Eastern Basin of Lake Ontario Warmwater Fisheries Assessment, 1976-2008

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Each year the New York State Department of Environmental Conservation (NYSDEC) assesses the warmwater fish community in New York waters of Lake Ontario's eastern basin. This long-term assessment program was initiated in 1976 to establish abundance indices for warmwater fishes in the eastern basin, with emphasis on smallmouth bass, walleye, yellow perch, and white perch. Data collected allows for evaluations of other population parameters including growth, age structure, year class strength, survival rates, and diet composition for some of the target species. Data collected during this assessment have been used to evaluate impacts of Double-crested cormorant predation on smallmouth bass and yellow perch populations in the eastern basin (O'Gorman and Burnett 2001, Lantry et al. 2002). This report focuses on 2008 abundance indices as they relate to previous years and provides an evaluation of smallmouth bass growth trends.

Methods

A standardized, stratified random design gillnetting assessment was conducted annually from 1976 through 2008 in the New York waters of Lake Ontario's eastern basin to assess the warmwater fish community. Sampling was initiated as early as July 29 and completed as late as August 25, typically occurring during the first two weeks of August. Since 1980, standardized net gangs (nine 50 ft panels, 8 ft deep, and stretch-mesh sizes ranging from 2-6 in by ½ in increments) were set overnight, on bottom and parallel to depth contours at predetermined, randomly selected sample locations. Detailed assessment methods and corrections for 1980, 1989, and 1993 survey and gear design changes were described previously (Eckert 1986, 1998, and 2006). A net set was deemed biased, and data from that set were not analyzed, when there was any indication of fouling or tampering. In 1993, gear changed from multifilament gill nets to monofilament gill nets and correction factors were determined, applied to multifilament catch data, and "monofilament equivalents" were calculated (Eckert 1998). The random survey design was stratified by three depth strata (Stratum 1: 12-30 ft; Stratum 2: 31-50 ft; Stratum 3: 51-100 ft) and five area strata (Grenadier Island, Chaumont Bay, Black River Bay, Henderson Bay, and Stony Island Areas) (Figure 1). Emphasis was placed on sampling depth stratum 1 and 2 with 10 and 9 net gangs, respectively, scheduled each year. Area strata were used primarily to ensure that all major geographic areas within depth strata 1 and 2 were sampled each year in proportion to their surface areas.

Prior to 1996 a net set was canceled and the catch of warmwater fish was assumed zero when the scheduled set location had stable water temperatures <50°F. Experience had shown that catches of warmwater fish were consistently zero in areas inundated by cold hypolimnetic waters (Eckert 2006). From 1996-2005 all scheduled net sets were completed regardless of temperature given the potential for a shift in fish depth distribution related to increased water clarity resulting from dreissenid mussel colonization. Similar shifts were observed with alewives, rainbow smelt and lake trout (e.g. O'Gorman et al. 2000). During that time period, 18 nets were set and pulled at temperatures <50°F. Sixteen out of 18 nets captured coldwater fish species (mean=10.5 coldwater fish per net, most of which were lake trout) and only seven of those 16 captured warmwater species (mean=3.7 warmwater fish per net). Two of the 18 nets captured zero fish. Beginning again in 2006, a net set was canceled and catch of warmwater fish was assumed zero when a net set was scheduled at a location with stable water temperatures <50°F because nets set in consistently cold water had zero to very low incidence of warmwater fish catch and relatively high incidence of coldwater fish catch, particularly lake trout (e.g. 1996-2005 data). Additionally, cancellation of net sets scheduled for consistently cold water would avoid the capture of lake trout, the focus of an international restoration effort (Lantry and Lantry 2009).

In 2008, 29 randomly chosen netting locations were determined prior to initiation of the assessment on August 4. From August 4 through August 14, we completed 26 unbiased net sets and canceled one additional net set because of stable, cold water temperatures at the predetermined netting location. We assumed a warmwater fish catch of zero at that canceled net location.

For each fish collected, we determined species, length and weight, and when possible sex and maturity (with the exception of longnose gar). We collected diet information from all predators (i.e. smallmouth bass, walleye, northern pike, and muskellunge) beginning in 2000. For each assessment year, scales were collected from all species with the exception of Ictalurids and longnose gar. We removed cleithra from all Esocids and pectoral spines from all Ictalurids. From 2003-2008 we collected otoliths in addition to scales from smallmouth bass >13.8 in, yellow perch >8.7 in, and all walleye and freshwater drum.

An index of abundance, as measured by mean stratified catch-per-unit-effort (CPUE = fish per overnight net set), was determined for the total warmwater fish catch and each fish species captured. Species diversity and CPUE by depth stratum were examined. Otoliths from walleye caught in 2008 were aged. Additional data analyses were completed for smallmouth bass including: 1) scales (1976-2003 and 2006-2008) and otoliths (2006-2008) were aged and mean length-at-age was determined, 2) for each sample year condition was calculated for each inch increment (7-19 in), and 3) the age composition of bass fully vulnerable to our gear was determined (i.e. $\geq$ 12 in) for each year 1976-2003 and 2006-2008.

Results and Discussion

2008 Water Temperature

In 2008, bottom temperatures for all net sets in depth strata 1 (12-30 ft) and 2 (31-50 ft) ranged from 72.3°F to 75.9°F. For net sets in stratum 3 (51-100 ft), bottom temperatures ranged between 51.3°F and 72.9°F. Three unbiased sets in depth stratum 3 may have experienced some periods of water temperatures <50°F, given that three coldwater fish species were captured in those nets.

Species Composition

Since 1976, 44 fish species were captured during the eastern basin gillnetting assessment (Table 1). In 2008, 1,369 fish were captured in unbiased net sets, representing 17 warmwater species (1,363 fish) and three coldwater species (six fish). The greatest species diversity and CPUE occurred in depth stratum 1 (15 species; CPUE=81.25). Eleven species were captured and CPUE was 46.63 in depth stratum 2. The lowest species diversity and catch typically occurs in depth stratum 3 (Eckert 2006), with only six warm water species captured and a CPUE of 28.33 in 2008.

Dominant species in the catch have changed over time. From 1976-1979 white perch, yellow perch and gizzard shad were the most commonly caught species and represented an average of 37.2%, 22.1% and 14.3% of the total catch, respectively (Table 1). Through the 1980s smallmouth bass (mean=25.2%), yellow perch (mean=25.0%) and white perch (mean=22.5%) dominated gillnet catches. Since 1990, smallmouth bass and yellow perch were the most common species, averaging 32.2% and 29.7% of the total warmwater catch, respectively. From 1995-2007 catches of white perch remained low (mean=3.7%); however, in 2008 it was the third most commonly caught species and represented 17.5% of the catch. Smallmouth bass (20.9%) and yellow perch (38.1%) remained the most common species captured in 2008 (Table 1).

Lake sturgeon is designated as a threatened species in New York State. Prior to 1995, this species was extremely rare in this assessment, with only one lake sturgeon captured in 19 years (Table 1). From

1995-2007, at least one sturgeon was collected in 11 of the 13 years. In 2008, no lake sturgeon were captured in this assessment.

Round goby (*Neogobius melanostomus*) is an invasive species first reported in southwestern Lake Ontario in 1998 and in the Bay of Quinte in 1999 (Mills et al. 2005). Since then, gobies have increased in both distribution and abundance throughout Lake Ontario (Walsh et al. 2007, Walsh et al. 2008). Although present in Lake Ontario for some time, gobies did not appear in this assessment until 2005 when two were captured (Table 1) and they have appeared in low numbers each year since. This assessment will not provide an index of goby abundance due to their relatively small size and the size-selective nature of the assessment gill nets. We are, however, able to gain insight into the importance of gobies in predator diets during early August from examination of predator stomachs.

Diet information from all predators captured was collected from 2000-2008. Although gobies were present in Lake Ontario as early as 1998, they did not appear during this survey until 2005 when they were caught in gillnets and observed in predator diets. The occurrence of gobies in smallmouth bass stomachs has increased each year since 2005 when 16 gobies were observed in bass stomachs. In 2006, 20.3% of the non-empty smallmouth bass stomachs processed contained gobies (mean=1.3 gobies/stomach). In 2007, gobies were found in 28.2% of the non-empty smallmouth bass stomachs processed (mean=1.2 gobies/stomach). The occurrence of round gobies increased in bass diets in 2008, when 51.0% of non-empty bass stomachs contained an average of 1.8 gobies/stomach. Gobies were also present in walleye diets each year from 2006-2008, when one goby was found in a walleye stomach each year. In 2008, round goby was present in two out of three non-empty northern pike stomachs. Although not quantified, round gobies were observed in stomachs of other fish species including rock bass, yellow perch and white perch. Double-crested cormorants in the eastern basin are also consuming round goby. This species first appeared in diets of cormorants at the Snake and Pigeon Island colonies in 2002 (Ross et al. 2003) and at the Little Galloo Island colony in 2004 (Johnson et al. 2005). Gobies were consumed each year since then and now dominate cormorant diets (Johnson et al. 2009).

<u>Abundance Trends, 1976-2008</u>

Total Warmwater Catch

The abundance index for warmwater fish in the New York waters of Lake Ontario's eastern basin was highest during the early years of the assessment (1976-1979 mean stratified CPUE: 209-257) then declined (1984-1986 mean CPUE=68.7; Table 1, Figure 2). The decline in warmwater fish abundance is primarily due to declining indices for white perch (1976-1979 mean CPUE=90.1, 1984-1986 mean CPUE=15.7), yellow perch (1976-1979 mean CPUE=51.8, 1984-1986 mean CPUE=17.6), gizzard shad (1976-1979 mean CPUE=34.7, 1984-1986 mean CPUE=0.6), and rock bass (1976-1979 mean CPUE=13.5, 1984-1986 mean CPUE=6.2) (Table 1, Figures 3-6). The mean stratified CPUE for all warmwater species reached a record low level in 1995 when CPUE was 14.9, 94% lower than the 1976-1979 average (Table 1, Figure 2).

