Summary of 1976-98 Warm Water Assessment

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This report summarizes gill net sampling carried out by the New York Department of Environmental Conservation (DEC) 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 1976-98 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, 2.4 m (8 ft) deep, and ranging in size from 51-152 mm (2-6 in) stretch mesh by 12.7 mm (0.5 in) size increments. The sampling was usually scheduled for the first two weeks of August, but has been started as early as July 30 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 the bottom to approximately 2.4 m above the bottom.

From 1976-79, the sampling utilized 274 m (900 ft) multifilament net gangs (each net panel 30 m [100 ft] long), half set at the 9m (30-ft) depth contour, and half set in deeper water between the 9m contour and the top of the thermocline. The 1976-79 sampling also excluded Chaumont, Black River, and Henderson Bays. In 1980, the sampling switched to shorter 137 m (450 ft) net gangs (each net panel 15 m [50 ft] long, but all other specifications remained the same); increased the number of net gangs set; included Chaumont, Black River, and Henderson Bays; and was conducted according to a stratified random sample design. This new design used three depth strata (stratum 1, 4-9 m [12-30 ft]; stratum 2, 10-15 m [31-50 ft]; stratum 3, 16-30 m [51-100 ft]), plus five area strata. 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 surface areas. Species diversity and total catch were highest in depth strata 1 and 2, and both were sampled in proportion to their surface areas with 10 and 9 net gangs respectively scheduled each year. Sampling effort within depth stratum 3 has varied, with 4 net gangs scheduled in 1980-83, 8 net gangs in 1984-88, and 10 net gangs from 1989-98.

In 1993, the 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 problems and costs with obtaining 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 1976-79 versus later years, were made using the 1980-85 data. Assuming that the relative species distribution between areas of the eastern basin remained the same from 1976-85, the 1980-85 data were used to calculate indices of relative species catch within the five geographic areas. used These species specific area abundance indices were then used to adjust the 1976-79 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 raw multifilament gill net catch data from 1976-92 to calculate "monofilament equivalent" catch values. Mean catch per standard 137 m (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 based on their respective surface areas within New York waters of the eastern basin (stratum 1: 0.20828; stratum 2: 0.18845; stratum 3: 0.60327).

The 1998 warm water assessment was conducted August 3-14 by Cape Vincent staff utilizing the R/V Shepherd. All 29 scheduled net gangs were set and retrieved without incident at the randomly chosen locations. During the first week of sampling (August 3-7), the thermocline was relatively deep and stable, at approximately 28 m (92 ft), with warm water fish such as smallmouth bass distributed throughout most of depth stratum 3. On August 12, winds shifted to the northeast resulting in a dramatic upwards shift in the thermocline to depths as shallow as 7 m (23 ft). Warm water fish in nets set August 12 and 13 were consequently confined largely to the shallowest depths set, while cold water species such as lake trout were commonly caught in deeper sets. One other observation of note was the occurrence of substantial accumulations of the new exotic zooplankter *Cercopagis pengoi*. Easily visible accumulations were observed hanging on the twine of nets set above the thermocline at depths greater than 9 m (30 ft).

Results and Discussion

1998 Summary:

Species and numbers of fish captured by depth strata in the 1998 sampling, and stratified CPUE estimates with their corresponding 95% confidence limits are presented in Table 1. As in most other years, numbers of fish and species diversity were highest in depth stratum 1, declining progressively through stratum 2 and stratum 3. The two most commonly captured species since 1994 have been smallmouth bass and yellow perch, and in 1998 these two species contributed 62.9% of the total warm water fish captured (smallmouth bass 36.75%, yellow perch 26.14%). Two unusual warm water species captured in 1998 were largemouth bass and lake sturgeon. The largemouth bass capture (one fish, Chaumont Bay area) appeared to be an unusual event, since it was the first time this species has been collected over the 23 years sampled, despite the fact that substantial populations are known to exist (and are intentionally fished for by sport anglers) in many areas within the eastern basin. The capture of three lake sturgeon in 1998 equals the total number captured in the previous 22 years, and in combination with the capture of single individuals in 1995 and 1997, does suggest an increase in this species. The lake sturgeon collected in 1998 were taken in three separate net sets (two in Chaumont Bay, one in Henderson Bay), were all nearly identical in length (581-600 mm [22.9-23.6 in]), and were all quickly removed from the nets and released without apparent injury.

Numbers of cold water fish captured in the 1998 sampling were higher than normal, but similar to other years (i.e., 1987) when a number of the selected net sites (especially those in depth strata 1 and 2) were in cold water due to large thermocline fluctuations. Of the 73 total cold water fish (including 66 lake trout) caught in the 1998 sampling, 68 (including 64 lake trout) were captured in nets set August 12 or 13.

Species Trends 1976-1998:

Catch per unit effort data for warm water fish

collected in the 1976-98 assessment netting are shown in Table 2. Trends in abundance are most readily apparent in plots of CPUE against year sampled, and data for 15 of the more important warm water species, plus the total of all warm water species, are shown in Figure 1 (pages 7-14). Overall the warm water fish community in New York waters of Lake Ontario's eastern basin has undergone significant change during the 23-year sampling period, declining from a high of approximately 200-250 fish per net gang in 1976-79, to approximately 20 fish per net gang in 1997 and 1998 (Figure 1, p. 7). This has involved significant declines among most species that were abundant at the start of the assessment program.

Smallmouth bass have always been an important component of the Lake Ontario warm water community, but through 1985 were typically third in abundance behind white perch and yellow perch. By 1988, smallmouth bass emerged as the most commonly captured species in the assessment netting, a position they have maintained since, except for 1996 when yellow perch were higher. Smallmouth bass have shown a cyclic pattern of abundance with two obvious high and low periods (Figure 1, p. 7). Unfortunately, the last four years (1995-98) have been one of the two documented low periods, and CPUE values for all four years are lower than any previously recorded year. Smallmouth bass CPUE did increase in 1998 to 9.36 fish per net gang, a 55.2% increase compared to 1997. However, 95% confidence intervals around the 1998 estimate overlap broadly with the 1996 and 1997 estimates, and the differences are not statistically significant. Age 3 fish were the most abundant age group in the 1998 catch (DEC, unpublished file data), comprising 42.3% of the smallmouth bass sampled.

