Summary of 1976-2005 Warm Water Assessment

T.H. Eckert

New York State Department of Environmental Conservation
Cape Vincent, New York 13618

This report summarizes gill net sampling carried out by the New York State Department of Environmental Conservation (NYSDEC) to assess fish stocks in New York waters of Lake Ontario's eastern basin. Warm water assessment is a long-term trend-through-time sampling program designed to provide an annual overview of the warm water fish community. The sampling provides information on a wide variety of species and variables, but is targeted at establishing abundance indices from catch per unit effort (CPUE) data, with emphasis on smallmouth bass, walleye, yellow perch, and white perch.

Sampling Procedures

The 1976-2005 warm water assessment utilized standardized gangs of sinking gill net, set overnight on bottom, parallel to the depth contours. Each net gang consisted of nine equal length net panels, 8 feet deep, and ranging in size from 2-6 inch stretch mesh by ½ inch size increments. Sampling was usually scheduled for the first two weeks of August, but has commenced as early as July 29 and ended as late as August 25. Depth contours and depth strata boundaries all refer to the maximum water depth, although the nets actually sampled a band of water extending from bottom to approximately 8 feet above bottom.

From 1976-1979, the sampling utilized 900 foot multifilament net gangs (each net panel 100 ft long), half set at the 17-foot depth contour (5 meters), and half set in deeper water between the 17-foot contour and the top of the thermocline. The 1976-1979 sampling also excluded Chaumont, Black River, and Henderson Bays. In 1980, a number of significant modifications were made in the sampling. Net panel length was reduced from 100 to 50 feet (all other specifications remained the same); the number of net gangs set was increased; Chaumont, Black River, and Henderson Bays were included among the locations sampled; and a stratified random sample design was used to select netting sites. This new design used three depth strata (stratum 1, 12-30 ft; stratum 2, 31-50 ft; stratum 3, 51-100 ft), plus five area strata (Figure 1). Species diversity and mean catch were highest in depth strata 1 and 2, and sampling effort was concentrated there. Both were sampled in proportion to their surface areas, with 10 and 9 net gangs, respectively, scheduled each year. The 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 respective surface areas. Sampling effort within depth stratum 3 has varied, with 4 net gangs scheduled in 1980-1983, 8 net gangs in 1984-1988, and 10 net gangs from 1989-2005.

In 1993, sampling was again modified by switching from multifilament gill nets to monofilament gill nets. This latest change was implemented in part to take advantage of the greater efficiency associated with handling monofilament gill nets, and in part due to cost and availability of multifilament netting of the proper specifications.

Corrections for changes in sample and net design that occurred between 1979 and 1993 have been described previously (Eckert 1986, 1998). Adjustments for differences in areas sampled in 1976-1979 versus later years were made using the 1980-1985 data. Assuming that the relative species distribution between areas of the eastern basin remained the same from 1976-1985, the 1980-1985 data were used to calculate indices of relative species catch within the five geographic areas. These species specific area abundance indices were then

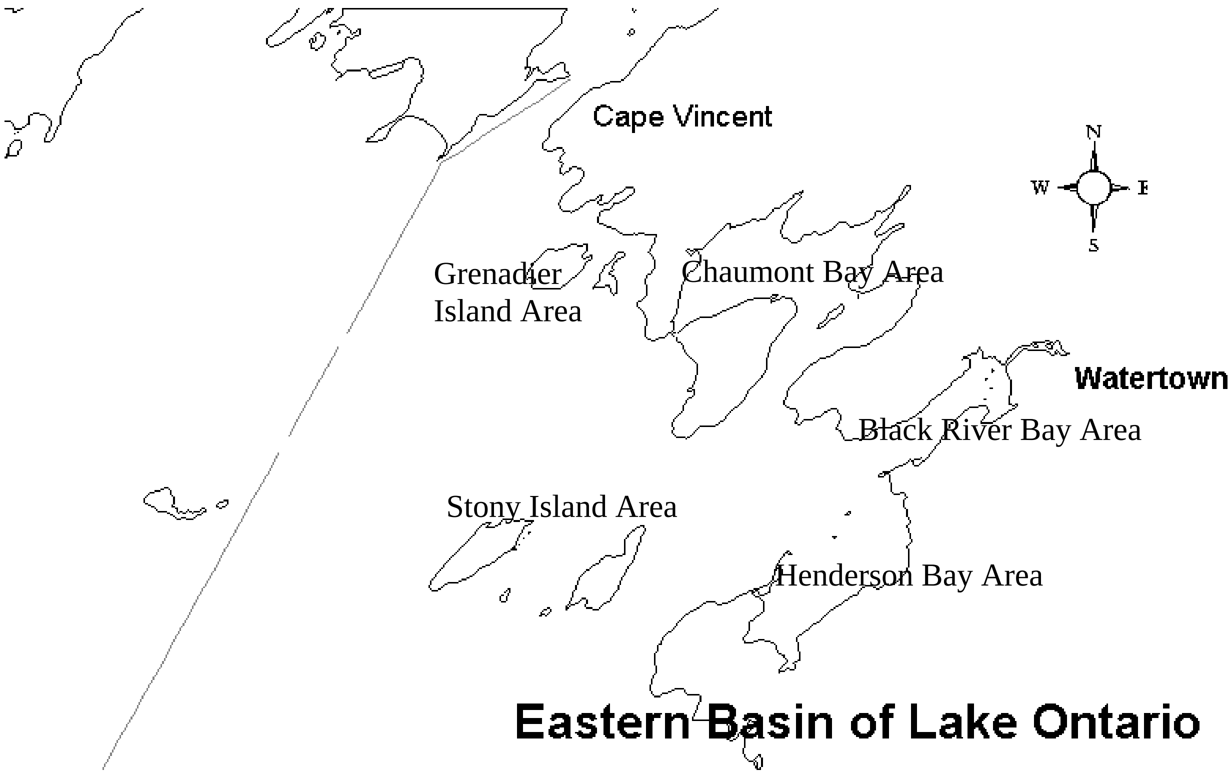


Figure 1. Map of New York waters of Lake Ontario's eastern basin showing the five area strata used in the DEC 1980-2005 warm water assessment.

used to adjust the 1976-1979 data for those areas of the eastern basin which were not sampled. Adjustments for the change from multifilament to monofilament mesh gill nets were calculated from 34 paired mono/multifilament net gangs set in 1990-93. Significant differences in CPUE data were found among eight species. Multifilament nets caught significantly higher numbers of brown bullhead and pumpkinseed, while monofilament nets caught significantly higher numbers of white perch, rock bass, smallmouth bass, yellow perch, walleye and freshwater drum. No significant differences were detected in the ages or sizes of fish collected in the two net types. Correction factors were applied to the multifilament gill net catch data from 1976-1992 to calculate "monofilament equivalent" catch values. Mean catch per standard 450 ft monofilament net gang, and 95% confidence limits, were calculated from raw (non-transformed) monofilament or "monofilament equivalent" catch data, using standard formulas for stratified random samples (Cochran 1977). Weighting factors for strata 1-3 were equal to their respective surface areas within New York waters of the eastern basin (stratum 1: 0.208; stratum 2: 0.188; stratum 3: 0.603).

Numbers of warm and cold water fish captured in deeper areas during the August assessment are largely dependent on water temperatures. Although a mix of warm and cold water species can be found in net gangs subjected to fluctuating water temperatures, experience had shown that catches of warm water fish were consistently zero in areas inundated by cold hypolimnetic waters. To avoid the unnecessary killing of cold water species such as lake trout, net gangs scheduled for locations in stratum 3 which had stable bottom temperatures less than 50˚F were often deleted prior to 1996. Whenever a scheduled net gang was deleted due to cold water temperatures, catches of all warm water fish were simply assumed to equal zero. Beginning in the mid 1990s, shifts in the distributions of alewives, rainbow smelt, and lake trout to greater depths were documented in Lake Ontario coincidental with the establishment of dreissenid mussels (O'Gorman et al. 2000). Due to concerns that factors such as increasing water clarity might also increase depth distributions of some warm water fish species, all scheduled net locations have been utilized since 1996 regardless of bottom water temperatures. These and other ecological changes might also affect fish distribution among the geographic areas of the eastern basin. Of particular concern was the possibility that predation by double-crested cormorants could significantly lower warm water fish abundance in the Stony Island area, due to the proximity of the Little Galloo Island nesting colony (Birt et al. 1987).

Results and Discussion

2005 Summary:

The 2005 warm water assessment was conducted as scheduled with 29 standard net gangs set at predetermined, randomly chosen locations between August 1 and August 10. The net gangs were set and retrieved by NYSDEC Cape Vincent and Watertown personnel, utilizing the R/V Seth Green at the deeper, more exposed locations (nets set August 8 and 9), and two 19-24 foot boats at the shallower, more protected sites (nets set August 1-4). This allowed completion of the sampling in just eight days (6 nights of netting). Nets set and retrieved by the R/V Seth Green were picked and processed onboard, while net gangs set and retrieved by the smaller boats were taken to Cape Vincent Fisheries Station to be picked and readied for resetting. The fish were all processed by staff from the Cape Vincent Station. The thermocline was quite stable and relatively deep throughout the sampling period, the result of predominately light to moderate southwest winds. Bottom temperatures for all net gangs set shallower than the 75-foot contour were 74˚F or higher. Three net gangs set at depths greater than 75 feet were subjected to bottom temperatures colder than 54˚F, while one net gang had bottom temperatures that varied from 73˚F at the time set to 55˚F at the time of retrieval.

Species and numbers of fish captured in 2005 by depth strata, and stratified CPUE estimates with their corresponding 95% confidence limits, are presented in Table 1. As in other years, numbers of fish and warm water fish species diversity, were highest in strata 1 and 2, declining in stratum 3. Total catch of all warm water species was 1,050 fish, a 51.7% increase compared to 2004. Depth stratum 2 contributed 40.6% of the total warm water catch, and had a mean catch of 47.33 fish per net gang, the eighth time among the 26 years sampled using the stratified random design that the warm water species CPUE was highest in stratum 2. Depth stratum 1 contributed 36.7% of the 2005 warm water catch, while depth stratum 3 contributed an above average 22.8%. Smallmouth bass, yellow perch, rock bass, walleye, and white perch were the most commonly captured species, contributing 84.1% of the total number of warm water fish sampled (smallmouth bass 39.4%, yellow perch 15.7%, rock bass 10.9%, walleye 9.2%, and white perch 8.9%). One lake sturgeon was captured in 2005, the ninth year among the last eleven that at least one individual has been captured. Prior to 1995, only one lake sturgeon was captured in 19 years of sampling. Two unusual sampling events first reported in the 2004 assessment, the capture of a large muskellunge and the complete absence of lake trout, were both observed again in 2005. The muskellunge captured in 2004 and 2005 were mature females, weighing 33.5 and 21.1 pounds, respectively. They were the first records of this species in the August warm water assessment, although fishermen have occasionally reported catching them within the areas sampled. The lack of lake trout was considered noteworthy since lake trout have traditionally been common in deeper, colder waters of depth stratum 3 in the month of August, and the 2004 and 2005 sampling included a total of 9 net gangs set in waters colder than 54˚F. Round goby made their first official appearance in the 2005 warm water assessment. This exotic species had been observed increasing its distribution and abundance along the south shore of Lake Ontario since 2001 (Eckert 2006), and its presence in the sampling was expected for several years. In 2005, two round gobies were captured in the gill nets, and

Table 1. Numbers of fish caught, stratified mean catch per standard 450 ft gill net gang, and 95% confidence intervals, for the 2005 warm water assessment netting conducted August 1 - August 10 in New York waters of Lake Ontario's eastern basin.

	Number Caught				Strat.	95% CI	
Common Name	Stratum 1	Stratum 2	Stratum 3	Total	CPUE	Lower	Upper
Warm Water Species:							
Lake Sturgeon	1	0	0	1	0.02	0	0.07
Longnose Gar	8	0	0	8	0.17	0	0.50
Northern Pike	5	1	1	7	0.19	0	0.37
Muskellunge	1	0	0	1	0.02	0	0.07
Common Carp	4	0	1	5	0.14	0	0.31
White Sucker	9	3	13	25	1.03	0	2.79
Silver Redhorse	15	1	0	16	0.33	0	0.84
Brown Bullhead	16	7	0	23	0.48	0.02	0.94
Channel catfish	16	23	0	39	0.81	0	1.63
Stonecat	1	2	0	3	0.06	0	0.14
White Perch	23	70	0	93	1.94	0	4.73
Rock Bass	42	64	8	114	2.70	0.78	4.61
Pumpkinseed	23	1	0	24	0.50	0	1.24
Smallmouth Bass	135	211	68	414	11.33	8.25	14.42
Largemouth Bass	1	0	0	1	0.02	0	0.07
Black Crappie	3	0	0	3	0.06	0	0.20
Yellow Perch	21	5	139	165	8.93	1.73	16.13
Walleye	55	33	9	97	2.38	0.52	4.24
Freshwater Drum	5	4	0	9	0.19	0.02	0.36
Round Goby	1	1	0	2	0.04	0	0.10
Warm Water Total	385	426	239	1050	31.36	23.89	38.83
Standard Gill Net Gangs	10	9	10	29			
Cold Water & Misc Species:							
Cisco	0	0	1	1			
Chinook Salmon	0	0	5	5			
Burbot	0	0	1	1			

an additional 16 were confirmed from smallmouth bass stomachs. One other rather unusual occurrence in the 2005 sampling was the capture of three stonecats, one each in three separate net gangs. Stonecats had not been captured in the warm water assessment since 1991, although they were present in 11 of 16 years from 1976-1991.

<u>Species Trends 1976-2005:</u>

Yearly CPUE estimates for all warm water fish collected in the 1976-2005 DEC Lake Ontario eastern basin warm water assessment are shown in Table A1. Statistical tests for trends in the catch data were conducted using regression analysis (SAS 1985, Proc REG, P=0.05) of the yearly CPUE estimates. Tests were routinely conducted for the entire 30-year sampling period, and for the 17-year period 1989-2005. This later time period was chosen since analysis of smallmouth bass data (Lantry et al. 2002) suggested that impacts from double-crested cormorant predation were reaching a threshold level around 1989. Additional species specific tests were conducted for other time periods when obvious changes were evident in the data. Graphs of yearly CPUE estimates, including 95% confidence intervals for the 1980-2005 sampling, are presented in Figure 2 for the total of all warm water fish, and in Figures A1-A5 for 15 of the more common warm water species. Trends in abundance are perhaps most easily seen in graphs of 3-year moving average CPUE plotted against the midpoint of the three years averaged (i.e., average 1976-1978 CPUE plotted against '77 [1977], average 1977-1979 CPUE plotted against '78, up to, average 2003-2005 CPUE plotted against '04). A 3-year moving average helps to dampen fluctuations due to yearly sample variation and removes the lines for 95% confidence intervals, making trends in the CPUE data easier to visualize. A graph of 3-year moving average CPUE for the total of all warm water species is included in Figure 2, and graphs for the individual species are embedded in the text in the areas where the species are being discussed. Figures A1-A5 also contain smaller graphs of 3-year moving average CPUE for each of the species shown.

