Lake Anna
2007

Background/stocking/regulations

Lake Anna is a 9,600-acre impoundment owned by the Dominion Virginia Power Company (Dominion). The reservoir spans Louisa, Spotsylvania and Orange counties and serves as cooling water for the two-unit North Anna Nuclear Power Station. Dominion has recently filed paperwork and initiated environmental studies needed to add two additional reactors to the site.

Fish stocking began in 1972 with introductions of largemouth bass, bluegill, redear sunfish and channel catfish. Subsequent stockings of redear, channel catfish, walleye, striped bass and largemouth bass (both Florida and northern strains) were made. Threadfin shad and blueback herring were successfully introduced in the 1980s. Striped bass and walleye were usually stocked annually until 2007 when walleye stocking was discontinued due to poor post-stocking survival.

A 20-inch minimum length limit and a four-per–day creel limit regulate striped bass harvest. A 12-15 inch slot length limit was established to restructure the largemouth bass population in 1985. Prior to that time, a 12-inch minimum size limit was in effect, but in 2005; the bass slot limit was rescinded due to extraordinarily high voluntary release rates of largemouth bass.

Creel survey

A 2005 daytime creel survey (a survey where anglers are interviewed about their fishing habits, preferences and success rates) indicated that annual fishing pressure was 13 hours/acre. This rate was considered moderate for a large reservoir and was below the previous Lake Anna sample (24 hours/acre in 2000); however, the 2000 survey was conducted during a drought year when lack of inclement weather likely increased fishing pressure. Additionally, both surveys were conducted during daylight hours from established boat access points. Thus, fishing effort originating from private docks and nighttime angling effort were not recorded resulting in an underestimate of true fishing pressure.

Preferred species selected by anglers in 2005 included largemouth bass (62%), striped bass (22%), crappie (15%) and catfish (1%). These fishing preferences were similar to those documented in 2000 but represented declines in percentage of anglers seeking largemouth bass and catfish and increases in percentage of anglers seeking striped bass and crappie (striped bass represented the largest shift in either direction – an increase from 15% to 22%). Dominant species *caught* (by number) were black crappie (49,011 or 48%) and largemouth bass (25,776 or 25%), but an extraordinary number of largemouth bass were released (99.5%). Thus, dominant species *harvested* (by number) were black crappie (31,670 or 82%) and striped bass (5966 or 15%). Striped bass harvest increased, likely concomitant with pressure, 246% from 2000 when only 4% of fish harvested were striped bass.

The aquatic weed *Hydrilla verticillata* became established in Lake Anna during the late 1980s, and abundance increased rapidly--from 96 acres in 1990 to 832 acres in 1994. Sterile (triploid) grass carp (N=6185) were stocked into Virginia Power's Waste Heat Treatment Facility (WHTF) in 1994 to control *Hydrilla*. The WHTF is separated from Lake Anna by three dikes, and thermal effluent enters the lake via gravity flow under the third dike. All grass carp stocked in the WHTF were marked with coded wire micro tags. No grass carp were stocked in Lake Anna. Grass carp began to appear in Lake Anna a short time after the stocking of the WHTF obviously having negotiated the gravity feed beneath the third dike. Hydrilla abundance declined rapidly in Lake Anna and in the WHTF during the following years. However, weather conditions during 1995 were suboptimal for aquatic macrophyte growth, and it is likely that the combination of these climactic conditions and foraging by grass carp reduced, and finally eliminated, *Hydrilla* from Lake Anna. Aquatic plants are generally considered desirable in an aquatic system. It has taken years for the grass carp population to decline through natural mortality and only recently have small amounts of aquatic vegetation begun to emerge.

