Surveillance and Status of Fish Stocks in Western Lake Erie, 2005*

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Abstract

Each summer and autumn since 1961, the Lake Erie Biological Station (LEBS) has conducted assessments of fish populations in western Lake Erie near East Harbor State Park, Ohio, and more recently has included assessments of fish diets, zooplankton, and benthic macroinvertebrates. The catches of major age-0 forage fishes (gizzard shad, [*Dorosoma cepedianum*], alewife [*Alosa pseudoharengus*] and emerald shiner [*Notropis atherinoides*]) fell below their 15-year (1991-2005) means. In contrast, the catches of spottail shiner (*Notropis hudsonius*) and trout-perch (*Percopsis omiscomaycus*), were higher than the long-term means. Catches of all major age-0 spiny-rayed fishes (yellow perch [*Perca flavescens*], walleye [*Sander vitreus*], white perch [*Morone americana*], white bass [*Morone chrysops*], and freshwater drum [*Aplodinotus grunniens*]) in 2005 were lower than the 15-year means. Catches of round goby (*Neogobius melanostomus*) (all ages combined) were lower than in any year since the species was first captured (1996). Mean lengths of emerald shiner, spottail shiner, yellow perch, walleye, white perch, and white bass were greater than their respective long-term means. In summer 2005, yellow perch diets were dominated by crustacean zooplankton and benthic macroinvertebrates, whereas white perch diets were dominated by zooplankton. Autumn 2005 diets for yellow perch consisted mostly of benthic macroinvertebrates and fish, while white perch consumed higher proportions of fish and zooplankton. *Hexagenia sp*. nymphs were the dominant taxonomic group in the fall diet of yellow perch. Zooplankton have contributed a higher mean percent weight of the diet in the past three years for both yellow perch and white perch. Benthic macroinvertebrates made up the largest proportion of the autumn diets for yellow perch during 2001-2004 and for white perch during 2003-2004. *Dreissena sp.* made up the largest portion of the benthic community near East Harbor State Park (mean = 62%), followed by Gastropoda. Calanoid copepods were the most abundant zooplankton taxon detected during both summer and fall sampling. The spring and autumn samples of yellow perch from commercial trap nets in 2005 were dominated by individuals from the 2001 year class, similar to last year.

In 2004, LEBS began an assessment of fish populations in the Ontario and Michigan waters of the western basin. Species diversity in 2005 was greater in autumn than in spring. Autumn densities of most age-0 forage fishes were higher in 2005 than in 2004. Both yellow perch and white perch consumed mainly zooplankton in spring and benthic macroinvertebrates in fall.

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Introduction

Since 1961, the U.S. Geological Survey, Lake Erie Biological Station (LEBS) has conducted annual bottom trawl surveys during summer and autumn near East Harbor State Park, Ohio. The objectives of this activity are to determine 1) relative abundance and growth of key young-of-year (age-0) fish species, 2) composition of benthic invertebrates and zooplankton, and 3) diets of yellow perch (*Perca flavescens*) and white perch (*Morone americana*). Relative abundance indices and growth data from these surveys provide information on potential recruitment of these important species. Abundances and composition of benthic invertebrates and changes in diet provide critical information on carrying capacity, expected growth, and condition of commercially important species. LEBS also collects fish samples from commercial trap nets in the western basin of Lake Erie. The objectives of this activity are to determine growth rates and age structures of commercially harvested species.

In 2004 LEBS began a cooperative effort with Ohio Department of Natural Resources (ODNR) and Ontario Ministry of Natural Resources (OMNR) to trawl in the spring (May-June) and autumn (September-October) at sites in Canadian and Michigan waters of the western basin. In previous years, most of these sites had been sampled only in August. The short-term goal of this program is to determine what sampling period is best for determining year class strength of forage fishes. Longer-term goals are to develop a protocol for a basin-wide estimate of forage fish density and biomass and to determine at which times of the year sampling should be conducted to best estimate year class strength of forage fishes. In 2004, we reported that autumn sampling provided a greater estimate of species diversity (Kocovsky et al. 2005). Hence, an additional objective for 2005 and beyond is to determine if that trend continues. We also reported seasonal differences in captures of species at some sites. Thus, we will also determine whether these trends are consistent among years. As this data set expands, we will be able to address both geographical and seasonal variability in prey species abundance and distribution within the western basin.

This report includes results from the LEBS annual trawl surveys, diets from selected fish species, and assessments of benthic and zooplankton communities in the western basin of Lake Erie, near East Harbor State Park, Ohio in 2005. For selected fish species, recruitment was evaluated by comparing the 2005 autumn abundance values of age-0 individuals with long-term (15-year) average catches. We compare relative abundances and growth of young-of-year fish species, composition of benthic invertebrates and zooplankton, and diets of yellow perch and white perch with results from previous years. In addition, we report size and age data from yellow perch specimens collected in 2005 from commercial trap net catches in western Lake Erie.

This report also contains second-year data on density and biomass of important forage fishes from 26 trawl stations in the western basin of Lake Erie. We compare spring versus autumn values of density and biomass for young-of-year and yearling-and-older for each species and we compare diversity of trawl catch and species composition by political jurisdiction. We also revisit some of our results from 2004 and identify similarities and differences between years.

Methods

East Harbor Studies

Collection of fish - Trawl surveys were conducted during the summer and autumn in western Lake Erie near East Harbor State Park, Ohio (Figure 1). On consecutive days (weather permitting) duplicate 10-min trawls were conducted at the 3, 4.5, and 6-m depth contours during the morning, afternoon, and night with a 7.9-m (headrope) bottom trawl. Total sampling effort was six hours (36 tows). Fish caught in the trawls were identified to species. Forage species (e.g., alewife [*Alosa pseudoharengus*], gizzard shad [*Dorosoma cepedianum*], emerald shiner [*Notropis atherinoides*], spottail shiner [*Notropis hudsonius*], and trout-perch [*Percopsis omiscomaycus*]) were categorized as either age 0 (hereafter: YOY) or yearling-and-older (hereafter: YAO). Spiny-rayed fish (e.g., yellow perch, white perch, white bass [*Morone chrysops*], walleye [*Sander vitreus*], and freshwater drum [*Aplodinotus grunniens*)] were categorized as YOY, yearling, and age 2 and older. Round goby (*Neogobius melanostomus*) caught in trawls were not categorized according to age in 2005. All round goby caught were reported as YAO.

Young-of-year abundance and growth - For each species, we calculated an index of abundance for 2005 based on catches of YOY fish caught in the trawls during autumn. This index was calculated as the mean number of YOY fish caught per hectare swept by the bottom trawl. Percent relative standard error (%RSE) of the index was calculated by dividing the standard error by the mean number caught per

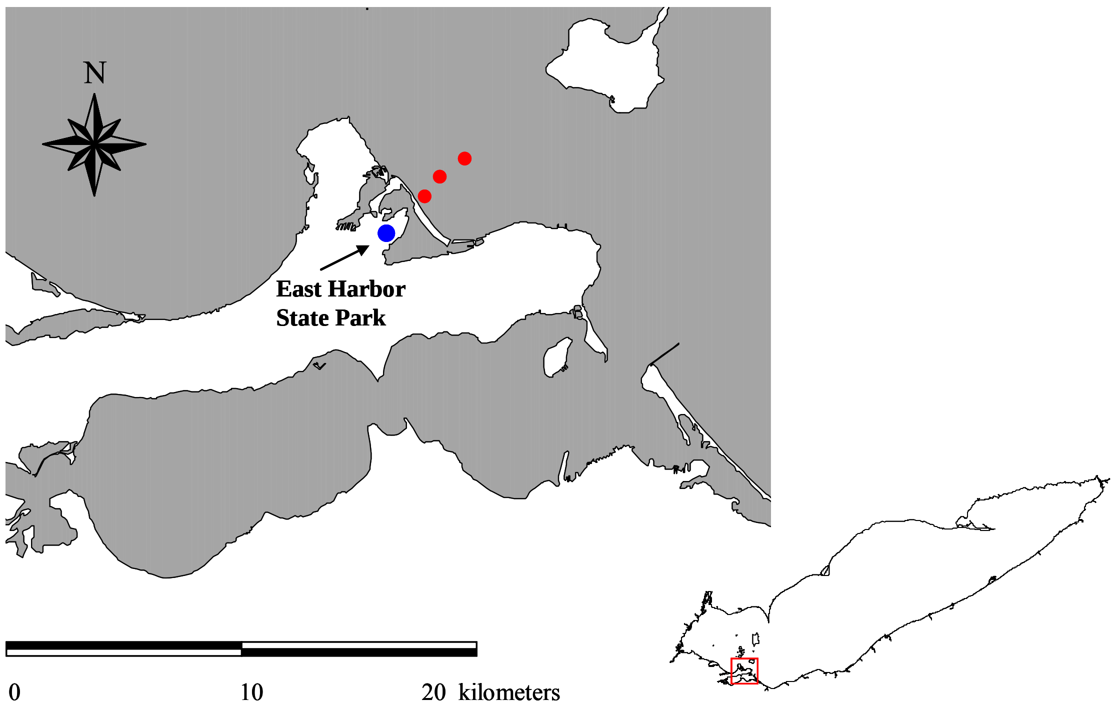

Figure 1. Location of sites sampled by the USGS Lake Erie Biological Station (red dots) offshore of East Harbor State Park (blue dot) in the western basin of Lake Erie.