Overall the warm water fish community in New York waters of Lake Ontario's eastern basin has undergone significant change during the 30-year sampling period, declining from a high of approximately 200-250 fish per net gang in 1976-1979, to a low of just under 20 fish per net gang in 2000-2004 (Figure 2, Table A1). This involved significant declines among most species that were abundant at the start of the assessment program. The stratified mean catch for all warm water species increased in 2005 to 31.4 fish per standard 450 ft net gang, the highest value estimated since 1993 and a 62.1% increase compared to the average of the previous 5 years, but still well below

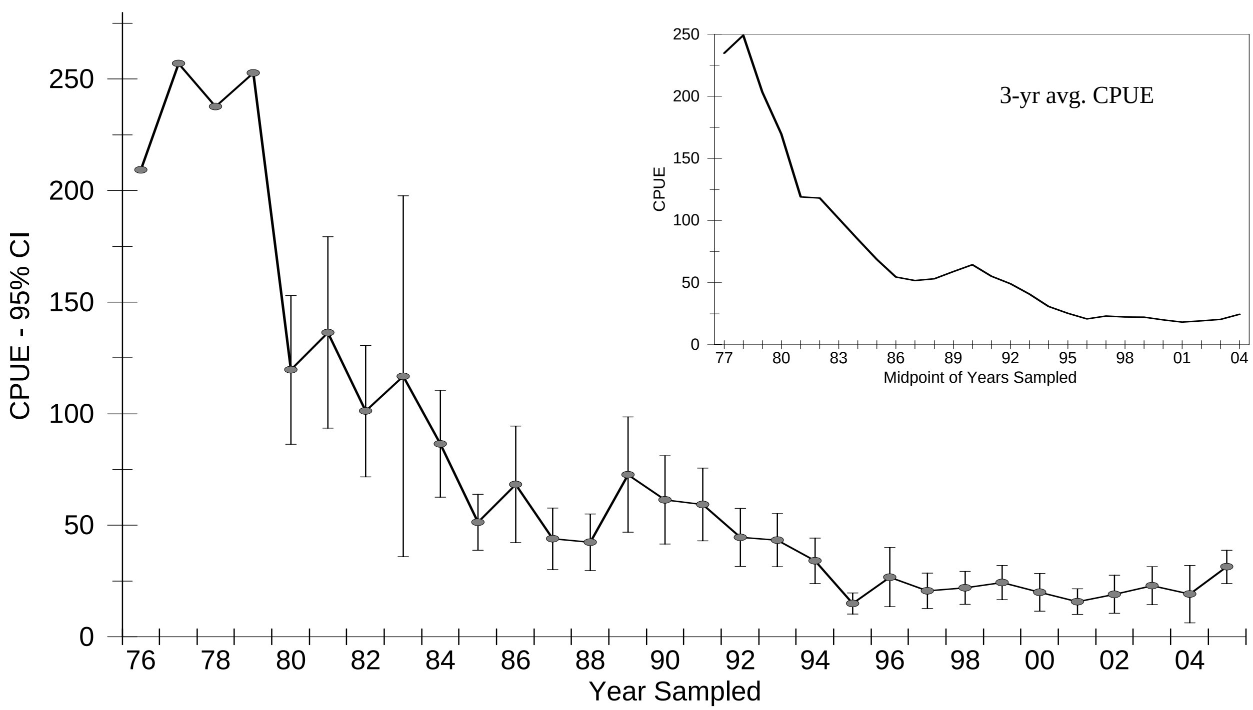
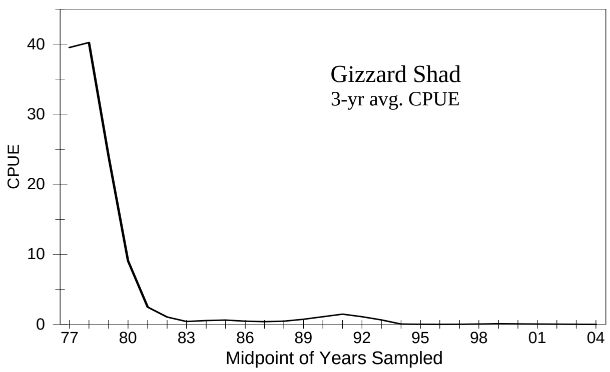


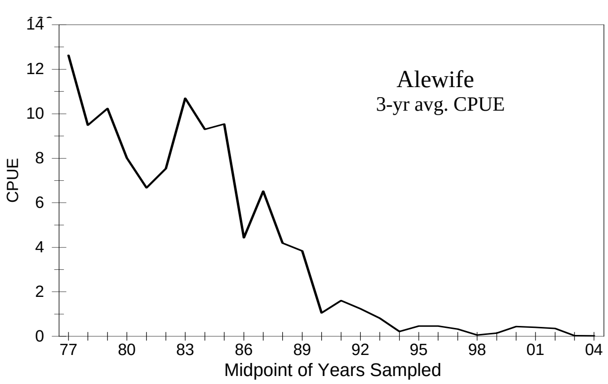
Figure 2. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for all warm water fish from the 1976-2005 warm water assessment conducted in New York waters of Lake Ontario's eastern basin. The inset graph shows 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

the CPUE estimates observed through the mid 1980s. Regression analysis shows highly significant downward trends for both the 1976-2005 (P<0.0001) and the 1989-2005 (P=0.0002) data series, but no significant trends in the 1993-2005 data.

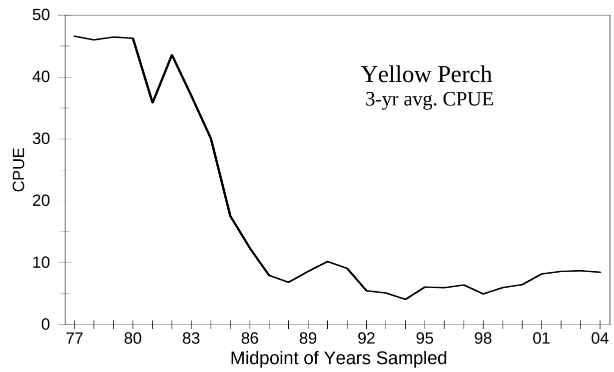
Gizzard shad, white perch, yellow perch, rock bass, and alewife, were all abundant, important members of the warm water community in 1976-1979, and have all shown fairly consistent, statistically significant, patterns of declining abundance over the 30-year sampling period. Of these species, gizzard shad showed the earliest and most precipitous decline in abundance, declining from a high of



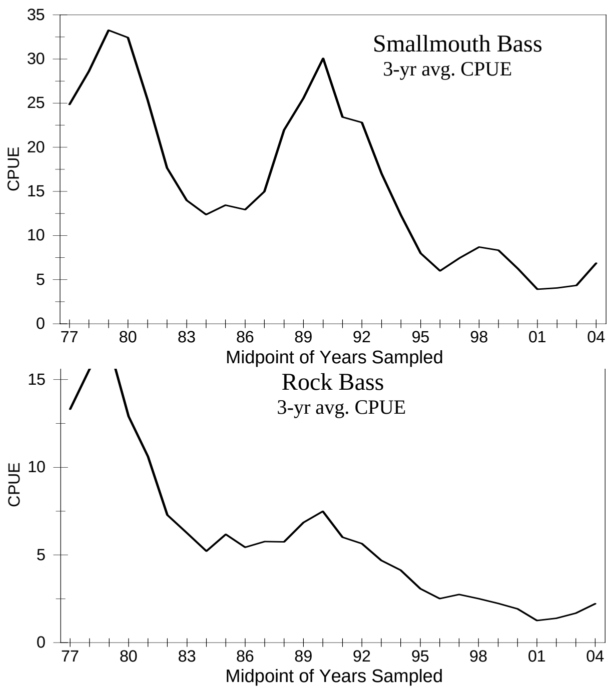
approximately 50 fish per net gang in 1977 and 1978 to less than one fish per net gang in 1982 (Figure A2, Table A1). Gizzard shad abundance has remained low since, with zero catches in 1995-1997, 2001, and 2003-2005. White perch was arguably the most common pan fish throughout Lake Ontario in the 1970s with catches in the eastern basin averaging over 90 fish per net gang in 1976-1979 (Figure A2, Table A1). White perch catches declined consistently through the 1980s and



early 1990s, reaching a low of just 0.06 fish per net gang in 1995. Regression analysis shows highly significant downward trends for both the 1976-2005 (P<0.0001) and the 1989-2005 (P=0.0007) data series. White perch abundance has shown a slow but statistically significant upward trend from 1995-2005 (P=0.0085), with catches averaging 1.1 per net gang for the five years from 2001-2005. The 2005 CPUE estimate of 1.9 per net gang was the highest value observed since 1994, but compared to the period prior to 1995, white perch catches still remain low and tend to be concentrated in the larger embayments. Yellow perch was the second most common pan fish in the eastern basin assessment from 1976-1979 with catches averaging over 45 fish per net gang. Yellow perch catches declined dramatically in the early and mid 1980s, reaching a low of 2.2 fish per net gang in 1988 (Figure A1, Table A1). Catches increased in 1989 and have remained comparatively stable since, averaging 7.27 fish per net gang from 1989-2005 and showing no statistically significant trends. The 2005 CPUE

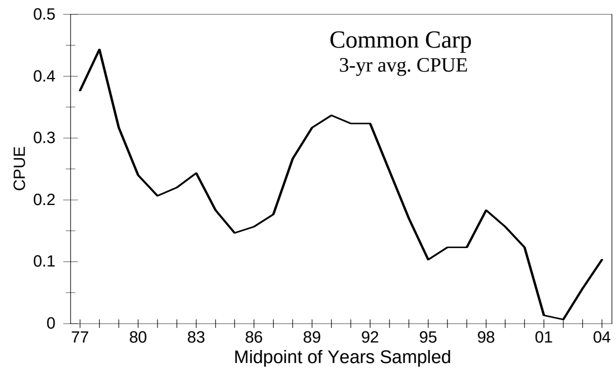


estimate was 8.9 yellow perch per net gang, up 32.5% compared to 2004 and up 22.8% compared to the 1989-2005 average. Fall trawl sampling conducted by the USGS Oswego Biological Field Station showed increased production of age-0 yellow perch in 1991-95 (O'Gorman and Burnett 2001), raising expectations for increased abundance and increased gill net catches in subsequent years. However, these stronger year classes were apparently negated by increases in mortality rates, including increases among fish age 0-2 (perch too small to be exploited by recreational or commercial fisheries, but heavily preyed upon by double-crested cormorants [O'Gorman and Burnett 2001]). The fact that yellow perch were the most commonly



captured fish in the 2000-2003 assessment netting is due largely to decreases in catches of other species, rather than increases in yellow perch. Rock bass catch in the eastern basin assessment peaked in 1978 with an estimate of 22.1 fish per net gang. Catch rates declined sharply in the early 1980s, remained fairly stable through the early 1990s, but then began a second more gradual decline that continued through 2002 when catch dropped to 1.1 fish per net gang (Figure A2, Table A1). Regression analysis shows highly significant downward trends for both the 1976-2005 (P<0.0001) and the 1989-2005 (P=0.0002) data series. Rock bass CPUE estimates increased from 2003-2005, and regression analysis of the 12 years from 1994-2005 shows no statistically significant trends. The 2005 rock bass CPUE was estimated at 2.7 fish per net gang, a 29.2% increase compared to 2004 and a 145.5% increase compared to the low point observed in 2002. Alewife catch data show higher yearly variation, with an overall pattern of declining catches from the late 1970s through the early 1990s, followed by consistently low catches through 2005 (Figure A5, Table A1). No alewife were captured in four of the last 12 years of assessment netting, including both 2004 and 2005. Regression analysis shows significant downward trends for the 1976-2005 (P<0.0001) and 1989-2005 (P=0.0159) data series, but no significant trends in the 1993-2005 data. Other sampling programs confirm lower alewife abundance in Lake Ontario as well as shifts in temporal distribution, particularly in the eastern basin since the mid 1990s (O'Gorman et al. 2000, O'Gorman et al. 2005). Alewife catches in the warm water netting are also potentially influenced by gill net selectivity. Since only larger adult alewives are readily captured in the smallest mesh sizes used (2 inch stretch mesh), comparatively small changes in age composition or growth rate may significantly change vulnerability to the standard net gangs used.

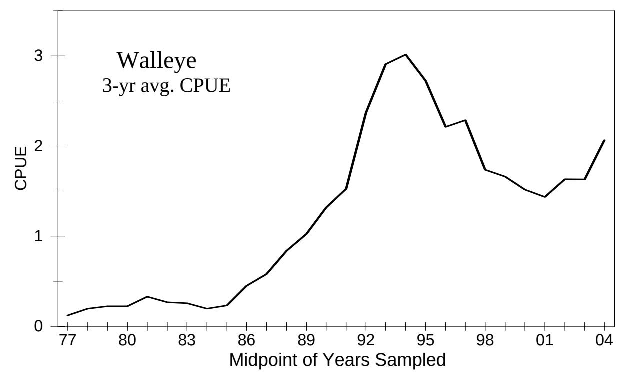
Smallmouth bass have always been an important component of the Lake Ontario warm water community, and the most commonly sought species in the eastern basin recreational fishery (McCullough and Einhouse 1999). From 1976-1979 smallmouth bass were typically the third or fourth most commonly captured fish in the assessment netting (Table A1), with catches averaging 27.6 fish per net gang, approximately half those of the most common species. As abundance of these other species declined, smallmouth bass became an increasingly larger proportion of the fish sampled, and since 1986 have been either the first or second most commonly captured species in the assessment netting. In 2005, the smallmouth bass catch was more than double the second most commonly captured species, contributing 39.4% of the total warm water catch. Smallmouth bass have shown a statistically significant pattern of decline over the entire 30-year sample period (P<0.0001), but with obvious peaks in CPUE estimates around 1980 and1989 (Figures A1, Table A1). These peaks were directly attributable to recruitment of large numbers of bass from the strong 1973 and 1983 year classes, respectively (Chrisman and Eckert 1999). Catches of age 2-4 bass in the assessment netting also indicated strong year classes in 1987, 1988, 1995, and 1997 (Casselman et al. 2002, Eckert 2000). Despite the presence of these four strong year classes, smallmouth bass catches showed a highly significant decline from 1989-2005. This decline has been linked to increases in mortality of bass between ages 3 and 6, and coincides with documented increases in the number of double-crested cormorants and their predation on smallmouth bass (Chrisman and Eckert 1999; Lantry et al. 2002). Smallmouth bass catches in the assessment nets have remained relatively low since 1994, with the lowest point observed in 2001. Catches increased substantially in 2005 with an estimate of 11.3 smallmouth bass per net gang, the highest estimate since 1994 and a 169.1% increase compared to the previous 5 years. Regression analysis of the 1994-2005 and 1995-2005 data series failed to detect any recent significant trends.



The decline of smallmouth bass in the eastern basin in the 1990s was in direct contrast to bass populations along the southern shore of Lake Ontario. The NYSDEC fishing boat census documented a significant increase in smallmouth bass catch rates between 1985 and 2003, suggesting a corresponding increase in smallmouth bass abundance (Eckert 2006). This increase in smallmouth bass was corroborated by gill net sampling conducted near Pultneyville, NY (20 miles east of Rochester) in 1976-79 and in 2000-01, utilizing the same standard net gangs and methods as the eastern basin warm water assessment (Eckert and Pearsall 2002). Mean smallmouth bass CPUE at the Pultneyville site rose from 15.4 bass in 1976-79 to 82.6 bass in 2000-01, a 438% increase, while eastern basin mean CPUE estimates declined from 27.6 bass in 1976-79 to just 4.0 bass in 2000-01, an 86% decrease.

