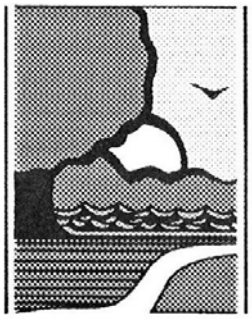

Illinois Department of Natural Resources
Division of Fisheries

Salmonid Community of Lake Michigan: 2009 Fall Harbor Assessment

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EXECUTIVE SUMMARY

Four salmonid species have been stocked annually in the Illinois waters of Lake Michigan at rates of approximately 304,000 Chinook salmon and 300,000 coho salmon, 100,000 rainbow trout and 100,000 brown trout. The number of Chinook salmon stocked in Illinois waters was reduced to approximately 250,500 in 2006 in a lakewide effort to reduce the prey demand placed on the forage base by the number of Chinook salmon in the lake. In fall 2009, we sampled mature salmonids in four Illinois harbors to assess their relative abundance, age and growth, and the homing tendency of marked fish.

Coho salmon and Chinook salmon comprised 95% of the sample. Catch-per-unit-effort (CPUE) declined at North Point Marina and Waukegan south harbor compared to 2008, however the decline was limited primarily to coho salmon. Notable changes for 2009 were a significant increase in coho at Diversey Harbor. Chinook salmon catch rates were similar to 2008 at all sites.

Similar to 2007 and 2008, most (39%) of the Chinook salmon we sampled were age-2 however age-3 Chinook salmon comprised a greater portion of the sample in 2002, 2004, and 2006. Fin-clipped Chinook salmon released at Waukegan south harbor were collected at sites other than the stocking location (North Point Marina – 4 fish). Similar to the previous years, 63% of the Chinook salmon sampled in Waukegan south harbor were stocked in that harbor. The abundance of Chinook salmon not stocked in Waukegan south harbor but sampled in that harbor was substantially reduced in 2005 - 2008 compared to previous years.

INTRODUCTION

The origin of the salmon fishery of Lake Michigan dates back to 1966 when coho salmon were first stocked as a means to utilize and ultimately control the over-abundant alewife population (Keller, *et al*. 1990). Since 1976, approximately 14.7 million salmonids have been stocked annually into Lake Michigan in an attempt to control alewife population growth and also support the world class fishery that had developed. Salmonids were first stocked in Illinois waters in 1976 and salmonid stocking in Illinois currently accounts for approximately 6% of the lakewide stockings. The current Illinois stocking plan includes 250,500 Chinook salmon, 300,000 coho salmon, 100,000 rainbow trout, and 100,000 and brown trout that are stocked annually (Table 1).

Since the Illinois shoreline of Lake Michigan lacks permanent flowing tributaries, salmon and trout are stocked in harbors. Adult fish that return to these harbors in the fall are sampled by Lake Michigan Program staff using a DC electrofishing boat. This technique has proven both convenient and effective for collecting information on mature salmon and trout in harbors with relatively low water conductivity (approx. 150 μm/cm).

The objectives of the fall salmonid harbor sampling were to: 1) collect fish flesh samples to update the Illinois Fish Consumption Advisory; 2) collect data on returning fin-clipped fish and assess movements and fidelity to stocking sites; and 3) collect information on the condition and abundance of returning fish to address questions regarding health of the fish and the effects on the forage base.

METHODS

Fish were sampled using a Smith-Root Model 5.0 GPP Pulsed-DC electrofishing unit, operated at 12-14 amps and 120 pulses per second. Total sampling time was based on harbor size, weather conditions, and the amount and type of fish collected. Most sites were sampled for approximately one hour; in some cases however, the entire site was sampled in less than 60 minutes. Selection of sampling sites (Figure 1) was based on harbor configurations that were conducive to electrofishing (i.e., < 3 m in depth) and harbors in which salmonids were stocked. In 2009, we sampled both basins of North Point Marina and the south harbor at Waukegan, Diversey Harbor and adjacent Lincoln Park Lagoon (referred to as only Diversey Harbor throughout), and Jackson Park inner harbor weekly between mid-September and mid-November (Table 2).

