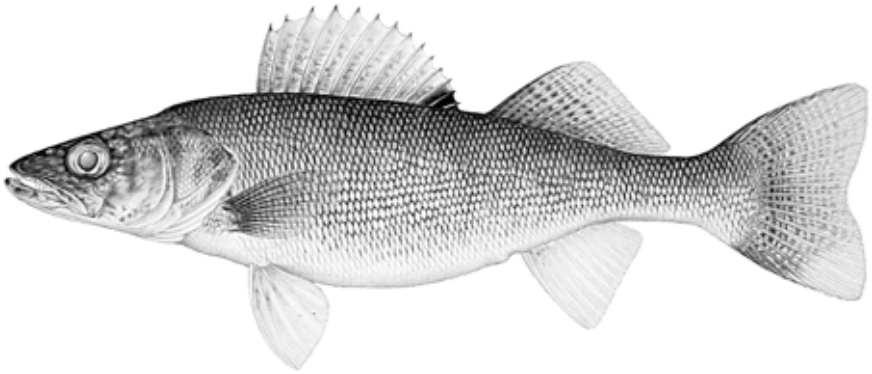
Report of the

LAKE ERIE WALLEYE TASK GROUP

March 2001



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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

Charges to the WTG from the STC, 2000-2001

The charges from the Standing Technical Committee to the Walleye Task Group for the period from March 2000 to February 2001 were to:

1) Assess the effectiveness of various exploitation options and potential expectations for stock response and use this analysis to derive a recommended multi-year TAC that will "reverse declines and rebuild stocks of walleye and achieve a broad distribution of benefits throughout Lake Erie" to support the Lake Erie Coordinated Percid Management Strategy (CPMS)

2) Develop recommended west-central and eastern basin allowable harvest ranges for 2001 incorporating risk assessment and using state-of-the-art population and yield models.

3) Maintain and update centralized time series required for population models including tagging, fishing harvest and effort by grid, growth rate, maturity schedule, and agency or interagency abundance indices.

4) Use various data (harvest and effort, index fishing, tagging, etc.) on spatial and temporal distribution of walleye to determine stock discreteness and contributions to lakewide fisheries and the relative stability of recruitment from river versus shoal spawners.

5) Use the SWIM model to evaluate the long-term effect of various management strategies on sustainability of walleye.

6) Assist Forage Task Group with bioenergetic analysis of walleye consumption of prey fish.

Review of Walleye Fisheries in 2000

The 2000 total estimated lakewide harvest of walleye was 3.6 million fish, a 24% decline from 4.8 million in 1999 and the lowest harvest since 1983 (Tables 1 and 2). The total harvest represented less than half of the total allowable catch (TAC) and included fish caught incidentally in commercial fisheries for other species. Commercial harvest of walleye dropped 34% to 2.3 million fish in 2000 with similar reductions across all Management Units (Table 2, Fig. 2). The commercial harvest was close to the 1975-2000 mean. Conversely, the sport harvest of 1.3 million fish was similar to 1999 in total and by Management Unit, but was only half of the 1975-2000 mean (Table 2, Fig. 2).

Total commercial gill net effort increased 4% to 43,054 kilometers of net with similar increases in all Management Units (Table 3, Figure 3). Total sport effort continued the declining trend seen since 1988 dropping 11% to 4,183 angler hours, the lowest since 1978 (Table 3, Figure 4). Management Units 1-3 exhibited similar declines, 10%, while Unit 4 declined 20%.

Commercial catch-per-unit-of-effort (CUE) declined substantially to 53.2 walleye/kilometer of net in 2000, half the long-term mean and a continuation of a declining trend observed since 1987 (Table 4, Figure 5). Declines were smallest in Unit 2 (30%) and similar in other Units (37-42%). Sport CUE's showed a slight increase in all units although, the average catch rate of 0.32 fish/angler hour was 29% below the 1975-2000 mean (Table 4, Figure 5).

Harvests in both fisheries were dominated by the 1996 (29% overall), 1997 (24% overall), and 1998 (20% overall) year-classes (Tables 5 and 6). These three year-classes comprised 82% of the harvest in Unit 1 and 64% in Unit 2 however, only the 1996 year-class was prominent in Unit 3 (29%) and Unit 4 (16%). Harvests of older age groups increased from west to east with 72% of the fish harvested in Unit 4 being age-6 and older. Overall, older age groups were well represented with age six and older fish making up 23% of the lakewide harvest.

Mean age of the catch typically increases from west to east by management unit, and in 2000 it ranged from 3.7 to 9.8 years in the sport fishery and from 3.7 to 6.5 in the commercial fishery, with a mean of 4.2 years for the entire fishery (Table 7). Modest increases were seen in both sport (4.2 years) and commercial (3.8 years) fisheries primarily due to increased contribution of the 1996 year-class. Both fisheries and the lakewide average were above long-term means.

Coordinated Percid Management Strategy

The Lake Erie Committee (LEC) of the Great Lakes Fishery Commission announced in March, 2000 that it would develop a coordinated, long-term strategy to protect and rebuild the walleye and yellow perch stocks in Lake Erie, that was referred to as the Coordinated Percid Management Strategy (CPMS). In June the LEC, made up of fishery managers from around the lake, met to discuss the status of walleye stocks. The LEC had been increasingly concerned about the declining abundance of walleye in Lake Erie since the late 1980s. A number of indicators were reviewed which demonstrated large changes had occurred with the walleye population of Lake Erie in the 1990's:

- reduced and more variable fishing success for both sport and commercial fisheries
- declining indices of abundance (fishery and index cues; CAGEAN population estimates)
- truncated population structure (fewer older fish)
- increased reliance on juvenile fish in the harvest
- reduced survival
- geographic distribution declining in east and central basins to a stronghold in the west
- declining growth rates

The Committee noted that the harvest of walleye may not have been the sole cause of the problem (other factors include: exotics such as zebra mussels and gobies, habitat and food web changes), but if harvest levels were kept too high, the recovery of walleye stocks would be severely restricted or prevented. Concerns regarding the model and its parameters (M, Ft) were not believed to have caused serious stock assessment problems because harvests had fallen short of Total Allowable Catches (TAC) through the 1990's.

To halt these trends and promote recovery of walleye, the LEC proposed substantial changes in the walleye harvest. It was agreed that development of a conservative total allowable catch for 2001 that would not be increased for 3 years would be the most likely strategy to achieve the CPMS objectives.

Accordingly, a new charge was added to the Walleye Task Group for 2000/2001 to: " *to derive a recommended multi-year TAC that will "reverse declines and rebuild stocks of walleye and achieve a broad distribution of benefits throughout Lake Erie"*. The Walleye Task Group identified the following activities to meet this new charge:

a) develop and refine the essential analytical tools to support accurate estimation of walleye stock size by catch-at-age analysis.
b) update and refine our estimates of walleye population parameters (survival, natural mortality, growth, …)
c) review the current yield model and analysis and evaluate the use of alternate yield analysis to derive a Recommended Allowable Harvest (RAH)
d) identify past and current walleye stock status, the relation of stock to recruitment and exploitation, the role of habitat, fish community and other factors that could influence walleye production, and identify potential constraints that could influence realisation of the CPMS objective and its timeframe for achievement
e) define movement and exploitation of walleye stocks in L. Erie to support management of the stock concept

The WTG identified tasks a) to c) as priority steps which were the focus of their work in 2000. For the first task, the WTG explored and developed the use of Auto Differentiation Model Builder (ADMB) software (C++ based) to generate catch-at-age analysis as an alternate to the previously used R. Deriso CAGEAN software (Fortran based) that had been used since 1990. The new software alleviated some previous constraints: allowed the use of a longer data series (22 vs. 16 years), the addition of auxiliary sources of effort-catch data (e.g., index fishing survey gear which should add an 'unbiased' input expected to reduce residuals), and removed the terminal F parameter (see section: " *Transition to ADMB Catch-Age Analysis from CAGEAN"*). For the second task, the WTG updated estimates of walleye population parameters (Z, S, M, …). For the third task, an alternate yield analysis was derived that should promote rebuilding of walleye stocks (see section: *"Allowable Harvest Recommendations for 2001, 2002, and 2003"*).

In January, the Walleye Task Group sought an external scientific review to evaluate their progress. The reviewers, Drs. R. Myers and J. Bence, endorsed the priorities and analyses completed by the Walleye Task Group to support the CPMS. The reviewers also generated independent estimates of L. Erie walleye stock size which were similar to those of the task group.

Transition to ADMB Catch-at-Age Analysis from CAGEAN

With growing concerns about the accuracy of CAGEAN abundance and fishery mortality estimates, the WTG sought alternative methods to assess walleye population dynamics. In

January 2000, WTG members reviewed Auto Differentiated Model Builder (ADMB) software at a workshop conducted by Dr. Pat Sullivan, Cornell University, as an alternative method to execute catch-at-age analysis. The main advantages of ADMB catch-at-age analysis over CAGEAN include flexibility for adding longer time series (>16 years), including additional auxiliary information (survey data sets), and modification of output parameters. Moreover, WTG members could modify the program code to explore more options than available under CAGEAN. Dr. Sullivan and Ph.D. student Scott Boomer developed a working ADMB prototype model for Lake Erie walleye that, when configured similarly (16-year time series, no auxiliary information, M=0.32, and terminal F constraint in effect), closely matched CAGEAN estimates of abundance and F from a year ago. However, Dr. Sullivan recommended against having a terminal F constraint in the model, so it was inactivated in future configurations.

After months of exploring various model configurations with ADMB, WTG members recommended ADMB to estimate abundance and mortality trends in the Lake Erie walleye population, due to the previously stated advantages of this model over CAGEAN. The group further agreed to 1) include the years 1978 through 2000 in the analyses, 2) establish blocks of time (1978-83, 1984-88, 1989-2000) to accommodate changing catchability in the fisheries, 3) accept an instantaneous natural mortality rate (M) of 0.32 for all age groups in all years (as derived from tag-return analyses), and 4) estimate catch, effort, and auxiliary gear weighting coefficients (lambdas) with techniques outlined by the original developers of catch-at-age analysis. Auxiliary survey gear data were derived from a composite, catch-per-unit-effort index of relative abundance that incorporated three fall index gill net series for the western and central basins (from MDNR, ODNR, and OMNR) and one spring trap net series (MDNR). The index was weighted to equally represent contributions from all surveys and generally depicted a growing walleye population from 1978-1989 that declined thereafter (Fig. 7). Catch and effort lambdas were set at 1.0 for the commercial fishery. Lambdas for the recreational fishery were estimated from preliminary model outputs, resulting in a catch lambda of 1.0 and an effort lambda of 0.2. The survey gear lambda was set at 1.0. Thus, model outputs were strongly (but equally) influenced by fishery catch, gill net effort, and survey gear data sets, and were only marginally influenced by trends in angler effort. This configuration reflected the relative level of confidence attributed to each of these data sources as valid indicators of walleye abundance.

Trends in abundance were highly correlated between CAGEAN and ADMB catch-at-age analysis runs but were substantially lower in the ADMB version (Fig. 8). For example, walleye abundance in 1999 was estimated at 36.8 million fish, 36% lower than CAGEAN estimates a year ago (57.9 million fish, WTG Report 2000). Differences in estimated abundance between models were attributed to the expanded time series in the ADMB model (from 16 to 23 years) and the inclusion of the auxiliary survey gear index. Both models estimate declines in walleye abundance of about 60% from 1988 through 2000.

Walleye Standing Stock Size, 1978-2000

The WTG has adopted the ADMB version of catch-at-age analysis for estimation of walleye standing stock size and fishing mortality rates. Age-2 and older walleye abundance was estimated, on average, at 35.2 million fish (Table 8) prior to the 2000 fishing season or about

40% lower than the projected estimates (49.8 million fish) of a year ago from CAGEAN. However, the 95% confidence interval for the 2000 population average (23 to 47 million, Fig. 9) overlaps the projected range (38 to 61 million) from a year ago. The fisheries removed about 13% of the available standing stock, resulting in an estimated survival of about 62% in 2000 (Table 8). From these survival rates, we estimate a population of about 22 million (14 to 29 million, 95% C.I.) age-3 and older walleyes in 2001.

Abundance of age-2 walleye was estimated from regression models of observed age-2 abundance (from catch-at-age analysis) on August age-0 interagency bottom trawl indices (Fig. 10). Estimated abundance of the 1999 year class for 2001 is 26.2 million fish (21 to 32 million, 95% C.I.), which ranks as the strongest year class since 1986 (Fig. 11). The 2000 year class, expected to be the weakest since 1995, is projected to recruit only about 3.7million age-2 fish (3 to 4 million, 95% C.I.) to the population in 2002 (Fig. 11).

The total projected abundance of age-2 and older walleye in 2001 is 34 to 63 million fish, or 48.4 million fish on average (Table 9). About 54% of the population is attributable to the 1999 year class, 40% to ages 3-6, and 6% from year classes prior to 1995 (Table 9, Fig. 12). The projected average abundance of 48.4 million adult walleye is slightly above average for the 1990s and the highest since 1993 but it is largely composed of age-2 (1999 year-class) fish (Fig. 12). Adult walleye abundance will decline in 2002, owing to a weak 2000 year class (Table 9), but the full extent of the decline will be influenced by fishing mortality in 2001.