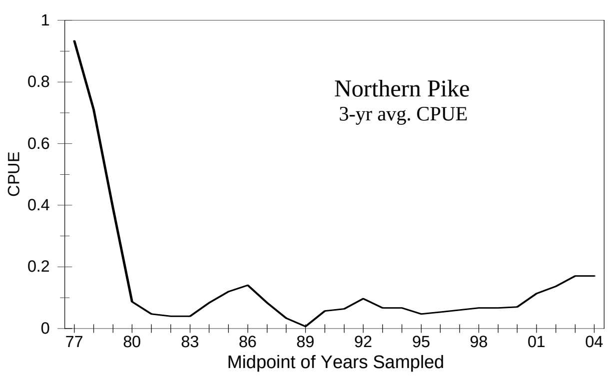
In 2004 and 2005, smallmouth bass harvest and catch declined substantially in the NYSDEC fishing boat census. Reasons for these declines remain speculative, since age data for the harvested fish or other independent measures of abundance or age structure, are not available. Regardless, the basic harvest patterns established in the 1990s remained intact. Smallmouth bass harvest and catch rates among boat anglers in the Pultneyville area were more than double those estimated in the Henderson area, with an overall upward trend in relative harvest rates in the Pultneyville area compared to the lake-wide harvest rates (Eckert 2006).

Walleye is the only relatively common species that has shown a statistically significant increase in CPUE ($P<0.0001$) over the 30-year sampling period (Figure A1, Table A1). Although the long-term trend is upwards, walleye catches did peak in 1993, and showed a significant downward trend from 1993-2002 ($P=0.0016$). Walleye catches rose in 2003-2005, and the 2005 estimate was 2.4 fish per net gang. This was the highest walleye CPUE value observed since 1996, and a 46.6% increase compared to the previous five years. Regression analysis shows no statistically significant trends in the 1994-2005 walleye CPUE data series.

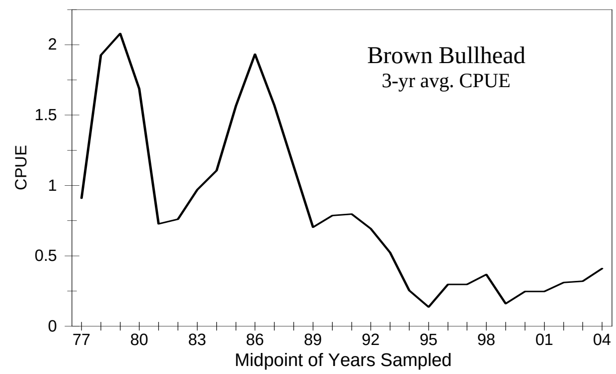


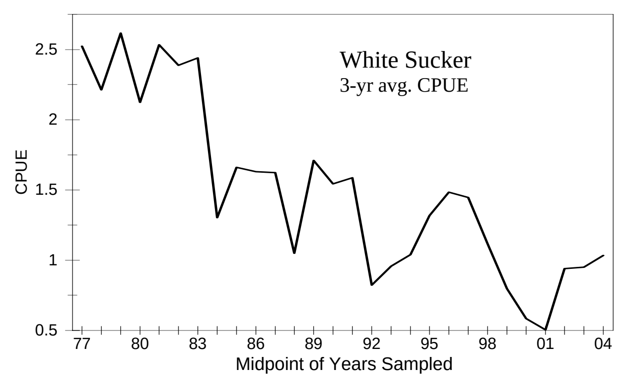
The 2004 warm water assessment report (Eckert 2005) documented an unusually large catch of age-1 walleye, indicating the presence of a strong 2003 year class. This year class was again evident in the 2005 sampling with an unusually strong contribution
of walleye 14-18 inches long (12 of 97 walleye sampled). The 2005 assessment netting also resulted in the capture of four age-1 walleye (2004 year class), well below the 21 age-1 fish observed in 2004, but still above the average of the 28 years from 1976-2003.

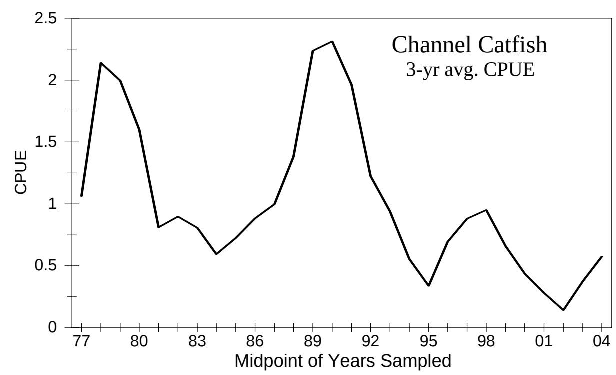
Among the remaining warm water species, only eight are considered common enough to warrant analysis of trends in CPUE estimates. These species (Figures A3-A5, Table A1) show a variety of patterns , with downward trends predominating. Only two species, northern pike and pumpkinseed, show significant upward trends over some portion of the years tested. Northern pike show an early and dramatic decline in CPUE over the 30 years sampled (P=0.0133), similar to gizzard shad, but in contrast to gizzard shad, they were never a major component of the warm water catch in the eastern basin. Catches declined dramatically by 1979, and regression analysis of the 27-year period from 1979-2005 shows no statistically significant trends. Northern pike CPUE estimates showed a variable decline through 1990, and since 1989 have shown a modest but statistically significant upward trend (P=0.0026). Common carp, brown bullhead, and white sucker all show significant patterns of declining abundance over the 30-year sampling period (P=0.0011, 0.0045, and 0.0017, respectively), although their yearly CPUE estimates are more variable than for the more abundant



species. Common carp also show a statistically significant decline in CPUE since 1989 (P=0.0021). Brown bullhead show only a marginally significant decline (P=0.0550) in CPUE since 1989, while white sucker show no significant trends (P=0.2537). Channel catfish show a more cyclic pattern of abundance with obvious peaks in CPUE around 1979 and 1990. Regression analysis shows only a marginally significant downward trend over the entire 30-year sample period (P=0.0787), but a highly significant downward trend in CPUE since 1989 (P=0.0047). Pumpkinseed and freshwater drum both show peaks in gill net catches before 1980, but the yearly CPUE estimates are quite variable. Regression analysis shows no statistically significant trends in CPUE over the entire 30-year sample period, but pumpkinseed do show a statistically significant upward trend from 1991-2005 (P=0.0016) while freshwater drum show a statistically significant downward trend from 1989-2005 (P=0.0381). Silver redhorse show no statistically significant trends in CPUE data among any of the time periods tested.

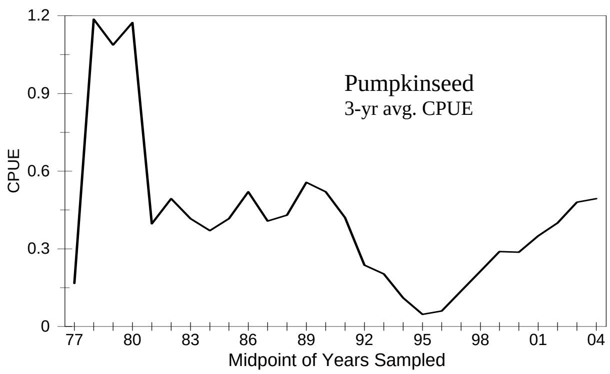


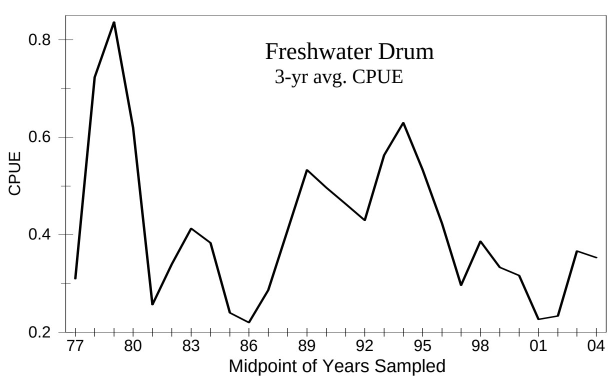


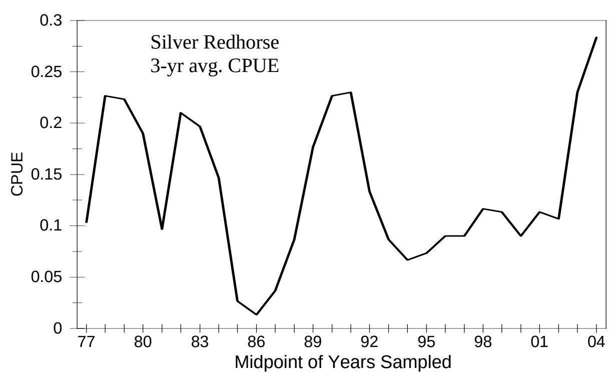


Distribution Shifts:

Changes in depth and geographic distribution were investigated using relative catches of smallmouth bass, yellow perch, walleye, and rock bass (the four most common and recreationally important species over the range of years sampled), plus the total of all warm water species. Relative CPUE values were calculated separately each year for the three depth strata, and the five area strata (depth strata 1 and 2 only), from the 1980-2005 sampling. The mean catch in each of the three depth strata in any given year was divided by the highest depth strata value for that year; and similarly, the mean catch in each of the five area strata was divided by the highest area strata value for that year. This resulted in a value of 1.0 for the depth and area strata that had the highest mean catch for that species or species group in that particular year. Values for the remaining two depth and four area strata were less than 1.0 and directly proportional to the catch within those strata (Tables A2-A6, Figures A6-A15). Sample sizes for each depth or area stratum were small (maximum of 9-10 net gangs per year for the depth strata, and 2-5 net gangs per year for the area strata), making the estimates more prone to variation from random sample error, and the relative catch estimates are generally quite variable from year to year. Trends in the relative CPUE values over the 26-years sampled were tested using regression analysis (SAS 1985, Proc REG, P=0.05).







Relative catch estimates for the total of all warm water species showed no statistically significant trends in any of the depth strata (Table A2, Figure A6), with typically the highest, least variable catches in depth stratum 1 (12-30 ft, 26-year average 0.96), lower, more variable catches in depth stratum 2 (31-50 ft; average 0.80); and the lowest and most variable catches in depth stratum 3 (51-100 ft; average 0.35). Walleye catches were also highest in depth stratum 1 (Table A5, Figure A9; highest relative catch in 23 of 26 years, average 0.95), but walleye do show statistically significant upward trends in relative catch in depth stratum 2 (P=0.0010) and depth stratum 3 (P=0.0291). Smallmouth bass, yellow perch, and rock bass, all had slightly higher average relative catches in depth stratum 2 compared to depth stratum 1, and all three showed some statistically significant trends in relative catches. Smallmouth bass (Table A3, Figure A7) show a statistically significant upward trend in relative catch in depth stratum 1 (P=0.0498), with the highest relative catches in stratum 1 in 10 of the last 14 years. Yellow perch (Table A4, Figure A8) show the opposite, with significant downward trends in relative catches in depth stratum 1 (P=0.0012) and depth stratum 2 (P=0.0119; lowest relative catch in just 5 or 26 years, but in 3 of those were 2003-2005). Rock bass (Table A6, Figure A10) relative catches show statistically significant trends in all three depth strata. An upward trend in stratum 1 (P=0.0068, highest relative catches in 8 of the last 10 years), and downward trends in depth stratum 2 (P=0.0151) and stratum 3 (P=0.0382). Regardless of any changes in depth distribution among the different species, catches of all warm water fish continue to be reduced by cold water temperatures, and have remained at or near zero in the August sampling wherever bottom temperatures were consistently at or below 50˚F.

Graphs of relative CPUE by area strata are given in Figures A11-A15. Relative catch estimates for the total of all warm water species (Table A2, Figure A11) show a statistically significant upward trend in Chaumont Bay (P=0.0426), and a statistically significant downward trend in Henderson Bay (P=0.0168), over the 26-year data series. Smallmouth bass relative catches (Table A3, Figure A12) show a significant upward tend in the Chaumont Bay area (P=0.0095), and a significant downward trend in the Stony Island area (P=0.0001). Relative catch data for yellow perch (Table A4, Figure A13) show a statistically significant downward trend in the Stony Island area (P=0.0407). This downward trend in the Stony Island area had been particularly striking, and may be directly related to predation by double-crested cormorants (Birt et al. 1987, O'Gorman and Burnett 2001). Although relative catches of yellow perch were never high in the Stony Island area, catches were zero in 13 of the 16 years from 1988-2003. Walleye also show one statistically significant trend in the Stony Island area (Table A5, Figure A14), but in contrast to yellow perch, it is an upward trend (P=0.0158, highest relative catches in 13 of the last 15 years) Rock bass (Table A6, Figure A15) show no statistically significant trends among the five area strata in the 1980-2005 relative catch estimates.

References

Birt, V.L., T.B. Birt, D. Goulet, D.K. Cairns, and W.A. Montevecchi. 1987. Ashmole's halo: direct evidence for prey depletion by a seabird. Marine Ecology Progress Series 40: 205-208.

Casselman, J.M., D.M. Brown, J.A. Hoyle and T.H. Eckert. 2002. Effects of climate and global warming on year-class strength and relative abundance of smallmouth bass in eastern Lake Ontario. Pages 73-90 *in* D.P. Philipp and M.S. Ridgway, editors. Black Bass: ecology, conservation, and management. American Fisheries Society, Symposium 31, Bethesda, Maryland.

Chrisman, J.R. and T.H. Eckert. 1999. Population trends among smallmouth bass in the eastern basin of Lake Ontario, 1976-97. Section 2 *in* Final Report: To assess the impact of double-crested cormorant predation on smallmouth bass and other fish of the eastern basin of Lake Ontario. NYSDEC Special Report - February 1, 1999. New York State Department of Environmental Conservation, Bureau of Fisheries, Albany, N.Y.

Cochran, W.G. 1977. Sampling Techniques, 3rd edition. John Wiley and Sons, New York.

Eckert, T.H. 1986. 1985 warm water assessment. Section 6 *in* NYSDEC 1986 Annual Report, Bureau of Fisheries, Great Lakes Fisheries Section, Lake Ontario Unit to the Lake Ontario Committee and the Great Lakes Fishery Commission.

Eckert, T.H. 1998. Summary of 1976-97 warm water assessment. Section 2 *in* NYSDEC 1997 Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

Eckert, T.H. 2000. Summary of 1976-99 warm water assessment. Section 4 *in* NYSDEC 1999 Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

Eckert, T.H. 2005. Summary of 1976-2004 warm water assessment. Section 4 *in* NYSDEC 2004 Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

Eckert, T.H. 2006. 2005 Lake Ontario fishing boat census. Section 2 *in* NYSDEC 2005 Annual

Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

Eckert, T.H. and W. Pearsall. 2002. Comparisons of warm water gill netting: Pultneyville and eastern basin. Section 22 *in* NYSDEC 2001 Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

Lantry, B.F., T.H. Eckert, C.P. Schneider, and J.R. Chrisman. 2002. The relationship between the abundance of smallmouth bass and double-crested cormorants in the eastern basin of Lake Ontario. Journal Great Lakes Research 28(2):193-201.

McCullough, R.D. and D.W. Einhouse. 1999. Lake Ontario eastern basin creel survey, 1998. Section 4 *in* Final Report: To assess the impact of double-crested cormorant predation on smallmouth bass and other fish of the eastern basin of Lake Ontario. NYSDEC Special Report - February 1, 1999. New York State Department of Environmental Conservation, Bureau of Fisheries, Albany, N.Y.

O'Gorman, R., J.H. Elrod, R.W. Owens, C.P. Schneider, T.H. Eckert, and B.F. Lantry. 2000. Shifts in depth distributions of alewives, rainbow smelt, and age-2 lake trout in southern Lake Ontario following establishment of dreissenid. Transactions of the American Fisheries Society 129: 1096-1106.