More detailed analyzes of the 1976-97 smallmouth bass data are presented in the 1997 annual report (Chrisman and Eckert 1998). This report documents a decrease in annual survival rate among bass ages 6-12 since 1990, and a progressive shift in the modal age group of bass captured towards younger age 3 and age 4 fish, suggesting decreased survival among younger age classes as well.

Yellow perch, rock bass, white perch, gizzard shad, and alewife (Figure 1, p. 8-10), were all important members of the warm water community in 1976-79, and have all shown a pattern of declining abundance over the 23-year sampling period. Yellow perch and rock bass continue to be important components of the warm water catch (second and third most commonly captured species in 1998), while white perch, gizzard shad and alewife catches have dropped to extremely low levels. Northern pike (Figure 1, p. 13) have also shown a significant decline in CPUE over the sampling period, but were never a major component of the warm water catch in the eastern basin. Seven other species of fish, white sucker, channel catfish, brown bullhead, pumpkinseed, freshwater drum, common carp, and silver redhorse (Figure 1, p. 11-14), have remained common in the catches without any clear trend in CPUE. Walleye is the only species that has shown an obvious trend towards increasing abundance (Figure 1, p. 10), and since 1995 has been the third or fourth most commonly caught species.

References

Chrisman, J.R. and T.H. Eckert. 1998. Population trends among smallmouth bass in the eastern basin of Lake Ontario. Great Lakes Fishery Commission, Lake Ontario Committee Meeting, Niagara Falls, Ontario, March 26-27, 1998.

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

Eckert, T.H. 1986. 1985 Warm Water Assessment. Great Lakes Fishery Commission, Lake Ontario Committee Meeting, Gananoque, Ontario, March 4-5, 1986, Appendix VII, pages 327-342.

Eckert, T.H. 1998. Summary of 1976-97 Warm Water Assessment. Great Lakes Fishery Commission, Lake Ontario Committee Meeting, Niagara Falls, Ontario, March 24-25, 1998.

Table 1. Numbers of fish caught, stratified mean catch per standard 137 m gill net gang, and 95% confidence intervals, for the 1998 warm water assessment netting conducted August 3-14 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	2	1	0	3	0.06	-0.01	0.14
Longnose Gar	1	0	0	1	0.02	-0.03	0.07
Alewife	0	0	1	1	0.06	-0.08	0.20
Gizzard Shad	4	0	0	4	0.08	-0.04	0.21
Northern Pike	3	0	0	3	0.06	-0.04	0.16
Carp	5	0	0	5	0.10	-0.08	0.29
Quillback	2	0	0	2	0.04	-0.05	0.14
White Sucker	28	18	1	47	1.02	0.18	1.86
Silver Redhorse	6	0	0	6	0.13	-0.04	0.29
Brown Bullhead	3	0	0	3	0.06	-0.04	0.16
Channel Catfish	31	5	0	36	0.75	0.20	1.30
White Perch	14	0	0	14	0.29	-0.37	0.95
White Bass	2	0	0	2	0.04	-0.05	0.14
Rock Bass	61	15	9	85	2.13	0.97	3.28
Pumpkinseed	14	0	0	14	0.29	-0.19	0.77
Smallmouth Bass	164	65	76	305	9.36	4.95	13.78
Largemouth Bass	1	0	0	1	0.02	-0.03	0.07
Black Crappie	1	0	0	1	0.02	-0.03	0.07
Yellow Perch	88	117	12	217	5.01	1.27	8.74
Walleye	27	23	18	68	2.13	1.02	3.24
Freshwater Drum	10	2	0	12	0.25	-0.03	0.53
Warm Water Total	467	246	117	830	21.94	14.58	29.30
Cold Water Species:							
Lake Whitefish	0	1	0	1	0.02	-0.03	0.07
Chinook Salmon	0	0	1	1	0.06	-0.08	0.20
Brown Trout	0	3	1	4	0.12	-0.04	0.29
Lake Trout	4	29	33	66	2.68	-1.37	6.73
Burbot	0	0	1	1	0.06	-0.08	0.20

Table 2. Catch per unit effort data from the 1976-98 warm water assessment netting conducted during the month of August in New York waters of Lake Ontario's eastern basin.

	Mean Catch per 137 m 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
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	0.20	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
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 2. Catch per unit effort data from the 1976-98 warm water assessment netting continued.

	Mean Catch per 137 m Monofilament Gill Net Gang										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Lake Sturgeon	0	0	0	0	0	0	0	0.02	0	0.02	0.06
Longnose Gar	0	0	0.08	0	0	0.48	0.35	0	0	0.02	0.02
Bowfin	0	0	0	0	0.02	0	0	0	0	0	0
American Eel	0	0	0.02	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
Gizzard Shad	0.24	0.69	1.26	1.39	1.79	0.12	0.06	0	0	0	0.08
Northern Pike	0	0.02	0	0.15	0.04	0.10	0.06	0.04	0.04	0.08	0.06
Goldfish X Carp	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
Golden Shiner	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
Quillback	0.02	0.04	0.04	0.08	0	0.04	0	0	0.04	0	0.04
Longnose Sucker	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
Silver Redhorse	0.07	0.17	0.29	0.22	0.18	0	0.08	0.12	0.02	0.13	0.12
Shorthead Redhorse	0	0	0	0	0	0	0.02	0	0	0.02	0
Brown Bullhead	0.61	0.84	0.66	0.86	0.87	0.35	0.35	0.06	0	0.83	0.06
Channel Catfish	0.97	2.40	3.34	1.20	1.35	1.12	0.35	0.19	0.47	1.42	0.75
Stonecat	0	0.02	0	0.02	0	0	0	0	0	0	0
Trout-perch	0.15	0	0	0.12	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
White Bass	0.13	0.08	0	0.10	0	0.02	0	0	0	0	0.04
Rock Bass	4.94	7.53	8.08	6.86	3.09	6.99	3.99	1.41	3.79	2.33	2.13
Pumpkinseed	0.25	0.64	0.78	0.14	0.34	0.23	0.04	0.06	0.04	0.08	0.29
Bluegill	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
Largemouth Bass	0	0	0	0	0	0	0	0	0	0	0.02
Black Crappie	0.02	0.02	0.06	0	0	0.04	0	0	0	0	0.02
Yellow Perch	2.19	10.06	13.61	6.97	6.72	2.78	5.87	3.68	8.76	5.53	5.01
Walleye	0.80	0.96	1.31	1.68	1.59	3.84	3.29	1.91	2.97	1.76	2.13
Freshwater Drum	0.45	0.53	0.62	0.34	0.43	0.52	0.74	0.63	0.23	0.41	0.25
Total	42.42	72.71	61.35	59.34	44.57	43.32	34.08	14.91	26.73	20.58	21.94