Allowable Harvest Recommendations for 2001, 2002, and 2003

A major objective of the CPMS is to halt the walleye decline by 2003 through conservative Total Allowable Catches over the 2001-03 period. Moreover, the LEC desires a single TAC that will serve as a ceiling across all years and will not be exceeded though it could be reduced if necessary to meet the objective. Given these directives, the WTG has temporarily abandoned the use of the past target fishing mortality rate ($F_{0.1}$) in favor of a simpler approach that does not require long-term assumptions about growth or natural mortality. Essentially, we have balanced recruitment gains in the population against removals by fishing and natural causes, such that projected abundance in 2003 will be no less than that in 2000. Since age-2 recruitment can be forecasted through 2002 from trawl data (Fig.11, Table 9), we need only an estimate for the 2001 year class to project the supply of fish through 2003. Walleye survival can then be influenced by managing fishing mortality to ensure that abundance in 2003 is at least as high as it was in 2000. Natural mortality (M) is assumed to be 0.32, as estimated from analysis of tag-return data by the WTG.

The strength of the 2001 year class will measured with interagency trawling in August. In lieu of that estimate, we applied a normal probability distribution function to calculate the probability of having a year class of any abundance level, based on the mean (13.880 million fish) and standard deviation (8.147 million fish) of age-2 abundance from estimates in 1990-2001(Tables 8-9). For example, we estimate a 60% chance of having at least 12 million age-2 recruits and an 80% chance of at least 7 million age-2 recruits in 2003 (Fig. 13).

Projected fishing mortality can be modeled, relative to the levels in 2000, to quantify resulting changes in abundance under different recruitment levels (Fig. 14). If age-2 recruitment from the 2001 year class is at least average (i.e., 50% probability of occurring), no reductions in the 2001 fishing mortality would be necessary to halt the decline in abundance by 2003. However, if the 2001 year class is weak (i.e., < 7 million age-2 fish), we cannot halt the decline by 2003, regardless of fishing intensity. Ultimately, we selected a recruitment level that would likely occur in a majority of years (60% probability), which requires a 30% reduction in fishing mortality relative to levels in 2000 to halt the decline in abundance by 2003 (Table 9, Fig. 15).

By applying the reduced fishing mortality rate to projected standing stock size estimates, we calculated expected catches, with 95% C.I.'s, for 2001, 2002, and 2003 (Table 10). Mean catches are about 3.4 million fish (2.0 to 4.8 million, 95% C.I.) in 2001-02 and 2.9 million fish (1.7 to 4.1 million, 95% C.I.) in 2003. **The Walleye Task Group recommends the LEC adopt a conservative TAC that would not exceed 3.4 million fish for any year within the 2001-03 period.** A conservative harvest strategy will:

1. *Promote survival of the strong 1999 year class and enhance its contribution as maturing fish to the reproductive population by 2003,*
2. *Increase potential quantity of eggs being deposited by the walleye population each year*
3. *Broaden the age composition in the population, and*
4. *Address continued uncertainty about the effects of reduced productivity on sustainable fish yields.*

Other Walleye Task Group Charges

Centralized Databases

WTG members currently manage several databases. The tagged walleye database, consisting of tag return and tagged population information dating back to 1986, is maintained by MDNR. Fishery characteristics (catch at age and effort) are part of the database used in catch-at-age analysis. A more resolute version of these data (e.g., catch and effort by statistical grid) is managed by MDNR. Growth and maturity data are stored in an interagency gill net database that has been managed by ODNR-Sandusky. This database needs to be updated to include monofilament data from the OMNR Partnership program at sites used for calculation of the age-1 index for Ontario, as well as data from New York and Ontario for the eastern end of the lake. This database will also be reformatted and converted into a relational database to make it easier to use, update annually, and retrieve data. Relative abundance data from these gill net surveys has been managed in similar fashion. Growth and relative abundance data from the interagency trawl program in the western basin are stored in databases managed by MDNR. Use of WTG databases by non-members is permitted following protocol established in the 1994 WTG Report (Appendix A).

Analysis of Walleye Distribution Data

B. Haas, M. Turner, and B. Morrison are collaborating to write a manuscript summarizing results from the interagency tagging effort. Topics will include distribution of Lake Erie walleye and discreteness and differences among tagged populations, the use of reward tags to estimate non-recovery rates and estimation of mortality rates from tag return data. The publication should be completed in 2001. This work many be complimented by a project proposal by Dr. P. Sullivan to fund a student to collate and analyse walleye temporal / spatial distribution data.

SWIM Model and Management Strategies

During 2000, Tim Johnson worked to integrate the responses from managers and biologists regarding management scenario metrics and endpoints for SWIM. On the basis of these responses, he plans to construct a user-friendlier interface to encourage the management group to begin gaming with SWIM. Ongoing hardware and software updates by the different agencies may require the recording of SWIM in a more Windows NT compatible environment.

Assistance to the Forage Task Group

The WTG will continue to provide CAGEAN outputs, walleye tag recapture distributions, and other analyses of walleye abundance and distribution to assist the FTG with their bioenergetics charge of estimating forage consumption by Lake Erie predators.

Regulation Changes

The following walleye regulation changes are expected to be implemented in 2001:
Ontario: 2001 Sport Fishing – Bag Limit reduced to 4 fish March – April; 6 fish May – Feb.
Michigan: 2001 Sport Fishing – Bag Limit reduced from 10 fish to 6 fish effective April 1
Ohio: 2001 Sport Fishing – Bag Limit reduced to 4 fish March – April, 6 fish May – Feb.
Pennsylvania: 2001 – no regulation changes in effect
New York: 2001 – no regulation changes in effect
There are other fishing regulation changes that are proposed for 2002.

Recommended Charges to the Walleye Task Group in 2001-2002

The WTG recommends the following charges to the group in 2001-2002**:**

1) Continue analyses supporting development and refinement of the multi-year harvest strategy for walleye in support of the Coordinated Percid Management Strategy.
2) Produce recommended allowable Lake Erie walleye harvest ranges incorporating risk

assessment and using state-of-the-art population and yield models.

3) Maintain and update centralized time series required for population models including tagging, fishing harvest and effort by grid, growth rate, maturity schedule, and agency or interagency abundance indices.
4) Assemble and analyse various data (harvest and effort, index fishing, tagging, genetic, etc.) on the spatial and temporal distribution of Lake Erie walleye to determine stock discreteness and contributions to lakewide fisheries.
5) Assist the Forage Task Group with bioenergetic analysis of walleye consumption of prey fish.
6) Use various models to evaluate the long-term effects of different management strategies on sustainability of walleye.

Literature Cited

Henderson, B., R. Haas, R. Knight, R. Lorantas, M. Rawson. 1990. Quota estimation for Lake Erie walleye: model and results. Statistics and Modeling Group Report, Ontario Ministry of Natural Resources, 48 pp.

Table 1. Lake Erie walleye total allowable catch (top) and measured harvest (bottom), in numbers of fish, from 1976 to 2000. Allocations based on water area are: Ohio, 51.4%; Ontario, 43.3%; and Michigan, 5.3%. New York and Pennsylvania do not have assigned quotas but are included in the annual catch total.

Year	Michigan	Ohio	New York	Penn.	Ontario	Total
1976	80,500	479,500			355,000	915,000
	30,245	**640,200**			**206,860**	**877,305**
1977	87,600	521,600			386,300	995,000
	106,530	**2,167,500**			**371,403**	**2,645,433**
1978	73,000	433,000			321,000	827,000
	72,195	**1,586,756**			**446,774**	**2,105,725**
1979	207,000	1,230,000			911,000	2,348,000
	162,375	**3,314,442**			**734,082**	**4,210,899**
1980	261,700	1,558,600			1,154,100	2,974,400
	183,140	**2,169,800**			**1,049,269**	**3,402,209**
1981	367,400	2,187,900			1,620,000	4,175,300
	95,147	**2,942,900**			**1,229,017**	**4,267,064**
1982	504,100	3,001,700			2,222,700	5,728,500
	194,407	**3,015,400**			**1,260,852**	**4,470,659**
1983	572,000	3,406,000			2,522,000	6,500,000
	145,847	**1,864,200**			**1,416,101**	**3,426,148**
1984	676,500	4,028,400			2,982,900	7,687,800
	351,169	**4,055,000**			**2,178,409**	**6,584,578**
1985	430,700	2,564,400			1,898,800	4,893,900
	460,933	**3,730,100**			**2,435,627**	**6,626,660**
1986	660,000	3,930,000			2,910,000	7,500,000
	605,600	**4,399,400**			**2,617,507**	**7,622,507**
1987	490,100	2,918,500			2,161,100	5,569,700
	902,500	**4,433,600**			**2,688,558**	**8,024,658**
1988	397,500	3,855,000			3,247,500	7,500,000
	1,996,788	**4,890,367**	**85,282**		**3,054,402**	**10,026,838**
1989	383,000	3,710,000			3,125,000	7,218,000
	1,091,641	**4,191,711**	**129,226**		**2,793,051**	**8,205,628**
1990	616,000	3,475,500			2,908,500	7,000,000
	747,128	**2,282,520**	**47,443**		**2,517,922**	**5,595,013**
1991	440,000	2,485,000			2,075,000	5,000,000
	132,118	**1,577,813**	**34,137**		**2,266,380**	**4,010,449**
1992	329,000	3,187,000			2,685,000	6,200,000
	249,518	**2,081,919**	**14,384**		**2,497,705**	**4,843,525**
1993	556,500	5,397,000			4,546,500	10,500,000
	270,376	**2,668,684**	**40,032**		**3,821,386**	**6,800,483**
1994	400,000	4,100,000			3,500,000	8,000,000
	216,038	**1,468,739**	**59,345**		**3,431,119**	**5,175,247**
1995	477,000	4,626,000			3,897,000	9,000,000
	107,909	**1,435,188**	**26,964**		**3,813,527**	**5,383,570**
1996	583,000	5,654,000			4,763,000	11,000,000
	174,607	**2,316,425**	**38,728**	**89,087**	**4,524,639**	**7,054,400**
1997	514,000	4,986,000			4,200,000	9,700,000
	122,400	**1,248,846**	**29,395**	**88,682**	**4,072,779**	**5,473,421**
1998	546,000	5,294,000			4,460,000	10,300,000
	114,606	**2,303,911**	**34,090**	**124,814**	**4,220,042**	**6,793,408**
1999	477,000	4,626,000			3,897,000	9,000,000
	140,269	**1,033,733**	**23,133**	**89,038**	**3,541,250**	**4,827,423**
2000	408,000	395,7800			3,334,100	7,700,000
	252,280	**932,297**	**28,599**	**77,512**	**2,354,533**	**3,645,221**

Table 2. Annual harvest (thousands of fish) of Lake Erie walleye by gear, management unit, and agency. Units 4 and 5 are combined in Unit 4.