Since 1996, mean stratified CPUE for total warmwater fish catch varied without trend (Eckert 2006), averaging 23.0 and ranging between 14.9 (1995) and 31.4 (2005) (Table 1, Figure 2). In 2008, the mean stratified CPUE of 44.4 was 74.5% and 94.4% above previous 5-year (2003-2007) and 10-year (1998-2007) averages. This was the highest CPUE since 1992 and is primarily attributable to increased CPUE of white perch (CPUE=7.7, highest since 1991) and yellow perch (CPUE=16.9, highest since 1984; Table 1, Figure 3, Figure 4).

Alewife, smallmouth bass and walleye were other species influencing trends in the total warmwater CPUE. Alewife was relatively common in the assessment and varied without trend through 1988 before declining to low levels (Table 1, Figure 7). Trends for smallmouth bass and walleye, both common in the assessment, differed from the other species in that walleye catches increased since the start of the assessment (Figure 8) and smallmouth bass trends varied over time (Figure 9). Catches of other species (i.e. white sucker, brown bullhead, channel catfish, pumpkinseed sunfish, freshwater drum, northern pike, and common carp) were low and variable across the entire data series (Table 1, Figures 10-16).

White Perch

The most notable decline in the warmwater abundance index between the late 1970s and mid 1980s occurred with white perch and gizzard shad, the two most abundant species in 1977 and 1978. White perch declined 83% between the 1976-1979 and 1984-1986 time periods (Table 1, Figure 3). Their catch continued to decline, reached a low CPUE of 0.06 in 1995, and remained low through 2007. In 2008, white perch mean stratified CPUE was 7.7, a more than 6-fold increase over the previous 5-year average and the highest observed since 1991.

Gizzard Shad

Gizzard shad was one of the most abundant species at the start of the warmwater assessment program (Table 1, Figure 5). Abundance declined 98% from the 1976-1979 (mean CPUE=34.7) to 1984-1986 (mean CPUE=0.6) time periods. Since then, gizzard shad abundance remained low, with mean stratified CPUEs of zero or <1 in 23 of the last 27 years.

Yellow Perch

Yellow perch were commonly caught since the assessment began in 1976, however, abundance declined significantly through the early to mid-1980s reaching a low CPUE of 2.2 in 1988 (Table 1, Figure 4). After that, mean stratified CPUE varied without trend (Eckert 2006) and averaged 7.4 from 1989-2006 (range: 2.8 [1993]-13.6 [1990]). Yellow perch CPUE increased in 2007 to 14.0. In 2008, estimated yellow perch CPUE was 16.9, the highest CPUE since 1984, 129.5% higher than the 1989-2006 mean and 74.1% higher than the previous 5-year mean (2003-2007). Data collected during the Lake Ontario fishing boat survey also suggested relatively higher yellow perch abundance in 2008, in that although total fishing effort was among the lowest in 24 years surveyed, yellow perch catch and harvest were the second highest and highest estimated, respectively (Lantry and Eckert 2009). Additionally, there were several anecdotal reports of excellent yellow perch fishing (numbers and size) throughout the season and at several locations along the New York shoreline.

The increase in yellow perch CPUE may be attributable to several factors, including recent trends in cormorant abundance and diet, production of a strong year class, and changes in net catchability. Fall trawl sampling conducted in the eastern basin showed that relatively strong year classes of yellow perch were produced in the early 1990s (O'Gorman and Burnett 2001), however, anticipated increases in assessment CPUE at older ages did not occur. Analyses indicated increased mortality of age 0-2 perch during that time period which was attributed, in part, to increased predation by Double-crested cormorants (O'Gorman and Burnett 2001). Since then, management of the Double-crested cormorant population reduced both the number of cormorant feeding days (the measure used to evaluate cormorant management efforts) and the number of fish consumed (Johnson et al. 2009). Over the same time period round goby abundance increased. Round goby is now the species most commonly consumed by cormorants (Johnson et al. 2009), further reducing predation pressure on yellow perch. Increased yellow perch CPUE may be due to production of a strong year class coinciding with reduced predation pressure. Finally, if yellow perch growth improved, as was observed with smallmouth bass (this report), then vulnerability to our gear may have increased resulting in a higher mean stratified CPUE. Additional years of sampling (both gill net assessment and fall bottom trawling) and analysis of yellow perch growth and age data are needed for a more complete evaluation.

In 2008, yellow perch total lengths ranged between 4.3 in and 11.9 in, and averaged 9.1 in. Approximately 55% of perch captured were 9 in or larger (Figure 17). Weights of yellow perch captured in 2008 ranged from 0.03 lb to 0.80 lb and averaged 0.37 lb.

Rock Bass

Rock bass CPUE peaked in 1978 at 22.1, declined through the early 1980s, varied without trend through the early 1990s, then declined again to a relatively stable level through 2006 (Figure 6). In 2008, the rock bass CPUE (3.3) increased to the highest level since 1996, and was 67.9% and 74.7% above previous 5-year and 10-year averages, respectively.

Alewife

Alewife CPUE varied without trend through 1988, averaging 9.0 (Figure 7). CPUE subsequently declined and each year since 1993 alewife CPUEs were between zero and one. Although this survey does not effectively assess alewife abundance because it is not fully vulnerable to our gear, the trends we observed were similar to those observed in Lake Ontario bottom trawl surveys (O'Gorman et al. 2000, O'Gorman et al. 2008). The declining trends in alewife abundance and a shift in its temporal distribution were particularly evident in the eastern basin (O'Gorman et al. 2000, O'Gorman et al. 2005).

Walleye

Walleye is the only relatively common species with a significant increase in mean stratified CPUE ($P<0.0001$) over the 1976-2005 time period (Eckert 2006; Figure 8). Catches were lowest from the late 1970s through the mid-1980s (mean CPUE 1976-1986=0.2) and increased through the early 1990s with a peak CPUE of 3.8 in 1993 (Table 1). After that, mean stratified CPUE fluctuated without trend (Eckert 2006; Figure 8). The 2008 mean stratified CPUE of 2.3 was 23.3% and 35.5% above the previous 5-year and 10-year averages, respectively.

Evidence of a strong 2003 year class of walleye was evident in 2004 and 2005 sampling (Eckert 2005 and 2006). The high catch of this year class as age-1 fish in 2004 was unusual for this assessment given that age-1 catches of walleye have been rare throughout the data series (1976-2006). Increased catches of age-1 walleye in recent years (Eckert 2005 and 2006) may be due, in part, to improved growth or to increased natural reproduction in New York waters of the eastern basin. In 2008, the 2003 year class comprised 18.8% of the walleye catch. Age-3 walleye (2005 year class) also represented 18.8% of the catch. In 2008, walleye total lengths ranged between 13.1 in and 29.9 in, and averaged 22.3 in (Figure 17). Walleye weights ranged from 0.7 lb to 11.5 lb and averaged 5.0 lb.

Smallmouth Bass

Smallmouth bass have provided an important sport fishery in Lake Ontario's eastern basin for decades (Jolliff and LeTendre 1967, Panek 1981, NYDEC 1984, McCullough and Einhouse 1999). It has always been a relatively common species in the warmwater assessment and has been the most commonly or second most commonly captured species in the assessment since 1986 (Table 1). This is primarily due to significant declines of previously dominant species, particularly white perch and gizzard shad. In 2008, smallmouth bass was the second most commonly captured species, representing 20.9% of the total catch.

The smallmouth bass CPUE trend varied over time with mean stratified CPUE peaking during the 1979-1980 and 1989-1991 periods (Table 1, Figure 9). These peaks are attributable to strong 1973 and 1983 year classes (Chrisman and Eckert 1999). Data indicated that strong year classes were also produced in 1987, 1988, 1995, and 1997 (Chrisman and Eckert 1999, Eckert 2000, Casselman et al. 2002), however, subsequent increased CPUE was not evident in the assessment (Figure 9). Further analyses indicated increased mortality of age-3 to age-6 bass through the 1990s, which coincided with documented increases in the number of Double-crested cormorants (Chrisman and Eckert 1999, Lantry et al. 2002). CPUEs remained low through the mid to late 1990s (mean CPUE=8.3) and declined to record and near record lows during 2000-2004 (mean CPUE=4.2). Cormorant predation during these time periods was a significant contributing factor to the lower smallmouth bass indices of abundance. Smallmouth bass CPUE increased substantially in 2005 to 11.3 and remained near that level in 2006 (CPUE=10.6) (Table 1). In 2007, smallmouth bass CPUE declined 41.3% from the 2005-2006 average to 6.4. CPUE increased in 2008 to 9.3, which was 14.9% below the 2005-2006 average but was 120.4% higher than the 5-year period (2000-2004) when CPUE was at record low levels (Figure 9).

The recent relatively higher smallmouth bass abundance index may be due to several factors including improved catchability, recruitment of a strong year class, and/or reduced predation by Double-crested cormorants. Ongoing cormorant population management in the New York waters of the eastern basin has effectively reduced cormorant numbers and, since 2006, has maintained the number of cormorant feeding days to near target level (McCullough et al. 2007, Johnson et al. 2009). The decline in number of cormorant feeding days and their dietary shift to round goby (Johnson et al. 2009) appear to have reduced predation pressure on smallmouth bass. Recent changes in smallmouth bass growth and potential increased catchability are likely affecting the abundance index. Additional years of sampling, data analysis, and possibly development of a catchability correction factor are needed for a more complete evaluation.