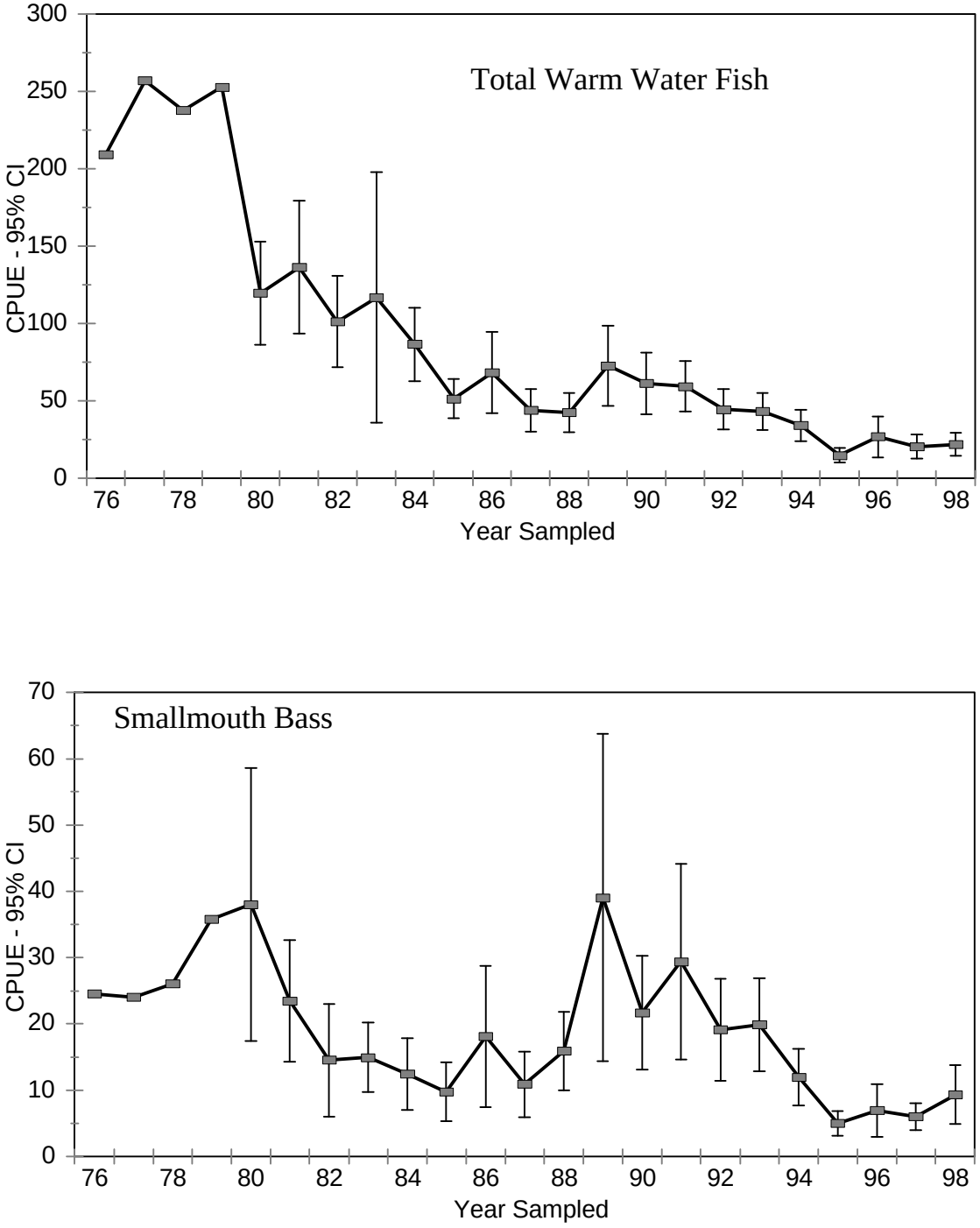
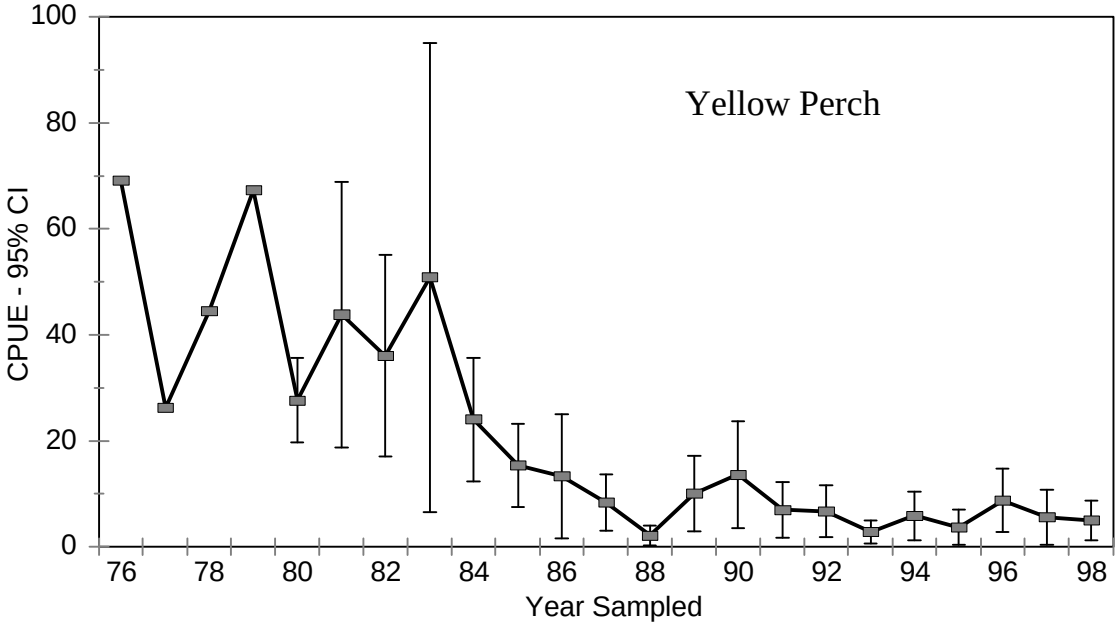


Figure 1. Catch per standard 137 m gill net gang and 95% confidence intervals for selected species from the 1976-98 warm water assessment conducted during the month of August in New York waters of Lake Ontario's eastern basin.