	Sport Fishery																		
	Unit 1				Unit 2			Unit 3			Unit 4				Commercial Fishery (ON)					
Year	**OH**	**MI**	**ON**	**Total**	**OH**	**ON**	**Total**	**OH**	**ON**	**Total**	**ON**	**PA**	**NY**	**Total**	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Total**	**Total**
1975	77	4	7	**88**	10	--	**10**	--	--	--	--	--	--	**98**	--	--	--	--	--	**98**
1976	605	30	50	**685**	35	--	**35**	--	--	--	--	--	--	**720**	113	44	--	--	**157**	**877**
1977	2,131	107	69	**2,307**	37	--	**37**	--	--	--	--	--	--	**2,343**	235	67	--	--	**302**	**2,645**
1978	1,550	72	112	**1,735**	37	--	**37**	--	--	--	--	--	--	**1,771**	274	60	--	--	**335**	**2,106**
1979	3,254	162	79	**3,495**	60	--	**60**	--	--	--	--	--	--	**3,555**	625	30	--	--	**656**	**4,211**
1980	2,096	183	57	**2,336**	49	--	**49**	24	--	**24**	--	--	--	**2,410**	953	40	--	--	**992**	**3,402**
1981	2,857	95	70	**3,023**	38	--	**38**	48	--	**48**	--	--	--	**3,109**	1,037	119	3	--	**1,159**	**4,268**
1982	2,959	194	49	**3,202**	49	--	**49**	8	--	**8**	--	--	--	**3,258**	1,077	134	2	--	**1,212**	**4,470**
1983	1,626	146	41	**1,812**	212	--	**212**	26	--	**26**	--	--	--	**2,051**	1,129	167	80	--	**1,376**	**3,427**
1984	3,089	351	39	**3,479**	787	--	**787**	179	--	**179**	--	--	--	**4,445**	1,639	392	108	--	**2,139**	**6,584**
1985	3,347	461	57	**3,865**	294	--	**294**	89	--	**89**	--	--	--	**4,248**	1,721	432	225	--	**2,379**	**6,627**
1986	3,743	606	52	**4,401**	480	--	**480**	176	--	**176**	--	--	--	**5,057**	1,651	558	356	--	**2,565**	**7,622**
1987	3,751	902	51	**4,705**	550	--	**550**	132	--	**132**	--	--	--	**5,387**	1,611	622	405	--	**2,637**	**8,024**
1988	3,744	1,997	18	**5,758**	584	--	**584**	562	--	**562**	--	--	85	**6,990**	1,866	762	409	--	**3,036**	**10,026**
1989	2,891	1,092	14	**3,997**	867	35	**901**	434	80	**514**	--	--	129	**5,542**	1,656	621	386	--	**2,664**	**8,206**
1990	1,467	747	35	**2,249**	389	14	**403**	426	23	**449**	--	--	47	**3,149**	1,615	529	302	--	**2,446**	**5,595**
1991	1,104	132	39	**1,275**	216	24	**239**	258	44	**302**	--	--	34	**1,851**	1,446	440	274	--	**2,160**	**4,011**
1992	1,479	250	20	**1,749**	338	56	**394**	265	25	**290**	--	--	14	**2,447**	1,547	534	316	--	**2,397**	**4,844**
1993	1,846	270	37	**2,154**	450	26	**476**	372	12	**384**	--	--	40	**3,054**	2,488	762	496	--	**3,746**	**6,800**
1994	992	216	21	**1,229**	291	20	**311**	186	21	**207**	--	--	59	**1,807**	2,307	630	432	--	**3,369**	**5,176**
1995	1,161	108	32	**1,301**	159	7	**167**	115	27	**141**	--	--	27	**1,636**	2,578	681	489	--	**3,748**	**5,384**
1996	1,442	175	17	**1,633**	645	8	**653**	229	27	**256**	--	89	39	**2,670**	2,777	1,107	589	--	**4,473**	**7,143**
1997	929	122	8	**1,059**	188	2	**190**	132	5	**138**	--	89	29	**1,506**	2,585	928	544	--	**4,057**	**5,563**
1998	1,790	115	34	**1,939**	215	5	**220**	299	5	**304**	19	125	34	**2,641**	2,497	1,166	462	28	**4,153**	**6,793**
1999	812	140	34	**987**	139	5	**144**	83	5	**88**	19	89	23	**1,349**	2,461	631	317	68	**3,478**	**4,827**
2000	674	252	34	**961**	165	5	**170**	93	5	**98**	19	78	29	**1,354**	1,603	444	196	48	**2,291**	**3,645**
Mean	2,026	352	42	**2,420**	286	19	**294**	203	25	**217**	19	96	47	**2,926**	1,543	470	320	35	**2,269**	**5,105**

Mean = long-term mean of all reported values through 2000

Table 3. Annual fishing effort for Lake Erie walleye by gear, management unit, and agency. Units 4 and 5 are combined into Unit 4.

	Sport Fishery[a]													Commercial Fishery (ON)[b]				
	Unit 1				Unit 2			Unit 3			Unit 4							
Year	OH	MI	ON	Total	OH	ON	Total	OH	ON	Total	ON	PA	NY	Total	Unit 1	Unit 2	Unit 3	Unit 4	Total
1975	486	30	46	**562**	61	--	**61**	--	--	--	--	--	--	**623**	--	--	--	--	--
1976	1,356	84	98	**1,538**	163	--	**163**	--	--	--	--	--	--	**1,701**	1,796	1,933	--	--	**3,729**
1977	2,768	171	130	**3,069**	151	--	**151**	--	--	--	--	--	--	**3,220**	4,282	1,572	--	--	**5,854**
1978	2,880	176	148	**3,204**	154	--	**154**	--	--	--	--	--	--	**3,358**	5,253	436	--	--	**5,689**
1979	4,179	257	97	**4,533**	169	--	**169**	--	--	--	--	--	--	**4,702**	5,798	1,798	--	--	**7,596**
1980	3,938	624	92	**4,654**	237	--	**237**	187	--	**187**	--	--	--	**5,078**	6,229	1,565	--	--	**7,794**
1981	5,766	447	138	**6,351**	264	--	**264**	382	--	**382**	--	--	--	**6,997**	6,881	2,144	622	--	**9,647**
1982	5,928	449	108	**6,484**	223	--	**223**	114	--	**114**	--	--	--	**6,821**	10,531	2,913	689	--	**14,133**
1983	4,168	451	118	**4,737**	568	--	**568**	128	--	**128**	--	--	--	**5,433**	11,205	5,352	5,814	--	**22,371**
1984	4,077	557	82	**4,716**	1,322	--	**1,322**	392	--	**392**	--	--	--	**6,430**	11,550	6,008	2,438	--	**19,996**
1985	4,606	926	84	**5,616**	1,078	--	**1,078**	464	--	**464**	--	--	--	**7,158**	7,496	2,800	2,983	--	**13,279**
1986	6,437	1,840	107	**8,384**	1,086	--	**1,086**	538	--	**538**	--	--	--	**10,008**	7,824	5,637	3,804	--	**17,265**
1987	6,631	2,193	84	**8,908**	1,431	--	**1,431**	472	--	**472**	--	--	--	**10,811**	6,595	4,243	3,045	--	**13,883**
1988	7,547	4,362	87	**11,996**	1,677	--	**1,677**	1,081	--	**1,081**	--	--	462	**15,216**	7,495	5,794	3,778	--	**17,067**
1989	5,246	3,794	81	**9,121**	1,532	77	**1,609**	883	205	**1,088**	--	--	556	**12,374**	7,846	5,514	3,473	--	**16,833**
1990	4,116	1,803	121	**6,040**	1,675	33	**1,708**	869	83	**952**	--	--	432	**9,132**	9,016	5,829	5,544	--	**20,389**
1991	3,616	440	144	**4,200**	1,241	79	**1,320**	724	155	**880**	--	--	440	**6,840**	10,418	5,055	3,146	--	**18,619**
1992	3,955	715	105	**4,775**	1,169	81	**1,249**	640	145	**786**	--	--	299	**7,109**	9,486	6,906	6,043	--	**22,435**
1993	3,943	691	125	**4,759**	1,349	70	**1,418**	1,062	125	**1,187**	--	--	305	**7,669**	16,283	11,656	7,420	--	**35,359**
1994	2,808	788	125	**3,721**	1,025	65	**1,090**	599	130	**729**	--	--	355	**5,894**	16,698	9,968	6,459	--	**33,125**
1995	3,188	277	125	**3,589**	803	65	**868**	355	130	**485**	--	--	259	**5,201**	20,521	12,113	7,850	--	**40,484**
1996	3,060	521	125	**3,706**	1,132	65	**1,197**	495	130	**625**	--	316	256	**6,101**	19,976	15,685	10,990	--	**46,651**
1997	2,748	374	88	**3,210**	864	45	**909**	492	91	**583**	--	388	273	**5,363**	15,708	11,588	9,094	--	**36,390**
1998	3,010	374	103	**3,487**	635	51	**686**	409	55	**464**	217	390	280	**5,524**	19,027	19,397	13,253	818	**52,495**
1999	2,368	411	103	**2,882**	603	51	**654**	323	55	**379**	217	397	171	**4,699**	21,432	10,955	7,630	1,444	**41,461**
2000	1,975	540	103	**2,618**	540	51	**591**	281	55	**336**	217	244	177	**4,183**	22,238	11,049	7,896	1,781	**43,054**
Mean	3,883	905	107	**4,894**	814	62	**842**	524	119	**589**	217	341	342	**6,453**	11,137	6,658	5,527	1,139	**22,393**

[a] Sport units of effort are thousands of angler hours.

[b] Estimated Standard (Total) Effort in kilometers of gill net = (walleye targeted effort x walleye total harvest)/ walleye targeted harvest.

Mean = long-term mean of all reported values through 2000.

Table 4. Annual catch per unit effort for Lake Erie walleye by gear, management unit, and agency. Units 4 and 5 are combined in Unit 4.

	Sport Fishery[a]																	
	Unit 1				Unit 2			Unit 3			Unit 4				Commercial Fishery (ON)[b]				
Year	OH	MI	ON	Total	OH	ON	Total	OH	ON	Total	ON	PA	NY	Total	Unit 1	Unit 2	Unit 3	Unit 4	Total
1975	0.16	0.13	0.16	**0.16**	0.17	--	**0.17**	--	--	--	--	--	--	**0.16**	--	--	--	--	--
1976	0.45	0.36	0.50	**0.45**	0.22	--	**0.22**	--	--	--	--	--	--	**0.42**	62.96	22.90	--	--	**42.19**
1977	0.77	0.62	0.53	**0.75**	0.24	--	**0.24**	--	--	-	--	--	--	**0.73**	54.88	42.57	--	--	**51.58**
1978	0.54	0.41	0.76	**0.54**	0.24	--	**0.24**	--	--	--	--	--	--	**0.53**	52.21	138.15	--	--	**58.80**
1979	0.78	0.63	0.81	**0.77**	0.36	--	**0.36**	--	--	--	--	--	--	**0.76**	107.87	16.74	--	--	**86.30**
1980	0.53	0.29	0.62	**0.50**	0.21	--	**0.21**	0.13	--	**0.13**	--	--	--	**0.47**	152.96	25.30	--	--	**127.32**
1981	0.50	0.21	0.51	**0.48**	0.14	--	**0.14**	0.12	--	**0.12**	--	--	--	**0.44**	150.66	55.40	4.91	--	**120.09**
1982	0.50	0.43	0.45	**0.49**	0.22	--	**0.22**	0.07	--	**0.07**	--	--	--	**0.48**	102.24	45.92	2.76	--	**85.78**
1983	0.39	0.32	0.34	**0.38**	0.37	--	**0.37**	0.20	--	**0.20**	--	--	--	**0.38**	100.74	31.22	13.70	--	**61.49**
1984	0.76	0.63	0.48	**0.74**	0.60	--	**0.60**	0.46	--	**0.46**	--	--	--	**0.69**	141.88	65.32	44.35	--	**106.99**
1985	0.73	0.50	0.68	**0.69**	0.27	--	**0.27**	0.19	--	**0.19**	--	--	--	**0.59**	229.55	154.46	75.55	--	**179.12**
1986	0.58	0.33	0.49	**0.52**	0.44	--	**0.44**	0.33	--	**0.33**	--	--	--	**0.51**	210.97	99.03	93.71	--	**148.58**
1987	0.57	0.41	0.61	**0.53**	0.38	--	**0.38**	0.28	--	**0.28**	--	--	--	**0.50**	244.23	146.49	133.05	--	**189.97**
1988	0.50	0.46	0.21	**0.48**	0.35	--	**0.35**	0.52	--	**0.52**	--	--	0.18	**0.46**	248.97	131.44	108.23	--	**177.91**
1989	0.55	0.29	0.17	**0.44**	0.57	0.45	**0.56**	0.49	0.39	**0.47**	--	--	0.23	**0.45**	211.13	112.69	111.19	--	**158.26**
1990	0.36	0.41	0.29	**0.37**	0.23	0.42	**0.24**	0.49	0.28	**0.47**	--	--	0.11	**0.34**	179.14	90.71	54.45	--	**119.96**
1991	0.31	0.30	0.27	**0.30**	0.17	0.30	**0.18**	0.36	0.28	**0.34**	--	--	0.08	**0.27**	138.80	87.03	87.08	--	**116.00**
1992	0.37	0.35	0.19	**0.37**	0.29	0.69	**0.32**	0.41	0.18	**0.37**	--	--	0.05	**0.34**	163.05	77.31	52.30	--	**106.83**
1993	0.47	0.39	0.30	**0.45**	0.33	0.37	**0.34**	0.35	0.09	**0.32**	--	--	0.13	**0.40**	152.83	65.39	66.80	--	**105.95**
1994	0.35	0.27	0.17	**0.33**	0.28	0.31	**0.28**	0.31	0.16	**0.28**	--	--	0.17	**0.31**	138.16	63.18	66.87	--	**101.70**
1995	0.36	0.39	0.25	**0.36**	0.20	0.12	**0.19**	0.32	0.21	**0.29**	--	--	0.10	**0.31**	125.65	56.19	62.24	--	**92.57**
1996	0.47	0.34	0.13	**0.44**	0.57	0.13	**0.55**	0.46	0.21	**0.41**	--	0.28	0.15	**0.44**	139.01	70.58	53.59	--	**95.88**
1997	0.34	0.33	0.10	**0.33**	0.22	0.04	**0.21**	0.27	0.06	**0.24**	--	0.23	0.11	**0.28**	164.59	80.06	59.80	--	**111.48**
1998	0.59	0.31	0.33	**0.56**	0.34	0.10	**0.32**	0.73	0.08	**0.65**	0.09	0.32	0.12	**0.48**	131.25	60.11	34.83	34.16	**79.11**
1999	0.34	0.34	0.33	**0.34**	0.23	0.10	**0.22**	0.26	0.08	**0.23**	0.09	0.22	0.14	**0.29**	114.84	57.62	41.57	47.36	**83.89**
2000	0.34	0.47	0.33	**0.37**	0.31	0.10	**0.29**	0.33	0.08	**0.29**	0.09	0.32	0.16	**0.32**	72.07	40.23	24.81	27.09	**53.22**
Mean	0.49	0.38	0.39	**0.48**	0.31	0.27	**0.31**	0.34	0.18	**0.32**	0.09	0.29	0.13	**0.45**	144.95	74.16	60.63	31.80	**107.47**

[a] Sport CPE = Number/angler hour

[b] Commercial CPE = Number/kilometer of gill net

Mean = long-term mean of all reported values through 2000

Table 5. Catch at age of walleye harvest by management unit, gear, and agency in Lake Erie during 2000. Units 4 and 5 are combined in Unit 4. Pennsylvania data were not available.