Salmonid species were the target of sampling efforts. Abundance of non-target species (e.g., alewife, gizzard shad, and carp) was usually only noted. Sampled fish were dip-netted and held onboard until biological data were obtained. Fish were measured to the nearest 5 mm (maximum total length) and weighed. In addition, clipped fins, lamprey wounds, sex and maturity, and snag hook wounds were recorded. Otoliths were collected from Chinook salmon and processed as per Robillard and Marsden (1996). Fall harbor assessment catch-per-unit-effort (CPUE) was calculated as the number of fish sampled per 1 hr electrofishing effort.

RESULTS AND DISCUSSION

A total of 756 salmonids were sampled in four Illinois harbors during 2009. Chinook salmon (226) and coho salmon (494) comprised the greatest numbers of fish sampled; brown trout and rainbow trout numbers were less (Table 3).

Fall assessment CPUE for all salmonids combined was higher in Diversey Harbor (56.2 fish/hour) than in Waukegan south harbor (34.5 fish/hour), North Point Marina (6.7 fish/hour), or Jackson Park inner harbor (14.0 fish/hour). CPUE declined at North Point Marina and Waukegan south harbor compared to 2008. Three of the four sampling sites are stocked with a full compliment of the four species, however North Point Marina is only stocked with 10,000 brown trout (Table 1). In general, fall harbor assessment catch rates of salmonids have been highest at Waukegan south harbor (Figure 2).

CPUEs vary from year to year at each of the sampling sites depending on the success of capturing particular species during their peak spawning run, water temperatures, growth and survival, and variability in sport angler harvest. For purposes of this assessment, it is generally assumed that CPUEs represent actual returns regardless of variability in electrofishing effort among harbors.

Chinook Salmon

Chinook salmon CPUE was higher in Waukegan south harbor (23.2 fish/hour) than in Diversey Harbor (4.0 fish/hour) Jackson Park inner harbor (4.4 fish/hour), and North Point Marina (2.8 fish/hour). Chinook salmon CPUE increased at Waukegan south harbor and Jackson Park inner harbor in 2009, and was similar to 2008 at the other two sites.

Sampled Chinook salmon ranged in length from 315 to 965 mm and length was directly related to age, there was relatively little overlap of length ranges of young age groups in 2009 compared to previous years (Figure 3). The length distribution of Chinook salmon generally has been tri-modal and usually comprised of four age-groups (ages-0 through 3). Four age-0 Chinook salmon (stocked in 2009) were sampled. Four age-4 Chinook salmon also were sampled in 2009; only one age-4 Chinook salmon was sampled during 2001 through 2004.

Fin clips were evident on 113 of 226 Chinook salmon we sampled in 2009. Since 1999, all Chinook salmon stocked in Waukegan south harbor have been fin-clipped; Chinook salmon stocked in Diversey and Jackson Park Harbors have not (except 10,000 in Jackson in 2006). All Chinook salmon bearing a right pectoral left ventral (RPLV) fin clip (2005), and the majority of Chinook salmon bearing a left pectoral right ventral (LPRV) fin clip (2006), right pectoral (RP) fin clip (2007), and left pectoral (LP) fin clip (2008) were sampled in Waukegan harbor in 2009, indicating at least moderate fidelity to stocking site (Table 4). Only 63% (105 of 168) of the Chinook salmon sampled in Waukegan south harbor were fin-clipped however indicating that straying into Waukegan south harbor from other stocking sources does occur; clipped Chinook salmon accounted for between 52 and 73% of the catch in Waukegan south harbor in 2003-2008. Sixteen Chinook salmon were sampled in North Point Marina and four of those fish had a fin clip indicating Waukegan south harbor as the origin. No Chinook salmon have been stocked in North Point Marina, so all of those fish strayed to that harbor from other sources. One marked Chinook salmon was sampled in both Diversey Harbor (31 Chinook salmon total) and Jackson Park inner harbor (11 Chinook salmon total). Both of these fin-clipped Chinook salmon had a LPRV fin clip indicating that they were stocked in 2006 and may have been stocked into Waukegan or Jackson Harbors.

Coho salmon

Coho salmon CPUE was more than five times higher at Diversey Harbor (50.8 fish/hour) compared to Waukegan south harbor (9.1 fish/hour). Catch rate for coho salmon has been variable among harbors, with the exception of Waukegan south harbor in 1998-2002, when coho salmon CPUE was consistently near 25 fish/hour. Coho salmon CPUE increased (200-500%) at all harbors from 2006 and 2007 and from 2007 to 2008 except at Jackson Park inner harbor. CPUEs in 2006 and 2007 were the lowest CPUEs since before 1998.

