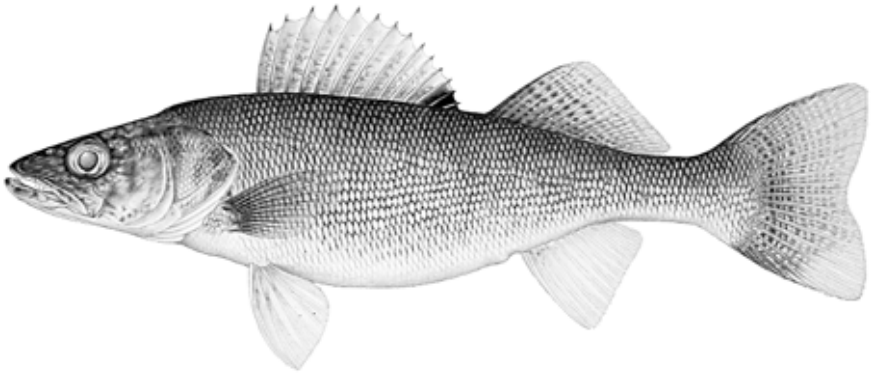
Report of the

LAKE ERIE WALLEYE TASK GROUP

March 2000



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Presented to:

Standing Technical Committee
Lake Erie Committee
Great Lakes Fishery Commission

Charges to the WTG from the STC, 1999-2000

The charges from the Standing Technical Committee to the Walleye Task Group for the period from March 1999 to February 2000 were to:

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

2) Develop recommended west-central and eastern basin allowable harvest ranges for 2000 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 search for evidence of stock discreteness and contributions to lakewide fisheries and of the relative stability of recruitment from river versus shoal spawners.

5) Assist the Forage Task Group with bioenergetic analysis of prey fish consumption by walleye.

SWIM Model and Management Strategies

In November 1999 the WTG began the process of identifying indicators and endpoints to be used in management scenarios for SWIM. Biologists and managers from around the lake were asked to identify which metrics (indicators) they would use to assess the state of the walleye resource. Examples would include angler and commercial CUE, total stock size, and mean weight in the harvest. In addition, the agencies were asked to identify the minimum and optimum level of each of the metrics they identified to help define the range of management objectives for walleye.

To demonstrate the value of this exercise, a series of simulations were run to explore the uncertainty in natural mortality rate (M) and exploitation rate (u). One hundred simulations were run at each of 25 combinations of M and u, with each simulation representing 100 years of population data. A response surface was created for each of a number of potential metrics and hypothetical management targets overlaid. The simulations demonstrated the trade-off between M and u, and were discussed from the perspective of how uncertainty in M necessitated more precise estimates of, and more tightly regulated, exploitation.

Finally, the interaction between different management targets was explored by comparing the percent of time (% of simulations) that the desired target was achieved for each metric. Not surprisingly, as exploitation rate increased it became increasingly difficult to sustain management

objectives, owing to constraints on system carrying capacity (i.e. only so many walleye can be produced). However, different management objectives declined at different rates, challenging the manager to evaluate the suite of metrics, and explore tradeoffs between ecological vs. economic factors.

During 2000, Tim Johnson will work to integrate the responses from managers and biologists regarding the metrics and endpoints. On the basis of these responses, he will 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 recoding of SWIM in a more Windows NT compatible environment.

Development of Recommended Allowable Harvest (RAH) in 2000

Calculation of the recommended allowable harvest (RAH) for 2000 was completed using the management model developed by Henderson et al. (1990) with minor modifications discussed below. Briefly, this process consisted of 1) catch-at-age-analysis (CAGEAN) on 1984-99 harvest and effort data to estimate standing stock size in 1999, 2) projection of age-3 and older standing stock in 2000 from CAGEAN estimates of survival rates for age-2 and older walleye in 1999, 3) prediction of age-2 recruitment in 2000 from age-1 relative abundance in gill net surveys during fall 1999 and age-0 relative abundance from interagency August trawls in 1998 and 1999, and 4) estimated yield at the optimum sustained rate (F-opt) from the 2000 standing stock estimates.