		Comm'l	Sport					All Gears	
Unit	**Age**	**OMNR**	**OMNR**	**ODNR**	**MDNR**	**NYDEC**	**Total**	**OMNR**	**Total**
1	1	**14,304**	0	2,548	1444	--	**3,992**	14,304	**18,296**
	2	**307,387**	5,086	195,614	70,196	--	**270,896**	312,473	**578,283**
	3	**522,810**	20,918	109,716	99,472	--	**230,106**	543,728	**752,916**
	4	**503,593**	3,646	198,415	54,259	--	**256,320**	507,239	**759,913**
	5	**40,210**	2,399	30,468	11,401	--	**44,268**	42,609	**84,478**
	6	**125,129**	960	49,110	8006	--	**58,076**	126,089	**183,205**
	7+	**89,282**	1,344	88,283	7,502	--	**97,129**	90,626	**186,411**
	Total	**1602715**	**34,353**	**674,154**	**252,280**	**--**	**960,787**	**1,637,068**	**2,563,502**
2	1	**11,044**	0	7419	--	--	**7419**	11,044	**18,463**
	2	**66,262**	0	47,666	--	--	**47,666**	66,262	**113,928**
	3	**72,028**	207	23,829	--	--	**24,036**	72,235	**96,064**
	4	**144,577**	0	36,193	--	--	**36,193**	144,577	**180,770**
	5	**12,238**	0	6,252	--	--	**6,252**	12,238	**18,490**
	6	**49,411**	622	12,901	--	--	**13,523**	50,033	**62,934**
	7+	**88,928**	4,143	30,535	--	--	**34,678**	93,071	**123,606**
	Total	**444488**	**4,972**	**164,795**	**--**	**--**	**169,767**	**449,460**	**614,255**
3	1	**138**	0		--	--		138	**138**
	2	**14,404**	0	5,502	--	--	**5,502**	14,404	**19,906**
	3	**18,093**	0	4,564	--	--	**4,564**	18,093	**22,657**
	4	**60,511**	0	24,055	--	--	**24,055**	60,511	**84,566**
	5	**5,409**	0	1,178	--	--	**1,178**	5,409	**6,587**
	6	**36,158**	0	12,556	--	--	**12,556**	36,158	**48,714**
	7+	**61,179**	4,650	45,493	--	--	**50,143**	65,829	**111,322**
	Total	**195,892**	**4,650**	**93,348**	**--**	**--**	**97,998**	**200,542**	**293,890**
4	1	**100**	0	--	--	--	--	100	**100**
	2	**1,084**	0	--	--	1924	**1924**	1084	**3008**
	3	**1,441**	844	--	--	749	**6,631**	2,285	**8,072**
	4	**13,579**	638	--	--	5078	**14475**	14,217	**28,054**
	5	**1,783**	2,025	--	--	214	**8,518**	3,808	**10,301**
	6	**11,302**	2,531	--	--	3580	**14,870**	13,833	**26,172**
	7+	**18,967**	13,169	--	--	17,054	**78,900**	32,136	**97,867**
	Total	**48,256**	**19,207**	**--**	**--**	**28,599**	**125,318**	**67,463**	**173,574**
All	1	**25,586**	0	9,967	1444	--	**11,411**	25,586	**36,997**
	2	**389,137**	5,086	248,782	70,196	1924	**325,988**	394,223	**715,125**
	3	**614,372**	21,969	138,109	99,472	749	**265,337**	636,341	**879,709**
	4	**722,260**	4,284	258,663	54,259	5078	**331,043**	726,544	**1,053,303**
	5	**59,640**	4,424	37,898	11,401	214	**60,216**	64,064	**119,856**
	6	**222,000**	4,113	74,567	8006	3580	**99,025**	226,113	**321,025**
	7+	**258,356**	23,306	164,311	7,502	17,054	**260,850**	281,662	**519,206**
	Total	**2,291,351**	**63,182**	**932,297**	**252,280**	**28,599**	**1,353,870**	**2,354,533**	**3,645,221**

Table 6. Percent age composition of walleye harvest by management unit, gear, and agency in Lake Erie during 2000. Units 4 and 5 are combined in Unit 4. Pennsylvania data were not available.

		Comm'l	Sport					All Gears	
Unit	**Age**	**OMNR**	**OMNR**	**ODNR**	**MDNR**	**NYDEC**	**Total**	**OMNR**	**Total**
1	1	**0.9**	0.0	0.4	0.6	--	**0.4**	0.9	**0.7**
	2	**19.2**	14.8	29.0	27.8	--	**28.2**	19.1	**22.6**
	3	**32.6**	60.9	16.3	39.4	--	**23.9**	33.2	**29.4**
	4	**31.4**	10.6	29.4	21.5	--	**26.7**	31.0	**29.6**
	5	**2.5**	7.0	4.5	4.5	--	**4.6**	2.6	**3.3**
	6	**7.8**	2.8	7.3	3.2	--	**6.0**	7.7	**7.1**
	7+	**5.6**	3.9	13.1	3.0	--	**10.1**	5.5	**7.3**
	Total	**100**	**100**	**100**	**100**	**--**	**100**	**100**	**100**
2	1	**2.5**	0.0	4.5	--	--	**4.4**	2.5	**3.0**
	2	**14.9**	0.0	28.9	--	--	**28.1**	14.7	**18.5**
	3	**16.2**	4.2	14.5	--	--	**14.2**	16.1	**15.6**
	4	**32.5**	0.0	22.0	--	--	**21.3**	32.2	**29.4**
	5	**2.8**	0.0	3.8	--	--	**3.7**	2.7	**3.0**
	6	**11.1**	12.5	7.8	--	--	**8.0**	11.1	**10.2**
	7+	**20.0**	83.3	18.5	--	--	**20.4**	20.7	**20.1**
	Total	**100**	**100**	**100**	**--**	**--**	**100**	**100**	**100**
3	1	**0.1**	0.0	0.0	--	--	**0.0**	0.1	**0.0**
	2	**7.4**	0.0	5.9	--	--	**5.6**	7.2	**6.8**
	3	**9.2**	0.0	4.9	--	--	**4.7**	9.0	**7.7**
	4	**30.9**	0.0	25.8	--	--	**24.5**	30.2	**28.8**
	5	**2.8**	0.0	1.3	--	--	**1.2**	2.7	**2.2**
	6	**18.5**	0.0	13.5	--	--	**12.8**	18.0	**16.6**
	7+	**31.2**	100.0	48.7	--	--	**51.2**	32.8	**37.9**
	Total	**100**	**100**	**100**	**--**	**--**	**100**	**100**	**100**
4	1	**0.2**	0.0	--	--	--	**--**	0.1	**0.1**
	2	**2.2**	0.0	--	--	6.7	**1.5**	1.6	**1.7**
	3	**3.0**	4.4	--	--	2.6	**5.3**	3.4	**4.7**
	4	**28.1**	3.3	--	--	17.8	**11.6**	21.1	**16.2**
	5	**3.7**	10.5	--	--	0.7	**6.8**	5.6	**5.9**
	6	**23.4**	13.2	--	--	12.5	**11.9**	20.5	**15.1**
	7+	**39.3**	68.6	--	--	59.6	**63.0**	47.6	**56.4**
	Total	**100**	**100**	**--**	**--**	**100**	**100**	**100**	**100**
All	1	**1.1**	0.0	1.1	0.6	--	**0.8**	1.1	**1.0**
	2	**17.0**	8.0	26.7	27.8	6.7	**24.1**	16.7	**19.6**
	3	**26.8**	34.8	14.8	39.4	2.6	**19.6**	27.0	**24.1**
	4	**31.5**	6.8	27.7	21.5	17.8	**24.5**	30.9	**28.9**
	5	**2.6**	7.0	4.1	4.5	0.7	**4.4**	2.7	**3.3**
	6	**9.7**	6.5	8.0	3.2	12.5	**7.3**	9.6	**8.8**
	7+	**11.3**	36.9	17.6	3.0	59.6	**19.3**	12.0	**14.2**
	Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 7. Annual mean age (years) of Lake Erie walleye by gear, management unit, and agency. Units 4 and 5 are combined in Unit 4.

	Sport Fishery[a]																	
	Unit 1				Unit 2			Unit 3			Unit 4			Commercial Fishery (ON)[b]					
Year	OH	MI	ON	Total	OH	ON	Total	OH	ON	Total	ON	NY	Total	Unit 1	Unit 2	Unit 3	Unit 4	Total	Total
1975	2.53	2.53	3.26	**2.59**	1.53	--	**1.53**	--	--	**--**	--	--	**2.48**	--	--	--	--	--	**2.48**
1976	2.49	2.49	2.35	**2.48**	2.05	--	**2.05**	--	--	**--**	--	--	**2.46**	1.51	1.51	--	--	**1.51**	**2.29**
1977	3.29	3.29	2.64	**3.27**	2.44	--	**2.44**	--	--	**--**	--	--	**3.26**	2.74	2.74	--	--	**2.74**	**3.20**
1978	3.50	3.62	3.07	**3.48**	3.33	--	**3.33**	--	--	**--**	--	--	**3.48**	2.69	2.69	--	--	**2.69**	**3.35**
1979	2.71	2.71	2.67	**2.71**	2.29	--	**2.29**	--	--	**--**	--	--	**2.70**	2.83	2.83	--	--	**2.83**	**2.72**
1980	3.00	3.00	2.84	**2.99**	2.92	--	**2.92**	2.65	--	**2.65**	--	--	**2.99**	2.96	2.96	--	--	**2.96**	**2.98**
1981	3.61	2.97	3.47	**3.58**	2.62	--	**2.62**	2.72	--	**2.72**	--	--	**3.56**	3.00	3.00	2.99	--	**3.00**	**3.41**
1982	3.25	3.25	2.76	**3.24**	2.58	--	**2.58**	2.51	--	**2.51**	--	--	**3.23**	2.81	2.81	2.81	--	**2.81**	**3.12**
1983	3.03	3.03	3.17	**3.03**	2.25	--	**2.25**	2.07	--	**2.07**	--	--	**2.94**	3.47	3.47	3.47	--	**3.47**	**3.15**
1984	2.64	2.64	2.90	**2.64**	2.61	--	**2.61**	2.68	--	**2.68**	--	--	**2.64**	2.89	2.89	2.89	--	**2.89**	**2.72**
1985	3.36	3.36	3.17	**3.36**	3.24	--	**3.24**	3.58	--	**3.58**	--	--	**3.35**	3.04	3.04	3.04	--	**3.04**	**3.24**
1986	3.73	3.61	3.54	**3.71**	3.69	--	**3.69**	4.08	--	**4.08**	--	--	**3.72**	3.61	3.70	4.22	--	**3.72**	**3.72**
1987	3.83	3.32	3.78	**3.73**	3.68	--	**3.68**	4.10	--	**4.10**	--	--	**3.73**	3.71	3.47	3.40	--	**3.61**	**3.69**
1988	3.97	3.43	4.58	**3.78**	3.81	--	**3.81**	5.37	--	**5.37**	--	4.87	**3.93**	3.27	3.15	3.89	--	**3.32**	**3.74**
1989	4.48	3.75	4.29	**4.28**	4.65	4.29	**4.63**	5.13	4.29	**5.00**	--	5.59	**4.43**	3.49	3.51	4.22	--	**3.60**	**4.16**
1990	4.44	4.64	5.00	**4.52**	5.31	5.41	**5.31**	6.41	5.41	**6.36**	--	5.70	**4.90**	3.91	3.90	4.60	--	**4.00**	**4.50**
1991	4.91	5.29	5.01	**4.96**	6.22	6.03	**6.20**	6.70	5.91	**6.58**	--	6.36	**5.41**	4.21	4.63	5.14	--	**4.41**	**4.87**
1992	4.60	3.49	3.45	**4.42**	4.89	6.72	**5.15**	5.67	6.42	**5.74**	--	6.35	**4.71**	4.03	4.23	5.49	--	**4.27**	**4.49**
1993	4.60	4.41	4.09	**4.57**	5.79	6.45	**5.83**	5.98	6.17	**5.98**	--	6.15	**4.96**	3.64	4.38	5.21	--	**4.00**	**4.43**
1994	4.53	4.19	5.84	**4.49**	5.38	6.41	**5.44**	6.22	6.85	**6.28**	--	6.49	**4.93**	3.65	4.36	5.60	--	**4.03**	**4.35**
1995	4.04	3.55	4.74	**4.01**	6.07	7.29	**6.12**	6.08	7.17	**6.28**	--	6.80	**4.47**	3.38	4.63	5.92	--	**3.94**	**4.10**
1996	3.98	3.46	4.31	**3.93**	4.22	7.22	**4.26**	6.06	7.57	**6.21**	--	6.47	**4.28**	3.57	3.36	5.21	--	**3.73**	**3.93**
1997	4.21	3.99	4.21	**4.19**	5.30	5.30	**5.30**	6.27	6.27	**6.27**	--	6.25	**4.58**	3.87	3.68	4.83	--	**3.95**	**4.11**
1998	3.74	3.13	3.15	**3.69**	4.66	8.09	**4.74**	4.64	7.81	**4.69**	9.55	10.13	**4.03**	3.26	4.00	5.26	7.00	**3.71**	**3.83**
1999	3.72	3.16	3.43	**3.63**	5.35	9.17	**5.49**	5.95	10.00	**6.16**	8.15	10.29	**4.21**	3.41	4.29	5.28	6.76	**3.81**	**3.91**
2000	3.94	3.27	3.43	**3.74**	4.12	9.17	**4.27**	6.36	10.00	**6.53**	8.15	9.75	**4.39**	3.69	4.67	5.65	6.46	**4.11**	**4.21**
Mean	3.70	3.45	3.67	**3.65**	3.82	6.56	**3.85**	4.76	6.69	**4.78**	9.68	6.72	**3.82**	3.30	3.48	4.41	6.82	**3.43**	**3.63**

Mean = long-term mean of all reported values through 2000.