Sampled coho salmon ranged in length from 390 to 875 mm (Figure 4). Previous sampling has indicated that the typical length distribution contains of single mode and is skewed toward smaller sizes. The mean length of coho salmon we sampled in 2009 (577 mm) was nearly 2 inches longer than usual (525 mm).

No fin-clipped coho salmon have been stocked in Illinois harbors since 1998. Previous information on returns of fin-clipped coho salmon has indicated that coho salmon generally return to Illinois harbors to spawn following two summers in the lake. One of the 494 coho salmon sampled in 2009 had a fin clip (adipose). The origin of the clipped fish was the state of Michigan.

Rainbow Trout

Only Arlee-strain rainbow trout were stocked in Illinois harbors in 1999 – 2001, and approximately 50,000 Arlee-strain and 60,000 Skamania-strain rainbow trout have been stocked each year since 2002. In general, relatively few rainbow trout are sampled during the fall in comparison to coho and Chinook salmon. The time-series of relatively low CPUEs provides little meaningful information on whether a trend in the data exists or not. The majority of

rainbow trout sampled had a adipose right-pectoral fin clip indicating Illinois origin (Skamania strain).

An attempt to mark all rainbow trout stocked in Lake Michigan has been less than successful. In Illinois and Michigan, all rainbow trout have been fin-clipped prior to stocking since 1996. Less than half of the 500,000 rainbow trout stocked in Wisconsin waters are usually marked however, and less than 10% of the 500,000 rainbow trout stocked by Indiana are marked. Fin clips were evident most (19 of 25) rainbow trout. Only one of those fin clips (AdRP) corresponded to rainbow trout stocked in Illinois waters (17 fish). The average length of rainbow trout we sampled in 2009 was 702 mm (Figure 5).

Brown trout

The number of brown trout that we have sampled in any particular year has been highly variable and most strongly influenced by the number sampled at North Point Marina. Brown trout CPUEs have been variable among harbors and years although the recent trend has been declining CPUEs. Given that the number of brown trout stocked in Illinois waters has been consistent, it is likely that the variability in sport angler harvest and fall returns of brown trout is driven by stocking in other states (e.g., 1.2 million stocked in Wisconsin waters annually), the closing of a primary shore fishing site (Midwest Generation in Waukegan), and weather patterns, rather than the strain (Plymouth Rock) of brown trout stocked in Illinois.

Fins typically are not clipped on brown trout stocked in Illinois waters because significant regeneration of the fins and the naturally-occurring curving of the fins by this species make identification difficult. None of the brown trout we sampled had fin clips. The length distribution of brown trout that we sampled in 2009 was similar to previous years (Figure 6).

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

The number of Chinook salmon stocked in Lake Michigan was reduced in 1999 in an effort to minimize stress on the limited forage base and lessen the possibility of another epizootic outbreak which resulted in mass die-offs of Chinook salmon in the past. Large numbers of age-0 Chinook salmon (stocked in 1999) were collected in the 1999 fall harbor assessment and that cohort was well represented as age-1 in 2000 and age-2 in 2001. This cohort accounted for 56% of the Chinook salmon we sampled in 2002. Virtually no age-0 Chinook salmon however were collected in 2000 – 2009. Chinook salmon numbers were reduced again in 2006 and the effect of that reduction has yet to be fully realized but may have accounted for decreases in CPUEs of age-3 Chinook salmon in our survey.

Recommendation: Work with Salmonid Task Group of the Lake Michigan Committee to continue development of an assessment of the effects of reduced Chinook salmon stocking on a lakewide basis and add data to the Red Flags evaluation table.

A high return rate of stocked salmon to Illinois harbors is not likely to be realized since Illinois lacks tributary streams in which fish may imprint and return to at maturity and relatively few fish are stocked compared to other jurisdictions. In an attempt to identify stocking site fidelity and track mortality rates, all fin-clipped Chinook salmon stocked in Illinois waters have been stocked in Waukegan south harbor since 1999. Similar percentages of fin-clipped Chinook salmon were found each year in both Waukegan south harbor (53 and 52%) and North Point Marina (25 and 24%) in 2003 and 2004. Percentages increased at both locations in 2005 and 2006 and were similar in 2007. The decline to 61% (2008) and 63% (2009) clipped fish in Waukegan south

harbor may indicate a stabilization of these return rates which is a critical key to understanding movement patterns and fidelity.

