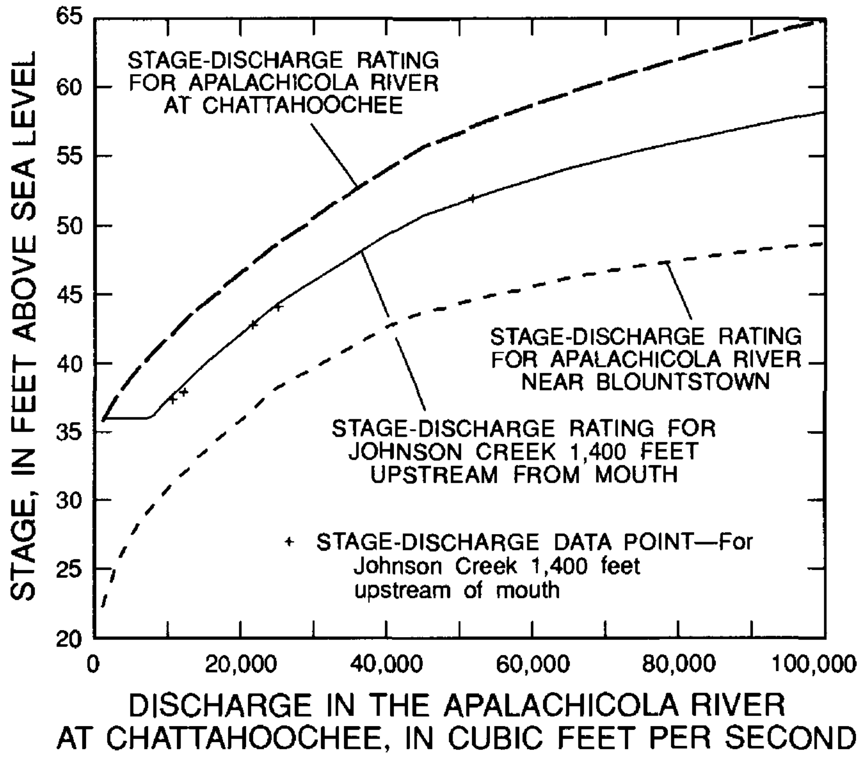
Stage-discharge ratings showing relation between flow at Chattahoochee and stage at floodplain reference points on Flat Creek and Johnson Creek



Appendix IA. Stage at Flat Creek 120 feet upstream from mouth, Apalachicola River at Chattahoochee, and Apalachicola River near Blountstown in relation to discharge in Apalachicola River at Chattahoochee.



Appendix IB. Stage-discharge points and rating for Flat Creek 900 feet upstream from mouth, and stage-discharge ratings for Chattahoochee and Blountstown gaging stations.



Appendix IC. Stage-discharge data points and rating for Johnson Creek 1,400 feet upstream from mouth, and stage-discharge ratings for Chattahoochee and Blountstown gaging stations.

Appendix II

Summary of fish collections in the floodplain of the Apalachicola River

Appendix II. Summary of fish collections in the floodplain of the Apalachicola River