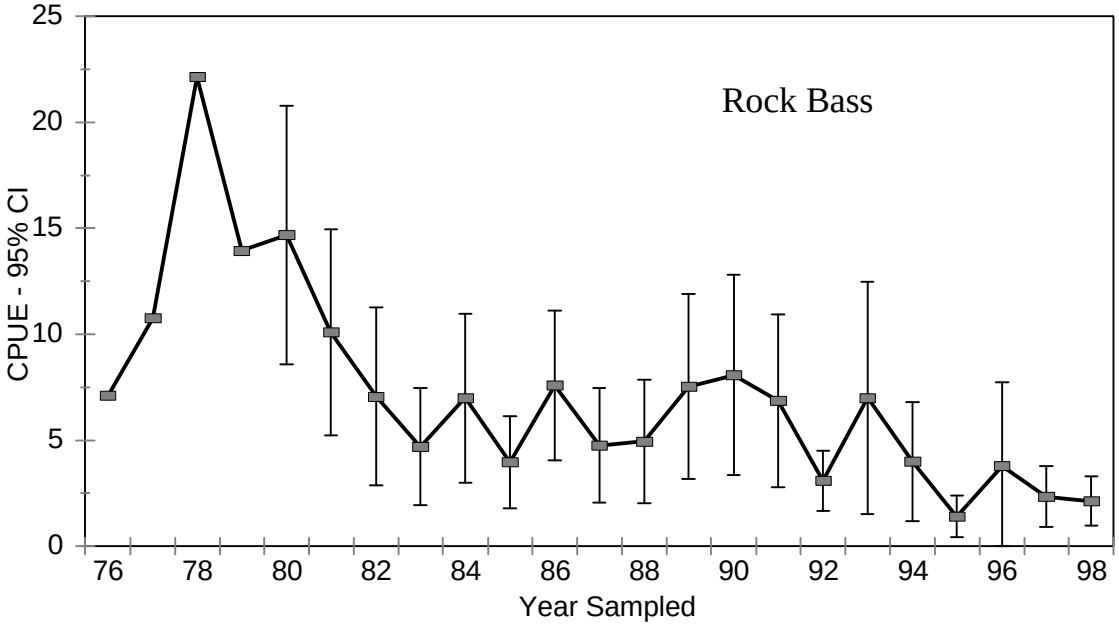
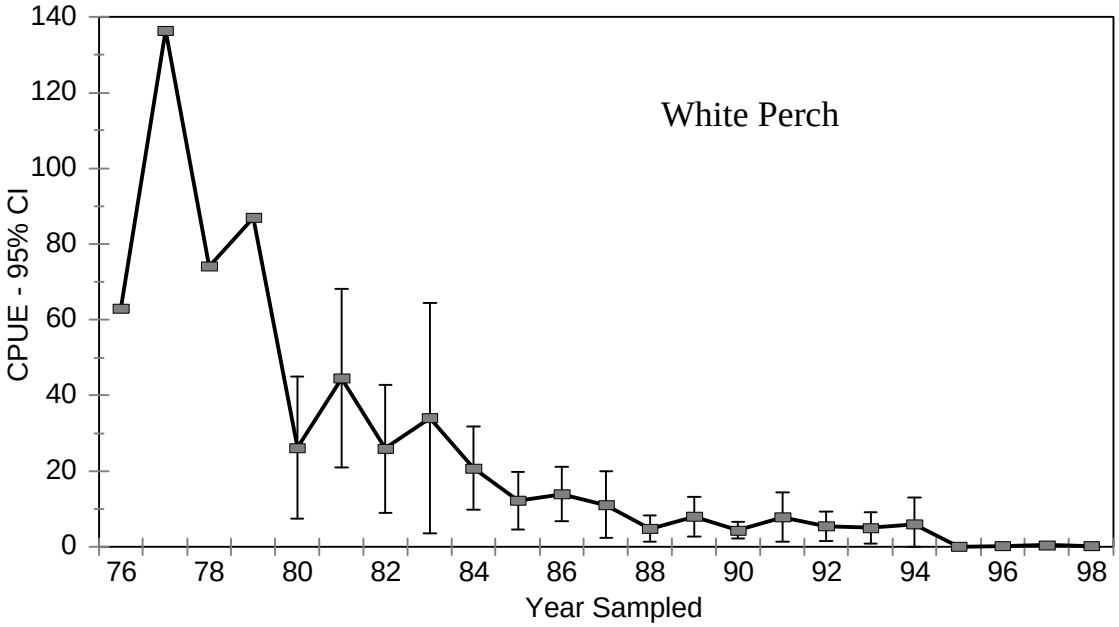
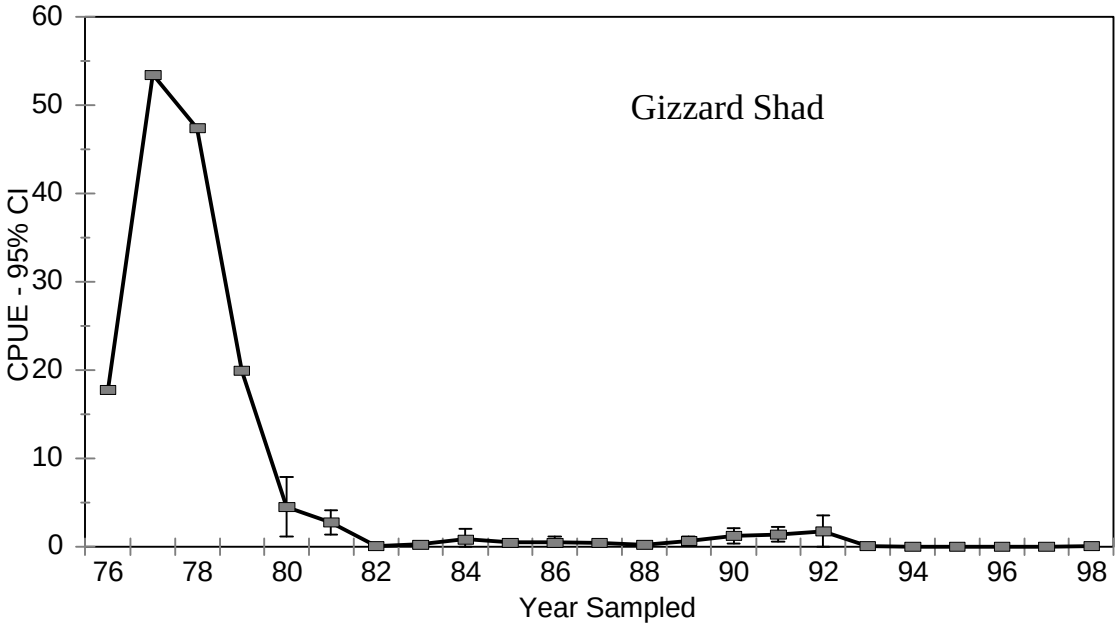