hectare and then multiplying this ratio by 100. For each species, potential recruitment was then evaluated by comparing the abundance index for 2005 with the 15-year average. Individuals from a subsample of fishes from each trawl sample were measured for total length to assess growth. Changes in growth were evaluated by comparing autumn mean lengths with the 20-year average of autumn mean lengths.

Yellow perch and white perch diets in 2005 - In both seasons, we removed stomachs and otoliths from a maximum of five yellow perch and five white perch, all age-2-and-older, at each of the three depths and for each time period. Stomachs were frozen in the field and transported to the laboratory. Ages of specimens were estimated by examining the otoliths under a microscope in the laboratory. Prey items in stomachs were identified in the laboratory to the lowest reasonable taxonomic level, enumerated, and measured. Weights were calculated for individual invertebrates from length measurements and by appropriate length-weight regressions (Dumont et al. 1975; Culver et al. 1985; G, Mittlebach, The Ohio State University, unpublished data). Results were reported as frequency of occurrence and mean percent weight (Wallace 1981) by species and by season. Only stomachs that contained food items were included in these calculations.

Benthic macroinvertebrates - Samples of benthic macroinvertebrates were collected in both seasons during daylight (morning or afternoon) trawling sessions, using a standard Ponar dredge. Three replicate samples were taken from the 6-meter station during each season (n = 12). Sediment and fine organic matter were removed and the remaining sample was preserved in 95% ethanol and Phloxin-B. Invertebrates collected were later sorted, identified to lowest reasonable taxonomic level, and enumerated in the laboratory. All samples were combined to estimate relative density (mean number/m^2) and percent composition of benthic taxa collected.

Zooplankton - Zooplankton samples were collected by vertically towing a 0.5-m diameter (153-µm mesh), conical plankton net at the 6-m station in both seasons. In autumn, three replicate samples were collected during morning, afternoon and night trawling sessions, yielding a total of 18 samples. In summer, one of the afternoon samples was not collected, which resulted in a total of 15 samples for that season. The 33 total samples were pooled by date and time, yielding five composite summer samples and six composite autumn samples. Zooplankton were then identified to lowest reasonable taxonomic level and enumerated in the laboratory to estimate relative abundance (mean number/m^3) and percent composition. Due to the difficulty of properly enumerating the amount of Bryozoa larvae, the presence of this taxon was simply noted.

Commercial Trap Net Studies: *Yellow Perch*

Samples of yellow perch were collected from commercial trap nets offshore of Kelleys Island in western Lake Erie in spring and autumn 2005. Spring samples were collected on 5, 16, and 26 May. Autumn samples were collected on 28 October, 6 November, and 22 November. Lake whitefish (*Coregonus clupeaformis*), which are ordinarily sampled from commercial traps, were not collected in 2005 due to a limited fall catch.

Length and weight of each specimen were measured, and sex and maturity were determined by inspecting the gonads. Otoliths were removed, and ages of specimens were estimated by examining the otoliths in the laboratory. Summary statistics were reported in order to provide insights into the current status, abundance, age, and growth of selected species.

Western Basin Studies

Sampling sites were randomly chosen by depth stratification (3-6, 6-9, and 9-12 m). Sites in Ontario were selected to match those sampled by OMNR in summer. We sampled at 26 sites in Ontario and Michigan waters of Lake Erie, which is about 56% of sites sampled by OMNR in the western basin (Figure 2). Spring samples were collected 13 June, 21 June, and 22 June 2005. Autumn samples were collected 21 September, 22 September, and 4 October. The long sampling period in both seasons was due to poor weather. We used a 7.9-m (headrope) bottom trawl that was towed for 10 min on-bottom at a speed of 3.5 km/hr.

For small trawl catches, all fish were identified to species and enumerated. For large trawl catches (generally more than 1,000 fish), the number of

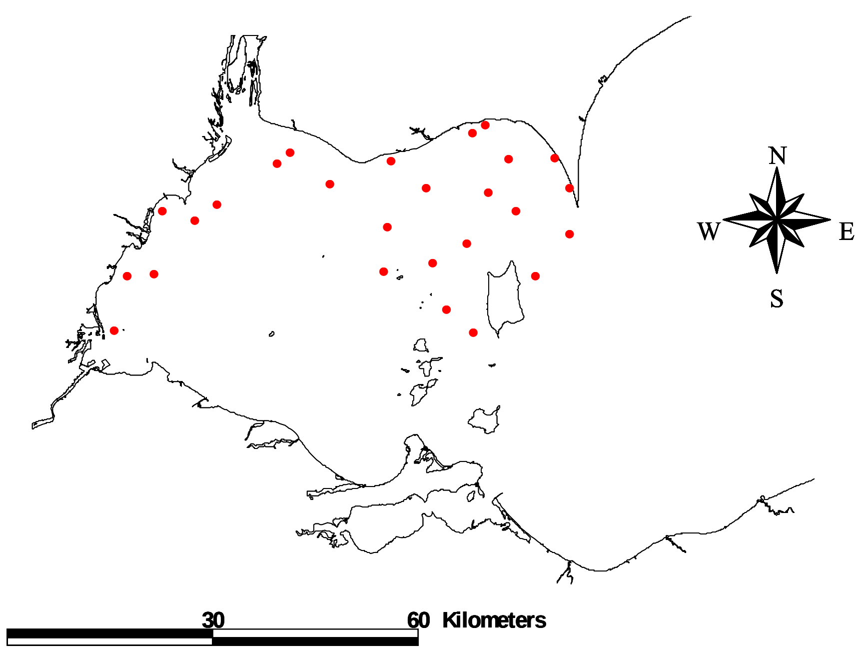

Figure 2. Location of stations sampled with a bottom trawl in June, September, and October in the Western Basin of Lake Erie, 2005.

individuals was estimated using a weight-based subsampling method. Forage fish were then placed in bags and the bags placed on ice for later examination in the laboratory. In the laboratory, fish were measured for total length (nearest mm), and weighed (nearest 0.01 g).

For small numbers of fish (ca. 30 or fewer), all fish were measured and weighed. For larger numbers, subsamples of 30-100 fish were measured and weighed.

For each trawl tow, we calculated density of each species and age-class by dividing the number of fish of each species and age class captured in a trawl sample by the area swept by the trawl. The density of fish was expressed as number per hectare (ha). Area swept was calculated as width of the trawl opening (3.9 m, measured using SCANMAR acoustic net mensuration gear) multiplied by the distance towed. The distance towed was measured as the difference in starting and ending latitude-longitude determined using differential Global Positioning System (GPS). Biomass for a species and age group was calculated for each trawl sample by multiplying average weight for a species and year class by the density and is expressed in kg per ha. For a few species, weights were not measured; hence biomass estimates were not calculated for those species. For round goby, values were reported for all ages combined. For the remaining species, age groups considered were YOY and YAO. Ages were determined using age-length keys for species in the western basin developed from historical LEBS samples. Average density and biomass for a species and year class within a season were calculated by taking the arithmetic mean of all samples within a season. We compared spring and autumn species richness at the sampling stations with a paired t-test.

In both seasons, we removed stomachs from a maximum of five yellow perch and five white perch, all age-2-and-older, at each trawl station. Stomachs were frozen in the field and transported to the laboratory. Methods for analyzing stomach contents and evaluating diets were the same as those described above for stomachs collected in the East Harbor studies. This was the first year in which diet data were collected. Therefore, no long-term trends were reported.