Table 8. Estimated abundance at age (millions), survival (S), and exploitation (*u*) for Lake Erie walleye, 1978 - 2000 (from ADMB catch-age analysis, M=0.32)

Year	2	3	4	5	6	7+	Total	S	*u*
1978	1.977	5.064	1.696	0.164	0.166	0.190	9.258	0.491	0.280
1979	15.013	1.218	2.701	0.848	0.072	0.158	20.009	0.436	0.346
1980	8.799	8.787	.587	1.201	0.320	0.088	19.783	0.536	0.226
1981	6.945	5.607	4.936	0.316	0.592	0.202	18.597	0.469	0.306
1982	13.495	4.184	2.832	2.336	0.131	0.333	23.310	0.499	0.270
1983	9.609	8.344	2.217	1.421	1.052	0.214	22.857	0.583	0.170
1984	71.131	6.327	4.927	1.279	0.784	0.703	85.150	0.596	0.154
1985	7.826	47.343	3.835	2.918	0.724	0.856	63.502	0.643	0.098
1986	22.870	5.388	30.833	2.459	1.816	0.993	64.359	0.625	0.120
1987	22.764	15.537	3.406	19.156	1.478	1.704	64.045	0.623	0.122
1988	54.225	15.462	9.854	2.118	11.459	1.925	95.043	0.608	0.140
1989	15.343	36.431	9.597	5.976	1.227	7.778	76.352	0.621	0.125
1990	13.070	10.404	23.019	5.944	3.558	5.465	61.459	0.645	0.096
1991	6.725	9.005	6.769	14.776	3.717	5.718	46.710	0.656	0.083
1992	17.246	4.663	5.913	4.404	9.452	6.130	47.809	0.635	0.108
1993	22.729	11.785	2.970	3.717	2.704	9.687	53.592	0.600	0.150
1994	3.805	15.127	7.066	1.752	2.129	7.384	37.262	0.615	0.131
1995	17.132	2.560	9.257	4.271	1.037	5.851	40.107	0.604	0.144
1996	18.954	11.428	1.535	5.480	2.474	4.190	44.061	0.574	0.180
1997	1.969	12.357	6.523	0.860	2.979	3.784	28.472	0.607	0.141
1998	24.564	1.316	7.438	3.879	0.502	4.073	41.773	0.551	0.208
1999	11.882	15.721	.723	3.992	2.002	2.529	36.848	0.601	0.148
2000	12.475	7.907	9.375	0.425	2.298	2.696	35.177	0.616	0.130

Table 9. Projection of Lake Erie walleye stock size estimates to 2001-02 and expected total allowable harvest under a strategy to halt population declines by 2003. The strategy entails a 30% reduction in F relative to that estimated in 2000 and an assumed recruitment of 12 million age-2 fish in 2003. Min and Max represent lower and upper 95% confidence intervals.

	2000 Parameters from ADMB catch-age analysis								
	Stock Size (millions)				Mortality Rates				Survival Rate
Age	Mean	SE	Min	Max	(F)	(Z)	(A)	(*u*)	(S)
2	12.475	3.328	5.818	19.131	0.075	0.395	0.327	0.062	0.673
3	7.907	1.644	4.619	11.195	0.169	0.489	0.387	0.133	0.613
4	9.375	1.792	5.791	12.960	0.181	0.501	0.394	0.142	0.606
5	0.425	0.080	0.266	0.585	0.202	0.522	0.407	0.157	0.593
6	2.298	0.437	1.425	3.172	0.202	0.522	0.407	0.157	0.593
7+	2.696	0.537	1.622	3.771	0.154	0.474	0.377	0.122	0.623
Total	35.177		19.540	50.813	0.164	0.484	0.384	0.130	0.616

	Projected 2001 Parameters											
	Stock Size (millions)				Mortality Rates				Survival Rate	Expected 2001 Catch		
Age	Mean	SE	Min	Max	(F)	(Z)	(A)	(*u*)	(S)	Mean	Min	Max
2	26.192		21.565	31.808	0.054	0.374	0.312	0.045	0.688	1.154	0.950	1.402
3	8.400	1.764	4.872	11.929	0.121	0.441	0.356	0.097	0.644	0.803	0.466	1.141
4	4.850	1.019	2.813	6.887	0.129	0.449	0.362	0.104	0.638	0.496	0.288	0.704
5	5.680	1.193	3.295	8.066	0.144	0.464	0.371	0.116	0.629	0.644	0.373	0.914
6	0.252	0.053	0.146	0.358	0.144	0.464	0.371	0.116	0.629	0.029	0.017	0.041
7+	3.043	0.639	1.765	4.321	0.110	0.430	0.349	0.089	0.651	0.266	0.154	0.378
Total	48.418		34.456	63.369	0.117	0.437	0.354	0.095	0.646	3.392	2.248	4.579

	Projected 2002 Parameters											
	Stock Size (millions)				Mortality Rates				Survival Rate	Expected 2002 Catch		
Age	Mean	SE	Min	Max	(F)	(Z)	(A)	(*u*)	(S)	Mean	Min	Max
2	3.698		3.385	4.042	0.053	0.373	0.311	0.044	0.689	0.163	0.149	0.178
3	18.042	3.789	10.464	25.619	0.118	0.438	0.355	0.096	0.645	1.726	1.001	2.450
4	5.420	1.138	3.144	7.697	0.127	0.447	0.360	0.102	0.640	0.554	0.321	0.787
5	3.103	0.652	1.800	4.406	0.142	0.462	0.370	0.113	0.630	0.352	0.204	0.499
6	3.580	0.752	2.077	5.084	0.142	0.462	0.370	0.113	0.630	0.406	0.235	0.576
7+	2.143	0.450	1.243	3.043	0.108	0.428	0.348	0.087	0.652	0.187	0.109	0.266
Total	35.987		22.112	49.892	0.115	0.435	0.353	0.093	0.647	3.388	2.019	4.757

	Projected 2003 Parameters *											
	Stock Size (millions)				Mortality Rates				Survival Rate	Expected 2003 Catch		
Age	Mean	SE	Min	Max	(F)	(Z)	(A)	(*u*)	(S)	Mean	Min	Max
2	12.000	2.520	6.960	17.040	0.053	0.373	0.311	0.044	0.689	0.529	0.307	0.751
3	2.548	0.535	1.478	3.618	0.118	0.438	0.355	0.096	0.645	0.244	0.141	0.346
4	11.641	2.445	6.752	16.531	0.127	0.447	0.360	0.102	0.640	1.190	0.690	1.690
5	3.467	0.728	2.011	4.924	0.142	0.462	0.370	0.113	0.630	0.393	0.228	0.558
6	1.956	0.411	1.134	2.777	0.142	0.462	0.370	0.113	0.630	0.222	0.129	0.315
7+	3.654	0.767	2.120	5.189	0.108	0.428	0.348	0.087	0.652	0.320	0.185	0.454
Total	35.267		20.455	50.079	0.115	0.435	0.353	0.093	0.647	2.897	1.680	4.113

* assumes recruitment that has not yet been assessed

Table 10. Projected annual TAC's (mean with lower and upper 95% C.I.'s) needed to halt the decline in walleye abundance by 2003, assuming recruitment of at least 12 million age-2 fish in 2003.

Year	Mean	Min	Max
2001	**3.39**	2.25	4.58
2002	**3.39**	2.02	4.76
2003	**2.90**	1.68	4.11

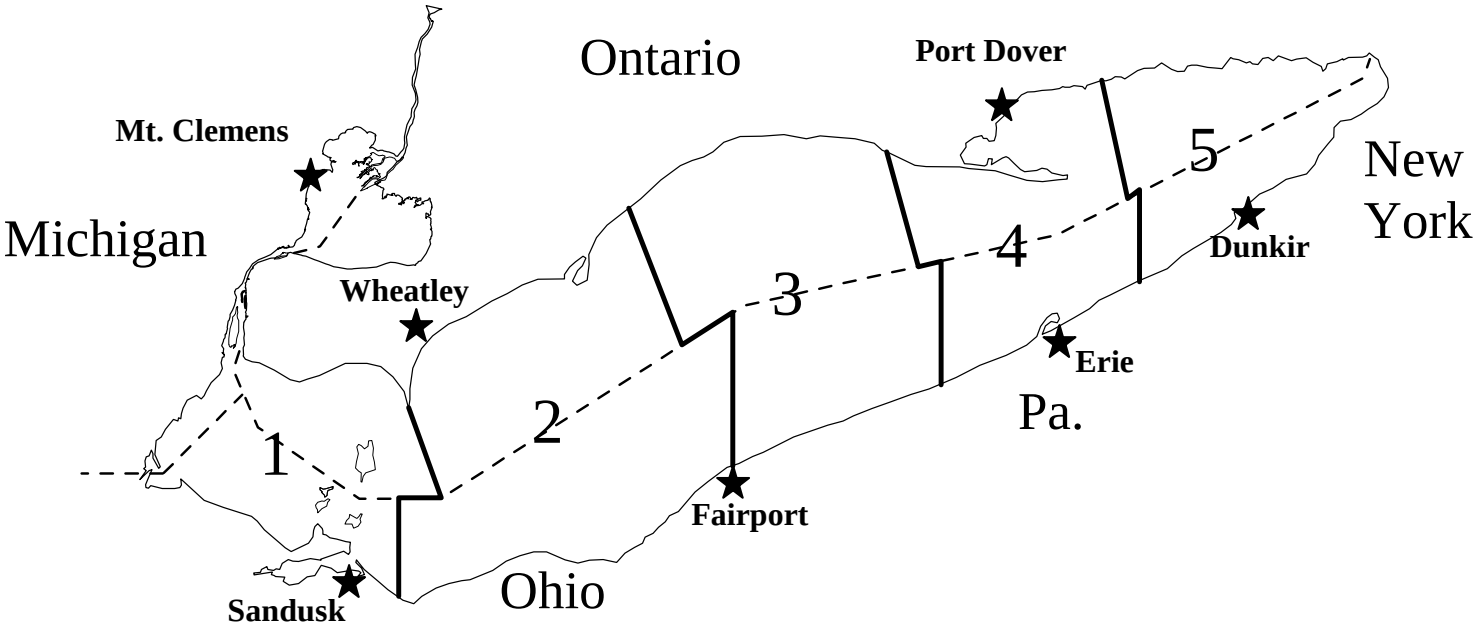

Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of walleye.