Fish Sampling

Historically, rotenone sampling at Lake Anna was conducted every three years to generate species composition and biomass estimates. This sampling involved the poisoning of four coves with a piscicide, and collected data were used to evaluate forage abundance (gizzard shad, threadfin shad, and blueback herring) for stocked predators and monitor overall fish community composition. However, due to extremely high variances in biomass estimates, heavy shoreline development (with the potential for public relations problems) and intensive manpower requirements; rotenone use at Lake Anna was discontinued after 1995. Increased gill netting with larger, multi-panel nets was determined to be an adequate replacement for community structure and forage evaluation while providing the needed data for predator stocking evaluation. Current annual sampling includes spring electrofishing for largemouth bass in the upper, middle and lower portion of the reservoir. Upper lake electrofishing is conducted on Pamunky Creek (above Terry's Run); middle lake sampling is conducted in the vicinity of the splits (to Stubbs Bridge on Pamunky Creek and Route 719 on the North Anna River); and lower lake sampling is conducted between the Dam and Dike II. Gill net surveys are stratified by upper and lower lake (using Route 208 as the boundary), and specific sites are selected based on a random block design. A total of 36 net nights of effort are conducted annually (one net set overnight is one net night). Gill nets are 200 X 8 feet and have eight different 25-foot panels that allow the sampling of most sizes of fish present in the lake. Typically, with either gear; fish are measured for total length and weight and released. However, ear stones (otoliths) may occasionally be removed from fish to determine exact age. This information is crucial when evaluating certain population parameters and determining stocking success.

Stockings during the past decade included striped bass and walleye (Table 1). Stocking rates and locations were variable in attempts to maximize hatchery resources. Stocking evaluations are included below as part of a species-by-species summary of fish population status.

Largemouth Bass

Largemouth bass mean electrofishing catch rate (CPUE, or number caught per hour of electrofishing) for all size groups increased or remained stable over the past decade, and most were at or near record levels in 2006 (Table 2, Figure 1). Size groups of largemouth bass are universally defined as stock (at least 8 inches), quality (at least 12 inches), preferred (at least 15 inches), and memorable (at least 20 inches). Fingerlings are less than 8 inches. CPUE trend of fingerling, stock-size, quality-size and preferred-size bass between 1993 and 2006 had remarkably similar gradual, ascending slopes suggesting abundance of these size groups increased. Data points undulate in a typical fashion around these trend lines, but overall increases of quality and preferred size groups were statistically significant. Stock-size fish are generally considered to be mature (or nearly so) and recruited to the population. Minimal variation in bass fingerling catch rate suggested Lake Anna is a stable system and produces consistent year classes (or cohorts) of bass from year-to-year. Minimal variability in stock-size bass catch rate similarly suggested the adult population was stable.

CPUE was always significantly higher in the upper and middle lake than in the lower lake. This was likely due to a productivity gradient expected in a large tributary storage impoundment, as biomass is usually much higher at upstream locations.

Largemouth bass structural indices (PSD and RSDs) paralleled catch rates and suggested that population size structure shifted gradually upwards - towards larger individuals (Table 3). PSD (proportional stock density) is an index that describes the size structure of a population and may be used in context of predator/prey relationships to determine balance within a fish community. Simply - the larger the number; the larger the proportion of big fish in a population. PSD for largemouth bass is determined by the ratio of the number of bass that are greater than eight inches but also greater than 12 inches. Similarly, RSD-P (relative stock density of preferred bass) is a ratio of the number of bass that are greater than eight inches but also greater than 15 inches. PSD and RSD-P values suggested the population had adequate numbers of large bass - especially as a ratio to smaller fish given that the sample size in 2006 (430) was the largest ever collected.

Otoliths have not collected from bass since 2002. Otoliths from a subset of bass collected during electrofishing were removed in 1999-2002 to evaluate growth and mortality. Bass growth rates were above average for young fish, as fish reached 7.2 inches, 10.6 inches and 13.1 inches by their first, second and third years. However, growth slowed in the upper portion of, and just over, the slot (since removed). A typical bass reached 15 inches at 4.4 years and averaged only about one inch per year until age eight or nine. Evidence suggested that bass at Lake Anna may be stockpiling and stunting, albeit at a more desirable size than typically occurs. Current growth patterns require a bass about ten years (at a conservative minimum) to reach citation length (22 inches). Based on growth curves, it's more likely that citation bass are at least 12 years old unless other factors are at work (e.g., forage and growth variability). Fish up to age 13 were collected.

Total annual mortality (the percentage of the bass population that dies each year from all causes) was 27% for fish aged 2-12 based on a catch curve of bass sampled in 2002. When other years were combined, the overall mortality estimate was 31%. While these estimates assume constant recruitment (equal production of young fish from year-to-year), they are low and support current and previous findings at Lake Anna (e.g., high bass abundance and structural indices, rapid to slow growth pattern, low relative weight, and low harvest). Total annual mortality is composed of natural and fishing mortality. Estimates of annual natural mortality were similar to the rates listed above (for total mortality) and thus further suggested fishing mortality was very low.

