RESOURCE PARTITIONING AMONG CENTRARCHIDS
IN COPAN RESERVOIR

By

SUSAN LYNN MEARNS

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

1979

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE
December, 1985

RESOURCE PARTITIONING AMONG CENTRARCHIDS

IN COPAN RESERVOIR

Thesis Approved:

Larry G. Talent
Thesis Adviser

Rudolph J. Miller

O. Eugene Maughan

Norman N. Durham
Dean of Graduate College

PREFACE

This thesis is submitted to the faculty of the Graduate College of Oklahoma State University in partial fulfillment of the requirements for the degree of Master of Science in Zoology (Fishery Biology). The research project was funded through the Oklahoma Cooperative Fish and Wildlife Unit by the Oklahoma Department of Wildlife Conservation. Funds were made available as part of D-J Federal Aid to Factors Influencing Fish Populations in Oklahoma Lakes and Ponds Project F-41-R-6, Job 9. This thesis is written in the format required for manuscripts submitted to the journal Copeia.

I wish to express my appreciation to O.E. Maughan, R.J. Miller, and L.G. Talent for serving as my committee members and providing me with advice and supervision. I would also like to thank W.D. Warde for sharing his computer language (SAS) expertise with me.

My research could not have been conducted without the assistance that M.A. England, M.Y. Knapp, and D.D. Oakey provided during the course of this study.

Finally, special gratitude is expressed to S.C. Leon for his continual guidance in the field, his assistance in preparing this manuscript and his belief that I would succeed.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

INTRODUCTION

Midwestern crappie populations (Pomoxis annularis and P. nigromaculatus) are typically stunted (Cooper et al. 1970, Al-Rawi 1972, Johnson and Andrews 1973), and several theories have been proposed to explain this phenomenon. Over-harvesting of larger size classes by anglers (Elrod 1971), genetic deviations resulting in smaller size classes, and interspecific competition for resources (Costa and Cummins 1972) are current hypotheses used to explain stunting. I attempted to examine the relationship between resource availability and resource utilization of certain centrarchid species and interpret these results based on interspecific and intraspecific competition between crappie and other centrarchids.

During early impoundment, black crappie (Pomoxis nigromaculatus) populations are often the dominant crappie species (Ball and Kilambi 1972), but as midwestern impoundments age, the density of black crappie decreases, and white crappie (Pomoxis annularis) usually become dominant (Neal 1960). Increased turbidity (Neal 1960, Neal 1961) and decreased productivity (Ball and Kilambi 1972) are possible explanations for the phenomenon, but competitive exclusion (Zaret and Rand 1982) may be an alternate explanation.

Several studies have been conducted on the food habits of black and white crappie (Clemens 1952, Greene and Murphy 1974, Ager 1975, Wright and O'Brien 1982), but few studies have examined food habits in relation to resource availability. Relating resource availability to food habits is required before any conclusions on competitive interactions can be made.

Evaluating species interactions requires understanding of the species niche. Hutchinson (1958) formulated the concept of a niche as an n-dimensional hypervolume whose axes are critical physical and environmental factors. At least three dimensions of this niche have been studied extensively; place, food and time (Pianka 1969, Zaret and Rand 1971). MacArthur (1957) implied that food determines the abundance of all species because it is the only resource utilized by all species that is incapable of being shared. In support of this hypothesis, it has been shown that species sharing similar habitats have the most distinct food preferences (Zaret and Rand 1971). Partitioning may occur by utilizing the same resource at different times (different hours of the day, different seasons) or at dissimilar sizes.

Examining the niche overlap between species is necessary before one can decide whether partitioning of resources has occurred. Zaret and Rand (1971) defined niche overlap as the use (usually at the same time) by more than one organism of the same resource, regardless of resource abundance. Partitioning of a resource could be interpreted as a consequence of resource competition. Competition has been defined by Milne (1961) as the endeavor of two or more animals to gain the same particular object or to gain a portion of the object when that object is not sufficient for both. Miller (1967) differentiated between competition as the co-utilization of the same resource, and interference competition as an activity that limits a competitor's access to a necessary resource.

One common method used by organisms to partition resources and avoid competition is to occupy different habitats. However, before one can demonstrate that competition is responsible for the distribution of species, it is necessary to prove that distributions are not random (Conner and Simberloff 1979).

The organization within a community is based upon the numerical abundance and spatial distribution of all species. These factors can be the result of interspecific competition (Hairston 1959). The influence of spatial distribution has been demonstrated by the clumping of rare species, and the associated failure of diversity indices to remain constant when sample size was increased (Hairston and Byers 1954).

Originally, interspecific competition was equated with ecological overlap between species niches, including similarity of diet, habitat use or time of foraging. One defect in this concept is that simply sharing resources may not limit population growth or density (Bender et al. 1984). I attempted to relate dietary overlap with the spatial distributions of centrarchids by examining food habits as they corresponded to resource availability.

Species diversity of food utilized reflects not only the diversity of resources (Roughgarden 1974) but the niche width or breadth relative to resources utilized by the entire population. Niche breadth is defined as the distance through the niche along some line in space (Smith 1982). The primary function of niche breadth is as an inverse measure of ecological specializations. Measures of niche breadth have been used to determine resource partitioning; for example, smaller animals have also been shown to exhibit greater diet specialization than larger animals (Emlen 1973), and wide-niched species are thought to be better adapted to certain environments (Levins 968). If a specific resource becomes limited, species with specialized diets would probably not adapt as well as generalists. Examining the diets of certain species in Copan should indicate whether the fishes were specialists or generalists, and consequently whether they would be expected to survive should resources become limited.

STUDY AREA

Copan Reservoir was constructed by the Tulsa District, Corps of Engineers, in 1980, under authorization of the Flood Control Act of 1962. The dam is located on the Little Caney River in Washington County, two miles southwest of Copan, Oklahoma, at river mile 7.4. The dam consists of an earthen embankment and a grated concrete spillway, with a combined length of 1.5 miles.

The Little Caney River is a 69-mile tributary of the Caney River, in the Verdigris River watershed, which flows through southeastern Kansas and northeastern Oklahoma. The watershed is approximately 40 miles long with a maximum width of 16 miles. The terrain is rolling, with moderate timber and heavy growth along the river banks. The drainage basin contains 520 square miles, 505 of which are upstream of the damsite.

Copan dam was closed on 1 April 1983. Three days later, the reservoir reached its mean conservation pool elevation of 710.0 ft. above sea level. At this level, the reservoir had a storage capacity of 43000 acre-feet, a surface area of 5000 acres, and 30 miles of shoreline.

MATERIALS AND METHODS

Biweekly sampling was initiated in May 1983 and continued through October 1984. This year-and-one-half time period was separated into seasons: spring -March, April, May; summer -June, July, August; fall -September, October, November; winter -December, January, February. Occasionally, additional collections were made in the fall season 1984 to corroborate previous findings.

Five major sections of differing habitat characteristics exist in the reservoir (Figure 1). Section I consists of the shoreline and pelagia in association with the dam. Section II has several woody areas in addition to a pelagic environment. Section III encompasses two protected coves. Section IV is a heavily forested area, through which the Little Caney River meanders. Section V is a shallow, windswept portion of the reservoir characterized by high turbidity.

Once each month five standard sites and five random sites were sampled. The five standard sites (Figure 1) were selected based on habitat diversity and fish species diversity. Random sites were selected by using a random numbers table (Rohlf and Sokal 1969).

Sampling equipment used included barrel nets (cylindrical nets with concave funnel ends 0.2 m in diameter, 1.4 m in length and 0.9 m diameter), modified fyke nets with a 20 m lead attached to two rectangular frames, 1.83 m x 0.91 m, followed by four hoops (0.76 m diameter), experimental gill nets (multifilament nylon mesh, 45.72 m in length, 2.44 m deep, with five panels each 9.14 m long, with mesh sizes: 1.91, 2.54, 3.18, and 5.08 centimeters (cm)), and electroshocking with a 16-foot aluminum jon boat equipped with a Sears 3000 watt generator and Coffelt VVP-15 voltage regulator.

Several types of sampling gear were employed at each site to reduce sampling bias. Each month, generally one gill net and one fyke net were set at each site. During the winter season three barrel nets were set in each area of the reservoir that was sampled. Barrel nets were used in the winter because their design facilitated setting and retrieving these nets under ice. Barrel nets were the principle sampling method utilized during 1983, and were retrieved at two-hour intervals. Modified fyke nets were anchored offshore, with the lead line stretching perpendicular to the shoreline. Catch was monitored at six-hour intervals during the day and once after each night set. Experimental gill nets, set perpendicular to shore, were used in the pelagic areas. Larger mesh sizes were located in deeper water, and gill nets were checked at twelve-hour intervals. The modified fyke nets and gill nets were employed in 1984, and electroshocking was also initiated during 1984.

All fishes collected were weighed to the nearest gram (gm) and measured (total and standard lengths) to the nearest millimeter (mm). Scale samples were collected from the left side of each fish, posterior to the depressed pectoral fin and below the lateral line. A random subsample of fishes were preserved; all others were returned to the reservoir. In addition to these measurements, gape width (measured from maxilla to maxilla) and body depth were recorded to the nearest 0.01 mm.

During 1983, stomachs were removed in the field by making a posterior cut at the esophagus and an anterior cut at the intestine.

Stomachs were initially placed in 10% formalin and later transferred to 70% isopropyl alcohol. Food items were enumerated and classified to the lowest taxonomic unit I could identify. Following identification, each item was dried at 80°C for six to eight hours, and dry weights were measured to the nearest 0.0001 gm.

Fishes collected during 1984 were injected in the field with 10 cc of 10% formalin and preserved in a formalin solution. Stomachs were removed in the lab following the same procedure outlined above.

Size classes were used to differentiate the size structure of the population. Each of the nine size classes was determined using 30 mm increments of the fishes standard length. Therefore, fishes collected and compared ranged in size from 0-30 mm to 241-270 mm. All species were not represented in every size class at similar times.

Plankton samples from 10 vertical m of water were collected at each site with an 80 micron-mesh plankton sampler during each field trip and preserved in Lugol's solution (Pennack 1978). Biomass was estimated by filtering each sample through a Millipore Filter, drying the filtrate at 50°C for a minimum of three hours, then weighing the dried material.

Benthic organisms were collected with an Ekman dredge during 1983 and a Petersen dredge in 1984. Samples were preserved in 70% isopropyl solution. Subsamples of each dredge haul were obtained by sorting the sample for 10-minute time increments until the entire dredge haul was completely sorted. Organisms found in the subsample were counted and identified.

Physical parameters including dissolved oxygen, temperature, salinity, and conductivity, were measured using YSI meters at the location of each net. The pH was measured using a Corning pH meter.

The Schoener index of overlap was used to measure overlap between the diets of centrarchids. This index avoids the problems of the indexes of Horn and Levins in that values generated are not dependent upon the proportion of food in a certain category that one species ingests when that particular category is not utilized by other species (Wallace 1981). When resource availability data is absent, the Schoener index is considered adequate as a measure of potential overlap (Hurlbert 1978), and therefore one of the least objectionable indexes available (Wallace 1981). Since resource abundance data was collected during this study, and the assumption was made that abundance approximates availability, the Schoener index was chosen as an acceptable index to measure potential overlap among centrarchids in Copan Reservoir.

The Schoener index of overlap is expressed as

$$\alpha = 1-0.5 \left(\sum_{i=1}^{n} |p_{xi} - p_{yi}| \right)$$

where p_{xi} = the proportion of food category i in the diet of species x,

p_{yi} = the proportion of food category i in the diet of species y, and

n = the number of food categories.

Overlap values of 0.60 or greater were judged biologically significant, based on work by Zaret and Rand (1971). An overlap value of 1.00 usually indicates complete overlap among organisms.

The average of the weight percentage of ingested items was used to measure diet. This measure was used to determine the values substituted for p_{xi} and p_{yi} in the Schoener index, and to evaluate the importance of certain components of a diet, even though they were a small proportion of the total weight. The two items with the highest average weights were designated important (Tables 10-18), and were of primary interest in determining dietary overlap.

RESULTS AND DISCUSSION

SPECIES FOOD HABITS AND DISTRIBUTION

The contents of 1718 stomachs were examined from May 1983 to October 1984. Food was present in 63.45% of the stomachs (Table 1).

Green sunfish (Lepomis cyanellus) ingested mostly shrimp and crayfish, notably Macrobrachium ohione and Orconectes neglectus and bluegill, Lepomis macrochirus (Table 2). Fish in the smallest size class (91-120 mm) ingested M. ohione in large numbers (Figure 3), and bluegill were preyed upon by all size classes (Table 2). These dietary habits differ little from those previously recorded. Green sunfish have been reported to feed on benthos (Jones et al. 1977), frogs including Rana spp., the striped chorus frog (Pseudacris triseriata), and the spadefoot toad (Scaphiopus bombifrons) (Kruse and Francis 1977), drifting macroinvertebrates (Mancini et al. 1977), aquatic insects, clams, crayfish and fish (Cross and Collins 1975, Pflieger 1975, Minckley 1982), and bats (Jones and Hettler 1959). The specific prey item ingested is dependent upon the foraging site used by the fish (Gatz 1981).

Green sunfish were primarily collected from site III (Figure 2), a protected cove characterized by a silty substrate and submerged vegetation. Habitats consisting of rocks, woody debris or stems of vegetation which are used for cover are known habitat types where green sunfish occur (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975).

Warmouth sunfish (Lepomis gulosus) ingested similar items to those taken by green sunfish (Tables 2,3) but the size classes of fishes taking each item differed (Figure 3). Warmouth ingested crayfish, small fish and larval aquatic insects in Copan (Table 3). Young warmouth have been reported to take mostly Crustacea, primarily Daphnia (Pflieger 1975), whereas the adults feed on crayfish, Isopoda, immature and adult aquatic insects (Minckley 1973, Cross and Collins 1975, Miller and Robison 1975).

Warmouth sunfish were found in sites I, II, and III and were the predominant species collected from site II which, as previously described, had submerged bushes, shrubs and trees in addition to a rubble substrate. Warmouth select thick growths of submergent vegetation associated with soft mud bottoms (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975, Trautman 1981) and tend to be sedentary and avoid light (Cross and Collins 1975, Pflieger 1975). These preferred habitats differ from those selected by other sunfish, and limit interactions between warmouth and other species.