Growth and Condition

Mean lengths of smallmouth bass have fluctuated over the 33 year data series and, since the mid to late 1990s, have generally been above age-specific long term means for all ages (2-13) (Figure 18). Age-1 bass first appeared in the assessment in 1994 and appeared in low numbers during the 1995, 1997-2000, 2002, and 2006-2008 sample years. It is not currently known if age-1 bass were captured in 2004 or 2005 because scale samples are not aged for those years. In 2008, mean length-at-age was at or near record high for all ages 2-10 (Figure 18). In 2008, smallmouth bass total lengths ranged between 7.2 in (182mm) and 21.6 in (548mm), and averaged 14.3 in (362.6mm) (Figure 17). Bass weights ranged from 0.19 lb (88g) to 5.9 lb (2,678g) and averaged 2.1 lb (953.6g). Smallmouth bass condition varied about the long term mean from 1976-2005 for each length group from 7-12 in (Figure 19). From 2006-2008, condition factors for the 8-9 and 11-18 inch length groups were at the highest levels recorded in the 33-year data series. Condition of the 16-18 in length groups has trended upward since the early to mid 1990s (Figure 19). Recent improved condition of smallmouth bass in Lake Ontario's eastern basin may be due, in part, to consumption of round goby.

In addition to improved growth and condition, we observed a change in age composition of bass fully recruited to our gear and of legally harvestable size (i.e. $\geq$ 12 in) (Figure 20). For years prior to 1997, 98.1% (1976-1996 mean) of bass $\geq$ 12 in were age 5 and older and only 1.9% were ages 3 or 4. Age-3 bass $\geq$ 12 in were very rare in the assessment through that time period. Since 1997, mean length-at-age was above the long term average for all age-3 and older bass (Figure 18). From 1997 through 2003, age-3 and age-4 bass $\geq$ 12 in appeared in greater frequency, and represented an average of 19.7% of bass $\geq$ 12 in (Figure 20). During that time period, age 5 and older bass comprised 80.3% of the catches. In 2008, 74.0% of bass $\geq$ 12 in were age 5 and older and 26.0% were age-3 and age-4 (Figure 20). Given the improved growth and increased proportion of younger bass recruiting to the gill nets, evaluation of changes in catchability is necessary.

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Table 1. Stratified mean catch per unit effort data from the 1976-2008 warmwater assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

	Stratified Mean Catch per 450 ft Monofilament Gill Net Gang											
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Lake Sturgeon	0	0	0	0	0	0.02	0	0	0	0	0	0
Longnose Gar	0	0	0	0	0.04	0	0	0.04	0	1.19	0.04	0
Bowfin	0	0	0	0	0.02	0.02	0	0	0	0	0	0
American Eel	0	0	0.06	0.03	0	0	0	0	0	0	0	0
Alewife	20.96	2.07	14.83	11.57	4.30	8.18	7.53	6.90	17.65	3.35	7.61	2.32
Gizzard Shad	17.82	53.45	47.38	19.95	4.52	2.78	0.10	0.29	0.87	0.50	0.48	0.44
Northern Pike	0.83	1.04	0.93	0.16	0.08	0.02	0.04	0.06	0.02	0.17	0.17	0.08
Muskellunge	0	0	0	0	0	0	0	0	0	0	0	0
Goldfish X Carp	0	0	0	0.17	0	0	0	0	0	0	0	0
Common Carp	0.25	0.55	0.33	0.45	0.17	0.10	0.35	0.21	0.17	0.17	0.10	0.20
Golden Shiner	0	0	0	0	0.02	0	0	0	0.04	0.02	0	0
Spottail Shiner	0	0	0	0	0	0	0	0.15	0	0	0	0
Quillback	0	0	0	0.31	0.04	0.06	0	0.04	0	0	0.02	0
Longnose Sucker	0	0	0	0	0.02	0	0	0	0	0	0	0
White Sucker	4.04	0.63	2.90	3.11	1.84	1.42	4.34	1.40	1.58	0.93	2.47	1.49
Silver Redhorse	0.06	0.05	0.20	0.43	0.04	0.10	0.15	0.38	0.06	0	0.02	0.02
Shorthead Redhorse	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	1.12	0.2	1.41	4.17	0.66	0.23	1.29	0.76	0.86	1.70	2.14	1.96
Channel Catfish	0.41	1.03	1.75	3.64	0.6	0.56	1.27	0.86	0.29	0.63	1.25	0.77
Stonecat	0	0.04	0.26	0.08	0	0.23	0.30	0.02	0.04	0.06	0.04	0
Trout-perch	0	0	0	0	0	0.15	0.15	0	0.08	0	0	0.08
White Perch	63	136.42	74.11	86.98	26.2	44.53	25.98	34.02	20.78	12.23	13.94	11.14
White Bass	0	0	0.13	0	0.02	0.06	0.26	0	0.06	0.02	0.06	0.06
Rock Bass	7.10	10.75	22.13	13.94	14.69	10.09	7.06	4.69	6.99	3.96	7.58	4.76
Pumpkinseed	0	0.44	0.06	3.06	0.14	0.32	0.73	0.43	0.09	0.59	0.57	0.40
Bluegill	0	0	0	0	0	0	0.04	0	0	0	0	0
Smallmouth Bass	24.51	24.05	26.04	35.74	38.02	23.47	14.55	14.96	12.44	9.76	18.14	10.89
Largemouth Bass	0	0	0	0	0	0	0	0	0	0	0	0
Black Crappie	0	0	0	0.04	0.02	0.02	0.02	0.06	0.02	0.1	0	0
Yellow Perch	69.09	26.20	44.44	67.32	27.63	43.81	36.07	50.85	24.02	15.35	13.32	8.36
Walleye	0.05	0.20	0.12	0.27	0.28	0.12	0.59	0.09	0.09	0.41	0.19	0.75
Freshwater Drum	0.19	0	0.74	1.43	0.34	0.09	0.34	0.59	0.31	0.25	0.16	0.25
Round Goby	0	0	0	0	0	0	0	0	0	0	0	0
Total	209.4	257.13	237.8	252.8	119.7	136.4	101.2	116.8	86.50	51.38	68.30	43.98

Table 1 (continued). Stratified mean catch per unit effort data from the 1976-2008 warmwater assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

	Stratified Mean Catch per 450 ft Monofilament Gill Net Gang											
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Lake Sturgeon	0	0	0	0	0	0	0	0.02	0	0.02	0.06	0.04
Longnose Gar	0	0	0.08	0	0	0.48	0.35	0	0	0.02	0.02	0.08
Bowfin	0	0	0	0	0.02	0	0	0	0	0	0	0
American Eel	0	0	0.02	0	0	0	0	0	0	0	0	0
Alewife	9.64	0.59	1.29	1.27	2.26	0.18	0	0.48	0.92	0	0.06	0.12
Gizzard Shad	0.24	0.69	1.26	1.39	1.79	0.12	0.06	0	0	0	0.08	0.08
Northern Pike	0	0.02	0	0.15	0.04	0.10	0.06	0.04	0.04	0.08	0.06	0.06
Muskellunge	0	0	0	0	0	0	0	0	0	0	0	0
Goldfish X Carp	0	0	0	0	0	0	0	0	0	0	0	0
Common Carp	0.23	0.37	0.35	0.29	0.33	0.35	0.06	0.10	0.15	0.12	0.10	0.33
Golden Shiner	0	0	0	0	0	0	0	0	0	0	0	0
Spottail Shiner	0	0	0	0	0.06	0	0	0	0	0	0	0
Quillback	0.02	0.04	0.04	0.08	0	0.04	0	0	0.04	0	0.04	0
Longnose Sucker	0	0	0	0	0	0	0	0	0	0	0	0
White Sucker	0.91	0.75	3.47	0.41	0.88	1.18	0.81	1.13	2.01	1.31	1.02	1.02
Silver Redhorse	0.07	0.17	0.29	0.22	0.18	0	0.08	0.12	0.02	0.13	0.12	0.10
Shorthead Redhorse	0	0	0	0	0	0	0.02	0	0	0.02	0	0
Brown Bullhead	0.61	0.84	0.66	0.86	0.87	0.35	0.35	0.06	0	0.83	0.06	0.21
Channel Catfish	0.97	2.40	3.34	1.20	1.35	1.12	0.35	0.19	0.47	1.42	0.75	0.68
Stonecat	0	0.02	0	0.02	0	0	0	0	0	0	0	0
Trout-perch	0.15	0	0	0.12	0	0	0	0	0	0	0	0
White Perch	4.87	7.95	4.36	7.83	5.49	5.04	6.01	0.06	0.31	0.48	0.29	1.36
White Bass	0.13	0.08	0	0.10	0	0.02	0	0	0	0	0.04	0
Rock Bass	4.94	7.53	8.08	6.86	3.09	6.99	3.99	1.41	3.79	2.33	2.13	3.08
Pumpkinseed	0.25	0.64	0.78	0.14	0.34	0.23	0.04	0.06	0.04	0.08	0.29	0.27
Bluegill	0	0	0	0	0	0	0	0	0	0	0	0
Smallmouth Bass	15.92	39.05	21.72	29.4	19.13	19.91	11.99	5.01	6.98	6.03	9.36	10.68
Largemouth Bass	0	0	0	0	0	0	0	0	0	0	0.02	0
Black Crappie	0.02	0.02	0.06	0	0	0.04	0	0	0	0	0.02	0
Yellow Perch	2.19	10.06	13.61	6.97	6.72	2.78	5.87	3.68	8.76	5.53	5.01	4.47
Walleye	0.80	0.96	1.31	1.68	1.59	3.84	3.29	1.91	2.97	1.76	2.13	1.32
Freshwater Drum	0.45	0.53	0.62	0.34	0.43	0.52	0.74	0.63	0.23	0.41	0.25	0.50
Round Goby	0	0	0	0	0	0	0	0	0	0	0	0
Total	42.42	72.71	61.35	59.34	44.57	43.32	34.08	14.91	26.73	20.58	21.94	24.40

