Table 40. Occurrence of plant species in ten evenly-spaced transects around Lake Wales.

Common name	Scientific name	Percent of Transects
alligator-weed	*Alternanthera philoxeroides*	30
smartweed	*Polygonum hydropiperoides*	20
cat-tail	*Typha* spp.	20
water-pennywort	*Hydrocotyle umbellata*	70
flat-sedge	*Cyperus odoratus*	20
torpedograss	*Panicum repens*	60

eliminated along with most other plants by 1979. The Florida Department of Natural Resources has continued to monitored the plant community of Lake Wales from 1982 to present. Very few aquatic macrophytes were recorded during that time, which is similar to our findings. Thus, the fish population in Lake Wales during this study can be considered the product of a hypereutrophic lake with virtually no aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Wales was 351 individuals/kg wet wt of host plant and 1.08 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Lake Wales, as estimated with a ponar dredge, was 287 individuals/m^2 and 35.4 g wet wt/m^2 (Table 5). The zooplankton population of Lake Wales was dominated by rotifers and nauplii with 24,300 and 22,400 individuals/m^3, respectively.

Fish

Fifteen species of fish were collected in Lake Wales (Table 41, 42, and 43) The most abundant species collected with rotenone sampling were threadfin shad and seminole killifish. These species had average standing stocks in littoral blocknets of 5,500 and 800 fish/ha, respectively (Table 41). The most abundant open-water species collected in the experimental gillnets were threadfin shad and bluegill with 40 and 21 fish/net/24 hr, respectively (Table 42). The most abundant species collected using electrofishing were the bluegill and seminole killifish with catch per **(Text continued on page 127)**

Table 41. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Wales. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Gizzard shad	0	0.0	0.0	0.0
Threadfin shad	5459	3541.2	7.9	2.4
Golden shiner	37	21.4	1.7	1.7
Seminole killifish	803	346.1	4.0	1.5
Bluefin killifish	8	8.2	0.0	0.0
Mosquitofish	8	8.2	0.0	0.0
Brook silverside	482	152.4	0.4	0.1
Bluegill	572	405.5	11.3	6.7
Redear sunfish	148	92.7	4.2	3.7
Largemouth bass	210	86.7	6.6	5.8
Black crappie	4	4.1	0.1	0.1
Blue tilapia	25	18.9	6.0	5.8
Total	7756		42.1	
Open-water nets (n=3) for total fish				
Gizzard shad	4	4.1	0.0	0.0
Threadfin shad	5747	2373.0	44.6	29.2
Golden shiner	0	0.0	0.0	0.0
Seminole killifish	189	170.9	0.3	0.2
Bluefin killifish	0	0.0	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	115	45.3	0.1	0.0
Bluegill	37	21.4	2.2	1.3
Redear sunfish	115	72.1	3.7	2.3
Largemouth bass	12	7.1	0.1	0.0
Black crappie	0	0.0	0.0	0.0
Blue tilapia	0	0.0	0.0	0.0
Total	6220		50.9	

Table 41. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Bluegill	12	7.1	1.7	1.27
Redear sunfish	29	28.8	3.1	3.12
Largemouth bass	4	4.1	2.1	2.07
Black crappie	0	0.0	0.0	0.00
Total	45		6.9	
Open-water nets (n=3) for harvestable fish				
Bluegill	21	10.9	1.9	1.10
Redear sunfish	21	14.8	2.9	2.44
Largemouth bass	0	0.0	0.0	0.00
Black crappie	0	0.0	0.0	0.00
Total	42		4.8	

Table 42. Experimental gillnet (five 10 meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Wales. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	8.3	5.90	8.9	6.41
Threadfin shad	39.7	30.67	1.4	0.97
Golden shiner	0.3	0.32	0.0	0.02
Lake chubsucker	8.0	3.51	6.8	3.08
Bluegill	21.0	18.01	2.1	1.80
Redear sunfish	7.3	6.84	1.1	0.94
Largemouth bass	6.0	4.04	1.8	1.46
Black crappie	10.3	6.01	0.9	0.36
Total	101.0		23.0	
Gillnets (n=3) for harvestable fish				
Bluegill	15.0	13.00	1.8	1.58
Redear sunfish	6.3	5.84	1.0	0.90
Largemouth bass	5.0	4.51	1.7	1.50
Black crappie	1.7	0.33	0.4	0.18
Total	28.0		5.0	

Table 43. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Wales. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Threadfin shad	110.0	31.94	4.0	0.28
Golden shiner	150.0	132.46	65.0	5.52
Seminole killifish	331.7	224.18	22.3	1.48
Brook silverside	78.3	41.83	0.6	0.03
Bluegill	938.3	449.91	163.6	6.91
Redear sunfish	53.3	16.87	66.5	2.88
Largemouth bass	91.7	29.71	77.5	3.08
Sunshine bass	1.7	1.68	0.3	0.03
Black crappie	6.7	6.67	5.3	0.53
Total	1761.7		405.2	
Electrofishing runs (n=6) for harvestable fish				
Bluegill	8.3	1.67	0.8	0.26
Redear sunfish	38.3	18.33	6.0	2.96
Largemouth bass	11.7	3.07	5.4	3.31
Sunshine bass	0.0	0.00	0.0	0.00
Black crappie	0.0	0.00	0.0	0.00
Total	58.3		12.3	

unit efforts of 940 and 332 fish per hour, respectively (Table 43). Average first year growth of bluegill, redear sunfish and largemouth bass was 61, 67 and 153 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 78 harvestable bluegill, 78 harvestable redear sunfish, and 12 harvestable largemouth bass per hectare in Lake Wales (Table 7).

Prior to our study and during a period of high hydrilla coverage (1974 to 1979), blocknets and rotenone were used to sample the fish population of Lake Wales (Hardin and Atterson 1980). The range of harvestable largemouth bass (8 to 108 fish), harvestable bluegill (12 to 1770 fish) and harvestable redear sunfish (78 to 725 fish) during those years is higher than our littoral estimates of 4, 12, and 29 fish/ha, respectively (Table 41). These data, therefore suggest that there has been a decrease in the fish population of Lake Wales over the last decade.

Clear Lake

Location and Morphology

Clear Lake is located in Pasco County, Florida (Latitude 28.20 N; Longitude 82.15 W). The lake lies in Dade City Hills division of the Ocala Uplift District (Brooks 1981). The geology is dominated by sand, silty sand, and clays of the Hawthorne Formation. Clear Lake was sampled from 1986 to 1987 and had a surface area, shoreline length and mean depth of 64 ha, 3.14 km and 5.9 m, respectively (Table 1).

Trophic Status and Water Chemistry

Clear Lake had an average total phosphorus concentration of 21 µg/L and an average total nitrogen concentration of 761 µg/L. Total chlorophyll *a* concentrations averaged 21 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.3 m (Table 2). The lake had an average pH of 8.6 and an average total alkalinity of 44.9 mg/L as $CaCO_3$. The average specific conductance was 195 µS/cm @ 25 C and the average water color was 13 Pt-Co units. Clear Lake was classified as an alkaline, eutrophic lake.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1974, Clear Lake had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 1% (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 2.1, 0 and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 4.8 mg chlorophyll *a*/cm^2 of host plant and 1.9 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Six species of aquatic macrophytes were collected in Clear Lake (Table 44). The most commonly encountered plant species were *Colocasia esculenta, Typha* spp. and *Ludwigia octovalis* which occurred in 80%, 30% and 20% of the transects, respectively.

Table 44. Occurrence of plant species in ten evenly-spaced transects around Clear Lake.

Common name	Scientific name	Percent of Transects
pickerelweed	*Pontederia cordata*	10
lizard's-tail	*Saururus cernuus*	10
cat-tail	*Typha* spp.	30
elephant-ear	*Colocasia esculenta*	80
water primrose	*Ludwigia octovalis*	20
carex sedge	*Carex* spp.	10
para grass	*Brachiaria mutica*	20
soft rush	*Juncus effusus*	10

In 1974, hydrilla was the dominant plant in Clear Lake, covering a large portion of the lake (Leslie et al. 1983). After grass carp were stocked in October 1974, hydrilla was eliminated along with most other plants by 1976, leaving low levels of aquatic macrophytes through 1982 (Leslie et al. 1983). Grass carp are still alive in the system and no aquatic vegetation has become reestablished. Thus, the fish population in Clear lake can be considered the product of an eutrophic lake with virtually no aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Clear Lake was

42 individuals/kg wet wt of host plants and 3.26 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Clear Lake, as estimated with a ponar dredge, was 1227 individuals/m^2 and 1.23 g wet wt/m^2 (Table 5). The zooplankton population of Clear Lake was dominated by copepods and rotifers with 153,000 and 87,600 individuals/m^3, respectively.

Fish

Twelve species of fish were collected in Clear Lake (Table 45 and 46). The most abundant species collected with rotenone sampling were bluegill and redear sunfish. These species had average standing stocks in littoral blocknets of 44,000 and 800 fish/ha, respectively (Table 45). No fish were captured in three gillnets. The most abundant species collected using electrofishing were bluegill and largemouth bass with catch per unit efforts of 5,100 and 230 fish per hour, respectively (Table 46). Average first year growth of bluegill, redear sunfish, and largemouth bass was 51, 61, and 161 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 23 harvestable bluegill, 40 harvestable redear sunfish and 8 harvestable largemouth bass per hectare in Clear Lake (Table 7).

No previous fisheries data were available for Clear Lake. The fish population, however, seemed to be depressed, especially the largemouth bass with only 8 harvestable fish/ha as estimated with a mark-recapture study (Table 7). We sampled Clear Lake again in 1990. The average harvestable fish population increased from 10 kg/ha in 1986 to 16.5 kg/ha in 1990. This large increase was due mostly to a change in the largemouth bass population, which increased from 4 to 17 harvestable fish/ha.

Lake Baldwin

Location and Morphology

Lake Baldwin is located in Orange County, Florida (Latitude 28.34 N; Longitude 81.19 W). The lake lies in the Groveland Karst division of the Central Lakes District (Brooks 1981). The geology is dominated by sand, silty sand, and clays of the Hawthorne Formation. Lake Baldwin was sampled three years between 1986 and 1989 and had a surface area, shoreline length, and mean depth of 80 ha, 3.09 km and 4.6 m, respectively (Table 1). **(Text continued on page 133)**

Table 45. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Clear Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Bowfin	4	4.1	0.9	0.9
Grass carp	8	4.1	27.6	25.2
Seminole killifish	663	394.3	4.1	2.1
Mosquitofish	140	110.5	0.1	0.0
Brook silverside	103	48.5	0.1	0.1
Warmouth	395	224.7	1.9	0.8
Bluegill	44234	15625.6	147.9	61.6
Redear sunfish	803	254.4	24.1	3.6
Largemouth bass	704	204.1	19.3	7.9
Black crappie	12	7.1	1.1	0.7
Total	47066		227.1	
Open-water nets (n=3) for total fish				
Bowfin	0	0.0	0.0	0.0
Grass carp	0	0.0	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	354	57.6	0.3	0.1
Warmouth	0	0.0	0.0	0.0
Bluegill	7818	3797.7	5.2	2.5
Redear sunfish	0	0.0	0.0	0.0
Largemouth bass	8	4.1	0.1	0.0
Black crappie	0	0.0	0.0	0.0
Total	8180		5.6	

Table 45. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	86	49.9	6.8	3.65
Redear sunfish	78	28.8	9.3	2.11
Largemouth bass	8	4.1	3.6	1.97
Black crappie	4	4.1	0.5	0.54
Total	177		20.3	
Open-water nets (n=3) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Black crappie	0	0.0	0.0	0.00
Total	0		0.0	

Table 46. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Clear Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Bowfin	5.0	5.00	85.3	8.53
Golden shiner	1.7	1.68	2.1	0.21
Grass carp	3.3	2.12	265.8	16.89
Yellow bullhead	1.7	1.68	1.2	0.12
Seminole killifish	230.0	54.65	20.2	0.43
Brook silverside	55.0	6.19	0.7	0.01
Bluegill	5103.3	793.18	447.0	4.82
Redear sunfish	210.0	77.24	36.5	1.20
Largemouth bass	231.7	41.75	159.9	5.36
Black crappie	18.3	18.33	4.7	0.47
Total	5860.0		1023.3	
Electrofishing runs (n=6) for harvestable fish				
Yellow bullhead	0.0	0.00	0.0	0.00
Bluegill	18.3	10.78	2.3	1.49
Redear sunfish	5.0	2.24	0.3	0.13
Largemouth bass	16.7	4.94	12.0	5.25
Black crappie	0.0	0.00	0.0	0.00
Total	40.0		14.6	

Trophic Status and Water Chemistry

Lake Baldwin is an eutrophic lake. The lake had an average total phosphorus concentration of 21 µg/L and an average total nitrogen concentration of 530 µg/L for the three years of our study (Table 2). Total chlorophyll *a* concentrations averaged 18 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.6 m (Table 2) The lake had an average pH of 8.0 and an average total alkalinity of 63 mg/L as $CaCO_3$. The average specific conductance was 179 µS/cm @ 25 C and the average water color was 12 Pt-Co units.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1978, Lake Baldwin had a low abundance of aquatic macrophytes (Shireman and Hoyer 1986). The percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes over four years of study ranged < 1 to 34% and < 1 to 3.5%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation ranged <1.0-1.9, 0, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes ranged from 11.2 to 24.3 mg chlorophyll *a*/cm^2 of host plant and 8.0 to 11.4 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Eleven species of aquatic macrophytes were collected from Lake Baldwin over the four years of study (Table 47). The most commonly encountered plant species were *Ludwigia octovalis, Typha* spp. and *Colocasia esculenta* which occurred in 80%, 50%, and 40% of the transects, respectively.

Between 1971 and 1979, hydrilla was the dominant plant in Lake Baldwin, covering up to 80% of the lake (Shireman and Hoyer 1986). After grass carp were stocked in October 1978, hydrilla was eliminated along with most other plants by 1980, leaving low levels of aquatic macrophytes through 1984 (Shireman and Hoyer 1986). Grass carp are still alive in the system and no aquatic vegetation has become established since that time. Thus, the fish population in Lake Baldwin can be considered the product of an eutrophic lake with extremely low levels of aquatic macrophytes.

Table 47. Occurrence of plant species in ten evenly-spaced transects around Lake Baldwin.

Common name	Scientific name	Percent of Transects
	1986	
alligator-weed	*Alternanthera philoxeroides*	30
smartweed	*Polygonum hydropiperoides*	20
pickerelweed	*Pontederia cordata*	10
cat-tail	*Typha* spp.	50
water-pennywort	*Hydrocotyle umbellata*	10
elephant-ear	*Colocasia esculenta*	40
water primrose	*Ludwigia octovalis*	80
maidencane	*Panicum hemitomon*	40
para grass	*Brachiaria mutica*	10
torpedograss	*Panicum repens*	20
	Rhynchospora inundata	20
	1988	
alligator-weed	*Alternanthera philoxeroides*	30
cat-tail	*Typha* spp.	10
elephant-ear	*Colocasia esculenta*	10
water primrose	*Ludwigia octovalis*	10
maidencane	*Panicum hemitomon*	10
para grass	*Brachiaria mutica*	10
	1989	
	No plants collected	

Invertebrates

The average number, and biomass of epiphytic macroinvertebrates in Lake Baldwin 1988 was 383 individuals/kg wet wt of host plant, and 0.63 g wet wt/kg wet wt of host plant (Table 5). The number, and biomass of benthic macroinvertebrates in Lake Baldwin, as estimated with a ponar dredge, ranged from 113 to 464 individuals/m^2, and from 0.6 to 139 g wet wt/m^2 over the four year study (Table 5). The zooplankton population of Lake Baldwin was dominated by cladocerans and rotifers ranging from 13,000 to 194,000 and

17,100 to 107,000 individuals/m^3, respectively (Table 5).

Fish

Twenty, 17, and 19 species of fish were collected from Lake Baldwin in 1986, 1988, and 1989, respectively (Table 48, 49, and 50). The most abundant species collected with rotenone, gillnet, and electrofishing sampling varied year to year over the four year period, but it seems that bluegill, redear sunfish, threadfin shad, and seminole killifish are the most abundant fish (by numbers) when examining all three sampling methods. Mark-recapture estimates made in 1986 indicated that there were 168 harvestable bluegill, 155 harvestable redear sunfish, and 19 harvestable largemouth bass per hectare in Lake Baldwin (Table 7).

The fish population of Lake Baldwin has been monitored with rotenone sampling almost on a yearly schedule since 1977 (Shireman and Hoyer 1986). Total and harvestable fish biomass ranged from 39 to 217 kg/ha and from 8.8 to 54 kg/ha, respectively, between 1977 and 1984. There was no significant difference in total or harvestable fish biomass between years with or without aquatic vegetation (Shireman and Hoyer 1986). These values are similar to the ones measured during our study (Table 48), suggesting that the fish population in Lake Baldwin has remained quite stable for the last 15 years. **(Text continued on page 148)**

Table 48. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Lake Baldwin. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=3) for total fish				
Threadfin shad	111	105.0	0.4	0.3
Taillight shiner	8	8.2	0.0	0.0
Lake chubsucker	4	4.1	0.2	0.2
Yellow bullhead	478	428.4	4.1	2.9
Brown bullhead	82	82.3	0.7	0.7
White catfish	251	86.3	3.0	2.0
Seminole killifish	519	426.2	5.0	4.3
Bluefin killifish	8196	8128.5	3.7	3.7
Mosquitofish	0	0.0	0.0	0.0
Redbreast sunfish	124	123.5	2.8	2.8
Warmouth	688	343.8	11.3	5.6
Bluegill	13824	2490.2	222.4	40.3
Redear sunfish	2367	961.3	77.4	31.2
Spotted sunfish	99	68.8	1.1	0.5
Largemouth bass	720	354.7	28.6	16.0
Swamp darter	115	115.3	0.1	0.1
Total	27586		360.8	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	4	4.1	0.6	0.59
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	449	92.8	35.5	9.96
Redear sunfish	350	167.9	41.3	20.63
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	54	28.8	19.4	11.47
Total	856		96.8	

Table 48. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Open-water nets (n=3) for total fish				
Threadfin shad	10617	5106.5	22.1	9.2
Taillight shiner	0	0.0	0.0	0.0
Lake chubsucker	0	0.0	0.0	0.0
Yellow bullhead	4	4.1	0.0	0.0
Brown bullhead	0	0.0	0.0	0.0
White catfish	0	0.0	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Bluefin killifish	226	110.5	0.2	0.1
Mosquitofish	4	4.1	0.0	0.0
Redbreast sunfish	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	152	117.2	1.6	1.2
Redear sunfish	4	4.1	1.3	1.3
Spotted sunfish	4	4.1	0.0	0.0
Largemouth bass	132	97.1	8.2	4.4
Swamp darter	12	12.4	0.0	0.0
Total	11156		33.4	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	4	4.1	1.2	1.23
Redear sunfish	4	4.1	1.3	1.31
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	16	10.9	7.9	4.16
Total	25		10.4	

Table 48. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Littoral nets (n=3) for total fish				
Threadfin shad	152	146.2	0.3	0.3
Golden shiner	1227	608.5	27.7	13.6
Yellow bullhead	17	16.5	2.6	2.6
Brown bullhead	78	35.9	2.9	2.1
White catfish	1066	647.3	12.1	10.6
Seminole killifish	519	307.3	3.1	1.7
Bluefin killifish	82	70.0	0.0	0.0
Mosquitofish	12	12.4	0.0	0.0
Sailfin molly	148	148.2	1.2	1.2
Brook silverside	165	146.2	0.2	0.2
Redbreast sunfish	519	258.8	5.5	2.8
Warmouth	424	346.9	8.3	7.5
Bluegill	18138	10490.3	177.9	90.3
Redear sunfish	1400	772.5	26.6	10.0
Spotted sunfish	272	265.5	6.6	6.0
Largemouth bass	445	290.8	18.9	15.8
Swamp darter	432	224.7	0.5	0.3
Total	25095		294.2	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	8	8.2	2.4	2.38
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	12	7.1	1.2	0.63
Warmouth	12	12.4	1.3	1.26
Bluegill	325	164.5	29.8	15.34
Redear sunfish	58	28.8	7.3	3.64
Spotted sunfish	12	7.1	1.2	0.68
Largemouth bass	37	24.7	16.1	13.55
Total	465		59.2	

Table 48. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Open-water nets (n=3) for total fish				
Threadfin shad	774	357.0	1.8	1.0
Golden shiner	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Brown bullhead	0	0.0	0.0	0.0
White catfish	4	4.1	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Bluefin killifish	0	0.0	0.0	0.0
Mosquitofish	4	4.1	0.0	0.0
Sailfin molly	0	0.0	0.0	0.0
Brook silverside	0	0.0	0.0	0.0
Redbreast sunfish	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	91	78.2	0.4	0.2
Redear sunfish	4	4.1	0.2	0.2
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	4	4.1	0.8	0.8
Swamp darter	4	4.1	0.0	0.0
Total	885		3.2	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	4	4.1	0.8	0.82
Total	4		0.8	

Table 48. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Littoral nets (n=3) for total fish				
Threadfin shad	2873	2720.3	6.0	5.7
Golden shiner	29	10.9	1.3	0.6
Grass carp	8	8.2	50.3	50.3
Yellow bullhead	222	116.7	3.1	2.0
White catfish	74	56.6	0.6	0.5
Seminole killifish	852	485.0	3.5	1.7
Bluefin killifish	0	0.0	0.0	0.0
Mosquitofish	301	214.7	0.2	0.1
Brook silverside	984	437.3	1.2	0.5
Redbreast sunfish	189	153.0	1.3	1.0
Warmouth	119	75.6	0.8	0.7
Bluegill	13523	5513.0	136.1	44.6
Redear sunfish	630	321.8	19.0	10.1
Spotted sunfish	387	271.2	1.8	1.0
Largemouth bass	165	40.5	31.7	14.8
Swamp darter	25	14.3	0.0	0.0
Total	20382		256.8	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	8	8.2	1.9	1.93
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	124	65.4	11.0	5.02
Redear sunfish	58	14.8	7.0	1.51
Spotted sunfish	4	4.1	0.4	0.41
Largemouth bass	33	10.9	30.3	14.44
Total	226		50.6	

Table 48. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Open-water nets (n=3) for total fish				
Threadfin shad	3981	2022.6	9.6	3.7
Golden shiner	0	0.0	0.0	0.0
Grass carp	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
White catfish	4	4.1	0.2	0.2
Seminole killifish	0	0.0	0.0	0.0
Bluefin killifish	12	12.4	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	12	7.1	0.0	0.0
Redbreast sunfish	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	231	22.9	8.9	7.4
Redear sunfish	185	167.1	24.3	21.1
Spotted sunfish	4	4.1	0.0	0.0
Largemouth bass	41	14.8	24.3	8.0
Swamp darter	8	8.2	0.0	0.0
Total	4479		67.4	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	70	70.0	7.4	7.43
Redear sunfish	148	130.1	22.6	19.37
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	25	7.1	24.2	7.92
Total	243		54.2	

Table 49. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Lake Baldwin. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1986			
Gillnets (n=3) for total fish				
Florida gar	0.7	0.32	0.8	0.61
Longnose gar	0.7	0.66	1.5	1.48
Lake chubsucker	0.3	0.32	0.4	0.42
Brown bullhead	0.3	0.32	0.2	0.21
White catfish	0.3	0.32	0.6	0.63
Bluegill	3.7	2.66	0.3	0.25
Redear sunfish	0.3	0.32	0.0	0.01
Largemouth bass	6.3	3.93	2.7	1.86
Black crappie	0.3	0.32	0.2	0.23
Total	13.0		6.8	
Gillnets (n=3) for harvestable fish				
Brown bullhead	0.3	0.33	0.2	0.21
White catfish	0.3	0.33	0.6	0.63
Bluegill	1.3	0.88	0.2	0.16
Redear sunfish	0.0	0.00	0.0	0.00
Largemouth bass	6.0	3.61	2.6	1.81
Black crappie	0.3	0.33	0.2	0.23
Total	8.3		3.9	

Table 49. (Continued)

Common Name	Fish number	Standard Error	Fish weight (kg/net/24 hr)	Standard Error	(number/net/24 hr)
		1988			
Gillnets (n=3) for total fish					
Florida gar		0.7	0.33	0.8	0.01
White catfish		0.3	0.33	0.6	1.86
Bluegill		2.3	1.86	0.1	0.23
Redear sunfish		0.3	0.33	0.0	0.63
Largemouth bass		3.0	1.15	1.4	0.08
Total		6.66		2.98	
Gillnets (n=3) for harvestable fish					
White catfish		0.3	0.33	0.6	0.63
Bluegill		0.0	0.00	0.0	0.00
Redear sunfish		0.0	0.00	0.0	0.00
Largemouth bass		3.0	1.15	1.4	0.79
Total		3.3		2.1	

Table 49. (Concluded)

Common Name	Fish number	Standard Error	Fish weight (kg/net/24 hr)	Standard Error	(number/net/24 hr)
		1989			
Gillnets (n=3) for total fish					
Florida gar		0.3	0.33	0.6	0.19
Threadfin shad		4.0	2.65	0.1	0.03
Golden shiner		5.7	2.96	0.4	0.09
Bluegill		1.0	0.58	0.1	0.13
Redear sunfish		0.3	0.33	0.1	0.27
Black crappie		0.7	0.33	0.2	0.50
Total		12.0		1.4	
Gillnets (n=3) for harvestable fish					
Bluegill		0.3	0.33	0.0	0.03
Redear sunfish		0.3	0.33	0.1	0.09
Black crappie		0.3	0.33	0.1	0.14
Total		1.0		0.3	

Table 50. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Baldwin. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1986		
Electrofishing runs (n=6) for total fish				
Golden shiner	6.7	6.67	2.5	0.25
Brown bullhead	1.7	1.68	0.1	0.01
Seminole killifish	173.3	71.31	21.0	0.96
Warmouth	5.0	3.42	2.1	0.16
Bluegill	936.7	395.29	204.2	8.81
Redear sunfish	106.7	16.67	42.4	0.60
Spotted sunfish	1.7	1.68	0.5	0.05
Largemouth bass	41.7	13.52	62.2	4.17
Total	1273.4		334.9	
Electrofishing runs (n=6) for harvestable fish				
Brown bullhead	0.0	0.00	0.0	0.00
Warmouth	1.7	1.67	0.2	0.16
Bluegill	31.7	14.47	3.1	1.46
Redear sunfish	20.0	7.30	2.0	0.68
Spotted sunfish	0.0	0.00	0.0	0.00
Largemouth bass	11.7	7.92	4.9	3.95
Total	65.0		10.2	

Table 50. (Continued)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1988		
Electrofishing runs (n=6) for total fish				
Threadfin shad	25.0	23.82	1.6	0.16
Golden shiner	60.0	33.01	19.4	1.06
Seminole killifish	25.0	10.21	2.2	0.10
Warmouth	1.0	1.00	1.0	0.10
Bluegill	430.0	180.68	80.8	3.34
Redear sunfish	42.0	17.53	13.4	0.48
Largemouth bass	21.0	6.34	122.4	3.74
Total	604.0		240.8	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	1.0	1.00	0.1	0.10
Bluegill	12.0	7.27	0.9	0.56
Redear sunfish	5.0	1.84	0.4	0.16
Largemouth bass	13.0	3.26	12.0	3.72
Total	31.0		13.4	

Table 50. (Concluded)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1989		
Electrofishing runs (n=4) for total fish				
Bowfin	1.5	1.50	53.3	5.33
Threadfin shad	3.0	1.73	0.1	0.00
Golden shiner	63.0	61.02	42.2	4.15
Seminole killifish	7.5	5.68	1.2	0.11
Brook silverside	9.0	9.00	0.1	0.01
Redbreast sunfish	1.5	1.50	1.3	0.13
Bluegill	873.0	254.91	188.8	4.82
Redear sunfish	27.0	7.14	21.9	0.26
Largemouth bass	46.5	14.97	243.6	8.90
Total	1032.0		552.4	
Electrofishing runs (n=4) for harvestable fish				
Redbreast sunfish	1.5	1.50	0.1	0.13
Bluegill	39.0	13.53	3.0	1.02
Redear sunfish	10.5	1.50	1.7	0.19
Largemouth bass	28.5	11.59	23.9	8.98
Total	79.5		28.7	

Lake Susannah

Location and Morphology

Lake Susannah is located in Orange County, Florida (Latitude 28.34 N; Longitude 81.19 W). The lake lies in the Groveland Karst division of the Central Lakes District (Brooks 1981). The geology is dominated by sand, silty sand, and clays of the Hawthorne Formation. Lake Susannah was sampled three years between 1986 and 1989. The lake had a surface area, shoreline length, and mean depth of 31 ha, 1.89 km and 3.8 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lake Susannah had an average total phosphorus concentration of 22 µg/L and an average total nitrogen concentration of 675 µg/L over the three years of our study (Table 2). Total chlorophyll *a* concentrations averaged 25 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.5 meters (Table 2). The lake had an average pH of 8.0 and an average total alkalinity of 31 mg/L as $CaCO_3$. The average specific conductance was 126 µS/cm @ 25 C and the average water color was 11 Pt-Co units. The average adjusted chlorophyll *a* concentration was 25 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Lake Susannah was an eutrophic lake during this study.

Aquatic Plants

Lake Susannah had a low abundance of aquatic macrophytes. The percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes over four years of study ranged from 3.3 to 13% and 0.5 to 2%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation ranged from 1.8 to 11.1, 0.3 to 0.6, and 0.2 to 1.7 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes ranged from 13.9 to 39.5 mg chlorophyll *a*/cm^2 of host plant and from 18.2 to 53.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected from Lake Susannah over the four year study with the following species being most common: *Micranthemum umbrosum, Panicum repens.*, and *Nitella* spp. (Table 51).

Table 51. Occurrence of plant species in ten evenly spaced transects around Lake Susannah.