Relatively few orangespotted sunfish (Lepomis humilis) were collected from Copan Reservoir (Table 1), and these individuals consumed largely larval aquatic insects (Table 4). Other authors have reported that orangespotted sunfish ingest small Crustacea, larval aquatic insects and an occasional small fish (Cross and Collins 1975, Pflieger 1975).

In Copan, orangespotted sunfish were found at site I, an area characterized by a silted rocky substrate. Low numbers of individuals were also collected at sites II, III, and V (Figure 2). Site II was characterized by submerged vegetation along the shoreline and a rubble substrate. Site III was an area of the reservoir that contained two protected coves, one of which stratifies during the summer seasons. Site V was shallow, turbid and windswept with submerged vegetation and aquatic macrophytes in abundance. Orangespotted sunfish tolerate high turbidity and siltation (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975, Trautman 1981), and are tolerant of fluctuating water levels (Cross and Collins 1975).

Most of the bluegill collected in Copan preyed predominately upon benthic organisms, Lumbricidae, and Arachnida (Table 5). The high incidence of ingested Lumbricidae may be attributable to the young age of Copan. As Copan flooded, terrestrial invertebrates became an available resource utilized by certain species of centrarchids. Copan was constructed for flood control purposes; consequently, the reservoir floods each spring, contributing additional sources of terrestrial invertebrates to the aquatic benthos already present. Bluegill are known to be opportunistic feeders which ingest such items as Cladocera, benthos (Gerking 1966, Costa and Cummins 1972, O'Brien et al. 1976, Lemly and Dimmick 1982), Amphipoda, Diptera (Flemer and Woolcott 1966, El-Shamy 1974, Cross and Collins 1975, Mancini et al. 1979, Minckley 1982), and vegetation and prey in direct association with vegetation (Clay 1973, Sadizowski and Wallace 1976, Mittelbach 1981).

Bluegills were found throughout the reservoir (Figure 2). Other authors have reported that bluegill sunfish occur in habitats that are characterized by submerged vegetation and steep sides (Cross and Collins 1975, Pflieger 1975).

Longear sunfish (Lepomis megalotis) in Copan Reservoir fed primarily on bottom organisms, including larval and adult aquatic insects and crayfish (Table 6 and Figure 4). Others have reported that the diet of the longear sunfish consists of insects (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975), small invertebrates and an occasional small fish (Miller and Robison 1975, Pflieger 1975).

Site I, where most of the longears were collected, was a windswept portion of the reservoir, characterized by intermittent willow shrubs and a rocky substrate covered by a fine layer of silt. The weedy areas interspersed throughout site I, where this species was collected (Figure 2), were habitats supporting high densities of larval and adult aquatic insects. Clear waters with either a sandy, firm clay or rock substrate are preferred by longear sunfish (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975, Trautman 1981).

Redear sunfish (Lepomis microlophus) ingested a variety of prey organisms, including Cladocera and aquatic organisms in Copan (Table 7) but foraged mostly on bottom dwellers such as Lumbricidae, snails and crayfish (Figure 5). This species typically feeds on molluscs (Cross and Collins 1975, Miller and Robison 1975, Pflieger 1975, Minckley 1982) and has heavy pharnygeal bones armed with blunted molariform teeth that aid in crushing shells (Minckley 1982).

Redear sunfish occurred almost exclusively at site III (Figure 2). This site includes Endacott's Pond (Figure 1), an impoundment constructed in the 1950's which contained an established centrarchid population prior to inundation. Endacott's Pond was the only area of the reservoir that stratified each summer. The substrate consisted of silt in the deeper water and submerged vegetation along the shoreline and in the center of the pond where an island once existed. This species is typically found inhabiting the deeper waters of lakes and ponds, often congregating around brush and stumps (Miller and Robison 1975, Pflieger 1975).

White crappie were one of the predominant species of Centrarchidae present in Copan (Table 1) during 1983-1984 and fed predominately on gizzard shad (Dorosoma cepedianum) and centrarchids (Table 8). White crappie (91-120 mm) fed on gizzard shad consistently (Figure 6); and during the spring season of 1984, white crappie in the 61-90 mm size class ingested some larval gizzard shad. White crappie are known predators of insects, Ephemeroptera, Crustacea (Clemens 1952, Marcy 1954, Neal 1960, Mathur and Robins 1971, Costa and Cummins 1972, Wright and O'Brien 1982), Amphipoda, Chironomidae, Chaoboridae, Hirudinia (Maret and Peters 1979), and either gizzard shad or threadfin shad (Dorosoma Petenense (Hall as cited in Clemens 1952, Buck and Cross as cited in Clemens 1952, Ball and Kilambi 1972, Greene and Murphy 1974, Heidinger 1978).

More white crappie were found at sites I, III and V than at sites II and IV in Copan (Figure 2). The season during which the individuals were collected was an important factor in locating these fishes. During late spring and early summer, site V was used for spawning activities. Fishes collected from this site were gravid and found in shallow vegetated water. Site III was an area inhabited by young of the year and larvae in the summer season. The protection of the cove in combination with submerged vegetation afforded cover for immature fishes. During the remainder of the year, white crappie were found in the pelagia. The white crappie is usually found in deeper water (Ball and Kilambi 1972) but occurs throughout most reservoirs (Clemens 1952).

Black crappie in Copan fed on the same items as white crappie but ingested centrarchids (*Lepomis* spp. and *Pomoxis* spp.) with greater frequency than gizzard shad (Table 9). The diet of black crappie has been reported to include Cladocera, Copepoda, Amphipoda (Neal 1961, Ager 1971, Costa and Cummins 1972, Hanson and Qadri 1979), Crustacea, terrestrial and aquatic insects (Neal 1961, Ball and Kilambi 1972, Greene and Murphy 1974, Minckley 1982) and fish (Neal 1961, Ager 1971, Ball and Kilambi 1972).

In Copan, black crappie were collected from all sites, but the largest percentage of fishes was collected from site III (Figure 2), an area of the reservoir characterized by both a silty and vegetated substrate. This diverse site was protected from the wind because of its east-west orientation and a breached dam between it and the main body of the reservoir (Figure 1). Black crappie usually occur along the shoreline (Neal 1961, Ball and Kilambi 1972), as well as in the pelagic areas of other reservoirs (Ager 1971).

In most reservoirs where black crappie and white crappie coexist, they appear to have similar food habits (Neal 1960, Neal 1961, Ball and Kilambi 1972, Costa and Cummins 1972). However, in Copan, white crappie fed on gizzard shad at a smaller size class than did black crappie (Figure 6). In addition, black crappie (greater than 61 mm) which are typically piscivorous, used other dietary sources more extensively than gizzard shad (Table 9). It did not appear that food resources used by both black and white crappie were limiting.

Benthic organisms found in Copan Reservoir during 1983-1984 consisted primarily of larval aquatic insects. Snails, earthworms and trichopterans were also available as forage (Table 10). The resources used as forage in Copan Reservoir were abundant throughout this study.

Therefore, all the species of centrarchids appeared to use a non-limited food supply, whether they ingested the same or different items.

Copan Reservoir is unique, with many diverse habitat structures available for utilization by many different species of fishes. Each of the five broad areas designated (Figure 1) have different habitat characteristics. Site I was located in front of the dam, and the substrate consisted of silt in the pelagia and rocks in the littoral zone. Site II had submerged bushes, shrubs and trees, in addition to a rubble substrate. Site III contained Endacott's Pond, a unique cove that was the only area of the reservoir to stratify (both temperature and dissolved oxygen) in the summer. Site IV consisted of flooded timber and the Little Caney River channel. Site V was a shallow, turbid and windswept area of the reservoir.

There were distinct spatial distributions of certain centrarchids. Orangespotted sunfish and longear sunfish were collected primarily from site I, warmouth from site II and green sunfish and redear sunfish from site III (Figure 2). Assuming that resource abundance was equivalent to availability, it is improbable that the dietary resources in Copan during this study were responsible for the segregation of certain species.

The physical parameters measured (dissolved oxygen, temperature, salinity, conductivity and pH) did not differ significantly between sites I and II during this study. The available habitat, then, could be responsible for the majority of longear sunfish and orangespotted sunfish found at site I, and the high incidence of occurrence of warmouth at site II. Preferences for structure and substrate, along with activity patterns displayed by the fishes, are reasonable theories useful in predicting where and when orangespotted sunfish, longear sunfish and warmouth can be found in Copan Reservoir.

Site III supported a large percentage of centrarchids during this study (Figure 2). Redear sunfish were found in deep water, typically near structure, while green sunfish were collected along the shoreline, also in association with structure. The diets of these two species did not differ significantly from the diets of the other centrarchids collected from this site and throughout the reservoir. Possibly these species encountered a habitat type which fit their requirements for depth and substrate. Since dietary resources were not limiting, segregation of species was probably habitat related in Copan Reservoir.

SIZE CLASS FOOD HABITS AND OVERLAP

All species of fishes between 0-30 mm and 31-60 mm fed primarily on Cladocera and benthic invertebrates (Tables 11,12). Fishes were identified as prey organisms in the diet of representatives of three species (green sunfish, warmouth and white crappie) of the 61-90 mm size class (Table 13). Bluegill sunfish (<u>Lepomis macrochirus</u>) were ingested by green sunfish and warmouth during the fall season of 1983 and the summer season of 1984, respectively. White crappie fed predominately on gizzard shad during the spring season of 1984.

During the summer and fall seasons of 1983 and the spring season of 1984, white crappie (91-120 mm) ingested gizzard shad (Table 14), as did warmouth during the summer of 1984. The other two species of piscivorous centrarchids, black crappie and green sunfish, ingested prey organisms belonging to the genus <u>Lepomis</u> during the fall of 1983 and summer of 1983, respectively. An increase in the occurrence of crayfish as a principle component of diet was noted for all species except blue gill, white crappie and black crappie in the 91-120 mm size class for the duration of this study (Table 14).

Earthworms (Lumbricidae) and larval and adult aquatic insects were present in the diet in the smaller size classes of all species (Tables 12-16) but decreased in importance for fishes of the 181-210 mm, 211-240 mm, and 241-270 mm size classes (Tables 17-19).

I made the assumption that resource abundance was equivalent to resource availability and that partitioning of a resource would not be expected unless that resource was limiting (MacArthur 1957). I selected as a standard of significance the one designated by Zaret and Rand (1971); values between 0.60 and 1.00. Significant overlap values were obtained for different size classes of the same species and between species.

Relatively few Schoener overlap values were biologically significant during the spring 1983 season (Table 20). Green sunfish (91-120 mm) and bluegill sunfish (61-90 mm) food habits overlapped. *Daphnia* accounted for the overlap in 1983 (Table 2) and chironomids contributed significantly to the overlap in 1984 (Table 5). Chironomidae were an abundant resource during the spring of 1984 (Table 10), and although both green sunfish and bluegill were predominately collected from site III (Figure 2), diet overlap probably did not limit these species. Green sunfish (181-210 mm) and white crappie (241-270 mm) food habits overlapped. The principal resource used by both green sunfish (Table 2) and white crappie (Table 8) was *Daphnia*. *Daphnia* was an abundant resource found throughout the reservoir (Table 10), and it is improbable that they were limiting. Longear sunfish (121-150 mm) and black crappie (151-180 mm) (Table 20) food habits overlapped. Chironomidae were responsible for the overlap values between longears (Table 6), and both black crappie (Table 9), and white crappie (Table 8). The abundance of chironomids (Table 10) lessens the probability that their usage would limit these species.

The incidence of biologically significant values increased during the summer 1983 season (Table 21). Significant overlap occurred between warmouth (121-150 mm and 151-180 mm) and between orangespotted sunfish (61-90 mm) and longear sunfish (61-90 mm and 91-120 mm). Chironomidae were an abundant resource at site I during the spring of 1983 (Table 10), and both longears and orangespots predominated at this site (Figure 2). Significant overlap also occurred between bluegill sunfish (61-90 mm) and longear sunfish (61-90 mm and 91-120 mm). Bluegills (61-90 mm) also overlapped with orangespots (61-90 mm). Overlap also occurred between bluegills (91-120 mm with 121-150 mm), redears (121-150 mm with 151-180 mm), and white crappie (91-120 mm with 121-150 mm and 151-180 mm with 151-180 mm). White crappie (61-90 mm) also overlapped (0.72) with black crappie (91-120 mm).

Black crappie and white crappie overlapped in diet significantly during the summer (Table 21) and fall seasons of 1983 (Table 22), and during the spring (Table 24) and summer seasons of 1984 (Table 25). The most common dietary items ingested by both species were Chaoboridae, Chironomidae, _Daphnia_, _Dorosoma cepedianum_, and _Pomoxis_ spp. (Tables 8,9). Chaoborids, chironomids and, to some extent, _Daphnia_ were abundant throughout this study (Table 10). _Dorosoma cepedianum_ was also abundant (personal observation) and heavily utilized by all predators. _Pomoxis_ spp. occurred in the diets only after spawn (Tables 8,9). Since the resources which accounted for the significant degree of overlap were abundant, it seems probable that black crappie and white crappie were not limited by forage.

During the fall season of 1983, intraspecific overlap became even more pronounced (Table 22). Green sunfish in the 61-90 mm size class overlapped with those in the 151-180 mm size class; bluegills in the 61-90 mm size class overlapped with those in the 91-120 mm and 121-150 mm size classes. White crappie in the 31-60 mm size class overlapped with those in the 61-90 mm size class and white crappie in the 91-120 mm size class overlapped with those in the 151-180 mm, 181-210 mm, and 211-240 mm size classes. White crappie in the 151-180 mm size class overlapped with both those in the 181-210 mm and those in the 211-240 mm size classes, and white crappie in the 181-210 mm size class overlapped with those in the 211-240 size class, black crappie in the 61-90 mm size class overlapped with those in the 91-120 mm size class.

Interspecifically, biologically significant overlap occurred between bluegills 31-60 mm and longears 91-120 mm, between longears 91-120 mm and white crappie 0-30 mm, and between white crappie and black crappie in the following size classes: white crappie 31-60 mm with black crappie 61-90 mm, and white crappie 61-90 mm with black crappie 61-90 mm and 91-120 mm.

During the summer (Table 21) and fall seasons of 1983 (Table 22), the food habits of longear sunfish overlapped with those of bluegill sunfish. The majority of longear sunfish collected from Copan Reservoir came from site I, whereas the majority of bluegill collected were from site III (Figure 2). Therefore, although overlap values were significant, it is improbable that these two species competed for forage.