Recommendation: Continue to stock Waukegan south harbor with clipped Chinook salmon for at least one additional year to determine if the percentage of fish that stray into Waukegan harbor from other stocking sites is consistent among years. Provide double-marked fish for the lakewide assessment of Chinook salmon natural recruits through 2011.

LITERATURE CITED

Keller, M., K. D. Smith, and R. W. Rybicki. 1990. Review of Salmon and Trout Management in Lake Michigan. Report to the Michigan Department of Natural Resources. 254pp.

Robillard, S. R., and J. E. Marsden. 1996. Comparison of otolith and scale ages for yellow perch from Lake Michigan. Journal of Great Lakes Research 22(2):429-435.

Table 1. Annual salmonid stocking plan for the Illinois waters of Lake Michigan and sites where fall harbor assessments are conducted. Numbers of fish are approximate and rounded to the nearest 1,000.

Location	Fall harbor assessment site	Number of fish stocked				
		Coho salmon	Chinook salmon	Rainbow trout (Arlee)	Rainbow trout (Skamania)	Brown trout
North Point Marina	X					10,000
Waukegan south harbor	X	100,000	83,500		25,000	10,000
Highland Park				10,000		10,000
Dawes Park				10,000		10,000
Belmont Harbor						10,000
Montrose Harbor				10,000		10,000
Diversey Harbor	X	100,000	83,500		25,000	10,000
Burnham Harbor				10,000		10,000
Jackson inner harbor	X	100,000	83,500	10,000		10,000
Calumet Harbor						10,000
Totals		300,000	250,500	50,000	50,000	100,000

Table 2. Amount of electrofishing effort (min) and water temperature in four Illinois harbors sampled in 2009.

	Location			
Dates	North Point Marina	Waukegan south harbor	Diversey Harbor	Jackson Park inner harbor
22, 24 September	42 / 69 F	45 / 70 F	60 / 71 F	35 / 74 F
29 Sept, 1, 2 Oct	42 / 61 F	60 / 60 F	47 / 66 F	35 / 65 F
7, 9 October	45 / 59 F	60 / 58 F	55 / 58 F	10 /
13, 14 October	45 / 52 F	60 / 52 F	52 / 54 F	not sampled
19, 20 October	35 / 50 F	50 / 52 F	70 / 50 F	25 / 50 F
26, 30 October	30 / 52 F	55 / 52 F	63 / 55 F	25 /
2, 6 November	45 / 51 F	50 / 51 F	55 / 50 F	20 / 51 F
9, 13 November	55 / 51 F	55 / 42 F	60 / 50 F	not sampled

Table 3. Total electrofishing effort (hrs:min) and numbers of salmonids sampled in four Illinois harbors in 2009. The double underline indicates species which were not stocked in North Point Marina.

		Species				
Harbor	Effort (hrs)	Coho Salmon	Chinook Salmon	Rainbow Trout	Brown Trout	All Salmonids
North Point Marina	5.65	13	16	1	8	38
Waukegan south harbor	7.25	66	168	13	3	250
Diversey Harbor	7.70	391	31	10	1	433
Jackson Park inner harbor	2.50	24	11	0	0	35
All harbors	23.1	494	226	24	12	756

Table 4. Number of Chinook salmon with Illinois fin clips sampled in four Illinois Harbors in 2009.