Species	Number of fish, in percent: Dipnet collections in isolated swamp during low water [incomplete][1]	Electrofishing collections in sluggish floodplain tributaries during low water[2]	Electrofishing collections in floodplain during high water[3] [incomplete][4]
Spotted gar		6.7	
Longnose gar		.2	
Bowfin		8.0	0.1
American eel		3.6	.1
Skipjack herring		.4	
Gizzard shad		2.6	.6
Threadfin shad		1.8	87.6
Redfin pickerel			.1
Chain pickerel		.8	.1
Carp		2.1	.1
Golden shiner	0.6	3.1	
Bluestripe shiner			1.0
Pugnose minnow		.3	
Redeye chub		.6	
Taillight shiner		[5]1.4	<.1
Coastal shiner		.3	.4
Weed shiner		<.1	.2
Blacktail shiner		1.6	2.8
Bandfin shiner			.2
Lake chubsucker		.3	
Spotted sucker		4.1	.1
Grayfin redhorse		.4	<.1
Snail bullhead		<.1	
Yellow bullhead		.1	
Brown bullhead		.1	
Channel catfish		.6	
Spotted bullhead		<.1	
Pirate perch	.2	[5]1.1	
Atlantic needlefish		[6]---	
Eastern starhead topminnow			.1
Blackspotted topminnow			.1
Bluefin killifish	.4		
Mosquitofish	97.0	.1	[7]<.1
Least killifish	.4	<.1	[7]---
Brook silverside		9.6	3.3
Sunshine bass		<.1	
Flier		.2	
Everglades pygmy sunfish		.1	<.1
Okefenokee pygmy sunfish	1.1	<.1	.1
Redbreast sunfish		3.5	1.3
Warmouth		3.9	<.1
Orangespotted sunfish		.1	
Bluegill	.2	24.5	.6
Dollar sunfish		.1	
Redear sunfish		4.7	.5
Spotted sunfish		3.0	.1
Largemouth bass		7.1	.2
Black crappie		2.9	
Blackbanded darter		<.1	
Striped mullet		<.1	
Hogchoker		.1	
Total:	100.0	99.9	99.9
Total number of fish:	470	2,282	[4]3,090 (382)
Total number of species:	7	44	27
Total unit effort in minutes:	NA	320	140
Total catch per unit effort in number of fish per minute:	NA	7.1	[4]22.1 (2.7)

[1]Collections were made in November 1992 by Helen Light and other USGS staff; identifications were made by Michael Hill, Florida Game and Fresh Water Fish Commission (FGFWFC). Data are from files of the USGS and have not been reported in any previous publication. These data are considered incomplete because of minimal effort. Also, all numbers are estimates because not all fish were counted (the purpose of the trip was to collect mosquitofish for contamination analysis). Fish were collected from two sites in upper river swamps that had been isolated from the river for approximately 7 months.

[2]Thirty-three collections were made in Iamonia Lake, Equaloxic Creek, Florida River, River Styx, Kennedy Creek, and Owl Creek in June, August, and October, 1985 by FGFWFC. Sites were located an average distance of 3 miles upstream from the confluence of the tributary with the main channel of the Apalachicola River and all tributaries were hydrologically connected to the main channel at the time of sampling. These data were reported in summarized form (without numbers of fish) in Hill and others (1990). The numbers reported here have not been reported in any previous publication and are derived from raw data in the files of the FGFWFC.

[3]Collections were made in February 1983 by FGFWFC. Data was retrieved from FGFWFC files and have not been reported in any previous publication.

[4]Most of this collection (87 percent) consisted of small (less than 4 inches) threadfin shad. Shad tend to concentrate in schools, which results in high variability in the catches. The remaining catch, not counting the threadfin shad, was 382 fish (catch per unit effort on remaining fish is 2.7 fish per minute). This collection is considered incomplete, because the number of fish caught (excluding threadfin shad) is too small to be representative, considering the diversity of the fish population in the Apalachicola. The amount of effort (140 minutes of electroshocking time) would be adequate under normal, low water conditions, but is too small in this case, because catch efficiency during floods is usually much lower than during low water periods.

[5]In this collection, these species were commonly collected in upper reaches of tributaries but rarely collected in lower reaches of tributaries. These species were also rare in main channel collections reported by Hill and others, 1990 (p. 16, 17).

[6]Two observations of Atlantic needlefish in Moccasin Slough, a tributary of River Styx in the lower Apalachicola River floodplain, were made on August 2 and 3, 1993, by Helen Light and Melanie Darst. Observation sites were 1,100 feet and 3,100 feet upstream of the mouth of Moccasin Slough where it joins the River Styx.

[7]An additional high water collection not quantified in this table reported large numbers of mosquitofish and small numbers of least killifish collected by dipnet in the Apalachicola floodplain during flooding. This collection was made in November 1992 by Helen Light and other USGS staff in flooded swamps of the lower river near the Sumatra gage.