Relative Weights (Wr, a measure to describe the plumpness or well-being of a fish) were highest in upper lake bass and declined down lake. The lowest Wr values were from lower lake fish. Overall, Wr values at Lake Anna were lower than for largemouth bass from other district waters.

Stomachs taken from fish sacrificed for otoliths were analyzed, and 61% were empty. Bass that had stomach contents ate fish (35%), artificial lures (2%), crayfish (1%) and insects (1%). Many consumed fish were unidentifiable, but the following were observed in decreasing abundance: bluegill, white perch and threadfin shad. It is likely that many of the unidentifiable items were shad (either gizzard or threadfin).

Striped Bass

Striped bass were stocked annually at a variable rate (Table 1) in an effort to determine an optimum stocking rate for Lake Anna, as overstocking could result in reduced growth, survival and/or recruitment. Lake Anna striped bass stockings were evaluated with gill nets (for fish under age 5). Older (larger) individuals were caught periodically and provided useful information, but the maximum bar mesh size of 2 inches precluded reliable sampling of larger striped bass.

Generally, young fish grew quickly through age 3 (when they reached the legal 20-inch minimum size), but growth slowed thereafter. Striped bass averaged 10, 18 and 22 inches at ages 1, 3, and 5. This pattern of striped bass growth (rapid growth of juvenile and sub-adult fish followed by slow growth of adults) is common in southeastern reservoirs with marginal habitat such as Lake Anna. Habitat needs shift as striped bass age, and summer conditions at Lake Anna typically find water temperature and dissolved oxygen combinations marginal for adult striped bass, especially in the lower portion of the reservoir. For comparison, striped bass at Smith Mountain Lake; a reservoir with good adult striped bass summer habitat, averaged 10, 21 and 26 inches at the ages 1, 3, and 5.

Efforts to correlate number of fish stocked with abundance, based on gill net catch, were unsuccessful. Stocking rates between 5 and 32 fish per acre were used in an effort to establish the best striped bass stocking rate for Lake Anna (more fish are not always better, and excessive stocking can lead to increased competition, lower body mass during the first winter and subsequent poor recruitment). Findings suggest that the number of striped bass that recruit to the population is based, at least in part, on other variables (likely environmental effects or forage abundance, such as zooplankton, at the time of stocking). It was noteworthy that the lightest stocking (5 per acre in 2001) resulted in the lowest catch of age 0 fish in 2001 and the second lowest catch of age 1 fish the following year (2002), but catch of this year class was average over the next two years. Intermediate stocking rates (10-11 per acre) resulted in some of the strongest and most persistent year classes. The highest density stocking occurred in 2006 when 32 fish per acre were stocked. This stocking resulted in a record catch of age-0 fish (110). It will be interesting to follow this year class through time to see if it is as persistent as other dominant year classed (e.g., 1997).

Cohort based mortality estimates were calculated for each striped bass year class with ample data (1997-2003). These estimates provided the total annual mortality rate – that is, the percentage of the year class that died each year from all causes. Essentially, each stocking was considered a subgroup, and these groups were followed through time to see how they survived. The oldest year classes had the most data points (or years of catch-per-unit-effort data) and provide the best relationship. The 1997 year class had only a 28% total annual mortality rate (fish age 0-5) which translated into a high 72% survival rate. Other survival estimates with large data sets were similar and ranged from 64-74%. Two estimates had lower survival (51-61%), but these had fewer data points. These findings suggest that the overall mortality rate for striped bass at Lake Anna is moderate to low.

Relative abundance of striped bass in Lake Anna was estimated by catch rate or catch per unit effort (CPUE). This was simply the number of striped bass caught per net night of effort. Since new netting protocols were established in 1997, CPUE for striped bass in gill nets has ranged from 3.0 (1998) to 5.9 (2006). The 10-year striped bass average CPUE was 4.0 (Table 4). Most striped bass were caught in the upper portion of the reservoir. The North Anna River from Rose Valley upstream to Route 719 and the Pamunky River from Jetts Island upstream to Terry's Run were typically very productive locations during November and December netting.