			Sample Location (2009)			
Fin Clip	Year Stocked	Location Stocked	North Point Marina	Waukegan south harbor	Diversey Harbor	Jackson Park inner harbor
RPLV	2005	Waukegan south harbor	0	4	0	0
LPRV	2006	Waukegan / Jackson	2	33	1	1
RP	2007	Waukegan south harbor	1	50	0	0
LP	2008	Waukegan south harbor	1	19	0	0

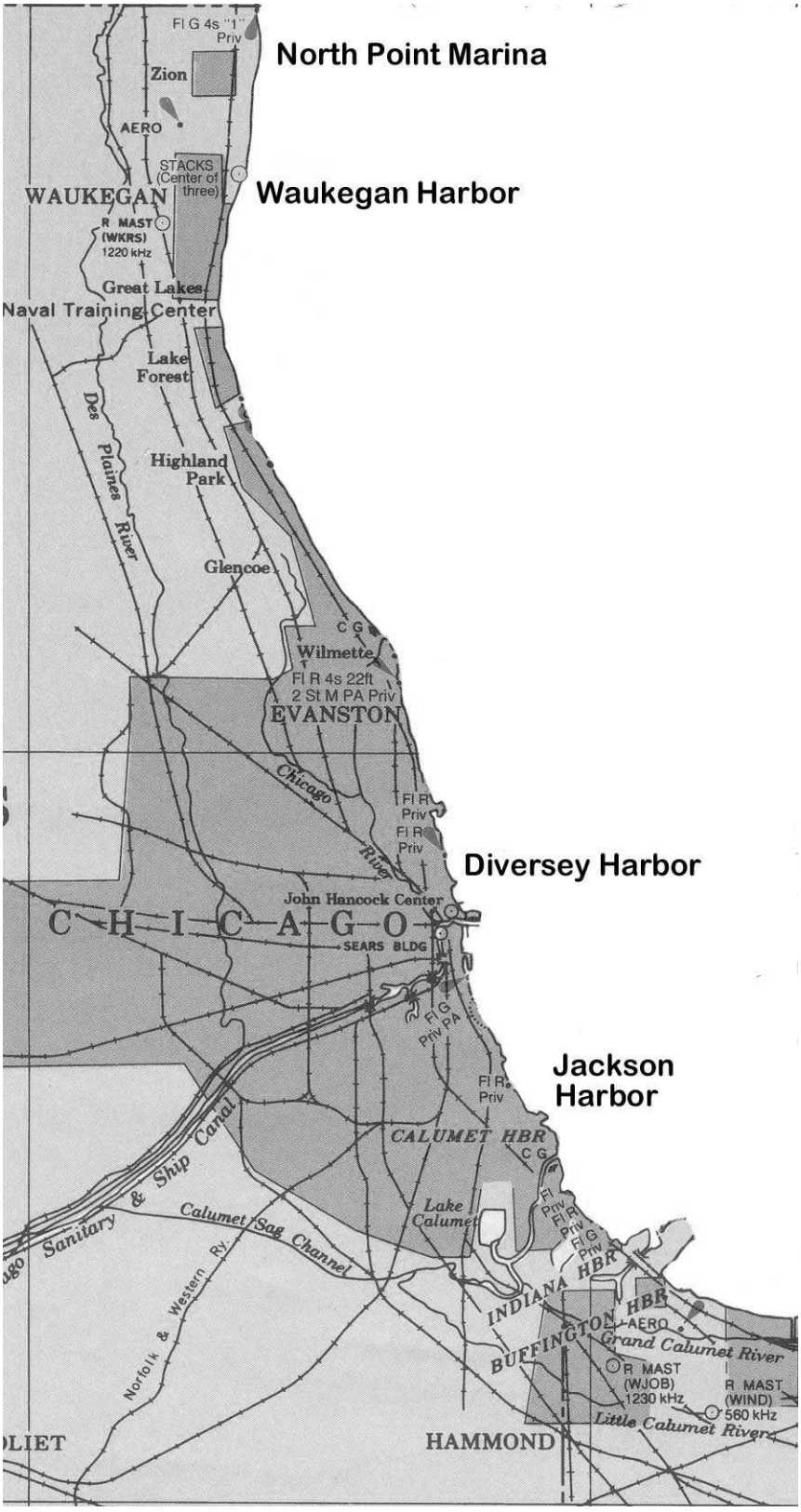

Figure 1. Harbors where salmonids were sampled in 2009.