Appendix III

Relative abundance of Apalachicola River fish species in floodplains of eastern rivers

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers

This appendix lists the 91 species of fishes known to inhabit the main channel of the Apalachicola River and gives their relative abundance in floodplain habitats of eastern rivers based on a review of the literature and in the Apalachicola River floodplain based on Appendix II. Excludes coastal and estuarine species that are restricted to the lower Apalachicola River.

Abbreviations:

MA, most abundant by number;

AB, abundant, 10 percent or greater;

CM, common, 1 to 9.99 percent (in collections with sample size of 200 or less, at least 3 individuals were required for the species to be considered common, less than 3 were placed in the rare category);

RA, rare, less than 1 percent;

REP, evidence of spawning or use of floodplain as nursery (young-of-year fishes, or fishes in spawning condition);

EX, exclusive to floodplain (rare or absent in main channel);

PROB, probable, but records lacking or inclusive, according to Baker and others (1991).

Apalach, Apalachicola River, drainage area 19,600 mi^2 (square miles);

Black, Black Creek, a tributary of the Pascagoula River in southeastern Mississippi, drainage area 77 mi^2;

Creep, Creeping Swamp, a tributary of Swift Creek, which is a tributary of Neuse River, which flows into Pamlico Sound, located in the coastal plain of North Carolina, drainage area 31 mi^2;

Escam, Escambia River in west Florida, drainage area 3,817 mi^2;

IrvCrCanada, Irvine Creek, a tributary of the Grand River which flows into Lake Erie, located in southern Ontario, Canada, drainage area unknown but based on the reported discharge is probably less than 125 mi^2;

Kank, Kankakee River, a tributary of the Illinois River, which flows into the upper Mississippi River just above its confluence with the Missouri River, located in northeastern Illinois, drainage area 2,295 mi^2;

LoMiss, as used in Baker's article (B1) it means lower Mississippi River from Ohio River confluence to Gulf of Mexico, as used in Guillory's article (G1) it means a more specific location on the lower Mississippi River located in south central Louisiana, drainage area at Gulf of Mexico is 1,254,500 mi^2;

Mingo, Mingo National Wildlife Refuge (NWR), a large bottomland hardwoods area located in southeastern Missouri, contains old drainage ditches (ca. 1930) and the Old Mingo River channel. [NOTE: These stream-like features drain into the St. Francis River which is a tributary of the Mississippi River. The drainage area of Mingo NWR is unknown, however the refuge itself is 34 mi^2 and it drains part of the Ozarks which are outside the refuge (Terry Peacock, Mingo NWR, oral commun., 1994)];

Oak, Oakmulgee Creek, a tributary to the Cahaba River in the Alabama River drainage, located in west-central Alabama, drainage area 220 mi^2;

Ochlock, Ochlockonee River in north Florida, drainage area near study sites 1,140 mi^2;

Pea, Pea River, a tributary of the Choctawhatchee River, located in southeastern Alabama, drainage area 959 mi^2;

SanFe, Santa Fe River, a tributary of the Suwannee River in north central Florida, drainage area 1,017 mi^2;

UpSuw, Upper Suwannee River from below the sill at Okeefenokee Swamp to Fargo in southeastern Georgia, drainage area at Fargo 1,260 mi^2 (including Okefenokee Swamp).

elec, electrofishing	sein, seine
mtrp, minnow trap	rote, rotenone
otrp, other trap	obsv, observation only
fnet, fyke net	comb, combination of gear types
dipn, dipnet	unk, unknown gear type

a, appendix;

t, table;

A2, Appendix II in this report (Summary of fish collections in floodplain of Apalachicola River);

B1, Baker and others (1991),

B2, Bass and Hitt (1973);

B3, Beecher and others (1977) [NOTE #1: The bulk of the collections reported in Beecher and others (1977), were made in an Escambia River oxbow when it was completely isolated from the main river, but a few collections were made in the oxbow when it was connected. Recollections of the senior author are that gizzard shad, threadfin shad, longnose gar, and striped mullet were present in the oxbow when it was connected but not when it was isolated (H. A. Beecher, oral commun., 1994). However, all of this data is entered in the last column (unknown hydrologic condtions) due to the uncertainty of the authors recollections. NOTE #2: Largemouth and spotted bass were grouped together because identification was not clearly differentiated between the two. The bulk of them were largemouth but some were clearly spotted. (H.A. Beecher, oral commun., 1994)];

F1, Finger and Stewart (1987);

F2, Foster and others (1988);

G1, Guillory (1979);

H1, Halyk and Balon (1983);

H2, Holder (1971b);

K1, Knight and others (1991);

K2, Kwak (1988);

L1, Leitman and others (1991);

R1, Ross and Baker (1983);

W1, Walker and Sniffen (1985).