O'Gorman, R., and J.A.D. Burnett. 2001. Fish community dynamics in northeastern Lake Ontario with emphasis on the growth and reproductive success of yellow perch (Perca flavescens) and white perch (Morone americana), 1978 to 1997. Journal of Great Lakes Research 27(3): 367-383.

O'Gorman, R.W. Owens, S.E. Prindle, J.V. Adams, and T. Schaner. 2005. Status of major prey fish stocks in the U.S. waters of Lake Ontario, 2004. Section 12 *in* NYSDEC 2004 Annual Report, Bureau of Fisheries Lake Ontario Unit and St. Lawrence River Unit to the Great Lakes Fishery Commission's Lake Ontario Committee.

SAS Institute. 1985. SAS procedures guide for personal computers, version 6 edition. SAS Institute, Cary, North Carolina.

Table A1. Stratified mean catch per unit effort data from the 1976-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

	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	0	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	1.12	0.20	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	0.60	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	63.00	136.42	74.11	86.98	26.20	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	0.10	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	209.43	257.13	237.81	252.83	119.72	136.42	101.19	116.82	86.50	51.38	68.30	43.98

Table A1 (continued). Stratified mean catch per unit effort data from the 1976-2005 warm water assessment netting.

	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	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	29.40	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 A1 (continued). Stratified mean catch per unit effort data from the 1976-2005 warm water assessment netting.

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

Table A2. Stratified mean catch per standard 450 ft gill net gang, 95% confidence intervals, relative annual CPUE by depth strata, and relative annual CPUE by area for depth strata 1 and 2, for all warm water fish from the 1980-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

All Warm Water Fish Species

Year	Strat.	95% CI		Rel CPUE by Depth			Relative CPUE by Area (Strata 1&2)				
Sample	CPUE	Lower	Upper	Strat 1	Strat 2	Strat 3	Area 1	Area 2	Area 3	Area 4	Area 5
1980	119.72	86.40	153.04	1.00	0.76	0.39	0.63	0.43	0.32	1.00	0.41
1981	136.42	93.47	179.36	1.00	0.93	0.25	0.60	0.62	0.78	1.00	0.39
1982	101.19	71.72	130.65	0.94	1.00	0.21	0.89	0.61	0.86	1.00	0.51
1983	116.82	35.94	197.69	1.00	0.87	0.51	0.59	0.58	0.36	1.00	0.33
1984	86.50	62.65	110.34	1.00	0.58	0.13	0.51	0.39	0.65	1.00	0.45
1985	51.38	38.83	63.94	1.00	0.84	0.04	0.61	0.84	0.77	1.00	0.40
1986	68.30	42.17	94.44	0.96	1.00	0.41	0.64	0.86	0.87	1.00	0.50
1987	43.98	30.19	57.76	1.00	0.55	0.06	0.46	1.00	0.68	0.87	0.40
1988	42.42	29.70	55.13	1.00	0.77	0.36	0.43	0.49	0.51	1.00	0.62
1989	72.71	46.85	98.58	0.84	0.88	1.00	0.34	0.82	0.49	1.00	0.43
1990	61.35	41.54	81.16	0.84	1.00	0.51	0.99	1.00	0.69	0.97	0.53
1991	59.34	43.05	75.63	0.99	1.00	0.51	0.47	1.00	0.51	0.29	0.36
1992	44.57	31.62	57.53	1.00	0.68	0.44	0.77	1.00	0.39	0.92	0.29
1993	43.32	31.32	55.32	1.00	0.59	0.45	0.55	0.73	1.00	0.69	0.37
1994	34.08	23.91	44.25	1.00	0.90	0.21	0.38	1.00	0.87	0.78	0.45
1995	14.91	10.13	19.69	1.00	0.50	0.05	0.47	1.00	0.74	0.65	0.59
1996	26.73	13.48	39.99	0.94	1.00	0.50	0.54	0.61	1.00	0.15	0.41
1997	20.58	12.67	28.49	1.00	0.69	0.32	0.44	0.96	1.00	0.50	0.46
1998	21.94	14.58	29.30	1.00	0.59	0.25	0.68	1.00	0.44	0.60	0.43
1999	24.40	16.70	32.09	1.00	0.91	0.48	0.38	1.00	0.74	0.51	0.23
2000	19.92	11.48	28.36	0.79	1.00	0.37	0.65	0.68	0.37	1.00	0.24
2001	15.73	10.01	21.45	1.00	0.58	0.13	0.56	0.69	0.22	1.00	0.31
2002	19.06	10.46	27.66	0.74	1.00	0.24	0.60	0.79	1.00	0.83	0.22
2003	22.92	14.37	31.46	1.00	0.46	0.32	0.66	1.00	0.85	0.71	0.30
2004	19.10	6.24	31.95	1.00	0.73	0.34	1.00	0.72	0.83	0.73	0.37
2005	31.36	23.89	38.83	0.81	1.00	0.50	0.68	0.79	1.00	0.73	0.70

Table A3. Stratified mean catch per standard 450 ft gill net gang, 95% confidence intervals, relative annual CPUE by depth strata, and relative annual CPUE by area for depth strata 1 and 2, for smallmouth bass from the 1980-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

Smallmouth Bass

Year	Strat.	95% CI		Rel CPUE by Depth			Relative CPUE by Area (Strata 1&2)				
Sample	CPUE	Lower	Upper	Strat 1	Strat 2	Strat 3	Area 1	Area 2	Area 3	Area 4	Area 5
1980	38.02	17.40	58.64	0.56	0.61	1.00	1.00	0.36	0.07	0.27	0.98
1981	23.47	14.28	32.67	0.95	1.00	0.26	0.60	0.67	0.52	0.58	1.00
1982	14.55	6.04	23.07	0.58	1.00	0.23	1.00	0.81	0.44	0.33	0.86
1983	14.96	9.70	20.22	0.44	1.00	0.08	0.66	0.23	0.58	0.52	1.00
1984	12.44	7.03	17.86	1.00	0.95	0.03	1.00	0.16	0.21	0.47	0.85
1985	9.76	5.35	14.17	0.52	1.00	0.00	0.83	0.32	0.04	0.22	1.00
1986	18.14	7.51	28.76	0.57	1.00	0.70	0.86	0.34	0.52	0.35	1.00
1987	10.89	5.93	15.86	1.00	0.74	0.01	0.84	0.10	1.00	0.49	0.84
1988	15.92	9.96	21.87	0.96	1.00	0.26	0.47	0.29	0.33	0.76	1.00
1989	39.05	14.35	63.75	0.29	0.39	1.00	0.52	0.05	0.41	0.97	1.00
1990	21.72	13.13	30.31	0.38	1.00	0.57	1.00	0.28	0.02	0.45	0.68
1991	29.40	14.64	44.16	0.33	1.00	0.72	0.37	1.00	0.08	0.25	1.00
1992	19.13	11.45	26.80	1.00	0.86	0.96	0.74	0.50	0.08	1.00	0.41
1993	19.91	12.87	26.96	0.65	0.69	1.00	0.73	0.70	0.30	1.00	0.53
1994	11.99	7.75	16.23	1.00	0.94	0.60	0.48	0.72	0.00	1.00	0.93
1995	5.01	3.20	6.82	1.00	0.54	0.06	0.81	0.67	1.00	0.69	0.69
1996	6.98	2.99	10.97	1.00	0.98	0.37	0.59	1.00	0.91	0.10	0.34
1997	6.03	4.00	8.05	1.00	0.66	0.24	0.59	1.00	0.49	0.78	0.43
1998	9.36	4.95	13.78	1.00	0.44	0.46	0.55	1.00	0.27	0.81	0.84
1999	10.68	6.84	14.51	1.00	0.98	0.51	0.27	1.00	0.59	0.31	0.23
2000	5.01	2.65	7.38	0.93	1.00	0.48	1.00	0.80	0.28	0.80	0.86
2001	2.99	1.46	4.51	1.00	0.31	0.00	0.23	1.00	0.09	0.38	0.40
2002	3.76	1.71	5.81	0.74	1.00	0.08	0.11	0.73	1.00	0.32	0.32
2003	5.43	3.05	7.80	1.00	0.89	0.27	0.35	0.59	1.00	0.79	0.27
2004	3.84	1.76	5.92	1.00	0.89	0.12	1.00	0.30	0.56	0.46	0.42
2005	11.33	8.25	14.42	0.58	1.00	0.29	1.00	0.75	0.59	0.83	0.81

Table A4. Stratified mean catch per standard 450 ft gill net gang, 95% confidence intervals, relative annual CPUE by depth strata, and relative annual CPUE by area for depth strata 1 and 2, for yellow perch from the 1980-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

Yellow Perch

Year	Strat.	95% CI		Rel CPUE by Depth			Relative CPUE by Area (Strata 1&2)				
Sample	CPUE	Lower	Upper	Strat 1	Strat 2	Strat 3	Area 1	Area 2	Area 3	Area 4	Area 5
1980	27.63	19.64	35.63	1.00	0.96	0.44	1.00	0.59	0.77	0.83	0.14
1981	43.81	18.68	68.93	0.99	1.00	0.54	0.41	0.41	1.00	0.40	0.39
1982	36.07	17.09	55.06	1.00	0.72	0.23	0.84	0.42	1.00	0.30	0.26
1983	50.85	6.58	95.12	1.00	0.72	1.00	0.48	0.56	0.11	1.00	0.07
1984	24.02	12.30	35.73	0.59	1.00	0.42	0.65	0.88	1.00	0.57	0.50
1985	15.35	7.47	23.23	0.94	1.00	0.14	0.41	0.59	0.60	1.00	0.04
1986	13.32	1.54	25.10	1.00	0.74	0.58	0.31	0.65	1.00	0.65	0.06
1987	8.36	3.02	13.71	1.00	0.96	0.17	0.14	1.00	0.33	0.29	0.02
1988	2.19	0.30	4.08	0.65	1.00	0.12	0.80	1.00	0.00	0.83	0.00
1989	10.06	2.93	17.18	0.43	1.00	0.80	0.01	1.00	0.34	0.36	0.00
1990	13.61	3.52	23.70	0.59	1.00	0.44	0.14	0.82	1.00	0.21	0.08
1991	6.97	1.69	12.24	1.00	0.77	0.34	0.01	0.78	1.00	0.05	0.00
1992	6.72	1.82	11.63	0.66	1.00	0.70	0.15	0.85	1.00	0.47	0.00
1993	2.78	0.59	4.97	0.74	1.00	0.33	0.01	0.49	0.00	1.00	0.00
1994	5.87	1.29	10.44	0.93	1.00	0.01	0.00	0.26	1.00	0.64	0.00
1995	3.68	0.31	7.05	1.00	0.62	0.06	0.00	1.00	0.62	0.44	0.00
1996	8.76	2.75	14.77	0.39	1.00	0.90	0.10	0.32	1.00	0.19	0.00
1997	5.53	0.32	10.74	0.63	0.76	1.00	0.10	0.09	1.00	0.28	0.00
1998	5.01	1.27	8.74	0.68	1.00	0.09	0.73	1.00	0.32	0.61	0.00
1999	4.47	1.39	7.54	0.69	0.34	1.00	0.00	0.36	0.27	1.00	0.00
2000	8.58	1.25	15.91	0.33	1.00	0.48	0.25	0.07	0.16	1.00	0.01
2001	6.37	1.17	11.58	0.80	1.00	0.27	0.39	0.04	0.07	1.00	>0.01
2002	9.65	2.11	17.18	0.23	1.00	0.36	0.75	0.05	0.89	1.00	0.00
2003	9.82	2.91	16.72	1.00	0.28	0.62	0.93	1.00	0.35	0.67	0.00
2004	6.74	0.00	18.31	0.21	0.14	1.00	0.07	1.00	0.08	0.00	0.23
2005	8.93	1.73	16.13	0.15	0.04	1.00	1.00	0.13	0.13	0.00	0.15

Table A5. Stratified mean catch per standard 450 ft gill net gang, 95% confidence intervals, relative annual CPUE by depth strata, and relative annual CPUE by area for depth strata 1 and 2, for walleye from the 1980-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

Walleye

Year	Strat.	95% CI		Rel CPUE by Depth			Relative CPUE by Area (Strata 1&2)				
Sample	CPUE	Lower	Upper	Strat 1	Strat 2	Strat 3	Area 1	Area 2	Area 3	Area 4	Area 5
1980	0.28	0.00	0.71	1.00	0.14	0.00	1.00	0.00	0.00	0.00	0.13
1981	0.12	0.01	0.24	1.00	0.00	0.00	0.40	1.00	0.00	0.67	0.00
1982	0.59	0.15	1.04	1.00	0.13	0.00	1.00	0.00	0.31	0.42	1.00
1983	0.09	0.00	0.24	1.00	0.56	0.00	0.00	0.00	0.00	1.00	0.30
1984	0.09	0.00	0.20	1.00	0.00	0.00	0.00	0.75	0.00	1.00	0.60
1985	0.41	0.06	0.76	1.00	0.00	0.00	0.29	0.71	0.00	0.00	1.00
1986	0.19	0.02	0.35	1.00	0.22	0.00	0.27	1.00	0.00	0.00	0.53
1987	0.75	0.34	1.16	1.00	0.46	0.00	0.78	0.56	0.83	0.19	1.00
1988	0.80	0.26	1.34	1.00	0.77	0.10	1.00	0.38	0.00	0.38	0.15
1989	0.96	0.03	1.90	1.00	0.35	0.11	0.22	0.07	0.00	0.19	1.00
1990	1.31	0.62	2.00	1.00	0.77	0.04	1.00	0.35	0.14	0.46	0.56
1991	1.68	0.31	3.05	1.00	0.67	0.07	0.26	0.20	0.16	0.11	1.00
1992	1.59	0.78	2.40	1.00	0.56	0.03	0.54	0.05	0.10	0.63	1.00
1993	3.84	1.78	5.91	1.00	0.75	0.40	0.35	0.05	0.11	0.24	1.00
1994	3.29	1.80	4.78	0.75	1.00	0.22	0.59	0.28	0.13	0.11	1.00
1995	1.91	0.78	3.05	1.00	0.32	0.03	0.83	0.38	0.21	0.28	1.00
1996	2.97	1.01	4.92	1.00	0.61	0.10	0.66	0.04	0.11	0.02	1.00
1997	1.76	0.85	2.68	0.38	1.00	0.11	0.42	0.20	0.20	0.18	1.00
1998	2.13	1.02	3.24	1.00	0.95	0.67	0.60	0.15	0.10	0.40	1.00
1999	1.32	0.64	2.00	1.00	0.60	0.31	0.24	0.20	0.10	0.27	1.00
2000	1.53	0.58	2.48	0.64	1.00	0.20	1.00	0.27	0.08	0.05	0.37
2001	1.70	0.50	2.91	1.00	0.66	0.12	0.52	0.21	0.07	0.23	1.00
2002	1.08	0.31	1.85	1.00	0.29	0.09	0.42	0.24	0.00	0.06	1.00
2003	2.12	1.28	2.96	1.00	0.71	0.09	0.57	0.27	0.12	0.40	1.00
2004	1.69	0.98	2.40	1.00	0.59	0.00	0.63	0.57	1.00	0.33	0.63
2005	2.38	0.52	4.24	1.00	0.67	0.16	0.34	0.20	0.25	0.27	1.00

Table A6. Stratified mean catch per standard 450 ft gill net gang, 95% confidence intervals, relative annual CPUE by depth strata, and relative annual CPUE by area for depth strata 1 and 2, for rock bass from the 1980-2005 warm water assessment netting conducted late July through mid August in New York waters of Lake Ontario's eastern basin.