Common name	Scientific name	Percent of Transects
	1986	
floating water-hyacinth	*Eichhornia crassipes*	20
slender spikerush	*Eleocharis baldwinii*	40
smartweed	*Polygonum hydropiperoides*	10
pickerelweed	*Pontederia cordata*	30
baby-tears	*Micranthemum umbrosum*	70
cat-tail	*Typha* spp.	40
water-pennywort	*Hydrocotyle umbellata*	20
dwarf arrowhead	*Sagittaria subulata*	10
maidencane	*Panicum hemitomon*	10
torpedograss	*Panicum repens*	70
green algae	*Chlorphyta*	20
stonewort	*Nitella* spp.	20
	Rhynchospora inundata	10
	1988	
floating water-hyacinth	*Eichhornia crassipes*	50
slender spikerush	*Eleocharis baldwinii*	10
smartweed	*Polygonum hydropiperoides*	10
pickerelweed	*Pontederia cordata*	10
baby-tears	*Micranthemum umbrosum*	60
cat-tail	*Typha* spp.	20
water primrose	*Ludwigia octovalis*	30
maidencane	*Panicum hemitomon*	10
torpedograss	*Panicum repens*	70
stonewort	*Nitella* spp.	30
knot grass	*Paspalum distichum*	20

Table 51. (Concluded)

Common name	Scientific name	Percent of Transects
	1989	
floating water-hyacinth	*Eichhornia crassipes*	20
slender spikerush	*Eleocharis baldwinii*	20
pickerelweed	*Pontederia cordata*	10
baby-tears	*Micranthemum umbrosum*	60
cat-tail	*Typha* spp.	40
water-pennywort	*Hydrocotyle umbellata*	30
water primrose	*Ludwigia octovalis*	40
flat-sedge	*Cyperus odoratus*	10
maidencane	*Panicum hemitomon*	30
torpedograss	*Panicum repens*	60
stonewort	*Nitella* spp.	50
yellow-eyed grass	*Xyris* spp.	10

The plant community of Lake Susannah has been monitored by University of Florida from 1981 to present (Shireman and Hoyer 1985). From 1981 to 1983, hydrilla was the dominant plant covering almost 50% of the lake. In 1983, the lake was treated with flouridone (Trade Name Sonar) and stocked with hybrid grass carp (*Aristichthys nobilis* x *Ctenopharyngodon idella*), which died out a year later (Shireman and Hoyer 1985). In 1984, after a treatment with flouridone, hydrilla was eliminated and a small coverage of native vegetation (< 10 % coverage) has continued to existed in Lake Susannah. Thus, the fish population in Lake Susannah during our study, can be considered the product of an eutrophic lake with low levels aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Susannah ranged from 235 to 438 individuals/kg wet wt of host plant and from 0.93 to 1.25 g wet wt/kg wet wt of host plant, respectively (Table 5). The number and biomass of benthic macroinvertebrates in Lake Susannah, as estimated with a ponar dredge, ranged from 40 to 193 individuals/m2 and from 0.01 to 0.52 g wet wt/m^2 over the four year study (Table 5).

The zooplankton population was dominated by cladocerans and nauplii ranging from 82,500 to 141,000 and 48,200 to 246,000 individuals/m^3, respectively (Table 5).

Fish

A total of 21, 19, and 18 species of fish were collected from Lake Susannah in 1986, 1988, and 1989, respectively (Table 52, 53, and 54). The most abundant species collected with rotenone, gillnet and electrofishing methods varied from year to year over the four year period, but it seems that bluegill, redear sunfish, and largemouth bass were the most abundant fish. Mark-recapture estimates made in 1986 indicated that there were 43 harvestable bluegill, 53 harvestable redear sunfish, and 44 largemouth bass per hectare in Lake Susannah (Table 7).

The fish population of Lake Susannah has been monitored by use of blocknets and rotenone sampling by the University of Florida from 1981 to 1984 (Shireman and Hoyer 1985). The total fish biomass ranged from 95 to 285 kg/ha between 1981 and 1984 and from 76 to 260 kg/ha from 1986 to 1989 (Table 52). The harvestable fish population biomass ranged from 7 to 95 kg/ha between 1981 and 1984 (Shireman and Hoyer 1985) and from 12 to 63 kg/ha from 1986 to 1989 (Table 52). Thus, the fish population in Lake Susannah has remained relatively stable during the last ten years.

Lake Pearl

Location and Morphology

Lake Pearl is located in Orange County, Florida (Latitude 28.36 N; Longitude 81.15 W). The lake lies in the Holopaw-Indian Town Ridges and Swales division of the Eastern Flatwoods District (Brooks 1981). The geology is dominated by preglacial Pleistocene lagoonal, and prograded unlithified coastal sand. Lake Pearl was sampled for three years between 1986 and 1989 and had a surface area shoreline length and mean depth of 24 ha, 1.98 km and 2.0 m, respectively (Table 1). **(Text continued of page 166)**

Table 52. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Lake Susannah. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for total fish				
Threadfin shad	111	111.2	0.9	0.9
Golden shiner	3662	3661.8	16.5	16.5
Lake chubsucker	37	37.0	19.5	19.5
Yellow bullhead	216	43.2	9.1	2.0
Brown bullhead	111	111.2	1.2	1.2
Golden topminnow	327	290.2	0.5	0.5
Seminole killifish	1124	407.5	4.7	1.8
Bluefin killifish	4755	2803.5	1.2	0.7
Mosquitofish	766	321.1	0.3	0.1
Brook silverside	506	444.6	0.6	0.4
Bluespotted sunfish	1167	636.0	0.8	0.0
Warmouth	4378	1006.5	25.2	9.2
Bluegill	75514	51777.4	191.7	128.7
Redear sunfish	29949	19760.0	120.7	63.4
Spotted sunfish	6	6.2	0.3	0.3
Largemouth bass	1037	370.5	66.6	25.6
Black crappie	766	494.0	10.4	6.8
Swamp darter	513	129.7	0.3	0.1
Total	124945		470.3	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Open-water nets (n=2) for total fish				
Threadfin shad	1568	1568.5	8.0	8.0
Golden shiner	37	37.0	3.3	3.3
Lake chubsucker	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Brown bullhead	31	30.9	0.1	0.2
Golden topminnow	0	0.0	0.0	0.0
Seminole killifish	550	549.6	3.2	3.2
Bluefin killifish	9133	9120.5	1.9	1.9
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	210	197.6	0.3	0.3
Bluespotted sunfish	3791	3766.7	1.9	1.9
Warmouth	1673	1673.4	8.9	8.9
Bluegill	31962	31739.5	126.6	126.2
Redear sunfish	4773	4773.3	30.7	30.7
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	414	413.7	31.5	31.6
Black crappie	6	6.2	0.1	0.1
Swamp darter	25	24.7	0.0	0.0
Total	54173		216.6	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	31	6.2	7.0	3.49
Brown bullhead	0	0.0	0.0	0.00
Warmouth	19	18.5	2.6	2.63
Bluegill	321	247.0	29.6	23.52
Redear sunfish	142	18.5	25.2	3.83
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	117	30.9	46.6	16.54
Black crappie	0	0.0	0.0	0.00
Total	630		111.1	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Warmouth	6	6.2	0.5	0.53
Bluegill	235	234.6	17.7	17.66
Redear sunfish	86	86.4	13.7	13.71
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	49	49.4	17.4	17.43
Black crappie	0	0.0	0.0	0.00
Total	377		49.3	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
	1988			
Littoral nets (n=2) for total fish				
Threadfin shad	80	80.3	0.2	0.2
Golden shiner	2167	2142.7	61.9	61.8
Lake chubsucker	12	0.0	5.2	4.9
Yellow bullhead	86	24.7	7.5	2.3
Brown bullhead	80	67.9	2.1	0.6
White catfish	6	6.2	0.0	0.0
Golden topminnow	655	86.4	0.5	0.2
Seminole killifish	296	148.2	0.8	0.4
Bluefin killifish	8454	4106.4	2.1	1.0
Mosquitofish	1507	24.7	0.5	0.0
Least killifish	259	37.0	0.0	0.0
Bluespotted sunfish	38958	25990.6	16.0	10.7
Warmouth	7435	2223.0	74.3	37.9
Bluegill	26818	883.0	93.5	35.9
Redear sunfish	6027	728.7	31.9	10.5
Largemouth bass	611	80.3	91.3	64.2
Black crappie	204	203.8	1.7	1.7
Swamp darter	395	98.8	0.2	0.0
Total	94051		389.7	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
	1988			
Open-water nets (n=2) for total fish				
Threadfin shad	12	12.3	0.0	0.0
Golden shiner	6	6.2	0.0	0.0
Lake chubsucker	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Brown bullhead	0	0.0	0.0	0.0
White catfish	0	0.0	0.0	0.0
Golden topminnow	0	0.0	0.0	0.0
Seminole killifish	25	12.3	0.1	0.1
Bluefin killifish	25	24.7	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Least killifish	0	0.0	0.0	0.0
Bluespotted sunfish	136	37.0	0.1	0.0
Warmouth	519	197.6	0.1	0.0
Bluegill	673	376.7	11.2	10.7
Redear sunfish	562	277.9	8.0	6.7
Largemouth bass	31	30.9	8.6	8.7
Black crappie	0	0.0	0.0	0.0
Swamp darter	0	0.0	0.0	0.0
Total	1989		28.1	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	25	12.3	5.2	3.44
Brown bullhead	6	6.2	1.4	1.37
White catfish	0	0.0	0.0	0.00
Warmouth	117	67.9	12.2	6.96
Bluegill	124	98.8	11.8	10.15
Redear sunfish	31	30.9	3.0	2.97
Largemouth bass	105	55.6	80.2	61.76
Black crappie	0	0.0	0.0	0.00
Total	408		113.8	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Redear sunfish	31	30.9	4.1	4.08
Largemouth bass	12	12.3	7.5	7.51
Black crappie	0	0.0	0.0	0.00
Total	43		11.6	

Table 52. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Littoral nets (n=2) for total fish				
Threadfin shad	124	123.5	0.2	0.2
Golden shiner	117	92.6	2.1	0.3
Lake chubsucker	49	49.4	4.0	4.0
Yellow bullhead	12	0.0	1.5	0.5
Brown bullhead	31	30.9	0.3	0.3
Golden topminnow	556	555.7	0.5	0.5
Seminole killifish	858	92.6	5.1	1.7
Bluefin killifish	20458	6230.6	4.4	2.2
Mosquitofish	926	234.6	0.4	0.0
Brook silverside	253	6.2	0.3	0.0
Bluespotted sunfish	29980	1426.4	15.0	0.3
Warmouth	2118	1068.3	15.5	8.0
Bluegill	21014	4785.6	45.6	7.2
Redear sunfish	1229	117.3	11.1	2.8
Largemouth bass	327	18.5	38.1	6.6
Black crappie	0	0.0	0.0	0.0
Swamp darter	167	154.4	0.1	0.1
Total	78219		144.2	

Table 52. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Warmouth	19	18.5	1.9	1.89
Bluegill	25	0.0	2.1	0.15
Redear sunfish	56	30.9	6.4	4.26
Largemouth bass	68	30.9	33.9	6.53
Black crappie	0	0.0	0.0	0.00
Total	167		44.4	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	6	6.2	3.6	3.58
Warmouth	0	0.0	0.0	0.00
Bluegill	136	123.5	8.8	8.02
Redear sunfish	93	80.3	21.2	18.88
Largemouth bass	161	86.4	82.4	46.92
Black crappie	68	30.9	18.4	9.20
Total	463		134.3	

Table 53. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Lake Susannah. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1986			
Gillnets (n=3) for total fish				
Longnose gar	2.0	0.58	1.3	0.05
Golden shiner	2.0	0.58	0.2	0.23
Lake chubsucker	1.0	0.58	0.6	1.47
Yellow bullhead	0.3	0.33	0.1	0.81
Bluegill	5.3	4.37	0.3	0.37
Redear sunfish	0.7	0.33	0.1	0.05
Largemouth bass	11.3	6.17	4.3	2.08
Black crappie	1.7	0.33	0.4	0.04
Total	24.33		7.31	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	0.3	0.33	0.1	0.14
Bluegill	0.0	0.00	0.0	0.00
Redear sunfish	0.7	0.33	0.1	0.05
Largemouth bass	11.0	6.43	4.3	2.30
Black crappie	1.3	0.33	0.4	0.07
Total	13.3		5.0	

Table 53. (Continued)

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1988			
Gillnets (n=3) for total fish				
Florida gar	1.0	0.00	1.6	1.26
Threadfin shad	5.7	2.91	0.1	0.02
Golden shiner	3.7	3.18	0.3	0.01
Lake chubsucker	2.0	2.00	1.4	0.31
Yellow bullhead	2.0	1.53	1.0	0.01
Bluegill	17.0	7.57	0.4	0.04
Largemouth bass	1.7	1.20	1.0	0.97
Black crappie	0.3	0.33	0.0	0.04
Total	33.34		5.88	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	2.0	1.53	1.0	0.85
Bluegill	0.7	0.33	0.1	0.03
Largemouth bass	1.3	0.88	0.9	0.56
Black crappie	0.0	0.00	0.0	0.00
Total	4.0		2.0	

Table 53. (Concluded)

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1989			
Gillnets (n=3) for total fish				
Florida gar	0.7	0.67	1.3	1.90
Threadfin shad	0.7	0.67	0.0	2.98
Golden shiner	0.3	0.33	0.0	2.40
Lake chubsucker	0.3	0.33	0.3	0.05
Bluegill	1.3	0.33	0.0	0.01
Redear sunfish	0.3	0.33	0.0	0.80
Largemouth bass	3.0	2.52	1.0	0.32
Black crappie	0.7	0.67	0.0	0.14
Total	7.33		2.71	
Gillnets (n=3) for harvestable fish				
Bluegill	0.0	0.00	0.0	0.00
Redear sunfish	0.3	0.33	0.0	0.04
Largemouth bass	2.7	2.67	1.0	0.98
Black crappie	0.0	0.00	0.0	0.00
Total	3.0		1.0	

Table 54. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Lake Susannah. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1986		
Electrofishing runs (n=6) for total fish				
Florida gar	1.7	1.68	22.3	2.23
Golden shiner	204.1	80.52	7.3	0.29
Grass carp	1.4	1.41	164.6	16.46
Lake chubsucker	33.8	10.79	125.5	5.27
Golden topminnow	5.1	2.31	0.2	0.02
Seminole killifish	106.1	34.84	5.0	0.18
Mosquitofish	20.5	10.52	0.10	0.00
Brook silverside	57.9	19.40	0.8	0.02
Bluespotted sunfish	1.7	1.68	0.10	0.01
Warmouth	11.5	3.83	2.8	0.10
Bluegill	739.5	225.31	42.8	0.86
Redear sunfish	44.7	16.80	13.3	0.56
Largemouth bass	128.5	22.75	119.2	4.33
Black crappie	8.1	6.53	4.8	0.45
Total	1364.5		508.6	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	14.4	2.82	1.2	0.22
Redear sunfish	6.8	3.38	1.0	0.49
Largemouth bass	22.4	9.63	9.6	3.99
Black crappie	1.7	1.67	0.4	0.35
Total	45.2		12.2	

Table 54. (Continued)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1988		
Electrofishing runs (n=4) for total fish				
Golden shiner	13.5	9.60	2.0	0.19
Lake chubsucker	9.0	1.73	12.9	1.02
Golden topminnow	1.5	1.50	0.0	0.00
Seminole killifish	10.5	1.50	1.3	0.01
Sailfin molly	6.0	6.00	0.3	0.03
Warmouth	10.5	2.87	3.4	0.12
Bluegill	274.5	13.72	24.9	0.69
Redear sunfish	48.0	20.64	9.1	0.59
Largemouth bass	51.0	12.12	118.4	5.87
Black crappie	4.5	4.50	4.0	0.40
Total	429.0		176.2	
Electrofishing runs (n=4) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	3.0	3.00	0.2	0.19
Redear sunfish	1.5	1.50	0.1	0.10
Largemouth bass	16.5	6.18	10.3	5.99
Black crappie	3.0	3.00	0.3	0.33
Total	24.0		10.9	

Table 54. (Concluded)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1989		
Electrofishing runs (n=3) for total fish				
Threadfin shad	76.0	76.00	1.1	0.11
Golden shiner	6.0	6.00	0.4	0.04
Lake chubsucker	4.0	2.00	25.5	1.27
Seminole killifish	42.0	19.29	3.0	0.12
Mosquitofish	4.0	2.00	0.0	0.00
Brook silverside	10.0	10.00	0.10	0.01
Bluespotted sunfish	2.0	2.00	0.0	0.00
Warmouth	6.0	3.46	1.1	0.11
Bluegill	360.0	9.17	52.0	1.70
Redear sunfish	20.0	8.72	8.0	0.12
Largemouth bass	100.0	8.72	224.2	7.95
Black crappie	2.0	2.00	5.6	0.56
Total	632.0		321.0	
Electrofishing runs (n=3) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	10.0	7.21	0.9	0.67
Redear sunfish	2.0	2.00	0.3	0.27
Largemouth bass	34.0	8.72	20.8	7.67
Black crappie	2.0	2.00	0.6	0.56
Total	48.0		22.5	

Trophic Status and Water Chemistry

Lake Pearl is an eutrophic lake. Lake Pearl had an average total phosphorus concentration of 28 µg/L and an average total nitrogen concentration of 819 µg/L over the three years of study (Table 2). Total chlorophyll *a* concentrations averaged 22 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.9 meters (Table 2). The lake had an average pH of 7.4 and an average total alkalinity of 19 mg/L as $CaCO_3$. The average specific conductance was 118 µS/cm @ 25 C and the average water color was 68 Pt-Co units.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1980, Lake Pearl had a low abundance of aquatic macrophytes. The percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes over three years of study ranged from < 1 to 3.4% and from < 1 to 3.3%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation ranged from < 1.0 to 1.1 kg wet wt/m^2, from 0 to 2.0 kg wet wt/m^2, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes ranged from 8.5 to 25.9 mg chlorophyll *a*/cm^2 of host plant and from 2.7 to 5.0 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Eleven species of aquatic macrophytes were collected from Lake Pearl (Table 55). The most commonly encountered plant species were *Nuphar luteum, Ludwigia octovalis,* and *Alternanthera philoxeroides* which occurred in 90%, 60%, and 30% of the transects, respectively.

Between 1977 and 1981, hydrilla was the dominant plant in Lake Pearl, covering up to 95% of the lake (Shireman et al. 1984). After grass carp were stocked in 1980, hydrilla was eliminated with most other plants by 1981, leaving low levels of aquatic macrophytes through 1983 (Shireman et al. 1984). Grass carp are still alive in the system and no aquatic vegetation has become established since that time (Table 55). Thus, the fish population in Lake Pearl during this study can be considered the product of an eutrophic lake with low levels of aquatic vegetation.

Table 55. Occurrence of plant species in ten evenly-spaced transects around Lake Pearl.

Common name	Scientific name	Percent of Transects
	1986	
duck-potato	*Sagittaria lancifolia*	10
spatterdock	*Nuphar luteum*	90
water-pennywort	*Hydrocotyle umbellata*	10
water primrose	*Ludwigia octovalis*	10
sawgrass	*Cladium jamaicense*	10
	1988	
spatterdock	*Nuphar luteum*	100
	1989	
duck-potato	*Sagittaria lancifolia*	10
alligator-weed	*Alternanthera philoxeroides*	30
spatterdock	*Nuphar luteum*	90
bacopa	*Bacopa monnieri*	10
cat-tail	*Typha* spp.	20
water-pennywort	*Hydrocotyle umbellata*	20
water primrose	*Ludwigia octovalis*	60
buttonbush	*Cephalanthus occidentalis*	10
willow	*Salix* spp.	10
sawgrass	*Cladium jamaicense*	20
torpedograss	*Panicum repens*	10

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Pearl during 1988 was 383 individuals/kg wet wt of host plants and 0.63 g wet wt/kg wet wt of host plant, respectively (Table 5). The number and biomass of benthic macroinvertebrates in Lake Pearl, as estimated with a ponar dredge, ranged from 113 to 464 individuals/m^2 and from 0.6 to 139 g wet wt/m^2, respectively over our three year study (Table 5). The zooplankton population of Lake Pearl was dominated by cladocerans and rotifers ranging 76,600 to 275,000 and from 84,000 to 139,000 individuals/m^3, respectively (Table 5).

Fish

A total of 20, 18, and 21 species of fish were collected from Lake Pearl in 1986, 1988, and 1989, respectively (Table 56, 57, and 58). The most abundant species collected with rotenone, gillnet, and electrofishing methods varied year to year, but it seems that bluegill, redear sunfish, threadfin shad, and gizzard shad were the most abundant fish (by numbers) when examining all three sampling methods. Mark-recapture estimates made in 1986 indicated that there were 23 harvestable bluegill, 205 harvestable redear sunfish, and 30 harvestable largemouth bass per hectare in Lake Pearl (Table 7).

The fish population of Lake Pearl has been monitored with rotenone and blocknets almost on a yearly schedule since 1978 (Shireman et al. 1984). Shireman et al. (1984) suggested that both total fish stock and biomass declined with the elimination of submersed vegetation. Total numbers decreased from 38,000 fish/ha in 1980 to 1,600 fish/ha in 1982. Fish biomass decreased from a peak in 1979 of 215 kg/ha to 53 kg/ha in 1982. The average total fish biomass for this study was 60 kg/ha (Table 56), which is similar to the 1982 fish biomass estimate reported by Shireman et al. (1984). These data suggest that after the vegetation was removed from Lake Pearl the fish population has remained stable. **(Text continued on page 184)**

Table 56. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Lake Pearl. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for total fish				
Threadfin shad	2161	123.5	5.4	1.9
Golden shiner	723	710.1	7.8	7.7
Taillight shiner	6	6.2	0.1	0.1
Yellow bullhead	19	18.5	1.5	1.5
Seminole killifish	6	6.2	0.1	0.1
Bluefin killifish	37	37.0	0.0	0.0
Mosquitofish	167	6.2	0.1	0.0
Brook silverside	241	129.7	0.2	0.1
Warmouth	685	55.6	3.1	1.4
Bluegill	17105	2037.7	65.5	14.1
Dollar sunfish	74	74.1	0.2	0.2
Redear sunfish	463	30.9	15.4	11.4
Spotted sunfish	68	67.9	0.9	0.9
Largemouth bass	229	179.1	8.2	7.3
Black crappie	31	18.5	0.1	0.0
Total	22014		108.7	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Open-water nets (n=2) for total fish				
Threadfin shad	1321	728.7	3.7	1.9
Golden shiner	0	0.0	0.0	0.0
Taillight shiner	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Bluefin killifish	0	0.0	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	31	6.2	0.5	0.5
Dollar sunfish	0	0.0	0.0	0.0
Redear sunfish	0	0.0	0.0	0.0
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	0	0.0	0.0	0.0
Black crappie	0	0.0	0.0	0.0
Total	1352		4.2	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	6	6.2	0.9	0.88
Warmouth	0	0.0	0.0	0.00
Bluegill	86	86.4	9.3	9.28
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	111	98.8	11.4	9.83
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	12	12.3	3.2	3.17
Black crappie	0	0.0	0.0	0.00
Total	216		24.8	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	6	6.2	0.5	0.49
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Black crappie	0	0.0	0.0	0.00
Total	6		0.5	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Littoral nets (n=2) for total fish				
Florida gar	6	6.2	5.2	5.2
Bowfin	6	6.2	21.0	21.0
Gizzard shad	618	148.2	9.3	6.9
Threadfin shad	3798	1389.4	7.5	2.6
Golden shiner	642	419.9	4.3	2.8
Grass carp	6	6.2	18.5	18.5
Taillight shiner	19	18.5	25.1	25.1
Lake chubsucker	68	67.9	0.8	0.8
Seminole killifish	482	358.2	4.0	2.7
Brook silverside	148	74.1	0.3	0.3
Redbreast sunfish	692	0.0	4.3	0.2
Warmouth	303	203.8	2.7	0.7
Bluegill	5638	2081.0	63.1	23.1
Dollar sunfish	352	314.9	0.6	0.6
Redear sunfish	692	111.2	52.9	22.1
Spotted sunfish	19	6.2	0.3	0.2
Largemouth bass	68	43.2	18.3	14.4
Swamp darter	0	0.0	0.0	0.0
Total	13554		238.3	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Open-water nets (n=2) for total fish				
Florida gar	43	43.2	7.9	7.9
Bowfin	0	0.0	0.0	0.0
Gizzard shad	2797	352.0	26.6	4.9
Threadfin shad	7249	6817.2	17.3	16.4
Golden shiner	0	0.0	0.0	0.0
Grass carp	0	0.0	0.0	0.0
Taillight shiner	6	6.2	10.0	10.0
Lake chubsucker	0	0.0	0.0	0.0
Seminole killifish	37	37.0	0.4	0.4
Brook silverside	37	24.7	0.1	0.1
Redbreast sunfish	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	2303	2278.6	7.0	6.9
Dollar sunfish	0	0.0	0.0	0.0
Redear sunfish	37	37.0	0.4	0.4
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	6	6.2	2.0	2.0
Swamp darter	6	6.2	0.0	0.0
Total	12523		71.7	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1988		
Littoral nets (n=2) for harvestable fish				
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	12	12.3	1.3	1.26
Bluegill	179	129.7	15.8	11.65
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	272	123.5	45.5	24.16
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	19	6.2	11.9	8.36
Total	482		74.4	
Open-water nets (n=2) for harvestable fish				
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	6	6.2	0.0	0.01
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	6	6.2	2.0	2.02
Total	12		2.0	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Littoral nets (n=2) for total fish				
Bowfin	12	12.3	20.0	20:0
Gizzard shad	0	0.0	0.0	0.0
Threadfin shad	198	123.5	0.3	0.3
Golden shiner	80	18.5	0.5	0.1
Taillight shiner	6	6.2	0.1	0.1
Yellow bullhead	25	0.0	0.3	0.1
Seminole killifish	389	117.3	1.4	0.4
Mosquitofish	56	18.5	0.0	0.0
Least killifish	12	12.3	0.0	0.0
Brook silverside	80	55.6	0.1	0.1
Redbreast sunfish	1093	302.6	6.1	0.7
Warmouth	525	6.2	2.4	0.4
Bluegill	8701	2525.6	84.8	28.7
Dollar sunfish	309	12.3	0.3	0.1
Redear sunfish	969	413.7	25.1	1.9
Spotted sunfish	210	148.2	1.7	1.2
Largemouth bass	105	18.5	44.9	16.6
Black crappie	6	6.2	0.1	0.1
Swamp darter	19	6.2	0.0	0.0
Flier	12	12.3	0.0	0.0
Total	12807		188.3	

Table 56. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Open-water nets (n=2) for total fish				
Bowfin	0	0.0	0.0	0.0
Gizzard shad	445	209.9	68.0	38.2
Threadfin shad	4971	994.2	9.1	1.9
Golden shiner	0	0.0	0.0	0.0
Taillight shiner	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Least killifish	0	0.0	0.0	0.0
Brook silverside	37	12.3	0.0	0.0
Redbreast sunfish	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	56	6.2	0.1	0.0
Dollar sunfish	0	0.0	0.0	0.0
Redear sunfish	0	0.0	0.0	0.0
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	6	6.2	0.5	0.5
Black crappie	124	49.4	14.9	7.1
Swamp darter	0	0.0	0.0	0.0
Flier	0	0.0	0.0	0.0
Total	5638		92.8	

Table 56. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1989		
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Redbreast sunfish	6	6.2	0.4	0.40
Warmouth	0	0.0	0.0	0.00
Bluegill	204	80.3	18.8	7.92
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	111	12.3	18.3	1.33
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	74	0.0	44.5	16.90
Black crappie	0	0.0	0.0	0.00
Flier	0	0.0	0.0	0.00
Total	395		82.0	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Black crappie	68	30.9	12.9	5.10
Flier	0	0.0	0.0	0.00
Total	68		12.9	

Table 57. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Lake Pearl. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1986			
Gillnets (n=3) for total fish				
Florida gar	1.0	0.58	1.8	0.11
Longnose gar	3.7	1.67	4.8	0.06
Gizzard shad	1.0	0.58	0.4	0.51
Threadfin shad	2.3	2.33	0.1	0.34
Golden shiner	1.0	0.00	0.1	1.12
Taillight shiner	0.3	0.33	0.8	1.07
Lake chubsucker	1.3	0.33	0.6	0.01
Bluegill	1.7	0.88	0.1	0.15
Redear sunfish	1.7	0.33	0.3	0.02
Largemouth bass	5.3	1.67	2.1	0.09
Black crappie	2.7	1.76	0.1	0.60
Total	22.00		11.23	
Gillnets (n=3) for harvestable fish				
Bluegill	1.3	0.88	0.1	0.08
Redear sunfish	1.7	0.33	0.3	0.05
Largemouth bass	4.3	1.67	1.9	0.53
Black crappie	0.0	0.00	0.0	0.00
Total	7.3		2.3	

Table 57. (Continued)

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1988			
Gillnets (n=3) for total fish				
Florida gar	1.0	1.00	1.4	0.08
Gizzard shad	39.0	9.00	6.5	0.30
Lake chubsucker	0.5	0.50	0.5	0.16
Yellow bullhead	0.5	0.50	0.2	0.01
Bluegill	0.5	0.50	0.1	0.64
Redear sunfish	0.5	0.50	0.1	8.27
Largemouth bass	0.5	0.50	0.2	0.84
Black crappie	1.5	1.50	0.4	0.08
Total	44.0		9.4	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	0.5	0.50	0.2	0.22
Bluegill	0.5	0.50	0.1	0.05
Redear sunfish	0.5	0.50	0.1	0.13
Largemouth bass	0.5	0.50	0.2	0.18
Black crappie	1.0	1.00	0.3	0.34
Total	3.0		0.9	

Table 57. (Concluded)

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1989			
Gillnets (n=3) for total fish				
Florida gar	1.3	0.88	1.4	0.23
Gizzard shad	39.3	6.33	6.9	0.31
Golden shiner	0.7	0.33	0.0	0.02
Yellow bullhead	0.3	0.33	0.2	0.07
Bluegill	1.3	0.33	0.1	0.04
Redear sunfish	0.3	0.33	0.1	0.39
Largemouth bass	1.0	0.58	1.2	0.09
Black crappie	1.3	0.33	0.2	0.06
Total	45.7		10.1	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	2.0	1.00	0.8	0.46
Bluegill	0.3	0.33	0.2	0.23
Redear sunfish	0.0	0.00	0.0	0.00
Largemouth bass	0.3	0.33	0.0	0.03
Black crappie	0.0	0.00	0.0	0.00
Total	2.7		1.1	

Table 58. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Lake Pearl. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1986		
Electrofishing runs (n=6) for total fish				
Longnose gar	3.3	3.34	16.5	1.65
Bowfin	1.7	1.68	18.8	1.88
Threadfin shad	5.0	5.00	0.3	0.03
Golden shiner	425.0	246.15	28.5	1.69
Lake chubsucker	1.7	1.68	0.2	0.02
Seminole killifish	3.3	3.34	0.5	0.05
Mosquitofish	1.7	1.68	0.0	0.00
Brook silverside	156.7	128.91	1.4	0.11
Bluegill	843.3	203.66	83.2	0.75
Redear sunfish	46.7	14.07	29.6	0.85
Largemouth bass	70.0	15.49	145.7	7.20
Total	1558.3		324.7	
Electrofishing runs (n=6) for harvestable fish				
Bluegill	16.7	5.58	2.0	0.76
Redear sunfish	16.7	6.15	1.5	0.51
Largemouth bass	13.3	6.15	12.7	7.42
Total	46.7		16.2	

Table 58. (Continued)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1988		
Electrofishing runs (n=3) for total fish				
Longnose gar	2.0	2.00	6.2	0.62
Bowfin	12.0	9.17	0.6	0.04
Threadfin shad	76.0	43.31	5.0	0.32
Golden shiner	4.0	2.00	70.8	3.80
Lake chubsucker	2.0	2.00	15.2	1.52
Seminole killifish	32.0	14.00	4.3	0.19
Mosquitofish	8.0	4.00	0.2	0.01
Brook silverside	10.0	5.29	2.0	0.10
Bluegill	202.0	37.04	91.7	0.99
Redear sunfish	46.0	11.14	44.6	0.34
Largemouth bass	34.0	8.72	100.3	3.16
Total	428.0		340.8	
Electrofishing runs (n=3) for harvestable fish				
Redbreast sunfish	0.0	0.00	0.0	0.00
Bluegill	34.0	11.14	3.7	1.34
Redear sunfish	30.0	3.46	4.1	0.42
Largemouth bass	24.0	6.93	9.6	3.11
Total	88.0		17.4	

Table 58. (Concluded)

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
		1989		
Electrofishing runs (n=4) for total fish				
Florida gar	3.0	1.73	15.8	0.98
Bowfin	4.5	2.87	64.4	4.29
Gizzard shad	9.0	3.00	8.4	0.35
Threadfin shad	84.0	31.84	1.7	0.06
Golden shiner	13.5	7.89	2.6	0.16
Taillight shiner	3.0	1.73	35.1	2.05
Seminole killifish	15.0	7.55	1.4	0.06
Brook silverside	4.5	2.87	0.0	0.00
Redbreast sunfish	9.0	3.00	3.3	0.14
Bluegill	202.5	54.90	44.8	1.21
Redear sunfish	75.0	7.55	53.7	2.42
Largemouth bass	19.5	3.77	57.5	1.60
Total	442.5		288.5	
Electrofishing runs (n=4) for harvestable fish				
Redbreast sunfish	1.5	1.50	0.1	0.11
Bluegill	18.0	4.24	1.4	0.31
Redear sunfish	24.0	12.96	4.5	2.45
Largemouth bass	15.0	3.00	5.6	1.58
Total	58.5		11.7	

Cue Lake

Location and Morphology

Cue Lake is located in Putnam County, Florida (Latitude 29.40 N; Longitude 82.58 W). The lake lies in the Interlachen Sand Hills division of the Central Lake District (Brooks 1981). The geology is dominated deeply weathered clayey sand and granular sand of the Hawthorne Formation. Cue Lake was sampled from 1986 to 1987 and had a surface area, shoreline length, and mean depth of 59, ha, 2.86 km, and 3.5 m, respectively (Table 1).