Table 1 (continued). Stratified mean catch per unit effort data from the 1976-2008 warmwater assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

	Stratified Mean Catch per 450 ft Monofilament Gill Net Gang								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Lake Sturgeon	0.10	0.02	0	0.04	0.02	0.02	0.09	0.10	0
Longnose Gar	0	0.02	0	0	0.06	0.17	0.12	0.08	0.10
Bowfin	0	0	0	0	0	0	0	0	0
American Eel	0	0	0	0	0	0	0	0	0
Alewife	0.26	0.95	0.02	0.08	0	0	0.07	0.14	0.19
Gizzard Shad	0.13	0	0.06	0	0	0	0	0	0
Northern Pike	0.08	0.07	0.19	0.15	0.17	0.19	0.08	0.06	0.23
Muskellunge	0	0	0	0	0.02	0.02	0	0	0
Goldfish X Carp	0	0	0	0	0	0	0	0	0
Common Carp	0.04	0	0	0.02	0.15	0.14	0.11	0.02	0.05
Golden Shiner	0	0	0	0	0	0	0	0	0
Spottail Shiner	0	0	0	0	0	0	0	0	0
Quillback	0	0	0	0	0	0	0	0	0
Longnose Sucker	0	0	0	0	0	0	0	0	0
White Sucker	0.35	0.38	0.78	1.66	0.41	1.03	0.72	0.573	0.65
Silver Redhorse	0.12	0.05	0.17	0.10	0.42	0.33	0.02	0.02	0.08
Shorthead Redhorse	0	0.02	0	0	0	0	0	0	0
Brown Bullhead	0.21	0.32	0.21	0.40	0.35	0.48	0.31	0.54	2.12
Channel Catfish	0.54	0.09	0.21	0.12	0.79	0.81	0.15	0.12	0.57
Stonecat	0	0	0	0	0	0.06	0.02	0	0
Trout-perch	0	0	0	0	0	0	0	0	0
White Perch	0.92	1.04	1.09	0.42	1.18	1.94	0.92	0.81	7.75
White Bass	0	0	0	0	0	0	0	0	0
Rock Bass	1.47	1.22	1.10	1.84	2.09	2.70	2.43	0.70	3.27
Pumpkinseed	0.31	0.28	0.46	0.46	0.52	0.50	1.15	0.21	0.10
Bluegill	0	0	0	0	0	0	0	0	0
Smallmouth Bass	5.01	2.99	3.76	5.43	3.84	11.33	10.45	6.39	9.27
Largemouth Bass	0	0	0	0	0.02	0.02	0.02	0	0
Black Crappie	0	0	0.06	0	0.02	0.06	0	0.04	0.05
Yellow Perch	8.58	6.37	9.65	9.82	6.74	8.93	9.13	13.95	16.91
Walleye	1.53	1.70	1.08	2.12	1.69	2.38	1.94	1.33	2.33
Freshwater Drum	0.25	0.20	0.23	0.27	0.60	0.19	0.32	0.23	0.26
Round Goby	0	0	0	0	0	0.04	0.10	0.26	0.42
Total	19.92	15.73	19.06	22.92	19.10	31.36	28.16	25.6	44.36

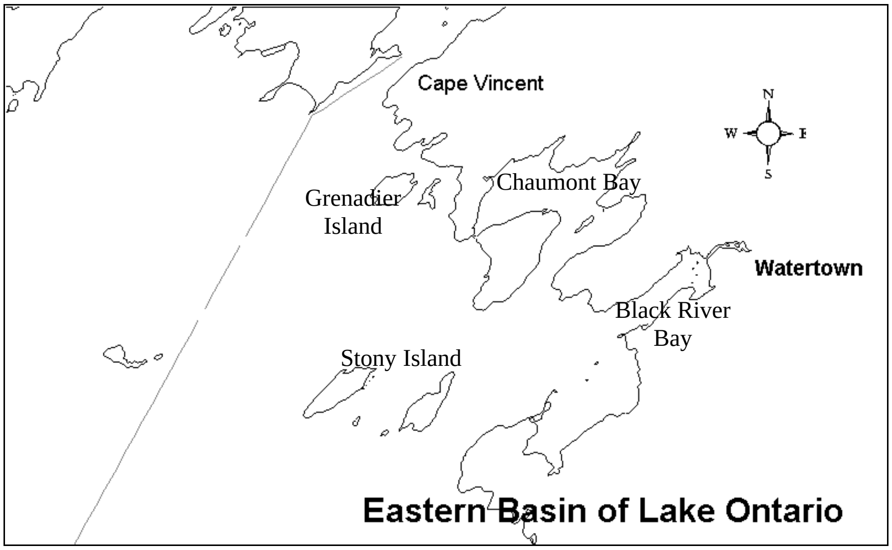

Figure 1. Map of New York waters of Lake Ontario's eastern basin showing five area strata used in the 1980-2008 warmwater assessment.

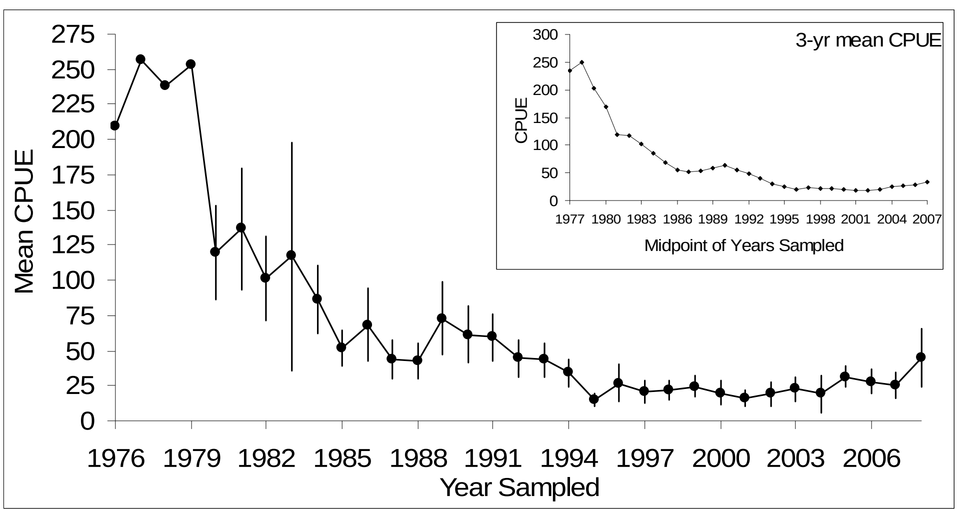

Figure 2. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for all warmwater fish from the 1976-2008 assessments.

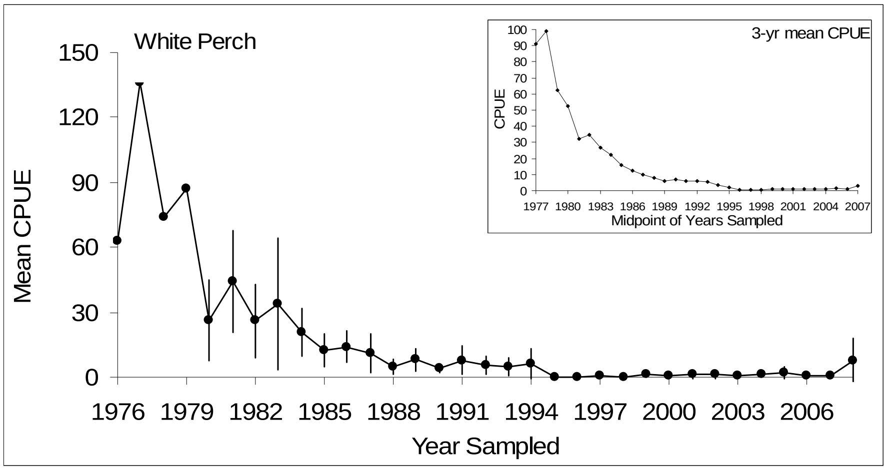

Figure 3. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for white perch, 1976-2008.

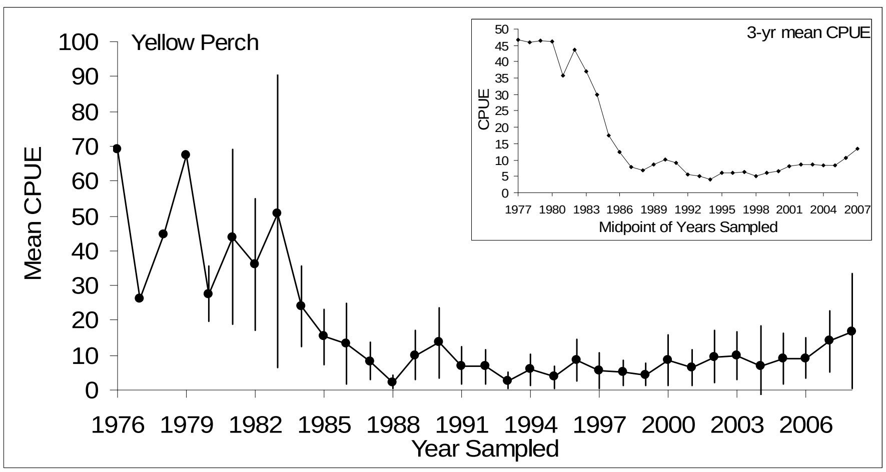

Figure 4. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for yellow perch, 1976-2008.