Results and Discussion

East Harbor Studies

Young-of-year abundance and growth - Autumn 2005 abundances of primary forage species, which included alewife, gizzard shad, and emerald shiner were considerably lower than their respective 15-year averages (Table 1). Alewives were absent from this year's trawl catches. Catches of gizzard shad have been relatively low for the past six years. Prior to 2000, catches were quite variable (Figure 3). Relatively high %RSEs for emerald shiner, spottail shiner, and trout-perch during 2002 and 2003 suggested that their respective temporal distributions in those years were more heterogeneous than in 2004 and 2005 (Figure 4). The low catch rates were similar to 2004. Spottail shiner and trout-perch densities for 2005 were higher than their respective 15-year averages (Table 1).

Table 1. Autumn catch rates of age-0 fish from bottom trawling near East Harbor State Park, Ohio, in western Lake Erie for 2005 and 15-year mean (1991-2005). Catch rates are expressed as the mean number per hectare swept by the trawl. Also included are percent relative standard errors (standard error of the mean number per hectare for a species divided by mean number per hectare X 100%).

	Number/hectare		Relative standard error %	
Species	**2005**	**15-year mean**	**2005**	**15-year mean**
alewife	0	71	0	17
gizzard shad	26	179	28	13
emerald shiner	280	1059	30	25
spottail shiner	82	65	20	12
trout-perch	142	77	26	8
yellow perch	4	113	40	11
walleye	1	13	23	12
white bass	1	5	51	19
white perch	818	994	25	7
freshwater drum	15	43	27	12

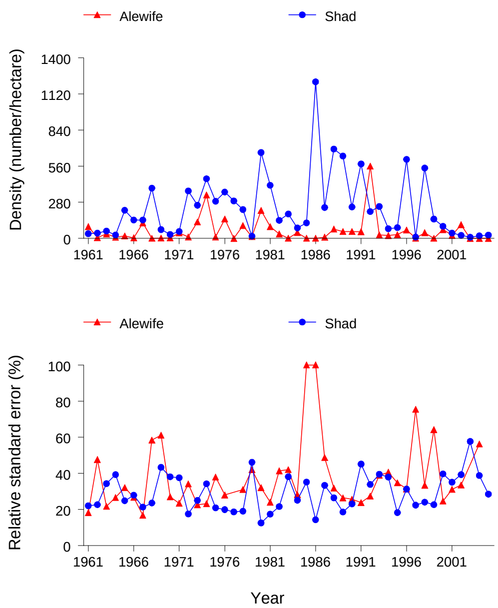

Figure 3. Density and relative standard error for age-0 alewife and gizzard shad as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1961-2005.

Autumn abundances of YOY individuals for all spiny-rayed species in 2005 were generally lower than their respective 15-year averages (Table 1). Abundances for white bass and freshwater drum were 20% and 35% of their respective long-term means. Although abundance of freshwater drum was higher in 2005 than in 2003, the 2005 index was one of the lowest recorded since data collection began in 1961. Similarly, the %RSEs of the abundances of white bass and freshwater drum were relatively high in recent years indicating variability between trawl catches (Figure 5). In 2005, the abundance of white perch was slightly less than the long-term average, but abundance increased from the previous two years (Figure 6). The abundance of YOY yellow perch was well below both the 15-year average and the mean abundance from 2003 (Figure 7). Abundances of YOY walleye have been relatively low in recent years (< 2/hectare since 2001) (Figure 7) and well below the 15-year average of 13/hectare.

In 2005, mean abundance for round goby (all ages combined) was similar to last year, but lower than in any year since they were first captured (1996)

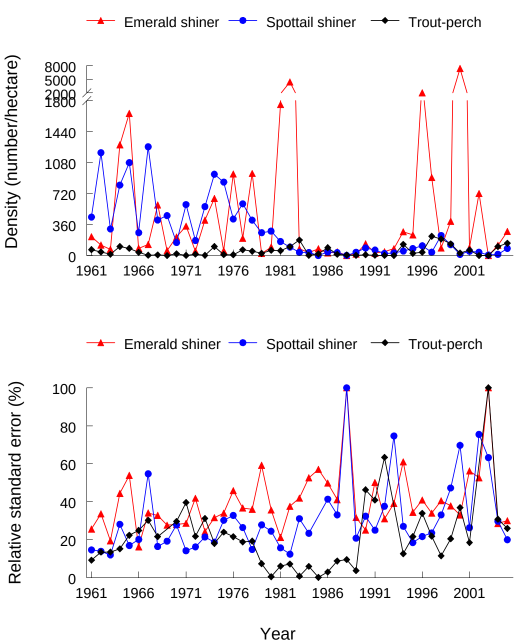

Figure 4. Density and relative standard error for age-0 emerald shiner, spottail shiner, and trout-perch as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1961-2005.

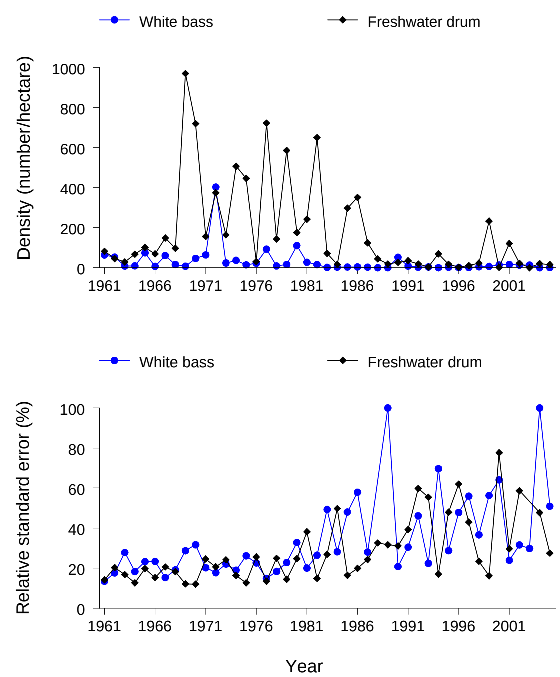

Figure 5. Density and relative standard error for age-0 white bass and freshwater drum as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1961-2005.

during index trawling. Until recently, round goby had been the most abundant species in trawl samples, but catches have been steadily declining since 2000 (Figure 8).

The mean lengths for two soft-rayed forage species, gizzard shad and trout-perch, in 2005 were similar to their respective long-term averages (Table 2). In contrast, mean lengths of emerald shiner and spottail shiner were greater in 2005 than their respective 20-year means. Mean total lengths of three spiny-rayed species, (yellow perch, white perch, and white bass) were higher than their respective 20-year means. Growth of age-0 freshwater drum and walleye remained somewhat consistent with the respective long-term means. Total length measurements for YOY round goby have not been obtained since 2002.

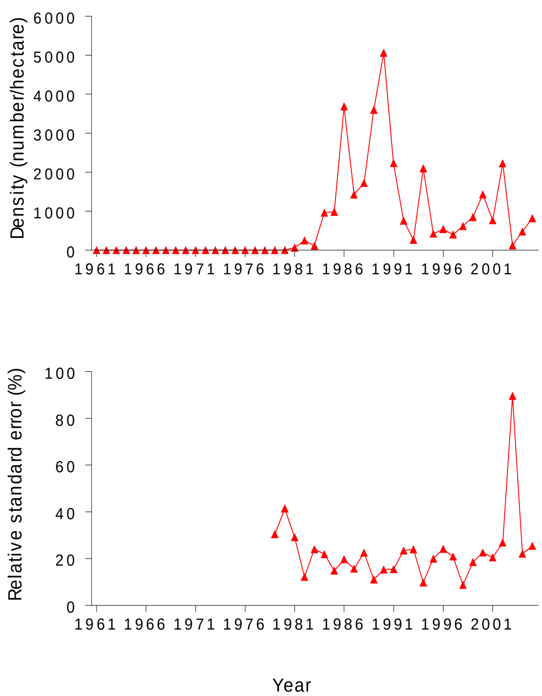

Figure 6. Density and relative standard error for age-0 white perch as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1961-2005.