Trophic Status and Water Chemistry

Cue Lake had an average total phosphorus concentration of 5 µg/L and an average total nitrogen concentration of 91 µg/L. Total chlorophyll *a* concentrations averaged 2 µg/L and the water clarity as measured by use of a Secchi disc was 5.8 m (Table 2). The lake had an average pH of 4.6 and an average total alkalinity of 0.5 mg/L as $CaCO_3$. The average specific conductance was 45 µS/cm @ 25 C and the average water color was 0 Pt-Co units. The adjusted chlorophyll *a* concentration for Cue Lake was 2.5 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Cue Lake was an oligotrophic lake during this study.

Aquatic Plants

Cue Lake had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 0.1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 4.1, 0, and 0.1 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 16.1 mg chlorophyll *a*/cm^2 of host plant and 5.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Six species of aquatic macrophytes were collected in Cue Lake with the following species most commonly encounter: *Panicum hemitomon, Fuirena sciropoidea,* and *Ludwigia repens* which occurred in 100%, 100%, and 80% of the transects, respectively (Table 59).

Prior to 1985, Cue Lake was relatively undeveloped maintaining a slight fringe of aquatic vegetation (Lamia 1987). Although 26 species of aquatic macrophytes were

Table 59. Occurrence of plant species in ten evenly-spaced transects around Cue Lake.

Common name	Scientific name	Percent of Transects
red ludwigia	*Ludwigia repens*	80
dwarf arrowhead	*Sagittaria subulata*	20
maidencane	*Panicum hemitomon*	100
	Fuirena sciropoidea	100
	Leersia hexandra	10
St. John's wort	*Hypericum* spp.	60

collected in Cue Lake during 1985, *Panicum hemitomon* and *Fuirena sciropoidea* were the dominant species (Lamia 1987). These plants also occupied 5 to 7% of the lake's surface area and about 0.1% of the lake's total volume, which was similar to the values for our study (Table 3). Thus, the fish population in Cue Lake can be considered the product of an oligotrophic lake with very low levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Cue Lake was 233 individuals/kg wet wt of host plant and 0.16 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Cue Lake, as estimated with a ponar dredge, was 513 individuals/m^2 and 2.08 g wet wt/m^2 (Table 5). The zooplankton population was dominated by nauplii and rotifers averaging 26,900 and 21,700 individuals/m^3, respectively (Table 5).

Fish

Six species of fish were collected from Cue Lake (Table 60, 61, and 62). The most abundant species collected with rotenone sampling in 1986 and 1987 were bluegill and largemouth bass. These species had average standing stocks in 1987 littoral blocknets of 562 and 272 fish/ha, respectively (Table 60). The most abundant open-water species collected in 1987 experimental gillnets were largemouth bass and lake chubsucker with 5.7, and 1.7 fish/net/24 hr, respectively (Table 61). **(Text continued on page 193)**

Table 60. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Cue. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for total fish				
Brown bullhead	12	12.3	14.9	14.9
Warmouth	25	0.0	0.0	0.0
Largemouth bass	272	74.1	29.1	17.7
Swamp darter	0	0.0	0.0	0.0
Total	309		44.0	
Open-water nets (n=2) for total fish				
Brown bullhead	0	0.0	0.0	0.0
Warmouth	19	18.5	0.0	0.0
Largemouth bass	0	0.0	0.0	0.0
Swamp darter	43	18.5	0.0	0.0
Total	62		0.0	

Table 60. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1986		
Littoral nets (n=2) for harvestable fish				
Brown bullhead	12	12.3	14.9	14.85
Warmouth	0	0.0	0.0	0.00
Largemouth bass	31	18.5	12.4	9.57
Total	43		27.3	
Open-water nets (n=2) for harvestable fish				
Brown bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Total	0		0.0	

Table 60. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1987		
Littoral nets (n=2) for total fish				
Lake chubsucker	124	123.5	26.6	26.6
Brook silverside	204	191.4	0.1	0.1
Warmouth	346	345.8	0.8	0.8
Bluegill	562	561.9	1.0	1.0
Largemouth bass	272	271.7	19.5	19.5
Swamp darter	0	0.0	0.0	0.0
Total	1507		48.0	
Open-water nets (n=2) for total fish				
Lake chubsucker	0	0.0	0.0	0.0
Brook silverside	698	636.0	0.3	0.3
Warmouth	0	0.0	0.0	0.0
Bluegill	6	6.2	0.0	0.0
Largemouth bass	0	0.0	0.0	0.0
Swamp darter	6	6.2	0.0	0.0
Total	710		0.3	

Table 60. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
		1987		
Littoral nets (n=2) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Largemouth bass	49	49.4	10.9	10.92
Total	49		10.9	
Open-water nets (n=2) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Total	0		0.0	

Table 61. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Cue Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1986			
Gillnets (n=3) for total fish				
Lake chubsucker	1.0	0.58	0.3	1.01
Largemouth bass	5.0	3.21	1.2	0.07
Total	6.00		1.45	
Gillnets (n=3) for harvestable fish				
Largemouth bass	3.3	2.03	1.0	0.59
Total	3.3		1.0	

Table 61. (Continued)

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
	1987			
Gillnets (n=3) for total fish				
Lake chubsucker	1.7	1.67	0.4	0.05
Brown bullhead	0.3	0.33	0.2	0.16
Warmouth	0.3	0.33	0.0	0.07
Largemouth bass	5.7	1.67	1.1	0.37
Total	8.00		1.71	
Gillnets (n=3) for harvestable fish				
Brown bullhead	0.3	0.33	0.2	0.16
Warmouth	0.0	0.00	0.0	0.00
Largemouth bass	4.0	2.65	1.0	0.59
Total	4.3		1.1	

Table 62. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Cue Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Lake chubsucker	30.3	11.56	79.7	2.73
Warmouth	1.0	1.00	0.1	0.01
Bluegill	10.0	6.32	0.8	0.07
Largemouth bass	181.3	55.45	167.7	4.46
Total	222.7		248.3	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	32.3	7.31	8.1	2.12
Total	32.3		8.1	

The most abundant species collected using electrofishing in 1986 were the largemouth bass, and lake chubsucker with catch per unit efforts of 181, and 30.3 per hour, respectively (Table 62). Average first year growth of largemouth bass was 164 mm TL (Table 6). Mark-recapture estimates indicated that there were seven harvestable largemouth bass per hectare in Cue Lake (Table 7).

The fish population of Cue Lake was estimated with blocknets in 1984 and 1985 (Lamia 1987) and the average total fish biomass from all nets ranged from 35 to 130 kg/ha. The total fish biomass averaged from all nets in 1986 and 1987 ranged from 22 to 24 kg/ha in our nets (Table 60). This suggests the fish population in Cue Lake may have decreased over the last few years. The major change seems to be with the yellow bullhead, which was estimated at 56 kg/ha in 1984, but was not collected in 1986 and 1987.

Alligator Lake

Location and Morphology

Alligator Lake is located in Columbia County, Florida (Latitude 30.10 N; Longitude 82.37 W). The lake lies in the Lake City Karst subdivision of the Northern Peninsual Slopes division of the Ocala Uplift District (Brooks 1981). The geology is dominated by sand and clays of the phosphatic Hawthorne Formation. Alligator Lake was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 137 ha, 5.32 km and 1.1 m, respectively (Table 1).

Trophic Status and Water Chemistry

Alligator Lake is a hypereutrophic lake. The lake had an average total phosphorus concentration of 371 µg/L and an average total nitrogen concentration of 2367 µg/L during this study. Total chlorophyll *a* concentrations averaged 84 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.5 m (Table 2). The lake had an average pH of 9.7 and an average total alkalinity of 45.9 mg/L as $CaCO_3$. The average specific conductance was 137 µS/cm @ 25 C and the average water color was 50 Pt-Co units.

Aquatic Plants

Alligator Lake had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 10%, and

10.2%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 1.7, 1.2, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 32.0 mg chlorophyll *a*/cm^2 of host plant and 19.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fifteen species of aquatic macrophytes were collected from Alligator Lake with the following three species most commonly encountered: *Alternanthera philoxeroides, Salix* spp., and *Panicum hemitomon* which occurred in 100%, 90%, and 60% of the transects, respectively (Table 63).

Table 63. Occurrence of plant species in ten evenly-spaced transects around Alligator Lake.

Common name	Scientific name	Percent of Transects
floating water-hyacinth	*Eichhornia crassipes*	10
common arrowhead	*Sagittaria latifolia*	20
alligator-weed	*Alternanthera philoxeroides*	100
slender spikerush	*Eleocharis baldwinii*	50
American lotus	*Nelumbo lutea*	10
red ludwigia	*Ludwigia repens*	20
smartweed	*Polygonum hydropiperoides*	30
pickerelweed	*Pontederia cordata*	10
water-pennywort	*Hydrocotyle umbellata*	20
southern naiad	*Najas guadalupensis*	30
buttonbush	*Cephalanthus occidentalis*	20
willow	*Salix* spp.	90
maidencane	*Panicum hemitomon*	60
soft rush	*Juncus effusus*	40
musk-grass	*Chara* spp.	10

The plant community of Alligator Lake has been monitored by the Florida Department of Natural Resources from 1982 to present. The major aquatic plants during this time were *Ceratophyllum demersum, Eichhornia crassipes, Najas guadalupensis*, and filamentous algae. The lake area covered by each species, however, ranged dramatically from 0% to over 50%. This was probably the result of the large fluctuation in water level during that time, including a complete drying of one of the lake's basins in 1984 and 1987 (Krummrich, Florida Game and Fresh Water Fish Commission, personal communication).

Thus, the fish population in Alligator Lake can be considered the product of a hypereutrophic lake with a dramatically fluctuating water level and plant community.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Alligator Lake was 871 individuals/kg wet wt of host plant and 1.27 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Alligator Lake, as estimated with a ponar dredge, was 2113 individuals/m^2 and 4.75 g wet wt/m^2 (Table 5). The zooplankton population of Alligator Lake was dominated by cladocerans and rotifers with 622,000 and 411,000 individuals/m^3, respectively (Table 5).

Fish

Eighteen species of fish were collected in Alligator Lake (Table 64, 65, and 66). The most abundant species collected with rotenone sampling were golden shiner and black crappie. These species had average standing stocks in littoral blocknets of 14,000 and 21,200 fish/ha, respectively (Table 64). The most abundant open-water species collected in the experimental gillnets were Florida gar and black crappie with 26 and 8 fish/net/24 hr, respectively (Table 65). The most abundant species collected using electrofishing were golden shiner and black crappie with catch per unit efforts of 103 and 66 fish per hour, respectively (Table 66). Average first year growth of bluegill, redear sunfish, and largemouth bass was 104, 93, and 178 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 21 harvestable bluegill, 7 harvestable redear sunfish and 28 harvestable largemouth bass per hectare in Alligator Lake (Table 7).

The fish population of Alligator Lake was sampled with rotenone and blocknets in 1975 by the Florida Game and Freshwater Fish Commission (Krummrich unpublished data). Total fish biomass ranged from 280 to 680 kg/ha in three different littoral nets, which was greater than the 211 and 98 kg/ha in our littoral and open-water nets, respectively (Table 64). This was probably the result of Alligator Lake's fluctuating water level two years prior to our sampling in 1987. **(Text continued on page 201)**

Table 64. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Alligator Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Florida gar	17	10.9	4.0	4.0
Bowfin	4	4.1	4.5	4.5
Golden shiner	13984	11959.5	58.5	27.6
Lake chubsucker	8	4.1	0.0	0.0
Brown bullhead	177	158.5	2.4	0.7
Mosquitofish	1494	450.8	0.6	0.3
Least killifish	29	28.8	0.0	0.0
Everglades pygmy sunfish	4	4.1	0.0	0.0
Bream	3083	1212.2	1.1	0.4
Warmouth	144	62.3	4.2	3.2
Bluegill	156	39.3	14.8	4.2
Redear sunfish	66	8.2	7.1	2.3
Spotted sunfish	8	8.2	0.2	0.2
Largemouth bass	1173	333.8	13.0	9.1
Black crappie	21193	14872.1	98.2	52.9
Swamp darter	33	27.0	0.0	0.0
Shiners	3363	3363.3	2.7	2.7
Total	44937		211.3	

Table 64. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Florida gar	0	0.0	0.0	0.0
Bowfin	0	0.0	0.0	0.0
Golden shiner	1309	1027.5	41.5	31.7
Lake chubsucker	4	4.1	0.0	0.0
Brown bullhead	0	0.0	0.0	0.0
Mosquitofish	25	24.7	0.0	0.0
Least killifish	0	0.0	0.0	0.0
Everglades pygmy sunfish	0	0.0	0.0	0.0
Bream	10543	10351.9	3.6	3.6
Warmouth	41	22.9	0.0	0.0
Bluegill	128	29.7	7.8	2.8
Redear sunfish	181	46.4	18.7	5.5
Spotted sunfish	0	0.0	0.0	0.0
Largemouth bass	403	182.4	1.0	0.4
Black crappie	1058	439.2	25.1	11.1
Swamp darter	0	0.0	0.0	0.0
Shiners	0	0.0	0.0	0.0
Total	13692		97.8	

Table 64. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Brown bullhead	12	7.1	1.9	1.09
Warmouth	21	14.8	3.2	2.67
Bluegill	70	21.8	10.8	3.53
Redear sunfish	25	12.4	4.5	2.75
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	12	12.4	9.3	9.33
Black crappie	8	8.2	1.6	1.62
Total	148		31.4	
Open-water nets (n=3) for harvestable fish				
Brown bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	29	14.8	4.6	2.43
Redear sunfish	115	40.5	14.5	4.87
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Black crappie	0	0.0	0.0	0.00
Total	144		19.1	

Table 65. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Alligator. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	25.7	8.41	24.7	8.27
Bowfin	0.7	0.33	1.6	0.84
Golden shiner	7.7	3.67	0.2	0.08
Lake chubsucker	0.3	0.33	0.2	0.23
Brown bullhead	2.3	2.33	0.3	0.31
Warmouth	0.3	0.33	0.0	0.02
Bluegill	0.3	0.33	0.1	0.07
Redear sunfish	0.3	0.33	0.0	0.04
Largemouth bass	2.0	0.58	1.2	0.39
Black crappie	8.3	3.28	0.2	0.09
Total	48.0		28.7	
Gillnets (n=3) for harvestable fish				
Brown bullhead	1.7	1.67	0.2	0.25
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.3	0.33	0.1	0.07
Redear sunfish	0.3	0.33	0.0	0.04
Largemouth bass	2.0	0.58	1.2	0.39
Black crappie	0.0	0.00	0.0	0.00
Total	4.3		1.6	

Table 66. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Alligator Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=7) for total fish				
Florida gar	14.6	5.98	126.2	5.06
Bowfin	2.6	2.56	46.3	4.63
Golden shiner	102.9	74.35	15.6	1.26
Brown bullhead	4.3	4.29	5.1	0.50
Seminole killifish	18.0	18.00	1.1	0.10
Warmouth	3.4	1.77	1.8	0.12
Bluegill	28.3	10.37	30.4	1.04
Redear sunfish	18.9	4.42	19.5	0.64
Largemouth bass	25.7	5.03	129.7	6.34
Black crappie	66.0	12.07	23.6	0.68
Total	284.6		399.2	
Electrofishing runs (n=7) for harvestable fish				
Brown bullhead	2.6	2.57	0.3	0.34
Warmouth	0.0	0.00	0.0	0.00
Bluegill	14.6	5.38	2.6	0.94
Redear sunfish	8.6	2.89	1.3	0.68
Largemouth bass	8.6	3.43	11.9	6.50
Black crappie	6.9	3.32	1.7	0.69
Total	41.1		17.9	

Crooked Lake

Location and Morphology

Crooked Lake is located in Lake County, Florida (Latitude 29.09 N; Longitude 81.36 W). The lake lies in the Ocala Scrub division of the Central Lake District (Brooks 1981). The geology is dominated by sand dunes made of well sorted fine sand. Crooked Lake was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 8.4 ha, 2.02 km and 2.3 m, respectively (Table 1).

Trophic Status and Water Chemistry

Crooked Lake had an average total phosphorus concentration of 7 µg/L and an average total nitrogen concentration of 313 µg/L. Total chlorophyll *a* concentrations averaged 2 µg/L and the water clarity as measured by use of a Secchi disc averaged 3.1 m (Table 2). The lake had an average pH of 4.6 and an average total alkalinity of 0.4 mg/L as $CaCO_3$. The average specific conductance was 45 µS/cm @ 25 C and the average water color was 4 Pt-Co units. The adjusted chlorophyll *a* for Crooked Lake was 13.2 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Crooked Lake was a eutrophic lake during this study.

Aquatic Plants

Crooked Lake had a moderate abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 27%, and 2.8%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 26.8, 3.8, and 2.4 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 27.1 mg chlorophyll *a*/cm^2 of host plant and 16.1 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected in Crooked Lake. The most commonly encountered plant species were *Myriophyllum heterophyllum, Nuphar luteum,* and *Brachiaria mutica,* which occurred in 100%, 100%, and 80% of the transects, respectively (Table 67).

The plant community of Crooked Lake was sampled by the University of Florida in 1985 and there was a moderate level of aquatic macrophytes present (Canfield and Joyce

1985). The major aquatic plants in the lake during 1985 were *Myriophyllum heterophyllum* and *Nuphar luteum*, which is similar to our findings in 1986 (Table 67).

Table 67. Occurrence of plant species in ten evenly-spaced transects around Crooked Lake.

Common name	Scientific name	Percent of Transects
slender spikerush	*Eleocharis baldwinii*	70
banana-lily	*Nymphoides aquatica*	40
spatterdock	*Nuphar luteum*	100
red ludwigia	*Ludwigia repens*	50
pickerelweed	*Pontederia cordata*	10
water-pennywort	*Hydrocotyle umbellata*	40
water-moss	*Fontinalis* spp.	10
variable-leaf milfoil	*Myriophyllum heterophyllum*	10
maidencane	*Panicum hemitomon*	100
para grass	*Brachiaria mutica*	80
	Leersia hexandra	60
St. John's wort	*Hypericum* spp.	10
red root	*Lachnanthes carolininana*	10

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Crooked Lake was 55 individuals/kg wet wt of host plant and 0.10 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Crooked Lake, as estimated with a ponar dredge, was 500 individuals/m^2 and 1.46 g wet wt/m^2 (Table 5). The zooplankton population of Crooked Lake was dominated by copepods and cladocerans with 183,000 and 84,100 individuals/m^3, respectively (Table 5).

Fish

Twelve species of fish were collected from Crooked Lake (Table 68, 69, and 70). The most abundant species collected with rotenone sampling were bluegill and warmouth. These species had average standing stocks in littoral blocknets of 5,200, and 1,600 fish/ha, respectively (Table 68). The most abundant open-water species collected in the experimental gillnets were lake chubsucker and bluegill with 7 and 6 fish/net/24 hr, respectively (69). The most abundant species **(Text continued on page 207)**

Table 68. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Crooked Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Golden shiner	54	27.0	4.0	3.4
Lake chubsucker	395	217.6	37.4	21.8
Yellow bullhead	29	4.1	3.5	1.5
Seminole killifish	29	28.8	0.1	0.1
Lined topminnow	107	107.0	0.1	0.1
Mosquitofish	91	72.1	0.1	0.1
Brook silverside	4	4.1	0.0	0.0
Warmouth	1597	526.2	9.5	2.3
Bluegill	5195	1247.1	46.9	11.4
Largemouth bass	1548	603.1	11.5	2.5
Swamp darter	37	31.1	0.0	0.0
Shiners	399	362.9	0.2	0.1
Total	9485		113.4	
Open-water nets (n=3) for total fish				
Golden shiner	4	4.1	0.4	0.4
Lake chubsucker	0	0.0	0.0	0.0
Yellow bullhead	0	0.0	0.0	0.0
Seminole killifish	0	0.0	0.0	0.0
Lined topminnow	0	0.0	0.0	0.0
Mosquitofish	12	12.4	0.0	0.0
Brook silverside	0	0.0	0.0	0.0
Warmouth	0	0.0	0.0	0.0
Bluegill	906	844.4	67.7	67.3
Largemouth bass	99	39.7	18.0	17.6
Swamp darter	0	0.0	0.0	0.0
Shiners	0	0.0	0.0	0.0
Total	1021		86.1	

Table 68. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	12	7.1	2.9	1.53
Warmouth	8	8.2	0.8	0.84
Bluegill	193	51.6	21.0	5.67
Largemouth bass	21	4.1	6.2	1.39
Total	235		30.9	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	679	679.3	60.1	60.07
Largemouth bass	16	16.5	16.9	16.89
Total	696		77.0	

Table 69. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Crooked Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=4) for total fish				
Golden shiner	0.5	0.50	0.1	0.06
Lake chubsucker	6.8	3.82	1.7	1.01
Yellow bullhead	0.3	0.25	0.1	0.07
Warmouth	2.0	1.22	0.1	0.05
Bluegill	5.8	2.56	0.4	0.16
Largemouth bass	1.0	0.41	0.2	0.07
Total	16.3		2.5	
Gillnets (n=4) for harvestable fish				
Yellow bullhead	0.3	0.25	0.1	0.07
Warmouth	0.0	0.00	0.0	0.00
Bluegill	2.8	1.11	0.3	0.12
Largemouth bass	0.5	0.29	0.1	0.07
Total	3.5		0.5	

Table 70. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Crooked Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Golden shiner	1.5	1.50	0.2	0.02
Lake chubsucker	39.0	21.98	67.3	4.08
Warmouth	6.0	2.45	3.5	0.18
Bluegill	54.0	18.49	36.9	2.47
Largemouth bass	19.5	12.82	45.9	2.65
Total	120.0		153.9	
Electrofishing runs (n=4) for harvestable fish				
Warmouth	1.5	1.50	0.2	0.16
Bluegill	22.5	14.77	3.2	2.35
Largemouth bass	12.0	6.93	4.1	2.40
Total	36.0		7.5	

collected using electrofishing were the bluegill and lake chubsucker with catch per unit efforts of 54, and 39 fish per hour, respectively (Table 70). Average first year growth of bluegill and largemouth bass was 61 and 146 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 56 harvestable largemouth bass per hectare in Crooked Lake (Table 7).

No previous fisheries data were available for Crooked Lake. Crooked Lake, however, is located in the Ocala National Forest in a relatively undeveloped site. Thus, the fish population in Crooked Lake can be considered the product of an eutrophic lake with low to moderate levels of aquatic vegetation.

Deep Lake

Location and Morphology

Deep Lake is located in Putnam County, Florida (Latitude 29.43 N; Longitude 82.57 W). The lake lies in the St Johns Offset division of the Central Lake District (Brooks 1981). The geology is dominated by quartz sand and quartzite gravel with basal kaolinitic sandy clay beds of the Hawthorne Formation. Deep Lake was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 4 ha, 1.61 km and 3.0 m, respectively (Table 1).

Trophic Status and Water Chemistry

Deep Lake had an average total phosphorus concentration of 2 µg/L and an average total nitrogen concentration of 158 µg/L. Total chlorophyll *a* concentrations averaged 1 µg/L and the water clarity as measured by use of a Secchi disc was the bottom of the lake (Table 2). The lake had an average pH of 4.6 and an average total alkalinity of 0.3 mg/L as $CaCO_3$. The average specific conductance was 36 µS/cm @ 25 C and the average water color was 4 Pt-Co units. The adjusted chlorophyll *a* value for Deep Lake was 99 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Deep Lake was a hypereutrophic lake during this study.

Aquatic Plants

Deep Lake had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 97%, and 21%,

respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 10.6, 2.5, and 11.7 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 14.0 mg chlorophyll *a*/cm^2 of host plant, and 11.7 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Twelve species of aquatic macrophytes were collected in Deep Lake. The most commonly encountered plant species were *Utricularia purpurea, Leersia hexandra,* and *Hypericum* spp., which occurred in 100%, 100% and 100% of the transects, respectively (Table 71).

Table 71. Occurrence of plant species in ten evenly-spaced transects around Deep Lake.

Common name	Scientific name	Percent of Transects
spatterdock	*Nuphar luteum*	80
pickerelweed	*Pontederia cordata*	30
lemon bacopa	*Bacopa caroliniana*	10
water-pennywort	*Hydrocotyle umbellata*	10
water-moss	*Fontinalis* spp.	10
purple bladderwort	*Utricularia purpurea*	100
bog-moss	*Mayaca fluviatilis*	10
buttonbush	*Cephalanthus occidentalis*	80
maidencane	*Panicum hemitomon*	90
	Leersia hexandra	100
St. John's wort	*Hypericum spp.*	100
	Eleocharis elongata	10

No previous vegetation studies have been conducted on Deep Lake. Deep Lake, however, is a private lake on undeveloped land and the owner (Mr. Jack Williams of Gainesville, Florida) and his land caretaker agree the lake's vegetation and general appearance have remained the same for several years prior to our sampling. Thus, the fish population in Deep Lake can be considered the product of a hypereutrophic lake with a high level of vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Deep Lake was

131 individuals/kg wet wt of host plant and 0.08 g wet wt/kg wet wt of host plant, respectively (Table 5). Average number and biomass of benthic macroinvertebrates in Deep Lake, as estimated with a ponar dredge, was 513 individuals/m^2 and 1.77 g wet wt/m^2, respectively (Table 5). The zooplankton population was dominated by copepods and nauplii with 31,600 and 11,600 individuals/m^3, respectively (Table 5).

Fish

Seventeen species of fish were collected in Deep Lake (Table 72, 73, and 74). The most abundant species collected with rotenone sampling were warmouth, and bluespotted sunfish. These species had average standing stocks in littoral blocknets of 3,200 and 990 fish/ha, respectively (Table 72). The most abundant open-water species collected in the experimental gillnets were warmouth and Florida gar with 1.8 and 1.3 fish/net/24 hr, respectively (Table 73). The most abundant species collected using electrofishing were bluegill and largemouth bass with catch per unit efforts of 40 and 17 fish per hour, respectively (Table 74). Average first year growth of bluegill and largemouth bass was 45, and 124 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 18 harvestable bluegill and 32 harvestable largemouth bass per hectare in Deep Lake (Table 7).