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.





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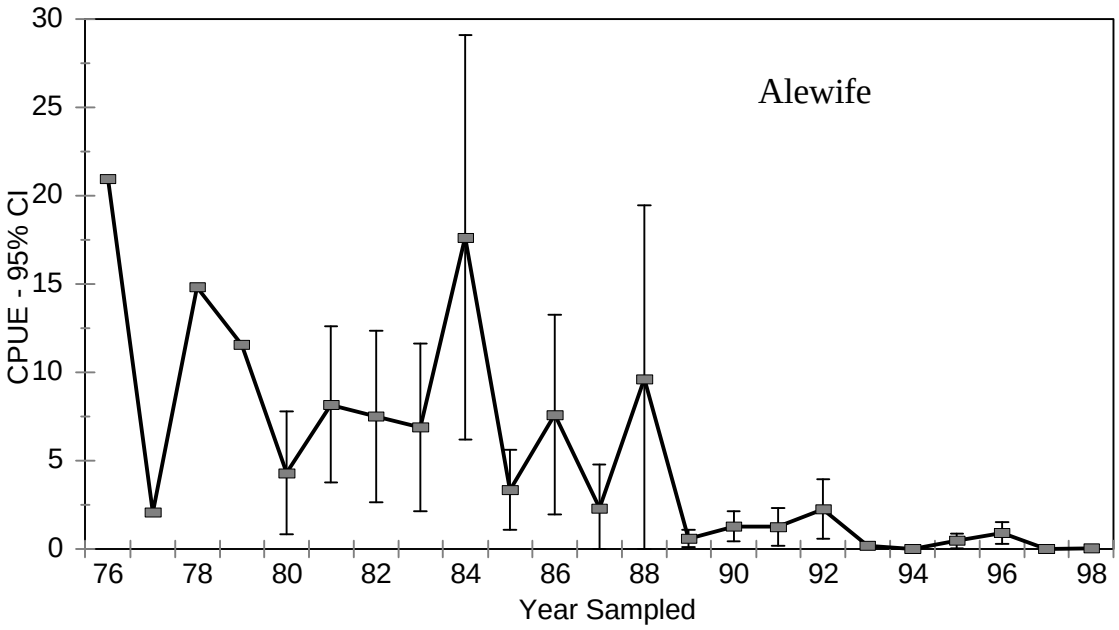