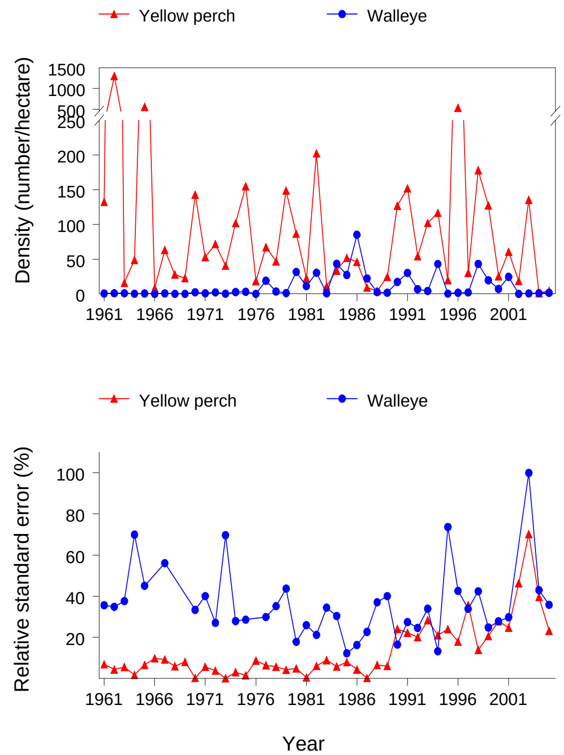

Figure 7. Density and relative standard error for age-0 yellow perch and walleye as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1961-2005.

Table 2. Autumn mean total lengths (mm) for age-0 individuals from bottom trawl catches near East Harbor State Park, Ohio in western Lake Erie in 1986-2005. Sample sizes are in parentheses and SE=standard error.

	2005		20-year mean	
Species	**Mean total length (N)**	**SE**	**Mean total length**	**SE**
alewife	- (0)	-	104	4.0
gizzard shad	99 (106)	2.5	100	2.8
emerald shiner	66 (122)	1.1	58	1.6
spottail shiner	81 (128)	0.6	77	1.4
trout-perch	74 (92)	0.6	75	1.1
yellow perch	87 (38)	1.4	83	1.0
walleye	198(11)	4.9	182	3.9
white perch	81 (98)	1.0	74	1.6
white bass	146 (8)	7.2	124	5.4
freshwater drum	102 (100)	1.6	103	2.5

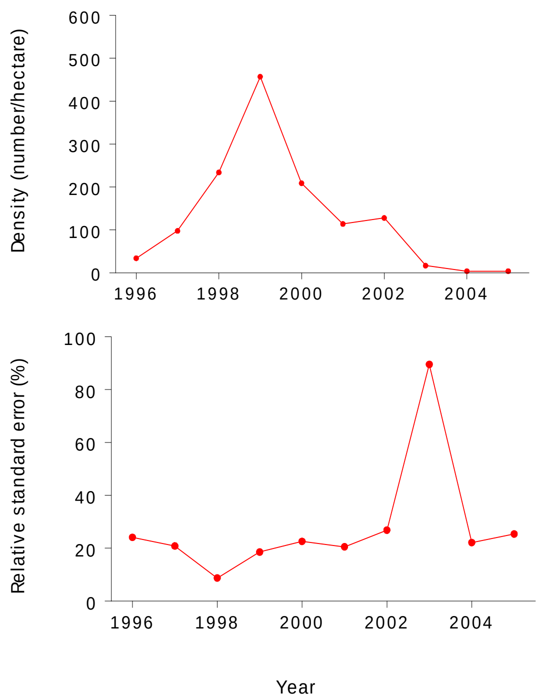

Figure 8. Density and relative standard error for round goby (all ages combined) as number of individuals per hectare from autumn bottom trawl catches in western Lake Erie near East Harbor State Park, Ohio, 1996-2005.

Yellow Perch and White Perch Diet Studies - Diets were determined from stomach samples collected from 105 yellow perch and 105 white perch during 2005. Seventy-nine percent of these stomachs contained food items. During summer, yellow perch consumed primarily zooplankton and benthic macroinvertebrates (53% and 46% respectively, by mean percent weight), followed by fish (1%) (Table 3). *Bythotrephes longimanus* made up almost the entire zooplankton component of the summer diets by both mean percent weight and percent frequency. *Hexagenia sp.*, *Dreissena sp.*, and Chironomidae dominated the benthic component of the summer diets. Yellow perch and white perch were the only identifiable fish consumed.

Autumn yellow perch diets were dominated by benthic macroinvertebrates (48% mean percent by weight) (Table 3). Yellow perch consumed more fish (37%) and less zooplankton (15%) in autumn than during summer. The benthic portion of the diet was dominated (both by mean percent weight and frequency) by *Hexagenia sp.*, followed by *Dreissena sp.* Amphipoda and Decapoda each accounted for 3.1% of the prey by weight and frequency. Round goby made up the major portion of the fish component of the autumn diets by both mean percent weight and frequency. *Leptodora kindtii* and *Bythotrephes longimanus* made up the greatest proportion of the zooplankton consumed by yellow perch in autumn. Although *Bosmina sp.* contributed the least by weight of the zooplankton recorded in the stomach samples, *Bosmina sp.* and *Leptodora kindtii* were the most frequently consumed zooplankton taxa.

Collectively, zooplankton and benthic invertebrates made up nearly ninety-eight percent of white perch diets by weight in summer (Table 4). *Bythotrephes longimanus* was the dominant zooplankton taxon consumed by white perch during summer by weight and percent frequency. The next major zooplankton prey was *Leptodora kindtii.* Chironomidae dominated the benthic macroinvertebrate component of the diet by mean percent weight and was among the most frequently consumed prey during summer. The only fish identified in summer white perch diets were gizzard shad, emerald shiner and spottail shiner, which collectively made up <1% by mean weight.

In contrast, white perch in autumn consumed mostly fish (43% mean percent weight), followed by zooplankton (34%), and benthic macroinvertebrates (23%) (Table 4). Spottail shiner was the dominant prey fish consumed, by both mean percent weight and frequency, followed by emerald shiner, round goby, and *Notropis sp.* *Bythotrephes longimanus* and *Leptodora kindtii* were the dominant zooplankton prey consumed in autumn. Amphipoda was the benthic macroinvertebrate most frequently consumed in autumn, followed by *Hexagenia sp.*

Table 3. Prey items identified in stomachs of age-2 and older yellow perch collected during summer and autumn 2005 near East Harbor State Park. Results for each taxon are expressed as mean percent (%) weight of all prey items and percent frequency of occurrence (% frequency).

	Summer (n = 48)		Autumn (n = 32)	
Prey	**Mean % weight**	**% frequency**	**Mean % weight**	**% frequency**
Bythotrephes longimanus	52.8	56.3	5.6	6.3
Leptodora kindtii	0.0	0.0	6.5	12.5
Daphnia sp.	0.0	0.0	0.0	0.0
Bosmina sp.	0.0	0.0	2.5	12.5
Copepoda	0.2	4.2	0.0	0.0
Total zooplankton	**53.0**		**14.6**	
Amphipoda	1.5	2.1	3.1	3.1
Chironomidae	11.8	20.8	1.3	9.4
Nematoda	4.4	8.3	2.4	6.3
Decapoda	0.0	0.0	3.1	3.1
Hydracarina	0.0	0.0	1.9	3.1
Trichoptera sp.	2.1	2.1	0.0	0.0
Gastropoda	0.3	2.1	0.0	0.0
Hexagenia sp.	13.4	14.6	32.4	43.8
Dreissena sp.	12.3	39.6	3.9	15.6
Total benthos	**45.8**		**48.1**	
emerald shiner	0.0	0.0	3.1	3.1
spottail shiner	0.0	0	6.3	6.3
trout-perch	0.0	0.0	3.1	3.1
white perch	0.1	2.1	6.3	6.3
yellow perch	0.1	4.2	0.0	0.0
round goby	0.0	0.0	15.4	21.9
Unidentified fish	1.0	2.1	3.1	3.1
Total fish	**1.2**		**37.3**	

Predator diet trends (2001-2005) – Yellow perch diets in summer exhibited marked changes between 2001 and 2005, most notably in the relationship between benthic macroinvertebrates and zooplankton (Figure 9). Percent composition of benthic macroinvertebrates decreased from 97% by weight in 2002 to 6% in 2003, then increased to 71% in 2004 and decreased to 45% in 2005. In contrast, zooplankton diet composition increased from absent in 2002 to 90% (by weight) in 2003, then decreased to 6% in 2004, and was the dominant prey in summer 2005 (53%). During 2001-2004, benthic macroinvertebrates generally dominated the autumn diet of yellow perch. In 2005, although fish increased to 37%, benthic macroinvertebrates continued to be an important dietary component in autumn (48%).