No previous fisheries studies have been done on Deep Lake. Deep Lake, however, is a private lake on undeveloped land and the owner (Mr. Jack Williams of Gainesville, Florida) and his land caretaker have observed no major change in the fish population over the last several years. **(Text continued on page 215)**

Table 72. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Deep Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Florida gar	6	6.2	0.7	0.7
Redfin pickerel	86	12.3	1.1	0.1
Lake chubsucker	247	98.8	18.8	11.7
Yellow bullhead	31	18.5	1.9	0.9
Golden topminnow	352	339.6	0.6	0.5
Lined topminnow	266	18.5	0.3	0.0
Bluefin killifish	49	12.3	0.0	0.0
Least killifish	6	6.2	0.0	0.0
Brook silverside	229	105.0	0.2	0.1
Everglades pygmy sunfish	457	123.5	0.1	0.0
Bluespotted sunfish	988	247.0	0.5	0.1
Warmouth	3199	222.3	21.9	6.6
Bluegill	661	253.2	19.1	6.6
Largemouth bass	142	18.5	23.2	15.8
Black crappie	12	12.3	0.8	0.8
Swamp darter	43	6.2	0.0	0.0
Total	6774		89.1	

Table 72. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=2) for total fish				
Florida gar	0	0.0	0.0	0.0
Redfin pickerel	6	6.2	0.0	0.0
Lake chubsucker	37	37.0	2.1	2.1
Yellow bullhead	0	0.0	0.0	0.0
Golden topminnow	0	0.0	0.0	0.0
Lined topminnow	12	12.3	0.0	0.0
Bluefin killifish	37	12.3	0.0	0.0
Least killifish	0	0.0	0.0	0.0
Brook silverside	6	6.2	0.0	0.0
Everglades pygmy sunfish	19	6.2	0.0	0.0
Bluespotted sunfish	352	18.5	0.2	0.1
Warmouth	457	37.0	0.6	0.1
Bluegill	840	49.4	17.3	6.7
Largemouth bass	136	0.0	8.4	6.4
Black crappie	0	0.0	0.0	0.0
Swamp darter	12	12.3	0.0	0.0
Total	1914		28.7	

Table 72. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	25	0.0	2.5	0.00
Bluegill	74	24.7	5.8	1.78
Largemouth bass	43	18.5	21.9	16.98
Black crappie	0	0.0	0.0	0.00
Total	142		30.2	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	43	43.2	3.8	3.82
Largemouth bass	25	12.3	5.8	4.07
Black crappie	0	0.0	0.0	0.00
Total	68		9.7	

Table 73. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Deep Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=4) for total fish				
Florida gar	1.3	0.95	0.6	0.37
Lake chubsucker	0.8	0.48	0.1	0.03
American eel	0.3	0.25	0.0	0.05
Warmouth	1.8	0.48	0.1	0.01
Bluegill	0.3	0.25	0.0	0.01
Largemouth bass	0.5	0.50	0.1	0.09
Total	4.8		0.9	
Gillnets (n=4) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	0.3	0.25	0.1	0.06
Total	0.3		0.1	

Table 74. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Deep Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=3) for total fish				
Florida gar	10.0	5.77	73.4	6.69
Golden topminnow	3.3	3.32	0.2	0.02
Lined topminnow	3.3	3.32	0.0	0.00
Warmouth	3.3	3.32	0.2	0.02
Bluegill	40.0	20.00	13.2	0.88
Largemouth bass	16.7	6.66	54.3	2.73
Swamp darter	3.3	3.32	0.0	0.00
Total	80.0		141.2	
Electrofishing runs (n=3) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	3.3	3.33	0.3	0.27
Largemouth bass	13.3	3.33	5.2	2.46
Total	16.7		5.4	

Lawbreaker

Location and Morphology

Lawbreaker is located in Lake County, Florida (Latitude 29.10 N; Longitude 81.37 W). The lake lies in the Ocala Scrub division of the Central Lake District (Brooks 1981). The geology is dominated by sand dunes of well sorted fine sand. Lawbreaker was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 4.8 ha, 1.23 km and 4.8 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lawbreaker had an average total phosphorus concentration of 1 µg/L and an average total nitrogen concentration of 108 µg/L. Total chlorophyll *a* concentrations averaged 1 µg/L and the water clarity as measured by use of a Secchi disc averaged 5.5 m (Table 2). The lake had an average pH of 4.4 and an average total alkalinity of 0 mg/L as $CaCO_3$. The average specific conductance was 65 µS/cm @ 25 C and the average water color was 0 Pt-Co units. Using the classification system of Forsberg and Ryding (1980, Lawbreaker was classified as an oligotrophic lake.

Aquatic Plants

Lawbreaker had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of <1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 3.8, 0 and 0.1 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 10.3 mg chlorophyll *a*/cm^2 of host plant, and 8.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Ten species of aquatic macrophytes were collected from Lawbreaker. The most commonly encountered plant species were *Panicum hemitomon, Fuirena sciropoidea,* and *Eleocharis baldwinii* , which occurred in 100%, 80% and 60% of the transects, respectively (Table 75).

The plant community of Lawbreaker was sampled in 1985 by Canfield and Joyce (1985). The percent of the lake covered with vegetation was extremely small (< 5%) and the dominant species of plants collected were *Panicum hemitomon* and *Fuirena sciropoidea*, which is similar to our findings for this study (Table 3 and 75). Thus, the fish

Table 75. Occurrence of plant species in ten evenly-spaced transects around Lawbreaker Lake.

Common name	Scientific name	Percent of Transects
slender spikerush	*Eleocharis baldwinii*	60
water-moss	*Fontinalis* spp.	10
buttonbush	*Cephalanthus occidentalis*	10
maidencane	*Panicum hemitomon*	100
	Fuirena sciropoidea	80
	Leersia hexandra	10
pipewort	*Eriocaulon* spp.	30
St. John's wort	*Hypericum* spp.	60
	Rhynchyospora tracyi	10
red root	*Lachnanthes carolininana*	10

population of Lawbreaker Lake can be considered the product of an oligotrophic lake with low abundance of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lawbreaker was 200 individuals/kg wet wt of host plant, and 0.22 g wet wt/kg wet wt of host plant, respectively (Table 5). Average number and biomass of benthic macroinvertebrates in Lawbreaker, as estimated with a ponar dredge, was 593 individuals/m^2 and 1.39 g wet wt/m^2 (Table 5). The zooplankton population in Lawbreaker was dominated by copepods and nauplii with 33,900 and 20,800 individuals/m^3, respectively (Table 5).

Fish

Four species of fish were collected in Lawbreaker (Table 76, 77, and 78). The most abundant species collected by use of rotenone sampling were warmouth and lake chubsucker. These species had average standing stocks in littoral blocknets of 660 and 370 fish/ha, respectively (Table 76). The most abundant open-water species collected in the experimental gillnets were warmouth and lake chubsucker with 12.5 and 0.5 fish/net/24 hr, respectively (Table 77). **(Text continued on page 219)**

Table 76. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Lawbreaker. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Lake chubsucker	371	148.2	32.9	13.5
Lined topminnow	6	6.2	0.0	0.0
Warmouth	661	105.0	9.6	0.1
Total	1038		42.5	
Open-water nets (n=1) for total fish				
Lake chubsucker	31	30.9	2.8	2.8
Lined topminnow	0	0.0	0.0	0.0
Warmouth	12	0.0	0.2	0.1
Total	43		3.0	
Littoral nets (n=2) for harvestable fish				
Warmouth	19	18.5	1.9	1.89
Total	19		1.9	
Open-water nets (n=2) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Total	0		0.0	

Table 77. Experimental gillnet (five 10-long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Lawbreaker. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=4) for total fish				
Lake chubsucker	0.5	0.50	0.0	0.02
Warmouth	12.5	4.03	0.4	0.15
Total	13.0		0.4	
Gillnets (n=4) for harvestable fish				
Warmouth	0.3	0.25	0.0	0.03
Total	0.3		0.0	

Table 78. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Lawbreaker. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Lake chubsucker	27.5	15.48	22.5	1.41
Lined topminnow	2.5	2.50	0.1	0.01
Bluefin killifish	10.0	10.00	0.1	0.01
Warmouth	7.5	4.80	1.0	0.06
Total	47.5		23.7	
Electrofishing runs (n=4) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Total	0.0		0.0	

The most abundant species collected using electrofishing were lake chubsucker and bluefin killifish with catch per unit efforts of 28 and 10 fish per hour, respectively (Table 78).

No previous fisheries studies have been conducted on Lawbreaker. Lawbreaker, however, is on undeveloped land in the Ocala National Forest (Canfield and Joyce 1985) and no major change in the fish population would have been expected over the last several years. Lawbreaker is also unique among the lakes that we sampled because it had no largemouth bass.

Round Pond

Location and Morphology

Round Pond is located in Lake County, Florida (Latitude 29.04 N; Longitude 81.49 W). The lake lies in the Central Lakes division of the Central Lake District (Brooks 1981). The geology is dominated by deeply weathered clayey sand and granular sands of the Hawthorne Formation. Round Pond was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 4.0 ha, 0.88 km and 1.3 m, respectively (Table 1).

Trophic Status and Water Chemistry

Round Pond had an average total phosphorus concentration of 3 µg/L and an average total nitrogen concentration of 444 µg/L. Total chlorophyll *a* concentrations averaged 3 µg/L and the water clarity as measured by use of a Secchi disc was the bottom of the lake (Table 2). The lake had an average pH of 4.8 and an average total alkalinity of 0.9 mg/L as $CaCO_3$. The average specific conductance was 41 µS/cm @ 25 C, and the average water color was 10 Pt-Co units. The adjusted chlorophyll *a* value in Round Pond was 47.2 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Round Pond was classified as an hypereutrophic lake during this study.

Aquatic Plants

Round Pond had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 100% and 79%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 2.8, 2.0, and 1.5 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 23.1 mg chlorophyll *a*/cm^2 of host plant and 23.3 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Sixteen species of aquatic macrophytes were collected from Round Pond. The most commonly encountered plant specie were *Utricularia purpurea, Myriophyllum heterophyllum,* and *Brachiaria mutica* , which occurred in 100%, 90% and 90% of the transects, respectively (Table 79).

The plant community of Round Pond was sampled in 1985 by Canfield and Joyce (1985). The percent of the lake covered with vegetation was large (100%) and the dominant

Table 79. Occurrence of plant species in ten evenly-spaced transects around Round Pond.

Common name	Scientific name	Percent of Transects
slender spikerush	*Eleocharis baldwinii*	70
banana-lily	*Nymphoides aquatica*	40
water-shield	*Brasenia schreberi*	30
spatterdock	*Nuphar luteum*	60
fragrant water-lily	*Nymphaea odorata*	10
variable-leaf milfoil	*Myriophyllum heterophyllum*	90
purple bladderwort	*Utricularia purpurea*	100
bog-moss	*Mayaca fluviatilis*	30
maidencane	*Panicum hemitomon*	60
	Fuirena sciropoidea	90
	Leersia hexandra	40
	Websteria confervoides	70
	Utricularia floridana	70
pipewort	*Eriocaulon* spp.	20
St. John's wort	*Hypericum* spp.	70
yellow-eyed grass	*Xyris* spp.	50

species of plants collected were *Utricularia purpurea,* and *Fuirena sciropoidea*, which was similar to our plant sampling for this study (Table 3 and 79). Thus, the fish population of Round Pond can be considered the product of a hypereutrophic lake with high abundance of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Round Pond was 192 individuals/kg wet wt of host plant, and 0.32 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Round Pond, as estimated with a ponar dredge, was 747 individuals/m^2 and 1.70 g wet wt/m^2, respectively (Table 5). The zooplankton population in Round Pond was dominated by copepods and cladocerans with 181,000 and 125,000 individuals/m^3, respectively (Table 5).

Fish

Nine species of fish were collected from Round Pond (Table 80, 81, and 82). The most abundant species collected with rotenone sampling were warmouth and lake chubsucker. These species had average standing stocks in littoral blocknets of 10,000, and 950 fish/ha, respectively (Table 80). The most abundant open-water species collected in the experimental gillnets were lake chubsucker and largemouth bass with 9.0, and 3.7 fish/net/24 hr, respectively (Table 81). The most abundant species collected using electrofishing were lake chubsucker and largemouth bass with catch per unit efforts of 48 and 8 fish per hour, respectively (Table 82). Average first year growth of bluegill and largemouth bass was 93 and 114 mm TL (Table 6). Mark-recapture estimates indicated that there were 14 harvestable bluegill and 16 harvestable largemouth bass per hectare (Table 7) in Round Pond.

No previous fisheries studies have been conducted on Round Pond. However, Round Pond is on undeveloped land in the Ocala National Forest (Canfield and Joyce 1985) and no major change in the fish population would have been expected over the last several years.

Carr Lake

Location and Morphology

Carr Lake is located in Leon County, Florida (Latitude 30.34 N; Longitude 84.17 W). The lake lies in the Tallahassee Red Hills subdivision of the State Line Hills division of the Ocala Uplift District (Brooks 1981). The geology is dominated by granular sand and clayey sand with some clay lenses of the Miccosukee Formation. Carr Lake was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 254 ha, 5.05 km and 1.9 m, respectively (Table 1).

Trophic Status and Water Chemistry

Carr Lake had an average total phosphorus concentration of 19 µg/L and an average total nitrogen concentration of 874 µg/L. Total chlorophyll *a* concentrations averaged 11 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.8 m (Table 2). The lake had an average pH of 6.4 and an average total alkalinity of 7.5 mg/L as $CaCO_3$. The average specific conductance was **(Text continued on page 226)**

Table 80. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Round Pond. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Lake chubsucker	945	67.9	51.4	9.5
Golden topminnow	679	296.4	0.5	0.2
Bluefin killifish	204	191.4	0.1	0.1
Least killifish	0	0.0	0.0	0.0
Warmouth	10047	339.6	38.8	4.6
Bluegill	438	80.3	22.2	6.7
Largemouth bass	852	160.6	12.8	7.5
Swamp darter	111	61.7	0.4	0.4
Total	13276		126.3	
Open-water nets (n=2) for total fish				
Lake chubsucker	587	30.9	72.8	15.3
Golden topminnow	93	67.9	0.2	0.1
Bluefin killifish	0	0.0	0.0	0.0
Least killifish	6	6.2	0.0	0.0
Warmouth	4069	1031.2	13.2	1.0
Bluegill	438	228.5	23.0	13.5
Largemouth bass	568	24.7	35.1	31.2
Swamp darter	117	92.6	0.1	0.1
Total	5879		144.2	

Table 80. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Warmouth	56	18.5	6.7	2.94
Bluegill	148	49.4	11.4	3.92
Largemouth bass	6	6.2	5.7	5.68
Total	210		23.8	
Open-water nets (n=2) for harvestable fish				
Warmouth	25	0.0	2.8	0.31
Bluegill	130	105.0	9.9	7.95
Largemouth bass	37	24.7	32.6	30.12
Total	191		45.3	

Table 81. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Round Pond. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Lake chubsucker	9.0	4.62	1.4	0.97
Warmouth	1.7	1.67	0.1	0.05
Bluegill	0.3	0.33	0.0	0.01
Largemouth bass	3.7	1.33	0.6	0.37
Total	14.7		2.1	
Gillnets (n=3) for harvestable fish				
Warmouth	1.0	1.00	0.0	0.05
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	1.0	0.58	0.3	0.31
Total	2.0		0.4	

Table 82. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Round Pond. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Lake chubsucker	47.5	4.80	37.0	0.31
Brook silverside	7.5	7.50	0.10	0.01
Bluegill	2.5	2.50	1.3	0.13
Largemouth bass	7.5	2.50	7.1	0.65
Total	65.0		45.4	
Electrofishing runs (n=4) for harvestable fish				
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	2.5	2.50	0.7	0.67
Total	2.5		0.7	

26 µS/cm @ 25 C and the average water color was 22 Pt-Co units. The adjusted chlorophyll *a* value in Carr Lake was 201 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Carr Lake was classified as a hypereutrophic lake during this study.

Aquatic Plants

Carr Lake had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 100%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 12.7, 7.0, and 9.9 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 24.0 mg

chlorophyll *a*/cm^2 of host plant and 13.8 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Sixteen species of aquatic macrophytes were collected in Carr Lake. The most commonly encountered plant species were *Nymphaea odorata, Cabomba pulcherrima,* and *Pontederia cordata* , which occurred in 100%, 100%, and 80% of the transects, respectively (Table 83).

Table 83. Occurrence of plant species in ten evenly-spaced transects around Carr Lake.

Common name	Scientific name	Percent of Transects
floating water-hyacinth	*Eichhornia crassipes*	60
common arrowhead	*Sagittaria latifolia*	20
frog's-bit	*Limnobium spongia*	60
water-shield	*Brasenia schreberi*	50
American lotus	*Nelumbo lutea*	10
fragrant water-lily	*Nymphaea odorata*	100
smartweed	*Polygonum hydropiperoides*	50
pickerelweed	*Pontederia cordata*	80
lemon bacopa	*Bacopa caroliniana*	10
water-pennywort	*Hydrocotyle umbellata*	20
cone-spur bladderwort	*Utricularia gibba*	30
purple bladderwort	*Utricularia purpurea*	70
purple fanwort	*Cabomba pulcherrima*	100
maidencane	*Panicum hemitomon*	60
para grass	*Brachiaria mutica*	10
	Utricularia foliosa	50

The plant community of Carr Lake has been monitored by the Florida Department of Natural Resources from 1982 to present. The major aquatic plants in the lake were *Nymphaea odorata* and *Cabomba pulcherrima.* The percentage area covered with these plants ranged 31 to 50% and 16 to 50%, respectively. Many other species of plant were also counted on Carr Lake in large abundances, which agrees with the plant data of this study (Table 3 and 83). Thus, the fish population in Carr Lake can be considered the product of a hypereutrophic lake with high levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Carr Lake was 116 individuals/kg wet wt of host plants and 0.75 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Carr Lake, as estimated with a ponar dredge, was 700 individuals/m^2, and 0.98 g wet wt/m^2 (Table 5). The zooplankton population of Carr Lake was dominated by cladocerans and copepods with 260,000 and 181,000 individuals/m^3, respectively (Table 5).

Fish

Fifteen species of fish were collected in Carr Lake (Table 84, 85, and 86). The most abundant species collected (by numbers) with rotenone sampling were black crappie and golden shiner. These species had average standing stocks in littoral blocknets of 400 and 340 fish/ha, respectively (Table 84). The most abundant open-water species collected in the experimental gillnets were golden shiner and largemouth bass with 38 and 9.3 fish/net/24 hr, respectively (Table 85). The most abundant species collected using electrofishing were lake chubsucker and largemouth bass with catch per unit efforts of 4.8 and 15.6 fish per hour, respectively (Table 86). Average first year growth of bluegill, redear sunfish, and largemouth bass was 74, 67, and 129 mm TL, respectively (Table 6). Mark-recapture estimates could not be completed in Carr Lake because of low electrofishing success. We could find no previous fisheries data on Carr Lake.

Hollingsworth

Location and Morphology

Hollingsworth is located in Polk County, Florida (Latitude 28.01 N; Longitude 81.56 W). The lake lies in the Bartow Embayment division of the Central Lakes District (Brooks 1981). The geology is dominated by phosphatic sand and clay from the Bone Valley Formation. Hollingsworth was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 144 ha, 4.23 km and 1.5 m, respectively (Table 1).

Trophic Status and Water Chemistry

Hollingsworth had an average total phosphorus concentration of 113 µg/L and an average total nitrogen concentration of 2517 µg/L. **(Text continued on page 232)**

Table 84. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Carr Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Redfin pickerel	0	0.0	0.0	0.0
Golden shiner	342	171.2	0.3	0.2
Lake chubsucker	4	4.1	0.8	0.8
Golden topminnow	45	14.8	0.1	0.0
Mosquitofish	12	7.1	0.0	0.0
Brook silverside	0	0.0	0.0	0.0
Bluespotted sunfish	41	25.0	0.0	0.0
Bream	156	126.0	0.1	0.1
Warmouth	124	99.1	0.4	0.4
Bluegill	119	43.0	2.3	1.2
Redear sunfish	0	0.0	0.0	0.0
Largemouth bass	136	42.8	3.3	2.6
Black crappie	403	245.9	1.0	0.7
Total	1383		8.3	
Open-water nets (n=3) for total fish				
Redfin pickerel	4	4.1	2.3	2.3
Golden shiner	7105	2266.3	17.7	4.1
Lake chubsucker	264	118.7	107.7	46.0
Golden topminnow	49	24.7	0.0	0.0
Mosquitofish	0	0.0	0.0	0.0
Brook silverside	494	281.7	0.2	0.1
Bluespotted sunfish	469	55.7	0.3	0.1
Bream	980	398.4	0.5	0.1
Warmouth	317	21.8	1.3	0.5
Bluegill	646	260.3	51.9	19.8
Redear sunfish	91	36.6	3.6	1.2
Largemouth bass	972	261.5	25.5	6.5
Black crappie	2729	367.3	5.5	1.0
Total	14120		216.5	

Table 84. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	8	8.2	1.1	1.11
Redear sunfish	0	0.0	0.0	0.00
Largemouth bass	4	4.1	2.6	2.55
Black crappie	0	0.0	0.0	0.00
Total	12		3.7	
Open-water nets (n=3) for harvestable fish				
Warmouth	8	4.1	0.8	0.42
Bluegill	284	95.9	44.3	17.28
Redear sunfish	16	4.1	3.2	1.03
Largemouth bass	41	10.9	19.2	5.99
Black crappie	4	4.1	0.9	0.94
Total	354		68.5	

Table 85. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Carr Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Bowfin	0.7	0.67	1.1	1.09
Golden shiner	38.0	20.43	3.4	2.00
Lake chubsucker	7.3	3.48	3.9	1.78
Brown bullhead	0.7	0.67	0.5	0.53
Warmouth	1.7	0.33	0.2	0.02
Bluegill	2.3	0.32	0.5	0.11
Redear sunfish	0.3	0.32	0.1	0.09
Largemouth bass	9.3	4.33	3.7	1.52
Total	60.3		13.4	
Gillnets (n=3) for harvestable fish				
Brown bullhead	0.7	0.67	0.5	0.53
Warmouth	1.0	0.00	0.1	0.02
Bluegill	1.7	0.33	0.5	0.13
Redear sunfish	0.3	0.33	0.1	0.09
Largemouth bass	7.7	3.18	3.5	1.39
Total	11.3		4.8	

Table 86. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Carr Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=5) for total fish				
Lake chubsucker	4.8	4.80	23.5	2.34
Brown bullhead	1.2	1.18	6.7	0.67
Bluegill	3.6	2.41	4.9	0.44
Largemouth bass	15.6	4.49	30.4	1.90
Total	25.2		65.5	
Electrofishing runs (n=5) for harvestable fish				
Brown bullhead	1.2	1.20	0.7	0.67
Bluegill	1.2	1.20	0.4	0.43
Largemouth bass	7.2	4.41	2.9	1.91
Total	9.6		4.0	

Total chlorophyll *a* concentrations averaged 135 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.3 m (Table 2). The lake had an average pH of 8.8 and an average total alkalinity of 51 mg/L as $CaCO_3$. The average specific conductance was 163 µS/cm @ 25 C and the average water color was 16 Pt-Co units. Using the classification system of Forsberg and Ryding (1980), Lake Hollingsworth was classified as a hypereutrophic lake during this study.

Aquatic Plants

Hollingsworth had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of <1%,

respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 9.3, 0.3, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 13.8 mg chlorophyll *a*/cm^2 of host plant and 3.8 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fifteen species of aquatic macrophytes were collected from Hollingsworth. The most commonly encountered plant species were *Colocasia esculenta, Alternanthera philoxeroides,* and *Typha* spp., which occurred in 100%, 60% and 60% of the transects, respectively (Table 87).

The plant community of Lake Hollingsworth has been monitored by the Florida Department of Natural Resources from 1982 to present. The major aquatic plants in the lake were *Typha* spp. and *Nelumbo lutea*, but these plants covered < 3% of the lake, which is similar to our findings (Table 3 and 87). Thus, the fish population in Lake Hollingsworth can be considered the product of a hypereutrophic lake with low levels of aquatic macrophytes.

Table 87. Occurrence of plant species in ten evenly-spaced transects around Lake Hollingsworth.

Common name	Scientific name	Percent of Transects
duck-potato	*Sagittaria lancifolia*	10
alligator-weed	*Alternanthera philoxeroides*	60
American lotus	*Nelumbo lutea*	40
smartweed	*Polygonum hydropiperoides*	10
pickerelweed	*Pontederia cordata*	10
cat-tail	*Typha* spp.	60
water-pennywort	*Hydrocotyle umbellata*	20
elephant-ear	*Colocasia esculenta*	100
water primrose	*Ludwigia octovalis*	60
giant bulrush	*Scirpus californicus*	10
maidencane	*Panicum hemitomon*	10
para grass	*Brachiaria mutica*	50
knot grass	*Paspalum distichum*	20
leconte sedge	*Cyperus lecontei*	10
	Scirpus americanus	20

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Hollingsworth was 116 individuals/kg wet wt of host plants and 0.14 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Hollingsworth, as estimated with a ponar dredge, was 240 individuals/m^2 and 1.82 g wet wt/m^2 (Table 5). The zooplankton population of Hollingsworth was dominated by rotifers and cladocerans with 286,000 and 68,700 individuals/m^3, respectively (Table 5).

Fish

Sixteen species of fish were collected from Hollingsworth (Table 88, 89, and 90). The most abundant species collected with rotenone sampling were bluegill and golden shiner. These species had average standing stocks in littoral blocknets of 6,100 and 2,300 fish/ha, respectively (Table 88). The most abundant open-water species collected in the experimental gillnets were gizzard shad and black crappie with 104 and 23 fish/net/24 hr, respectively (Table 89). The most abundant species collected using electrofishing were gizzard shad and bluegill with catch per unit efforts of 220 and 160 fish per hour, respectively (Table 90). Average first year growth of bluegill, redear sunfish, and largemouth bass was 87, 109, and 171 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 5 harvestable bluegill and 13 harvestable largemouth bass per hectare (Table 7).

The fish population of Hollingsworth from 1965 to 1969 was described as having an over abundance of forage fishes including gizzard shad, threadfin shad, and stunted bluegill. Largemouth bass, when stocked, grew fast and did well, but from 1965 to 1969 did not reproduce successfully in Hollingsworth (Horel 1968; Chew 1974). Total fish biomass as estimated with littoral blocknet samples taken by the Florida Game and Fresh Water Fish Commission from 1967 to 1970 ranged from 70 to 257 kg/ha (Ware et al. 1971). This is much less than the littoral blocknet samples collected for this study (Table 88). Our littoral nets averaged 1050 kg/ha. We also collected over 160 kg/ha of largemouth bass, including abundant young of the year, suggesting there has been a dramatic change in the fish population of Lake Hollingsworth since 1965. **(Text continued on page 239)**

Table 88. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Hollingsworth. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Gizzard shad	2717	1940	24.7	20.50
Golden shiner	2342	1342	7.4	5.97
Grass carp	37	21	92.9	51.44
Yellow bullhead	0	0	0.0	0.00
Seminole killifish	12	12	0.2	0.25
Mosquitofish	70	15	0.1	0.02
Brook silverside	33	33	0.0	0.00
Tidewater silverside	91	46	0.1	0.03
Bream	0	0	0.0	0.00
Warmouth	8	8	0.6	0.61
Bluegill	6089	2485	113.1	38.50
Redear sunfish	486	177	20.7	5.99
Largemouth bass	268	121	163.3	135.95
Black crappie	202	103	5.2	2.90
Blue tilapia	1128	572	618.1	534.92
Total	13483		1046.4	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	4	4.1	0.4	0.42
Bluegill	428	99.9	56.0	8.96
Redear sunfish	95	16.5	16.9	4.35
Largemouth bass	185	118.7	156.3	136.65
Black crappie	16	10.9	3.4	2.65
Total	729		233.0	

Table 88. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Gizzard shad	3845	1809	21.3	8.18
Golden shiner	78	29	1.4	0.84
Grass carp	0	0	0.0	0.00
Yellow bullhead	8	8	0.1	0.11
Seminole killifish	12	12	0.0	0.05
Mosquitofish	4	4	0.0	0.00
Brook silverside	4	4	0.0	0.01
Tidewater silverside	12	7	0.0	0.01
Bream	1103	1103	1.1	1.09
Warmouth	0	0	0.0	0.00
Bluegill	585	129	15.4	2.82
Redear sunfish	185	107	19.0	15.53
Largemouth bass	16	11	2.0	1.17
Black crappie	161	99	4.6	2.74
Blue tilapia	4	4	2.1	2.14
Total	6017		67.1	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	66	20.6	7.8	1.85
Redear sunfish	91	72.8	16.4	13.09
Largemouth bass	4	4.1	1.3	1.35
Black crappie	4	4.1	0.4	0.44
Total	165		26.0	

Table 89. Experimental gillnet (five10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Hollingsworth. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	1.3	0.88	1.2	0.98
Gizzard shad	104.3	4.84	8.8	0.51
Golden shiner	7.3	0.88	0.3	0.10
Bluegill	4.3	3.84	0.2	0.17
Redear sunfish	3.7	2.66	0.8	0.57
Largemouth bass	4.3	0.66	2.0	0.24
Black crappie	23.3	2.73	1.1	0.18
Blue tilapia	9.7	4.67	4.8	0.98
Total	158.3		19.3	
Gillnets (n=3) for harvestable fish				
Bluegill	1.0	0.58	0.1	0.06
Redear sunfish	3.3	2.33	0.8	0.56
Largemouth bass	3.7	0.67	2.0	0.26
Black crappie	0.7	0.33	0.1	0.09
Total	8.7		3.0	

Table 90. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Hollingsworth. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=5) for total fish				
Gizzard shad	222.0	118.63	3.4	0.14
Golden shiner	28.8	12.50	0.5	0.03
Grass carp	2.4	2.41	65.6	6.56
Yellow bullhead	3.6	3.61	0.0	0.00
Seminole killifish	25.2	18.04	4.9	0.28
Mosquitofish	15.6	9.97	0.0	0.00
Tidewater silverside	3.6	2.41	0.0	0.00
Bluegill	163.2	33.05	140.7	5.94
Redear sunfish	20.4	6.18	32.3	0.76
Largemouth bass	51.6	10.67	158.4	4.41
Blue tilapia	25.2	13.20	28.6	1.68
Total	561.6		434.6	
Electrofishing runs (n=5) for harvestable fish				
Yellow bullhead	0.0	0.00	0.0	0.00
Bluegill	70.8	34.64	12.0	5.76
Redear sunfish	16.8	3.50	3.2	0.76
Largemouth bass	24.0	3.79	14.1	4.75
Total	111.6		29.3	

Hunter

Location and Morphology

Hunter is located in Polk County, Florida (Latitude 28.02 N; Longitude 81.58 W). The lake lies in the Bartow Embayment division of the Central Lakes District (Brooks 1981). The geology is dominated by phosphatic sand and clays from the Bone Valley Formation. Hunter was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 40 ha, 2.33 km and 1.7 m, respectively (Table 1).

Trophic Status and Water Chemistry

Hunter is a hypereutrophic lake. The lake had an average total phosphorus concentration of 98 µg/L, and an average total nitrogen concentration of 1723 µg/L. Total chlorophyll *a* concentrations averaged 82 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.5 m (Table 2). The lake had an average pH of 9.0 and an average total alkalinity of 69 mg/L as $CaCO_3$. The average specific conductance was 182 µS/cm @ 25 C and the average water color was 17 Pt-Co units.

Aquatic Plants

Hunter had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 6.6, 0, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 13.3 mg chlorophyll *a*/cm^2 of host plant and 8.5 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fifteen species of aquatic macrophytes were collected in Lake Hunter. The most commonly encountered plant species were *Panicum hemitomon, Hydrocotyle umbellata,* and *Pontederia cordata* , which occurred in 90%, 80%, and 80% of the transects, respectively (Table 91).