Walleye

Walleye were historically stocked sporadically at Lake Anna (Table 1). However, as a result of a statewide walleye study and recommendations by the DGIF Walleye Committee, stockings were stabilized after 1997 with at least 25 per acre stocked thereafter (Lake Anna was included in a statewide walleye research project, and a special addition of *Virginia Wildlife* Magazine was published in June 2001 detailing findings. Reprints are available from DGIF Regional Offices). In addition to increasing the stocking rate and frequency, new stocking sites and methods were added in an effort to expand the population after it was discovered that most walleye were confined to the Pamuky River tributary arm. It was hypothesized that since all historical stockings had occurred in this arm of the upper reservoir, the population was exhibiting a homing tendency thereby limiting dispersion. Walleye stockings were evaluated with gill nets, and it was assumed that nets gave unbiased population samples of fish under age 4. Older (larger) individuals were caught periodically and provided useful information, but the maximum bar mesh size of 2 inches precluded reliable sampling of larger walleye.

Like striped bass, young walleye grew rapidly at Lake Anna attaining 19 inches after only three growing seasons. However, after reaching about 20 inches, growth declined and became sporadic. Further increases in total length occurred very slowly. Walleye averaged 11, 19 and 20 inches at ages 1, 3, and 5. Walleye up to age 12 were collected, but sample sizes were low for fish older than age 3.

Efforts to spatially expand the walleye population by adding stocking sites in the lower, middle and upper portions of the reservoir initially seemed successful but now appear dubious. Beginning in 1999 with Duke's Creek, one or more annual stocking sites were selected in portions of the reservoir where walleye stockings had not historically occurred (new sites were Christopher Run, Sturgeon Creek and the State Park). The percentage of walleye captured with gill nets in the upper vs. lower portion of Lake Anna should be a reasonable indicator of population dispersion (the assumption being given equal effort, catch in lower and upper reservoir portions should be similar). Historically, walleye catch in the upper lake was at or near 100% but dropped to around 50% in 1999 and 2000 after lower lake stockings. This indicated lower lake stockings were spatially expanding the population; however, lower lake catch was mostly age 0 (young-of-year) fish, and recent years saw upper lake catch return to the 80-95% range. Thus, the upper lake (specifically the Pamunky River arm) appears to possess habitat preferred by Lake Anna walleye.

The catch rate (CPUE) of walleye in gill nets ranged from a low of 0.4 (fish per net night) in 1998 and 2006 to 2.6 in 2002. Several years ago, the record catch in 2002 suggested new stocking protocols were finally increasing population size and provided optimism for the walleye population at Lake Anna. However, this optimism was short-lived, and CPUE declined each year after 2002 in a nearly linear trend to a record-tying low of 0.4 in 2006. Recent year classes (2005 and 2006) may have experienced poor recruitment due to fry (vs. fingerling) stocking, but the significant reduction in CPUE following 2002 was unanticipated and troubling. Walleye CPUE the past two years was below average despite annual stockings of at least 24 per acre from 1998-2003. It was likely that unmeasured factors on or about stocking dates (e.g., zooplankton abundance, water quality) impacted survival and subsequent recruitment. Thus, due to recruitment failures of stocked walleye and the resulting low population size combined with the low number of anglers pursuing (and catching) walleye, stockings were discontinued after 2006 (no walleye will be stocked in 2007 or later). Walleye will likely continue to be caught occasionally for at least another five years until natural and fishing mortality claim the remnants of this population.

Black Crappie

Black crappie were evaluated with experimental gill nets in 1997-2006. It was assumed that gill nets sampled to the entire population without bias. Otoliths were removed from all fish captured in 2002 to develop estimates of growth and mortality. Crappie were the second most abundant fish in gill nets, and although gill net effort was equal; most crappie (94%) were caught in the upper lake. Mean CPUE (catch per unit effort) in gill nets averaged 10.4 fish per net night between 1997-2006 with 1997 producing the highest (15.0) and 2000 the lowest (5.5) CPUE (Table 4). CPUE in 2006 (10.7) was slightly above average.

Black crappie size structure was excellent in 2006. Average size was nearly 9 inches, but very strong representation of 12-inch and over fish was present along with ample juvenile production. Mean size (based on total length) was significantly greater in 2006 than in any year since surveys began. Thus, spring 2007 should provide excellent crappie angling – both from the size and number standpoint.