Complete overlap values (1.00) occurred between white crappie in the 181-210 mm size class and white crappie in the 211-240 mm size class in the winter season of 1983-1984 (Table 22). Bluegills significantly overlapped (0.73) between the 91-120 mnm and the 121-150 mm size classes (Table 23).

There were 37 biologically significant overlap values in spring 1984 (Table 24), 20 of which involved intraspecific overlap. These overlaps were between the 121-150 mm and the 151-180 mm size classes of bluegills, between the 61-90 mm and 91-120 mm, 121-150 mm, 151-180 mm, 181-210 mm, 211-240 mm, and 241-270 mm size classes of white crappie, between the 91-120 mm and the 121-150 mm, 151-180 mm, 211-240 mm, and 241-270 mm size classes of white crappie, between the 121-150 mm and the 181-210 mm, 211-240 mm, and 241-270 mm size classes of white crappie, between the 211-240 mm and the 241-270 mm size classes of white crappie, between the 61-90 mm and 91-120 mm and 121-150 mm size classes of black crappie, and between the 91-120 mm and 121-150 mm size classes of black crappie (Table 24).

Green sunfish (91-120 mm) and bluegills (0-30 mm) had a significant overlap value of 0.64 (Table 24). Warmouth (151-180 mm) overlapped with white crappie in the spring of 1984 in the following size classes: 61-90 mm, 91-120 mm, 121-150 mm, 181-210 mm, 211-240 mm and 241-270 mm. The food habits of warmouth sunfish and white crappie overlapped several times during the spring season of 1984 (Table 24), and again in the summer of 1984 (Table 25). This overlap was attributed to the prey *Dorosoma cepedianum* (Tables 3,8). White crappie were collected from all sites, while warmouth were collected from sites I-III (Figure 2). *Dorosoma cepedianum* were an abundant forage found throughout the reservoir, and partitioning of gizzard shad by warmouth sunfish and white crappie probably did not occur. Warmouth (151-180 mm) overlapped with black crappie in the 211-240 mm size class. During the spring 1984 season, the food habits of black crappie overlapped with those of warmouth sunfish and bluegill (Table 24). Chironomidae were an abundant resource (Table 10) and were used by bluegill (Table 7) and black crappie (Table 9). Dorosoma cepedianum was the principal cause of dietary overlap between warmouth (Table 3) and black crappie (Table 9). Both dietary resources were abundant throughout the course of this study.

Orangespotted sunfish (31-60 mm) overlapped with black crappie (91-120 mm). Redear sunfish in the 61-90 mm size class and white crappie in the 31-60 mm size class overlapped. Chironomidae were the contributing category for overlap between white crappie (Table 7) and redear sunfish (Table 8) but were an abundant resource (Table 10) throughout the reservoir. Black crappie in the 211-240 mm size class overlapped with white crappie in the 61-90 mm, 91-120 mm, 181-210 mm, 211-240 mm, and 241-270 mm size classes.

Two complete overlap values of one occurred in the summer of 1984 (Table 25). These values occurred between 181-210 mm size class of white crappie and the 91-120 mm size class of warmouth; where the principal cause of overlap was gizzard shad, an abundant resource, and between the 151-180 mm and 181-210 mm size classes of white crappie (Table 25). White crappie overlapped significantly (0.91) between the 31-60 mm and the 61-90 mm size classes (Table 25). Redear sunfish (121-150 mm) and longear sunfish (61-90 mm) overlapped, as did black crappie (91-120 mm) with white crappie (31-60 mm), and black crappie (121-150 mm) with white crappie (91-120 mm). Significant overlap values occurred between redear sunfish and two species (orangespotted sunfish and long ear sunfish) (Tables 24,25). Orangespotted sunfish and longear sunfish were primarily found at site I, and the redear sunfish were collected almost exclusively from site III (Figure 2). Therefore, partitioning of dietary resources Chrysomelidae (Table 6) and Chironomidae (Tables 4,7) could not have occurred between these two species and the redear sunfish.

Orconectes neglectus and Macrobrachium ohione were the principal cause of dietary overlap between warmouth sunfish (Table 3) and green sunfish (Table 2) during the summer 1983 season (Table 21). Green sunfish were found to primarily inhabit site III, whereas warmouth were found in sites I-III (Figure 2). Although the diets of these two species appear similar, it does not appear reasonable to hypothesize that resources were limiting.

Larger fish had higher interspecific overlap within seasons than did smaller fish. This trend is particularly apparent in the species that are similar either in morphology or habitat selection; for example white crappie and black crappie, warmouth and green sunfish. These fishes used gizzard shad, Lepomis spp. and crayfish extensively in their diets (Table 15). Particularly for the white crappie, gizzard shad is an important component in the diet across all seasons when the predator reaches a size of 151 mm or greater (Tables 16-19).

Several species of centrarchids overlapped significantly in their utilization of dietary resources throughout this study. But Copan Reservoir was only two years old while this study was being conducted, and food resources were both diverse and abundant. The dietary overlap that occurred appeared to reflect this abundance.

The spatial distribution of several species of centrarchids (figure 2) might clarify species interactions that occurred during 1983-1984 in Copan.

FUTURE EXPECTATIONS FOR COPAN FISH POPULATIONS

As Copan ages, most populations of centrarchids (with the exception of bluegill) will probably not increase and may experience a steady decrease over time. Particularly, the numbers of orangespotted sunfish, longear sunfish, warmouth and redear sunfish might be expected to decline. Decreased numbers may be attributed to the decrease of suitable habitat, especially in the event of a drought which would cause a decrease in the mean conservation pool elevation of the reservoir and expose those areas currently inhabited by these species. However, even under these conditions, most of these centrarchids will find isolated habitats in the reservoir where they can survive.

It is expected that populations of black crappie will continue to decrease. This decrease could result from their dietary habit of ingesting other prey species instead of gizzard shad, when they are morphologically capable of handling piscivorous prey. I expect there will be isolated areas in the reservoir where remnant individuals will persist, but throughout the reservoir the total numbers of black crappie will probably decrease markedly. White crappie should always be present in Copan Reservoir. They utilize all areas of the reservoir, and their food resources will most likely always be abundant.

Large quantities of water flow through Copan Reservoir, particularly during the late winter and early spring seasons, and the Little Caney River still flows beneath the surface of this shallow reservoir. Therefore, although dietary resources are abundant presently, and it is expected they will be in the future; and habitat requirements are satisfied and probably always will be (as the reservoir rises in the spring due to flooding, more vegetation will be inundated, contributing to the available habitat), fish populations inhabiting Copan will be subjected to a flow-through situation. This factor could represent a significant problem for maintaining fish populations in Copan.

CONCLUSIONS

This study of resource partitioning typifies some of the difficulties associated with attempting to understand competitive species interactions.

Although significant dietary overlap occurred during the course of this study, other factors, including spatial separation and resource abundance, also need to be considered before reaching any conclusions.

The spatial distribution encountered at Copan was distinct, particularly among certain species such as redear sunfish and orangespotted sunfish. I do not believe this distribution was an artifact of resource partitioning. The resources used for forage by all species involved in this study were abundant, and resource abundance precludes limitation. Therefore, forage was not the resource responsible for the spatial distribution pattern observed.

The diets of these eight species, *Lepomis cyanellus*, *Lepomis gulosus*, *Lepomis humilis*, *Lepomis macrochirus*, *Lepomis megalotis*, *Lepomis microlophus*, *Pomoxis annularis*, and *Pomoxis nigromaculatus* were typical and similar to those reported by previous studies. It appears that resources were not being partitioned in Copan Reservoir during 1983 and 1984.

LITERATURE CITED

Ager, L.A. 1971. The fish of Lake Okeechobee, Florida. Q. Jl. Fla. Acad. Sci. 34: 53-62.

__________. 1975. Monthly food habits of black crappie. Proc. SE Assoc. Game and Fish Comm. 336 pp.

Al-Rawi, T.R. 1972. Investigating the validity of the scale method in determining the growth of two species of fish in Oklahoma and its relation to temperature and water level. Diss. Abstr. 33B(22): 959.

__________. 1972. Growth of white crappie and gizzard shad in Lake Keystone. Proc. Acad. Sci. 52: 1-5.

Ball, R.L. and R.V. Kilambi. 1972. Feeding ecology of the black and white crappie in Beaver Reservoir, Arkansas and its side effects on the relative abundance of the crappie species. Proc. Conf. SE Assoc. Game and Fish Comm. 26: 577-590.

Bender, E.A., T.J. Case and M.E. Gilpin. 1984. Perturbation experiments in community ecology: theory and practice. Ecology 65(1): 1-13.

Clay, W.M. 1975. The fishes of Kentucky. Kentucky Dept. of Fish and Wildlife Resources. Frankfort, Kentucky. 416 pp.

Clemens, H.P. 1952. Pre-impoundment studies of the summer food of three species of fishes in Tenkiller and Fort Gibson Reservoirs. Proc. Okla. Acad. Sci. 33: 72-79.

Conner, E.F. and D. Simberloff. 1979. The assembly of species communities: chance or competition? Ecology 60(6): 1132-1140.

Cooper, E.L., C.C. Wagner and G.E. Krantz. 1970. Bluegills dominate production in a mixed population of fish. Ecology 52: 280-290.

Costa, R.R. and K.W. Cummins. 1972. The contribution of Leptodora and other zooplankton to the diet of various fish. Am. Midl. Nat. 87(2): 559-564.

Cross, F.B. and J.T. Collins. 1975. Fishes in Kansas. University of Kansas, Museum of Natural History, Lawrence, Kansas. 189 pp.

El-Shamy, F.M.H. 1974. A comparison of feeding and growth of bluegill in Lake Wingra and Lake Mendota, Wisconsin. Diss. Abstr. 34B(10): 50-59.

Elrod, J.H. 1971. Dynamics of fish in an Alabama pond subjected to intensive angling. Trans. Am. Fish. Soc. 100: 757-768.

Emlen, J.M. 1973. Ecology: an evolutionary approach. Addison-Wesley, Reading, Massachusetts, USA.

Flemer, D.A. and W.S. Woolcott. 1966. Food habits and distribution of Tuckahoe Creek, Virginia with special emphasis on bluegill. Cheasapeake Sci. 7: 75-89.

Gatz, A.J. 1981. Morphologically inferred niche differentiation in stream fishes. Am. Midl. Nat. 106(1): 10-21.

Gerking, S.D. 1966. Timing and magnitude of the production of bluegill sunfish population and its food supply. Verh. int. Ver. Limnol. 15: 496-503.

Greene, D.S. and C.E. Murphy. 1974. Food and feeding habits of the white crappie (Pomoxis annularis) in Benbrook Lake, Tarrant County, Texas. Tex. J. Sci. 25(1-4): 35-51.

Hairston, N.G. and G.W. Byers. 1954. The soil arthropods of a field in southern Michigan. A study in community ecology. Contrib. Lab. Vert. Biol. Univ. Mich. 64: 1-37.

Hairston, N.G. 1959. Species abundance and community organization. Ecology 40: 404-416.

Hanson, J.M. and S.U. Qadri. 1979. Seasonal growth, food and feeding habits of young of the year black crappie in Ottawa Reservoir, Canada. Can. Field Nat. 93(3): 232-238.

Heidinger, R.C. 1978. Potential of the threadfin shad as a forage fish in midwestern power cooling reservoirs. Trans. Ill. State Acad. Sci. 70: 15-25.

Hurlbert, S.H. 1978. The measurement of niche overlap and some relatives. Ecology 59: 67-77.

Hutchinson, G.E. 1958. Concluding remarks, Cold Spring Symp. Quant. Biol. 22: 415-427.

Johnson, J.N. and A.K. Andrews. 1973. Growth of white crappie and channel catfish in relation to variations in mean annual water level of Lake Carl Blackwell, Oklahoma. Proc. Conf. SE Assoc. Game Fish Comm. 27: 767-776.

Jones, R.S. and W.F. Hettler. 1959. Bat feeding by green sunfish. Texas J. Sci. 11: 48.

Jones, F.V., W.D. Pearson and L.C. Fitzpatrick. 1977. Production of a fish taxocene in a Texas pond. Environ. Biol. Fishes 2(3): 241-260.

Kruse, K.C. and M.G. Francis. 1977. A predation deterrent in larvae of the bullfrog *Rana catesbiana*. Trans. Am. Fish. Soc. 106(3): 248-252.

Lemly, A.D. and J. F. Dimmick. 1982. Growth of young of the year and yearling centrarchids in relation to zooplankton in the littoral zone of lakes. Copeia 1982(2): 305-321.

Levins, R. 1968. Evolution in changing environments. Princeton Univ. Press, Princeton, New Jersey, USA.

MacArthur, R.H. 1957. On the relative abundance of bird species. Proc. Nat. Acad. Sci. 43: 293-295.

Mancini, E.R., and M. Busdosh and B.D. Steele. 1979. Utilization of autochthonous macroinvertebrate drift by a pool fish community in a woodland stream. Hydrobiologia 62(3): 249-256.

Marcy, D.E. 1954. The food and growth of the white crappie, Pomoxis annularis in Pymatunig Lake, Pennsylvania and Ohio. Copeia 1954: 236-239.

Maret, T.R. and E.J. Peters. 1979. Food habits of the white crappie in Branched Oak Lake, Nebraska. Trans. Nebr. Acad. Sci. 7: 75-82.

Mathur, D. and T.W. Robins. 1971. Food habits and feeding chronology of young white crappie, Pomoxis annularis, in Conowingo Reservoir. Trans. Am. Fish. Soc. 100: 307-311.

Miller, R.S. 1967. Pattern and process in competition. Advances in Ecol. Res. 4: 1-74.

Miller, R.J. and H.W. Robison. 1975. The fishes of Oklahoma. Oklahoma State Univ. Press, Stillwater, Oklahoma. 246 pp.

Milne, A. 1961. Definition of competition among animals. Soc. Exp. Biol. Symp. 15: 40-61.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Dept. 293 pp.

__________. 1982. Trophic interrelations among introduced fish in lower Colorado River, Southwest USA. Calif. Fish and Game 68(2): 78-89.

Mittelbach, G.G. 1981. Patterns of invertebrate size and abundance in aquatic habitats. Can. J. Fish. Aquat. Sci. 38(9): 896-904.

Neal, R.A. 1960. Black and white crappies in Clear Lake 1950-1961. Iowa State Coll. J. Sci. 37: 425-445.