Rock Bass

Year	Strat.	95% CI		Rel CPUE by Depth			Relative CPUE by Area (Strata 1&2)				
Sample	CPUE	Lower	Upper	Strat 1	Strat 2	Strat 3	Area 1	Area 2	Area 3	Area 4	Area 5
1980	14.69	8.59	20.79	0.72	1.00	0.75	1.00	0.23	0.44	0.18	0.66
1981	10.09	5.21	14.96	0.50	1.00	0.27	0.70	0.11	1.00	0.30	0.24
1982	7.06	2.86	11.27	0.38	1.00	0.21	0.81	0.11	1.00	0.28	0.62
1983	4.69	1.93	7.45	0.59	1.00	0.08	1.00	0.08	0.75	0.19	0.18
1984	6.99	3.00	10.98	0.53	1.00	0.24	1.00	0.18	0.33	0.20	0.87
1985	3.96	1.78	6.14	0.64	1.00	0.04	1.00	0.03	0.05	0.10	0.56
1986	7.58	4.05	11.11	0.44	1.00	0.27	0.89	0.07	1.00	0.41	0.46
1987	4.76	2.05	7.46	1.00	0.39	0.06	1.00	0.12	0.90	0.28	0.93
1988	4.94	2.04	7.84	0.90	1.00	0.36	0.80	0.08	1.00	0.19	0.66
1989	7.53	3.16	11.91	0.33	0.91	1.00	1.00	0.00	0.77	0.10	0.55
1990	8.08	3.36	12.80	1.00	0.67	0.31	0.35	0.00	0.11	1.00	0.27
1991	6.86	2.79	10.93	0.58	1.00	0.24	1.00	0.15	0.85	0.12	0.07
1992	3.09	1.67	4.50	0.61	1.00	0.46	1.00	0.41	0.27	0.41	0.27
1993	6.99	1.50	12.48	1.00	0.72	0.27	1.00	0.03	0.81	0.08	0.21
1994	3.99	1.17	6.81	0.39	1.00	0.18	1.00	0.00	0.12	0.12	0.54
1995	1.41	0.42	2.40	0.93	1.00	0.09	0.61	0.00	0.56	0.11	1.00
1996	3.79	0.00	7.74	1.00	0.71	0.52	1.00	0.05	0.87	0.03	0.42
1997	2.33	0.89	3.77	1.00	0.39	0.04	0.19	0.76	1.00	0.14	0.50
1998	2.13	0.97	3.28	1.00	0.27	0.15	1.00	0.03	0.65	0.08	0.48
1999	3.08	0.89	5.26	0.57	1.00	0.23	1.00	0.12	0.45	0.44	0.11
2000	1.47	0.67	2.27	1.00	0.53	0.13	1.00	0.25	0.83	0.11	0.27
2001	1.22	0.45	1.99	1.00	0.77	0.00	1.00	0.03	0.62	0.23	0.30
2002	1.10	0.21	1.99	1.00	0.34	0.56	1.00	0.23	0.83	0.25	0.07
2003	1.84	0.67	3.00	1.00	0.39	0.00	0.52	0.17	1.00	0.31	0.11
2004	2.09	0.82	3.35	1.00	0.85	0.02	1.00	0.23	0.18	0.58	0.16
2005	2.70	0.78	4.61	0.59	1.00	0.11	0.30	0.23	0.20	1.00	0.96

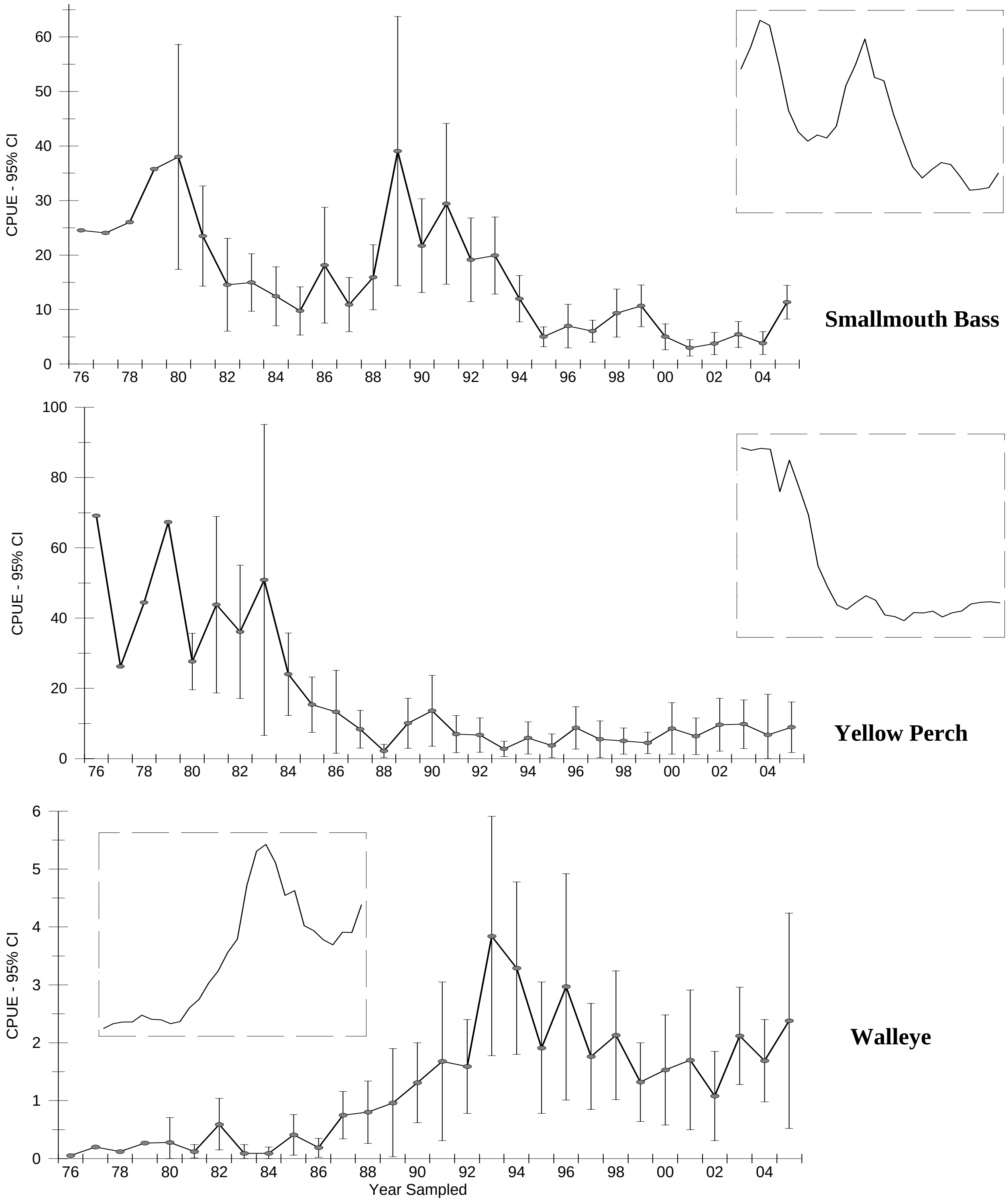


Figure A1. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for smallmouth bass, yellow perch, and walleye, from the 1976-2005 warm water assessment conducted in New York waters of Lake Ontario's eastern basin. The inset graphs show 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

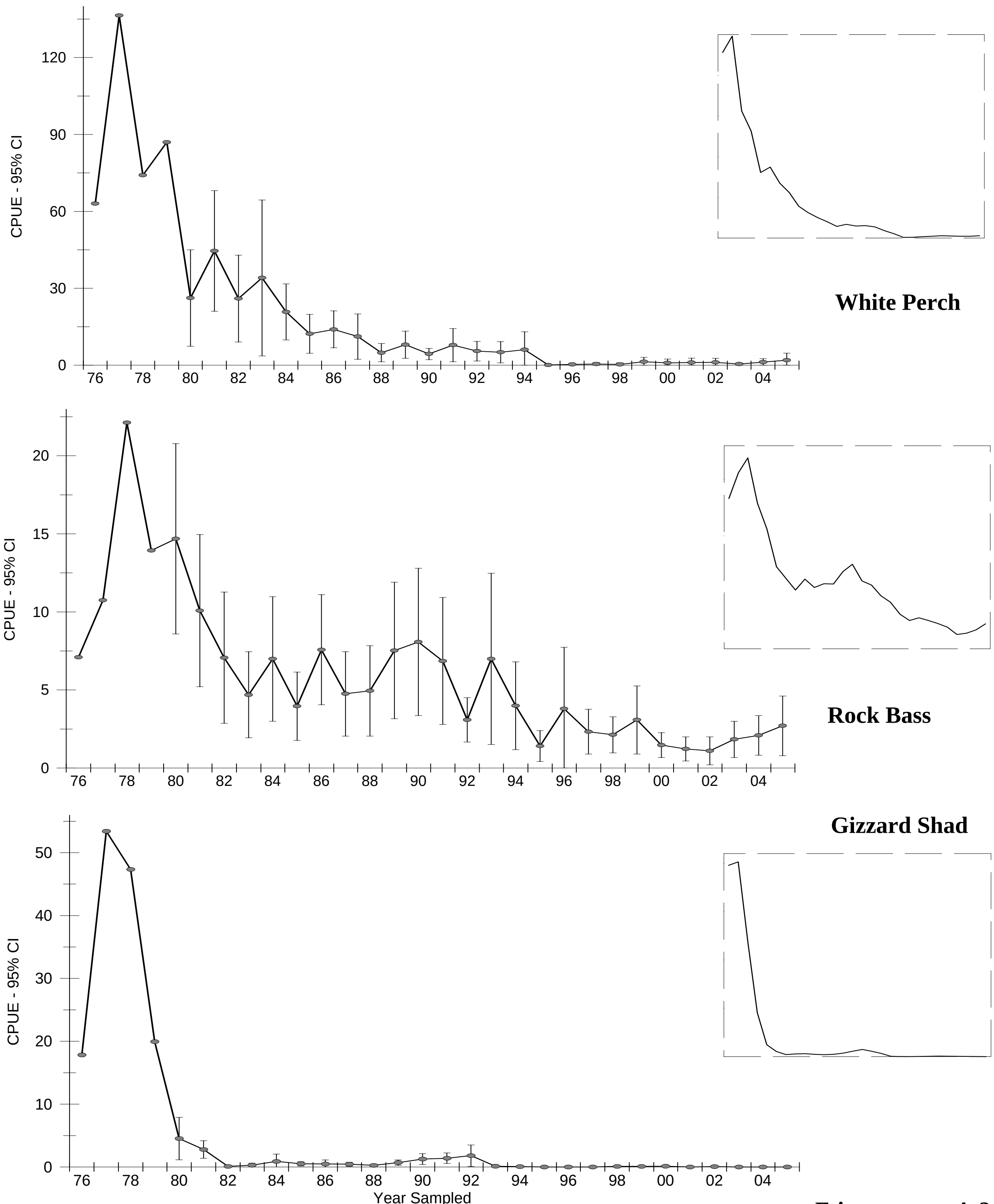


Figure A2. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for white perch, rock bass, and gizzard shad, from the 1976-2005 warm water assessment conducted in New York waters of Lake Ontario's eastern basin. The inset graphs show 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

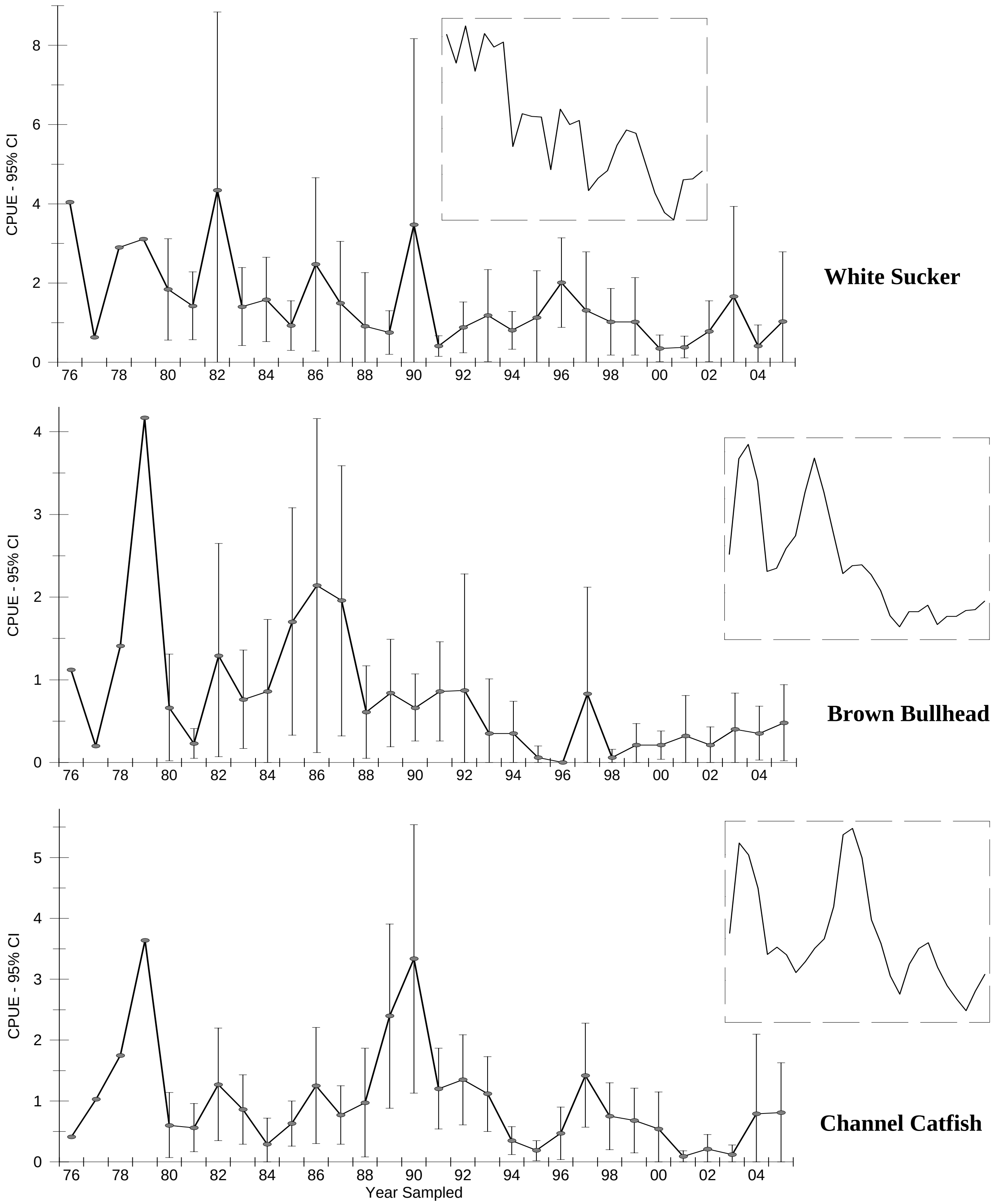


Figure A3. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for white sucker, brown bullhead, and channel catfish, from the 1976-2005 warm water assessment conducted in New York waters of Lake Ontario's eastern basin. The inset graphs show 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