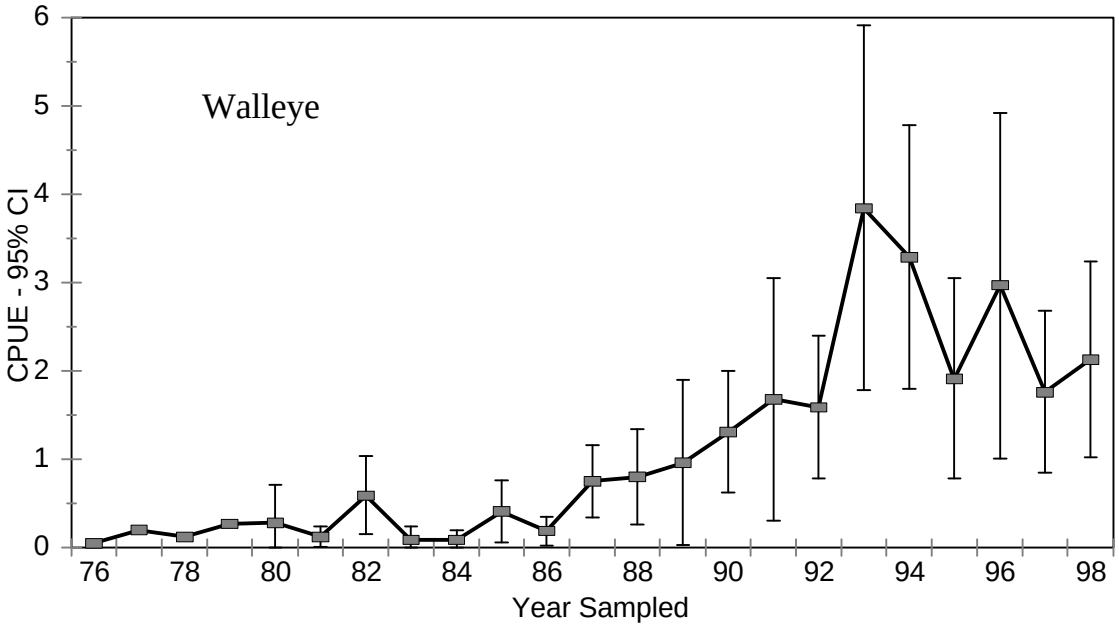
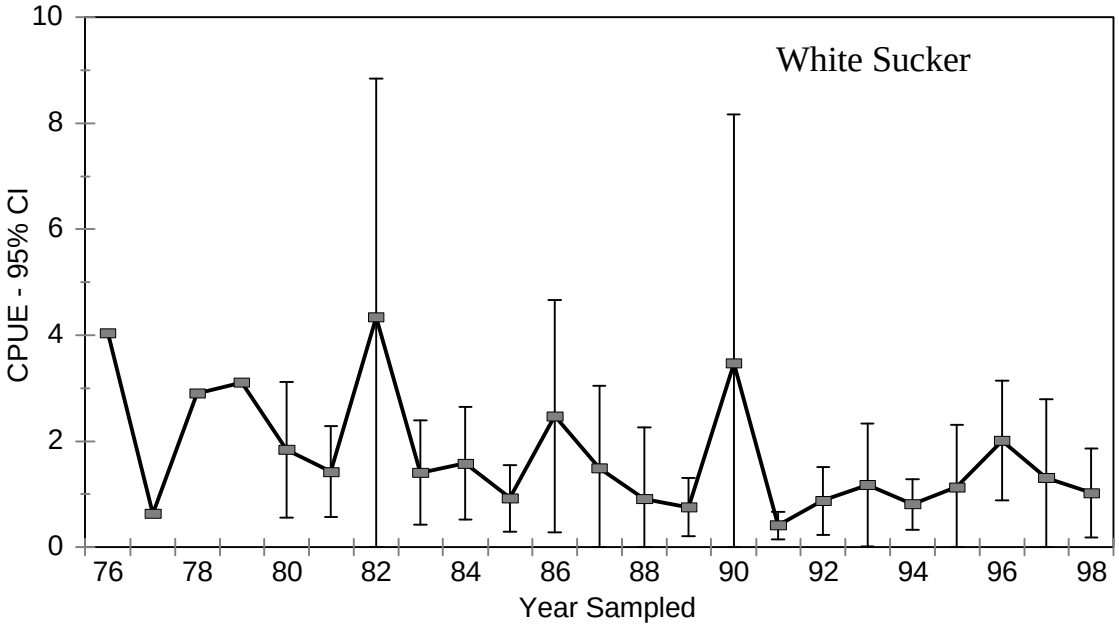


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.



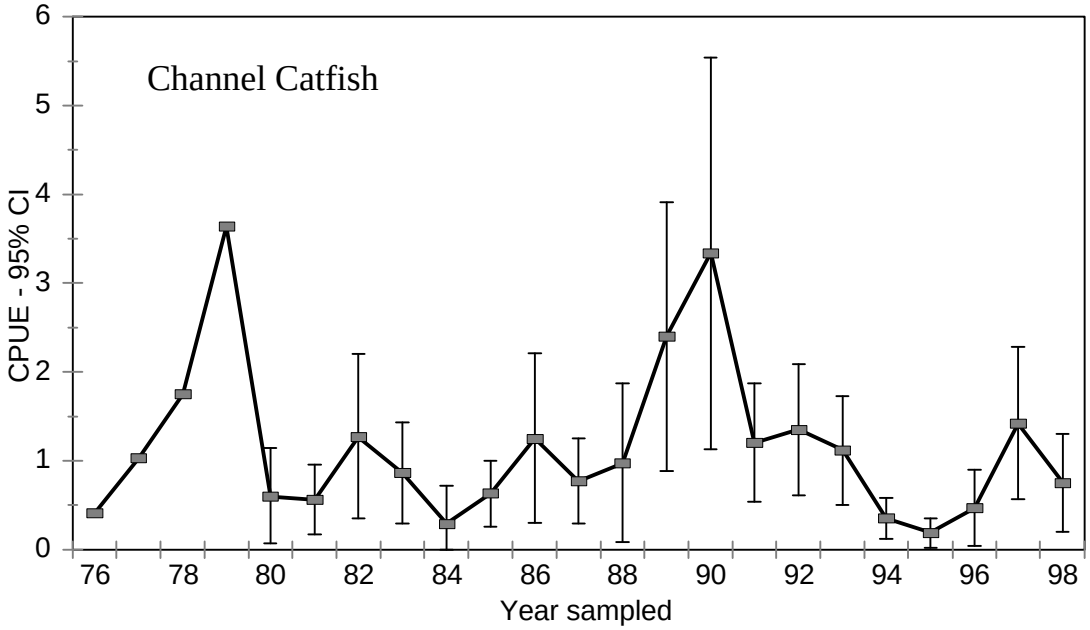
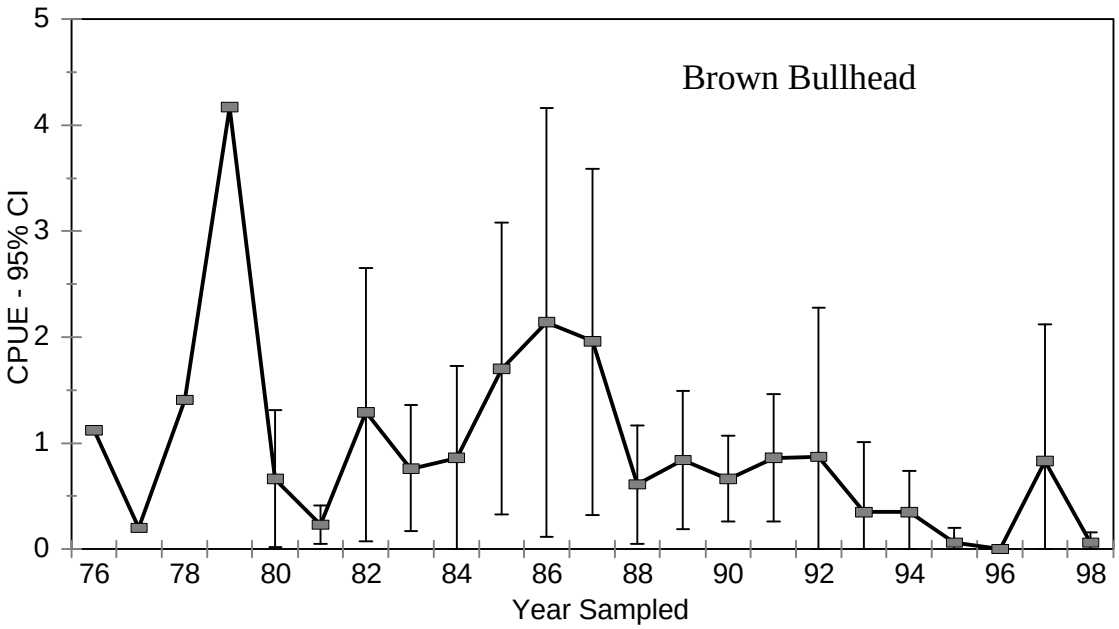


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.