Since 2001, white perch exhibited shifts in summer diet composition that were similar to yellow perch (Figure 10). Benthic macroinvertebrates and fish dominated the summer diets during 2001 and 2002. Zooplankton dominated summer diets in 2003 (72% by weight) and 2005 (66%). Fish were nearly absent from the summer diets in 2003 and 2005. In 2004, percent composition of fish in the summer diet increased to 45% while that of zooplankton decreased to 40%. Fish dominated the autumn diets during 2001 and 2002. In 2003 and 2004, benthic macroinvertebrates replaced fish as the dominant prey found in white perch stomachs in autumn. However, fish again dominated the autumn diets in 2005. Additionally, percent composition of zooplankton increased steadily from 7% in 2001 to 40% in 2004, although 2005 showed a slight decrease

Table 4. Prey items identified in stomachs of age-2 and older white perch collected during summer and autumn 2005 near East Harbor State Park. Results for each taxon are expressed as mean percent (%) weight of all prey items and percent frequency of occurrence (% frequency).

	Summer (n=47)		**Autumn (n=39)**	
Prey	**Mean % weight**	**% frequency**	**Mean % weight**	**% frequency**
Bythotrephes longimanus	53.9	68.1	14.1	20.5
Leptodora kindtii	11.4	17.0	13.6	15.4
Bosmina sp.	0.1	4.3	5.9	7.7
Daphnia sp.	0.1	6.4	0.0	0.0
Sididae	0.7	6.4	0.0	0.0
Copepoda	0.2	17.0	0.0	0.0
Total zooplankton	**66.4**		**33.6**	
Amphipoda	3.7	6.4	16.8	20.5
Chironomidae	24.1	61.7	0.1	7.7
Dreissena sp.	0.2	4.3	0.1	2.6
Hexagenia sp.	3.5	8.5	6.5	15.4
Total benthos	**31.5**		**23.5**	
gizzard shad	0.4	4.3	0.0	0.0
emerald shiner	0.1	2.1	12.3	25.6
spottail shiner	0.1	2.1	18.1	35.9
Notropis sp.	0.0	0.0	1.4	7.7
round goby	0.0	0.0	7.5	10.3
Unidentified fish	1.5	4.3	3.6	7.7
Total fish	**2.1**		**42.9**	

(33%). During 2004 and 2005, zooplankton also made up a larger proportion than fish in the autumn diet of white perch.

Benthic macroinvertebrates--Dreissena sp. made up the largest portion of the total benthic sample (Table 5). *Dreissena sp.* abundance decreased from 7,273/m^2 in 2004 to 2,363/m^2 in 2005, which disrupts a trend of increasing density observed since 1999. Due to the decrease in density from 2004 to 2005, percent composition of *Dreissena sp.* also decreased from 83% in 2004 to 62% in 2005. Gastropoda was the second most abundant taxon in 2005 (453/m^2). This is the highest density of Gastropoda recorded since the first benthic samples were taken in 1997 (4/m^2). Oligochaeta made up 8% of the total benthic sample, followed by Chironomidae and Amphipoda (both at 6%). The remaining taxa, which included Ephemeroptera, Nematoda, Hirudinea, and Trichoptera collectively accounted for less than 7%. Other taxa not present in 2004 but found in 2005 (Hydracarina and Sphaeriidae) contributed less than 1% of the total benthic sample.

Zooplankton--Calanoid copepods were the most abundant zooplankton collected in both seasons (Table 6). Cyclopoid copepods and Bosminidae were second most abundant in summer and autumn, respectively. The density of calanoid copepods in the summer (8,652/m^3) and autumn (7,451/m^3) of 2005 increased drastically from 2004, summer (1,197/m^3) and autumn (934/m^3). However, the percent

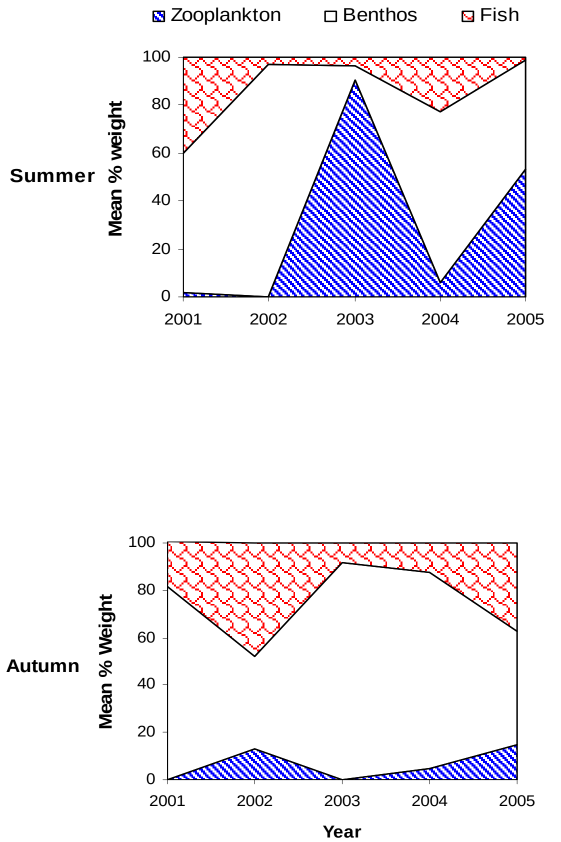

Figure 9. Mean percent weight of zooplankton, benthos, and fish recorded in stomachs of yellow perch collected in Lake Erie near East Harbor State Park, Ohio. Stomachs were collected in summer and autumn during 2001-2005.

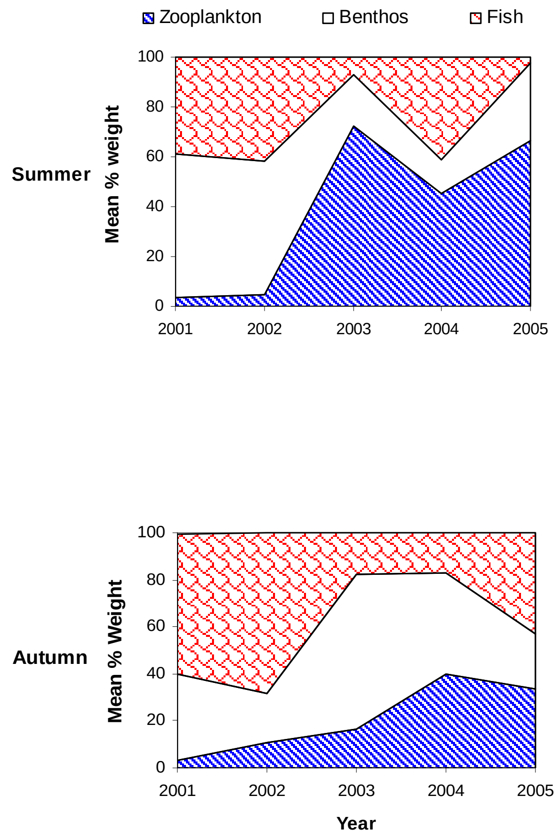

Figure 10. Contributions of zooplankton, benthos, and fish to the diet of white perch collected in Lake Erie near East Harbor State Park, Ohio. Stomachs were sampled in summer and autumn during 2001-2005.

compositions of calanoid copepods in 2005 were similar to summer (47%) and autumn (51%) of 2003.

Cyclopoid copepods experienced a drastic shift in abundance from summer (6,503/m^3) to autumn (779/m^3), which follows a seasonal abundance trend that has been observed since 2002. In contrast, *Daphnia rectocurva* increased from 2% (354/m^3) in the summer to 10% (1,410/m^3) in autumn. *Daphnia galeta mendotae*, which has not been detected during the summer since 2002, was recorded in the summer of 2005 (79/m^3, <1%), but not detected in the autumn. *Bythotrephes longimanus* was collected in the summer (8/m^3, <1%), but was also absent in the autumn. Chydoridae, as in 2004, was detected only in the autumn of 2005. However, in 2004 Chydoridae made up 22% (3,786/m^3) of the autumn sample, but in 2005 Chydoridae made up less than 1% (37/m^3). Bosminidae, *Dreissena sp.* veligers, Sididae and *Leptodora sp.* had relatively consistent seasonal proportions in both the summer and autumn. The proportion of copepod nauplii decreased from 9% (2,110/m^3) in summer to 1% (199/m^3) in autumn. This result is to be interpreted with caution. The plankton net used in this study (mesh size = 153 microns) will not catch all copepod nauplii, which are in some cases smaller than the mesh size. Bryozoa larvae were detected in one sample during the summer and in five samples during the autumn.