In 1983, Lake Hunter was completely drained and the plant community was reestablished by planting individual plants of several different species (Moxley and Williams 1984). Grass carp were subsequently stocked in Lake Hunter (Moxley and Williams 1985) and the aquatic vegetation has remained at low levels since 1985. Thus, the

Table 91. Occurrence of plant species in ten-evenly spaced transects around Lake Hunter.

Common name	Scientific name	Percent of Transects
duck-potato	*Sagittaria lancifolia*	20
alligator-weed	*Alternanthera philoxeroides*	70
smartweed	*Polygonum hydropiperoides*	10
pickerelweed	*Pontederia cordata*	70
cat-tail	*Typha* spp.	60
water-pennywort	*Hydrocotyle umbellata*	80
elephant-ear	*Colocasia esculenta*	60
water primrose	*Ludwigia octovalis*	20
buttonbush	*Cephalanthus occidentalis*	30
willow	*Salix* spp.	30
maidencane	*Panicum hemitomon*	90
leconte sedge	*Cyperus lecontei*	20

fish population in Hunter during this study can be considered the product of a hypereutrophic lake with low levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Hunter was 1247 individuals/kg wet wt of host plant and 35.8 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Hunter, as estimated with a ponar dredge, was 153 individuals/m^2 and 0.67 g wet wt/m^2 (Table 5). The zooplankton population of Lake Hunter was dominated by rotifers and copepods with 31,200 and 14,000 individuals/m^3, respectively (Table 5).

Fish

Eighteen species of fish were collected in Hunter (Table 92, 93, and 94). The most abundant species collected with rotenone sampling were gizzard shad and bluegill. These species had average standing stocks in littoral blocknets of 39,600 and 11,500 fish/ha, respectively (Table 92). The most abundant open-water species collected in the experimental gillnets were gizzard shad and **(Text continued on page 244)**

Table 92. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Hunter. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Gizzard shad	39588	17420	117.9	79.46
Golden shiner	247	235	1.3	1.17
Grass carp	19	19	52.7	52.66
Taillight shiner	630	506	0.4	0.24
Yellow bullhead	6	6	0.2	0.23
Brown bullhead	6	6	0.0	0.02
Seminole killifish	1241	179	6.3	2.47
Mosquitofish	99	99	0.0	0.03
Redbreast sunfish	2507	1531	34.4	21.72
Warmouth	130	117	3.8	3.20
Bluegill	11485	5101	112.8	67.04
Redear sunfish	1970	1056	37.5	7.89
Largemouth bass	327	43	28.7	17.96
Black crappie	62	62	0.2	0.25
Blue tilapia	1099	630	47.5	42.34
Total	59416		443.8	
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Redbreast sunfish	19	18.5	1.2	1.20
Warmouth	6	6.2	0.6	0.63
Bluegill	74	61.7	6.5	5.48
Redear sunfish	99	12.3	12.0	0.34
Largemouth bass	74	49.4	25.1	17.87
Black crappie	0	0.0	0.0	0.00
Total	272		45.4	

Table 92. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=2) for total fish				
Gizzard shad	228018	168009	345.6	227.75
Golden shiner	0	0	0.0	0.00
Grass carp	0	0	0.0	0.00
Taillight shiner	9244	9022	2.7	2.56
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	0	0	0.0	0.00
Seminole killifish	161	37	0.9	0.77
Mosquitofish	0	0	0.0	0.00
Redbreast sunfish	0	0	0.0	0.00
Warmouth	0	0	0.0	0.00
Bluegill	3563	2130	19.7	12.27
Redear sunfish	105	68	2.8	1.23
Largemouth bass	117	19	16.6	9.17
Black crappie	198	123	13.7	11.40
Blue tilapia	0	0	0.0	0.00
Total	241406		402.0	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	19	6.2	1.5	0.47
Redear sunfish	0	0.0	0.0	0.00
Largemouth bass	43	30.9	14.1	10.04
Black crappie	31	18.5	11.4	9.77
Total	93		27.0	

Table 93. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Hunter. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	5.3	2.73	9.5	4.94
Gizzard shad	162.7	64.33	11.9	5.69
Golden shiner	2.3	0.32	0.1	0.02
Yellow bullhead	0.3	0.32	0.2	0.20
Warmouth	0.3	0.32	0.0	0.02
Bluegill	8.7	2.85	0.5	0.22
Redear sunfish	4.3	1.45	0.2	0.08
Largemouth bass	7.0	1.73	2.0	0.21
Sunshine bass	7.7	0.88	5.5	0.33
Black crappie	7.0	2.52	0.8	0.46
Blue tilapia	3.0	1.00	1.8	0.78
Total	208.7		32.6	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	0.3	0.33	0.2	0.20
Warmouth	0.0	0.00	0.0	0.00
Bluegill	3.0	1.53	0.3	0.15
Redear sunfish	0.7	0.33	0.1	0.04
Largemouth bass	5.0	0.58	2.0	0.29
Sunshine bass	7.7	0.88	5.5	0.33
Black crappie	2.0	1.15	0.7	0.43
Total	18.7		8.7	

Table 94. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Hunter. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Gizzard shad	160.5	45.32	8.7	0.47
Golden shiner	42.0	28.25	0.8	0.05
Taillight shiner	1.5	1.50	0.0	0.00
Seminole killifish	138.0	57.29	8.5	0.31
Mosquitofish	19.5	9.60	0.10	0.00
Sailfin molly	1.5	1.50	0.10	0.01
Redbreast sunfish	45.0	15.97	4.7	0.15
Warmouth	6.0	2.45	3.8	0.17
Bluegill	298.5	55.39	39.8	0.46
Redear sunfish	58.5	16.32	11.5	0.55
Largemouth bass	66.0	10.68	91.8	1.77
Blue tilapia	60.0	23.11	20.7	0.94
Total	897.0		190.4	
Electrofishing runs (n=4) for harvestable fish				
Redbreast sunfish	0.0	0.00	0.0	0.00
Warmouth	1.5	1.50	0.1	0.12
Bluegill	1.5	1.50	0.2	0.15
Redear sunfish	3.0	3.00	0.2	0.21
Largemouth bass	22.5	7.09	8.1	1.88
Total	28.5		8.6	

sunshine bass with 163 and 8 fish/net/24 hr, respectively (Table 93). The most abundant species collected using electrofishing were gizzard shad and bluegill with catch per unit efforts of 161 and 299 fish per hour, respectively (Table 94). Average first year growth of bluegill, redear sunfish, and largemouth bass was 110, 107, and 196 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 5 harvestable redear sunfish

and 20 harvestable largemouth bass per hectare in Lake Hunter (Table 7).

Historically, Lake Hunter was a hypereutrophic lake with an overabundance of forage fish, principally gizzard shad and threadfin shad (Huish 1955; Ware and Horel 1971). A lake restoration project was conducted on Lake Hunter from 1983 to 1984. After draining and reflooding of Lake Hunter, 10,000 largemouth bass and 1,000 sunshine bass were stocked to establish a predator population (Moxley and Williams 1984). Electrofishing samples collected in 1984 and 1985 collected 11 species of fish and the total catch per unit effort ranged 38 to 93 kg/hr (Moxley and Williams 1985). These values were less than the 190 kg/hr collected during this study (Table 94), suggesting that the fish population of Lake Hunter has not yet stabilized from the restoration project.

Hartridge

Location and Morphology

Hartridge is located in Polk County, Florida (Latitude 28.03 N; Longitude 81.44 W). The lake lies in the Winter Haven Karst division of the Central Lakes District (Brooks 1981). The geology is dominated by deeply weathered clayey sand and granular sand of the Hawthorne Formation. Hartridge was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 176 ha, 5.51 km and 3.4 m, respectively (Table 1).

Trophic Status and Water Chemistry

Hartridge had an average total phosphorus concentration of 11 µg/L and an average total nitrogen concentration of 485 µg/L. Total chlorophyll *a* concentrations averaged 4 µg/L and the water clarity as measured by use of a Secchi disc averaged 2.3 m (Table 2). The lake had an average pH of 7.8 and an average total alkalinity of 37.6 mg/L as $CaCO_3$. The average specific conductance was 2172 µS/cm @ 25 C and the average water color was 12 Pt-Co units. The adjusted chlorophyll *a* value in Hartridge was 27.8 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Hartridge was classified as an eutrophic lake during this study.

Aquatic Plants

Hartridge had a moderate abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 60% and

11.5% respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 4.9, 0 and 8.0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 19.5 mg chlorophyll *a*/cm^2 of host plant and 30.5 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fourteen species of aquatic macrophytes were collected in Hartridge. The most commonly encountered plant species were Vallisneria *americana, Micranthemum umbrosum,* and *Typha* spp. , which occurred in 100%, 100% and 90% of the transects, respectively (Table 95).

Table 95. Occurrence of plant species in ten evenly-spaced transects around Lake Hartridge.

Common name	Scientific name	Percent of Transects
pickerelweed	*Pontederia cordata*	10
baby-tears	*Micranthemum umbrosum*	100
cat-tail	*Typha* spp.	90
water-pennywort	*Hydrocotyle umbellata*	20
coontail	*Ceratophyllum demersum*	30
hydrilla	*Hydrilla verticillata*	70
tapegrass	*Vallisneria americana*	100
cone-spur bladderwort	*Utricularia gibba*	30
southern naiad	*Najas guadalupensis*	10
water primrose	*Ludwigia octovalis*	10
maidencane	*Panicum hemitomon*	10
para grass	*Brachiaria mutica*	10
torpedograss	*Panicum repens*	10
	Utricularia foliosa	40

The plant community of Hartridge has been monitored by the Florida Department of Natural Resources from 1982 to present. The major aquatic plants in the lake during that time were *Vallisneria americana* and *Typha* spp., which is similar to our findings (Table 95). The percent area covered of these plant ranged 5 to 50% and 4 to 10%, respectively. Thus, the fish population in Hartridge can be considered the product of an eutrophic lake with moderate levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Hartridge was 35 individuals/kg wet wt of host plant and 1.21 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Hartridge, as estimated with a ponar dredge, was 213 individuals/m^2 and 5.07 g wet wt/m^2 (Table 5). The zooplankton population of Lake Hartridge was dominated by copepods an cladocerans with 59,800 and 57,000 individuals/m^3, respectively.

Fish

Twenty-one species of fish were collected from Hartridge (Table 96, 97, and 98). The most abundant species collected with rotenone sampling were bluespotted sunfish and bluefin killifish fish. These species had average standing stocks in littoral blocknets of 6,400 and 5,100 fish/ha, respectively (Table 96). The most abundant open-water species collected in the experimental gillnets were gizzard shad and largemouth bass with 5.7 and 4.7 fish/net/24 hr, respectively (Table 97). The most abundant species collected using electrofishing were the bluegill and largemouth bass with catch per unit efforts of 96 and 79 fish per hour, respectively (Table 98). Average first year growth, of bluegill, redear sunfish, and largemouth bass was 101, 78, and 126 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 5 harvestable bluegill and 24 harvestable largemouth bass per hectare in Lake Hartridge (Table 7).

The fish population of Lake Hartridge was monitored with blocknets in 1969 by the Florida Game and Fresh Water Fish Commission (Buntz and Mandoch 1970). Three littoral nets collected 15 species of fish and averaged 46 kg/ha, which compares well with the 16 species of fish and 44 kg/ha collected in littoral nets for this study (Table 96). These data suggest that the fish population in Lake Hartridge has remained stable for the last several years. **(Text continued on page 252)**

Table 96. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Hartridge. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Golden shiner	56	56	0.0	0.05
Tadpole madtom	537	414	0.6	0.46
Golden topminnow	12	12	0.0	0.04
Seminole killifish	6	6	0.0	0.02
Bluefin killifish	5138	4866	1.1	1.06
Mosquitofish	6	6	0.0	0.00
Brook silverside	259	247	0.2	0.19
Bluespotted sunfish	6366	6107	2.4	2.33
Warmouth	1507	1445	6.0	5.38
Bluegill	1031	117	14.4	9.13
Dollar sunfish	389	303	0.8	0.60
Redear sunfish	346	210	4.9	2.59
Spotted sunfish	259	235	2.5	1.68
Largemouth bass	513	340	11.3	4.63
Black crappie	0	0	0.0	0.00
Swamp darter	469	457	0.1	0.14
Total	16894		44.4	
Littoral nets (n=3) for harvestable fish				
Warmouth	12	12.3	1.1	1.05
Bluegill	49	49.4	4.3	4.35
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	12	12.3	4.6	4.63
Black crappie	0	0.0	0.0	0.00
Total	74		10.0	

Table 96. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Golden shiner	315	154	10.1	5.38
Tadpole madtom	0	0	0.0	0.00
Golden topminnow	0	0	0.0	0.00
Seminole killifish	0	0	0.0	0.00
Bluefin killifish	43	31	0.0	0.01
Mosquitofish	0	0	0.0	0.00
Brook silverside	6	6	0.0	0.01
Bluespotted sunfish	62	37	0.0	0.01
Warmouth	31	31	0.0	0.02
Bluegill	4705	556	24.7	4.34
Dollar sunfish	6	6	0.0	0.01
Redear sunfish	12	12	0.1	0.08
Spotted sunfish	6	6	0.1	0.08
Largemouth bass	167	93	11.8	10.87
Black crappie	6	6	2.9	2.91
Swamp darter	0	0	0.0	0.00
Total	5360		49.7	
Open-water nets (n=3) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	6	6.2	0.4	0.40
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	31	30.9	6.5	6.51
Black crappie	6	6.2	2.9	2.91
Total	43		9.8	

Table 97. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Hartridge. Mean values for experimental gill nets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	3.7	2.73	3.6	3.22
Gizzard shad	5.7	4.67	3.1	2.52
Lake chubsucker	0.7	0.66	0.4	0.42
Bluegill	0.3	0.32	0.0	0.00
Redear sunfish	0.3	0.32	0.1	0.10
Largemouth bass	4.7	1.85	1.8	0.70
Black crappie	0.3	0.32	0.1	0.07
Blue tilapia	0.7	0.66	0.5	0.47
Total	16.3		9.6	
Gillnets (n=3) for harvestable fish				
Bluegill	0.0	0.00	0.0	0.00
Redear sunfish	0.3	0.33	0.1	0.10
Largemouth bass	3.7	1.76	1.7	0.66
Black crappie	0.3	0.33	0.1	0.07
Total	4.3		1.9	

Table 98. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Hartridge. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=5) for total fish				
Florida gar	3.6	2.41	13.7	0.96
Bowfin	3.6	1.48	105.4	4.43
Golden shiner	1.2	1.18	0.6	0.06
Lake chubsucker	2.4	1.48	7.1	0.53
Bluefin killifish	1.2	1.18	0.0	0.00
Brook silverside	1.2	1.18	0.0	0.00
Bluespotted sunfish	1.2	1.18	0.0	0.00
Warmouth	4.8	2.24	2.3	0.14
Bluegill	96.0	23.77	33.0	0.85
Redear sunfish	13.2	4.40	15.4	0.55
Largemouth bass	79.2	12.21	137.8	3.63
Total	207.6		315.2	
Electrofishing runs (n=5) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	12.0	3.29	1.3	0.43
Redear sunfish	7.2	2.24	1.2	0.41
Largemouth bass	32.4	7.25	10.8	3.30
Total	51.6		13.3	

Lake Killarny

Location and Morphology

Lake Killarny is located in Orange County, Florida (Latitude 28.35 N; Longitude 81.22 W). The lake lies in Orlando Promontory division of the Central Lakes District (Brooks 1981). The geology is dominated by phosphatic sand and clayey sands of the Hawthorne Formation. Lake Killarny was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 96 ha, 5.78 km and 4.7 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lake Killarny was an eutrophic lake. During this study, the lake had an average total phosphorus concentration of 21 µg/L and an average total nitrogen concentration of 603 µg/L. Total chlorophyll *a* concentrations averaged 22 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.0 m (Table 2). The lake had an average pH of 8.4 and an average total alkalinity of 65.4 mg/L as $CaCO_3$. The average specific conductance was 193 µS/cm @ 25 C and the average water color was 19 Pt-Co units.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1981, Lake Killarny had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 1.2, 0.1, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 5.8 mg chlorophyll *a*/cm^2 of host plant and 2.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected in Lake Killarny. The most commonly encountered plant species were *Alternanthera philoxeroides, Colocasia esculenta,* and *Taxodium distichum* , which occurred in 80%, 80%, and 80% of the transects, respectively (Table 99).

The plant community of Lake Killarny has remained low for about 10 years because of the addition of grass carp. Thus, the fish population in Lake Killarny can be considered the

Table 99. Occurrence of plant species in ten evenly-spaced transects around Lake Killarny.

Common name	Scientific name	Percent of Transect
duck-potato	*Sagittaria lancifolia*	10
alligator-weed	*Alternanthera philoxeroides*	80
spatterdock	*Nuphar luteum*	10
cat-tail	*Typha* spp.	20
water-pennywort	*Hydrocotyle umbellata*	40
elephant-ear	*Colocasia esculenta*	80
wax myrtle	*Myrica ceriferia*	10
water primrose	*Ludwigia octovalis*	20
buttonbush	*Cephalanthus occidentalis*	40
willow	*Salix* spp.	20
maidencane	*Panicum hemitomon*	50
para grass	*Brachiaria mutica*	30
bald cypress	*Taxodium distichum*	80

product of an eutrophic lake with low levels of aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Killarny was 213 individuals/kg wet wt of host plant and 0.51 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Lake Killarny, as estimated with a ponar dredge, was 160 individuals/m^2 and 110.95 g wet wt/m^2 (Table 5). The zooplankton population in Lake Killarny was dominated by rotifers and nauplii with 90,500 and 25,500 individuals/m^3, respectively (Table 5).

Fish

Eighteen species of fish were collected in Lake Killarny (Table 100, 101, and 102). The most abundant species collected with rotenone sampling were bluegill and reader sunfish. These species had average standing stocks in littoral blocknets of 9,700 and 9,200 fish/ha, respectively (Table 100). The most abundant open-water species collected in the experimental gillnets were Florida gar, and **(Text continued on page 258)**

Table 100. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Killarny. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Florida gar	16	16	15.1	15.13
Gizzard shad	25	25	0.2	0.16
Threadfin shad	12	12	0.0	0.02
Golden shiner	1980	1724	6.1	2.64
Grass carp	45	15	81.6	24.54
Yellow bullhead	41	35	1.6	1.31
White catfish	33	27	0.2	0.18
Seminole killifish	687	267	4.7	1.85
Bluefin killifish	91	23	0.1	0.03
Brook silverside	21	4	0.0	0.00
Warmouth	12	0	0.6	0.34
Bluegill	9155	2588	113.0	40.79
Dollar sunfish	1898	617	4.3	1.49
Redear sunfish	9682	3425	105.1	30.35
Spotted sunfish	161	62	2.9	0.64
Largemouth bass	202	39	32.6	15.07
Blue tilapia	1536	320	34.3	13.96
Total	25597		402.5	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	4	4.1	0.4	0.42
Bluegill	268	151.3	26.3	15.42
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	350	109.1	37.5	10.59
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	66	29.7	29.0	14.23
Total	687		93.2	

Table 100. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Florida gar	0	0	0.0	0.00
Gizzard shad	1634	1549	18.5	15.93
Threadfin shad	395	371	1.0	0.94
Golden shiner	4	4	0.0	0.01
Grass carp	99	93	169.9	162.12
Yellow bullhead	0	0	0.0	0.00
White catfish	0	0	0.0	0.00
Seminole killifish	0	0	0.0	0.00
Bluefin killifish	4	4	0.0	0.01
Brook silverside	29	15	0.0	0.01
Warmouth	0	0	0.0	0.00
Bluegill	4	4	0.1	0.06
Dollar sunfish	0	0	0.0	0.00
Redear sunfish	8	8	0.4	0.45
Spotted sunfish	0	0	0.0	0.00
Largemouth bass	16	11	1.5	1.52
Blue tilapia	4	4	0.1	0.07
Total	2198		191.5	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	4	4.1	0.4	0.40
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	4	4.1	1.4	1.45
Total	8		1.8	

Table 101. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Killarny. Mean values for experimental gill nets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	3.0	2.52	2.9	2.58
Gizzard shad	0.7	0.66	0.1	0.15
Largemouth bass	1.0	0.58	0.4	0.20
Blue tilapia	0.7	0.66	0.5	0.50
Total	5.3		3.9	
Gillnets (n=3) for harvestable fish				
Largemouth bass	1.0	0.58	0.4	0.20
Total	1.0		0.4	

Table 102. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Killarny. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	4.0	4.00	42.9	4.29
Golden shiner	42.0	19.78	4.9	0.28
Grass carp	3.0	2.04	49.9	3.82
Seminole killifish	66.0	35.90	7.4	0.42
Brook silverside	3.0	1.35	0.0	0.00
Warmouth	1.0	1.00	0.9	0.09
Bluegill	352.0	80.16	86.8	1.51
Dollar sunfish	8.0	8.00	0.5	0.05
Redear sunfish	104.0	12.36	67.7	1.65
Spotted sunfish	3.0	2.04	0.7	0.05
Largemouth bass	39.0	7.06	204.2	4.94
Black crappie	29.0	29.00	10.6	1.06
Blue tilapia	11.0	3.92	28.0	1.62
Total	665.0		504.6	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	33.0	13.39	3.6	1.46
Dollar sunfish	0.0	0.00	0.0	0.00
Redear sunfish	50.0	13.02	5.3	1.62
Spotted sunfish	0.0	0.00	0.0	0.00
Largemouth bass	21.0	3.38	19.6	4.99
Black crappie	0.0	0.00	0.0	0.00
Total	104.0		28.5	

largemouth bass with 3.0 and 1.0 fish/net/24 hr, respectively (Table 101). The most abundant species collected using electrofishing were bluegill and redear sunfish with catch per unit efforts of 352 and 104 fish per hour, respectively (Table 102). Average first year growth of redear sunfish and largemouth bass was 103 and 166 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 100 harvestable bluegill, 235 harvestable redear sunfish and 14 harvestable largemouth bass per hectare in Lake Killarny (Table 7). We found no previous fisheries studies for Lake Killarny.

Lake Holden

Location and Morphology

Lake Holden is located in Orange County, Florida (Latitude 28.30; Longitude 81.23). The lake lies in Orlando Promontory division of the Central Lakes District (Brooks 1981). The geology is dominated by phosphatic sand and clayey sands of the Hawthorne Formation. Lake Holden was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 102 ha, 5.03 km, and 4.5 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lake Holden had an average total phosphorus concentration of 44 µg/L and an average total nitrogen concentration of 1226 µg/L. Total chlorophyll *a* concentrations averaged 64 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.5 m (Table 2). The lake had an average pH of 8.6 and an average total alkalinity of 62.9 mg/L as $CaCO_3$. The average specific conductance was 232 µS/cm @ 25 C and the average water color was 11 Pt-Co units. Using the classification system of Forsberg and Ryding (1980), Holden was classified as a hypereutrophic lake.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1974, Lake Holden had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 3.7, 0 and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 4.1 mg chlorophyll *a*/cm^2 of

host plant and 1.4 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Ten species of aquatic macrophytes were collected from Lake Holden (Table 103). The most commonly encountered plant species were *Colocasia esculenta, Ludwigia octovalis,* and *Typha* spp. which occurred in 70%, 40% and 30% of the transects, respectively.

Table 103. Occurrence of plant species in ten evenly-spaced transects around Lake Holden.

Common name	Scientific name	Percent of Transects
alligator-weed	*Alternanthera philoxeroides*	10
cat-tail	*Typha* spp.	30
water-pennywort	*Hydrocotyle umbellata*	10
elephant-ear	*Colocasia esculenta*	70
water primrose	*Ludwigia octovalis*	40
willow	*Salix* spp.	20
maidencane	*Panicum hemitomon*	20
para grass	*Brachiaria mutica*	20
torpedograss	*Panicum repens*	20
soft rush	*Juncus effusus*	10

The plant community of Lake Holden has remained low for about 15 years because of the addition of grass carp. Thus, the fish population in Holden can be considered the product of a hypereutrophic lake with low levels of aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Holden was 161 individuals/kg wet wt of host plant and 1.80 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Lake Holden, as estimated with a ponar dredge, was 2260 individuals/m^2 and 63.02 g wet wt/m^2 (Table 5). The zooplankton population in Holden was dominated by rotifers and nauplii with 39,700 and 28,000 individuals/m^3, respectively (Table 5).

Fish

Sixteen species of fish were collected from Lake Holden (Table 104, 105, and 106).

The most abundant species collected with rotenone sampling were bluegill and threadfin shad. These species had average standing stocks in littoral blocknets of 3,100 and 1,700 fish/ha, respectively (Table 104). The most abundant open-water species collected in the experimental gillnets were black crappie and white catfish with 9.7 and 5.7 fish/net/24 hr, respectively (Table 105). The most abundant species collected using electrofishing were bluegill and golden shiner with catch per unit efforts of 237 and 96 fish per hour, respectively (Table 106). Average first year growth of bluegill, redear sunfish, and largemouth bass was 66, 93, and 126 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 155 bluegill, 90 redear sunfish, and 10 largemouth bass per hectare (Table 7). We found no previous fisheries studies for Lake Holden.

Catherine

Location and Morphology

Catherine is located in Marion County, Florida (Latitude 29.11 N; Longitude 81.49 W). The lake lies in the Central Lakes division of the Central Lakes District (Brooks 1981). The geology is dominated by deeply weathered clayey sand and granular sands of the Hawthorne Formation. Catherine was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 41 ha, 4.46 km and 3.2 m, respectively (Table 1).

Trophic Status and Water Chemistry

Catherine had an average total phosphorus concentration of 2 µg/L and an average total nitrogen concentration of 303 µg/L. Total chlorophyll *a* concentrations averaged 2 µg/L and the water clarity as measured by use of a Secchi disc averaged 3.2 meters (Table 2). The lake had an average pH of 4.7 and an average total alkalinity of 0.4 mg/L as $CaCO_3$. The average specific conductance was 48 µS/cm @ 25 C, and the average water color was 3 Pt-Co units. The adjusted chlorophyll *a* value in Catherine was 12.3 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Catherine was classified as a eutrophic lake. **(Text continued on page 264)**

Table 104. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Holden. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Gizzard shad	251	121	2.1	1.03
Threadfin shad	1688	692	6.0	3.13
Golden shiner	659	193	7.9	3.14
Yellow bullhead	8	4	0.7	0.44
Brown bullhead	4	4	0.0	0.04
White catfish	49	37	2.1	2.00
Seminole killifish	25	12	0.3	0.14
Mosquitofish	12	7	0.0	0.00
Brook silverside	8	8	0.0	0.01
Warmouth	29	8	1.3	0.38
Bluegill	3100	1123	93.3	24.11
Redear sunfish	251	146	29.1	17.65
Largemouth bass	193	15	17.8	12.25
Black crappie	136	136	7.6	7.58
Blue tilapia	177	65	89.9	53.14
Total	6591		258.1	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	4	4.1	0.5	0.50
Brown bullhead	0	0.0	0.0	0.00
White catfish	4	4.1	1.6	1.65
Warmouth	4	4.1	0.4	0.37
Bluegill	210	68.8	18.0	5.46
Redear sunfish	222	129.7	28.2	16.99
Largemouth bass	21	14.8	12.9	12.00
Black crappie	12	12.4	1.0	1.04
Total	478		62.6	

Table 104. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Gizzard shad	1416	1197	10.7	9.75
Threadfin shad	9921	2652	29.6	11.83
Golden shiner	74	68	1.0	0.92
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	0	0	0.0	0.00
White catfish	0	0	0.0	0.00
Seminole killifish	0	0	0.0	0.00
Mosquitofish	0	0	0.0	0.00
Brook silverside	0	0	0.0	0.00
Warmouth	0	0	0.0	0.00
Bluegill	70	39	3.3	2.14
Redear sunfish	12	7	1.1	0.70
Largemouth bass	41	30	2.0	1.87
Black crappie	4	4	0.3	0.27
Blue tilapia	17	11	6.6	6.47
Total	11556		54.6	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	16	16.5	1.2	1.24
Redear sunfish	12	7.1	1.1	0.70
Largemouth bass	0	0.0	0.0	0.00
Black crappie	0	0.0	0.0	0.00
Total	29		2.4	

Table 105. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Holden. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	1.0	0.58	1.3	0.86
Gizzard shad	0.3	0.32	0.0	0.01
Golden shiner	0.3	0.32	0.0	0.01
White catfish	5.7	5.67	1.5	1.47
Bluegill	1.0	1.00	0.0	0.03
Largemouth bass	2.0	1.15	0.2	0.11
Black crappie	9.7	3.48	1.2	0.26
Blue tilapia	2.3	1.85	1.5	1.13
Total	22.3		5.7	
Gillnets (n=3) for harvestable fish				
White catfish	3.3	3.33	1.2	1.23
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	0.3	0.33	0.1	0.07
Black crappie	6.3	1.20	1.0	0.16
Total	10.0		2.3	

Table 106. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Holden. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Gizzard shad	28.0	11.45	1.5	0.07
Threadfin shad	21.0	5.74	0.7	0.03
Golden shiner	96.0	22.40	15.7	0.28
White catfish	1.0	1.00	4.0	0.40
Seminole killifish	5.0	1.83	0.8	0.04
Brook silverside	1.0	1.00	0.0	0.00
Bluegill	237.0	80.09	58.0	1.40
Redear sunfish	19.0	8.82	21.2	1.23
Largemouth bass	35.0	9.73	88.3	2.09
Black crappie	1.0	1.00	0.9	0.09
Blue tilapia	9.0	4.58	12.6	0.77
Total	453.0		203.7	
Electrofishing runs (n=6) for harvestable fish				
White catfish	1.0	1.00	0.4	0.40
Bluegill	17.0	8.68	1.5	0.79
Redear sunfish	17.0	9.35	2.1	1.25
Largemouth bass	12.0	3.10	8.1	2.05
Black crappie	0.0	0.00	0.0	0.00
Total	47.0		12.0	

Aquatic Plants

Catherine had a moderate abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 48% and 9.3%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 4.6, 1.1, and 2.9 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was

24.5 mg chlorophyll *a*/cm^2 of host plant and 30.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected in Catherine. The most commonly encountered plant species were *Utricularia purpurea, Panicum hemitomon,* and *Hypericum* spp., which occurred in 90%, 90%, and 90% of the transects, respectively. (Table 107).

Table 107. Occurrence of plant species in ten evenly-spaced transects around Lake Catherine.