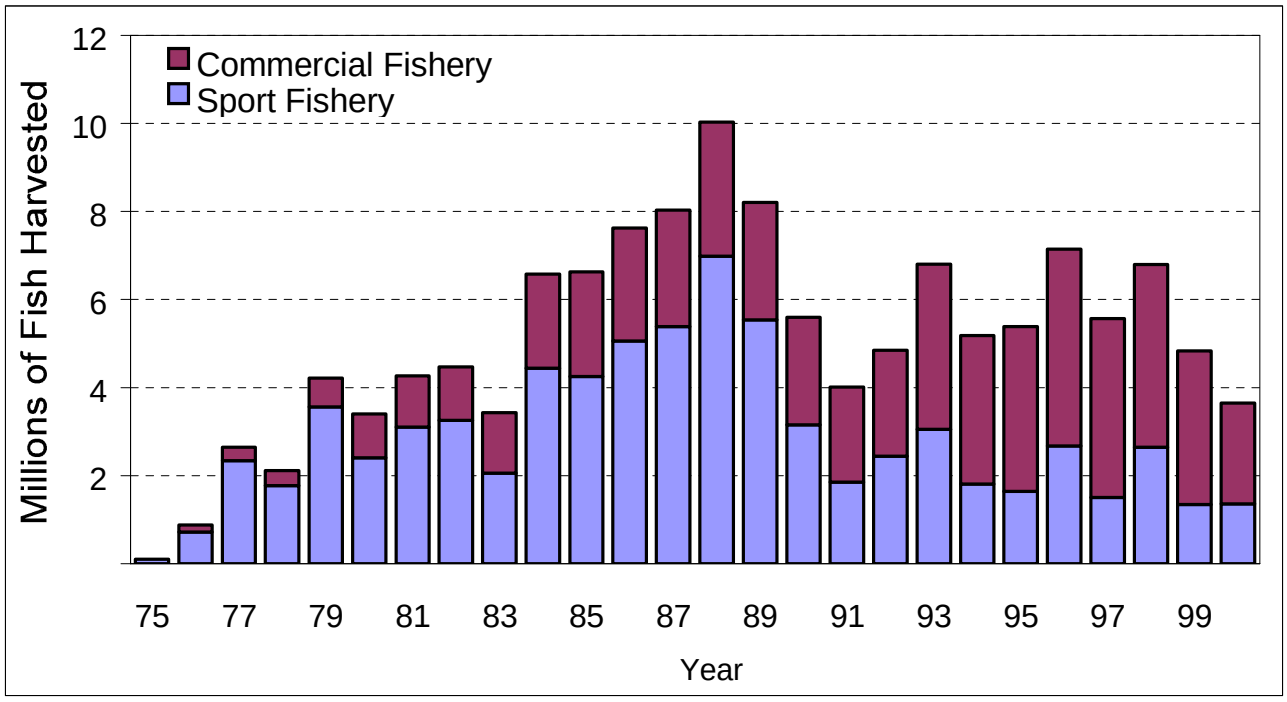

Figure 2. Lakewide harvest of Lake Erie walleye by sport and commercial fisheries, 1975 - 2000.

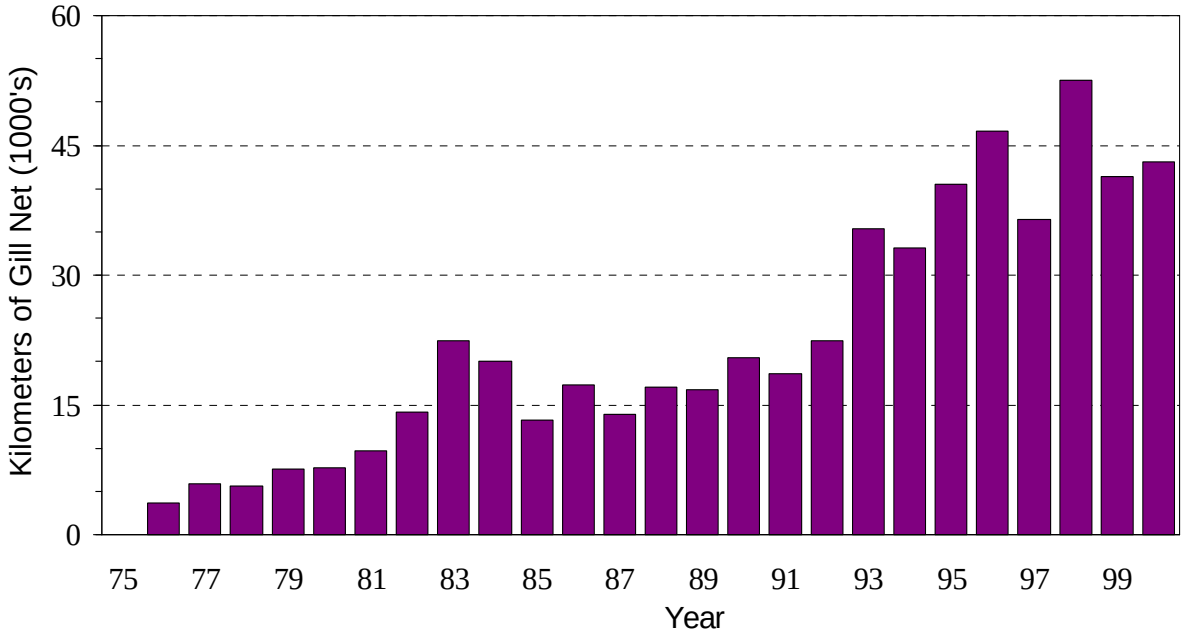

Figure 3. Lakewide total effort (kilometers of gill net) by commercial fisheries on Lake Erie walleye, 1975 – 2000

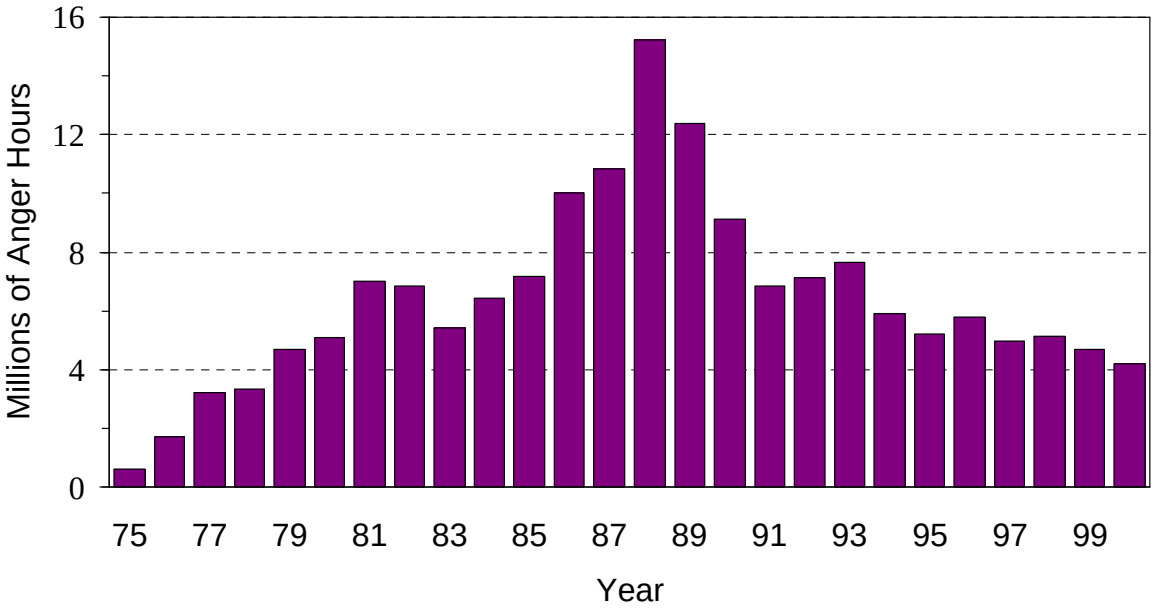

Figure 4. Lakewide total effort (angler hours) by sport fisheries for Lake Erie walleye, 1975 - 1999.

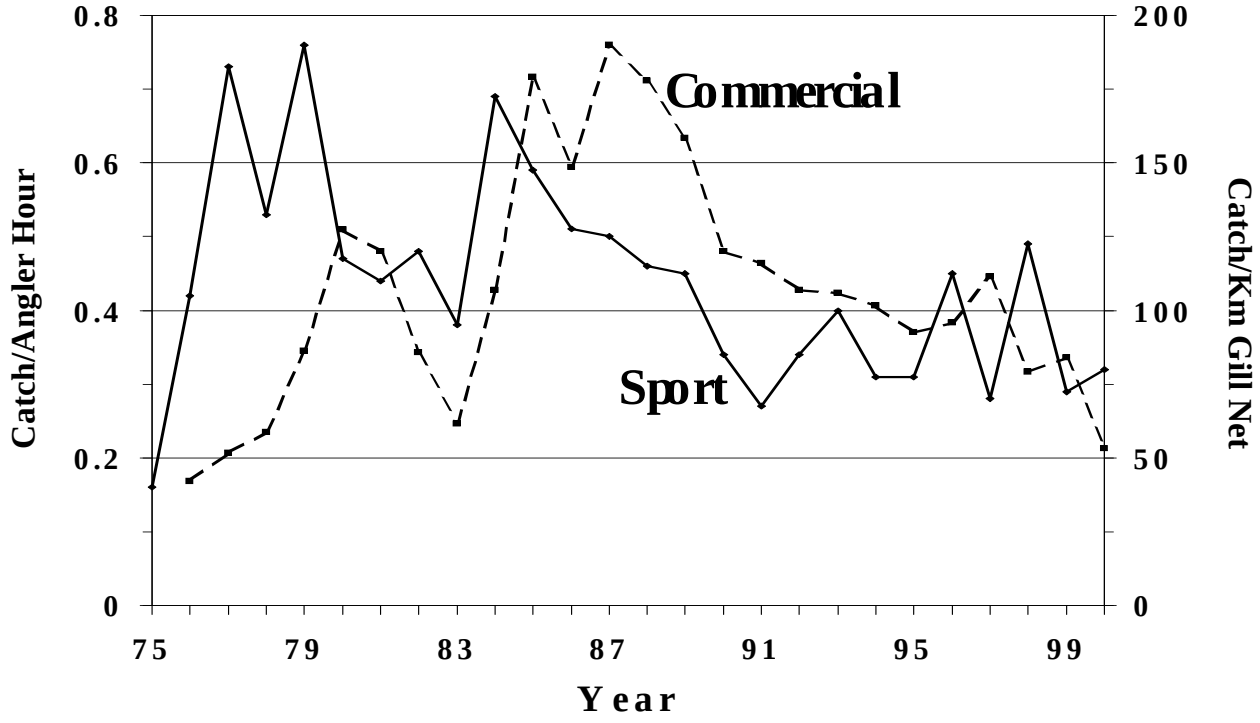

Figure 5. Lakewide CUE for Lake Erie sport and commercial walleye fisheries, 1975 - 2000

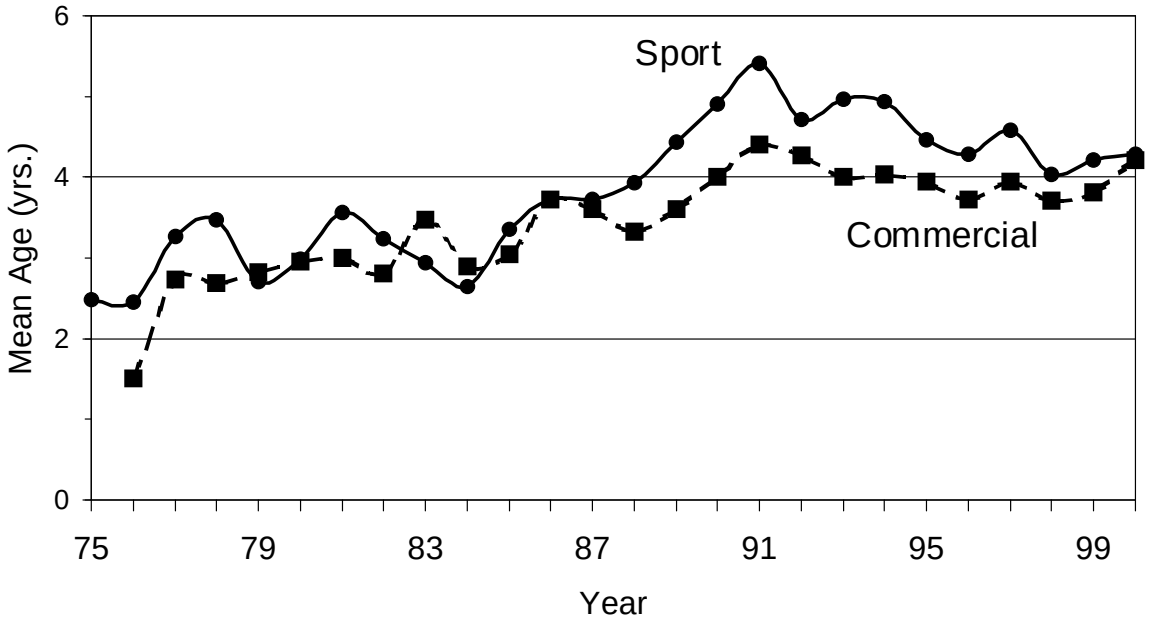

Figure 6. Lakewide mean age of Lake Erie walleye in sport and commercial harvests, 1975 - 2000

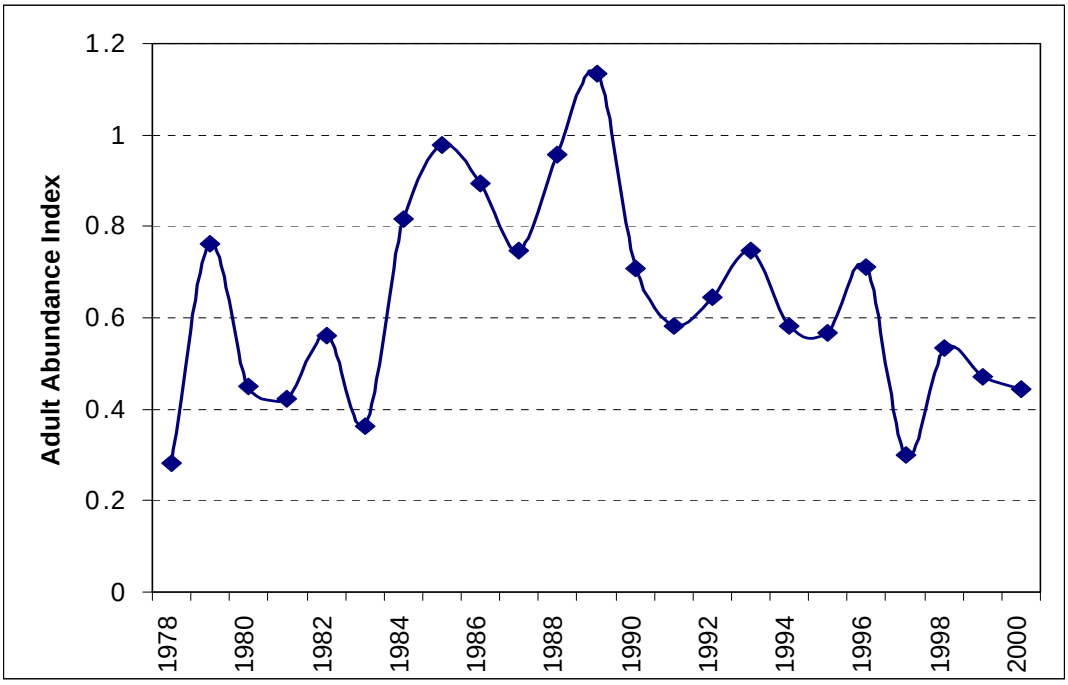

Figure 7. Stock size estimates of Lake Erie walleye 1978 – 2000.