Crappie growth, measured in 2002, was moderate but highly variable, which was typical. For example, age-3 fish averaged 8.3 inches total length but ranged from 5.8-12.4 inches. The mean length of age-3 crappie in other District waters (four small impoundments) was 8.5 inches. Sample sizes of crappie older than age 5 were small. Fish up to age 13 were collected in 2002, and an age 16 crappie was sampled several years prior to that. That fish was a nine-inch male; further illustrating the highly variable growth of Lake Anna crappie.

Catfish

Catfish populations were evaluated with experimental gill nets in 1997-2006. The five species caught (in decreasing abundance) were channel catfish, white catfish, yellow bullhead, brown bullhead and blue catfish; however, only the former two contributed significantly to overall biomass. Channel catfish were the fourth most prevalent species taken in gill nets.

Channel and white catfish CPUE (catch per unit effort) fluctuated during the period with no apparent trend within or between species. Highest CPUE occurred in 2005 for channel (6.2 fish per net night) and white catfish (4.9 per net night), but lowest CPUE occurred in 1997 for channel catfish (2.3 per net night) and in 2002 for white catfish (1.5 per net night). Catch of channel catfish was below average in 2002, while catch of white catfish was above average.

Channel catfish was one of the few species sampled in nearly equivalent numbers in the upper and lower portions of the reservoir - over 40% were collected from the lower reservoir, but average size was significantly greater in the upper reservoir. White catfish lengths were identical from both portions of the lake, but only 28% were collected below Route 208. Average total length of channel catfish was 15 inches, but several large specimens were observed including a potential world record. This monster was caught in a gill net and released in good condition near Dike III in December 2002 after weighing in at over 55 pounds.

Two small blue catfish were caught (one in 1997 and 1998). Their origin is unknown, as no stocking records exist for this species in Lake Anna; however, blue catfish were stocked in the Lake Anna watershed (Lake Orange) during the 1980s.

Forage

The forage base (members of the shad and herring family or clupeidae) includes gizzard and threadfin shad and blueback herring at Lake Anna. Most of the forage biomass is composed of gizzard shad, although blueback herring have been a challenge to effectively assess, and threadfin shad abundance is cyclic – based largely on minimum water temperatures, as this species has the proclivity to “winter kill”.

Estimates of gizzard shad biomass from historical rotenone samples ranged from near 100 to over 300 lbs/acre, while gill net CPUE (catch per unit effort) varied from 6.1 to 27.1 and averaged 13.9 fish per net night. The highest CPUE was in 2000, and the lowest was in 2004. It is unknown to what extent drought conditions in 2002 affected either the gizzard shad population or sampling efficiency, but reservoir levels were reduced in late 2001 when CPUE was 21.0. However, gizzard shad abundance has been cyclic, with low catch rates typically followed within a year to two by high catch rates. Catch rates of gizzard shad the past two years have been about average.

Gill nets were compared to night electrofishing for forage assessment in 2000 and were found to give acceptable (unbiased) estimates of size structure and had lower associated sampling variability. The size structure of the gizzard shad population fluctuated frequently but usually had a bimodal length distribution. Size distribution was good in 2006 with a bimodal length distribution suggesting a good diversity of forage and an average size of 8.6 inches. Most shad were caught in the upper lake.

Other Species

Lake Anna is home to many other species – some of various recreational importance including redear sunfish and white perch and others important ecologically such as creek chubsucker and white sucker. Habitats are variable throughout the lake, and species abundance can be sporadic. For example, chain pickerel (a native top level predator and sport fish) prefer slow moving coastal plain systems where tannins from leaf litter frequently stain the water and reduce pH to a level lower than typically found in the piedmont. Contrary Creek, while suffering from acid mine drainage, offers a unique habitat in Lake Anna and supports a thriving chain pickerel population. These species are sampled periodically in gill nets, and their abundance can be gauged by catch per unit effort or number caught per net night (Table 4).

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
STB	172	146	132	148	96	196	98	108	48	199	210	90	155	304
/ac	18	15	14	15	10	20	10	11	5	21	22	9	16	32
WAE	0	53	58	97	0	480	240	259	240	243	228	98	1600	623
/ac	0	6	6	10	0	50	25	27	25	25	24	10	167	65

Table 1. Predator Fingerling Stocking in Lake Anna 1993-2006 (numbers rounded to the nearest thousand; STB = striped bass, WAE = walleye; underlined numbers represent all or mostly fry).