__________. 1961. White and black crappies in Clear Lake, summer 1960. Proc. Iowa Acad. Sci. 68: 247-253.

O'Brien, W.J., and N.A. Slade and G.L. Vinyard. 1976. Apparent size as the determinant of prey selection by bluegill sunfish (*Lepomis macrochirus*). Ecology 57(6): 1304-1310.

Pennack, R.W. 1978. Freshwater invertebrates of the United States. Wiley and Sons. New York. 803 pp.

Pflieger, W.L. 1975. The fishes of Missouri. Missouri Dept. of Conservation. 343 pp.

Pianka, E.R. 1969. Sympatry of desert lizards (*Ctenotus*) in Western Australia. Ecology 50: 1012-1030.

Rohlf, F.J. and R.R. Sokal. 1969. Statistical Tables. W.H. Freeman and Co. San Francisco. 253 pp.

Roughgarden J. 1974. Niche width: Biogeographic patterns among *Anolis* lizard populations. The Am. Nat. 108: 429-442.

Sadizowski, M.R. and D.C. Wallace. 1976. A comparison of the food habits of size classes of three sunfish: *Lepomis macrochirus*, *L. gibbosus* and *L. cyanellus*. Am. Midl. Nat. 95(1): 220-225.

Smith, E.P. 1982. Niche Breadth, resource availability and inference. Ecology 63(6): 1675-1681.

Trautman, M.B. 1981. The fishes of Ohio. Ohio State Univ. Press in collaboration with the Ohio Sea Grant Program. 782 pp.

Wallace, R.K. 1981. An assessment of diet-overlap indexes. Trans. Am. Fish. Soc. 110(1): 72-77.

Wright, D.I. and W.J. O'Brien. 1982. Differential location of Chaoborus larvae and Daphnia by fish: The importance of motion and visible size. Am. Midl. Nat. 108(1): 68-73.

Zaret, T.M. and A.S. Rand. 1971. Competition in tropical stream fishes: Support for the competitive exclusion principle. Ecology 52: 336-342.

Table 1. Species and numbers of Centrarchids collected in Copan Reservoir from May 1983 through October 1984.

SPECIES	NO. of STOMACHS	% EMPTY
Lepomis cyanellus	109	42.20
Lepomis gulosus	43	55.81
Lepomis humilis	23	78.26
Lepomis macrochirus	612	37.90
Lepomis megalotis	79	45.57
Lepomis microlophus	129	55.81
Pomoxis annularis	600	27.67
Pomoxis nigromaculatus	123	27.64
TOTAL	1718	36.55 (628 stomachs)

Table 2. Dietary habits of *Lepomis cyanellus* in Copan Reservoir.

Lepomis cyanellus

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			1	Gyrin-idae	.00120	0		
61-90	4	digested material Brachy-centropydae	.00613 .00225	0			2	*Lepomis macrochirus* Isopoda	.05800 .02215	0			0			0		
91-120	14	*Daphnia* digested material	.00485 .00278	18	*Macro-brachium ohione* *Lepomis* spp.	.01002 .00464	2	other[1]	.01705	1	Chaobor-idae	.04690	6	digested material Chiro-nomidae	.01497 .01475	2	*Macro-brachium ohione*	.0087
121-150	9	*Cyclops* *Orconectes neglectes*	..11111 ..00804	18	*Lepomis macrochirus* digested material	.07106 .00664	7	vegeta-tion *Orconectes neglectes*	..02447 ..00901	0			4	*Macro-brachium ohione* digested material	.02390 .01328	1	*Lepomis macrochirus*	1.132
151-180	7	*Macro-brachium ohione* Dytisc-idae	.14784 .01713	3	*Macro-brachium ohione* *Orconectes neglectes*	..31447 ..17320	2	*Lepomis macrochirus*	.03035	0			0			0		
181-210	1	*Lepomis* spp. vegeta-tion	.06870 .03840	1	*Lepomis macrochirus*	.15360	0			0			0			0		

Table 3. Dietary habits of *Lepomis gulosus* in Copan Reservoir.

Lepomis gulosus

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			0			0		
61-90	0			5	Chironomidae	.00170	0			0			0			4	other[1]	.0272
					Brachycentropydae	.00150											*Lepomis macrochirus*	.0031
91-120	0			8	*Orconectes neglectes*	.02474	0			0			0			0		
					Calopterygidae	.00174												
121-150	0			7	*Macrobrachium ohione*	.07104	0			0			3	*Macrobrachium ohione*	.16300	0		
					Orconectes neglectes	.02271												
151-180	1	*Orconectes neglectes*	.13460	2	*Macrobrachium ohione*	.68355	0			0			2	*Dorosoma cepedianum*	1.1149	0		

[1] includes eggs, fish scales, detritus

Table 4. Dietary habits of *Lepomis humilis* in Copan Reservoir.

Lepomis humilis

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			2	digested material	.0013	0		
61-90	0			22	Chiro-nomidae	.005477	0			0			0			0		

Table 5. Dietary habits of *Lepomis macrochirus* in Copan Reservoir.

Lepomis macrochirus

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			1	Chironomidae digested material	.0001 .0001	0		
31-60	0			14	digested material *Lepomis* spp.	.00151 .00079	2	digested material Chironomidae	.00135 .00005	0			25	digested material Gomphidae	.00026 .00017	4	digested material *Daphnia*	.0003 .0003
61-90	17	*Daphnia* digested material	.00775 .00566	39	Chironomidae digested material	.00520 .00027	37	Lumbricidae Chironomidae	.00150 .00088	3	digested material Chironomidae	.0001 .00003	45	Chrysomelidae other[1]	.00237 .00236	7	Chironomidae Lumbricidae	.0025 .0019
91-120	30	*Daphnia* Lumbricidae	.01605 .01552	34	Chironomidae Hymenoptera	.00435 .00415	61	Chironomidae Lumbricidae	.00380 .00196	4	digested material	.00128	34	Lumbricidae digested material	.00716 .00657	0		
121-150	22	Lumbricidae digested material	.02520 .01632	30	Hymenoptera *Lepomis* spp.	.00965 .00704	77	Lumbricidae vegetation	.02860 .00428	5	digested material Lumbricidae	.02116 .00726	74	Lumbricidae Chrysomelidae	.06044 .00916	0		
151-180	4	digested material Caenidae	.01233 .00560	4	digested material other[1]	.00395 .00033	6	digested material Hymenoptera	.00913 .00785	1	vegetation	.01550	14	Lumbricidae Chironomidae	.07437 .01875	0		
181-210	0			0			0			0			1	vegetation Brachycentropydae	.03420 .00250	0		

Table 6. Dietary habits of Lepomis megalotis in Copan Reservoir.

Lepomis megalotis

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			0			0		
61-90	0			14	Chironomidae	.00937	0			0			2	vegetation	.05990	2	digested material	.0015
					digested material	.00056								Chironomidae	.00020		Corixidae	.0001
91-120	6	digested material	.00938	39	Chironomidae	.00614	4	digested material	.00210	0			6	Chrysomelidae	.01920	3	*Macrobrachium ohione*	.0043
		Lepidoptera	.00220		digested material	.00175		Chironomidae	.00158					digested material	.01540		digested material	.0024
121-150	2	vegetation	.01505	0			0			0			0			0		
		digested material	.00430															

Table 7. Dietary habits of *Lepomis microlophus* in Copan Reservoir.

Lepomis microlophus

SIZE CLASS	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
SL (mm)	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			0			0		
61-90	0			0			0			0			4	digested material Calopterygidae	.00173 .00040	0		
91-120	2	*Daphnia* *Physa* spp.	.00435 .00075	32	*Lymnaeus* *Orconectes neglectes*	..00960 .00429	0			0			2	Caenidae digested material	.01165 .00240	0		
121-150	10	*Daphnia* Lumbricidae	.01096 .00945	19	vegetation *Orconectes neglectes*	.01106 .00238	8	*Gyralus* Chironomidae	..00075 .00003	0			4	Chrysomelidae Chironomidae	.00270 .00120	2	digested material Chaoboridae	.0078 .0025
151-180	14	Lumbricidae digested material	.05244 .01179	12	vegetation other[1]	.01275 .00367	0			0			0			0		
181-210	12	*Physa* spp. Lumbricidae	.04353 .00978	0			0			0			0			0		

[1]includes eggs, fish scales, detritus

Table 8. Dietary habits of Pomoxis annularis in Copan Reservoir.

SIZE CLASS SL (mm)	SPRING 1983 no. stomachs	prey	mean wt	SUMMER no. stomachs	prey	mean wt	FALL no. stomachs	prey	mean wt	WINTER 1983 - 1984 no. stomachs	prey	mean wt	SPRING no. stomachs	prey	mean wt	SUMMER no. stomachs	prey	mean wt
0-30	0			0			3	digested material Chironomidae	.00257 .00230	0			0			0		
31-60	0			0			3	Daphnia	.00160	0			1	digested material Caenidae	.00200 .00060	6	Daphnia Cyclops	.0024 .0002
61-90	0			0			110	Daphnia Chironomidae	.00278 .00023	0			11	Dorosoma cepedianum Daphnia	.15332 .00474	1	Daphnia	.0001
91-120	0			35	Chaoboridae Dorosoma cepedianum	.02212 .01312	16	Dorosoma cepedianum Chironomidae	.07076 .00285	0			7	Dorosoma cepedianum Chironomidae	.13964 .00666	17	Chaoboridae digested material	.0097 .0026
121-150	11	Daphnia Dorosoma cepedianum	.01130 .00858	71	Dorosoma cepedianum Chaoboridae	.01559 .01271	13	Chironomidae Chaoboridae	.00518 .00475	0			19	Dorosoma cepedianum Orconectes neglectes	.08947 .02718	2	Lepomis spp. Chaoboridae	.0078 .0003
151-180	11	Pomoxis spp. Lepomis spp.	.02144 .01603	79	Dorosoma cepedianum Morone spp.	.04909 .00766	7	Dorosoma cepedianum Lepomis spp.	.13847 .00671	1	Dorosoma cepedianum	.05400	14	Daphnia Chironomidae	.01959 .00552	2	Dorosoma cepedianum	.2286
181-210	0			32	Dorosoma cepedianum Pomoxis spp.	.14518 .02857	2	Dorosoma cepedianum digested vegetation	.01250 .00240	1	Dorosoma cepedianum	.42620	15	Dorosoma cepedianum Lepomis spp.	.94273 .02778	1	Dorosoma cepedianum Daphnia	.5723 .0136
211-240	1	Chrysomelidae Corixidae	.00560 .00180	12	Dorosoma cepedianum Pomoxis spp.	.08723 .02857	7	Dorosoma cepedianum Pomoxis spp.	.78027 .01476	6	Dorosoma cepedianum	..60560	68	Dorosoma cepedianum Chironomidae	.55213 .02674	0		
241-270	1	Lepomis spp. vegetation	.17520 .03045	0			2	Pomoxis spp. Dorosoma cepedianum	.60035 .57185	0			6	Dorosoma cepedianum	1.07335	0		

Table 9. Dietary habits of *Pomoxis nigromaculatus* in Copan Reservoir.

Pomoxis nigromaculatus

SIZE CLASS SL (mm)	SPRING 1983 no. stomachs	prey	mean wt	SUMMER no. stomachs	prey	mean wt	FALL no. stomachs	prey	mean wt	WINTER 1983 - 1984 no. stomachs	prey	mean wt	SPRING no. stomachs	prey	mean wt	SUMMER no. stomachs	prey	mean wt
0-30	0			0			0			0			0			0		
31-60	0			0			0			0			0			0		
61-90	0			1	Chironomidae Chaoboridae	.00020 .00010	45	*Daphnia* Chironomidae	.00569 .00016	1	*Daphnia* Chironomidae	.00450 .00010	3	Chironomidae Digested material	.00473 .00300	0		
91-120	0			0			22	*Daphnia* *Lepomis* spp.	.00591 .00180	0			6	*Daphnia* Chironomidae	.00881 .00319	3	*Daphnia* Chaoboridae	.0136 .0089
121-150	0			0			2	Chaoboridae	.00735	0			2	*Daphnia* Chironomidae	.02620 .00760	1	Chaoboridae *Pomoxis* spp.	.0900 .0528
151-180	3	vegetation Tipulidae	2.33630 .33333	17	*Dorosoma cepedianum* *Pomoxis* spp.	.07656 .05033	0			0			0			0		
181-210	0			4	*Lepomis* spp.	.06330	0			0			0			0		
211-240	0			0			0			0			2	*Dorosoma cepedianum*	.88800	0		

Table 10. Benthic invertebrates in Copan Reservoir, 1983-1984.

SEASON	RESERVOIR SECTION	BENTHOS	%
Summer 1983	I	Chironomidae	10.53
		Chaoboridae larvae	43.86
		pupae	1.75
		Cyclops	43.86
	III	Chironomidae	17.42
		Chaoboridae larvae	80.68
		Cyclops	1.89
Fall 1983	I	Chironomidae	29.17
		Chaoboridae larvae	54.17
		Cyclops	16.67
	II	Chaoboridae larvae	35.29
		Cyclops	47.06
		Gammarus	5.88
		Elmidae larvae	5.88
		Lumbricidae	5.88
	III	Chironomidae	2.97
		Chaoboridae larvae	92.08
		pupae	0.25
		Cyclops	1.73
		Daphnia	0.25
		Psychodidae adult	0.74
		Lumbricidae	1.98
	IV	Chironomidae	7.69
		Chaoboridae larvae	46.15
		Cyclops	46.15
Winter 1983-1984	I	Chironomidae	46.15
		Chaoboridae larvae	38.46
		Psychodidae adult	7.69
		Limnaephilidae	7.69
	III	Chironomidae	5.88
		Chaoboridae larvae	85.29
		Lumbricidae	1.47
		Nematoda	7.35
Spring 1984	I	Chironomidae	80.85
		Chaoboridae larvae	2.13
		Gammarus	4.25
		Elmidae larvae	2.13
		Perlidae nymph	4.25
		Caenidae nymph	2.13
		Dytiscidae larvae	4.25

Table 10. continued.