Walleye Fisheries in 1999

The 1999 total estimated lakewide harvest of walleye was 4.8 million fish, a 29% decline from 6.8 million in 1998 (Tables 1 and 2). This includes fish caught incidentally in commercial fisheries for other species. Commercial harvest of walleye, in designated management units (Fig. 1), dropped 16% to 3.5 million fish with most of the reduction in Units 2 and 3 (Table 2, Fig. 2). While down, the commercial harvest remained above long-term means and was comparable to catches since 1993. Conversely, the sport harvest fell 49% to 1.3 million fish, the lowest since 1976 and was down in all units (Table 2, Fig. 2).

Commercial gill net effort fell 21% from the 1998 record 52,495 kilometers of net to 41,461 kilometers due to large reductions in Units 2 and 3 (Table 3, Figure 3). Sport effort continued the declining trend seen since 1988 dropping 15% to 4,699 angler hours, the lowest total since 1978 (Table 3, Figure 4).

Commercial catch-per-unit-of-effort (CUE) increased slightly during 1999 yet continues a declining trend since 1987 and is well below the long-term mean at 83.89 walleye/kilometer of net (Table 4, Figure 5). The largest decline was in Unit 1 while increases were seen in Units 3 and 4. Sport CUE's decreased in all units and especially in units 1 and 3. The overall rate of 0.29 fish/angler hour was the fourth lowest since 1975 (Table 4, Figure 5).

Harvests in both fisheries were dominated by the 1996 (48% overall), 1997 (17%

overall), and 1994 (13% overall) year classes (Tables 5 and 6). These three groups comprised around 83% of the harvest in Unit 1 and 68% in Unit 2. Harvests of older age groups increased from west to east with 88% of the fish harvested in unit 4 being age-5 and older. Older year classes continue to be well represented with age six and older fish making up 17% of the lakewide harvest.

Mean age of the catch ranged from 3.2 to 10.3 years in the sport fishery and from 3.4 to 6.8 in the commercial fishery and was 3.9 years for the entire fishery (Table 7). Increases were seen in both sport (4.21 years) and commercial (3.81 years) fisheries primarily due to the presence of the strong age-3 (1996) year class and a weak age-2 (1997) year class, which is normally a large part of both harvests. Despite a recent declining trend, both fisheries and the lakewide average remained above long-term means.

Walleye Standing Stock Size, 1984-99

Annual stock sizes of age-2 and older walleye were estimated with catch-at-age-analysis, CAGEAN (see Appendix A for command file configuration), as in previous years. We used an instantaneous natural mortality rate (M) of 0.32, which is higher than the 0.25 value used in 1999 (but identical to that used in 1991-98), as estimated from analysis of tag returns from 1986-99. Unusually low survival estimates in 1998, coupled with no evidence of increased exploitation from the tag data, accounted for the increase in M from a year ago. Catch and effort data were grouped into time blocks within CAGEAN to account for changes in catchability and selectivity in the fisheries. For the gill net fishery, two blocks (1984-89, 1990-99) were established for selectivity and no blocks were used for catchability calculations. For the angling fishery, three blocks (1984-85, 1986-89, and 1990-99) were established for selectivity and catchability. Terminal fishing mortality (F_t), the instantaneous mortality rate experienced by fully-vulnerable age groups in the most recent year, was set at 0.2, a level where model outputs tended to stabilize.

Age-2 and older walleye abundance was estimated at 57.9 million prior to the 1999 fishing season (Table 8, Fig. 7), about 8% below the projected mean estimate from a year ago. Abundance estimates were marginally higher than projected for age-2 and age-4 walleyes and lower for all other age groups (Figure 8). Our projected range of 49 to 77 million fish a year ago was slightly higher than recent CAGEAN estimates of 42 to 73 million fish. Overall, the fisheries removed about 8.4 % of the available standing stock, resulting in an estimated survival of about 66% in 1999 (Table 8, Fig. 9). Mean estimates of exploitation (9.4%) and survival (65.1%) from tag return data (1986-99) were similar to those from CAGEAN over the same time period (exploitation=8.2%, survival=65.7%). From these survival estimates, we estimate a population of about 27 to 48 million (38 million, mean) age-3 and older walleyes in 2000 (Table 10).