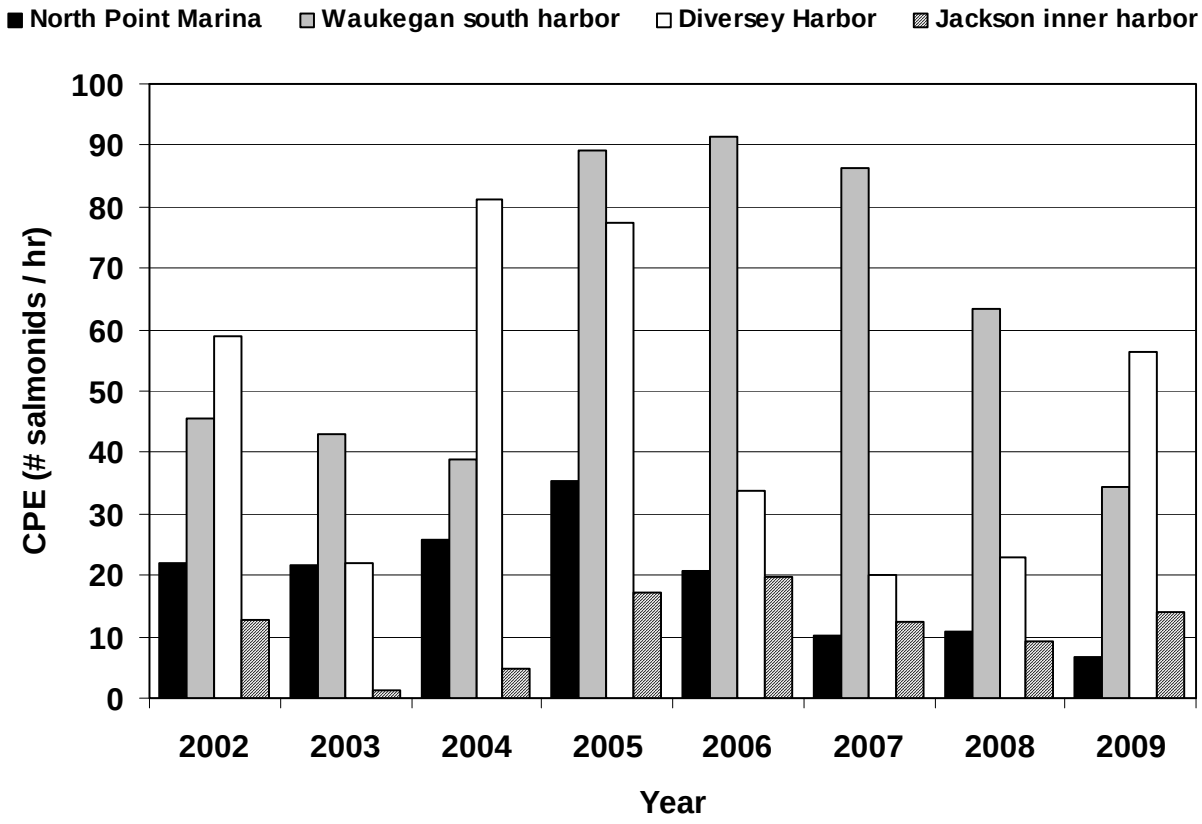

Figure 2. Catch-per-unit-effort for all salmonid species combined at four sampling sites, 2002-2009.