SEASON	RESERVOIR SECTION	BENTHOS	%
Spring 1984	II	Chironomidae	17.39
		Chaoboridae larvae	81.16
		Caenidae nymph	1.45
	III	Chironomidae	17.61
		Chaoboridae larvae	75.00
		Caenidae nymph	3.97
		Limnaephilidae	0.57
		Trichoptera	1.14
		Hydrophilidae	0.57
		Brachycentropydae	0.57
		Coleoptera	0.57
	V	Chironomidae	75.00
		Chaoboridae larvae	8.34
		Psychodidae adult	8.34
		Hydrophilidae	8.34
Summer 1984	I	Chironomidae	26.92
		Chaoboridae larvae	55.77
		pupae	1.92
		Gyrinidae adult	1.92
		Hydrophilidae	5.77
		Dytiscidae larvae	3.85
		adult	1.92
		Lymnaea	1.92
	II	Chironomidae	87.12
		Caenidae nymph	7.58
		Dytiscidae larvae	3.03
		Limnaephilidae	0.74
		Lymnaea	3.03
		Lumbricidae	0.74
		Arachnida	0.74
	III	Chironomidae	2.77
		Chaoboridae larvae	93.28
		pupae	3.16
		Simuliidae adult	0.39
		Psychodidae adult	0.39
	IV	Chaoboridae larvae	52.17
		pupae	39.13
		Hydrophilidae adult	4.35
		Coleoptera	4.35
	V	Chironomidae	9.10
		Chaoboridae larvae	79.55
		pupae	4.55

Table 10. continued.

SEASON	RESERVOIR SECTION	BENTHOS	%
Summer 1984	V	Capnidae nymph	2.27
		Gyralus spp.	2.27
		Physa spp.	2.27
Fall 1984	I	Chironomidae	12.50
		Chaoboridae larvae	50.00
		Psychodidae adult	12.50
		Brachycentropydae	25.00
	II	Chaoboridae larvae	100.00
	III	Chironomidae	0.91
		Chaoboridae larvae	98.63
		Arachnida	0.46
	IV	Chironomidae	0.33
		Chaoboridae larvae	96.73
		pupae	2.61
		Isopoda	0.33
	V	Chironomidae	16.67
		Chaoboridae larvae	83.34

Table 11. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

0-30 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	0			0			0			0			0			0		
Lepomis gulosus	0			0			0			0			0			0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	0			0			0			0			1	Chiro-nomidae	.00010	0		
														digested material	.00010			
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	0			0			0			0			0			0		
Pomoxis annularis	0			0			3	digested material	.00257	0			0			0		
								Chiro-nomidae	.00230									
Pomoxis nigromaculatus	0			0			0			0			0			0		

Table 12. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

31-60 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	0			0			0			0			1	Gyrinidae Chiro-nomidae	.00120 .00010	0		
Lepomis gulosus	0			0			0			0			0			0		
Lepomis humilis	0			0			0			0			2	digested material	.00130	0		
Lepomis macrochirus	0			0			0			0			25	digested material Gomphidae	.00026 .00017	4	digested material *Daphnia*	.0003 .0003
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	0			0			0			0			0			0		
Pomoxis annularis	0			0			3	*Daphnia*	.00160	0			1	digested material Caenidae	.00020 .00060	6	*Daphnia* *Cyclops*	.0024 .0002
Pomoxis nigromaculatus	0			0			0			0			0			0		

Table 13. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

61-90 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	4	digested material	.00613	0			2	*Lepomis macrochirus*	.05800	0			0			0		
		Brachycentropydae	.00225					Isopoda	.02215									
Lepomis gulosus	0			5	Chironomidae	.00170	0			0			0			4	other[1]	.0272
					Brachycentropydae	.00150											*Lepomis macrochirus*	.0031
Lepomis humilis	0			22	Chironomidae	.00548	0			0			0			0		
Lepomis macrochirus	17	*Daphnia*	.00775	39	Chironomidae	.00520	37	Lumbricidae	.00150	3	digested material	.00010	45	Chrysomelidae	.00237	7	Chironomidae	.0025
		digested material	.00566		digested material	.00027		Chironomidae	.00088		Chironomidae	.00003		other[1]	.00236		Lumbricidae	.0019
Lepomis megalotis	0			14	Chironomidae	.00937	0			0			2	vegetation	.05990	0		
					digested material	.00056								Chironomidae	.00020			
Lepomis microlophus	0			0			0			0			4	digested material	.00173	0		
														Calopterygidae	.00040			
Pomoxis annularis	0			0			110	*Daphnia*	.00278	0			11	*Dorosoma cepedianum*	.15332	1	*Daphnia*	.0001
								Chironomidae	.00023					*Daphnia*	.00473			
Pomoxis nigromaculatus	0			1	Chironomidae	.00020	45	*Daphnia*	.00569	1	*Daphnia*	.00450	3	Chironomidae	.00473	0		
					Chaoboridae	.00010		Chironomidae	.00016		Chironomidae	.00010		digested material	.00300			

[1]includes eggs, fish scales, detritus

Table 14. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

91-120 SIZE CLASS (SL mm)

SPECIES	SPRING 1983 no. stomachs	SPRING 1983 prey	SPRING 1983 mean wt	SUMMER no. stomachs	SUMMER prey	SUMMER mean wt	FALL no. stomachs	FALL prey	FALL mean wt	WINTER 1983 - 1984 no. stomachs	WINTER 1983 - 1984 prey	WINTER 1983 - 1984 mean wt	SPRING no. stomachs	SPRING prey	SPRING mean wt	SUMMER no. stomachs	SUMMER prey	SUMMER mean wt
Lepomis cyanellus	14	*Daphnia* digested material	.00485 .00277	18	*Macrobrachium ohione* *Lepomis* spp.	.01002 .00464	2	other[1]	.01705	1	Chaoboridae	.04690	6	digested material Chironomidae	.01497 .01475	2	*Macrobrachium ohione*	.0087
Lepomis gulosus	0			8	*Orconectes neglectes* Calopterygidae	.02474 .00174	0			0			0			2	*Dorosoma cepedianum*	.0124
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	30	*Daphnia* Lumbricidae	.01604 .01552	34	Chironomidae Hymenoptera	.00435 .00415	61	Chironomidae Lumbricidae	.00380 .00196	4	digested material	.00128	34	Lumbricidae digested material	.00716 .00657	0		
Lepomis megalotis	6	digested material Lepidoptera	.00938 .00220	39	Chironomidae digested material	.00614 .00175	4	digested material Chironomidae	.00210 .00158	0			6	Chrysomelidae digested material	.01920 .01540	3	*Macrobrachium ohione* digested material	.0043 .0024
Lepomis microlophus	2	*Daphnia* *Physa* spp.	.00435 .00075	32	*Lymnaeus* *Orconectes neglectes*	.00960 .00428	0			0			2	Caenidae digested material	.01165 .00240	0		
Pomoxis annularis	0			35	Chaoboridae *Dorosoma cepedianum*	.02212 .01312	16	*Dorosoma cepedianum* Chironomidae	.07076 .00285	0			7	*Dorosoma cepedianum* Chironomidae	.13964 .00666	17	Chaoboridae digested material	.0097 .0026
Pomoxis nigromaculatus	0			0			22	*Daphnia* *Lepomis* spp.	.00591 .00180	0			10	*Daphnia* Chironomidae	.00881 .00319	3	*Daphnia* Chaoboridae	.0136 .0089

[1]includes eggs, fish scales, detritus

Table 15. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

121-150 SIZE CLASS (SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	9	Cyclops Orconectes neglectes	.11111 .00804	18	Lepomis macrochirus digested material	.07105 .00664	7	vegetation Orconectes neglectes	.02447 .00901	0			4	Macrobrachium ohione digested material	.02390 .01328	1	Lepomis macrochirus	1.132
Lepomis gulosus	0			7	Macrobrachium ohione Orconectes neglectes	.07104 .02271	0			0			3	Macrobrachium ohione	.16300	0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	22	Lumbricidae digested material	.02520 .01632	30	Hymenoptera Lepomis spp.	.00965 .00704	77	Lumbricidae vegetation	.02860 .00428	5	digested material Lumbricidae	.02116 .00726	74	Lumbricidae Chrysomelidae	.06043 .00916	0		
Lepomis megalotis	2	vegetation digested material	.01505 .00430	0			0			0			0			0		
Lepomis microlophus	10	Daphnia Lumbricidae	.01096 .00945	19	vegetation Orconectes neglectes	.01106 .00238	8	Gyralus Chironomidae	.00075 .00003	0			4	Chrysomelidae Chironomidae	.00270 .00120	2	digested material Chaoboridae	.0078 .0025
Pomoxis annularis	11	Daphnia Dorosoma cepedianum	.01130 .00858	71	Dorosoma cepedianum Chaoboridae	.01559 .01271	13	Chironomidae Chaoboridae	.00518 .00475	0			19	Dorosoma cepedianum Orconectes neglectes	.08947 .01959	2	Lepomis spp. Chaoboridae	.0078 .0003
Pomoxis nigromaculatus	0			0			2	Chaoboridae	.00735	0			2	Daphnia Chironomidae	.02620 .01959	1	Chaoboridae Pomoxis spp.	.0900 .0526

Table 16. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

151-180 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	7	Macrobrachium ohione Dytiscidae	.14784 .01713	3	Macrobrachium ohione Orconectes neglectes	.31447 .17320	2	Lepomis macrochirus	.03035	0			0			0		
Lepomis gulosus	1	Orconectes neglectes	.13460	2	Macrobrachium ohione	.68355	0			0			2	Dorosoma cepedianum Lepomis spp.	1.11490 .02835	0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	4	digested material Caenidae	.01233 .00560	4	digested material other[1]	.00395 .00033	6	digested material Hymenoptera	.00913 .00785	1	vegetation	.01550	14	Lumbricidae Chironomidae	.07437 .01875	0		
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	14	Lumbricidae digested material	.05244 .01179	12	vegetation other[1]	.01275 .00367	0			0			0			0		
Pomoxis annularis	11	Pomoxis spp. Lepomis spp.	.02144 .01603	79	Dorosoma cepedianum Morone spp.	.04909 .00766	7	Dorosoma cepedianum Pomoxis spp.	.78027 .01476	1	Dorosoma cepedianum	.05400	14	Daphnia Chironomidae	.01959 .00552	2	Dorosoma cepedianum	.2286
Pomoxis nigromaculatus	3	vegetation Tipulidae	2.33630 .33333	17	Dorosoma cepedianum Pomoxis spp.	.07656 .05033	0			0			0			0		

[1]includes eggs, fish scales, detritus

Table 17. **Important prey organisms in 8 species of Centrarchids in Copan Reservoir.**

181-210 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	1	Lepomis spp.	.06870	1	Lepomis macrochirus	.15630	0			0			0			0		
		vegeta-tion	.03840															
Lepomis gulosus	0			0			0			0			0			0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	0			0			0			0			1	vegeta-tion	.03420	0		
														Brachy-centropydae	.00250			
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	12	Physa spp.	.04353	0			0			0			0			0		
		Lumbric-idae	.00978															
Pomoxis annularis	0			32	Dorosoma cepedianum	.14518	2	Dorosoma cepedianum	.01250	1	Dorosoma cepedianum	.42620	15	Dorosoma cepedianum	.94273	1	Dorosoma cepedianum	.5723
					Pomoxis spp.	.05548		digested material	.00240					Lepomis spp.	.02778		Daphnia	.0136
Pomoxis nigromaculatus	0			4	Lepomis spp.	.06330	0			0			0			0		

Table 18. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

211-240 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	0			0			0			0			0			0		
Lepomis gulosus	0			0			0			0			0			0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	0			0			0			0			0			0		
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	0			0			0			0			0			0		
Pomoxis annularis	1	Chrysomelidae	.00560	12	*Dorosoma cepedianum*	.08723	7	*Dorosoma cepedianum*	.78027	6	*Dorosoma cepedianum*	.60560	68	*Dorosoma cepedianum*	.55213	0		
		Corixidae	.00180		*Pomoxis* spp.	.02857		*Pomoxis* spp.	.01476					Chironomidae	.02674			
Pomoxis nigromaculatus	0			0			0			0			2	*Dorosoma cepedianum*	.88800	0		

Table 19. Important prey organisms in 8 species of Centrarchids in Copan Reservoir.

241-270 SIZE CLASS
(SL mm)

SPECIES	SPRING 1983			SUMMER			FALL			WINTER 1983 - 1984			SPRING			SUMMER		
	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt	no. stomachs	prey	mean wt
Lepomis cyanellus	0			0			0			0			0			0		
Lepomis gulosus	0			0			0			0			0			0		
Lepomis humilis	0			0			0			0			0			0		
Lepomis macrochirus	0			0			0			0			0			0		
Lepomis megalotis	0			0			0			0			0			0		
Lepomis microlophus	0			0			0			0			0			0		
Pomoxis annularis	2	Lepomis spp.	.17520	0			2	Pomoxis spp.	.60035	0			6	Dorosoma cepedianum	1.07335	0		
		vegetation	.03045					Dorosoma cepedianum	.57185									
Pomoxis nigromaculatus	0			0			0			0			0			0		

Table 20. Schoener overlap values between 8 species of Centrarchids in Copan Reservoir, spring 1983.

		Lepomis cyanellus					Lepomis gulosus		Lepomis macrochirus			
		61-90	91-120	121-150	151-180	181-210	121-150	151-180	61-90	91-120	121-150	151-180
Lepomis cyanellus	61- 90	1										
	91-120	0.46	1									
	121-150	0.03	0.02	1								
	151-180	0.02	0.02	0.05	1							
	181-210	0.00	0.00	0.00	0.00	1						
Lepomis gulosus	121-150	0.50	0.50	0.50	0.50	0.50	1					
	151-180	0.00	0.00	0.06	0.04	0.00	0.50	1				
Lepomis macrochirus	61- 90	0.47	0.67*	0.05	0.02	0.00	0.50	0.00	1			
	91-120	0.17	0.32	0.05	0.02	0.03	0.50	0.00	0.38	1		
	121-150	0.37	0.39	0.04	0.03	0.16	0.50	0.00	0.39	0.49	1	
	151-180	0.39	0.44	0.06	0.03	0.00	0.50	0.00	0.48	0.19	0.33	1
Lepomis megalotis	91-120	0.58	0.29	0.04	0.02	0.00	0.50	0.00	0.40	0.10	0.26	0.36
	121-150	0.26	0.22	0.01	0.00	0.36	0.50	0.00	0.23	0.31	0.22	0.22
Lepomis microlophus	61- 90	0.15	0.48	0.01	0.02	0.00	0.50	0.00	0.40	0.26	0.15	0.09
	91-120	0.34	0.39	0.04	0.02	0.00	0.50	0.00	0.45	0.51	0.52	0.25
	121-150	0.13	0.16	0.01	0.00	0.00	0.50	0.00	0.17	0.31	0.49	0.21
	151-180	0.02	0.02	0.02	0.00	0.00	0.50	0.00	0.04	0.20	0.19	0.07
Pomoxis annularis	121-150	0.18	0.23	0.06	0.18	0.13	0.50	0.03	0.26	0.29	0.34	0.13
	151-180	0.23	0.23	0.04	0.03	0.24	0.50	0.00	0.25	0.19	0.40	0.23
	211-240	0.01	0.11	0.01	0.01	[illegible]	0.50	0.00	0.04	0.08	0.04	0.04
	241-270	0.00	0.00	0.00	0.00	0.79*	0.50	0.00	0.00	0.03	0.16	0.00
Pomoxis nigromaculatus	151-180	0.00	0.00	0.00	0.00	0.36	0.50	0.00	0.00	0.00	0.00	0.00

*significant overlap

Table 20. continued.