Abundance of age-2 walleye was estimated from regression models of observed age-2 abundance (from CAGEAN) on August age-0 interagency bottom trawl indices and on fall Ontario partnership gill net age-1 indices (Table 9). Estimates of the strength of the 1998 year class were 11.9 million fish (range 10.8 to 12.9 million) from the 1998 summer age-0 trawl index

and 18.8 million fish (range 16.4 to 22.0 million) from the 1999 fall age-1 gill net index. Relatively close agreement between predicted values strongly indicates a 1998 year class of moderate strength (Figure 10). We used the estimate from the bottom trawl index (smaller historic mean residual) as the predictor of age-2 abundance (11.9 million fish) for the projected stock size in 2000. The 1999 year class is projected to recruit about 35 million age-2 fish to the population in 2001, an above-average cohort of fish.

The total projected abundance of age-2 and older walleye in 2000 is 38 to 61 million fish, or 49.8 million fish on average (Table 10). About 31% of the population is attributable to the 1996 year class, 22% from the 1997 year class, and 23% from 1991 and earlier hatches (Tables 8, 10). The projected average abundance of 49.8 million adult walleyes is slightly below average for the 1990s and similar to that observed in 1997 (Fig. 11), with a high proportion of fish over age-2.

Allowable Harvest Recommendations for 2000

Yield per recruit was calculated from the projected 2000 stock size estimates with the same von Bertalanffy and M parameters (see Table 10 footnote) used prior to 1999. With the new value (0.32) for M as described earlier, F_{opt} was calculated at 0.326, the same as that used in 1991-98. F_{opt} was scaled according to procedures established in the 1998 WTG Report to the Lake Erie Committee.

Allowable harvest for 2000, at optimum fishing mortality levels, is **9.7 (range 7.3 to 12.0) million fish**. *The Walleye Task Group recommends the LEC to adopt a conservative Total Allowable Catch (TAC) for 2000, favoring the lower end of the range for the following reasons:*

1. *The fishable population is 14% lower than 1999 (the 1999 TAC was 9.0 million fish).*
2. *The fishery will rely heavily on the 1996 year class for the third straight year due to weak 1997 and 1998 year classes.*
3. *A continued declining trend in commercial gill net catch rates since 1987.*
4. *Uncertainty about the effects of reduced productivity on sustainable fish yields.*

If the fisheries perform as in previous years, the harvest will likely be close to 5.0 million fish in 2000.

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 CAGEAN 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

M. Turner, B. Haas, and P. Ryan are collaborating to write a manuscript summarizing results from the interagency tagging effort. Topics will include distribution of Lake Erie walleye 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 this year.

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.

Recommended Charges to the WTG in 2000-2001

The WTG recommends the following charges to the group in 2000-2001**:**

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

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 search for evidence of stock discreteness and contributions to lakewide fisheries and of the relative stability of recruitment from river versus shoal spawners.

5) Assist the Forage Task Group with bioenergetic analysis of prey fish consumption by 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 1999. 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	Pennsylvania	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**