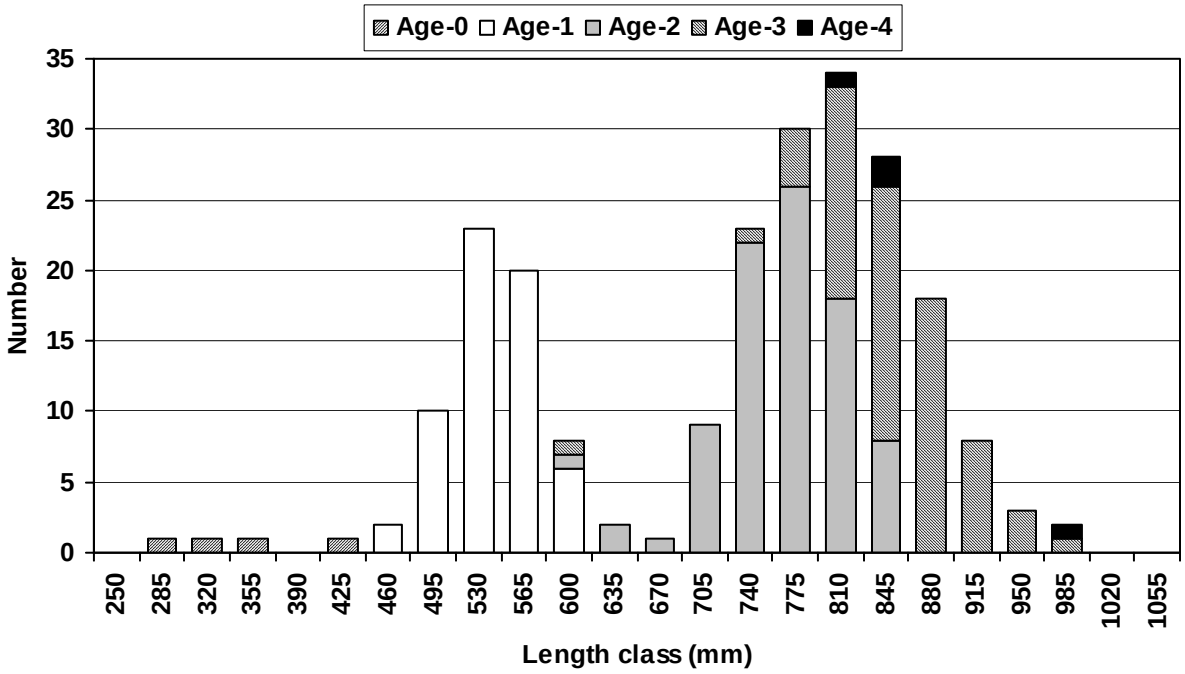

Figure 3. Length distribution of age-0 through age-4 Chinook salmon sampled in four Illinois harbors in 2009.

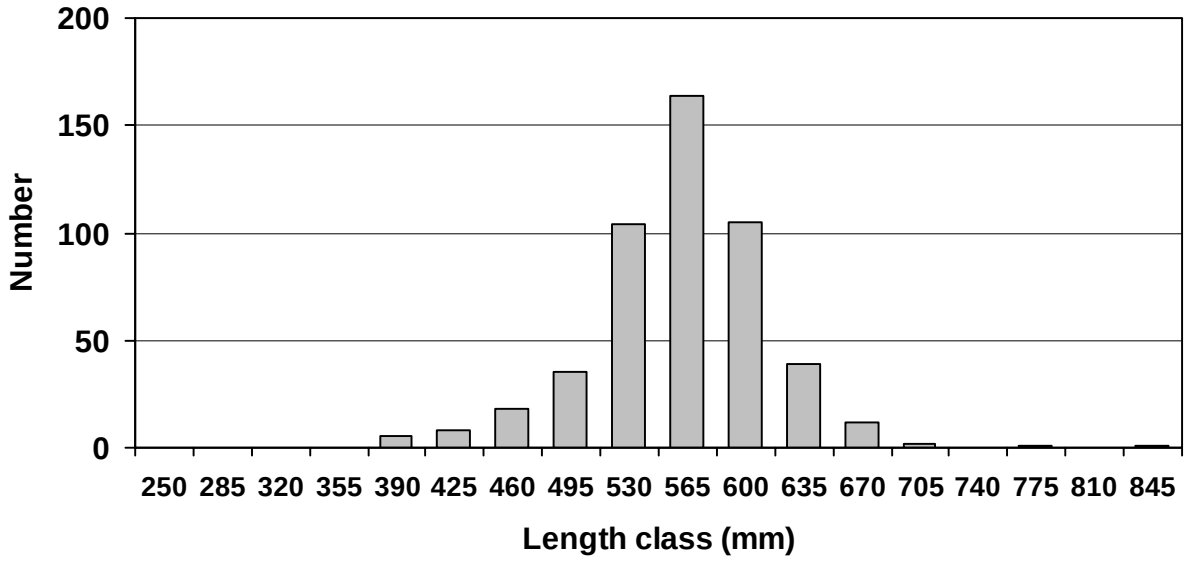

Figure 4. Length distribution of coho salmon sampled in four Illinois harbors in 2009.