		Lepomis megalotis		*Lepomis microlophus*				**Pomoxis annularis**				**Pomoxis nigromaculatus**
		91-120	121-150	61-90	91-120	121-150	151-180	121-150	151-180	211-240	241-270	151-180
Lepomis megalotis	91-120	1										
	121-150	0.22	1									
Lepomis microlophus	61- 90	0.02	0.00	1								
	91-120	0.19	0.13	0.41	1							
	121-150	0.15	0.14	0.09	0.44	1						
	151-180	0.05	0.02	0.14	0.35	0.27	1					
Pomoxis annularis	121-150	0.07	0.04	0.19	0.23	0.10	0.04	1				
	151-180	0.14	0.12	0.10	0.23	0.20	0.04	0.51	1			
	211-240	0.10	0.00	0.01	0.01	0.06	0.00	0.10	0.07	1		
	241-270	0.00	0.15	0.00	0.00	0.00	0.00	0.14	0.24	0.01	1	
Pomoxis nigromaculatus	151-180	0.00	0.77*	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.15	1

*significant overlap

Table 21. Schoener overlap values between 8 species of Centrarchids in Copan Reservoir, summer 1983.

		Lepomis cyanellus				*Lepomis gulosus*				*Lepomis humilis*	*Lepomis macrochirus*				
	SL (mm)	91-120	121-150	151-180	181-210	61-90	91-120	121-150	151-180	61-90	31-60	61-90	91-120	121-150	151-180
Lepomis cyanellus	91-120	1													
	121-150	0.11	1												
	151-180	0.39	0.04	1											
	181-210	0.05	0.84*	0.00	1										
Lepomis gulosus	61- 90	0.00	0.00	0.00	0.00	1									
	91-120	0.00	0.04	0.31	0.00	0.00	1								
	121-150	0.50	0.14	0.76*	0.10	0.00	0.20	1							
	151-180	0.39	0.00	0.56	0.00	0.00	0.00	0.64*	1						
Lepomis humilis	61- 90	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	1					
Lepomis macrochirus	31- 60	0.26	0.08	0.00	0.00	0.12	0.00	0.06	0.00	0.12	1				
	61- 90	0.02	0.05	0.00	0.00	0.53	0.00	0.00	0.00	0.92*	0.18	1			
	91-120	0.10	0.08	0.01	0.00	0.22	0.01	0.06	0.00	0.22	0.40	0.27	1		
	121-150	0.30	0.12	0.00	0.00	0.05	0.00	0.06	0.00	0.05	0.43	0.10	0.62*	1	
	151-180	0.04	0.08	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.49	0.07	0.23	0.19	1
Lepomis megalotis	61- 90	0.02	0.06	0.00	0.00	0.53	0.00	0.00	0.00	0.94*	0.18	0.97*	0.28	0.11	0.07
	91-120	0.11	0.12	0.05	0.00	0.54	0.06	0.11	0.00	0.62*	0.38	0.67*	0.48	0.32	0.20
Lepomis microlophus	91-120	0.02	0.07	0.28	0.00	0.00	0.30	0.20	0.00	0.00	0.04	0.03	0.10	0.03	0.04
	121-150	0.02	0.09	0.14	0.00	0.14	0.15	0.14	0.00	0.14	0.16	0.18	0.37	0.19	0.06
	151-180	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.10	0.08
Pomoxis annularis	91-120	0.20	0.08	0.00	0.00	0.47	0.00	0.00	0.00	0.05	0.10	0.10	0.13	0.15	0.10
	121-150	0.36	0.10	0.00	0.00	0.01	0.00	0.06	0.00	0.01	0.23	0.06	0.19	0.28	0.11
	151-180	0.26	0.07	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.04	0.12	0.16	0.05
	181-210	0.29	0.05	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.01	0.09	0.17	0.01
	211-240	0.02	0.02	0.12	0.00	0.00	0.00	0.12	0.50	0.00	0.11	0.15	0.00	0.00	0.00
Pomoxis nigromaculatus	61- 90	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.07	0.00	0.09	0.22	0.00	0.00	0.01
	151-180	0.00	0.00	0.00	0.32	0.00	0.00	0.35	0.00	0.00	0.11	0.03	0.00	0.00	0.05
	181-210	0.00	0.00	0.00	0.42	0.00	0.01	0.08	0.13	0.00	0.00	0.00	0.00	0.00	0.00

* significant overlap

Table 21. continued.

		Lepomis megalotis		*Lepomis microlophus*			*Pomoxis annularis*					*Pomoxis nigromaculatus*		
	SL (mm)	61-90	91-120	91-120	121-150	151-180	91-120	121-150	151-180	181-210	211-240	61-90	151-180	181-210
Lepomis megalotis	61- 90	1												
	91-120	0.67*	1											
Lepomis microlophus	91-120	0.03	0.08	1										
	121-150	0.18	0.23	0.17	1									
	151-180	0.01	0.00	0.00	0.68*	1								
Pomoxis annularis	91-120	0.09	0.09	0.04	0.10	0.01	1							
	121-150	0.07	0.16	0.04	0.06	0.01	0.72*	1						
	151-180	0.03	0.10	0.04	0.03	0.01	0.38	0.55	1					
	181-210	0.01	0.10	0.01	0.01	0.01	0.35	0.54	0.73*	1				
	211-240	0.00	0.00	0.01	0.00	0.01	0.00	0.41	0.49	0.53	1			
Pomoxis nigromaculatus	61- 90	0.00	0.07	0.00	0.01	0.06	0.72*	0.18	0.00	0.01	0.00	1		
	151-180	0.00	0.02	0.02	0.03	0.00	0.22	0.36	0.11	0.22	0.00	0.04	1	
	181-210	0.00	0.00	0.00	0.05	0.00	0.08	0.02	0.47	0.31	0.02	0.00	0.10	1

* significant overlap

Table 22. Schoener overlap values between 8 species of Centrarchids in Copan Reservoir, fall 1983.

		Lepomis cyanellus				Lepomis macrochirus					Lepomis megalotis	Lepomis microlophus
	SL (mm)	61-90	91-120	121-150	151-180	31-60	61-90	91-120	121-150	151-180	91-120	121-150
Lepomis cyanellus	61- 90	1										
	91-120	0.00	1									
	121-150	0.00	0.00	1								
	151-180	0.69*	0.00	0.00	1							
Lepomis macrochirus	31- 60	0.00	0.00	0.00	0.00	1						
	61- 90	0.02	0.00	0.00	0.00	0.22	1					
	91-120	0.01	0.00	0.13	0.00	0.15	0.61*	1				
	121-150	0.05	0.00	0.09	0.00	0.13	0.64*	0.50	1			
	151-180	0.00	0.00	0.02	0.00	0.49	0.22	0.14	0.11	1		
Lepomis megalotis	91-120	0.00	0.00	0.00	0.00	0.61*	0.47	0.52	0.14	0.49	1	
Lepomis microlophus	121-150	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.02	0.03	1
Pomoxis annularis	0- 30	0.00	0.00	0.00	0.00	0.51	0.47	0.54	0.15	0.49	0.90*	0.03
	31- 60	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
	61- 90	0.00	0.00	0.00	0.00	0.08	0.11	0.14	0.10	0.06	0.11	0.03
	91-120	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.02	0.04	0.03
	121-150	0.00	0.00	0.00	0.00	0.14	0.40	0.53	0.15	0.17	0.51	0.03
	151-180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181-210	0.00	0.00	0.00	0.00	0.16	0.16	0.11	0.09	0.16	0.16	0.00
	211-240	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	241-270	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pomoxis nigromaculatus	61- 90	0.00	0.00	0.00	0.00	0.04	0.04	0.07	0.05	0.04	0.04	0.03
	91-120	0.00	0.00	0.00	0.00	0.08	0.18	0.20	0.10	0.06	0.18	0.03
	121-150	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

* significant overlap

Table 22. continued.

	SL (mm)	*Pomoxis annularis* 0-30	31-60	61-90	91-120	121-150	151-180	181-210	211-240	241-270	*Pomoxis nigromaculatus* 61-90	91-120	121-150
Pomoxis annularis	0- 30	1											
	31- 60	0.10	1										
	61- 90	0.21	0.85*	1									
	91-120	0.04	0.00	0.04	1								
	121-150	0.57	0.06	0.18	0.05	1							
	151-180	0.00	0.00	0.00	0.95*	0.10	1						
	181-210	0.16	0.00	0.05	0.84*	0.11	0.84*	1					
	211-240	0.00	0.00	0.00	0.96*	0.00	0.96*	0.84*	1				
	241-270	0.00	0.00	0.00	0.49	0.00	0.49	0.49	0.51	1			
Pomoxis nigromaculatus	61- 90	0.14	0.95*	0.90*	0.03	0.10	0.00	0.02	0.00	0.00	1		
	91-120	0.28	0.58	0.70*	0.10	0.25	0.10	0.10	0.05	0.04	0.63*	1	
	121-150	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	1

* significant overlap

Table 23. Schoener overlap values between 8 species of Centrarchida in Copan Reservoir, winter 1983-1984.

		Lepomis cyanellus	*Lepomis macrochirus*				*Pomoxis annularis*			*Pomoxis nigromaculatus*
	SL (mm)	91-120	61-90	91-120	121-150	151-180	151-180	181-210	211-240	61-90
Lepomis cyanellus	91-120	1								
Lepomis macrochirus	61- 90	0.00	1							
	91-120	0.00	0.00	1						
	121-150	0.00	0.00	0.73*	1					
	151-180	0.00	0.00	0.00	0.12	1				
Pomoxis annularis	151-180	0.00	0.00	0.00	0.00	0.00	1			
	181-211	0.00	0.00	0.00	0.00	0.00	0.10	1		
	211-240	0.00	0.00	0.00	0.00	0.00	0.21	1.00*	1	
Pomoxis nigromaculatus	61- 90	0.00	0.11	0.00	0.13	0.00	0.00	0.00	0.00	1

* significant overlap

Table 24. Schoener overlap values between 8 species of Centrarchids in Copan Reservoir, spring 1984.

		Lepomis cyanellus			Lepomis gulosus		Lepomis humilis	Lepomis macrochirus						
	SL (mm)	31-60	91-120	121-150	121-150	151-180	31-60	0-30	31-60	61-90	91-120	121-150	151-180	181-210
Lepomis cyanellus	31- 60	1												
	91-120	0.08	1											
	121-150	0.00	0.32	1										
Lepomis gulosus	121-150	0.00	0.00	0.58	1									
	151-180	0.00	0.00	0.00	0.00	1								
Lepomis humilis	31- 60	0.00	0.32	0.33	0.00	0.00	1							
Lepomis macrochirus	0- 30	0.08	0.64*	0.33	0.00	0.00	0.50	1						
	31- 60	0.24	0.44	0.33	0.00	0.05	0.34	0.43	1					
	61- 90	0.05	0.27	0.24	0.00	0.01	0.15	0.19	0.23	1				
	91-120	0.08	0.42	0.23	0.00	0.00	0.23	0.32	0.36	0.51	1			
	121-150	0.07	0.22	0.05	0.00	0.02	0.05	0.12	0.17	0.37	0.55	1		
	151-180	0.08	0.23	0.01	0.00	0.00	0.01	0.20	0.16	0.22	0.39	0.76*	1	
	181-210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.04	0.01	0.00	1
Lepomis megalotis	61- 90	0.02	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00
	91-120	0.01	0.37	0.27	0.00	0.00	0.27	0.28	0.29	0.44	0.38	0.17	0.03	0.00
Lepomis microlophus	61- 90	0.08	0.33	0.33	0.00	0.00	0.80*	0.50	0.34	0.16	0.24	0.05	0.02	0.00
	91-120	0.08	0.25	0.16	0.00	0.00	0.16	0.25	0.25	0.19	0.25	0.12	0.10	0.00
	121-150	0.08	0.41	0.17	0.00	0.00	0.17	0.36	0.30	0.47	0.38	0.22	0.20	0.00
Pomoxis annularis	31- 60	0.00	0.33	0.33	0.00	0.00	0.77*	0.50	0.33	0.15	0.23	0.05	0.01	0.00
	61- 90	0.04	0.00	0.00	0.00	0.97*	0.00	0.00	0.06	0.02	0.00	0.02	0.02	0.00
	91-120	0.01	0.05	0.00	0.00	0.94*	0.00	0.04	0.11	0.06	0.05	0.06	0.05	0.00
	121-150	0.08	0.02	0.00	0.00	0.63*	0.00	0.01	0.08	0.03	0.02	0.04	0.04	0.00
	151-180	0.00	0.23	0.04	0.00	0.00	0.04	0.23	0.17	0.10	0.14	0.12	0.22	0.01
	181-210	0.04	0.00	0.00	0.00	0.99*	0.00	0.00	0.05	0.01	0.00	0.02	0.00	0.00
	211-240	0.00	0.04	0.00	0.00	0.92*	0.00	0.04	0.09	0.05	0.04	0.06	0.04	0.00
	241-270	0.08	0.00	0.00	0.00	0.98*	0.00	0.00	0.05	0.07	0.00	0.02	0.00	0.00
Pomoxis nigromaculatus	61- 90	0.00	0.59	0.27	0.00	0.00	0.27	0.69*	0.39	0.20	0.32	0.12	0.22	0.00
	91-120	0.00	0.53	0.33	0.00	0.23	0.22	0.36	0.22	0.14	0.06	0.02	0.03	0.00
	121-150	0.00	0.02	0.00	0.00	0.52	0.00	0.00	0.08	0.07	0.02	0.06	0.06	0.00
	211-240	0.00	0.00	0.00	0.00	0.66*	0.00	0.01	0.04	0.00	0.00	0.02	0.00	0.00

* significant overlap

Table 24. continued.