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													Commercial Fishery (ON)					
	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**	**Total**
75	77	4	7	**88**	10	--	**10**	--	--	**--**	--	--	--	**98**	--	--	--	--	--	**98**
76	605	30	50	**685**	35	--	**35**	--	--	**--**	--	--	--	**720**	113	44	--	--	**157**	**877**
77	2,131	107	69	**2,307**	37	--	**37**	--	--	**--**	--	--	--	**2,343**	235	67	--	--	**302**	**2,645**
78	1,550	72	112	**1,735**	37	--	**37**	--	--	**--**	--	--	--	**1,771**	274	60	--	--	**335**	**2,106**
79	3,254	162	79	**3,495**	60	--	**60**	--	--	**--**	--	--	--	**3,555**	625	30	--	--	**656**	**4,211**
80	2,096	183	57	**2,336**	49	--	**49**	24	--	**24**	--	--	--	**2,410**	953	40	--	--	**992**	**3,402**
81	2,857	95	70	**3,023**	38	--	**38**	48	--	**48**	--	--	--	**3,109**	1,037	119	3	--	**1,159**	**4,268**
82	2,959	194	49	**3,202**	49	--	**49**	8	--	**8**	--	--	--	**3,258**	1,077	134	2	--	**1,212**	**4,470**
83	1,626	146	41	**1,812**	212	--	**212**	26	--	**26**	--	--	--	**2,051**	1,129	167	80	--	**1,376**	**3,427**
84	3,089	351	39	**3,479**	787	--	**787**	179	--	**179**	--	--	--	**4,445**	1,639	392	108	--	**2,139**	**6,584**
85	3,347	461	57	**3,865**	294	--	**294**	89	--	**89**	--	--	--	**4,248**	1,721	432	225	--	**2,379**	**6,627**
86	3,743	606	52	**4,401**	480	--	**480**	176	--	**176**	--	--	--	**5,057**	1,651	558	356	--	**2,565**	**7,622**
87	3,751	902	51	**4,705**	550	--	**550**	132	--	**132**	--	--	--	**5,387**	1,611	622	405	--	**2,637**	**8,024**
88	3,744	1,997	18	**5,758**	584	--	**584**	562	--	**562**	--	--	85	**6,990**	1,866	762	409	--	**3,036**	**10,026**
89	2,891	1,092	14	**3,997**	867	35	**901**	434	80	**514**	--	--	129	**5,542**	1,656	621	386	--	**2,664**	**8,206**
90	1,467	747	35	**2,249**	389	14	**403**	426	23	**449**	--	--	47	**3,149**	1,615	529	302	--	**2,446**	**5,595**
91	1,104	132	39	**1,275**	216	24	**239**	258	44	**302**	--	--	34	**1,851**	1,446	440	274	--	**2,160**	**4,011**
92	1,479	250	20	**1,749**	338	56	**394**	265	25	**290**	--	--	14	**2,447**	1,547	534	316	--	**2,397**	**4,844**
93	1,846	270	37	**2,154**	450	26	**476**	372	12	**384**	--	--	40	**3,054**	2,488	762	496	--	**3,746**	**6,800**
94	992	216	21	**1,229**	291	20	**311**	186	21	**207**	--	--	59	**1,807**	2,307	630	432	--	**3,369**	**5,176**
95	1,161	108	32	**1,301**	159	7	**167**	115	27	**141**	--	--	27	**1,636**	2,578	681	489	--	**3,748**	**5,384**
96	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**
97	929	122	8	**1,059**	188	2	**190**	132	5	**138**	--	89	29	**1,506**	2,585	928	544	--	**4,057**	**5,563**
98	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**
99	812	140	34	**987**	139	5	**144**	83	5	**88**	19	89	23	**1,349**	2,461	631	317	68	**3,478**	**4,827**
Mean	2,080	356	42	**2,478**	291	20	**299**	208	27	**223**	19	101	49	**2,989**	1,540	471	327	28	**2,268**	**5,163**