Table 5. Composition of benthic macroinvertebrates offshore of East Harbor State Park, Ohio in 2005 (n = 12 samples), shown as number per square meter and percent (%) composition.

Taxon	**Mean number/m^2**	**Percent composition**
Dreissena sp.	2363	62%
Gastropoda	453	12%
Oligochaeta	295	8%
Chironomidae	241	6%
Amphipoda	214	6%
Ephemeroptera	120	3%
Nematoda	67	2%
Hirudinea	21	1%
Trichoptera	17	<1%
Hydracarina	11	<1%
Sphaeriidae	2	<1%
Total	3804	100%

Commercial Trap Net Studies

Yellow perch - Eight year classes were represented in the spring 2005 commercial sample (Table 7: n = 299). Specimens ranged in age from 2 (2003 year class) to 9 (1996 year class) years. All individuals collected were sexually mature. The sample was dominated (83.6%) by age-4 (i.e., 2001 year class) females (32.4%) and males (51.2%). Year classes 1997 and 1998 were each represented by only one individual. Year class 2003 was too small to be fully recruited by the trap net and was represented by one male and one female in our sample. The 2001 year class also dominated the 2004 spring sample but made up a smaller percentage of the sample (47%) (Bur et al. 2005). The apparent increase in 2005 in the proportion of total sample represented by the 2001 year class was due to lower catches of other year classes, particularly the 1998 (14.9% in 2004) and 1999 (22.2% in 2004) year classes.

Eight year classes were represented in the autumn 2005 commercial sample (Table 8: n = 297). Specimens ranged in age from 2 to 10 (1995 year class) years. All individuals collected were sexually mature. Females from the 2003 year class and males from the 2001 year class combined made up more than half of the sample. Collectively, the 2001 (49.5% of the total sample) and 2003 (38.7%) year classes accounted for 88.2% of the autumn 2005 sample. The 2001 year class also dominated the autumn 2004 commercial sample, accounting for 88.4% of the sample (Bur et al. 2005).

Western Basin Studies

Population, biomass, and total length - Twenty-four of the 26 sites were sampled in both spring and autumn. One site was sampled only in autumn and one site was sampled only in spring due to destruction of gear. Commercial fishing gear was present at another site in autumn, which resulted in a slightly different trawl path than at the same site in spring. Distance trawled was consistent between seasons and political jurisdiction, averaging 0.63 km. Area swept by the trawls was also consistent, averaging 0.24 ha in spring and 0.25 ha in autumn. Sampling effort in 2005 was more uniform than in 2004, when distances and areas sampled were higher in spring (Kocovsky et al. 2005).

Twenty-five species were captured in trawls. Several rare or unusual species (number and age class sampled) were captured, including: rock bass *Ambloplites rupestris* (4 YAO), lake sturgeon *Acipenser fulvescens* (1 sub-adult), silver lamprey *Ichthyomyzon unicuspis* (1) and lake whitefish (2 YOY). The rock bass, lake sturgeon, and silver lamprey were captured at sites nearest the mouth of the Detroit River. The lake whitefish were captured north of Pelee Island near the Ontario shoreline. One relatively common species of the western basin, freshwater drum, was captured in small numbers in spring and was virtually absent from autumn samples. No alewives were captured in spring and only one individual was captured in autumn. Smallmouth bass (*Micropterus dolomieu*) which is common in the western basin but rarely caught in trawls, was captured at three sites in Michigan waters and five sites in Ontario waters autumn.

Young-of-year white perch were captured at all sites in autumn whereas no single species was captured at all sites in spring. Trout-perch, rainbow smelt *Osmerus mordax*, emerald shiner, spottail shiner, and round goby were captured at more than half of the sites in autumn. Only yellow perch and round goby were captured at more than half of sites in spring.

Autumn samples were more diverse than spring samples. Autumn samples averaged 11.7 species

Table 6. Mean individuals/m^3 and percent (%) composition of crustacean zooplankton taxa in western Lake Erie near East Harbor State Park, Ohio in 2005. Abbreviation: ND = taxon not detected in sample.

	Summer (n = 5)		Autumn (n = 6)	
Taxon	**Mean number/m^3**	**Mean % composition**	**Mean number/m^3**	**Mean % composition**
Calanoid copepods	8652	39%	7451	54%
Cyclopoid copepods	6503	29%	779	6%
Bosminidae	3375	15%	2595	19%
Dreissena sp. veligers	817	4%	1127	8%
Copepod nauplii	2110	9%	199	1%
Sididae	477	2%	192	1%
Daphnia rectocurva	354	2%	1410	10%
Daphnia galeata mendotae	70	<1%	ND	ND
Leptodora sp.	73	<1%	19	<1%
Chydoridae	ND	ND	37	<1%
Bythotrephes longimanus	8	<1%	ND	ND

Table 7. Summary statistics for yellow perch (N = 299) collected from commercial trap net catches from western Lake Erie during spring, 2005. All specimens were mature. Abbreviation: SE = standard error.

					Total length (mm)		Mass (g)	
Age	**Sex**	**Year class**	**n**	**%N**	**Mean**	**SE**	**Mean**	**SE**
2	F	2003	1	0.3	167	-	54	-
	M	2003	1	0.3	168	-	48	-
3	F	2002	5	1.7	199	7.3	90	19.2
	M	2002	18	6.0	199	13.4	89	17.1
4	F	2001	97	32.4	229	16.4	136	34.6
	M	2001	153	51.2	208	11.8	100	19.7
5	F	2000	2	0.7	257	23.3	214	85.9
	M	2000	8	2.7	214	18.3	111	28.0
6	F	1999	3	1.0	263	48.6	255	176.5
	M	1999	7	2.3	219	17.4	125	33.6
7	M	1998	1	0.3	250	-	183	-
8	F	1997	1	0.3	300	-	268	-
9	M	1996	2	0.7	256	26.9	208	77.1

Table 8. Summary statistics for yellow perch (N = 297) collected from commercial trap net run catches from western Lake Erie during autumn, 2005. All specimens were mature. Abbreviation: SE = standard error.

					Total length (mm)		Mass (g)	
Age	**Sex**	**Year class**	**n**	**%N**	**Mean**	**SE**	**Mean**	**SE**
2+	F	2003	77	25.9	204	11.5	99	21.1
	M	2003	38	12.8	191	12.7	91	34.3
3+	F	2002	2	0.7	214	8.5	112	6.4
	M	2002	7	2.4	201	8.0	164.4	50.8
4+	F	2001	42	14.1	244	22.4	182	59.1
	M	2001	105	35.4	213	15.9	122	31.3
5+	F	2000	1	0.3	246	-	208	-
	M	2000	3	1.0	214	24.8	166	65.1
6+	F	1999	6	2.0	297	18.4	324	68.9
	M	1999	8	2.7	223	17.1	151	44.0
7+	F	1998	1	0.3	305	-	327	-
	M	1998	5	1.7	228	19.0	152	46.6
8+	M	1997	1	0.3	240	-	154	-
10+	M	1995	1	0.3	313	-	335	-

compared to 7.8 species in spring samples (n = 24 paired sites, t = 3.69, $P < 0.0001$). Only one site had fewer species of YOY in fall versus spring, all other sites increased by 1 to 7 species. Differences in species diversity between spring and autumn varied with life stage and sampling jurisdiction. When considering only YOY, four more species were captured, on average, in autumn versus spring. Ontario sites increased by 4.6 species, whereas Michigan sites increased by only 2.3 species (t = 1.89, P = 0.05). When considering only YAO, one fewer species was captured in autumn than in spring, but the difference varied with political jurisdiction. Michigan sites gained two species whereas Ontario sites lost less than one species (t = 2.8, P = 0.01). The most notable difference in species captured between spring and autumn was that emerald shiner were absent from Michigan waters in spring.