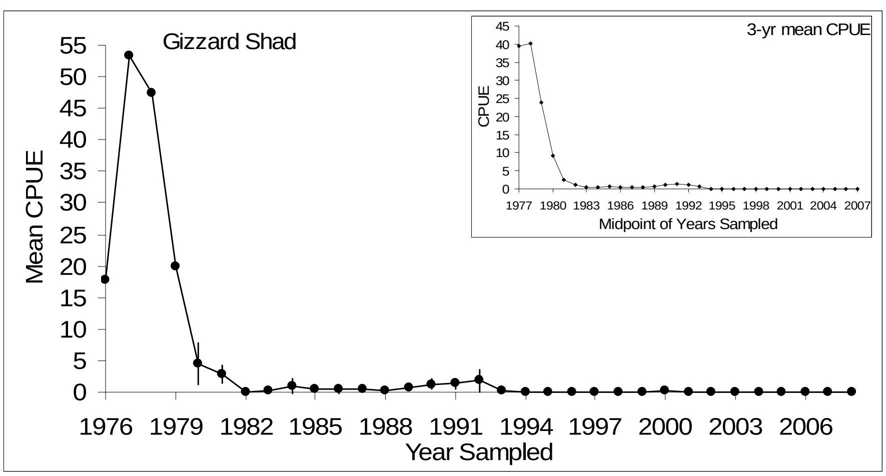

Figure 5. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for gizzard shad, 1976-2008.

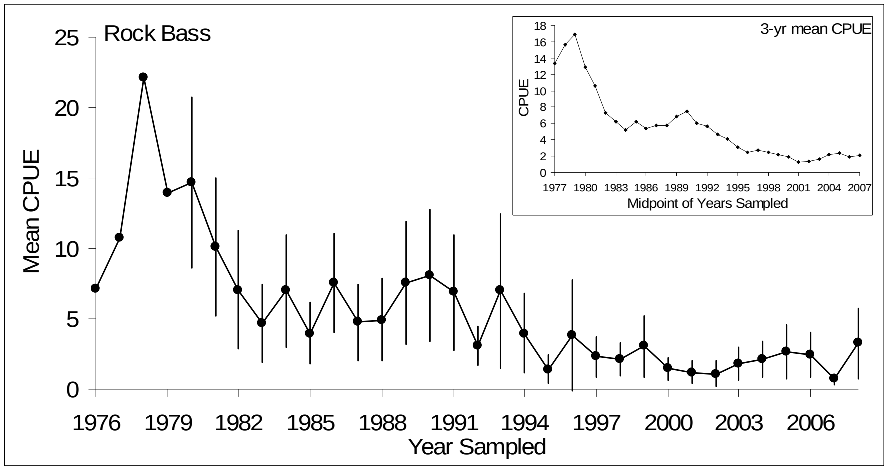

Figure 6. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for rock bass, 1976-2008.

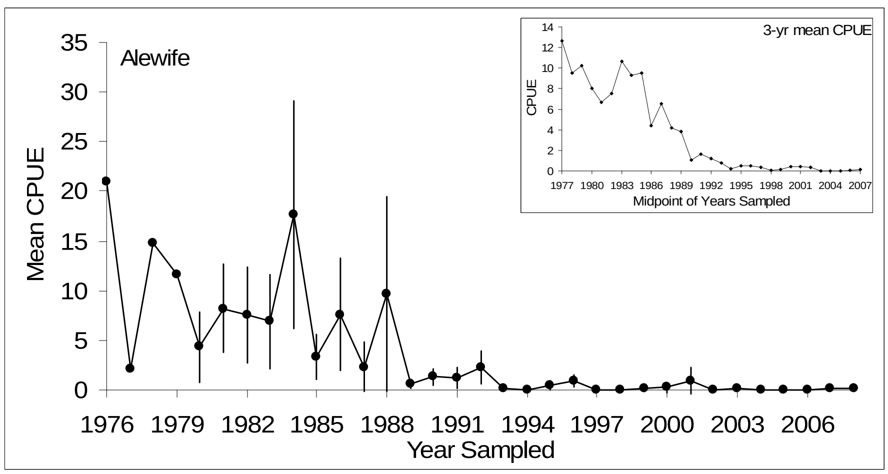

Figure 7. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for alewife, 1976-2008.

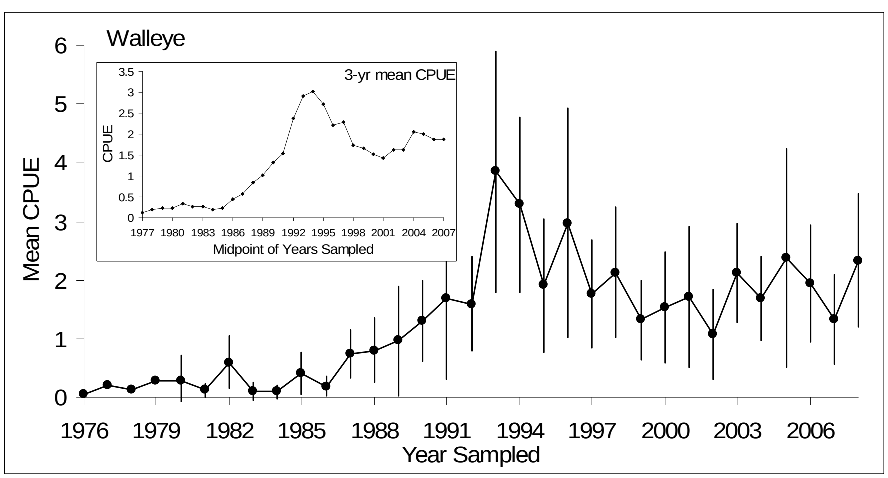

Figure 8. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for walleye, 1976-2008.

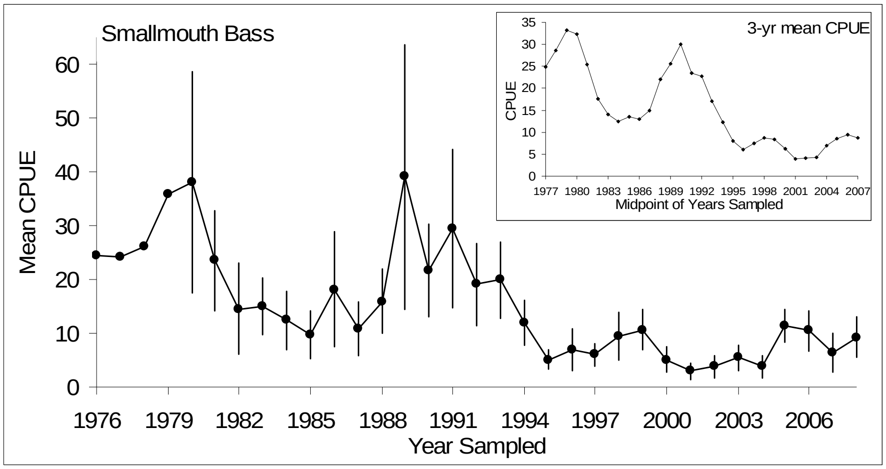

Figure 9. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for smallmouth bass, 1976-2008.

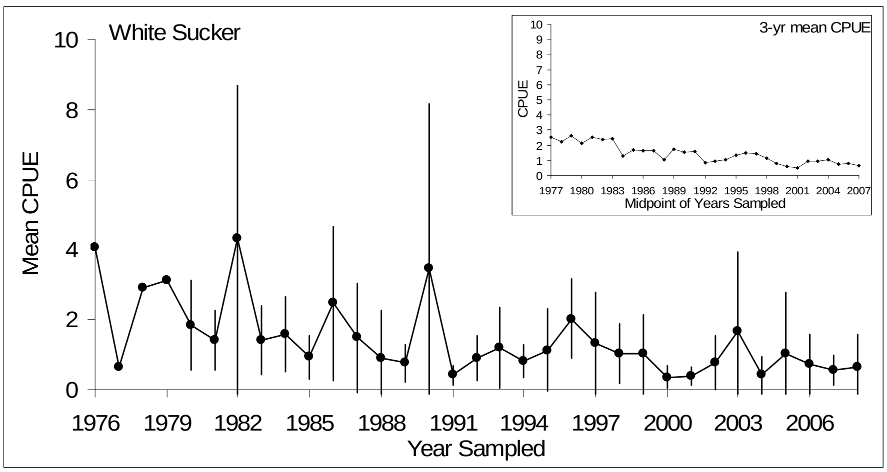

Figure 10. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for white sucker, 1976-2008.

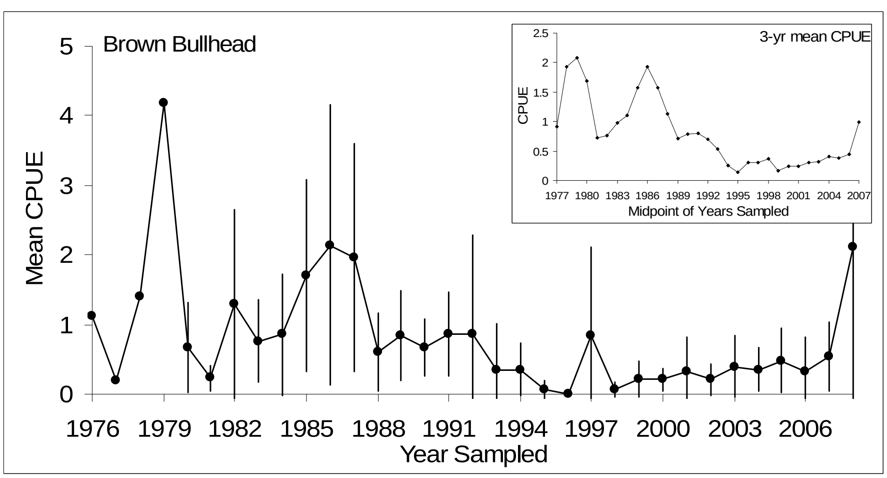

Figure 11. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for brown bullhead, 1976-2008.