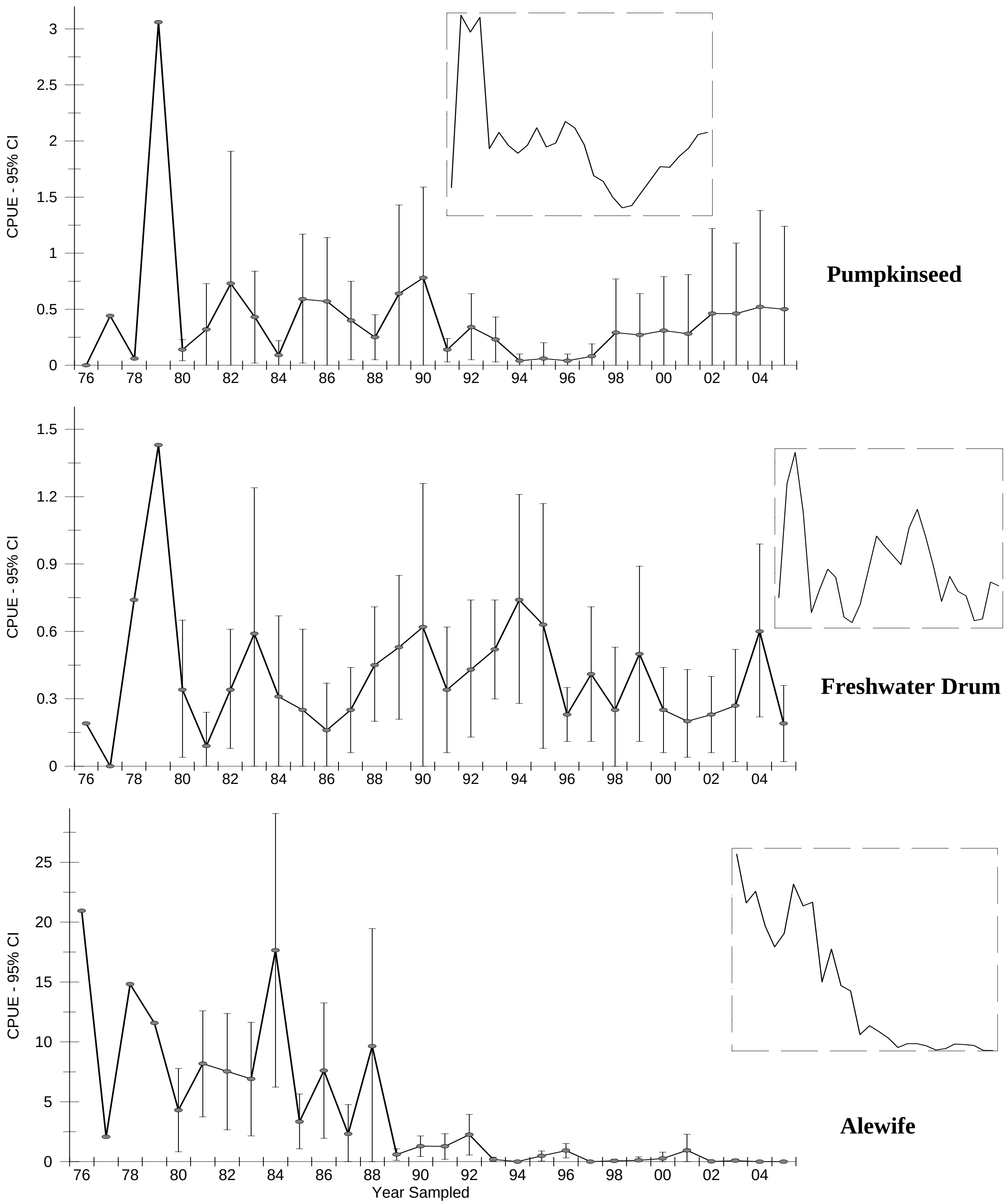


Figure A4. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for pumpkinseed, freshwater drum, and alewife, from the 1976-2005 warm water assessment conducted in New York waters of Lake Ontario's eastern basin. The inset graphs show 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

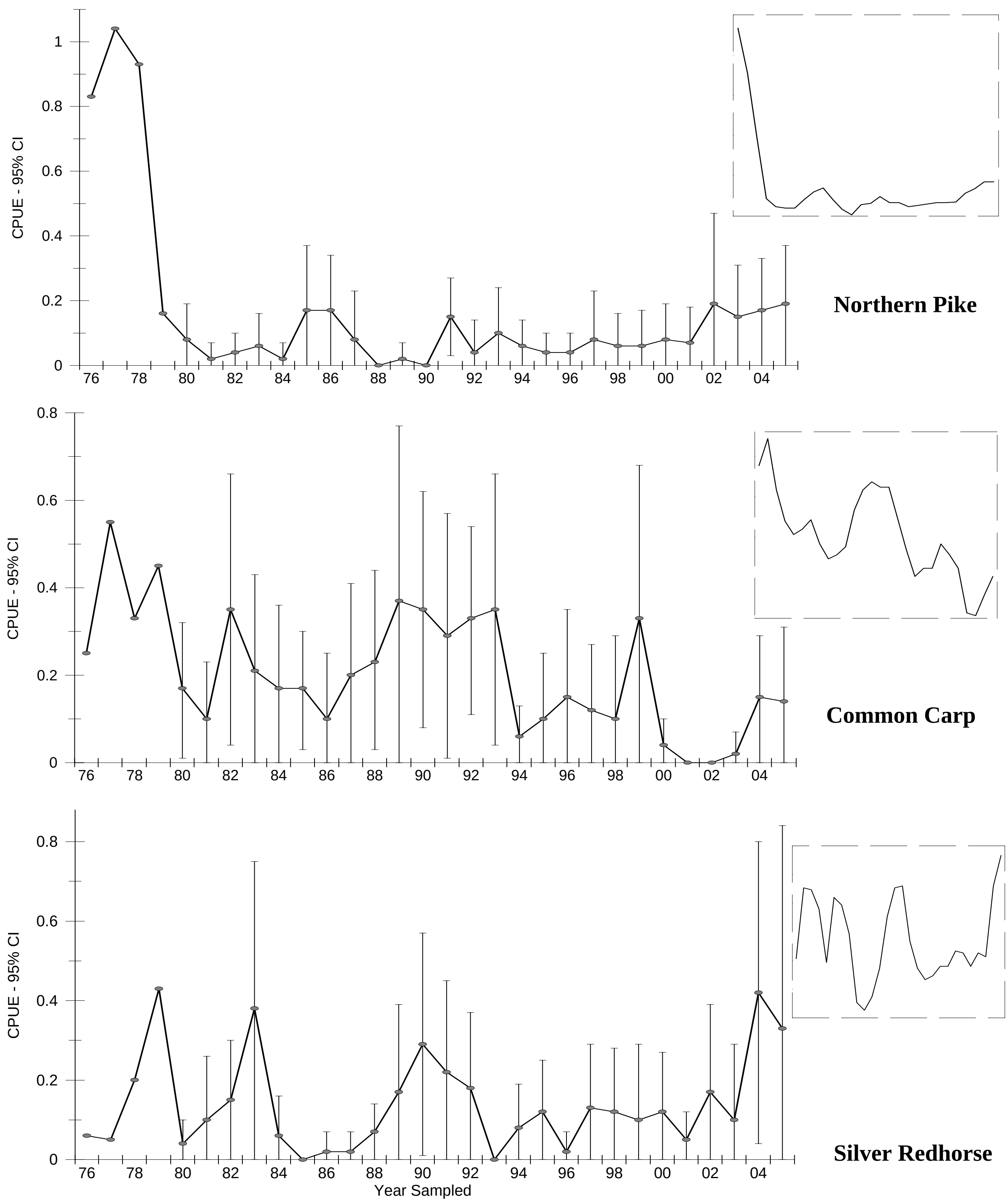


Figure A5. Stratified mean catch per 450 ft gill net gang and 95% confidence intervals for northern pike, common carp, and sliver redhorse, from the 1976-2005 warm water assessment conducted in New York

waters of Lake Ontario's eastern basin. The inset graphs show 3-year moving average catch per unit effort data plotted against the mid point of the years sampled.

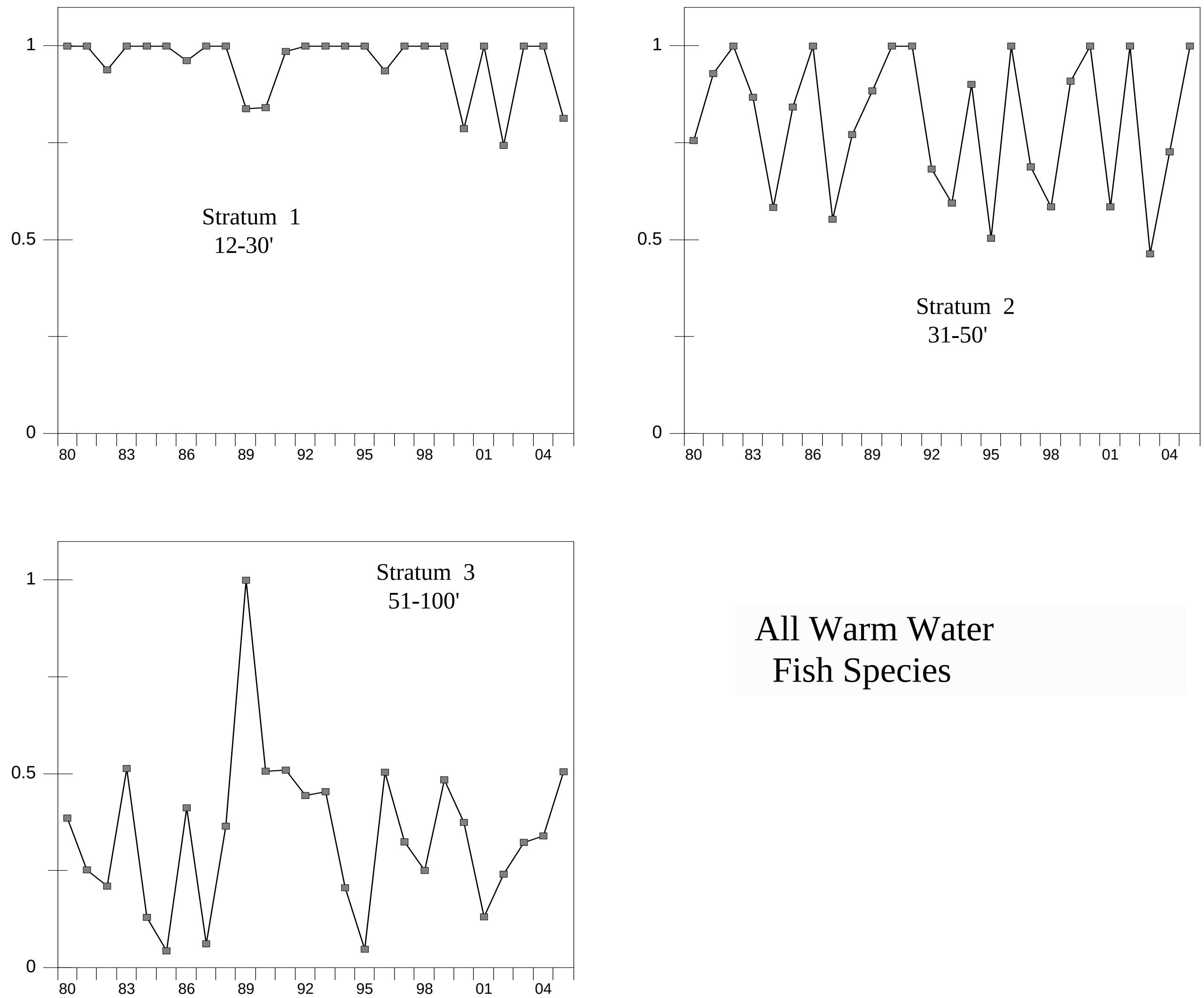


Figure A6. Relative CPUE by depth strata for all warm water fish species collected in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

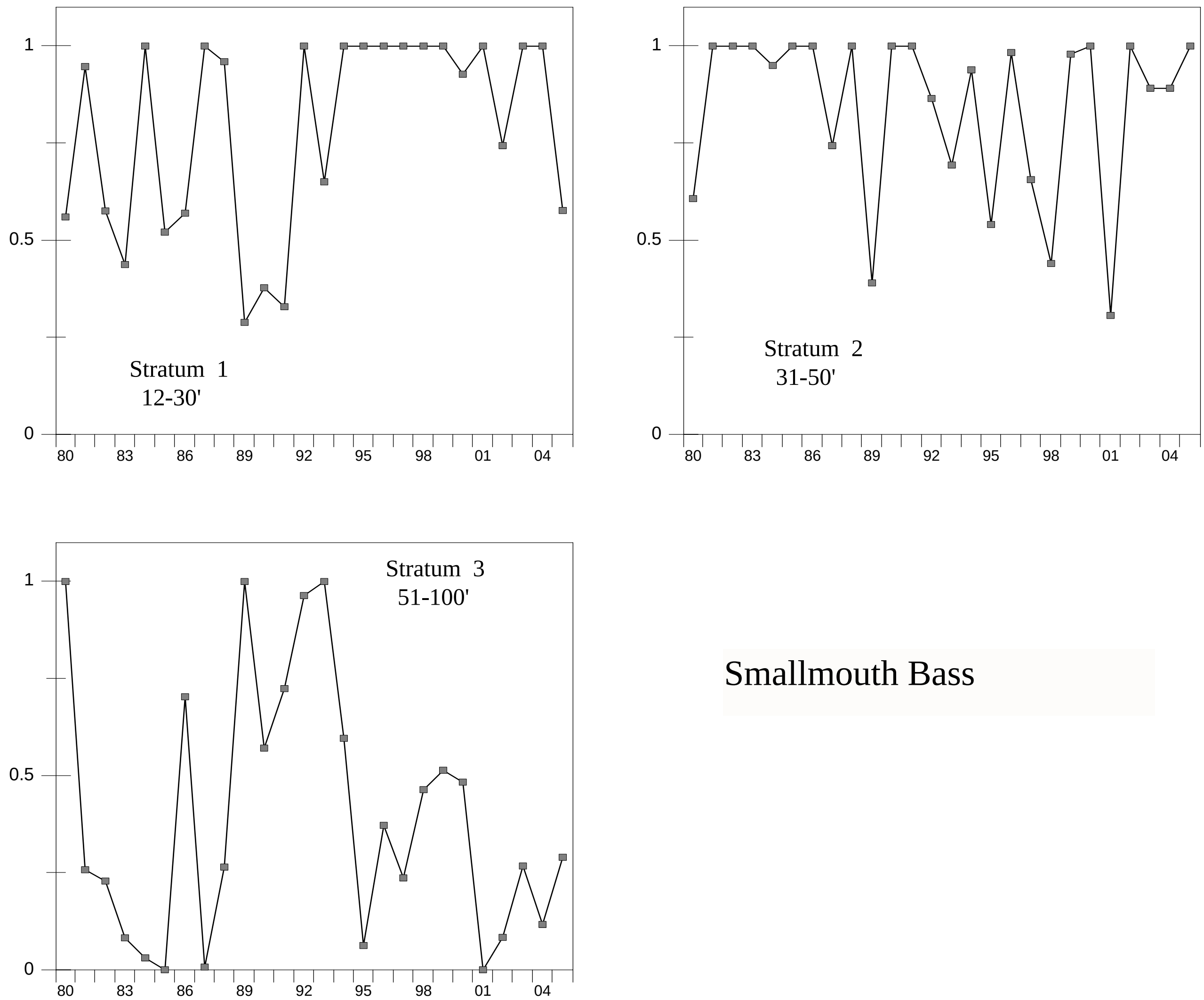


Figure A7. Relative CPUE by depth strata for smallmouth bass collected in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