Common name	Scientific name	Percent of Transects
banana-lily	*Nymphoides aquatica*	40
water-shield	*Brasenia schreberi*	10
spatterdock	*Nuphar luteum*	30
fragrant water-lily	*Nymphaea odorata*	30
red ludwigia	*Ludwigia repens*	10
variable-leaf milfoil	*Myriophyllum heterophyllum*	80
purple bladderwort	*Utricularia purpurea*	90
maidencane	*Panicum hemitomon*	90
	Fuirena sciropoidea	80
	Leersia hexandra	20
pipewort	*Eriocaulon* spp.	20
St. John's wort	*Hypericum* spp.	90
yellow-eyed grass	*Xyris* spp.	10

The plant community of Catherine was sampled in 1985 by Canfield and Joyce (1985). The percent of the lake covered with vegetation was large (100%) and the dominant species of plants collected were *Panicum hemitomon,* and *Utricularia purpurea*, which is similar to our findings for this study (Table 3 and 107). Thus, the fish population of Catherine can be considered the product of an eutrophic lake with high to moderate levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Catherine was 90 individuals/kg wet wt of host plant and 0.37 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Catherine, as estimated with

a ponar dredge, was 113 individuals/m^2 and 0.47 g wet wt/m^2 (Table 5). The zooplankton population in Catherine was dominated by copepods and nauplii with 161,000 and 86,500 individuals/m^3, respectively (Table 5).

Fish

Seventeen species of fish were collected from Catherine (Table 108, 109 and 110). The most abundant species collected with rotenone sampling were bluespotted sunfish and bluegill. These species had average standing stocks in littoral blocknets of 10,600 and 3,000 fish/ha, respectively (Table 108). The most abundant open-water species collected in the experimental gillnets were largemouth bass and bluegill with 6.0 and 1.7 fish/net/24 hr, respectively (Table 109). The most abundant species collected using electrofishing were lake chubsucker and largemouth bass with catch per unit efforts of 36.0, and 18.0 fish per hour, respectively (Table 110). Average first year growth of bluegill and largemouth bass was 43 and 139 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 18 harvestable largemouth bass per hectare in Lake Catherine (Table 7).

In 1982, a 15 minute electrofishing catch per unit effort sample was used to examine the fish population in Lake Catherine (U.S. Forest Service, Ocala National Forest, unpublished data). Five species of fish were collected with largemouth bass and lake chubsucker as the dominant species. This is similar to our electrofishing samples collected in 1987 (Table 110). The total and harvestable fish biomass collected in 1982 were 33 and 14 kg/hr, which also are similar to our values (Table 110) for 1987. These data suggest that the fish population in Lake Catherine has remained stable for the last several years.

Bell Lake

Location and Morphology

Bell Lake is located in Pasco County, Florida (Latitude 28.13 N; Longitude 82.27 W). The lake lies in Land-O-Lakes of the Tampa Plain division of the Ocala Uplift District (Brooks 1981). The geology is dominated silty sand overlaying limestone deposits of the Tampa Formation. Bell Lake was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 32 ha, 2.75 km and 2.7 m, respectively (Table 1).

(Text continued on page 270)

Table 108. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Catherine. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Golden shiner	346	239	1.0	0.52
Lake chubsucker	1079	285	23.7	7.29
Yellow bullhead	111	65	4.2	1.66
Seminole killifish	95	95	0.1	0.06
Lined topminnow	766	404	0.4	0.20
Mosquitofish	8	4	0.0	0.00
Least killifish	0	0	0.0	0.00
Brook silverside	12	7	0.0	0.01
Everglades pygmy sunfish	1947	1388	0.2	0.15
Bluespotted sunfish	10617	3456	3.3	1.14
Warmouth	2655	812	25.8	7.27
Bluegill	3038	1068	10.8	2.71
Dollar sunfish	548	104	1.0	0.21
Redear sunfish	0	0	0.0	0.00
Largemouth bass	210	21	20.7	12.12
Swamp darter	17	11	0.0	0.01
Total	21448		91.2	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	8	4.1	1.2	0.59
Warmouth	4	4.1	0.4	0.42
Bluegill	8	8.2	0.7	0.66
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Largemouth bass	25	12.4	16.1	12.65
Total	45		18.4	

Table 108. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Golden shiner	317	311	9.5	9.54
Lake chubsucker	428	305	6.9	3.08
Yellow bullhead	0	0	0.0	0.00
Seminole killifish	0	0	0.0	0.00
Lined topminnow	342	323	0.0	0.04
Mosquitofish	0	0	0.0	0.00
Least killifish	41	35	0.0	0.01
Brook silverside	82	82	0.1	0.07
Everglades pygmy sunfish	902	778	0.1	0.09
Bluespotted sunfish	5990	5231	1.3	1.00
Warmouth	696	473	2.2	1.38
Bluegill	5043	721	52.1	34.34
Dollar sunfish	17	11	0.0	0.01
Redear sunfish	8	8	1.2	1.20
Largemouth bass	239	52	38.7	20.48
Swamp darter	8	4	0.0	0.00
Total	14112		112.1	
Open-water nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	91	84.5	11.3	9.55
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	8	8.2	1.2	1.20
Largemouth bass	62	35.7	32.3	21.29
Total	161		44.8	

Table 109. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Catherine. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Lake chubsucker	0.3	0.32	0.0	0.02
Yellow bullhead	0.7	0.66	0.2	0.17
Warmouth	0.3	0.32	0.0	0.01
Bluegill	1.7	1.66	0.1	0.10
Largemouth bass	6.0	4.51	1.2	1.03
Total	9.0		1.5	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	0.7	0.67	0.2	0.17
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.3	0.33	0.1	0.07
Largemouth bass	1.7	1.67	0.7	0.72
Total	2.7		1.0	

Table 110. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Catherine. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Lake chubsucker	36.0	12.00	35.4	0.93
Lined topminnow	1.0	1.00	0.0	0.00
Warmouth	1.0	1.00	0.2	0.02
Bluegill	16.0	4.00	6.2	0.42
Largemouth bass	18.0	5.13	54.8	1.50
Flier	6.0	6.00	0.10	0.01
Total	78.0		96.6	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	2.0	2.00	0.4	0.40
Largemouth bass	7.0	1.84	4.8	1.44
Flier	0.0	0.00	0.0	0.00
Total	9.0		5.2	

Trophic Status and Water Chemistry

Bell Lake had an average total phosphorus concentration of 17 µg/L and an average total nitrogen concentration of 641 µg/L. Total chlorophyll *a* concentrations averaged 20 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.5 m (Table 2). The lake had an average pH of 7.6 and an average total alkalinity of 13.3 mg/L as $CaCO_3$. The average specific conductance was 116 µS/cm @ 25 C and the average water color was 21 Pt-Co units. Using the classification system of Forsberg and Ryding (1980), Bell Lake was an eutrophic lake during this study.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1975, Bell Lake had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of < 1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 2.3, 0.2, and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 6.5 mg chlorophyll *a*/cm^2 of host plant and 7.1 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fourteen species of aquatic macrophytes were collected in Bell Lake. The most commonly encountered plant species were *Hydrocotyle umbellata, Panicum repens,* and Colocasia *esculenta*, which occurred in 60%, 60%, and 40% of the transects, respectively (Table 111).

Table 111. Occurrence of plant species in ten evenly-spaced transects around Bell Lake.

Common name	Scientific name	Percent of Transects
spatterdock	*Nuphar luteum*	10
smartweed	*Polygonum hydropiperoides*	10
pickerelweed	*Pontederia cordata*	10
lemon bacopa	*Bacopa caroliniana*	20
exotic bur-reed	*Sparganium erectum*	10
cat-tail	*Typha* spp.	10
water-pennywort	*Hydrocotyle umbellata*	60
elephant-ear	*Colocasia esculenta*	40
water primrose	*Ludwigia octovalis*	30
buttonbush	*Cephalanthus occidentalis*	20
sawgrass	*Cladium jamaicense*	10
maidencane	*Panicum hemitomon*	10
torpedograss	*Panicum repens*	60
bald cypress	*Taxodium distichum*	20

The plant community of Bell Lake has remained low for about 15 years because of the addition of grass carp. Thus, the fish population in Bell Lake during this study can be considered the product of an eutrophic lake with low levels of aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Bell Lake was 59 individuals/kg wet wt of host plant and 0.07 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Bell Lake, as estimated with a ponar dredge, was 900 individuals/m^2 and 13.51 g wet wt/m^2 (Table 5). The zooplankton population in Bell was dominated by cladocerans and copepods with 71,300 and 52,000 individuals/m^3, respectively (Table 5).

Fish

Sixteen species of fish were collected in Bell Lake (Table 112, 113, and 114). The most abundant species collected with rotenone sampling, were bluegill and threadfin shad. These species had average standing stocks in littoral blocknets of 3,700 and 2,400 fish/ha, respectively (Table 112). The most abundant open-water species collected in the experimental gillnets were Florida gar, and largemouth bass with 7.0 and 3.7 fish/net/24 hr, respectively (Table 113). The most abundant species collected using electrofishing were the bluegill and threadfin shad with catch per unit efforts of 1058 and 426 fish per hour, respectively (Table 114). Average first year growth of bluegill, redear sunfish, and largemouth bass was 102, 86, and 172 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 9 harvestable bluegill, 33 harvestable redear sunfish, and 34 harvestable largemouth bass per hectare in Bell Lake (Table 7). We found no previous fisheries studies for Lake Bell.

Bonny

Location and Morphology

Bonny is located in Polk County, Florida (Latitude 28.02 N; Longitude 81.55 W). The lake lies in the Bartow Embayment division of the Central Lakes District (Brooks 1981). The geology is dominated by phosphatic sand and clay sands of the Bone Valley Formation. Bonny was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 143 ha, 6.37 km and 2.0 m, respectively (Table 1).

(Text continued on page 276)

Table 112. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Bell. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Threadfin shad	2421	259	5.5	1.04
Bluefin killifish	31	31	0.0	0.01
Mosquitofish	117	80	0.1	0.06
Brook silverside	500	253	0.4	0.18
Warmouth	25	25	0.5	0.50
Bluegill	3748	56	34.1	11.34
Dollar sunfish	12	0	0.0	0.02
Redear sunfish	618	12	17.8	1.13
Largemouth bass	74	12	5.1	4.39
Swamp darter	12	12	0.0	0.01
Total	7558		63.4	
Open-water nets (n=2) for total fish				
Threadfin shad	6527	722	18.7	3.94
Bluefin killifish	0	0	0.0	0.00
Mosquitofish	0	0	0.0	0.00
Brook silverside	43	19	0.0	0.02
Warmouth	0	0	0.0	0.00
Bluegill	86	49	0.1	0.12
Dollar sunfish	0	0	0.0	0.00
Redear sunfish	0	0	0.0	0.00
Largemouth bass	25	12	18.5	12.45
Swamp darter	0	0	0.0	0.00
Total	6681		37.4	

Table 112. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	86	24.7	14.7	7.10
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	43	18.5	4.3	1.79
Largemouth bass	19	18.5	4.5	4.48
Total	148		23.4	
Open-water nets (n=2) for harvestable fish				
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Largemouth bass	25	12.3	18.5	12.45
Total	25		18.5	

Table 113. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Bell. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	7.0	3.51	5.0	2.56
Threadfin shad	0.3	0.32	0.0	0.01
Lake chubsucker	0.3	0.32	0.2	0.20
Warmouth	0.3	0.32	0.0	0.01
Bluegill	0.7	0.32	0.0	0.03
Redear sunfish	1.3	0.88	0.1	0.08
Largemouth bass	3.7	1.33	1.7	0.72
Black crappie	0.3	0.32	0.0	0.01
Total	14.0		7.1	
Gillnets (n=3) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.3	0.33	0.0	0.03
Redear sunfish	0.3	0.33	0.1	0.07
Largemouth bass	3.0	1.00	1.6	0.69
Black crappie	0.0	0.00	0.0	0.00
Total	3.7		1.7	

Table 114. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Bell. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	1.0	1.00	0.8	0.08
Bowfin	1.0	1.00	17.5	1.75
Threadfin shad	426.0	325.11	10.9	0.62
Golden shiner	1.0	1.00	0.0	0.00
Lake chubsucker	3.0	3.00	0.3	0.03
American eel	1.0	1.00	1.0	0.10
Mosquitofish	1.0	1.00	0.0	0.00
Brook silverside	13.0	4.76	0.4	0.01
Warmouth	2.0	1.29	0.1	0.01
Bluegill	1058.0	652.03	85.2	2.17
Dollar sunfish	11.0	6.83	0.5	0.03
Redear sunfish	363.0	127.87	100.3	1.81
Largemouth bass	55.0	18.49	284.6	11.18
Total	1936.0		501.6	
Electrofishing runs (n=6) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	22.0	9.25	2.9	1.32
Dollar sunfish	0.0	0.00	0.0	0.00
Redear sunfish	27.0	5.31	3.1	0.49
Largemouth bass	39.0	16.01	27.4	11.12
Total	88.0		33.4	

Trophic Status and Water Chemistry

Bonny had an average total phosphorus concentration of 59 µg/L and an average total nitrogen concentration of 1858 µg/L. Total chlorophyll *a* concentrations averaged 40 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.6 m (Table 2). The

lake had an average pH of 7.8 and an average total alkalinity of 53 mg/L as $CaCO_3$. The average specific conductance was 255 µS/cm @ 25 C and the average water color was 33 Pt-Co units. The adjusted chlorophyll *a* value in Bonny was 50.5 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Bonny was classified as a hypereutrophic lake.

Aquatic Plants

Bonny had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 10%, and 6.5%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 8.1, 0 and 3.0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 16.1 mg chlorophyll *a*/cm^2 of host plant and 14.1 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Seven species of aquatic macrophytes were collected in Bonny. The most commonly encountered plant species were *Typha* spp., *Ludwigia repens*, and *Pontederia cordata*, which occurred in 80%, 50%, and 40% of the transects, respectively (Table 115).

Table 115. Occurrence of plant species in ten evenly-spaced transects around Lake Bonny.

Common name	Scientific name	Percent of Transects
common salvinia	*Salvinia rotundifolia*	10
duck-potato	*Sagittaria lancifolia*	20
alligator-weed	*Alternanthera philoxeroides*	20
red ludwigia	*Ludwigia repens*	50
smartweed	*Polygonum hydropiperoides*	20
pickerelweed	*Pontederia cordata*	40
cat-tail	*Typha* spp.	80

The plant community of Bonny has been monitored by the Florida Department of Natural Resources from 1982 to present. The water level of Lake Bonny fluctuated dramatically during this time period and Bonny almost dried completely in 1985. The major aquatic plants were *Hydrilla verticillata* and *Typha* spp. covering 1 to 53% and 1 to 5% of the lakes surface area respectively. Hydrilla coverage in Lake Bonny dropped from

53% in 1984 to < 1% in 1985 and remained at a low levels. After the drought, the coverage of many emergent species expanded. Thus, the fish population of Bonny can be considered the product of a hypereutrophic lake with fluctuating water levels and aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Bonny was 381 individuals/kg wet wt of host plant and 0.92 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Bonny, as estimated with a ponar dredge, was 293 individuals/m^2 and 6.58 g wet wt/m^2 (Table 5). The zooplankton population in Bonny was dominated by rotifers and copepods with 274,000 and 85,200 individuals/m^3, respectively (Table 5).

Fish

Sixteen species of fish were collected in Bonny (Table 116, 117, and 118). The most abundant species collected with rotenone sampling were bluegill and black crappie. These species had average standing stocks in littoral blocknets of 14,700 and 7,300 fish/ha, respectively (Table 116). The most abundant open-water species collected in the experimental gillnets were gizzard shad and Florida gar with 17.0 and 11.3 fish/net/24 hr, respectively (Table 117). The most abundant species collected using electrofishing were bluegill and threadfin shad with catch per unit efforts of 250 and 179 fish per hour, respectively (Table 118). Average first year growth of bluegill, redear sunfish, and largemouth bass was 92, 135, and 186 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 4 harvestable bluegill, 23 harvestable redear sunfish, and 6 harvestable largemouth bass per hectare (Table 7) in Lake Bonny.

Lake Bonny almost dried completely in 1985, thus changing the fish population dramatically. The fish surviving the drought are currently repopulating the lake. In 1987, our blocknet samples estimated a high total fish biomass, which would be expected in a hypereutrophic lake, but low harvestable fish biomass, especially largemouth bass (Table 116). The harvestable largemouth bass that were caught averaged over 1 kg (Table 116), suggesting missing year classes. This is changing, however, with a blocknet estimate of over 260 sub-harvestable largemouth bass per hectare in 1987 (Table 116). **(Text continued on page 283)**

Table 116. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Bonny. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Florida gar	17	4	7.4	2.61
Bowfin	12	7	20.7	14.52
Gizzard shad	1289	678	16.1	5.05
Threadfin shad	605	408	1.4	0.90
Golden shiner	8	8	0.2	0.15
Taillight shiner	226	64	0.1	0.02
Lake chubsucker	4	4	2.8	2.76
White catfish	49	26	1.3	0.79
Seminole killifish	124	37	1.2	0.61
Brook silverside	0	0	0.0	0.00
Warmouth	885	251	11.4	2.51
Bluegill	14659	4089	175.8	37.23
Redear sunfish	3038	920	56.2	20.12
Largemouth bass	264	62	18.5	10.36
Black crappie	7319	1934	80.7	10.35
Blue tilapia	33	27	26.0	17.70
Total	28532		419.8	
Littoral nets (n=3) for harvestable fish				
White catfish	0	0.0	0.0	0.00
Warmouth	4	4.1	1.3	1.32
Bluegill	1326	1239.6	7.5	4.15
Redear sunfish	66	25.0	15.2	5.66
Largemouth bass	4	4.1	11.6	11.57
Black crappie	132	69.3	31.3	16.91
Total	1531		66.9	

Table 116. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Florida gar	0	0	0.0	0.00
Bowfin	0	0	0.0	0.00
Gizzard shad	119	42	13.5	5.64
Threadfin shad	1478	729	3.3	1.49
Golden shiner	0	0	0.0	0.00
Taillight shiner	161	161	0.1	0.06
Lake chubsucker	0	0	0.0	0.00
White catfish	4	4	0.1	0.09
Seminole killifish	313	248	2.0	1.52
Brook silverside	4	4	0.0	0.00
Warmouth	0	0	0.0	0.00
Bluegill	210	106	1.8	1.27
Redear sunfish	218	141	4.0	2.72
Largemouth bass	115	47	2.4	1.08
Black crappie	91	73	1.4	0.69
Blue tilapia	0	0	0.0	0.00
Total	2713		28.4	
Open-water nets (n=3) for harvestable fish				
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	0	0.0	0.0	0.00
Redear sunfish	4	4.1	0.4	0.40
Largemouth bass	0	0.0	0.0	0.00
Black crappie	4	4.1	0.5	0.54
Total	8		0.9	

Table 117. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Bonny. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	11.3	3.18	9.7	0.78
Bowfin	0.3	0.32	0.7	0.66
Gizzard shad	17.0	7.51	4.9	1.24
White catfish	0.3	0.32	0.1	0.10
Bluegill	0.3	0.32	0.0	0.01
Largemouth bass	4.7	3.71	0.7	0.38
Black crappie	1.7	1.20	0.2	0.14
Blue tilapia	2.0	1.15	1.2	0.63
Total	37.7		17.6	
Gillnets (n=3) for harvestable fish				
White catfish	0.3	0.33	0.1	0.10
Bluegill	0.0	0.00	0.0	0.00
Largemouth bass	0.3	0.33	0.4	0.40
Black crappie	0.7	0.33	0.2	0.11
Total	1.3		0.7	

Table 118. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Bonny. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	18.0	4.90	125.2	3.31
Bowfin	4.0	2.00	63.2	3.06
Gizzard shad	29.0	6.08	39.5	1.21
Threadfin shad	179.0	45.55	5.5	0.13
Golden shiner	1.0	1.00	0.2	0.02
Lake chubsucker	1.0	1.00	5.0	0.50
White catfish	1.0	1.00	1.9	0.19
Seminole killifish	3.0	2.05	0.3	0.02
Bluegill	250.0	39.79	73.2	1.54
Redear sunfish	19.0	11.11	29.0	1.73
Largemouth bass	33.0	5.74	111.5	5.83
Black crappie	11.0	3.26	12.6	0.39
Blue tilapia	2.0	1.26	18.8	1.25
Total	551.0		485.9	
Electrofishing runs (n=6) for harvestable fish				
White catfish	1.0	1.00	0.2	0.19
Bluegill	6.0	3.10	1.1	0.60
Redear sunfish	10.0	5.93	2.7	1.60
Largemouth bass	6.0	2.19	10.4	5.80
Black crappie	5.0	1.84	1.2	0.40
Total	28.0		15.5	

Lake Harris

Location and Morphology

Lake Harris is located in Lake County, Florida (Latitude 28.46 N; Longitude 81.56 W). The lake lies in the Central Lakes division of the Central Lakes District (Brooks 1981). The geology is dominated by deeply weathered clayey sand and granular sands of the Hawthorne Formation. Harris was sampled from 1987 to 1988 and had a surface area, shoreline length, and mean depth of 5580 ha, 61.26 km, and 4.0 m, respectively (Table 1).

Trophic Status and Water Chemistry

Harris had an average total phosphorus concentration of 28 µg/L and an average total nitrogen concentration of 1550 µg/L. Total chlorophyll *a* concentrations averaged 37 µg/L and the water clarity as measured by use of a Secchi disc averaged 0.6 m (Table 2). The lake had an average pH of 8.5 and an average total alkalinity of 87 mg/L as $CaCO_3$. The average specific conductance was 248 µS/cm @ 25 C and the average water color was 15 Pt-Co units. The adjusted chlorophyll *a* value in Harris was 37.8 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Harris was classified as an eutrophic lake.

Aquatic Plants

Lake Harris had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 27%, and 2.4%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 2.4, 0.8, and 0.9 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 4.6 mg chlorophyll *a*/cm^2 of host plant and 2.3 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fourteen species of aquatic macrophytes were collected from Harris. The most commonly encountered plant species were *Paspalum distichum, Panicum hemitomon,* and *Sagittaria lancifolia* , which occurred in 100%, 90%, and 70% of the transects, respectively (Table 119).

The plant community of Lake Harris has been monitored by the Florida Department of Natural Resources from 1982 to present. In that time, 47 species of plants were identified

Table 119. Occurrence of plant species in ten evenly-spaced transects around Lake Harris.

Common name	Scientific name	Percent of the transects
floating water-hyacinth	*Eichhornia crassipes*	10
duck-potato	*Sagittaria lancifolia*	70
spatterdock	*Nuphar luteum*	20
fragrant water-lily	*Nymphaea odorata*	10
pickerelweed	*Pontederia cordata*	20
lemon bacopa	*Bacopa caroliniana*	10
cat-tail	*Typha* spp.	10
tapegrass	*Vallisneria americana*	30
Illinois pondweed	*Potamogeton illinoensis*	10
elephant-ear	*Colocasia esculenta*	30
sawgrass	*Cladium jamaicense*	20
maidencane	*Panicum hemitomon*	90
napier grass	*Pennisetum purpureum*	20
knot grass	*Paspalum distichum*	100

with *Potamogeton illinoensis* and *Hydrilla verticillata* the major submersed plants. These plants however, never covered more than 20% of the lake's surface area. Thus, the fish population of Lake Harris can be considered the product of an eutrophic lake with moderate to low levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Harris was 151 individuals/kg wet wt of host plant and 0.10 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Harris, as estimated with a ponar dredge, was 633 individuals/m^2 and 189.97 g wet wt/m^2 (Table 5). The zooplankton population of Lake Harris was dominated by cladocerans and copepods with 184,000 and 154,000 individuals/L, respectively (Table 5).

Fish

Thirty-four species of fish were collected in Lake Harris (Table 120, 121, and 122). The most abundant species collected with rotenone sampling were bluegill and taillight shiner. These species had average standing stocks in littoral blocknets of 9,600 and 1,500 fish/ha, respectively (Table 120). The most abundant open-water species collected in the experimental gillnets were gizzard shad and black crappie with 25.8, and 5.8 fish/net/24 hr, respectively (Table 121). The most abundant species collected using electrofishing were the threadfin shad and bluegill with catch per unit efforts of 48.6, and 29.4 fish per hour, respectively (Table 122).

In 1967 and 1968, the Florida Game and Fresh Water Fish Commission sampled the fish population in Lake Harris with rotenone and blocknets. Their total fish biomass estimates ranged 140 to 390 kg/ha, which brackets our estimate in littoral blocknets of 210 kg/ha (Table 120). These data suggest that there may have been little change in the fish population of Lake Harris since the late 1960s.

Lake Lindsey

Location and Morphology

Lake Lindsey is located in Hernando County, Florida (Latitude 28.37 N; Longitude 82.21 W). The lake lies in the Brooksville Hills division of the Ocala Uplift District (Brooks 1981). The geology is a mixture of three major types, but is dominated by sand and silty sands of the phosphatic Hawthorne Formation and fine sandy limestone of the Suwannee Limestone Formation. Lindsey was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 55 ha, 3.19 km and 2.2 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lindsey had an average total phosphorus concentration of 19 µg/L and an average total nitrogen concentration of 636 µg/L. Total chlorophyll *a* concentrations averaged 6 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.9 m (Table 2). The lake had an average pH of 6.9 and an average total alkalinity of 10.2 mg/L as $CaCO_3$. The average specific conductance was 33 µS/cm @ 25 C and the average water color was 37 Pt-Co units. The adjusted chlorophyll *a* value for **(Text continued on page 290)**

Table 120. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Harris. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=5) for total fish				
Florida gar	7	7	3.1	3.09
Gizzard shad	941	549	5.2	1.81
Threadfin shad	0	0	0.0	0.00
Redfin pickerel	2	2	0.1	0.13
Golden shiner	598	98	11.4	7.16
Taillight shiner	1499	1087	0.6	0.33
Lake chubsucker	5	3	1.0	0.91
Yellow bullhead	7	7	0.0	0.02
Brown bullhead	10	7	0.1	0.08
White catfish	17	11	0.1	0.05
Tadpole madtom	82	54	0.1	0.08
Seminole killifish	1052	528	2.8	1.06
Bluefin killifish	198	129	0.1	0.03
Mosquitofish	17	12	0.0	0.00
Sailfin molly	12	12	0.0	0.02
Brook silverside	178	178	0.0	0.03
Bluespotted sunfish	2	2	0.0	0.00
Redbreast sunfish	40	23	0.5	0.31
Warmouth	909	416	6.7	3.63
Bluegill	9608	5652	89.3	37.83
Dollar sunfish	442	273	1.2	0.69
Redear sunfish	1178	289	35.0	14.38
Spotted sunfish	111	52	0.4	0.35
Largemouth bass	249	100	24.1	10.64
Sunshine bass	0	0	0.0	0.00
Black crappie	553	301	12.3	3.95
Swamp darter	15	10	0.0	0.01
Shiners	1433	883	0.5	0.28
Blue tilapia	17	11	11.3	10.34
Atlantic needlefish	12	8	0.4	0.29
Total	19197		206.4	

Table 120. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=6) for total fish				
Florida gar	0	0	0.0	0.00
Gizzard shad	2495	674	19.3	12.55
Threadfin shad	391	389	0.9	0.81
Redfin pickerel	0	0	0.0	0.00
Golden shiner	109	71	2.5	1.67
Taillight shiner	4277	2547	2.7	1.55
Lake chubsucker	0	0	0.0	0.00
Yellow bullhead	4	4	0.0	0.05
Brown bullhead	0	0	0.0	0.00
White catfish	0	0	0.0	0.00
Tadpole madtom	0	0	0.0	0.00
Seminole killifish	220	47	0.8	0.26
Bluefin killifish	0	0	0.0	0.00
Mosquitofish	0	0	0.0	0.00
Sailfin molly	0	0	0.0	0.00
Brook silverside	21	18	0.0	0.01
Bluespotted sunfish	16	16	0.0	0.02
Redbreast sunfish	0	0	0.0	0.00
Warmouth	251	201	1.1	0.93
Bluegill	4691	2614	17.3	10.27
Dollar sunfish	16	16	0.0	0.03
Redear sunfish	453	124	8.9	5.79
Spotted sunfish	6	4	0.0	0.00
Largemouth bass	101	41	5.5	2.58
Sunshine bass	2	2	0.3	0.25
Black crappie	368	156	8.9	4.75
Swamp darter	101	101	0.1	0.11
Shiners	121	117	0.1	0.10
Blue tilapia	0	0	0.0	0.00
Atlantic needlefish	82	37	3.0	1.56
Total	13727		71.4	

Table 120. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=5) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	7	4.9	0.7	0.46
Bluegill	262	164.5	34.8	22.36
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	94	50.1	25.2	13.23
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	35	15.3	18.1	10.44
Sunshine bass	0	0.0	0.0	0.00
Black crappie	25	8.7	3.4	1.23
Total	422		82.1	
Open-water nets (n=6) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Redbreast sunfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	25	13.5	2.5	1.34
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	31	22.5	6.7	5.04
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	8	6.1	1.9	1.35
Sunshine bass	0	0.0	0.0	0.00
Black crappie	16	9.4	2.3	1.30
Total	80		13.3	

Table 121. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Harris. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=6) for total fish				
Florida gar	0.5	0.34	0.2	0.14
Longnose gar	3.5	0.96	5.5	1.45
Bowfin	0.5	0.50	0.7	0.65
Gizzard shad	25.8	4.35	11.2	1.68
Golden shiner	4.3	2.16	0.2	0.12
Lake chubsucker	0.3	0.22	0.2	0.12
Brown bullhead	0.2	0.18	0.1	0.10
Channel catfish	0.5	0.50	0.6	0.64
White catfish	0.2	0.18	0.9	0.95
Bluegill	0.5	0.34	0.0	0.01
Redear sunfish	0.7	0.34	0.1	0.06
Largemouth bass	4.2	1.45	1.7	0.80
Striped bass	0.2	0.17	0.0	0.02
Sunshine bass	1.0	0.37	0.1	0.06
Black crappie	5.8	1.85	0.5	0.20
Total	48.2		22.1	
Gillnets (n=6) for harvestable fish				
Brown bullhead	0.2	0.17	0.1	0.10
Channel catfish	0.5	0.50	0.6	0.64
White catfish	0.2	0.17	0.9	0.95
Bluegill	0.0	0.00	0.0	0.00
Redear sunfish	0.3	0.21	0.1	0.05
Largemouth bass	2.7	0.99	1.6	0.78
Sunshine bass	0.3	0.21	0.1	0.05
Black crappie	1.5	0.56	0.4	0.18
Total	5.7		3.8	

Table 122. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Harris. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=10) for total fish				
Florida gar	4.8	3.07	26.4	1.46
Bowfin	2.4	0.98	59.8	2.67
Threadfin shad	48.6	22.35	1.4	0.06
Golden shiner	19.2	8.80	1.6	0.07
Taillight shiner	1.2	0.80	0.0	0.00
Yellow bullhead	0.6	0.60	1.8	0.18
Bluegill	29.4	9.65	27.4	1.15
Largemouth bass	15.6	3.12	48.7	1.67
Black crappie	1.8	1.28	0.9	0.08
Blue tilapia	0.6	0.60	6.1	0.61
Atlantic needlefish	4.8	1.96	0.8	0.03
Total	129.0		174.9	
Electrofishing runs (n=10) for harvestable fish				
Yellow bullhead	0.6	0.60	0.2	0.18
Bluegill	13.8	5.73	2.3	1.03
Largemouth bass	6.6	2.09	4.4	1.68
Black crappie	0.0	0.00	0.0	0.00
Total	21.0		6.9	

Lindsey was 36.2 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Lindsey was classified as an eutrophic lake. This agrees well with the findings of Canfield (1981), who studied the lake when there were no aquatic plants present.