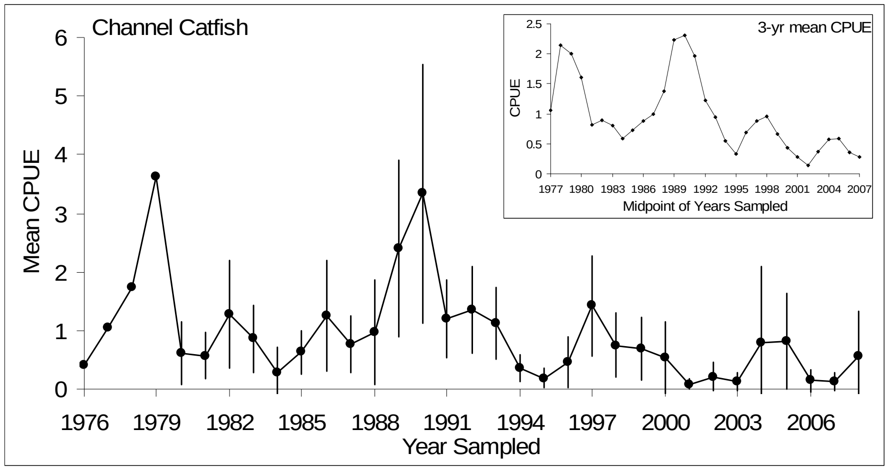

Figure 12. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for channel catfish, 1976-2008.

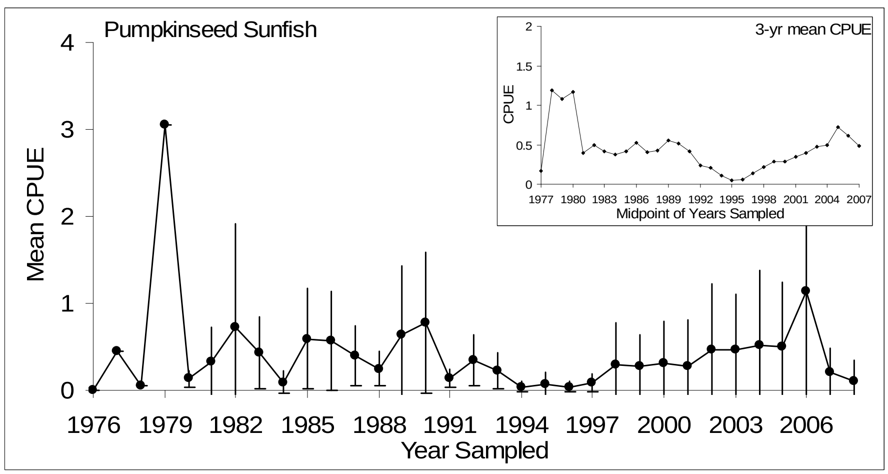

Figure 13. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for pumpkinseed sunfish, 1976-2008.

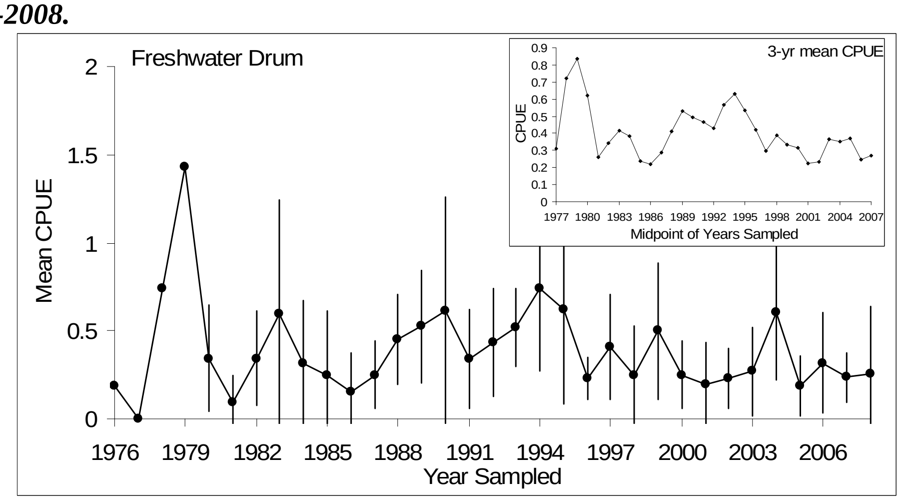

Figure 14. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for freshwater drum, 1976-2008.

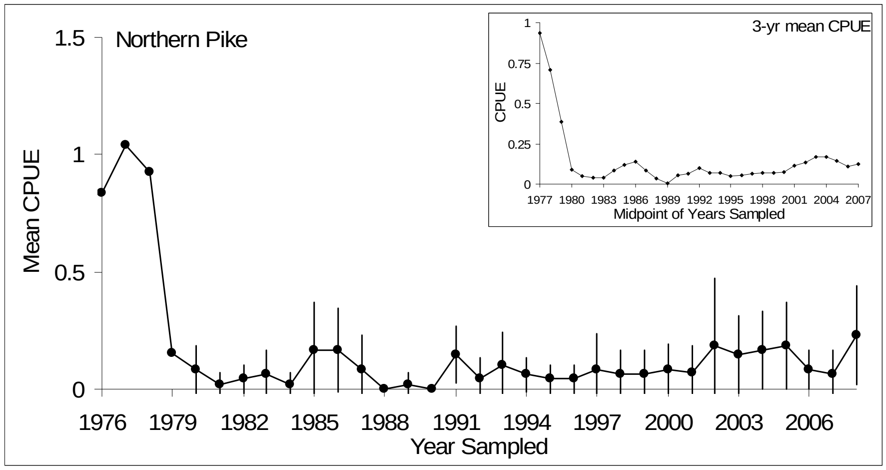

Figure 15. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for northern pike, 1976-2008.

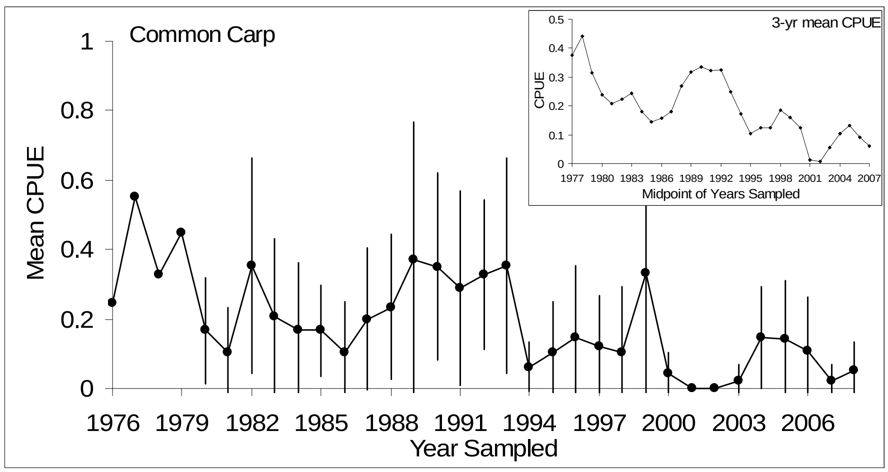

Figure 16. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for common carp, 1976-2008.

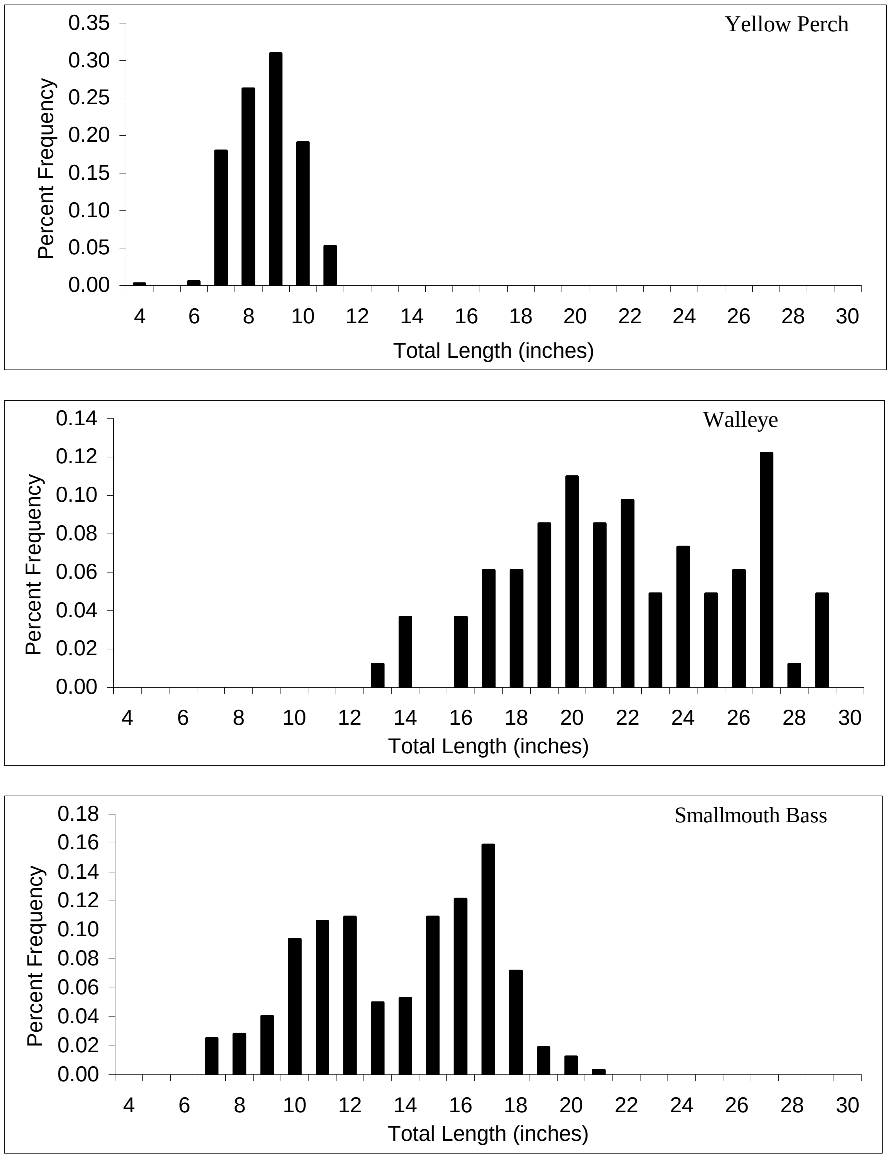

Figure 17. Length frequency distribution of yellow perch, walleye, and smallmouth bass collected during the warmwater assessment in 2008.