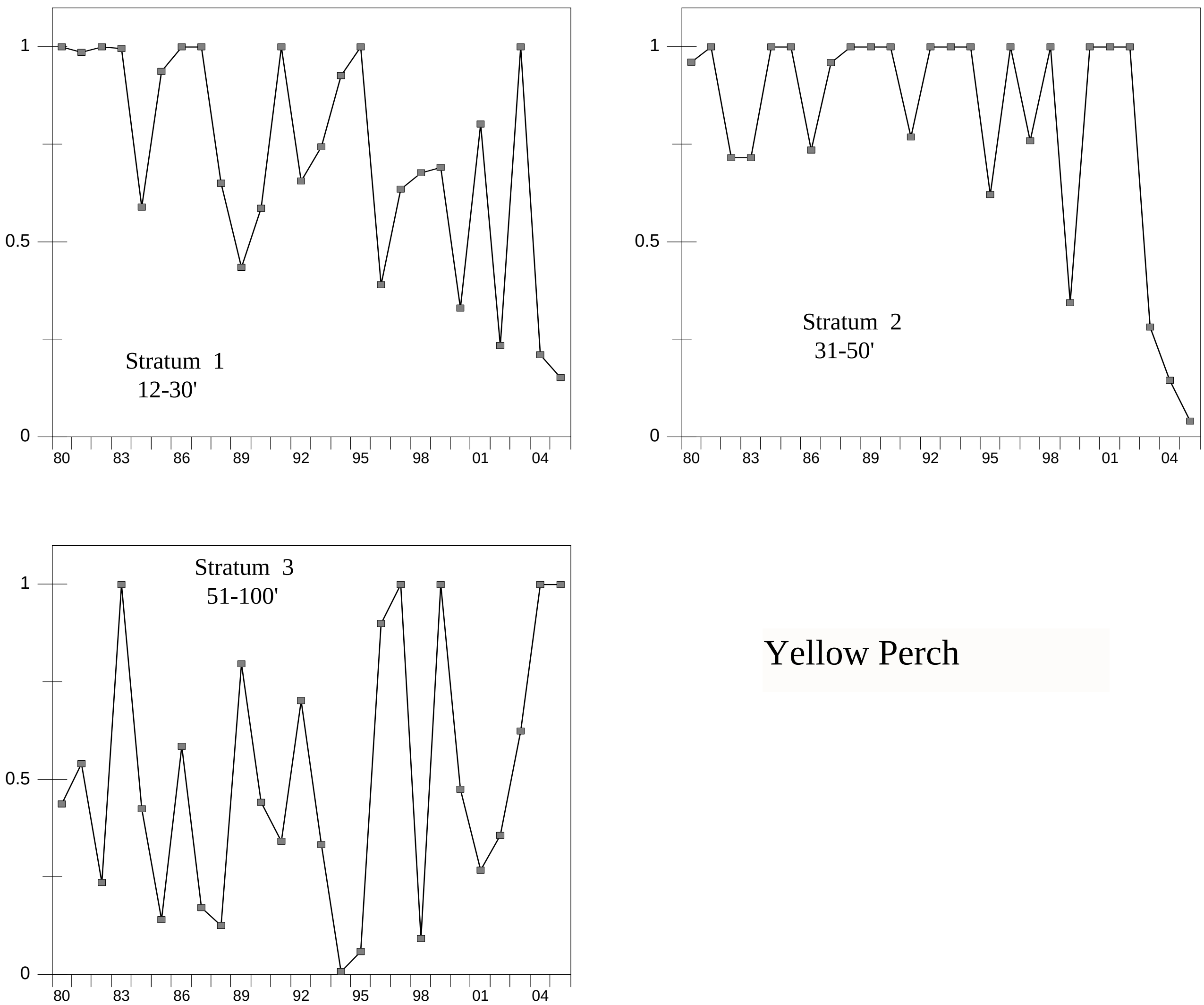


Figure A8. Relative CPUE by depth strata for yellow perch collected in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

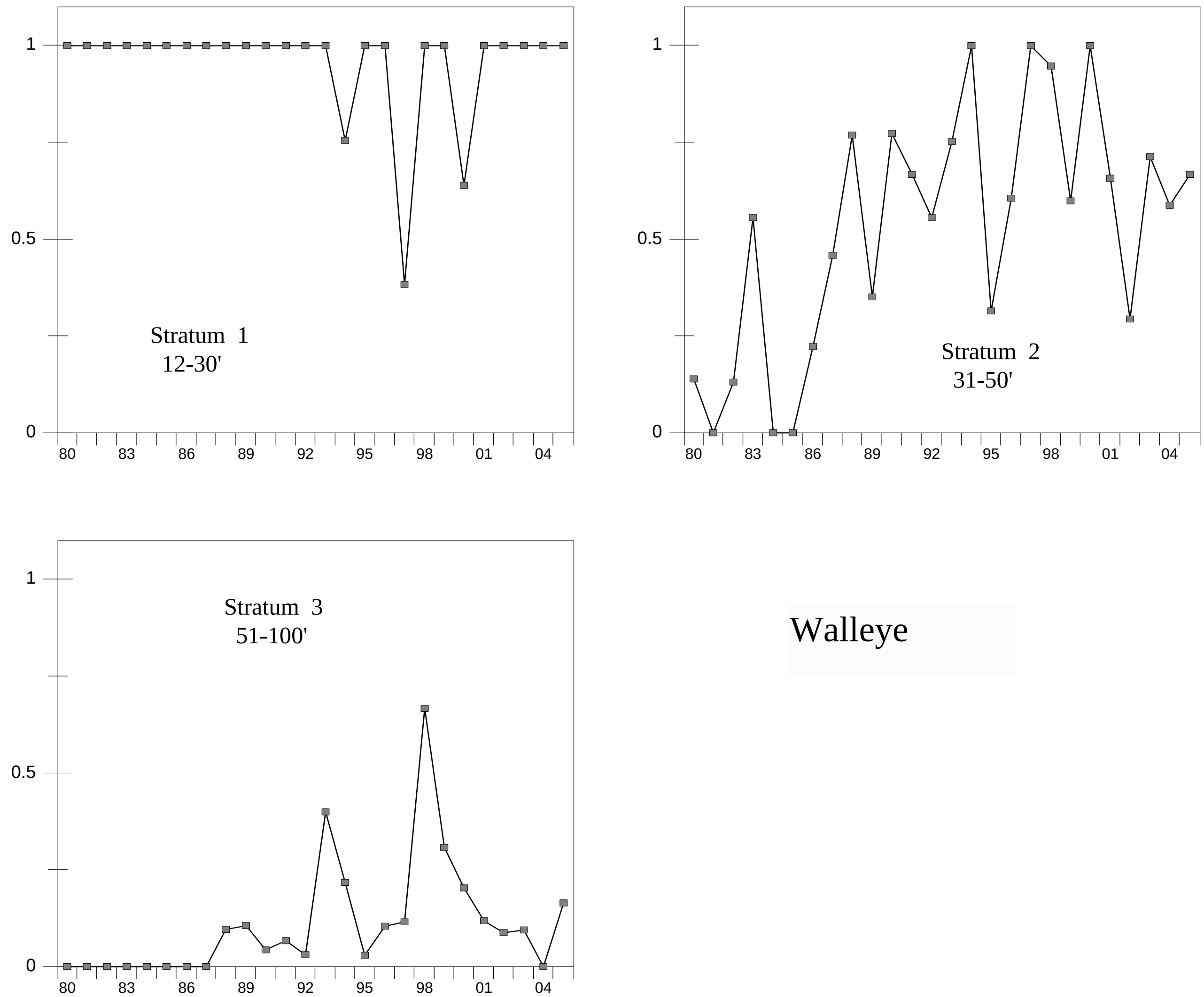


Figure A9. Relative CPUE by depth strata for walleye collected in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

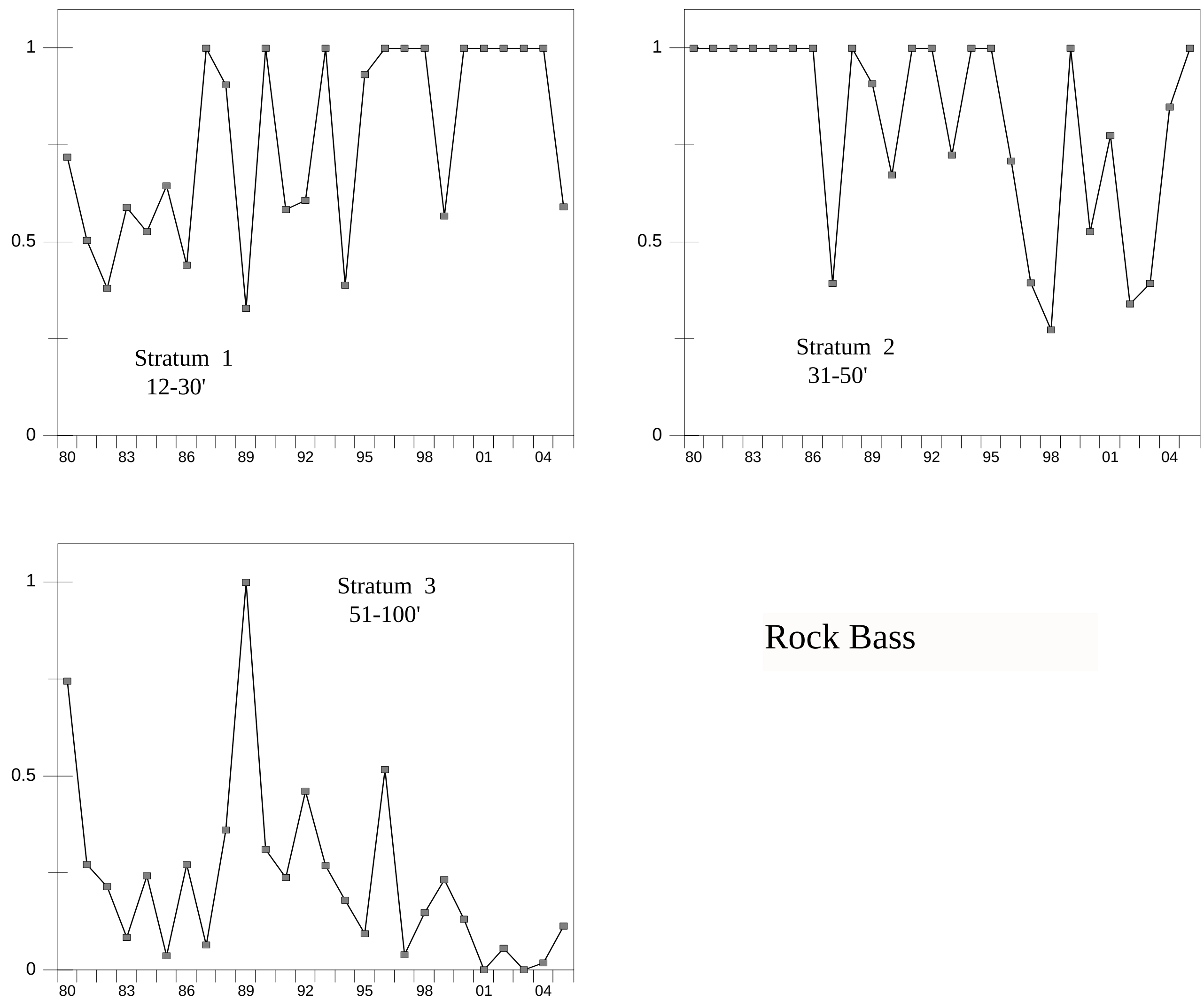


Figure A10. Relative CPUE by depth strata for rock bass collected in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

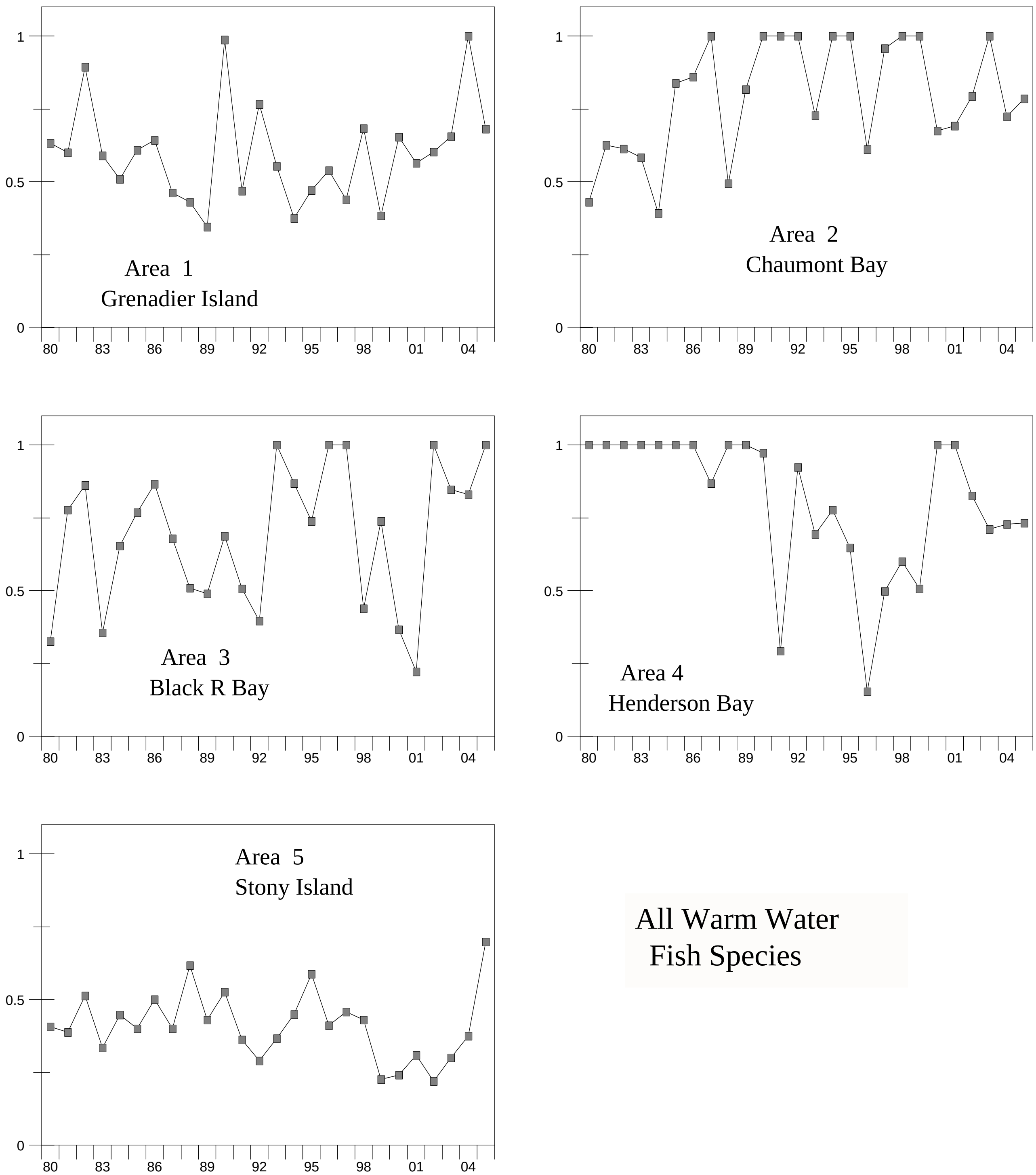


Figure A11. Relative CPUE by geographic area for all warm water fish species collected in depth strata 1 and 2 in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