Aquatic Plants

Lindsey had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 100% and 79.6%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 3.0, 1.3, and 1.8 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 19.0 mg chlorophyll *a*/cm^2 of host plant and 15.4 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Seventeen species of aquatic macrophytes were collected from Lake Lindsey (Table 123). The most commonly encountered plant species were *Brasenia schreberi, Nuphar luteum,* and *Cabomba pulcherrima*, which occurred in 100%, 100%, and 100% of the transects, respectively.

Table 123. Occurrence of plant species in ten evenly-spaced transects around Lake Lindsey.

Common name	Scientific name	Percent of the Transects
giant duckweed	*Spirodela polyrhiza*	10
floating water-hyacinth	*Eichhornia crassipes*	20
common salvinia	*Salvinia rotundifolia*	10
duck-potato	*Sagittaria lancifolia*	90
water-shield	*Brasenia schreberi*	100
spatterdock	*Nuphar luteum*	100
fragrant water-lily	*Nymphaea odorata*	100
pickerelweed	*Pontederia cordata*	100
cat-tail	*Typha* spp.	10
water-pennywort	*Hydrocotyle umbellata*	10
coontail	*Ceratophyllum demersum*	30
cone-spur bladderwort	*Utricularia gibba*	10
purple fanwort	*Cabomba pulcherrima*	100
buttonbush	*Cephalanthus occidentalis*	10
willow	*Salix* spp.	30
maidencane	*Panicum hemitomon*	90
	Cyperus elegans	30

No previous vegetation studies have been conducted on Lake Lindsey, but Canfield (1981) during a lake survey in 1980 observed little or no vegetation in Lake Lindsey. Canfield (1981) measured an average chlorophyll *a* value of 39 µg/L, a much larger value

than reported for this study (6 µg/L; Table 2), which is probably the result of the large increase in aquatic vegetation from 1980 to 1988. Thus, the fish population in Lake Lindsey can be considered the product of an eutrophic lake with a rapidly increasing abundance of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Lake Lindsey was 48 individuals/kg wet wt of host plant and 0.24 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Lindsey, as estimated with a ponar dredge, was 1327 individuals/m^2 and 1.65 g wet wt/m^2 (Table 5). The zooplankton population of Lindsey was dominated by rotifers and nauplii with 171,000 and 36,600 individuals/m^3, respectively (Table 5).

Fish

Thirteen species of fish were collected in Lake Lindsey (Table 124, 125, and 126). The most abundant species collected with rotenone sampling were warmouth and bluegill. These species had average standing stocks in littoral blocknets of 1,600 and 1,600 fish/ha, respectively (Table 124). The most abundant open-water species collected in the experimental gillnets were golden shiner and largemouth bass with 5.7, and 3.0 fish/net/24 hr, respectively (Table 125). The most abundant species collected using electrofishing were largemouth bass and warmouth with catch per unit efforts of 18 and 4.5 fish per hour, respectively (Table 126). Average first year growth of bluegill, redear sunfish, and largemouth bass was 56, 69, and 146 mm TL, respectively (Table 6). We found no previous fisheries data for Lake Lindsey.

Loften Pond

Location and Morphology

Loften Pond is located in Leon County, Florida (Latitude 30.21 N; Longitude 84.23 W). The lake lies in the Lake Munson Hills subdivision of the Big Bend Karst division of the Ocala Uplift District (Brooks 1981). The geology is dominated by beach and dune sand and deeply weathered coarse to fine sand with some clay lenses. Loften Pond was sampled from 1988 to 1989 and had a surface area, **(Text continued on page 296)**

Table 124. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Lake Lindsey. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Golden shiner	37	26	1.2	1.15
Brown bullhead	16	11	3.4	1.75
White catfish	342	336	51.2	50.12
Golden topminnow	136	51	0.2	0.08
Bluefin killifish	1293	958	0.4	0.27
Mosquitofish	140	73	0.1	0.04
Brook silverside	8	8	0.1	0.06
Pirate perch	0	0	0.0	0.00
Warmouth	1643	729	15.9	7.14
Bluegill	1643	303	64.8	10.78
Redear sunfish	45	29	2.7	1.92
Largemouth bass	259	142	20.7	10.41
Black crappie	95	65	6.7	4.07
Total	5656		167.4	
Open-water nets (n=3) for total fish				
Golden shiner	132	126	3.8	3.54
Brown bullhead	0	0	0.0	0.00
White catfish	0	0	0.0	0.00
Golden topminnow	4	4	0.0	0.00
Bluefin killifish	235	40	0.1	0.03
Mosquitofish	0	0	0.0	0.00
Brook silverside	0	0	0.0	0.00
Pirate perch	4	4	0.0	0.00
Warmouth	99	63	0.9	0.46
Bluegill	1046	352	37.8	13.60
Redear sunfish	37	25	3.5	2.36
Largemouth bass	280	92	8.2	5.84
Black crappie	222	122	5.5	2.90
Total	2058		59.9	

Table 124. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Brown bullhead	12	7.1	3.1	1.54
White catfish	148	142.1	31.4	30.25
Warmouth	12	7.1	1.6	1.01
Bluegill	288	39.3	39.6	14.30
Redear sunfish	12	12.4	1.5	1.47
Largemouth bass	33	16.5	18.8	10.87
Black crappie	25	14.3	6.1	3.81
Total	531		101.9	
Open-water nets (n=3) for harvestable fish				
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	107	68.5	11.0	6.97
Redear sunfish	33	27.0	3.3	2.48
Largemouth bass	16	10.9	7.3	6.21
Black crappie	12	7.1	4.2	3.39
Total	169		25.8	

Table 125. Experimental gillnet (five10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Lake Lindsey. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Golden shiner	5.7	2.85	0.6	0.32
Brown bullhead	0.3	0.33	0.1	0.06
Warmouth	0.3	0.33	0.0	0.02
Bluegill	1.0	0.58	0.1	0.04
Redear sunfish	0.3	0.33	0.0	0.03
Largemouth bass	3.0	0.58	0.6	0.15
Black crappie	0.3	0.33	0.1	0.06
Total	11.0		1.5	
Gillnets (n=3) for harvestable fish				
Brown bullhead	0.3	0.33	0.1	0.06
Warmouth	0.3	0.33	0.0	0.02
Bluegill	0.3	0.33	0.0	0.03
Redear sunfish	0.3	0.33	0.0	0.03
Largemouth bass	2.0	0.00	0.6	0.17
Black crappie	0.3	0.33	0.1	0.06
Total	3.7		0.8	

Table 126. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Lake Lindsey. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Golden topminnow	3.0	3.00	0.10	0.01
Warmouth	4.5	2.87	0.5	0.05
Bluegill	3.0	1.73	3.7	0.27
Largemouth bass	18.0	8.49	16.6	1.32
Total	28.5		20.9	
Electrofishing runs (n=4) for harvestable fish				
Warmouth	0.0	0.00	0.0	0.00
Bluegill	1.5	1.50	0.3	0.29
Largemouth bass	6.0	4.24	1.6	1.33
Total	7.5		1.9	

shoreline length, and mean depth of 5 ha, 2.03 km and 2.6 m, respectively (Table 1).

Trophic Status and Water Chemistry

Loften Pond had an average total phosphorus concentration of 5 µg/L and an average total nitrogen concentration of 633 µg/L. Total chlorophyll *a* concentrations averaged 2 µg/L and the water clarity as measured by use of a Secchi disc averaged 2.5 m (Table 2). The lake had an average pH of 4.9 and an average total alkalinity of 1 mg/L as $CaCO_3$. The average specific conductance was 20 µS/cm @ 25 C and the average water color was 20 Pt-Co units. The adjusted chlorophyll *a* value in Loften was 4.1 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Loften Pond was classified as a mesotrophic lake.

Aquatic Plants

Loften Pond had a moderate abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 87% and 22%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 0.3, 0.6, and 0.6 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 9.4 mg chlorophyll *a*/cm^2 of host plant and 11.7 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fourteen species of aquatic macrophytes were collected in Loften Pond. The most commonly encountered plant species were *Myriophyllum heterophyllum, Utricularia purpurea,* and *Hypericum* spp., which occurred in 100%, 100%, and 100% of the transects, respectively (Table 127).

Table 127. Occurrence of plant species in ten evenly-spaced transects around Loften Pond.

Common name	Scientific name	Percent of Transects
slender spikerush	*Eleocharis baldwinii*	40
banana-lily	*Nymphoides aquatica*	40
spatterdock	*Nuphar luteum*	30
fragrant water-lily	*Nymphaea odorata*	40
variable-leaf milfoil	*Myriophyllum heterophyllum*	100
purple bladderwort	*Utricularia purpurea*	100
maidencane	*Panicum hemitomon*	80
	Fuirena sciropoidea	60
	Utricularia floridana	20
pipewort	*Eriocaulon* spp.	50
St. John's wort	*Hypericum* spp.	100

No previous vegetation studies have been done on Loften pond, but Loften Pond is located on undeveloped land in the Apalachicola National Forest and no major change in the aquatic vegetation would be expected. Thus, the fish population in Loften can be considered the product of a mesotrophic lake with moderate levels of vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Loften Pond was 35 individuals/kg wet wt of host plant and 0.03 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Loften Pond, as estimated with a ponar dredge, was 307 individuals/m^2 and 0.43 g wet wt/m^2 (Table 5). The zooplankton population of Loften Pond was dominated by rotifers and cladocerans with 216,000 and 114,000 individuals/m^3, respectively (Table 5).

Fish

Ten species of fish were collected from Loften Pond (Table 128, 129 and 130). The most abundant species collected with rotenone sampling were warmouth and largemouth bass. These species had average standing stocks in littoral blocknets of 2,900 and 420 fish/ha, respectively (Table 128). The only open-water species collected in the experimental gillnets was the largemouth bass with 1 fish/net/24 hr (Table 129). The most abundant species collected using electrofishing were chain pickerel and lake chubsucker with catch per unit efforts of 19.5, and 13.5 fish per hour, respectively (Table 130). Average first year growth of bluegill and largemouth bass was 43 and 125 mm TL, respectively (Table 6).

No previous fisheries studies have been done on Loften Pond. However, Loften is located on undeveloped land in the Apalachicola National Forest and no major change in the fish population would be expected.

Moore Lake

Location and Morphology

Moore Lake is located in Leon County, Florida (Latitude 30.23 N; Longitude 84.24 W). The lake lies in the Tallahassee Red Hills subdivision of the Stateline Hills division of the Ocala Uplift District (Brooks 1981). The geology is dominated by beach and dune-sand and deeply weathered coarse to fine sands with some clay lenses. Moore Lake was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 28 ha, 1.77 km and 2.9 m, respectively (Table 1). **(Text continued on page 302)**

Table 128. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Loften Pond. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Redfin pickerel	111	0	7.3	1.78
Chain pickerel	142	56	8.8	5.03
Lake chubsucker	161	12	8.7	5.38
Seminole killifish	6	6	0.0	0.01
Lined topminnow	278	19	0.3	0.02
Brook silverside	130	43	0.1	0.06
Everglades pygmy sunfish	62	62	0.0	0.01
Warmouth	2946	401	17.9	3.72
Bluegill	86	0	8.6	0.03
Largemouth bass	420	259	5.0	3.80
Total	4341		56.8	
Open-water nets (n=2) for total fish				
Redfin pickerel	0	0	0.0	0.00
Chain pickerel	0	0	0.0	0.00
Lake chubsucker	0	0	0.0	0.00
Seminole killifish	0	0	0.0	0.00
Lined topminnow	0	0	0.0	0.00
Brook silverside	0	0	0.0	0.00
Everglades pygmy sunfish	0	0	0.0	0.00
Warmouth	6	6	0.0	0.02
Bluegill	142	68	16.5	11.68
Largemouth bass	136	12	36.0	28.56
Total	284		52.4	

Table 128. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Chain pickerel	6	6.2	1.7	1.73
Warmouth	19	18.5	2.9	2.94
Bluegill	62	0.0	7.4	0.02
Largemouth bass	6	6.2	3.0	3.01
Total	93		15.1	
Open-water nets (n=2) for harvestable fish				
Chain pickerel	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	117	80.3	15.4	12.19
Largemouth bass	19	6.2	34.0	28.03
Total	136		49.5	

Table 129. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Loften Pond. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=1) for total fish				
Largemouth bass	1.0	0.00	0.5	0.00
Total	1.0		0.5	
Gillnets (n=1) for harvestable fish				
Largemouth bass	1.0	0.00	0.5	0.00
Total	1.0		0.5	

Table 130. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Loften Pond. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Redfin pickerel	1.5	1.50	0.1	0.01
Chain pickerel	19.5	4.50	57.1	1.71
Lake chubsucker	13.5	3.77	20.5	0.52
Warmouth	1.5	1.50	2.3	0.23
Bluegill	4.5	1.50	5.3	0.28
Largemouth bass	3.0	1.73	2.3	0.20
Total	43.5		87.5	
Electrofishing runs (n=4) for harvestable fish				
Chain pickerel	10.5	2.87	4.7	1.66
Warmouth	1.5	1.50	0.2	0.23
Bluegill	3.0	1.73	0.5	0.31
Largemouth bass	0.0	0.00	0.0	0.00
Total	15.0		5.4	

Trophic Status and Water Chemistry

Moore Lake had an average total phosphorus concentration of 5 µg/L and an average total nitrogen concentration of 353 µg/L. Total chlorophyll *a* concentrations averaged 3 µg/L and the water clarity as measured by use of a Secchi disc averaged 5.3 m (Table 2). The lake had an average pH of 5.8 and an average total alkalinity of 2.2 mg/L as $CaCO_3$. The average specific conductance was 17 µS/cm @ 25 C and the average water color was 19 Pt-Co units. The adjusted chlorophyll *a* value for Moore Lake was 5.3 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Moore Lake was classified as a mesotrophic lake during this study.

Aquatic Plants

Moore Lake had a moderate abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 40% and 13.9%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 1.7, 0.2, and 1.3 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 14.9 mg chlorophyll *a*/cm^2 of host plant and 25.2 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Nine species of aquatic macrophytes were collected from Moore Lake. The most commonly encountered plant species were *Myriophyllum heterophyllum, Utricularia purpurea,* and *Panicum hemitomon* , which occurred in 100%, 100%, and 100% of the transects, respectively (Table 131).

Table 131. Occurrence of plant species in ten evenly-spaced transects around Moore Lake.

Common name	Scientific name	Percent of Transects
spatterdock	*Nuphar luteum*	10
fragrant water-lily	*Nymphaea odorata*	10
water-moss	*Fontinalis* spp.	90
variable-leaf milfoil	*Myriophyllum heterophyllum*	100
purple bladderwort	*Utricularia purpurea*	100
maidencane	*Panicum hemitomon*	100
	Utricularia floridana	100
St. John's wort	*Hypericum* spp.	50
bald cypress	*Taxodium distichum*	100

No previous vegetation studies have been done on Moore Lake. However, Moore is located on undeveloped land in the Apalachicola National Forest and no major change in the aquatic vegetation would be expected. Thus, the fish population in Moore Lake can be considered the product of an mesotrophic lake with moderate levels of vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Moore Lake was 84 individuals/kg wet wt of host plant and 0.21 g wet wt/kg wet wt of host plant (Table 5).

Average number and biomass of benthic macroinvertebrates in Moore, as estimated with a ponar dredge, was 607 individuals/m^2 and 2.01 g wet wt/m^2 (Table 5). The zooplankton population in Moore Lake was dominated by rotifers and cladocerans with 128,000 and 55,300 individuals/m3, respectively (Table 5).

Fish

Fifteen species of fish were collected from Moore Lake (Table 132, 133, and 134). The most abundant species collected with rotenone sampling were warmouth and bluegill. These species had average standing stocks in littoral blocknets of 14,300, and 4,200 fish/ha, respectively (Table 132). The most abundant open-water species collected in the experimental gillnets were largemouth bass and lake chubsucker with 4.0 and 1.0 fish/net/24 hr, respectively (Table 133). The most abundant species collected using electrofishing were bluegill and chain pickerel with catch per unit efforts of 18 and 9.6 fish per hour, respectively (Table 134). Average first year growth of bluegill and largemouth bass was 38 and 138 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 14 harvestable largemouth bass per hectare in Moore Lake (Table 7).

The fish population in Moore Lake was examined in 1986 with one 20-minute electrofishing sample (US Forest Service 1986, unpublished data). The total fish biomass catch per unit effort was estimated at 17.2 kg/hour, which is similar to the value reported for this study (33 kg/hour; Table 134). Thus, the fish population in Moore Lake seems to have been stable over the last several years.

Live Oak

Location and Morphology

Live Oak is located in Osceola County, Florida (Latitude 28.13 N; Longitude 81.14 W). The lake lies in the Kissimmee Valley division of the Eastern Flatwoods District (Brooks 1981). The geology is dominated by lagoonal deposits of unlithified silty sands. Live Oak was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 152 ha, 4.99 km, and 3 m, respectively (Table 1). **(Text continued on page 308)**

Table 132. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Moore Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Redfin pickerel	191	19	0.9	0.09
Chain pickerel	86	0	9.8	0.39
Yellow bullhead	25	25	0.7	0.75
Tadpole madtom	6	6	0.0	0.01
Lined topminnow	68	31	0.1	0.04
Pygmy killifish	31	19	0.0	0.00
Brook silverside	117	31	0.1	0.01
Everglades pygmy sunfish	926	543	0.1	0.07
Bluespotted sunfish	173	148	0.3	0.32
Warmouth	14308	809	50.1	12.11
Bluegill	4205	475	26.6	4.24
Dollar sunfish	834	327	2.7	0.60
Largemouth bass	673	93	4.8	1.75
Swamp darter	6	6	0.0	0.00
Total	21650		96.3	
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	37	37.0	4.3	4.25
Bluegill	68	6.2	8.9	2.70
Dollar sunfish	0	0.0	0.0	0.00
Largemouth bass	12	0.0	4.1	1.96
Total	117		17.2	

Table 132. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=2) for total fish				
Redfin pickerel	0	0	0.0	0.00
Chain pickerel	0	0	0.0	0.00
Yellow bullhead	0	0	0.0	0.00
Tadpole madtom	0	0	0.0	0.00
Lined topminnow	0	0	0.0	0.00
Pygmy killifish	0	0	0.0	0.00
Brook silverside	0	0	0.0	0.00
Everglades pygmy sunfish	0	0	0.0	0.00
Bluespotted sunfish	0	0	0.0	0.00
Warmouth	117	105	0.1	0.07
Bluegill	142	142	4.5	4.45
Dollar sunfish	0	0	0.0	0.00
Largemouth bass	99	99	0.6	0.62
Swamp darter	6	6	0.0	0.01
Total	364		5.2	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	19	18.5	3.1	3.09
Dollar sunfish	0	0.0	0.0	0.00
Largemouth bass	0	0.0	0.0	0.00
Total	19		3.1	

Table 133. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Moore Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=2) for total fish				
Redfin pickerel	0.5	0.50	0.0	0.04
Lake chubsucker	1.0	1.00	0.6	0.62
Bluegill	0.5	0.50	0.2	0.19
Largemouth bass	4.0	0.00	1.3	0.49
Total	6.0		2.2	
Gillnets (n=2) for harvestable fish				
Bluegill	0.5	0.50	0.2	0.19
Largemouth bass	3.0	1.00	1.3	0.55
Total	3.5		1.5	

Table 134. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Moore. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=5) for total fish				
Redfin pickerel	2.4	1.47	0.1	0.01
Chain pickerel	9.6	1.47	16.7	0.48
Brook silverside	4.8	2.24	0.1	0.00
Warmouth	4.8	3.50	2.0	0.13
Bluegill	18.0	5.02	5.1	0.16
Largemouth bass	2.4	1.47	9.2	0.59
Total	42.0		33.3	
Electrofishing runs (n=5) for harvestable fish				
Chain pickerel	3.6	2.40	1.0	0.68
Warmouth	1.2	1.20	0.1	0.12
Bluegill	1.2	1.20	0.1	0.12
Largemouth bass	2.4	1.47	0.9	0.59
Total	8.4		2.1	

Trophic Status and Water Chemistry

Live Oak had an average total phosphorus concentration of 13 µg/L and an average total nitrogen concentration of 389 µg/L. Total chlorophyll *a* concentrations averaged 9 µg/L and the water clarity as measured by use of a Secchi disc averaged 2.6 m (Table 2). The lake had an average pH of 7.1 and an average total alkalinity of 11.5 mg/L as $CaCO_3$. The average specific conductance was 132 µS/cm @ 25 C and the average water color was 22 Pt-Co units. The adjusted chlorophyll *a* value for Live Oak was 17.8 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Live Oak was classified as an eutrophic lake during this study.

Aquatic Plants

Live Oak had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 100% and 55%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 2.0, 0.3 and 1.6 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 20.3 mg chlorophyll *a*/cm^2 of host plant and 21.5 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fifteen species of aquatic macrophytes were collected in Live Oak. The most commonly encountered plant species were *Hydrilla verticillata, Nymphoides aquatica* and *Scirpus californicus* , which occurred in 100%, 70% and 60% of the transects, respectively (Table 135).

Table 135. Occurrence of plant species in ten evenly-spaced transects around Live Oak Lake.

Common name	Scientific name	Percent of Transects
duck-potato	*Sagittaria lancifolia*	20
slender spikerush	*Eleocharis baldwinii*	50
banana-lily	*Nymphoides aquatica*	70
spatterdock	*Nuphar luteum*	20
fragrant water-lily	*Nymphaea odorata*	10
pickerelweed	*Pontederia cordata*	30
cat-tail	*Typha* spp.	40
water-pennywort	*Hydrocotyle umbellata*	10
hydrilla	*Hydrilla verticillata*	100
purple bladderwort	*Utricularia purpurea*	10
giant bulrush	*Scirpus californicus*	60
maidencane	*Panicum hemitomon*	30
	Fuirena sciropoidea	20
	Eleocharis elongata	10
knot grass	*Paspalum distichum*	10

Live Oak is a private lake with no public access. Hydrilla was extremely abundant in Live Oak several years prior to this study (personal communications from the home owners on Live Oak). Thus, the fish population of Live Oak can be considered the product of an eutrophic lake with high levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Live Oak was 60 individuals/kg wet wt of host plant and 0.06 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Live Oak, as estimated with a ponar dredge, was 253 individuals/m^2 and 1.77 g wet wt/m^2 (Table 5). The zooplankton population in Live Oak was dominated by nauplii and rotifers with 174,000 and 78,400 individuals/m^3, respectively (Table 5).

Fish

Fifteen species of fish were collected in Live Oak (Table 136, 137, and 138). The most abundant species collected with rotenone sampling were warmouth and bluespotted sunfish. These species had average standing stocks in littoral blocknets of 2,800 and 1,900 fish/ha, respectively (Table 136). The most abundant open-water species collected in the experimental gillnets were largemouth bass and gizzard shad with 7.0, and 5.0 fish/net/24 hr, respectively (Table 137). The most abundant species collected using electrofishing were largemouth bass and bluegill with catch per unit efforts of 22 and 17 fish per hour, respectively (Table 138). Average first year growth of bluegill, redear sunfish, and largemouth bass was 53, 64, and 146 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 2 harvestable redear sunfish, and 24 harvestable largemouth bass per hectare in Live Oak Lake (Table 7). No previous fisheries data were available for Live Oak.

Koon Lake

Location and Morphology

Koon Lake is located in Lafayette County, Florida (Latitude 30.02 N; Longitude 83.06 W). The lake lies in the San Padro Bay subdivision of the Flats and Swamps division of the Ocala Uplift District (Brooks 1981). The geology is dominated by poorly drained terrace deposits of surface sand over clayey sand. Koon was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 44 hectares, 3.58 kilometers, and 1.5 meters, respectively (Table 1). **(Text continued on page 316)**

Table 136. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Live Oak. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Florida gar	12	12	6.3	6.35
Bowfin	8	4	5.3	2.87
Redfin pickerel	8	4	0.0	0.02
Chain pickerel	37	14	3.8	3.46
Golden shiner	103	80	0.1	0.05
Lake chubsucker	12	12	2.6	2.55
Yellow bullhead	4	4	0.3	0.33
Brown bullhead	37	25	0.1	0.08
Golden topminnow	16	16	0.0	0.02
Lined topminnow	4	4	0.0	0.01
Bluefin killifish	465	160	0.2	0.07
Brook silverside	37	37	0.0	0.05
Bluespotted sunfish	1857	590	2.0	0.77
Warmouth	2836	1121	18.0	13.31
Bluegill	943	403	12.7	5.40
Dollar sunfish	387	240	1.1	0.76
Redear sunfish	955	293	13.4	4.05
Spotted sunfish	4	4	0.2	0.18
Largemouth bass	490	106	14.2	1.99
Black crappie	0	0	0.0	0.00
Swamp darter	12	7	0.0	0.01
Total	8229		80.6	

Table 136. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Florida gar	0	0	0.0	0.00
Bowfin	0	0	0.0	0.00
Redfin pickerel	0	0	0.0	0.00
Chain pickerel	0	0	0.0	0.00
Golden shiner	0	0	0.0	0.00
Lake chubsucker	0	0	0.0	0.00
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	0	0	0.0	0.00
Golden topminnow	0	0	0.0	0.00
Lined topminnow	0	0	0.0	0.00
Bluefin killifish	156	90	0.1	0.06
Brook silverside	0	0	0.0	0.00
Bluespotted sunfish	309	142	0.3	0.13
Warmouth	255	105	0.8	0.58
Bluegill	1062	283	12.8	4.09
Dollar sunfish	16	4	0.0	0.01
Redear sunfish	78	39	0.5	0.36
Spotted sunfish	0	0	0.0	0.00
Largemouth bass	371	167	6.2	3.48
Black crappie	4	4	0.1	0.12
Swamp darter	0	0	0.0	0.00
Total	2252		20.8	

Table 136. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Chain pickerel	4	4.1	3.6	3.58
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Warmouth	58	57.6	6.4	6.36
Bluegill	41	35.2	3.3	2.81
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	16	16.5	1.4	1.42
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	37	7.1	10.5	2.69
Black crappie	0	0.0	0.0	0.00
Total	156		25.1	
Open-water nets (n=3) for harvestable fish				
Chain pickerel	0	0.0	0.0	0.00
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	4	4.1	0.3	0.29
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	0	0.0	0.0	0.00
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	4	4.1	2.1	2.10
Black crappie	0	0.0	0.0	0.00
Total	8		2.4	

Table 137. Experimental gillnet (five 10-meter long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Live Oak. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	3.3	1.76	2.0	1.02
Longnose gar	2.7	1.76	3.8	2.67
Bowfin	1.0	0.00	1.3	0.29
Gizzard shad	5.0	3.21	4.1	2.59
Chain pickerel	0.7	0.33	0.3	0.22
Golden shiner	0.3	0.33	0.0	0.02
Warmouth	0.3	0.33	0.0	0.01
Bluegill	2.0	1.00	0.1	0.09
Largemouth bass	7.0	2.52	3.2	1.75
Black crappie	0.7	0.33	0.1	0.10
Total	23.0		14.9	
Gillnets (n=3) for harvestable fish				
Chain pickerel	0.3	0.33	0.2	0.24
Warmouth	0.0	0.00	0.0	0.00
Bluegill	0.3	0.33	0.1	0.07
Largemouth bass	5.0	2.65	3.0	1.78
Black crappie	0.3	0.33	0.1	0.11
Total	6.0		3.5	

Table 138. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Live Oak. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	14.0	9.25	35.4	2.29
Bowfin	1.0	1.00	14.9	1.49
Redfin pickerel	1.0	1.00	0.2	0.02
Chain pickerel	2.0	1.26	12.7	0.98
Lake chubsucker	4.0	2.00	10.3	0.51
Warmouth	1.0	1.00	0.5	0.05
Bluegill	17.0	4.22	5.9	0.18
Redear sunfish	5.0	1.84	3.5	0.19
Largemouth bass	22.0	4.00	45.1	1.30
Total	67.0		128.4	
Electrofishing runs (n=6) for harvestable fish				
Chain pickerel	2.0	1.26	1.3	0.98
Warmouth	0.0	0.00	0.0	0.00
Bluegill	2.0	1.26	0.3	0.19
Redear sunfish	3.0	2.05	0.3	0.20
Largemouth bass	10.0	3.35	3.8	1.21
Total	17.0		5.6	

Trophic Status and Water Chemistry

Koon had an average total phosphorus concentration of 5 µg/L and an average total nitrogen concentration of 687 µg/L. Total chlorophyll *a* concentrations averaged 3.0 µg/L and the water clarity as measured by use of a Secchi disc averaged 1.4 m (Table 2). The lake had an average pH of 5.2 and an average total alkalinity of 2.6 mg/L as $CaCO_3$. The average specific conductance was 29 µS/cm @ 25 C and the average water color was 63 Pt-Co units. The adjusted chlorophyll *a* value for Koon Lake was 16.5 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Koon Lake was classified as an eutrophic lake.

Aquatic Plants

Koon Lake had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 96.7%, and 92.6%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 0.8, 0.9 and 0.9 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 17.3 mg chlorophyll *a*/cm^2 of host plant and 34.7 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Fifteen species of aquatic macrophytes were collected from Koon. The most commonly encountered plant species were *Brasenia schreberi, Myriophyllum heterophyllum* and *Utricularia purpurea*, which occurred in 100%, 100%, and 90% of the transects, respectively (Table 139).