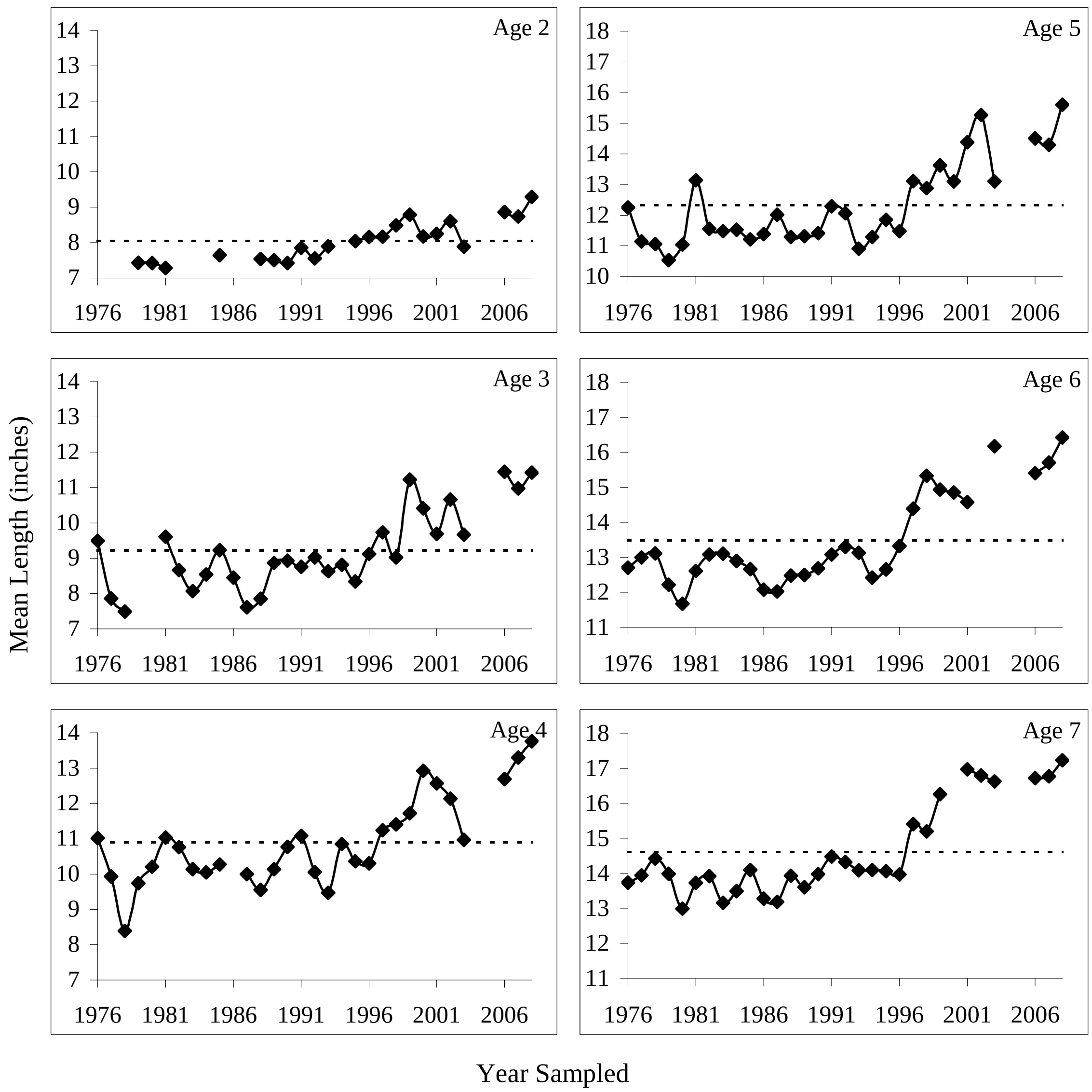

Figure 18. Mean length at age (age 2-13) by year sampled (1976-2003 and 2006-2008) for smallmouth bass collected during the warmwater assessment (continued on next page).

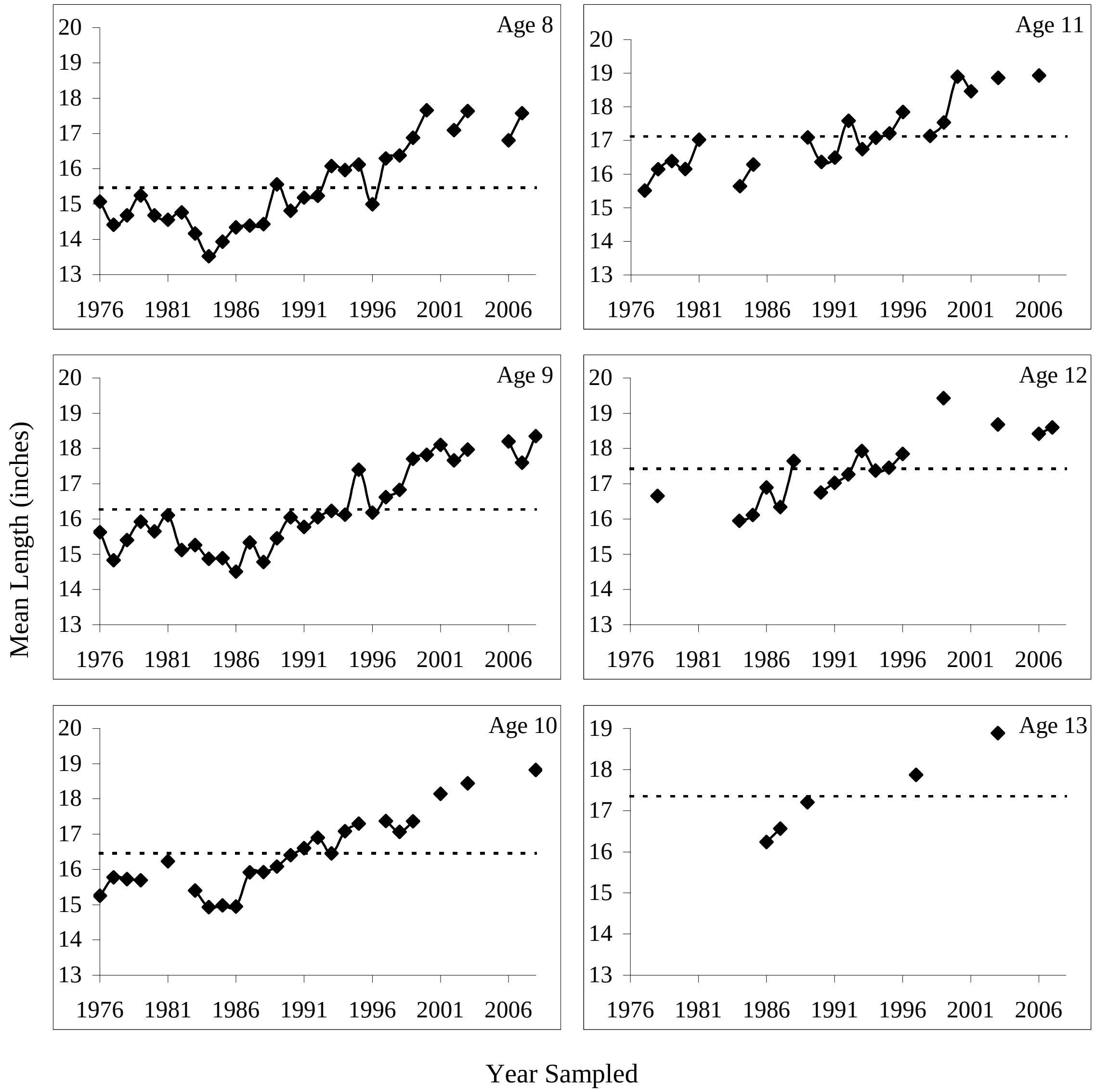

Figure 18 (continued). Mean length at age (age 2-13) by year sampled (1976-2003 and 2006-2008) for smallmouth bass collected during the warmwater assessment.