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Southern brook lamprey				
Gulf of Mexico sturgeon				
Spotted gar	CM,LoMiss,comb,B1 *Similar sp: Florida Gar:* CM,Ochlock,obsv,t4,L1	CM,Apalach,elec,A2 CM,LoMiss,comb,B1 *Similar sp: Florida Gar:* CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2	CM,LoMiss,comb,B1 *Similar sp: Florida Gar:* RA,Ochlock,elec,t5,L1 CM,Ochlock,fnet,t3,L1 RA,UpSuw,rote,t2,H2 CM,SanFe,elec,t33,B2	RA,Escam,elec,B3
Longnose gar	RA,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,LoMiss,comb,B1	RA,LoMiss,comb,B1	RA,Ochlock,mtrp,a1,L1 RA,Escam,elec,B3
Bowfin	RA,LoMiss,comb,B1 RA,Kank,sein,K2	CM,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 REP,Ochlock,a3,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 AB,LoMiss,comb,B1 CM,Kank,otrp,K2	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 RA,Ochlock,mtrp,t3,L1 RA,UpSuw,rote,t2,H2 RA,UpSuw,rote,t3,H2 RA,SanFe,elec,t33,B2 CM,Pea,comb,t9,K1 RA,Black,otrp,R1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1 RA,Creep,comb,t6,W1	CM,Escam,elec,B3
American eel		CM,Apalach,elec,A2	RA,Apalach,elec,A2 RA,LoMiss,comb,B1 CM,Creep,comb,t6,W1	RA,Escam,elec,B3
Alabama shad				
Skipjack herring		RA,Apalach,elec,A2 AB,LoMiss,comb,B1	RA,LoMiss,comb,B1	
Gizzard shad		CM,Apalach,elec,A2 AB,Ochlock,elec,t5,L1 AB,LoMiss,comb,B1	RA,Apalach,elec,A2 AB,Ochlock,elec,t5,L1 RA,Ochlock,fnet,t3,L1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1	CM,Escam,elec,B3
Threadfin shad		CM,Apalach,elec,A2 AB,LoMiss,comb,B1	MA,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1	CM,Escam,elec,B3

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Redfin pickerel	RA,Ochlock,mtrp,t4,L1 CM,Ochlock,otrp,t4,L1 EX,Ochlock,p.21,L1 *Similar sp.: Grass pickerel* CM,LoMiss,comb,B1 AB,Kank,sein,K2	CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2 *Similar sp.: Grass pickerel* RA,LoMiss,comb,B1 MA,Kank,otrp,K2	RA,Apalach,elec,A2 CM,UpSuw,rote,t2,H2 AB,UpSuw,rote,t3,H2 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 CM,Black,otrp,R1 RA,Black,sein,R1 AB,Creep,comb,t6,W1 *Similar sp.: Grass pickerel* CM,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1	
Chain pickerel	RA,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 CM,Pea,comb,t9,K1 RA,Oak,comb,t8,K1 RA,Black,otrp,R1 RA,Black,sein,R1 RA,LoMiss,comb,B1	CM,Escam,elec,B3
Carp		CM,Apalach,elec,A2 AB,LoMiss,comb,B1 RA,Kank,otrp,K2	RA,Apalach,elec,A2 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1	
Silverjaw minnow			RA,Black,sein,R1	
Clear chub				
Golden shiner	RA,Apalach,dipn,A2 AB,LoMiss,comb,B1	CM,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 RA,LoMiss,comb,B1 RA,Kank,otrp,K2	RA,Ochlock,elec,t5,L1 RA,Ochlock,fnet,t3,L1 AB,SanFe,elec,t33,B2 AB,Pea,comb,t9,K1 RA,Oak,comb,t8,K1 RA,Black,sein,R1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1 RA,Creep,comb,t6,W1	
Bluestripe shiner			CM,Apalach,elec,A2	
Ironcolor shiner				
Dusky shiner				
Pugnose minnow	CM,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,LoMiss,comb,B1 RA,Kank,otrp,K2	CM,Ochlock,elec,t5,L1 RA,Ochlock,mtrp,t3,L1 CM,Oak,comb,t8,K1 RA,Black,sein,R1 CM,LoMiss,comb,B1	CM,Escam,elec,B3 RA,Escam,sein,B3
Redeye chub		RA,Apalach,elec,A2		
Sailfin shiner				