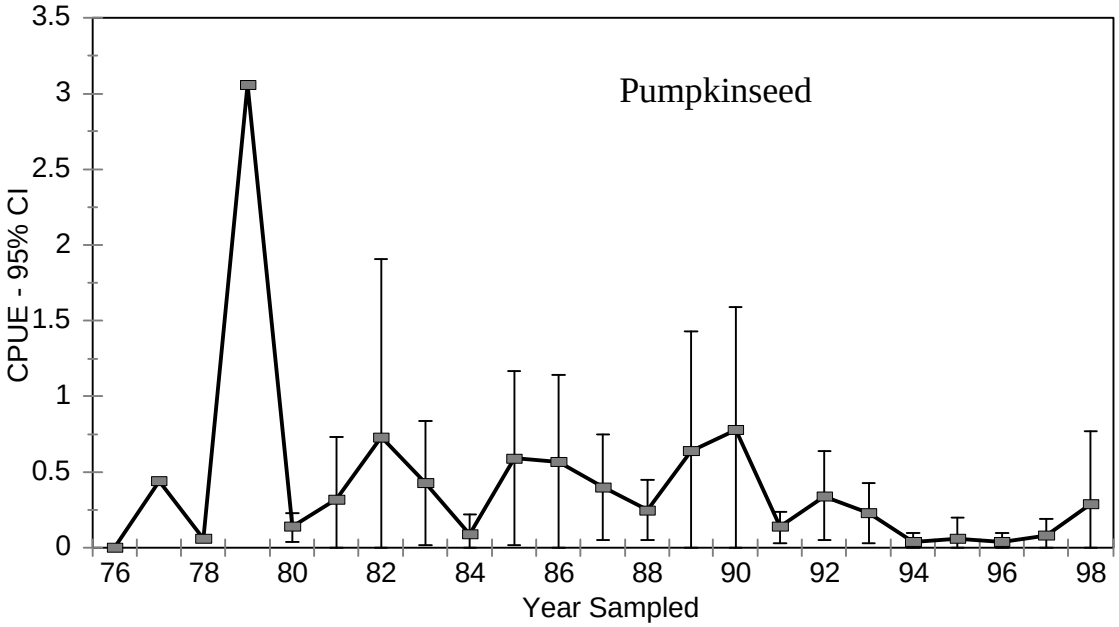
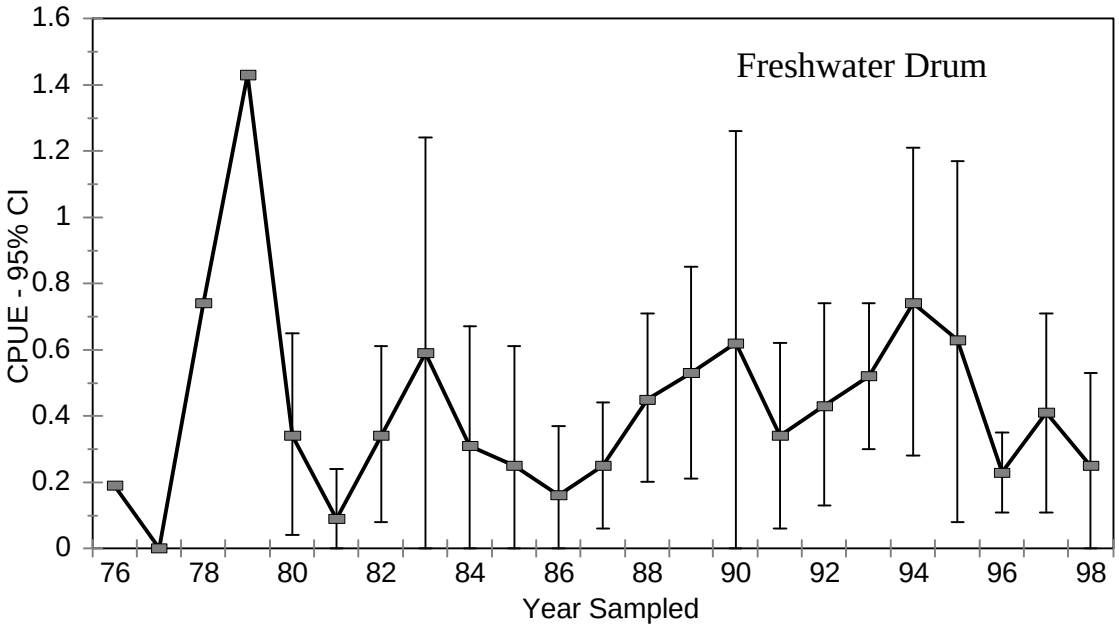


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.