Mean = long-term mean of all reported values through 1998

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**
75	486	30	46	**562**	61	--	**61**	--	--	--	--	--	--	**623**	--	--	--	--	--
76	1,356	84	98	**1,538**	163	--	**163**	--	--	--	--	--	--	**1,701**	1,796	1,933	--	--	**3,729**
77	2,768	171	130	**3,069**	151	--	**151**	--	--	--	--	--	--	**3,220**	4,282	1,572	--	--	**5,854**
78	2,880	176	148	**3,204**	154	--	**154**	--	--	--	--	--	--	**3,358**	5,253	436	--	--	**5,689**
79	4,179	257	97	**4,533**	169	--	**169**	--	--	--	--	--	--	**4,702**	5,798	1,798	--	--	**7,596**
80	3,938	624	92	**4,654**	237	--	**237**	187	--	**187**	--	--	--	**5,078**	6,229	1,565	--	--	**7,794**
81	5,766	447	138	**6,351**	264	--	**264**	382	--	**382**	--	--	--	**6,997**	6,881	2,144	622	--	**9,647**
82	5,928	449	108	**6,484**	223	--	**223**	114	--	**114**	--	--	--	**6,821**	10,531	2,913	689	--	**14,133**
83	4,168	451	118	**4,737**	568	--	**568**	128	--	**128**	--	--	--	**5,433**	11,205	5,352	5,814	--	**22,371**
84	4,077	557	82	**4,716**	1,322	--	**1,322**	392	--	**392**	--	--	--	**6,430**	11,550	6,008	2,438	--	**19,996**
85	4,606	926	84	**5,616**	1,078	--	**1,078**	464	--	**464**	--	--	--	**7,158**	7,496	2,800	2,983	--	**13,279**
86	6,437	1,840	107	**8,384**	1,086	--	**1,086**	538	--	**538**	--	--	--	**10,008**	7,824	5,637	3,804	--	**17,265**
87	6,631	2,193	84	**8,908**	1,431	--	**1,431**	472	--	**472**	--	--	--	**10,811**	6,595	4,243	3,045	--	**13,883**
88	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**
89	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**
90	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**
91	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**
92	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**
93	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**
94	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**
95	3,188	277	125	**3,589**	803	65	**868**	355	130	**485**	--	--	259	**5,201**	20,521	12,113	7,850	--	**40,484**
96	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**
97	2,748	374	88	**3,210**	864	45	**909**	492	91	**583**	--	388	273	**5,363**	15,708	11,588	9,094	--	**36,390**
98	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**
99	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**
Mean	4,019	931	107	**5,057**	834	63	**860**	541	125	**607**	217	365	356	**6,615**	10,344	6,344	5,358	818	**20,917**

[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 1998.

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
75	0.16	0.13	0.16	**0.16**	0.17	--	**0.17**	--	--	--	--	--	--	**0.16**	--	--	--	--	--
76	0.45	0.36	0.50	**0.45**	0.22	--	**0.22**	--	--	--	--	--	--	**0.42**	62.96	22.90	--	--	**42.19**
77	0.77	0.62	0.53	**0.75**	0.24	--	**0.24**	--	--	-	--	--	--	**0.73**	54.88	42.57	--	--	**51.58**
78	0.54	0.41	0.76	**0.54**	0.24	--	**0.24**	--	--	--	--	--	--	**0.53**	52.21	138.15	--	--	**58.80**
79	0.78	0.63	0.81	**0.77**	0.36	--	**0.36**	--	--	--	--	--	--	**0.76**	107.87	16.74	--	--	**86.30**
80	0.53	0.29	0.62	**0.50**	0.21	--	**0.21**	0.13	--	**0.13**	--	--	--	**0.47**	152.96	25.30	--	--	**127.32**
81	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**
82	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**
83	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**
84	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**
85	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**
86	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**
87	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**
88	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**
89	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**
90	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**
91	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**
92	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**
93	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**
94	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**
95	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**
96	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**
97	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**
98	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**
99	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**
Mean	0.50	0.38	0.39	**0.48**	0.31	0.29	**0.31**	0.34	0.19	**0.32**	0.09	0.28	0.13	**0.45**	147.99	75.57	62.52	34.16	**109.73**

[a] Sport CPE = Number/angler hour

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

Mean = long-term mean of all reported values through 1998

Table 5. Catch at age of walleye harvest by management unit, gear, and agency in Lake Erie during 1999. Units 4 and 5 are combined in Unit 4. Pennsylvania data were not available.