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Bannerfin shiner		RA,Ochlock,elec,t5,L1	CM,Ochlock,elec,t5,L1	
Longnose shiner				
Taillight shiner	AB,Ochlock,mtrp,t4,L1 REP,Ochlock,A2,L1 EX,Ochlock,p.21,L1 CM,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1	RA,Escam,elec,B3 RA,Escam,sein,B3 EX,Escam,elec,B3
Coastal shiner		RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1	
Flagfin shiner				
Weed shiner		RA,Apalach,elec,A2 AB,Ochlock,elec,t5,L1 RA,LoMiss,comb,B1 RA,Kank,otrp,K2	RA,Apalach,elec,A2 MA,Ochlock,elec,t5,L1 CM,Ochlock,mtrp,t3,L1 RA,Ochlock,dipn,t3,L1 CM,Pea,comb,t9,K1 AB,Oak,comb,t8,K1 AB,Black,otrp,R1 AB,Black,sein,R1 RA,LoMiss,comb,B1	RA,Escam,elec,B3
Blacktail shiner		CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1	RA,Escam,elec,B3
Bluenose shiner			CM,Black,sein,R1	
Bandfin shiner			RA,Apalach,elec,A2	
Creek chub	AB,IrvCrCanada,rote,H1 REP,IrvCrCanada,,H1			
Quillback		RA,LoMiss,comb,B1	RA,LoMiss,comb,B1	
Lake chubsucker		RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2	RA,Ochlock,fnet,t3,L1 MA,UpSuw,rote,t2,H2 RA,UpSuw,rote,t3,H2 RA,Pea,comb,t9,K1	REP,Mingo,otrp,F1
Spotted sucker	RA,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,SanFe,elec,t33,B2 CM,Oak,comb,t8,K1 RA,LoMiss,comb,B1 REP,LoMiss,sein,G1	CM,Escam,elec,B3
Grayfin redhorse		RA,Apalach,elec,A2	RA,Apalach,elec,A2	*Similar sp.: Blacktail redhorse:* CM,Escam,elec,B3
Snail bullhead		RA,Apalach,elec,A2		
White catfish			CM,Ochlock,fnet,t3,L1	