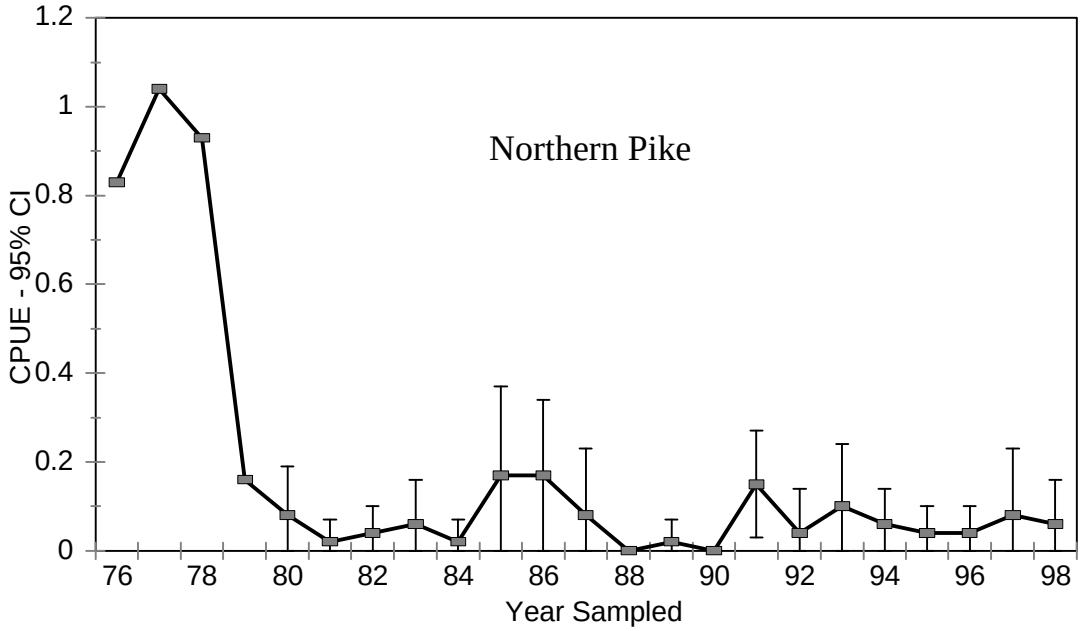
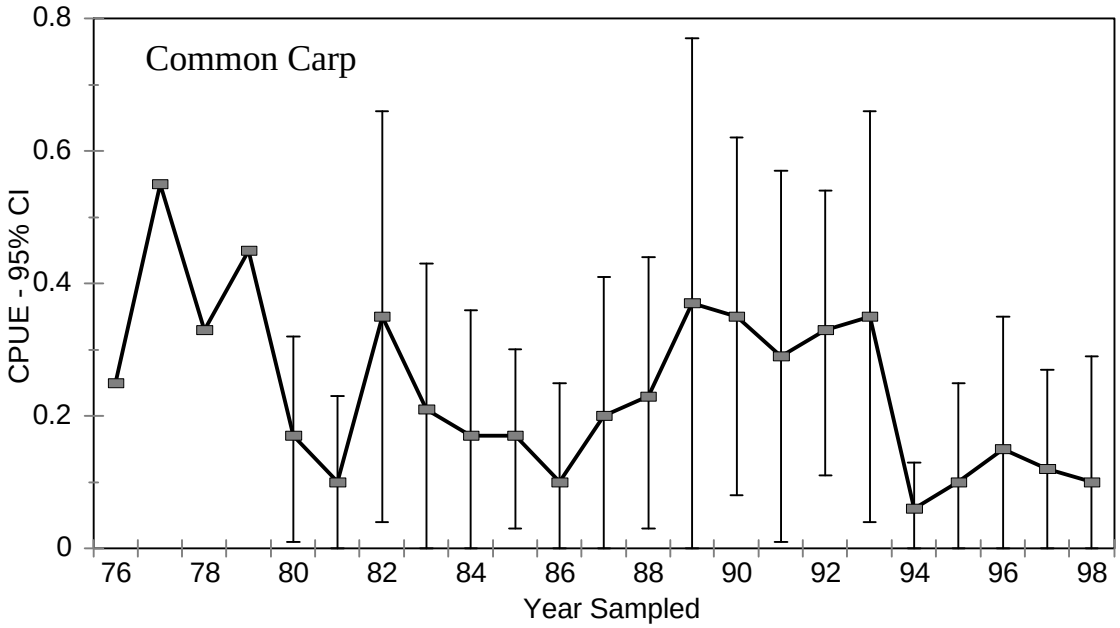


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.



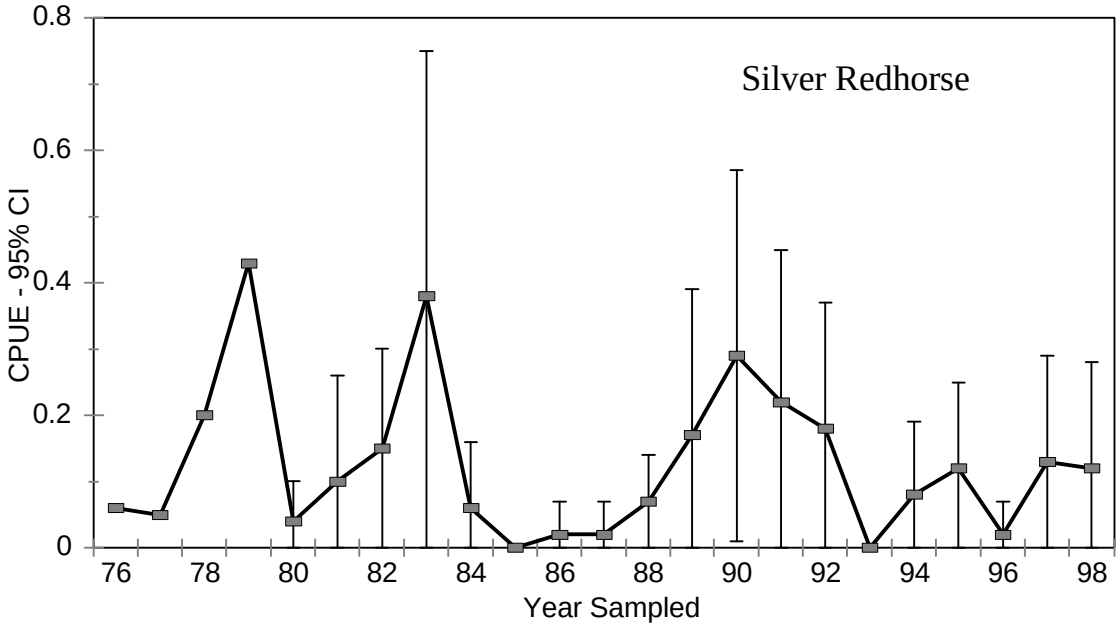


Figure 1 - continued. CPUE estimates and 95% confidence intervals for selected species.