The plant community of Koon Lake has been monitored by Florida Department of Natural Resources from 1982 to present. During that time, 29 species of plants were identified. Several species maintained a coverage of 20 to 45% of the lake's surface area, including *Brasenia schreberi, Myriophyllum heterophyllum, Cabomba caroliniana* and *Utricularia purpurea*. Thus, the fish population in Koon Lake during this study can be considered the product of a eutrophic lake with high abundance of aquatic macrophytes.

Invertebrates

The average number, and biomass of epiphytic macroinvertebrates in Koon Lake was 406 individuals/kg wet wt of host plant and 1.12 g wet wt/kg wet wt of host plant (Table

Table 139. Occurrence of plant species in ten evenly-spaced transects around Koon Lake.

Common name	Scientific name	Percent of Transects
banana-lily	*Nymphoides aquatica*	60
water-shield	*Brasenia schreberi*	100
spatterdock	*Nuphar luteum*	30
fragrant water-lily	*Nymphaea odorata*	30
lemon bacopa	*Bacopa caroliniana*	40
cat-tail	*Typha* spp.	10
water-pennywort	*Hydrocotyle umbellata*	10
variable-leaf milfoil	*Myriophyllum heterophyllum*	100
purple bladderwort	*Utricularia purpurea*	90
purple fanwort	*Cabomba pulcherrima*	30
buttonbush	*Cephalanthus occidentalis*	30
maidencane	*Panicum hemitomon*	80
	Utricularia floridana	20
pipewort	*Eriocaulon* spp.	10
bald cypress	*Taxodium distichum*	80

5). Average number and biomass of benthic macroinvertebrates in Koon Lake, as estimated with a ponar dredge, was 433 individuals/m^2 and 0.45 g wet wt/m^2 (Table 5). The zooplankton population in Koon Lake was dominated by copepods and cladocerans with 104,000 and 126,000 individuals/m^3, respectively (Table 5).

Fish

Twenty-three species of fish were collected from Koon Lake (Tables 140, 141 and 142). The most abundant species collected with rotenone sampling were the bluespotted sunfish, and warmouth. These species had average standing stocks in the littoral blocknets of 401 and 161 fish/ha, respectively (Table 141). The most abundant open-water species collected in the experimental gillnets were yellow bullhead and largemouth bass with 1.7 and 1.0 fish/net/24 hr, respectively (Table 142). The most abundant species collected using electrofishing were the lake chubsucker and largemouth bass with catch per unit efforts of 12 and 9 fish per hour, respectively (Table 143). The first year growth of bluegill, and largemouth bass was 48 and 147 mm TL, respectively (Table 6). **(Text continued on page 223)**

Table 140. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Koon Lake. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Redfin pickerel	12	12	0.1	0.09
Chain pickerel	43	19	2.0	0.19
Golden shiner	6	6	0.0	0.02
Grass carp	0	0	0.0	0.00
Lake chubsucker	124	111	4.7	2.14
Yellow bullhead	6	6	1.8	1.79
Brown bullhead	12	12	0.7	0.71
Golden topminnow	19	6	0.0	0.01
Lined topminnow	6	6	0.0	0.01
Mosquitofish	6	6	0.0	0.00
Pygmy killifish	0	0	0.0	0.00
Brook silverside	6	6	0.0	0.00
Pirate perch	6	6	0.0	0.04
Bluespotted sunfish	401	278	0.3	0.21
Warmouth	161	62	0.9	0.84
Bluegill	142	31	2.7	1.34
Largemouth bass	74	12	31.8	29.14
Swamp darter	6	6	0.0	0.00
Flier	6	6	0.0	0.02
Shiners	6	6	0.0	0.00
Total	1044		45.1	

Table 140. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=2) for total fish				
Redfin pickerel	0	0	0.0	0.00
Chain pickerel	0	0	0.0	0.00
Golden shiner	19	19	0.1	0.11
Grass carp	6	6	31.4	31.37
Lake chubsucker	0	0	0.0	0.00
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	12	12	0.0	0.04
Golden topminnow	19	19	0.0	0.02
Lined topminnow	6	6	0.0	0.01
Mosquitofish	49	49	0.0	0.02
Pygmy killifish	19	19	0.0	0.00
Brook silverside	12	0	0.0	0.00
Pirate perch	0	0	0.0	0.00
Bluespotted sunfish	25	25	0.0	0.02
Warmouth	222	210	0.2	0.13
Bluegill	62	49	2.3	0.06
Largemouth bass	179	179	7.9	7.87
Swamp darter	6	6	0.0	0.01
Flier	0	0	0.0	0.00
Shiners	12	12	0.0	0.04
Total	648		41.9	

Table 140. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Chain pickerel	0	0.0	0.0	0.00
Yellow bullhead	6	6.2	1.8	1.79
Brown bullhead	6	6.2	0.7	0.71
Warmouth	0	0.0	0.0	0.00
Bluegill	6	6.2	1.4	1.40
Largemouth bass	12	0.0	31.5	29.03
Flier	0	0.0	0.0	0.00
Total	31		35.4	
Open-water nets (n=2) for harvestable fish				
Chain pickerel	0	0.0	0.0	0.00
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	12	0.0	1.7	0.67
Largemouth bass	12	12.3	7.7	7.75
Flier	0	0.0	0.0	0.00
Total	25		9.4	

Table 141. Experimental gillnet (five10-long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Koon Lake. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	0.7	0.67	0.2	0.24
Golden shiner	0.3	0.33	0.0	0.02
Grass carp	0.3	0.33	1.6	1.57
Yellow bullhead	1.7	1.20	1.2	0.62
Brown bullhead	0.3	0.33	0.2	0.23
Redear sunfish	0.3	0.33	0.1	0.07
Largemouth bass	1.0	0.58	0.7	0.61
Black crappie	1.0	0.00	0.5	0.04
Total	5.7		4.5	
Gillnets (n=3) for harvestable fish				
Yellow bullhead	1.7	1.20	1.2	0.62
Brown bullhead	0.3	0.33	0.2	0.23
Redear sunfish	0.3	0.33	0.1	0.07
Largemouth bass	1.0	0.58	0.7	0.61
Black crappie	1.0	0.00	0.5	0.04
Total	4.3		2.6	

Table 142. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Koon Lake. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	6.0	3.79	23.4	1.50
Chain pickerel	7.0	2.86	29.8	1.74
Golden shiner	5.0	5.00	0.3	0.03
Grass carp	1.0	1.00	54.4	5.44
Lake chubsucker	12.0	3.79	34.9	1.31
Lined topminnow	1.0	1.00	0.0	0.00
Mosquitofish	1.0	1.00	0.0	0.00
Brook silverside	1.0	1.00	0.0	0.00
Warmouth	2.0	1.26	0.3	0.03
Bluegill	8.0	4.82	26.7	1.58
Largemouth bass	9.0	4.02	15.0	0.82
Total	53.0		184.7	
Electrofishing runs (n=6) for harvestable fish				
Chain pickerel	3.0	2.05	2.5	1.73
Warmouth	0.0	0.00	0.0	0.00
Bluegill	7.0	3.92	2.6	1.53
Largemouth bass	4.0	2.00	1.4	0.80
Total	14.0		6.5	

The fish population of Koon Lake was sampled by the Florida Game and Fresh Water Fish Commission with rotenone in 1972, 1979 and 1985 (Krummrich, unpublished data). The average total fish biomass ranged from 27 to 240 kg/ha, which brackets the littoral biomass value reported for this study (45 kg/ha, Table 140). These data suggest that the fish population in Koon Lake has fluctuated considerably in the last 20 years and that when we sampled it, the population was considerably less then the highest reported value.

Watertown

Location and Morphology

Watertown is located in Columbia County, Florida (Latitude 30.11 N; Longitude 82.36 W). The lake lies in the St. Augustine Ridge Sets division of the Eastern Flatwoods District (Brooks 1981). The geology is dominated by sand, silty sand, and phosphatic clays of the Hawthorne Formation. Watertown was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 19 ha, 1.64 km, and 3.8 m, respectively (Table 1).

Trophic Status and Water Chemistry

Watertown had an average total phosphorus concentration of 27 µg/L and an average total nitrogen concentration of 777 µg/L. Total chlorophyll *a* concentrations averaged 24 µg/L and the water clarity as measured by use of a Secchi disc averaged 1m (Table 2). The lake had an average pH of 7.9, and an average total alkalinity of 59.2 mg/L as $CaCO_3$. The average specific conductance was 147 µS/cm @ 25 C and the average water color was 27 Pt-Co units. Watertown was classified as an eutrophic lake during this study using the classification system of Forsberg and Ryding (1980), .

Aquatic Plants

Watertown had a low abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 6.7%, and 0.8%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 1.0, 0 and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 6.4 mg chlorophyll *a*/cm^2 of host plant and 4.7 mg chlorophyll *a*/kg wet wt of host plant (Table 3).

Three species of aquatic macrophytes were collected in Watertown, *Alternanthera philoxeroides, Typha* spp. and *Panicum hemitomon* , which occurred in 10%, 10% and 30% of the transects, respectively (Table 143).

Table 143. Occurrence of plant species in ten evenly-spaced transects around Lake Watertown.

Common name	Scientific name	Percent of transects
alligator-weed	*Alternanthera philoxeroides*	10
cat-tail	*Typha* spp.	10
maidencane	*Panicum hemitomon*	30

The plant community of Watertown was monitored by the Florida Game and Fresh Water Fish Commission from 1982 to present (Krummrich et al. 1982; Krummrich et al. 1988). In 1982, water hyacinth covered about 20% of the lake and hydrilla covered 2% of Watertown's surface area. Dense mats of filamentous algae were dominant in Watertown by 1985. Triploid grass carp were stocked in 1985 and 1986 to control the mats of filamentous algae and by 1988 few aquatic plants remained in Watertown. Thus, the fish population in Watertown during this study can be considered the product of an eutrophic lake with recently removed mats of filamentous algae.

Invertebrates

The average number, and biomass of epiphytic macroinvertebrates in Watertown was 428 individuals/kg wet wt of host plant and 0.87 g wet wt/kg wet wt of host plant (Table 5). Average number, and biomass of benthic macroinvertebrates in Watertown, as estimated with a ponar dredge, was 2180 individuals/m^2 and 6.60 g wet wt/m^2, respectively (Table 5). The zooplankton population was dominated by cladocerans and copepods with 88,000 and 39,300 individuals/m3, respectively (Table 5).

Fish

Eighteen species of fish were collected from Watertown (Table 144 and 145). The most abundant species collected with rotenone **(Text continued on page 329)**

Table 144. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Watertown. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for total fish				
Gizzard shad	296	296	2.1	2.13
Threadfin shad	1414	1315	0.9	0.86
Golden shiner	4106	3946	135.0	134.79
Grass carp	19	19	24.6	24.64
Yellow bullhead	148	86	9.2	6.19
Brown bullhead	93	43	0.6	0.57
American eel	0	0	0.0	0.00
Bluefin killifish	36538	19420	9.6	4.46
Mosquitofish	0	0	0.0	0.00
Brook silverside	12	12	0.0	0.01
Warmouth	6	6	0.3	0.28
Bluegill	1439	105	38.2	13.60
Redear sunfish	68	31	10.2	6.30
Spotted sunfish	6	6	0.3	0.29
Largemouth bass	2328	117	52.9	34.65
Black crappie	401	191	6.2	5.20
Shiners	74	74	0.1	0.06
Total	46949		290.2	

Table 144. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=2) for total fish				
Gizzard shad	6	6	0.1	0.06
Threadfin shad	278	228	0.4	0.36
Golden shiner	154	105	0.2	0.08
Grass carp	0	0	0.0	0.00
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	80	80	2.2	2.18
American eel	6	6	4.2	4.20
Bluefin killifish	34061	30467	7.5	6.58
Mosquitofish	68	68	0.0	0.02
Brook silverside	12	12	0.0	0.02
Warmouth	86	86	0.0	0.04
Bluegill	1538	228	6.3	2.93
Redear sunfish	25	12	5.7	4.48
Spotted sunfish	0	0	0.0	0.00
Largemouth bass	7021	1068	69.1	35.69
Black crappie	1260	1161	3.2	0.51
Shiners	43	31	0.0	0.02
Total	44639		98.9	

Table 144. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=2) for harvestable fish				
Yellow bullhead	31	18.5	7.2	5.34
Brown bullhead	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	111	74.1	19.9	15.58
Redear sunfish	49	12.3	8.7	4.80
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	37	24.7	48.0	37.21
Black crappie	0	0.0	0.0	0.00
Total	228		83.8	
Open-water nets (n=2) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	12	12.3	2.2	2.17
Warmouth	0	0.0	0.0	0.00
Bluegill	43	30.9	3.7	2.75
Redear sunfish	25	12.3	5.7	4.48
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	62	24.7	62.9	32.54
Black crappie	6	6.2	0.8	0.81
Total	148		75.3	

Table 145. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Watertown. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=4) for total fish				
Bowfin	1.50	1.50	3.00	3.00
Gizzard shad	1.50	1.50	0.00	0.02
Golden shiner	30.00	14.49	0.3	0.20
Yellow bullhead	1.50	1.50	0.2	0.16
Mosquitofish	4.50	1.50	0.00	0.00
Brook silverside	1.50	1.50	0.0	0.01
Bluegill	105.00	21.70	4.5	2.13
Redear sunfish	3.00	1.73	0.1	0.09
Largemouth bass	60.00	16.25	25.3	11.12
Black crappie	3.00	3.00	0.1	0.06
Total	211.5		33.6	
Electrofishing runs (n=4) for harvestable fish				
Yellow bullhead	1.5	1.50	0.2	0.16
Bluegill	10.5	7.09	2.1	1.76
Redear sunfish	0.0	0.00	0.0	0.00
Largemouth bass	27.0	9.95	23.7	10.70
Black crappie	0.0	0.00	0.0	0.00
Total	39.0		26.0	

sampling were the bluefin killifish and golden shiner. These species had average standing stocks in littoral blocknets of 36,500 and 4,100 fish/ha, respectively (Table 144). No gillnets were set in Watertown due to the abundance of alligators and their destructive behavior. The most abundant species collected using electrofishing were the golden shiner and mosquitofish with catch per unit efforts of 30 and 4.5 fish per hour, respectively (Table 145). The first year growth of bluegill, redear sunfish and largemouth bass was 55, 67 and 166 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 402 harvestable bluegill, 13 harvestable redear sunfish and 26 harvestable largemouth bass per hectare (Table 7) in Watertown.

The fish population in Watertown was sampled with rotenone in 1975, 1976 and 1987 by the Florida Game and Fresh Water Fish Commission (Krummrich et al. 1987). Total fish biomass ranged from 92 to 197 kg/ha, which was less then the littoral estimate reported for this study (290 kg/ha, Table 144). This difference, however, is the result of a large population of golden shiners that was collected in our littoral blocknets (135 kg/ha of golden shiners, Table 144), but not in previous blocknet samples. Disregarding golden shiners, the fish population seems to have remained stable over the last 15 years.

Patrick

Location and Morphology

Patrick is located in Polk County, Florida (Latitude 27.48 N; Longitude 81.30 W). The lake lies in the Eastern Complex of the Central Ridge subdivision of the Lake Wales Ridge division of the Central Lake District (Brooks 1981). The geology is dominated by beach and dune sand and deeply weathered coarse to fine sand with some clay lenses. Patrick was sampled from 1988 to 1989 and had a surface area, shoreline length, and mean depth of 159 ha, 4.65 km and 1.8 m, respectively (Table 1).

Trophic Status and Water Chemistry

Patrick had an average total phosphorus concentration of 10 µg/L, and an average total nitrogen concentration of 1808 µg/L. Total chlorophyll *a* concentrations averaged 5 µg/L and the water clarity as measured by use of a Secchi disc averaged 2.0 meters (Table 2). The lake had an average pH of 8.1 and an average total alkalinity of 58.9 mg/L as $CaCO_3$. The average specific conductance was 320 µS/cm @ 25 C and the average water color was

16 Pt-Co units. The adjusted chlorophyll *a* value for Lake Patrick was 15.5 µg/L. Using this value and the classification system of Forsberg and Ryding (1980), Patrick was classified as an eutrophic lake during this study.

Aquatic Plants

Patrick had a high abundance of aquatic macrophytes with a percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes of 93.3% and 42.1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 1.1, 0.4, and 1.3 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 21.4 mg chlorophyll *a*/cm^2 of host plant and 42.1 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected from Patrick. The most commonly encountered plant species were *Cladium jamaicense, Hydrilla verticillata,* and *Potamogeton illinoensis* , which occurred in 100%, 90% and 90% of the transects, respectively (Table 146).

In Lake Patrick, hydrilla was first reported in 1983 and levels increased from 1 to 76% coverage by 1985 (Porak et al. 1990). Floridone treatments reduced the coverage of hydrilla to 50% by 1988. The abundance of Illinois pondweed, however, was also high during this time with a frequency of occurrence of 34% (Porak et al. 1990). Thus, the fish population in Patrick during this study can be considered the product of an eutrophic lake with moderate to high levels of aquatic macrophytes.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Patrick was 49 individuals/kg wet wt of host plant and 0.06 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Patrick, as estimated with a ponar dredge, was 200 individuals/m^2 and 47.98 g wet wt/m^2, respectively (Table 5). The zooplankton population in Patrick was dominated by cladocerans and copepods with 175,000 and 163,000 individuals/m^3, respectively (Table 5).

Table 146. Occurrence of plant species in ten evenly-spaced transects around Lake Patrick.

Common name	Scientific name	Percent of the Transects
duck-potato	*Sagittaria lancifolia*	90
spatterdock	*Nuphar luteum*	50
fragrant water-lily	*Nymphaea odorata*	80
pickerelweed	*Pontederia cordata*	10
cat-tail	*Typha* spp.	50
water-pennywort	*Hydrocotyle umbellata*	10
hydrilla	*Hydrilla verticillata*	90
tapegrass	*Vallisneria americana*	50
cone-spur bladderwort	*Utricularia gibba*	10
Illinois pondweed	*Potamogeton illinoensis*	90
sawgrass	*Cladium jamaicense*	100
maidencane	*Panicum hemitomon*	70
	Fuirena sciropoidea	20

Fish

Twenty-five species of fish were collected from Patrick (Table 147, 148 and 149). The most abundant species collected with rotenone sampling were the mosquitofish and warmouth. These species had average standing stocks in littoral blocknets of 22,700 and 6,900 fish/ha, respectively (Table 147). The most abundant open-water species collected in the experimental gillnets were Florida gar and gizzard shad with 13 and 6.7 fish/net/24 hr, respectively (Table 148). The most abundant species collected using electrofishing were bluegill and largemouth bass with catch per unit efforts of 43 and 42 fish per hour, respectively (Table 149). The first year growth of bluegill, redear sunfish and largemouth bass was 60, 52 and 170 mm TL, respectively (Table 6). Mark-recapture estimates indicated that there were 1 harvestable bluegill and 34 harvestable largemouth bass per hectare in Lake Patrick (Table 7). We found no previous fisheries data for Lake Patrick.

(Text continued on page 337)

Table 147. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Patrick. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Longnose gar	4	4	0.0	0.03
Bowfin	4	4	3.3	3.28
Gizzard shad	0	0	0.0	0.00
Threadfin shad	0	0	0.0	0.00
Chain pickerel	165	4	14.5	1.95
Golden shiner	1585	247	4.6	1.30
Lake chubsucker	432	226	19.5	17.47
Yellow bullhead	99	49	2.0	1.77
Brown bullhead	136	65	3.6	1.35
White catfish	62	56	0.5	0.39
Tadpole madtom	1383	785	2.4	1.19
Golden topminnow	74	43	0.1	0.09
Bluefin killifish	325	272	0.1	0.07
Mosquitofish	22654	9854	7.1	3.19
Brook silverside	66	36	0.1	0.08
Bluespotted sunfish	3573	2168	1.7	1.10
Warmouth	6858	2604	25.0	12.61
Bluegill	2363	202	22.8	8.50
Dollar sunfish	25	25	0.1	0.15
Redear sunfish	5298	1110	36.0	6.49
Spotted sunfish	758	428	4.5	2.26
Largemouth bass	309	33	17.4	4.41
Black crappie	1634	307	7.8	3.28
Swamp darter	0	0	0.0	0.00
Total	47807		173.1	

Table 147. (Continued)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Open-water nets (n=3) for total fish				
Longnose gar	0	0	0.0	0.00
Bowfin	0	0	0.0	0.00
Gizzard shad	99	99	0.1	0.12
Threadfin shad	25	7	0.0	0.01
Chain pickerel	45	18	4.8	0.70
Golden shiner	4	4	0.0	0.00
Lake chubsucker	12	12	2.2	2.18
Yellow bullhead	0	0	0.0	0.00
Brown bullhead	4	4	0.0	0.00
White catfish	0	0	0.0	0.00
Tadpole madtom	0	0	0.0	0.00
Golden topminnow	0	0	0.0	0.00
Bluefin killifish	0	0	0.0	0.00
Mosquitofish	15129	7963	4.7	2.55
Brook silverside	1219	643	1.6	0.50
Bluespotted sunfish	424	246	0.4	0.25
Warmouth	2100	1031	3.9	2.66
Bluegill	3413	1131	25.0	7.65
Dollar sunfish	0	0	0.0	0.00
Redear sunfish	3450	1185	8.2	1.90
Spotted sunfish	0	0	0.0	0.00
Largemouth bass	247	77	35.3	8.91
Black crappie	66	29	4.4	4.22
Swamp darter	1095	974	0.4	0.37
Total	27330		91.1	

Table 147. (Concluded)

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for harvestable fish				
Chain pickerel	21	4.1	8.1	0.92
Yellow bullhead	4	4.1	1.4	1.44
Brown bullhead	8	8.2	1.3	1.25
White catfish	0	0.0	0.0	0.00
Warmouth	54	22.9	6.7	3.14
Bluegill	86	62.2	9.1	6.50
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	70	35.2	11.5	5.98
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	33	10.9	13.3	5.53
Black crappie	8	8.2	2.2	2.17
Total	284		53.6	
Open-water nets (n=3) for harvestable fish				
Chain pickerel	8	4.1	2.3	1.14
Yellow bullhead	0	0.0	0.0	0.00
Brown bullhead	0	0.0	0.0	0.00
White catfish	0	0.0	0.0	0.00
Warmouth	0	0.0	0.0	0.00
Bluegill	82	35.2	9.1	4.13
Dollar sunfish	0	0.0	0.0	0.00
Redear sunfish	12	0.0	1.4	0.20
Spotted sunfish	0	0.0	0.0	0.00
Largemouth bass	99	25.7	27.9	8.11
Black crappie	21	20.6	4.2	4.24
Total	222		45.0	

Table 148. Experimental gillnet (five 10-long sections of 1.9, 2.5, 3.8, 5.1, and 6.4 cm bar mesh, which were 2.4 meter deep) catch per unit effort estimates of total and harvestable fish number (number/net/24 hr) and weight (kg/net/24 hr) for Patrick. Mean values for experimental gillnets are listed by species with the corresponding standard error of the mean.

Common Name	Fish number (number/net/24 hr)	Standard Error	Fish weight (kg/net/24 hr)	Standard Error
Gillnets (n=3) for total fish				
Florida gar	13.0	4.00	5.1	0.82
Gizzard shad	6.7	3.38	3.3	1.66
Chain pickerel	2.7	1.20	0.7	0.32
Lake chubsucker	0.3	0.33	0.0	0.03
Warmouth	2.3	1.33	0.2	0.14
Bluegill	1.0	0.58	0.1	0.07
Largemouth bass	5.0	1.00	2.0	0.61
Black crappie	0.7	0.67	0.2	0.19
Total	31.7		11.7	
Gillnets (n=3) for harvestable fish				
Chain pickerel	1.3	0.33	0.5	0.21
Warmouth	1.3	0.88	0.2	0.11
Bluegill	0.7	0.33	0.1	0.06
Largemouth bass	3.7	0.67	1.8	0.55
Black crappie	0.3	0.33	0.2	0.19
Total	7.3		2.8	

Table 149. Electrofishing catch per unit effort estimates of total and harvestable fish number (number/hr) and weight (kg/hr) for Patrick. Mean values are listed by species with the corresponding standard error of the mean.

Common Name	Number (number/hr)	Standard Error	Weight (kg/hr)	Standard Error
Electrofishing runs (n=6) for total fish				
Florida gar	24.0	5.6	7.9	2.7
Bowfin	4.0	2.0	6.4	3.3
Chain pickerel	16.0	3.3	4.7	1.0
Golden shiner	14.0	6.3	0.1	0.0
Lake chubsucker	9.0	3.0	3.1	1.1
Yellow bullhead	1.0	1.0	0.7	0.7
Golden topminnow	1.0	1.0	0.0	0.0
Mosquitofish	1.0	1.0	0.0	0.0
Warmouth	1.0	1.0	0.1	0.1
Bluegill	43.0	9.5	1.0	0.3
Redear sunfish	14.0	6.3	0.6	0.4
Largemouth bass	42.0	9.7	13.1	3.3
Total	170.0		37.56	
Electrofishing runs (n=6) for harvestable fish				
Chain pickerel	9.0	1.34	4.0	0.87
Yellow bullhead	1.0	1.00	0.7	0.68
Warmouth	1.0	1.00	0.10	0.08
Bluegill	3.0	1.34	0.4	0.20
Redear sunfish	4.0	2.97	0.5	0.35
Largemouth bass	22.0	4.00	12.0	2.67
Total	40.0		17.6	

Orienta

Location and Morphology

Orienta is located in Seminole County, Florida (Latitude 28.39 N; Longitude 81.22 W). The lake lies in the Casselberry-Oviedo-Geneva-Chuluota Hills division of the Central Lakes District (Brooks 1981). The geology is dominated by sand, silty sand, and phosphatic clays of the Hawthorne Formation. Orienta was sampled from 1988 to 1989, and had a surface area, shoreline length, and mean depth of 52 ha, 6.26 km and 3.4 m, respectively (Table 1).

Trophic Status and Water Chemistry

Lake Orienta is an eutrophic lake. Orienta had an average total phosphorus concentration of 25 µg/L and an average total nitrogen concentration of 448 µg/L during this study. Total chlorophyll *a* concentrations averaged 9 µg/L and the water clarity as measured by use of a Secchi disc averaged 2.2 m (Table 2). The lake had an average pH of 6.8 and an average total alkalinity of 6.6 mg/L as $CaCO_3$. The average specific conductance was 114 µS/cm @ 25 C and the average water color was 17 Pt-Co units.

Aquatic Plants

Due to the addition of grass carp for aquatic macrophyte control in 1980, Lake Orienta had a low abundance of aquatic macrophytes. The percent area coverage (PAC) and percent volume infested (PVI) with aquatic macrophytes were < 1%, respectively (Table 3). The average above-ground biomass of emergent, floating-leaved and submersed vegetation was 0.5, 0 and 0 kg wet wt/m^2, respectively (Table 3). The average epiphytic algal concentration associated with the aquatic macrophytes was 4.6 mg chlorophyll *a*/cm^2 of host plant and 4.8 mg chlorophyll *a*/kg wet wt of host plant (Table 3). Thirteen species of aquatic macrophytes were collected from Orienta. The most commonly encountered plant species were *Salix* spp., *Hydrocotyle umbellata* and *Panicum repens* , which occurred in 80%, 20% and 20% of the transects, respectively (Table 150).

In 1979, hydrilla was the dominant aquatic macrophyte in Lake Orienta averaging 0.1 kg/m^2 (Osborne et al. 1982). After the addition of grass carp in 1980, hydrilla and other submersed vegetation was eliminated by the end of 1981 to present. Thus, the fish

Table 150. Occurrence of plant species in ten evenly-spaced transects around Lake Orienta.

Common name	Scientific name	Percent of Transects
alligator-weed	*Alternanthera philoxeroides*	10
bacopa	*Bacopa monnieri*	20
baby-tears	*Micranthemum umbrosum*	10
cat-tail	*Typha* spp.	10
water-pennywort	*Hydrocotyle umbellata*	20
elephant-ear	*Colocasia esculenta*	20
water primrose	*Ludwigia octovalis*	20
buttonbush	*Cephalanthus occidentalis*	10
willow	*Salix* spp.	80
sawgrass	*Cladium jamaicense*	10
para grass	*Brachiaria mutica*	10
torpedograss	*Panicum repens*	20
.	*Fuirena sciropoidea*	20

population in Lake Orienta during this study can be considered the product of an eutrophic lake with low levels of aquatic vegetation.

Invertebrates

The average number and biomass of epiphytic macroinvertebrates in Orienta was 63 individuals/kg wet wt of host plant and 0.32 g wet wt/kg wet wt of host plant (Table 5). Average number and biomass of benthic macroinvertebrates in Orienta, as estimated with a ponar dredge, was 273 individuals/m^2, and 830 g wet wt/m^2 (Table 5). The zooplankton population in Lake Orienta was dominated by rotifers and cladocerans with 103,000 and 39,200 individuals/m^3, respectively (Table 5).

Fish

Seventeen species of fish were collected from Orienta (Table 151, 152, and 153). The most abundant species collected with rotenone sampling were threadfin shad and bluegill. These species had average standing stocks in littoral blocknets of 2,600 and 1,200 fish/ha, respectively (Table 151). The most abundant **(Text continued on page 342)**

Table 151. Blocknet-rotenone estimates of total and harvestable fish stock (number/hectare) and standing crop (kg/hectare) for Orienta. Mean values for littoral and open-water nets are listed by species with the corresponding standard error of the mean.

Common Name	Stock (number/ha)	Standard Error	Standing Crop (kg/ha)	Standard Error
Littoral nets (n=3) for total fish				
Bowfin	0	0	0.0	0.00
Gizzard shad	296	169	126.8	79.84
Threadfin shad	2643	2569	3.3	3.21
Grass carp	8	8	29.6	29.60
Yellow bullhead	8	4	0.1	0.04
White catfish	8	8	1.7	1.73
Seminole killifish	25	14	0.1	0.09
Sailfin molly	12	12	0.2	0.19
Brook silverside	86	58	0.1	0.07
Bluespotted sunfish	4	4	0.1	0.06
Warmouth	37	26	0.9	0.52
Bluegill	1161	402	32.6	14.77
Redear sunfish	268	61	26.3	6.78
Largemouth bass	132	36	9.7	4.59
Black crappie	4	4	0.5	0.54
Total	4693		232.1	
Littoral nets (n=3) for harvestable fish				
Yellow bullhead	0	0.0	0.0	0.00
White catfish	4	4.1	1.7	1.72
Warmouth	4	4.1	0.4	0.42
Bluegill	177	103.9	14.9	8.42
Redear sunfish	189	50.1	24.7	6.59
Largemouth bass	21	10.9	7.0	3.91
Black crappie	4	4.1	0.5	0.54
Total	399		49.4	