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Yellow bullhead	REP,Ochlock,a3,L1 CM,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 CM,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1 CM,Kank,otrp,K2	RA,Ochlock,otrp,t3,L1 CM,Ochlock,fnet,t3,L1 AB,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1	REP,Mingo,otrp,F1
Brown bullhead	REP,Ochlock,a3,L1 PROB,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1	RA,Ochlock,mtrp,t3,L1 MA,Ochlock,fnet,t3,L1 REP,Ochlock,a3,L1 EX,Ochlock,p.21,L1 RA,UpSuw,rote,t2,H2 RA,SanFe,elec,t33,B2 PROB,LoMiss,comb,B1 RA,Creep,comb,t6,W1	RA,Escam,elec,B3 REP,Mingo,otrp,F1
Channel catfish		RA,Apalach,elec,A2 AB,LoMiss,comb,B1	CM,Ochlock,fnet,t3,L1 RA,SanFe,elec,t33,B2 CM,LoMiss,comb,B1	
Spotted bullhead		RA,Apalach,elec,A2		
Black madtom			CM,Oak,comb,t8,K1	
Tadpole madtom	PROB,LoMiss,comb,B1 RA,Kank,sein,K2	PROB,LoMiss,comb,B1 CM,Kank,otrp,K2	RA,Oak,comb,t8,K1 CM,Black,otrp,R1 PROB,LoMiss,comb,B1	
Speckled madtom			RA,Oak,comb,t8,K1 RA,Black,otrp,R1	
Flathead catfish		RA,LoMiss,comb,B1	RA,LoMiss,comb,B1	
Pirate perch	RA,Apalach,dipn,A2 MA,Ochlock,mtrp,t4,L1 CM,Ochlock,otrp,t4,L1 CM,Ochlock,dipn,t4,L1 REP,Ochlock,a2,L1 AB,LoMiss,comb,B1 AB,Kank,sein,K2	CM,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 REP,Ochlock,a2,L1 AB,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1 AB,Kank,otrp,K2	AB,Ochlock,mtrp,t3,L1 REP,Ochlock,a2&3,,L1 CM,UpSuw,rote,t2,H2 AB,UpSuw,rote,t3,H2 MA,Pea,comb,t9,K1 MA,Oak,comb,t8,K1 RA,Black,otrp,R1 RA,Black,sein,R1 AB,LoMiss,comb,B1 REP,Mingo,otrp,F1 MA,Creep,comb,t6,W1	
Atlantic needlefish		RA,Apalach,obsv,A2		
Golden topminnow	CM,LoMiss,comb,B1	RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1	RA,UpSuw,rote,t2,H2 CM,LoMiss,comb,B1	
Banded topminnow				

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Eastern starhead topminnow		CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2	RA,Apalach,elec,A2 CM,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 RA,LoMiss,sein,G1 CM,Black,sein,R1	
Blackspotted topminnow	CM,LoMiss,comb,B1	RA,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 RA,Black,otrp,R1 AB,Black,sein,R1 CM,LoMiss,comb,B1	RA,Escam,elec,B3
Pygmy killifish		RA,UpSuw,rote,t5,H2	CM,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2	
Bluefin killifish	RA,Apalach,dipn,A2			
Mosquitofish	MA,Apalach,dipn,A2 RA,Ochlock,mtrp,t4,L1 MA,Ochlock,dipn,t4,L1 REP,Ochlock,a2&3,L1 AB,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 REP,Ochlock,a2,L1 MA,UpSuw,rote,t4,H2 AB,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 MA,Ochlock,dipn,t3,L1 REP,Ochlock,a2&3,L1 AB,UpSuw,rote,t2,H2 RA,UpSuw,rote,t3,H2 CM,Pea,comb,t9,K1 MA,Black,sein,R1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1	RA,Escam,sein,B3
Least killifish	RA,Apalach,dipn,A2 CM,Ochlock,dipn,t4,L1 REP,Ochlock,a2,L1 EX,Ochlock,p.21,L1	RA,Apalach,elec,A2	RA,Ochlock,dipn,t3,L1	
Brook silverside	CM,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,Ochlock,dipn,t3,L1 REP,Ochlock,a3,L1 CM,UpSuw,rote,t2,H2 RA,UpSuw,rote,t3,H2 AB,SanFe,elec,t33,B2 RA,Pea,comb,t9,K1 CM,Black,sein,R1 CM,LoMiss,comb,B1	CM,Escam,elec,B3 MA,Escam,sein,B3
White bass		RA,Ochlock,elec,t5,L1 RA,LoMiss,comb,B1	CM,Ochlock,fnet,t3,L1 REP,Ochlock,a2,L1 CM,LoMiss,comb,B1	
Striped bass		RA,LoMiss,comb,B1		
Sunshine bass		RA,Apalach,elec,A2		
Shadow bass	*Similar sp. A.rupestris:* RA,IrvCrCanada,rote,H1 AB,Kank,sein,K2	*Similar sp. A.rupestris:* CM,Kank,otrp,K2		