	SL (mm)	*Lepomis megalotis* 61-90	*Lepomis megalotis* 91-120	*Lepomis microlophus* 61-90	*Lepomis microlophus* 91-120	*Lepomis microlophus* 121-150	*Pomoxis annularis* 31-60	*Pomoxis annularis* 61-90	*Pomoxis annularis* 91-120	*Pomoxis annularis* 121-150	*Pomoxis annularis* 151-180	*Pomoxis annularis* 181-210	*Pomoxis annularis* 211-240	*Pomoxis annularis* 241-270
Lepomis megalotis	61- 90	1												
	91-120	0.00	1											
Lepomis microlophus	61- 90	0.00	0.28	1										
	91-120	0.00	0.16	0.16	1									
	121-150	0.00	0.54	0.17	0.28	1								
Pomoxis annularis	31- 60	0.00	0.00	0.77*	0.39	0.21	1							
	61- 90	0.00	0.01	0.00	0.00	0.01	0.00	1						
	91-120	0.00	0.01	0.00	0.05	0.05	0.00	0.95*	1					
	121-150	0.00	0.09	0.00	0.02	0.02	0.00	0.64*	0.63*	1				
	151-180	0.00	0.00	0.05	0.14	0.25	0.05	0.03	0.64*	0.18	1			
	181-210	0.00	0.01	0.00	0.00	0.00	0.00	0.97*	0.94*	0.63*	0.00	1		
	211-240	0.00	0.00	0.00	0.04	0.04	0.00	0.93*	0.97*	0.62*	0.04	0.92*	1	
	241-270	0.00	0.00	0.00	0.00	0.00	0.00	0.96*	0.94*	0.61*	0.00	0.97*	0.92*	1
Pomoxis nigromaculatus	61- 90	0.00	0.28	0.27	0.31	0.40	0.33	0.03	0.03	0.05	0.48	0.00	0.04	0.00
	91-120	0.00	0.33	0.16	0.22	0.27	0.12	0.04	0.02	0.03	0.27	0.00	0.00	0.00
	121-150	0.00	0.01	0.00	0.07	0.11	0.00	0.52	0.22	0.47	0.00	0.58	0.56	0.52
	211-240	0.00	0.00	0.00	0.00	0.00	0.00	0.61*	0.73*	0.50	0.00	0.77*	0.85*	0.91*

* significant overlap

Table 24. continued.

	SL (mm)	*Pomoxis nigromaculatus* 61- 90	91-120	121-150	211-240
Pomoxis nigromaculatus	61- 90	1			
	91-120	0.62*	1		
	121-150	0.65*	0.77*	1	
	211-240	0.12	0.00	0.24	1

* significant overlap

Table 25. Schoener overlap values between 8 species of Centrarchids in Copan Reservoir, summer 1984.

		Lepomis cyanellus		Lepomis gulosus		Lepomis macrochirus		Lepomis megalotis		Lepomis microlophus
	SL (mm)	91-120	121-150	61-90	91-120	31-60	61-90	61-90	91-120	121-150
Lepomis cyanellus	91-120	1								
	121-150	0.00	1							
Lepomis gulosus	61- 90	0.00	0.10	1						
	91-120	0.00	0.00	0.00	1					
Lepomis macrochirus	31- 60	0.00	0.00	0.00	0.00	1				
	61- 90	0.00	0.00	0.01	0.00	0.34	1			
Lepomis megalotis	61- 90	0.00	0.00	0.00	0.00	0.47	0.21	1		
	91-120	0.50	0.00	0.07	0.00	0.40	0.30	0.33	1	
Lepomis microlophus	121-150	0.00	0.00	0.01	0.00	0.49	0.33	0.64*	0.33	1
Pomoxis annularis	31- 60	0.00	0.00	0.00	0.00	0.42	0.02	0.02	0.02	0.02
	61- 90	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.00
	91-120	0.00	0.00	0.01	0.00	0.17	0.26	0.17	0.17	0.36
	121-150	0.00	0.00	0.01	0.00	0.01	0.05	0.02	0.02	0.05
	151-180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181-210	0.50	0.00	0.00	1.00*	0.00	0.00	0.00	0.00	0.00
Pomoxis nigromaculatus	91-120	0.00	0.00	0.01	0.00	0.40	0.10	0.00	0.00	0.20
	121-150	0.50	0.00	0.01	0.00	0.00	0.10	0.00	0.00	0.20

* significant overlap

Table 25. continued.

	SL (mm)	*Pomoxis annularis* 31-60	61-90	91-120	121-150	151-180	181-210	*Pomoxis nigromaculatus* 91-120	121-150
Pomoxis annularis	31- 60	1							
	61- 90	0.91*	1						
	91-120	0.00	0.00	1					
	121-150	0.01	0.00	0.17	1				
	151-180	0.00	0.00	0.00	0.00	1			
	181-210	0.00	0.00	0.00	0.00	1.00*	1		
Pomoxis nigromaculatus	91-120	0.60*	0.60*	0.40	0.04	0.00	0.00	1	
	121-150	0.00	0.00	0.68*	0.04	0.00	0.00	0.40	1

* significant overlap

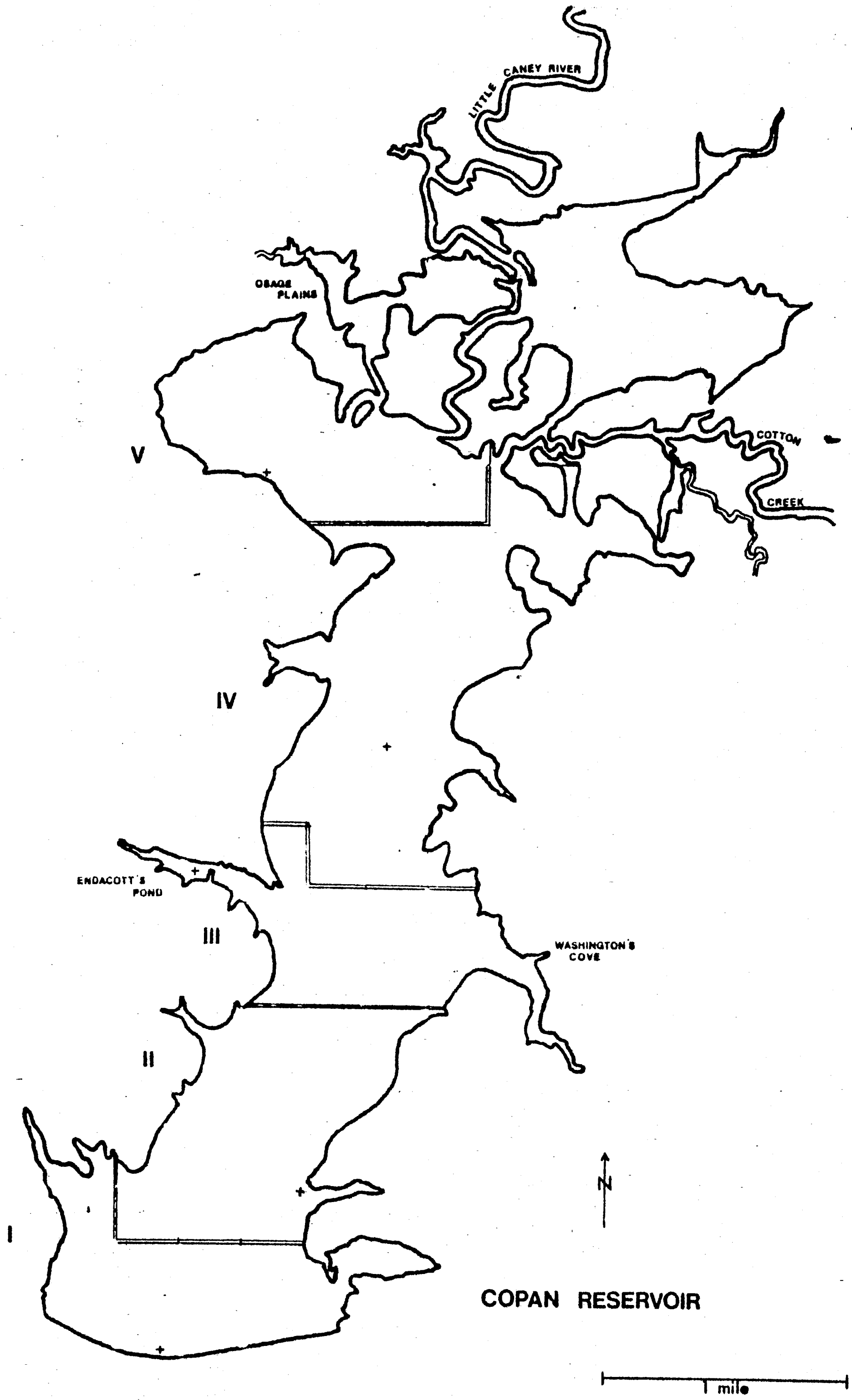

Figure 1. A Map of Copan Reservoir.

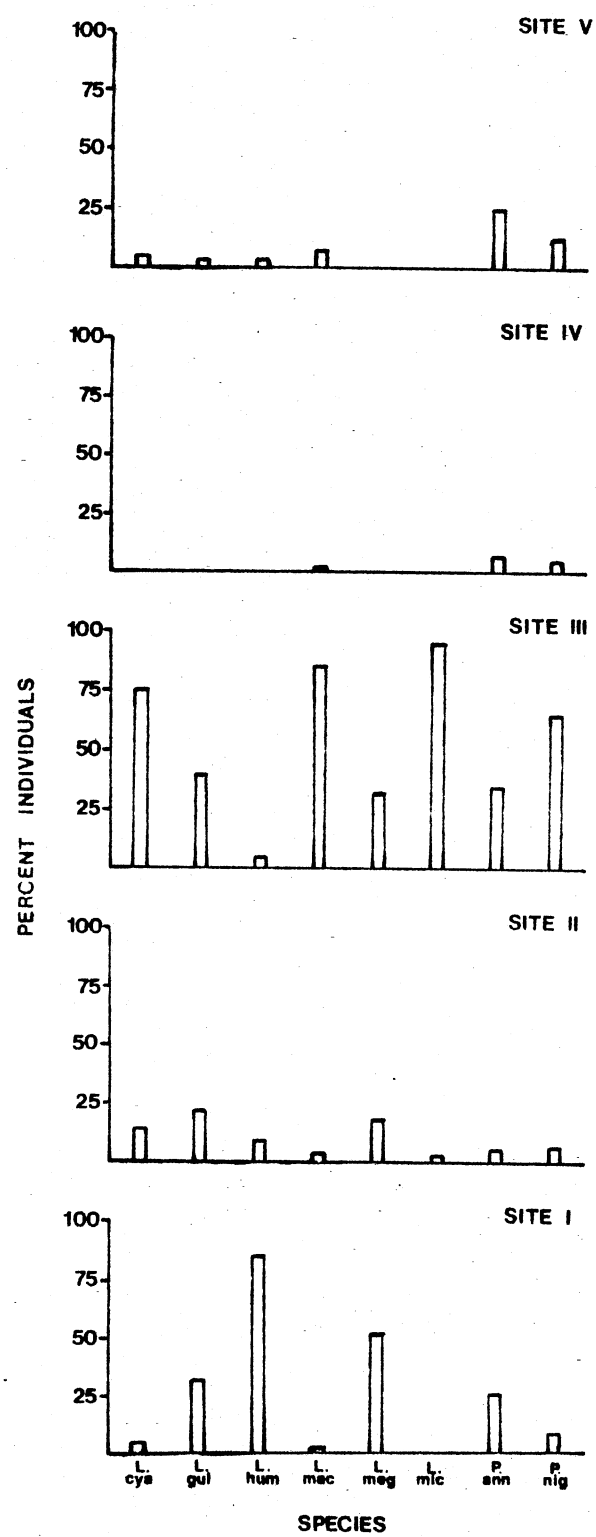

Figure 2. Percent of Individuals Collected from Each Site in Copan Reservoir, 1983-1984.

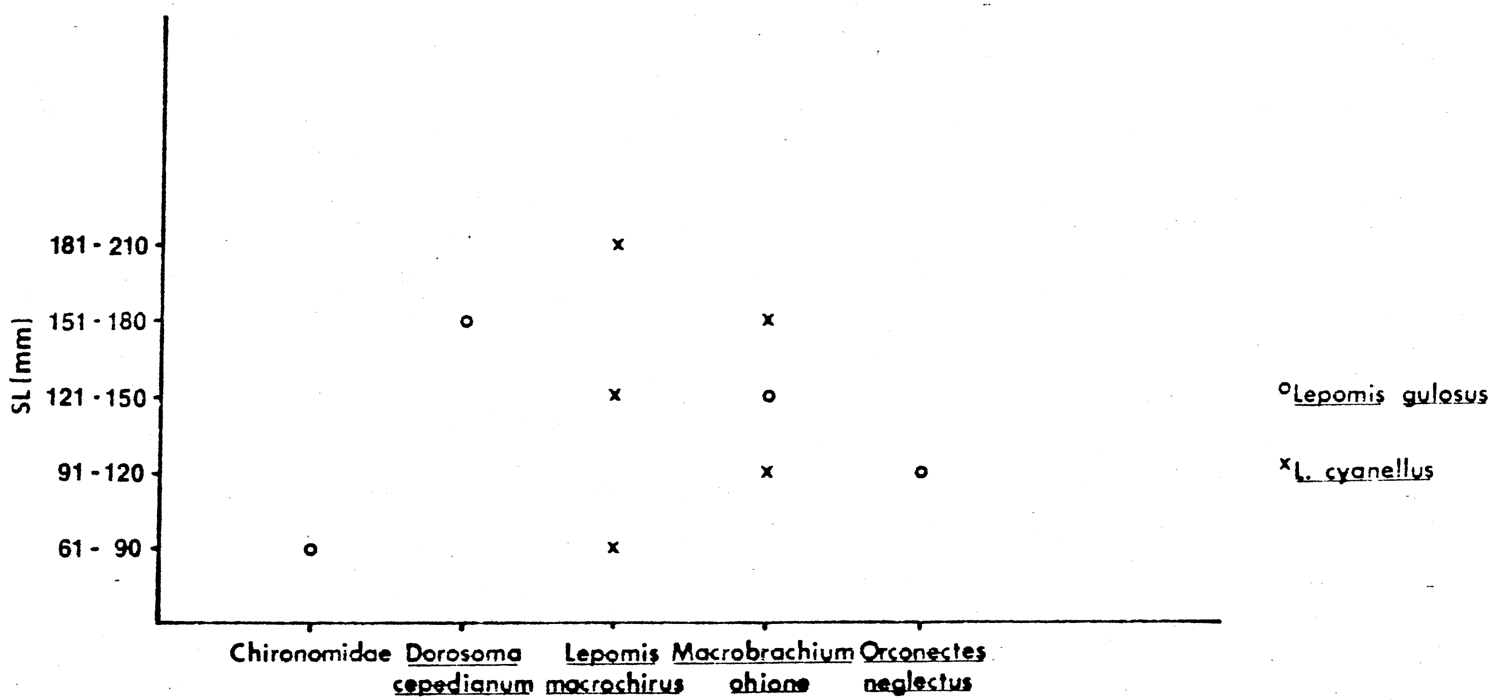

Figure 3. A Comparison of Important Prey Items, Based on Mean Weight, Ingested by Lepomis gulosus and Lepomis cyanellus.