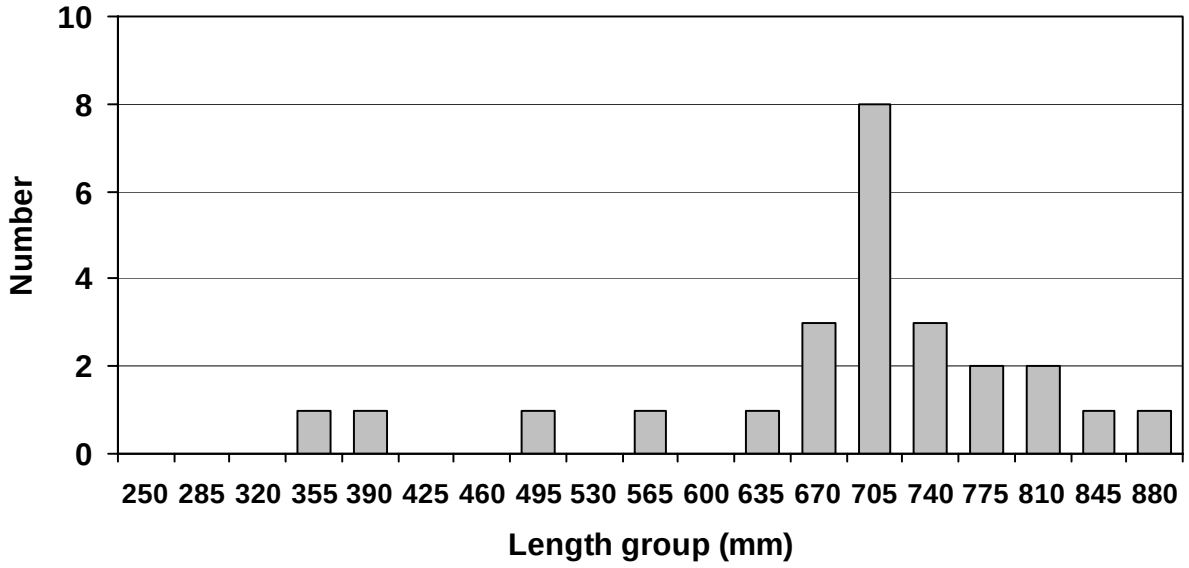

Figure 5. Length distribution of rainbow trout sampled in four Illinois harbors in 2009.

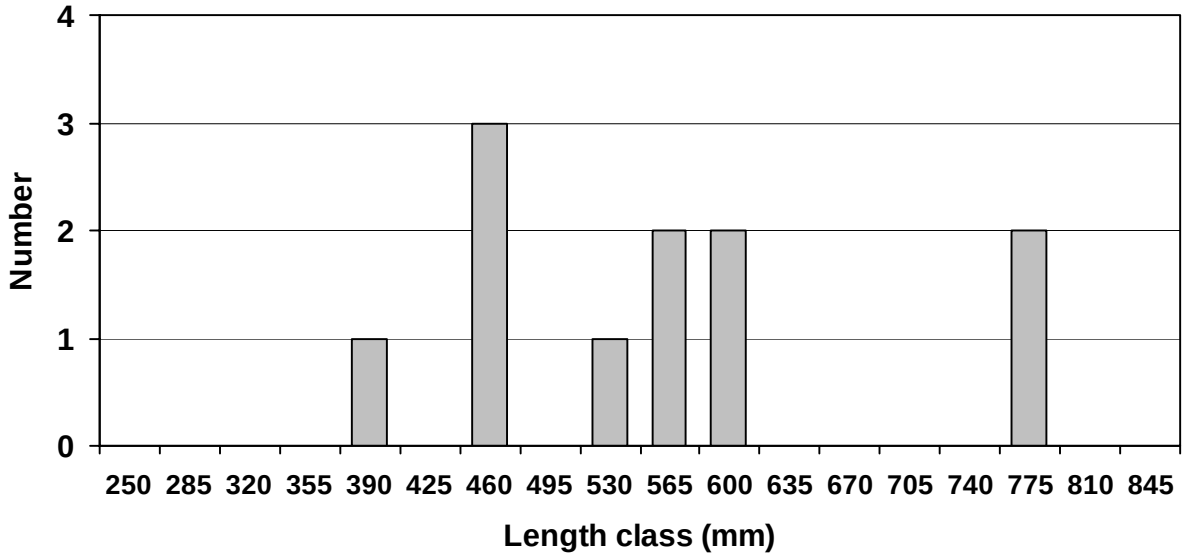

Figure 6. Length distribution of brown trout sampled in four Illinois harbors in 2009.