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Flier	CM,Ochlock,mtrp,t4,L1 MA,Ochlock,otrp,t4,L1 RA,Ochlock,dipn,t4,L1 REP,Ochlock,a2&3,L1 EX,Ochlock,p.21,L1 AB,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1	RA,Ochlock,elec,t5,L1 CM,Ochlock,mtrp,t3,L1 RA,Ochlock,fnet,t3,L1 REP,Ochlock,a2&3,L1 RA,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 CM,SanFe,elec,t33,B2 CM,Pea,comb,t9,K1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1 CM,Creep,comb,t6,W1	
Everglades pygmy sunfish		RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1	RA,Apalach,elec,A2	RA,Escam,sein,B3
Okefenokee pygmy sunfish	CM,Apalach,dipn,A2	RA,Apalach,elec,A2	RA,Apalach,elec,A2	
Banded pygmy sunfish	RA,Ochlock,mtrp,t4,L1 AB,Ochlock,dipn,t4,L1 REP,Ochlock,a2,L1 EX,Ochlock,p.21,L1 AB,LoMiss,comb,B1	RA,LoMiss,comb,B1	RA,Ochlock,dipn,t3,L1 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 CM,Black,otrp,R1 RA,Black,sein,R1 CM,LoMiss,comb,B1 REP,Mingo,otrp,F1 RA,Creep,comb,t6,W1	
Bluespotted sunfish	CM,Ochlock,mtrp,t4,L1 REP,Ochlock,a2,L1 EX,Ochlock,p.21,L1	RA,Ochlock,elec,t5,L1 REP,Ochlock,a2,L1 AB,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2	AB,Ochlock,mtrp,t3,L1 AB,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 RA,Creep,comb,t6,W1	
Banded sunfish		CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2	CM,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 CM,Creep,comb,t6,W1	
Redbreast sunfish		CM,Apalach,elec,A2 AB,Ochlock,elec,t5,L1	CM,Apalach,elec,A2 AB,Ochlock,elec,t5,L1 MA,Ochlock,mtrp,t3,L1 AB,Ochlock,fnet,t3,L1 MA,SanFe,elec,t33,B2	
Green sunfish	RA,Ochlock,mtrp,p14,L1 RA,LoMiss,comb,B1 CM,Kank,sein,K2	RA,LoMiss,comb,B1 AB,Kank,otrp,K2	RA,Oak,comb,t8,K1 AB,Black,otrp,R1 RA,Black,sein,R1 RA,LoMiss,comb,B1 RA,Creep,comb,t6,W1	

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Warmouth	AB,Ochlock,mtrp,t4,L1 AB,Ochlock,otrp,t4,L1 CM,Ochlock,dipn,t4,L1 REP,Ochlock,a2,L1 AB,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2 AB,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,Ochlock,mtrp,t3,L1 RA,Ochlock,dipn,t3,L1 CM,Ochlock,fnet,t3,L1 CM,UpSuw,rote,t2,H2 CM,UpSuw,rote,t3,H2 RA,SanFe,elec,t33,B2 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 CM,Black,otrp,R1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1 RA,Creep,comb,t6,W1	CM,Escam,elec,B3
Orangespotted sunfish	RA,LoMiss,comb,B1 RA,Kank,sein,K2	RA,Apalach,elec,A2 CM,LoMiss,comb,B1 AB,Kank,otrp,K2	CM,LoMiss,comb,B1	
Bluegill	RA,Apalach,dipn,A2 AB,Ochlock,mtrp,t4,L1 CM,Ochlock,otrp,t4,L1 RA,Ochlock,dipn,t4,L1 CM,LoMiss,comb,B1 CM,Kank,sein,K2	MA,Apalach,elec,A2 MA,Ochlock,elec,t5,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 AB,LoMiss,comb,B1 CM,Kank,otrp,K2	RA,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 CM,Ochlock,mtrp,t3,L1 AB,Ochlock,dipn,t3,L1 AB,Ochlock,fnet,t3,L1 CM,SanFe,elec,t33,B2 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 MA,Black,otrp,R1 CM,Black,sein,R1 AB,LoMiss,comb,B1 REP,LoMiss,sein,G1 REP,Mingo,otrp,F1 RA,Creep,comb,t6,W1	MA,Escam,elec,B3 CM,Escam,sein,B3
Dollar sunfish		RA,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 CM,UpSuw,rote,t4,H2 CM,UpSuw,rote,t5,H2	RA,Ochlock,elec,t5,L1 CM,UpSuw,rote,t2,H2 RA,LoMiss,sein,G1 CM,Black,otrp,R1 RA,Black,sein,R1	
Redear sunfish	RA,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,Ochlock,mtrp,t3,L1 CM,Ochlock,fnet,t3,L1 CM,SanFe,elec,t33,B2 RA,Pea,comb,t9,K1 CM,Black,otrp,R1 RA,Black,sein,R1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1 RA,Creep,comb,t6,W1	CM,Escam,elec,B3