	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Ave
Finger.	13	4	7	5	8	8	7	7	10	11	8	9	8	8
Stock	54	55	45	54	59	50	49	60	49	58	42	65	78	55
Quality	31	36	28	41	42	37	39	45	32	40	33	40	59	39
Prefer.	15	17	12	19	21	19	21	25	14	19	14	26	29	19
Memora.	2	2	0	3	2	1	4	2	1	1	1	4	2	2
Total	67	59	52	59	67	58	56	67	59	69	50	74	86	63

Table 2. Mean electrofishing catch per unit effort (CPUE) of various size groups of largemouth bass at Lake Anna, 1993-2006 with 13-year average (Ave). Fingerlings are less than eight inches, stock are at least 8 inches, quality are at least 12 inches, preferred are at least 15 inches, and memorable are as least 20 inches; note no sample conducted in 1994.

	1993	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
PSD	60	65	60	75	74	75	80	75	65	69	80	61	76
RSDP	29	33	27	36	35	39	43	42	29	32	35	40	37
RSDM	5	4	2	4	3	5	7	4	2	2	1	3	3
N	180	297	441	198	381	290	278	337	294	346	248	248	430

Table 3. Largemouth bass structural indices from electrofishing surveys at Lake Anna, 1993-2006 (PSD=proportional stock density, RSD=relative stock density; see narrative for explanation, N=total sample size).

Species	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Mean
Gizzard shad	8.5	11.8	9.3	27.1	21.0	6.2	22.2	6.1	11.3	15.2	13.9
B. crappie	15.0	11.2	13.7	5.5	8.2	12.2	6.3	11.4	10.0	10.7	10.4
White perch	2.6	8.1	12.5	11.3	15.1	8.5	10.4	13.5	11.7	7.8	10.2
Channel cat	2.3	5.7	3.5	4.1	5.5	4.7	5.5	4.5	6.2	4.0	4.6
Striped bass	4.4	3.0	3.1	4.8	3.5	3.7	3.9	4.0	3.3	5.9	4.0
W. catfish	1.9	4.5	3.4	2.2	2.4	1.5	2.2	3.2	4.9	3.2	2.9

Threadfin	1.6	1.0	0.4	3.6	1.6	1.3	7.3	2.6	0.9	1.6	2.2
Blueback	1.4	0.7	0.1	8.5	1.0	0.0	4.3	0.2	0.2	0.4	1.7
Largemouth	1.4	1.2	0.8	1.0	0.7	1.9	1.3	1.3	2.2	1.4	1.3
Walleye	0.6	0.4	1.0	1.6	1.0	2.6	2.0	1.5	0.9	0.4	1.2
Spot. shiner	0.6	0.2	0.6	1.0	0.8	0.4	0.5	0.2	0.1	0.1	0.5
White sucker	0.5	0.8	0.3	1.0	0.7	0.1	0.2	0.2	0.4	0.7	0.4
Bluegill	0.1	0.2	0.3	0.3	1.1	0.3	0.6	0.4	0.7	0.2	0.4
Redear	0.2	0.5	0.4	0.2	0.8	0.2	0.2	0.2	0.6	0.7	0.4
B. bullhead	0.0	0.0	0.1	0.3	0.3	0.3	0.1	0.2	0.2	0.1	0.2
C.chubsucker	0.1	0.0	0.3	0.0	0.9	0.1	0.1	0.1	0.2	0.1	0.2
C. carp	0.1	0.1	0.2	0.3	0.3	0.2	0.1	0.2	0.3	0.2	0.2
Y. bullhead	0.3	0.4	0.1	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.2
C. pickerel	0.1	0.0	0.1	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.1
Quillback	0.0	0.0	0.0	0.3	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Yellow perch	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.1
G. shiner	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Redbreast	0.0	0.1	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.1
Warmouth	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.1
Blue catfish	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
G. sunfish	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
S'fin. shiner	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
S. redhorse	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1

Table 4. Catch per unit effort (number of fish per net night) for 28 fish species sampled at Lake Anna for ten years with gill nets. Fish listed in decreasing order of abundance for mean catch.

Figure1