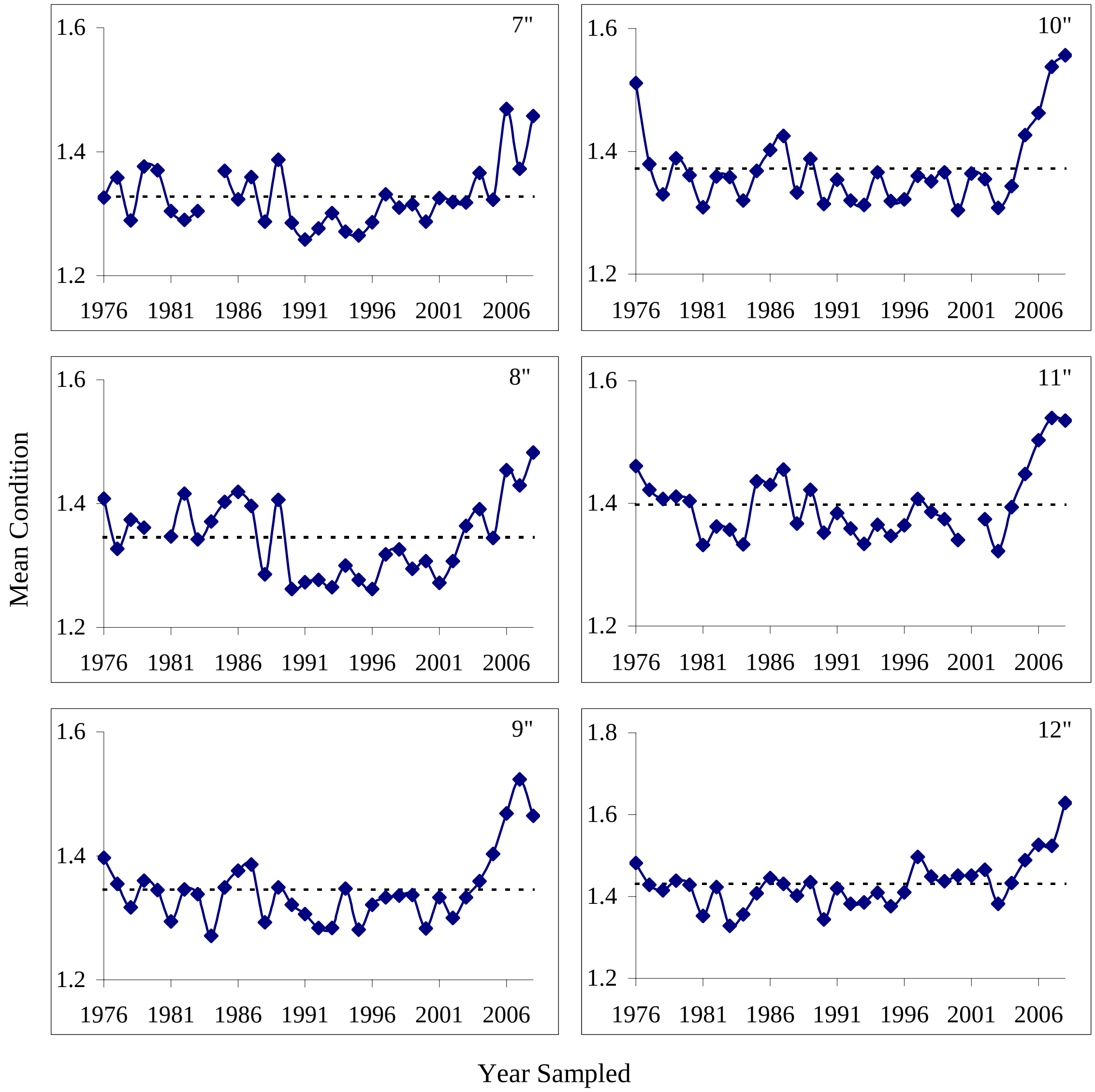

Figure 19. Mean condition (7-18 inch increments) by year sampled (1976-2008) for smallmouth bass collected during the warmwater assessment (continued on next page).

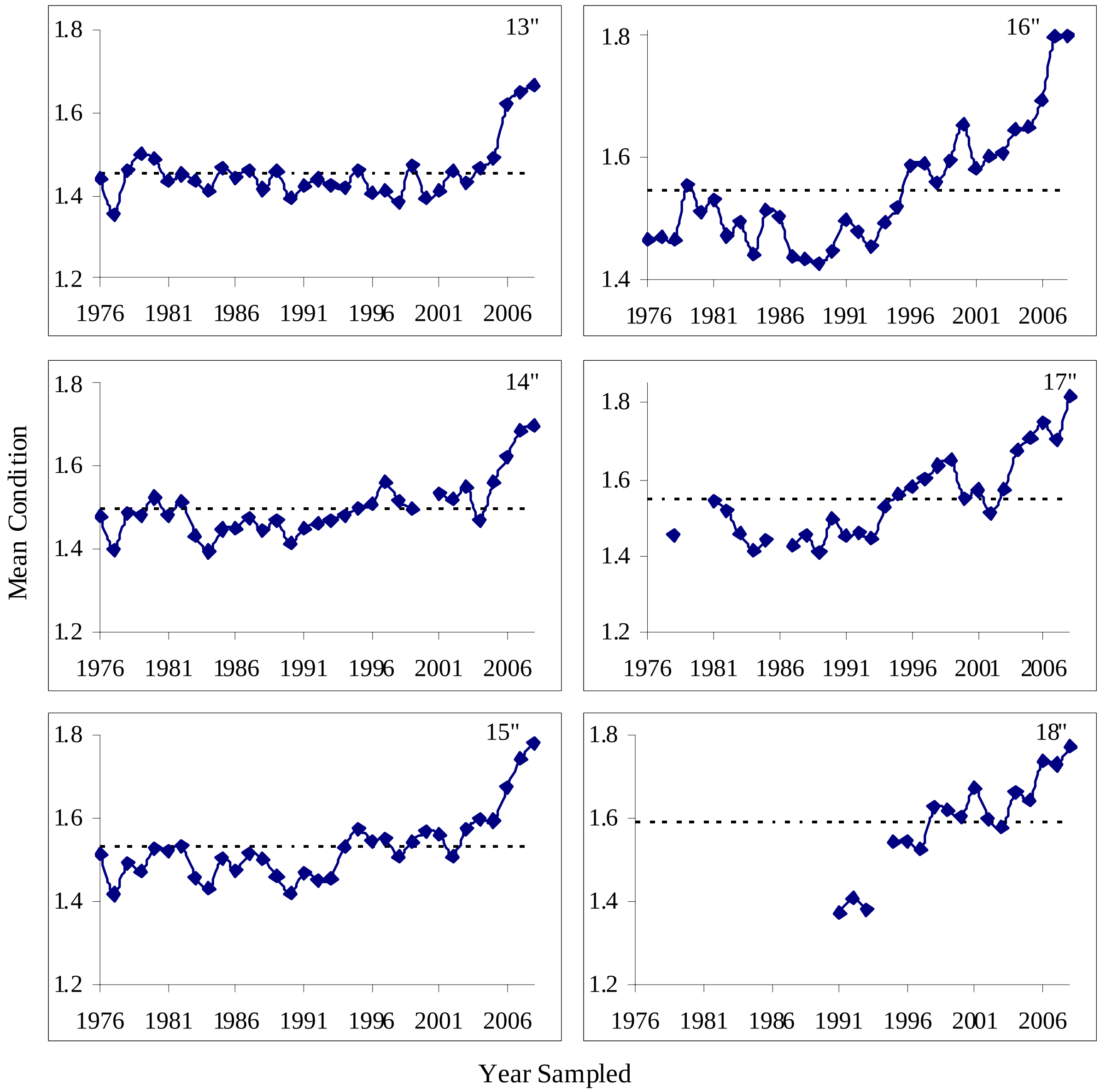

Figure 19 (continued). Mean condition (7-18 inch increments) by year sampled (1976-2008) for smallmouth bass collected during the warmwater assessment.

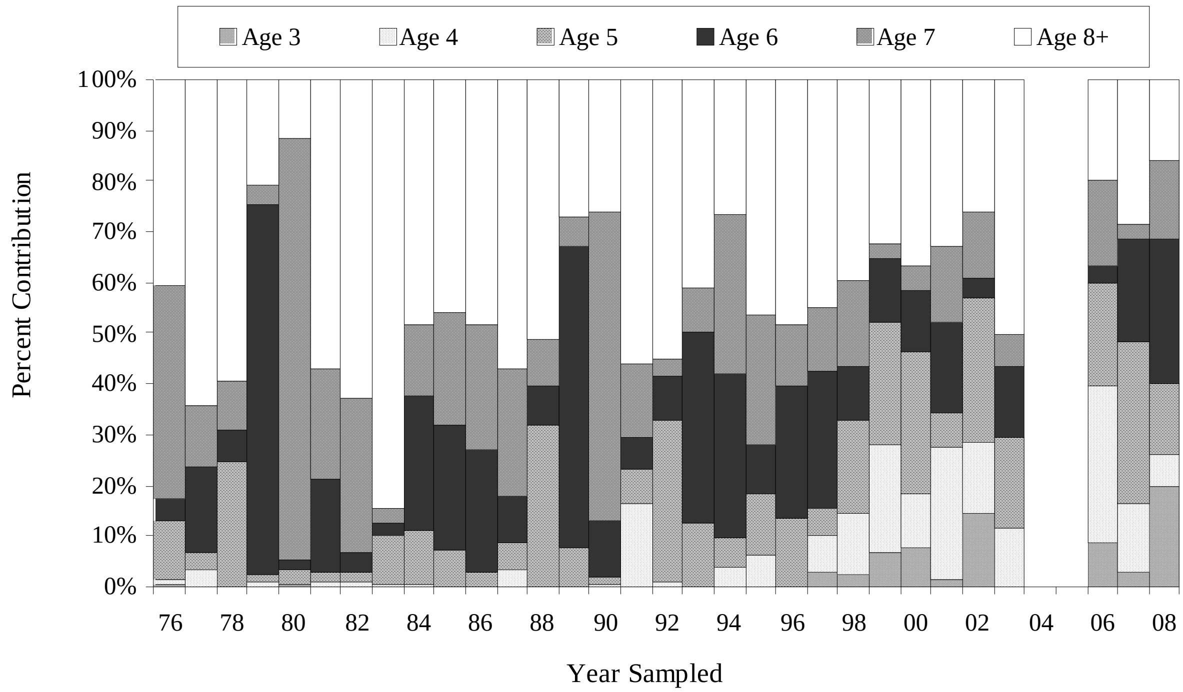

Figure 20. Age composition of smallmouth bass ≥ 12 inches in the warmwater assessment (1976-2003 and 2006-2008).