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Spotted sunfish	CM,LoMiss,comb,B1	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1	RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 RA,Ochlock,mtrp,t3,L1 RA,UpSuw,rote,t3,H2 RA,SanFe,elec,t33,B2 CM,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 CM,LoMiss,comb,B1 RA,Black,otrp,R1	RA,Escam,elec,B3
Shoal bass				
Spotted bass				RA(possibly CM), Escam,elec,B3
Largemouth bass	RA,LoMiss,comb,B1 CM,Kank,sein,K2	CM,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,UpSuw,rote,t4,H2 RA,UpSuw,rote,t5,H2 CM,LoMiss,comb,B1	RA,Apalach,elec,A2 CM,Ochlock,elec,t5,L1 RA,Ochlock,fnet,t3,L1 REP,Ochlock,a3,L1 AB,SanFe,elec,t33,B2 RA,Pea,comb,t9,K1 CM,Black,sein,R1 CM,LoMiss,comb,B1 REP,Mingo,otrp,F1	CM,Escam,elec,B3
Black crappie	CM,Ochlock,mtrp,t4,L1 CM,Ochlock,otrp,t4,L1 RA,Ochlock,dipn,t4,L1 REP,Ochlock,a3,L1 RA,Kank,sein,K2	CM,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 RA,UpSuw,rote,t5,H2 RA,LoMiss,comb,B1 RA,Kank,otrp,K2	RA,Ochlock,elec,t5,L1 CM,Ochlock,fnet,t3,L1 CM,SanFe,elec,t33,B2 RA,Pea,comb,t9,K1 CM,LoMiss,comb,B1 REP,LoMiss,sein,G1 RA,Creep,comb,t6,W1	CM,Escam,elec,B3 REP,Mingo,otrp,F1
Florida sand darter				
Brown darter			RA,SanFe,elec,t33,B2	
Swamp darter		RA,Ochlock,elec,t5,L1	RA,Ochlock,dipn,t3,L1 RA,Creep,comb,t6,W1	
Goldstripe darter				
Gulf darter		RA,Ochlock,elec,t5,L1 REP,Ochlock,a2,L1	RA,Ochlock,elec,t5,L1 CM,Ochlock,mtrp,t3,L1 RA,Pea,comb,t9,K1 CM,Oak,comb,t8,K1 CM,Black,otrp,R1 CM,Black,sein,R1	
Yellow perch				
Blackbanded darter		RA,Apalach,elec,A2 RA,Ochlock,elec,t5,L1 REP,Ochlock,a2,L1	RA,Ochlock,elec,t5,L1 CM,Ochlock,mtrp,t3,L1 RA,Oak,comb,t8,K1 RA,Black,otrp,R1	
Sauger		CM,LoMiss,comb,B1	RA,LoMiss,comb,B1	

Appendix III. Relative abundance of Apalachicola River fish species in floodplains of eastern rivers--Continued

Species of fishes known to inhabit main channel of Apalachicola River	Occurrence in isolated floodplain ponds and sloughs during low water	Occurrence in connected floodplain backwaters, oxbows, and tributaries during low water	Occurrence in inundated floodplain during high water	Occurrence in floodplain under unknown hydrologic conditions
Mountain mullet				
Striped mullet		RA,Apalach,elec,A2	CM,SanFe,elec,t33,B2	RA,Escam,elec,B3
Southern flounder				
Hogchoker		RA,Apalach,elec,A2		