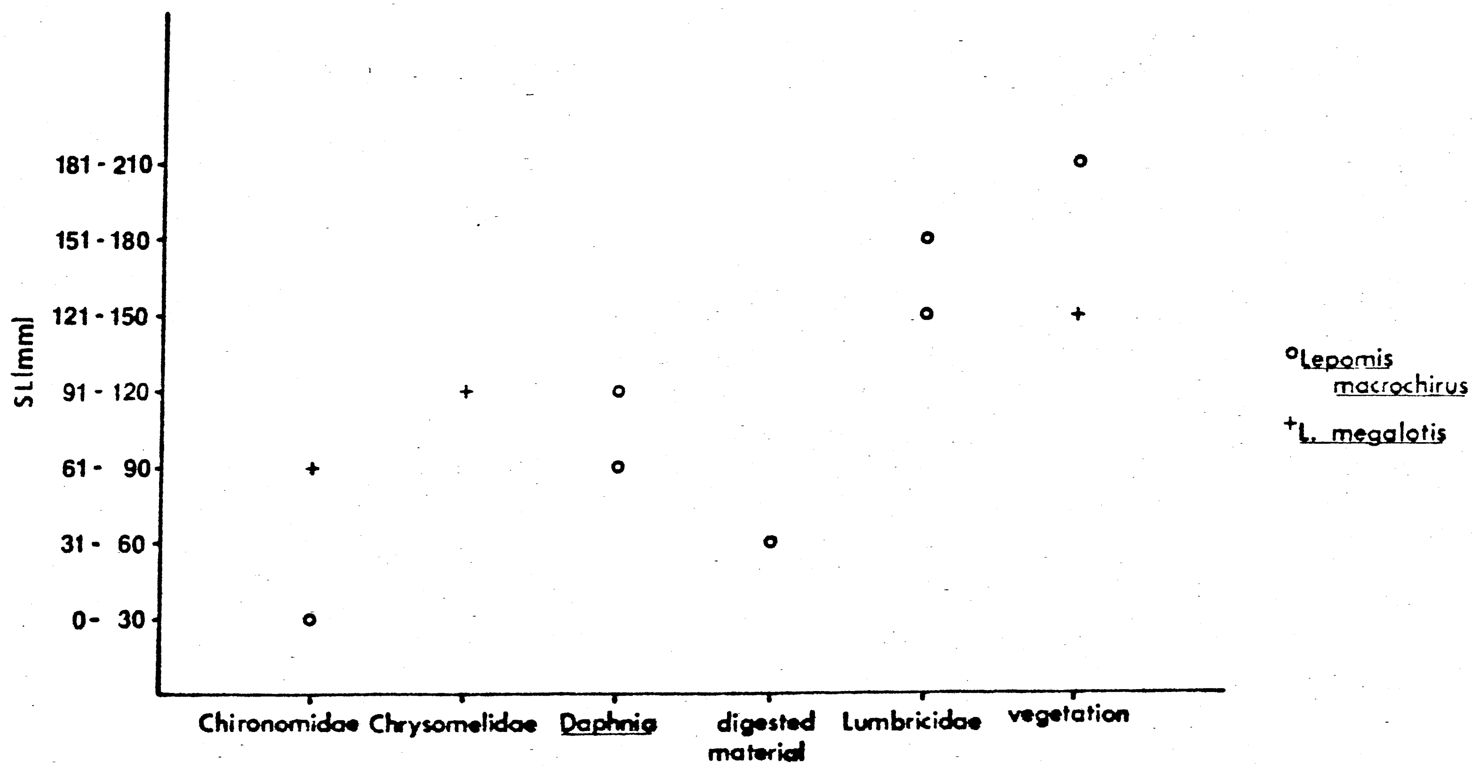

Figure 4. Comparison of Important Prey Items, Based on Mean Weight, Ingested by Lepomis macrochirus and Lepomis megalotis.

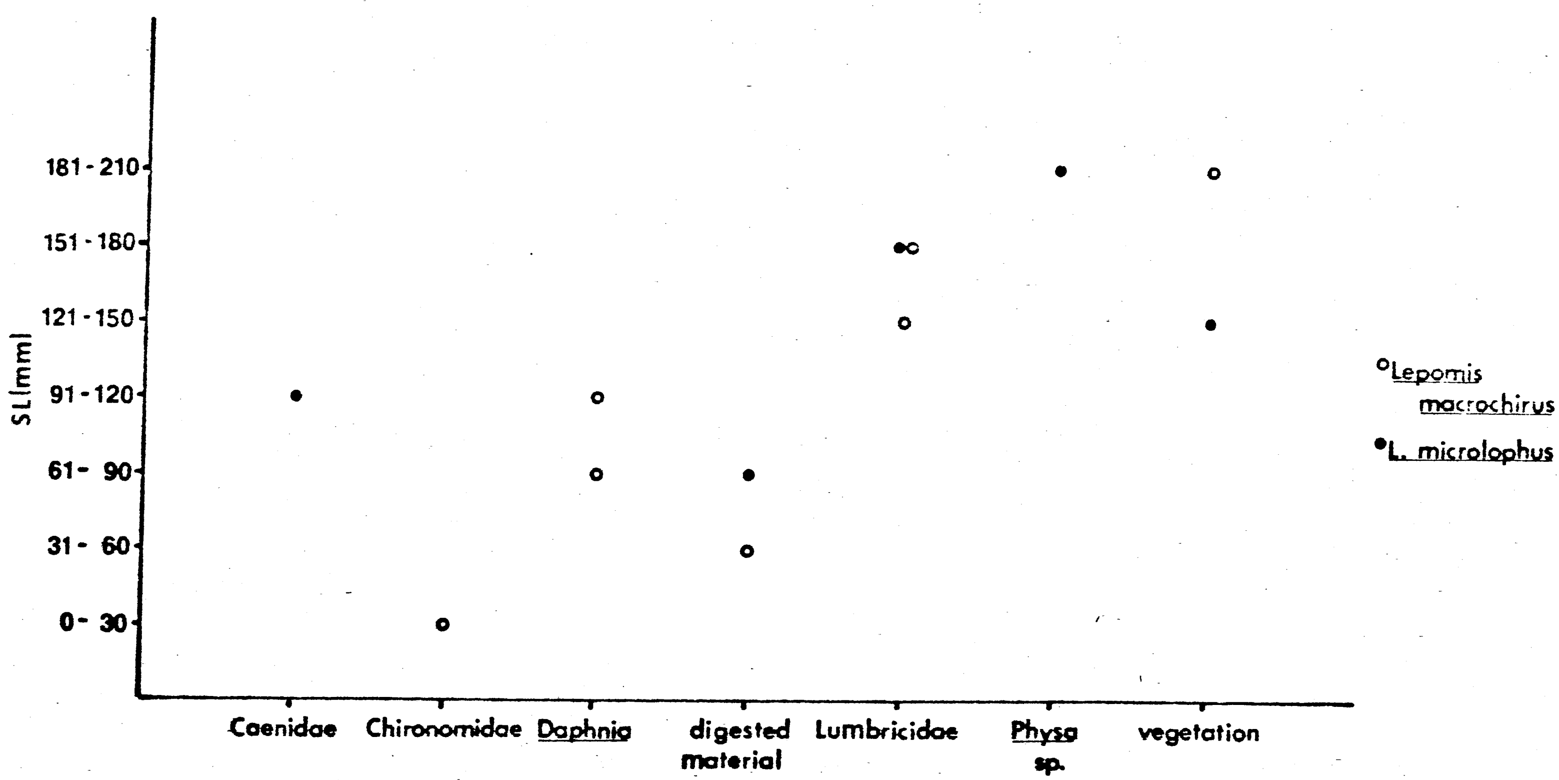

Figure 5. A Comparison of Important Prey Items, Based on Mean Weight, Ingested by *Lepomis macrochirus* and *Lepomis microlophus*.

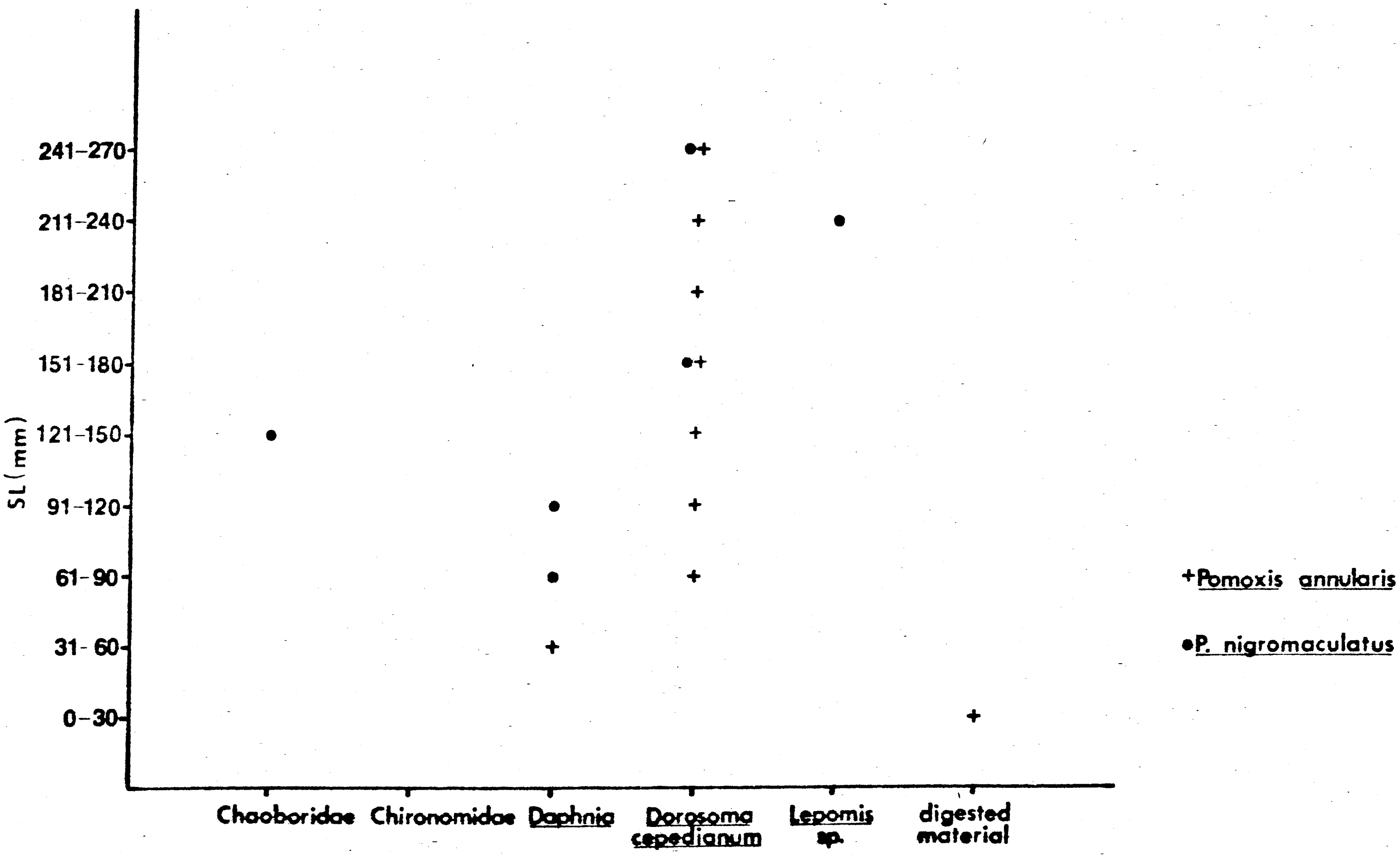

Figure 6. A Comparison of Important Prey Items, Based on Mean Weight, Ingested by Pomoxis annularis and Pomoxis nigromaculatus.

VITA

Susan Lynn Mearns

Candidate for the Degree of

Master of Science

Thesis: RESOURCE PARTITIONING AMONG CENTRARCHIDS IN COPAN RESERVOIR

Major Field: Zoology (Fishery Biology)

Biographical:

Personal Data: Born on 5 March 1959, in Bethlehem, Pennsylvania, the daughter of Frederick W. and Wilma L. Mearns.

Education: Graduated from Owen J. Roberts Senior High School, Bucktown, Pennsylvania, June 1976; received Bachelor of Science degree from Oklahoma State University, Stillwater, Oklahoma, May 1979; completed requirements for Master of Science degree in Zoology (Fishery Biology) from Oklahoma State University, December 1985.

Professional Experience: Nursery Technician, 1980 to 1981, Oklahoma State Forest Tree Nursery, Washington, Oklahoma; Field Technician, 1982, Soil Conservation Service, Medford, Oklahoma; Graduate Teaching Assistant, 1983, Department of Zoology, Oklahoma State University, Stillwater, Oklahoma; Graduate Research Assistant, 1983 to 1985, Oklahoma Cooperative Fish and Wildlife Research Unit, Oklahoma State University, Stillwater, Oklahoma.

Professional Affiliations: American Fisheries Society, Animal Behavior Society, American Society of Ichthyologists and Herpetologists, The Ecological Society of America.