Spring densities of YAO were highest (in descending rank order) for emerald shiner, trout-perch, round goby, yellow perch, and white perch (Table 9). The ranks of the autumn densities of YAO were generally concordant with the ranks of spring densities with two notable exceptions. Spottail shiner was the most abundant YAO in autumn but only the seventh most abundant in spring, and emerald shiner was the most abundant YAO caught in spring but was one of the least abundant in autumn. Autumn YOY densities were highest for white perch, emerald shiner, spottail shiner, trout-perch, and yellow perch. The ranks of the density estimates for spring YAO and for fall YOY were generally concordant. Four of the five species that had highest densities of spring YAO also had high autumn YOY densities.

Spring biomasses of YAO were highest (in descending rank order) for trout-perch, emerald shiner, round goby (all ages combined), rainbow smelt, and spottail shiner (Table 10). Weights were not measured for several abundant species in the spring, including white perch and yellow perch. Therefore, rank order of biomass may not accurately reflect biomasses in the sample. Autumn biomasses of YAO were highest for round goby (all ages combined), white bass, spottail shiner, trout-perch, and gizzard shad. Rank order of species by biomass Yellow perch biomass decreased (-22%) despite the was mostly unrelated to rank order of density for YAO. However, lack of biomass estimates for spring YAO may have affected the rankings for biomass. For YOY in autumn, biomass was highest for white perch, followed by emerald shiner, trout-perch, spottail shiner, and white bass. Ranks of biomass estimates for YOY were generally similar to the ranks of density estimates. Four of the five highest-ranked species for biomass were also among the five highest ranked for density.

Differences in average total lengths of forage fishes in 2005 (Table 11) compared to 2004 varied by species. Total length of YOY in autumn was shorter for gizzard shad, rainbow smelt, trout-perch, and spottail shiner. White perch, emerald shiner, and yellow perch YOY were longer in autumn 2005 compared to 2004.

Densities of YOY forage fishes in autumn were higher in 2005 than in 2004 for all species except rainbow smelt (69% decrease), trout-perch (64% decrease), and logperch *Percina caprodes* (20% decrease). Differences in biomass were consistent with and on the same order of magnitude as differences in density for rainbow smelt (90% decrease), trout-perch (73% decrease), white perch (32% increase), and logperch (100% increase). increase in density. Emerald shiner had a much higher increase in biomass compared to the increase in density (density increased 11%, biomass increased 500%). This apparent discrepancy could have been a result of measurement error of mass. However, mean total length of YOY emerald shiner was 87% longer in 2005 than in 2004. Given the cubic relationship of mass to length, this result would account for a large proportion of the disparity between the difference in density and the difference in biomass. The large increase in emerald shiner density is likely due to extraordinarily favorable conditions for emerald shiner recruitment in 2005.

Compared to 2004, estimates of year class strength in 2005 based on density estimates versus those based on biomass estimates were generally consistent. In 2004, rank estimates of year class strength using density estimates were different than rank estimates of year class strength based on biomass. Thus, these two years' data yield different conclusions regarding the relative value of density versus biomass estimates for estimating year class strength. Results from 2005 suggest that either measure suffices, whereas 2004 data suggest quite different assessments. As additional years' data are added we will be able to further assess the relative value of density versus biomass estimates for estimating year class strength.

Table 9. Mean density (number/ha) of young-of-year (YOY) and yearling-and-older (YAO) forage fish species captured in trawls (n = 24) during surveys in Ontario and Michigan waters of the western basin of Lake Erie. For round goby, all ages were combined and reported as YAO. Percent relative standard error (%RSE) is 100*(standard error of the mean/mean). Asterisks indicate that %RSE was not calculated owing to insufficient sample size.

	Spring		Autumn			
Species	**YAO**	**%RSE**	**YOY**	**%RSE**	**YAO**	**%RSE**
alewife	0	*	0.2	500.0	0	*
gizzard shad	0	*	7.2	292.9	3.6	191.6
rainbow smelt	16.5	252.9	17.5	238.0	0	*
trout-perch	93.5	173.2	134.2	193.3	18.4	159.9
white perch	32.3	317.0	916.3	160.8	14.0	157
white bass	0.3	347.3	6.3	255.4	4.8	180.2
freshwater drum	3.8	232.1	0	*	0.3	344.8
silver chub	3.6	351.3	0	*	2.0	300.0
emerald shiner	114.9	200.9	404.2	457.0	0.8	499.4
spottail shiner	6.9	222.5	165.3	191.2	20.2	276.6
mimic shiner	1.0	274.9	2.6	433.5	0.2	503.1
smallmouth bass	0	*	0.2	393.6	2.9	212.5
logperch	0	*	0.8	250.0	0	*
yellow perch	56.9	223.9	24.2	191.0	8.9	143.4
walleye	1.9	198.8	1.4	252.1	1.8	194.4
round goby	66.5	177.2	*	*	28.3	134.6

Table 10. Mean biomass (kg/ha) of young-of-year (YOY) and yearling-and-older (YAO) forage fish species captured in trawls (n = 24) during surveys in Ontario and Michigan waters of the western basin of Lake Erie in 2005. For round goby, all ages were combined and reported as YAO. Percent relative standard error (%RSE) is 100*(standard error of the mean/mean). Asterisks indicate that %RSE was not calculated owing to insufficient sample size.

	Spring		**Autumn**			
Species	**YAO**	**%RSE**	**YOY**	**%RSE**	**YAO**	**%RSE**
alewife	0	*	0.001	627.0	0	*
gizzard shad	0	*	0.04	418.1	0.07	179.1
rainbow smelt	0.12	527.7	0.004	249.8	0	*
trout-perch	0.49	171.0	0.29	192.9	0.13	164.9
white perch	*	*	2.3	84.5	0.04	224.0
white bass	*	*	0.05	375.7	0.16	251.8
freshwater drum	*	*	0	*	*	*
silver chub	0.10	274.8	0	*	0.07	293.2
emerald shiner	0.38	231.1	0.52	460.7	0.005	465.2
spottail shiner	0.11	330.5	0.28	196.9	0.14	247.6
mimic shiner	0.0002	340.0	0.001	478	0.0002	410
smallmouth bass	0	*	0.01	446.3	0.04	266.1
logperch	0	*	0.001	360	0	*
yellow perch	*	*	0.03	246.9	*	*
walleye	*	*	*	*	*	*
round goby	0.31	224.8	*	*	0.21	141.0

Mean total length of autumn YOY gizzard shad, rainbow smelt, trout-perch and spottail shiner were all lower in 2005 than in 2004. Two of these species (gizzard shad and spottail shiner) had higher densities than in 2004 and two species (rainbow smelt and trout-perch) had lower densities. White perch, emerald shiner, and yellow perch had greater mean total lengths in 2005, and all three had higher densities as well. Increases in total length accompanied by increases in density between 2004 and 2005 for many forage fish species suggest that overall lake conditions were more favorable for recruitment of YOY forage fishes in 2005.

The absence of emerald shiner YAO from Michigan waters in spring is one distributional difference that falls along political jurisdictions, but it is also likely a result of differences in environmental conditions. Emerald shiner is a broadcast spawner (Gilbert and Burgess 1979) that spawns in spring over hard surfaces (Ross 2001). The soft substrates in Michigan waters of the western basin of Lake Erie are likely unsuitable spawning habitat for emerald shiner, which would explain their absence from this area during their spawning season. Differences in life stages captured at a site between seasons may be another indicator of differences in suitability of spawning or rearing habitat.

Diets of Yellow Perch and White Perch – We determined diets of 132 yellow perch and 66 white perch from stomach samples collected during spring and autumn 2005. Ninety-two percent of these stomachs contained food items. Collectively, zooplankton (70%) and benthic macroinvertebrates (27%) accounted for 97% (mean percent weight) of the spring diets of yellow perch (Table 12). Yellow perch fed most heavily in spring on *Leptodora kindtii* and *Daphnia sp.* (69% and 63% frequency, respectively). Other zooplankton consumed by yellow perch in spring include Chydoridae, *Bosmina sp.*, Copepoda and Sididae. *Hexagenia sp.* was the dominant benthic macroinvertebrate by both mean percent weight (12%) and percent frequency (42%), followed by *Trichoptera sp.* and Chironomidae. Fish species identified in spring yellow perch diets were emerald shiner, yellow perch and round goby.