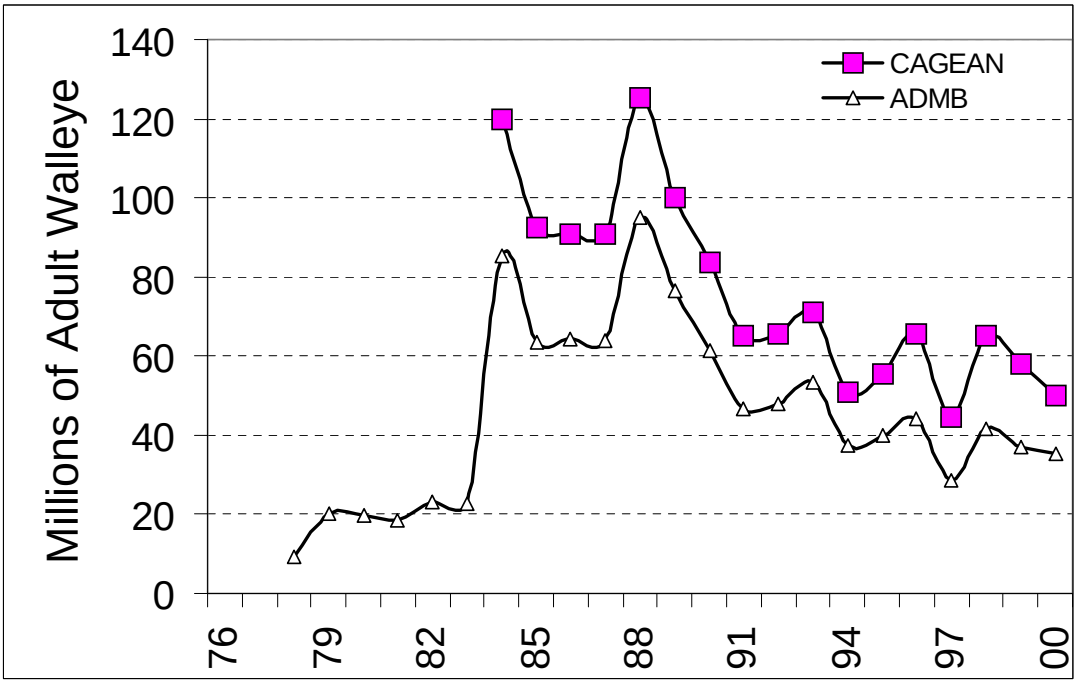

Figure 8. Abundance of walleye from former CAGEAN and current ADMB catch-at- age analysis

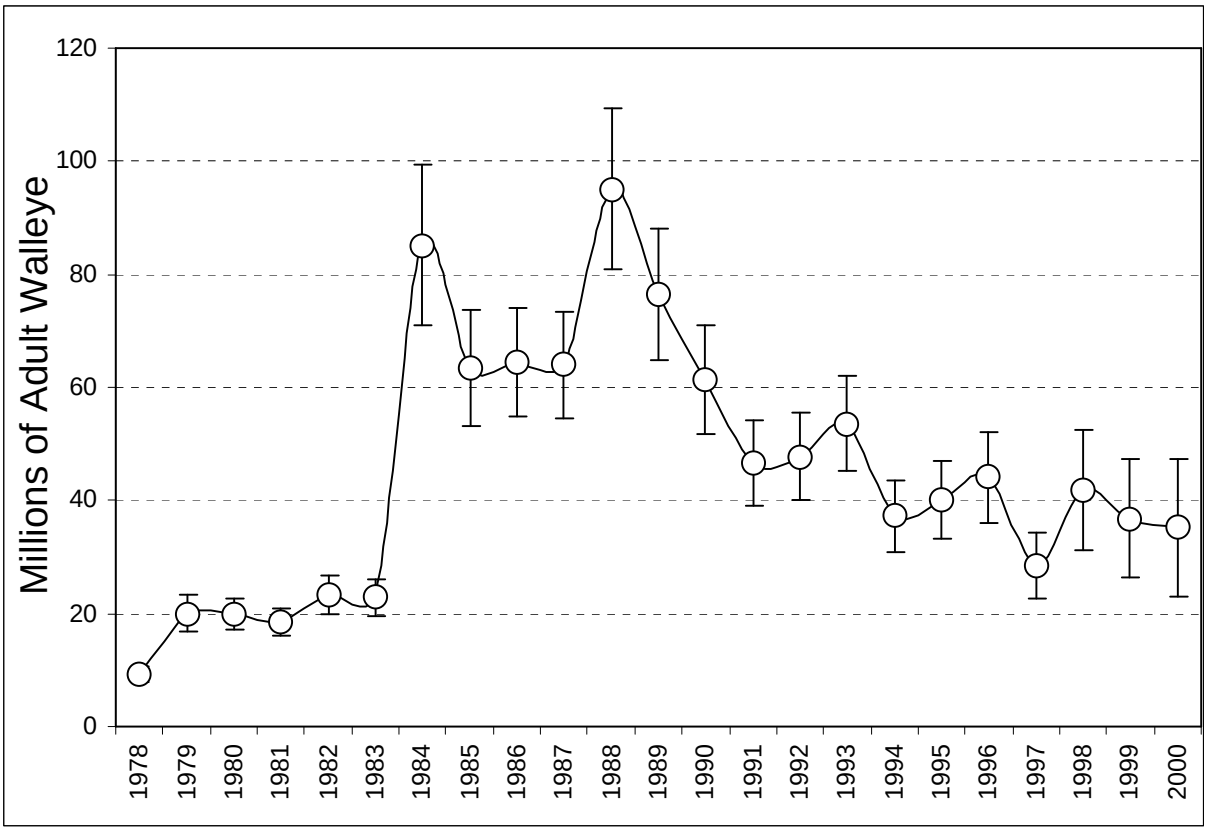

Figure 9. Estimated walleye stock size from ADMB with error bars

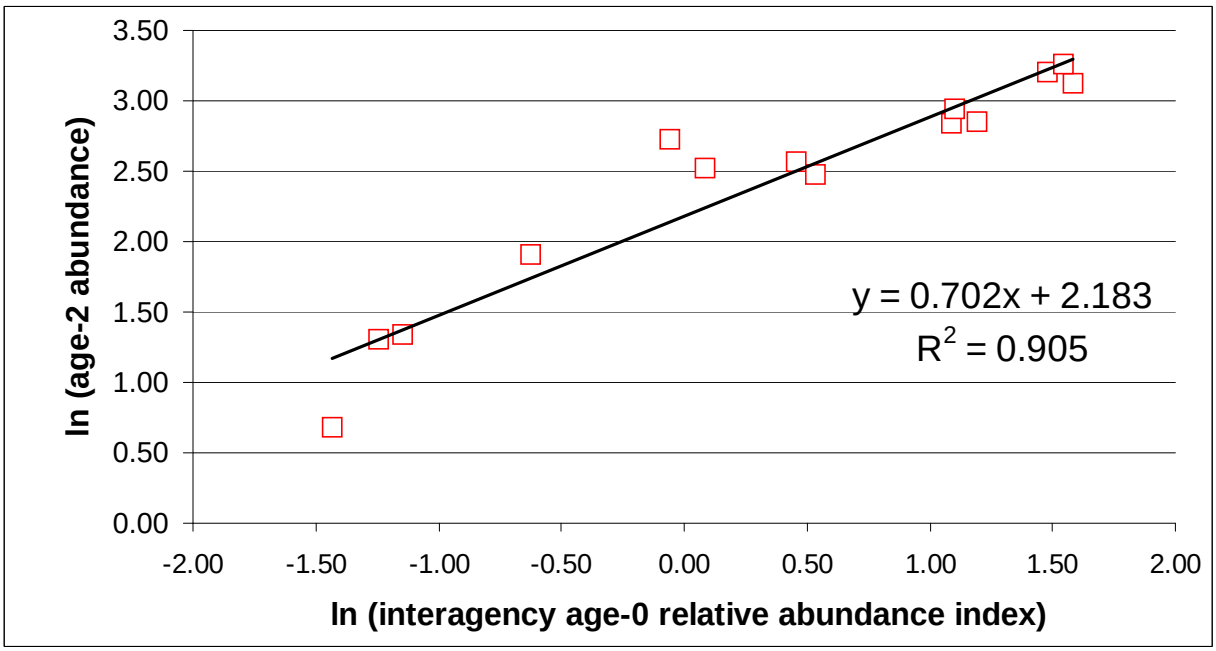

Figure 10. Estimated abundance of age-2 Lake Erie walleye from CAGEAN (M=0.32) and as projected from interagency trawl indices for the 1999 and 2000 year classes.

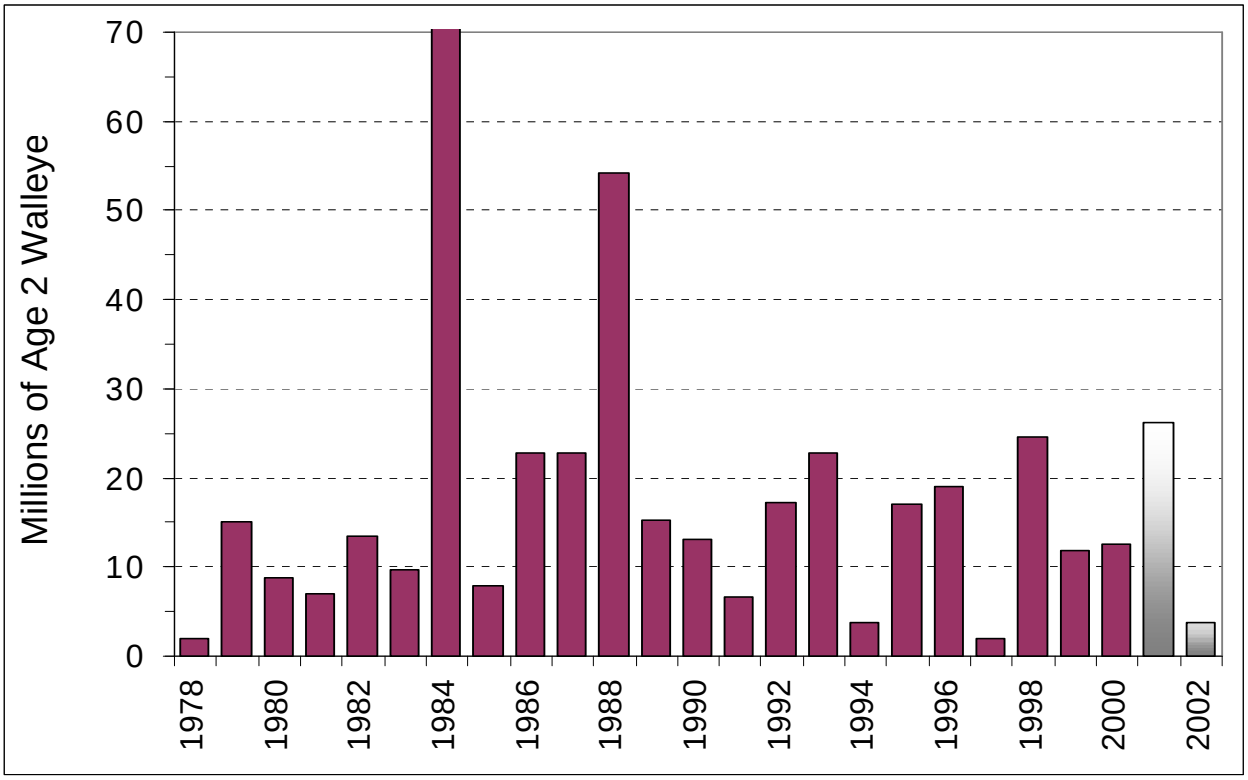

Figure. 11. Estimated abundance of age-2 Lake Erie walleye from CAGEAN (M=0.32) and as projected from interagency trawl indices for the 2001 and 2002 year classes.