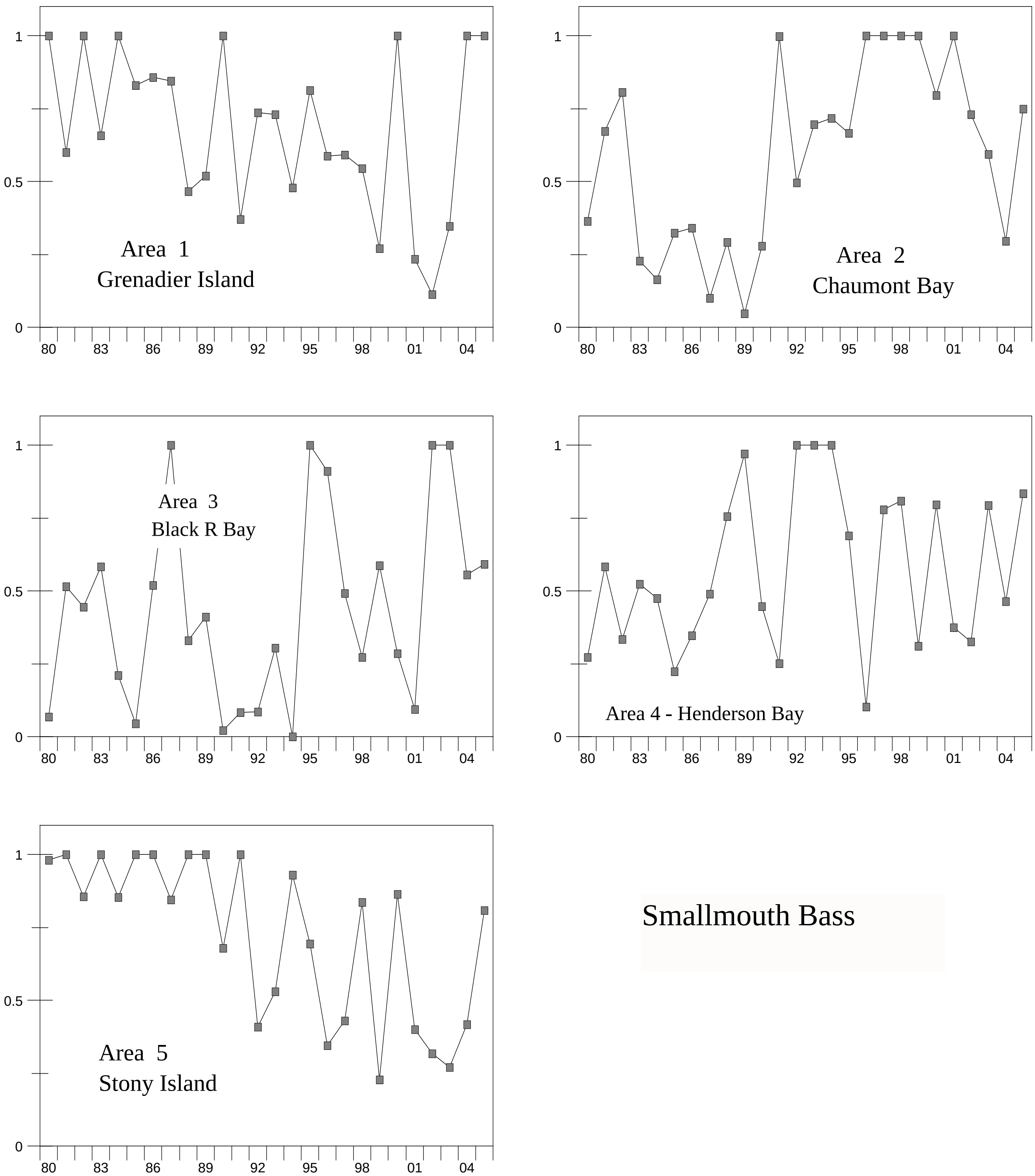


Figure A12. Relative CPUE by geographic area for smallmouth bass collected in depth strata 1 and 2 in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

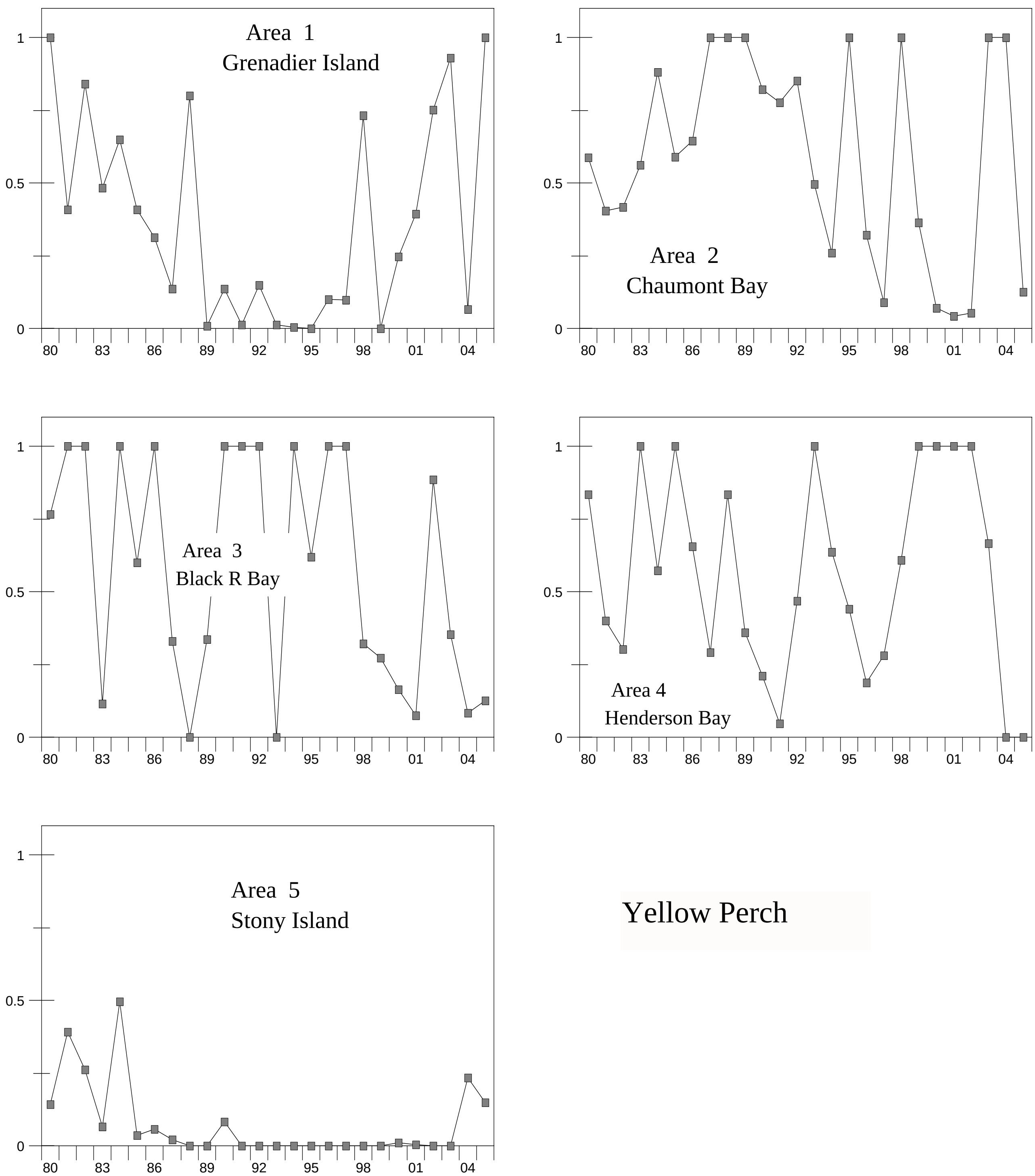


Figure A13. Relative CPUE by geographic area for yellow perch collected in depth strata 1 and 2 in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

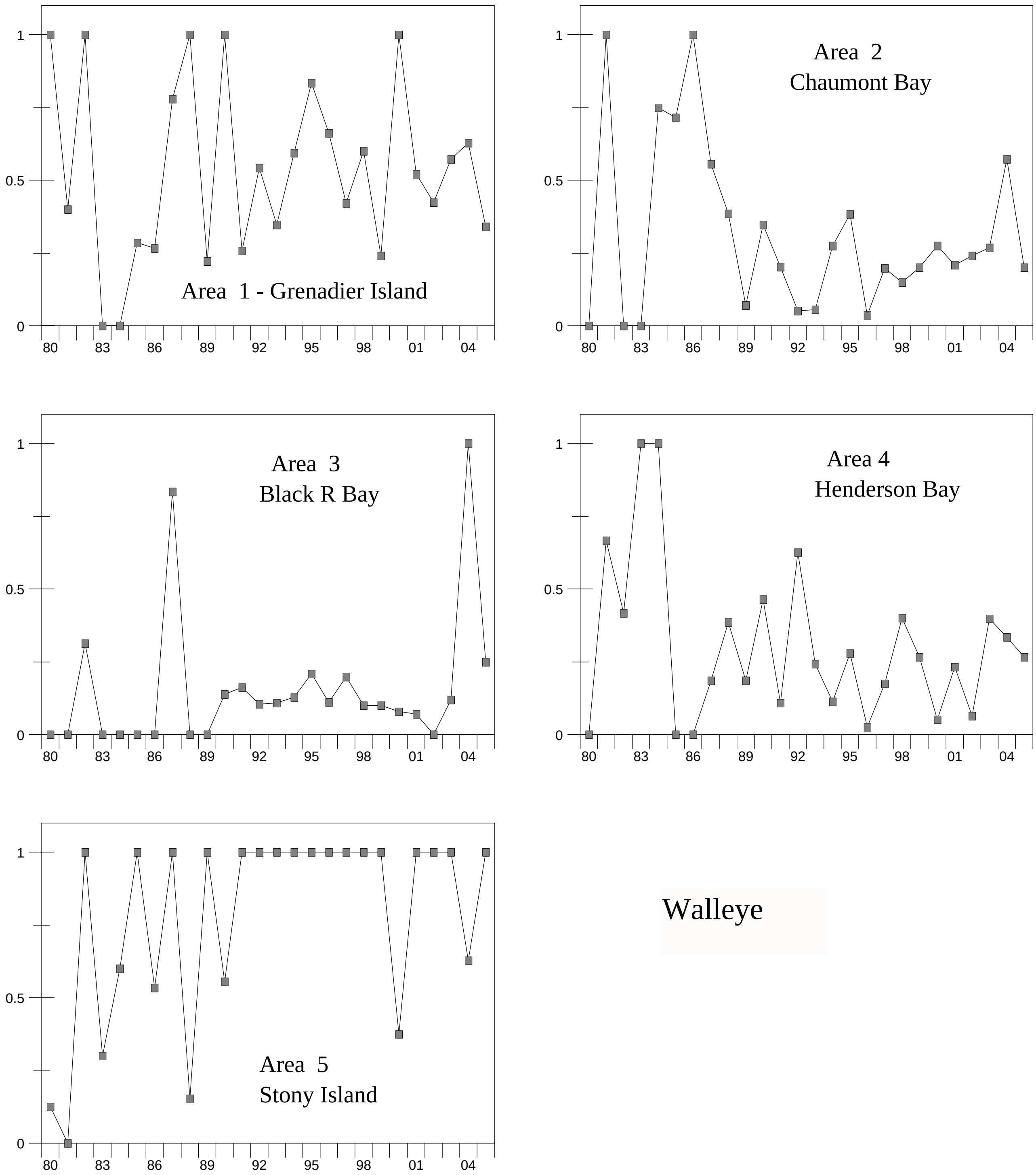


Figure A14. Relative CPUE by geographic area for walleye collected in depth strata 1 and 2 in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.

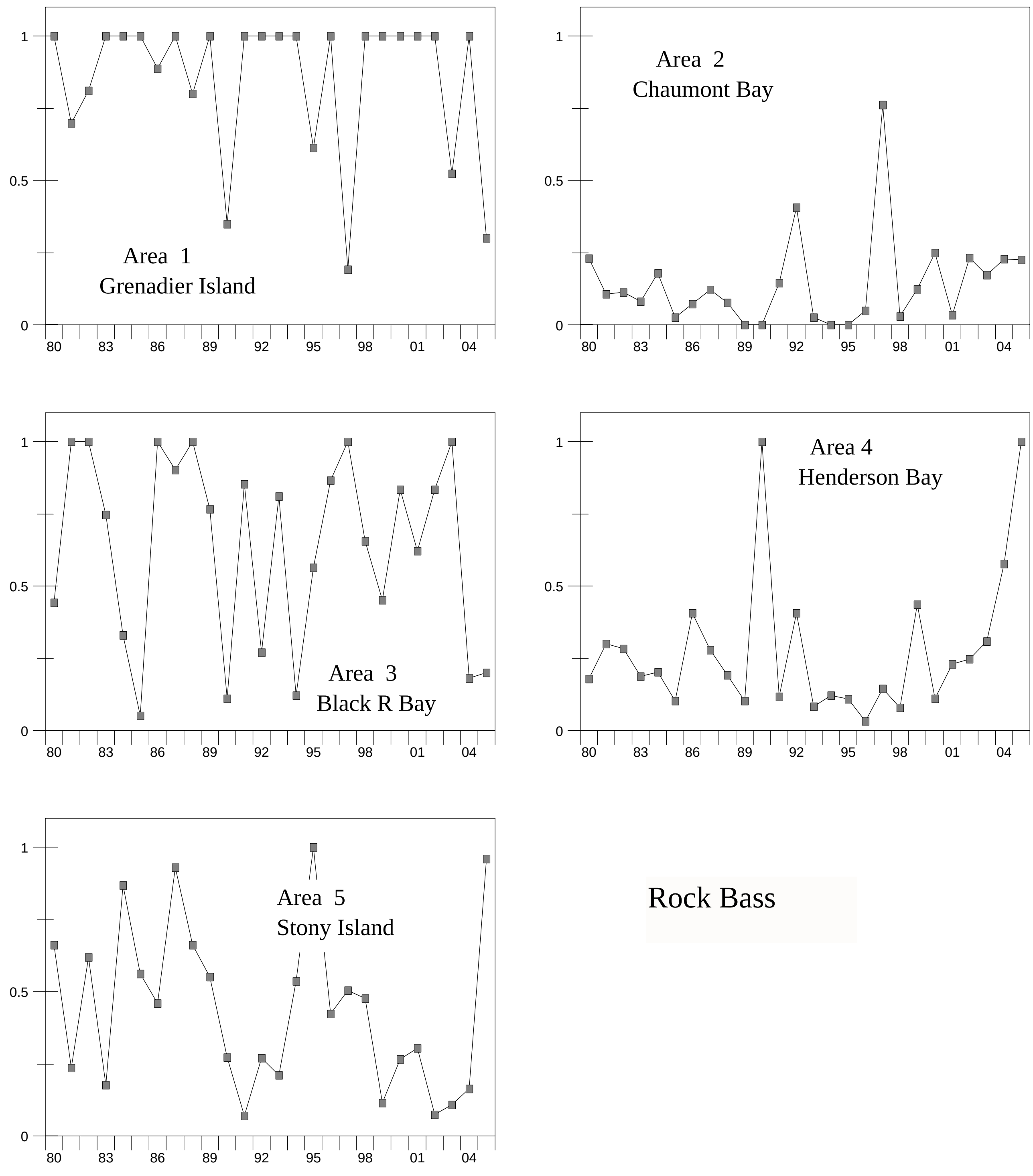


Figure A15. Relative CPUE by geographic area for rock bass collected in depth strata 1 and 2 in warm water assessment netting in New York waters of Lake Ontario's eastern basin, 1980-2005. Relative CPUE on Y-axis, year collected on X-axis.