Yellow perch diets in autumn were dominated by benthic macroinvertebrates (66% mean percent weight) with fish and zooplankton contributing 20% and 14% respectively (Table 12). As in the spring, yellow perch consumed a variety of different benthic macroinvertebrates. *Hexagenia sp.* was the dominant benthic macroinvertebrate consumed by percent weight and frequency, followed by Nematoda and Chironomidae. In autumn, round goby and emerald shiner were the only fish species identified in yellow perch stomachs. Among zooplankton consumed in autumn by yellow perch, *Leptodora kindtii*, *Daphnia sp.,* and *Bosmina sp.,* were dominant by weight and frequency.

Nearly 90% of white perch spring diets were made up of zooplankton (Table 13). Benthic macroinvertebrates contributed the remaining 10% mean percent weight. No fish were observed in spring white perch stomachs. As with yellow perch in spring, *Leptodora kindtii* was the dominant prey item consumed by mean percent weight (52%) and percent frequency (80%). *Daphnia sp.* added another 35% by weight and was observed in nearly every white perch stomach (97%). Chironomidae was the dominant benthic macroinvertebrate consumed by mean percent weight. Although *Hexagenia sp.* only contributed 2% by weight, percent frequency was considerably higher (30%).

Autumn white perch diets were dominated by benthic macroinvertebrates (56% mean percent weight), followed by zooplankton (35%) and fish (8%) (Table 13). Chironomidae and Nematoda were the dominant benthic taxa consumed by percent weight. *Leptodora kindtii* and Copepoda were the dominant zooplankton prey consumed by weight (25% collectively). Zooplankton taxa most frequently consumed were Copepoda and *Daphnia sp.* Spottail shiner and round goby were the only fish species consumed by white perch in autumn.

We expect to learn more about spatial segregation and distribution of species and diet of predator species within the western basin as this data set develops. Our data, when combined with data from ODNR and OMNR, will help us to better quantify prey population status, geographic and seasonal dynamics, and diets of yellow perch and white perch in the entire western basin of Lake Erie.

Table 11. Mean total length (TL: nearest mm), standard error (SE), and sample size (N) of young-of-year (YOY) and yearling-and-older (YAO) forage fish species captured during autumn trawling surveys in Ontario and Michigan waters of the western basin of Lake Erie in 2005. Asterisks indicate no fish were sampled, or in the case of SE that only one individual of a species was measured. For round goby, all ages were combined under YAO.

	Spring YAO			Autumn YOY			Autumn YAO		
Species	**TL**	**SE**	**N**	**TL**	**SE**	**N**	**TL**	**SE**	**N**
alewife	*	*	*	97	*	1	*	*	*
gizzard shad	*	*	*	73	3.6	22	131	4.0	22
rainbow smelt	104	2.3	81	37	0.5	70	*	*	*
trout-perch	83	0.7	293	65	0.4	253	94	0.8	80
white perch	*	*	*	84	0.7	217	124	7.0	2
white bass	*	*	*	95	2.8	24	148	3.1	20
freshwater drum	*	*	*	*	*	*	*	*	*
silver chub	120	10.2	22	*	*	*	154	7.4	11
emerald shiner	71	0.8	223	58	0.4	130	96	*	1
spottail shiner	103	4.8	28	55	1.3	252	94	2.5	44
mimic shiner	44	3.5	2	42	0.5	16	55	*	1
smallmouth bass	*	*	*	86	4.5	9	111	1.8	11
yellow perch	*	*	*	89	2.3	13	*	*	*
walleye	*	*	*	*	*	*	*	*	*
round goby	62	1.1	215	*	*	*	74	2.0	133

Table 12. Diet of age-2 and older yellow perch collected during spring and autumn 2005 in Ontario and Michigan waters of the western basin of Lake Erie, expressed as mean percent (%) weight of all prey items and percent frequency of occurrence (% frequency).

	Spring (n = 89)		**Autumn (n = 30)**	
Prey	**Mean % weight**	**% frequency**	**Mean % weight**	**% frequency**
Leptodora kindtii	42.1	65.2	4.6	6.7
Daphnia sp.	22.9	68.5	6.2	10.0
Bosmina sp.	0.1	10.1	3.4	6.7
Copepoda	1.5	38.0	0.3	3.3
Sididae	0.5	5.6	0.0	0.0
Chydoridae	2.6	12.4	0.0	0.0
Total zooplankton	**69.7**		**14.5**	
Amphipoda	1.1	1.1	3.3	3.3
Chironomidae	3.8	28.1	7.4	13.3
Ostracoda	0.1	11.2	0.0	0.0
Nematoda	0.7	12.4	10.1	16.7
Oligochaeta	0.2	2.2	0.0	0.0
Hirudinea	0.8	2.2	0.0	0.0
Sphaeriidae	0.0	0.0	0.8	6.7
Trichoptera sp.	6.9	23.6	0.0	0.0
Gastropoda	0.0	0.0	3.1	3.3
Hydracarina sp.	1.1	2.2	0.0	0.0
Dreissena sp.	1.1	6.7	3.7	10.0
Hexagenia sp.	12.2	41.6	37.4	43.3
Total benthos	**28.0**		**65.8**	
emerald shiner	0.1	1.1	2.0	3.3
yellow perch	1.1	1.1	0.0	0.0
round goby	1.1	2.2	12.7	16.7
unidentified fish	0.0	0.0	5.0	6.7
Total fish	**2.3**		**19.7**	

Table 13. Diet of age-2 and older white perch collected during spring and autumn 2005 in Ontario and Michigan waters of the western basin of Lake Erie, expressed as mean percent (%) weight of all prey items and percent frequency of occurrence (% frequency).

	Spring (n = 30)		Autumn (n = 33)	
Prey	**Mean % weight**	**% frequency**	**Mean % weight**	**% frequency**
Leptodora kindtii	52.0	80.6	12.9	15.2
Bosmina sp.	0.0	22.6	1.5	9.1
Daphnia sp.	34.5	96.8	9.5	30.3
Sididae	0.1	12.9	0.2	18.2
Copepoda	3.0	41.9	12.4	54.5
Total zooplankton	**89.6**		**36.5**	
Ostracoda	0.0	0.0	1.6	6.1
Nematoda	0.0	0.0	12.2	33.3
Chironomidae	8.5	12.9	27.4	45.5
Sphaeriidae	0.0	0.0	0.1	12.1
Dreissena sp.	0.0	0.0	6.2	9.1
Hexagenia sp.	1.8	29.0	8.4	12.1
Total benthos	**10.3**		**55.9**	
spottail shiner	0.0	0.0	4.5	6.1
round goby	0.0	0.0	3.0	3.0
Total fish	**0.0**		**7.5**	

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References

Bur, M.T., M.A. Stapanian, P.M. Kocovsky, S.J. Galbreth, and A.M. Czarnecki. 2005. Surveillance and status of fish stocks in western Lake Erie, 2004. Report to the Standing Technical Committee of the Lake Erie Committee. Great Lakes Fishery Commission, Ann Arbor, MI. 13 p.

Culver, D.A., M.M. Boucherle, D.J. Bean, J.W. Fletcher. 1985. Biomass of freshwater crustacean zooplankton from length-weight regressions. Canadian Journal of Fisheries and Aquatic Sciences 42:1380-1390.

Dumont, H.J. 1975. The dry weight estimate of biomass in a selection of Cladocera, Copepoda, and Rotifera from the plankton, periphyton, and benthos of continental waters. Oecologia 19:75-97

Gilbert, C.R., and G.H. Burgess. 1979. *Notropis atherinoides* (Rafinesque) emerald shiner. Pages 231-232 in D. S. Lee et al. *Atlas of North American Freshwater Fishes*. North Carolina State Museum of Natural History, Raleigh.

Kocovsky, P.M., M.T. Bur, and M.A. Stapanian. 2005. Comparison of spring and autumn bottom trawl sampling in the western basin of Lake Erie. Report to the Great Lakes Fishery Commission, Lake Erie Committee, Niagara Falls, Ontario, March 2005.

Ross, S.T. 2001. Fishes of Mississippi. University Press of Mississippi, Jackson. Wallace, R.K. 1981. An assessment of diet-overlap indexes. Transactions of the American Fisheries Society 110:72-76.

Wallace, R.K. 1981. An assessment of diet-overlap indexes. Transactions of the American Fisheries Society 110:72-76.