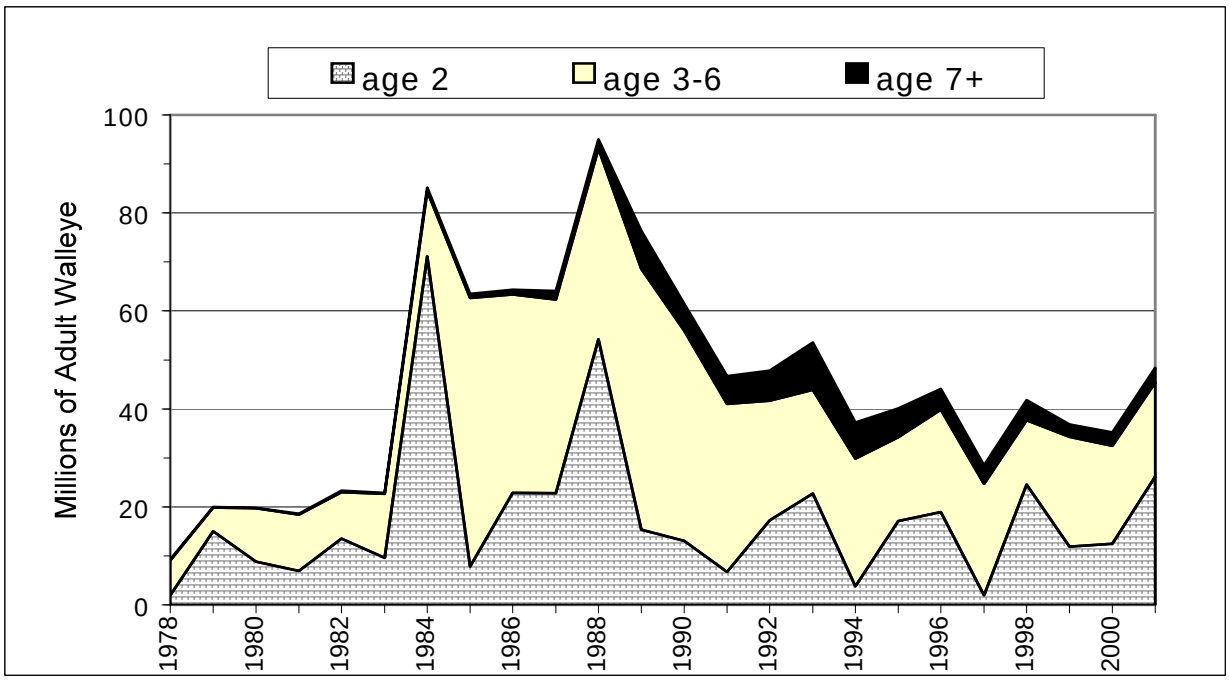

Figure 12. Trends in abundance of Lake Erie walleye by age group from ADMB, 1978 - 2001

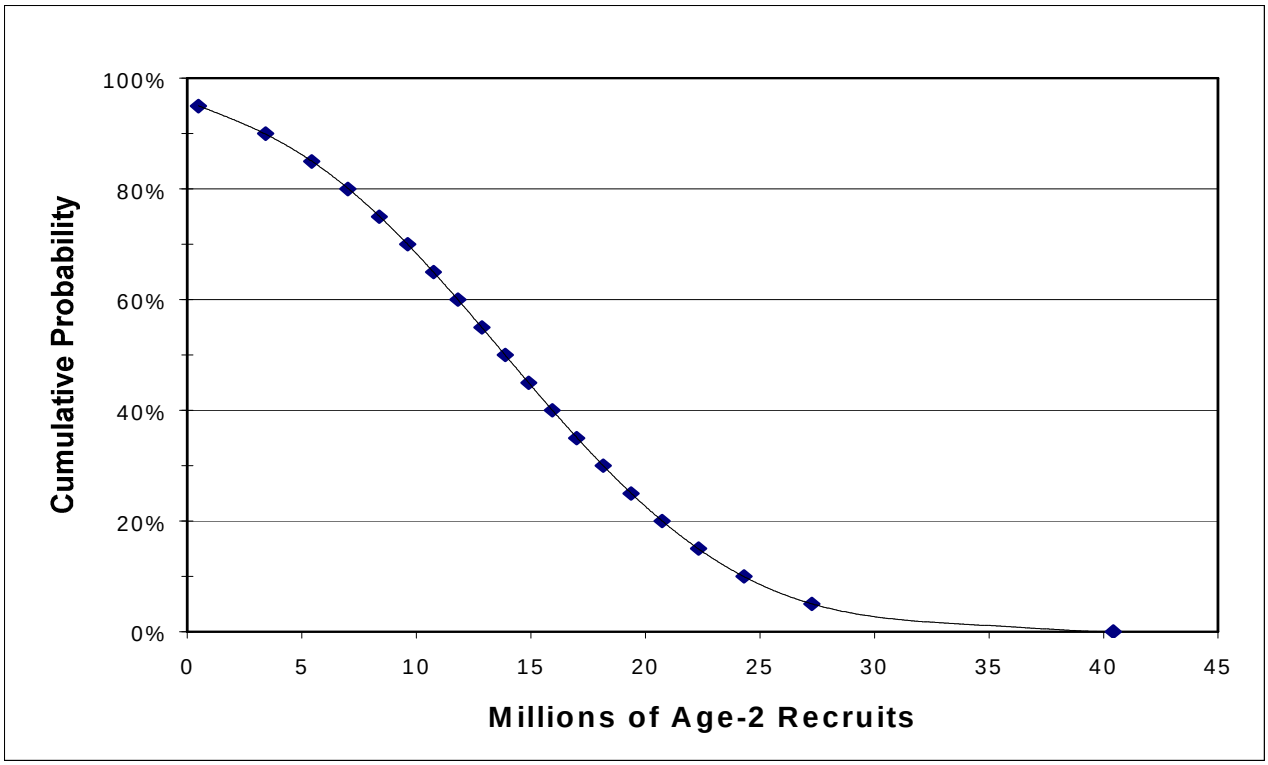

Figure 13. Cumulative Probability of obtaining various numbers of Age-2 recurits

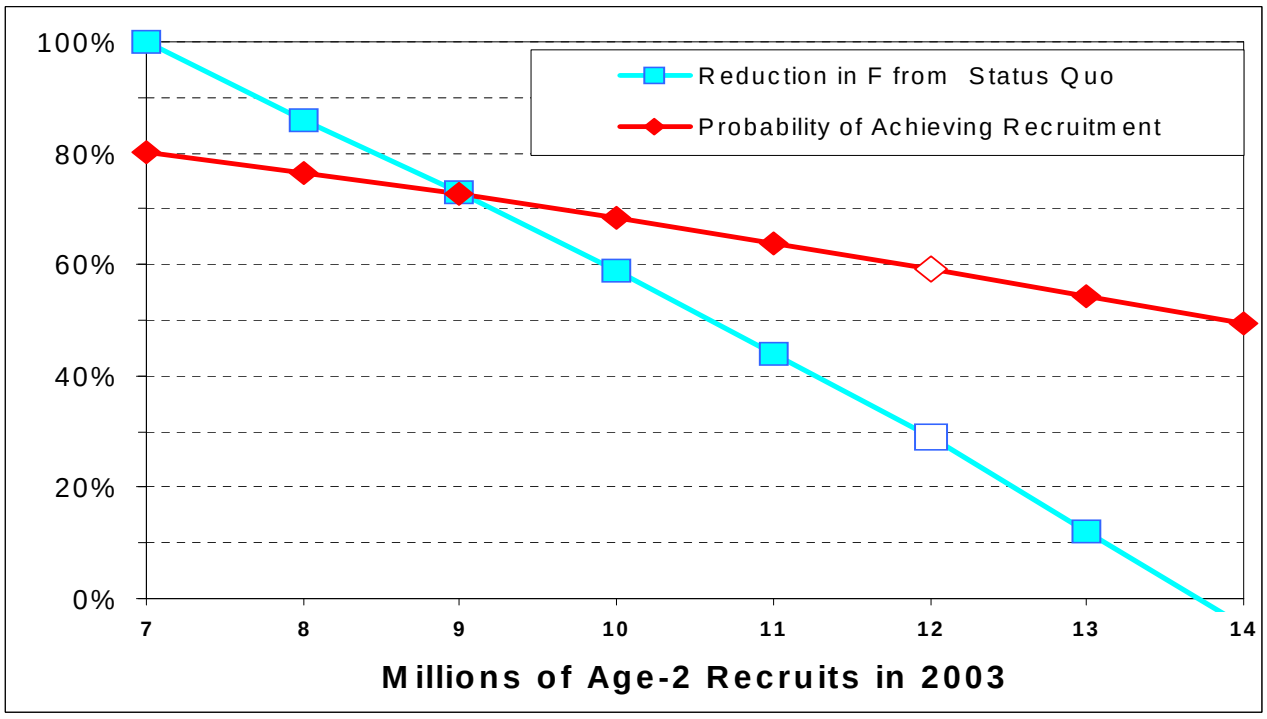

Figure 14. Reduction in fishing mortality (F) from status quo and probability of achieving various numbers of age-2 recruits

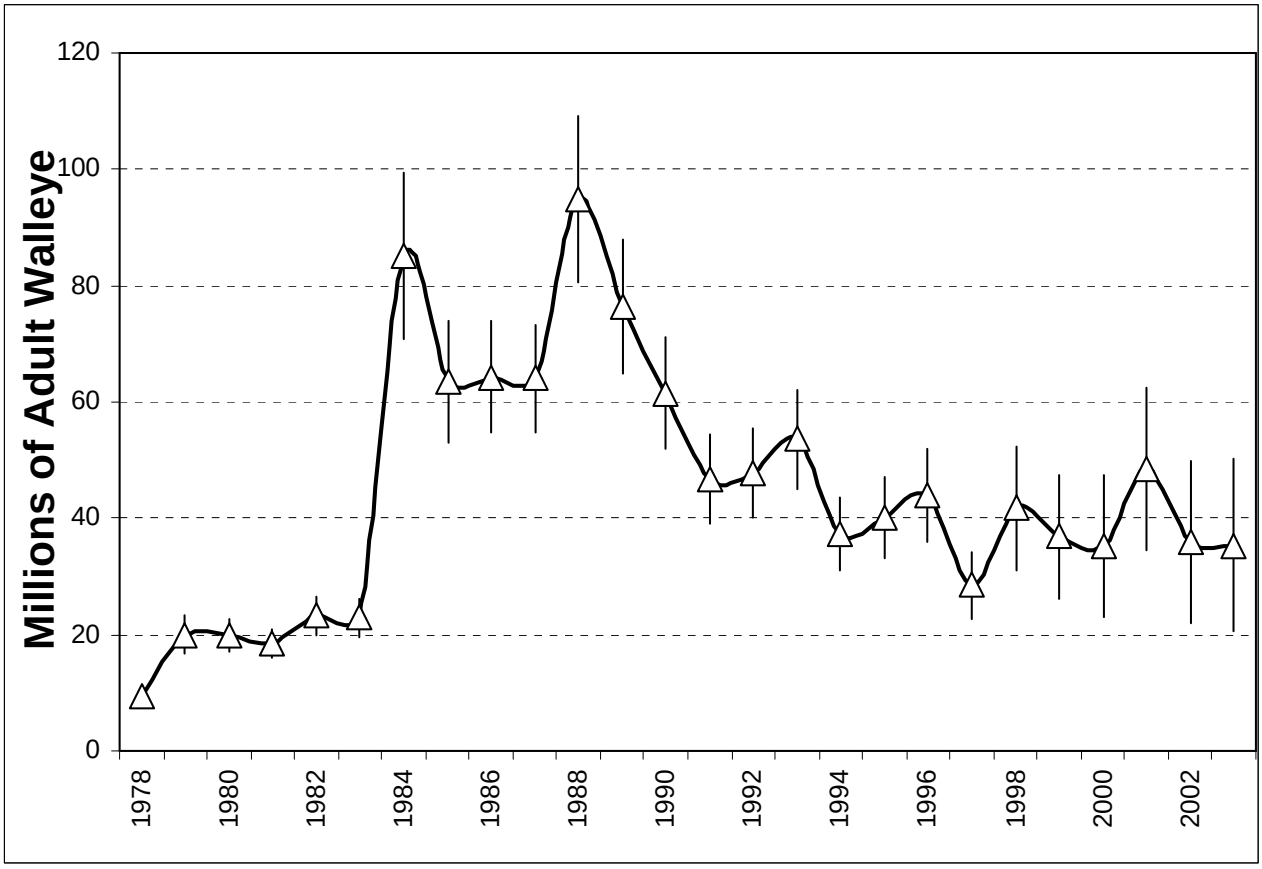

Figure 15. Estimated walleye stock size in 1978-2001 and projected to 2002-2003