		Commercial	Sport					All Gears	
Unit	**Age**	**OMNR**	**OMNR**	**ODNR**	**MDNR**	**NYDEC**	**Total**	**OMNR**	**Total**
1	1	**92,713**	0	4,233	0	--	**4,233**	92,713	**96,946**
	2	**498,814**	5,086	171,989	38,578	--	**215,653**	503,900	**714,467**
	3	**1,299,524**	20,918	371,028	66,988	--	**458,934**	1,320,442	**1,758,458**
	4	**64,021**	3,646	34,003	24,308	--	**61,957**	67,667	**125,978**
	5	**292,712**	2,399	90,160	6,110	--	**98,669**	295,111	**391,381**
	6	**82,515**	960	79,463	904	--	**81,327**	83,475	**163,842**
	7+	**130,964**	1,344	61,181	3,381	--	**65,906**	132,308	**196,870**
	Total	**2,461,263**	**34,353**	**812,057**	**140,269**	--	**986,679**	**2,495,616**	**3,447,942**
2	1	**19,363**	0	0	--	--	**0**	19,363	**19,363**
	2	**49,246**	0	4,014	--	--	**4,014**	49,246	**53,260**
	3	**323,055**	207	51,312	--	--	**51,519**	323,262	**374,574**
	4	**18,163**	0	6,596	--	--	**6,596**	18,163	**24,759**
	5	**78,176**	0	22,237	--	--	**22,237**	78,176	**100,413**
	6	**38,180**	622	14,584	--	--	**15,206**	38,802	**53,386**
	7+	**105,092**	4,143	39,883	--	--	**44,026**	109,235	**149,118**
	Total	**631,275**	**4,972**	**138,626**	--	--	**143,598**	**636,247**	**774,873**
3	1	**1,681**	0	0	--	--	**0**	1,681	**1,681**
	2	**18,098**	0	1,223	--	--	**1,223**	18,098	**19,321**
	3	**100,750**	0	25,626	--	--	**25,626**	100,750	**126,376**
	4	**12,564**	0	2,133	--	--	**2,133**	12,564	**14,697**
	5	**67,463**	0	15,535	--	--	**15,535**	67,463	**82,998**
	6	**23,527**	0	5,345	--	--	**5,345**	23,527	**28,872**
	7+	**93,061**	4,650	33,188	--	--	**37,838**	97,711	**130,899**
	Total	**317,144**	**4,650**	**83,050**	--	--	**87,700**	**321,794**	**404,844**
4	1	**1,949**	0	--	--	0	**0**	1,949	**1,949**
	2	**1,465**	0	--	--	0	**0**	1,465	**1,465**
	3	**4,831**	844	--	--	2,628	**3,472**	5,675	**8,303**
	4	**1,161**	638	--	--	0	**638**	1,799	**1,799**
	5	**15,225**	2,025	--	--	2,799	**4,824**	17,250	**20,049**
	6	**6,868**	2,531	--	--	861	**3,392**	9,399	**10,260**
	7+	**36,887**	13,169	--	--	16,845	**30,014**	50,056	**66,901**
	Total	**68,386**	**19,207**	--	--	**23,133**	**42,340**	**87,593**	**110,726**
All	1	**115,706**	0	4,233	0	0	**4,233**	115,706	**119,939**
	2	**567,623**	5,086	177,226	38,578	0	**220,890**	572,709	**788,513**
	3	**1,728,160**	21,969	447,966	66,988	2,628	**539,551**	1,750,129	**2,267,711**
	4	**95,909**	4,284	42,732	24,308	0	**71,324**	100,193	**167,233**
	5	**453,576**	4,424	127,932	6,110	2,799	**141,265**	458,000	**594,841**
	6	**151,090**	4,113	99,392	904	861	**105,270**	155,203	**256,360**
	7+	**366,004**	23,306	134,252	3,381	16,845	**177,784**	389,310	**543,788**
	Total	**3,478,068**	**63,182**	**1,033,733**	**140,269**	**23,133**	**1,260,317**	**3,541,250**	**4,738,385**

Table 6. Percent age composition of walleye harvest by management unit, gear, and agency in Lake Erie during 1999. Units 4 and 5 are combined in Unit 4. Pennsylvania data were not available.

		Commercial	Sport					All Gears	
Unit	**Age**	**OMNR**	**OMNR**	**ODNR**	**MDNR**	**NYDEC**	**Total**	**OMNR**	**Total**
1	1	**3.8**	0.0	0.5	0.0	--	**0.4**	3.7	**2.8**
	2	**20.3**	14.8	21.2	27.5	--	**21.9**	20.2	**20.7**
	3	**52.8**	60.9	45.7	47.8	--	**46.5**	52.9	**51.0**
	4	**2.6**	10.6	4.2	17.3	--	**6.3**	2.7	**3.7**
	5	**11.9**	7.0	11.1	4.4	--	**10.0**	11.8	**11.4**
	6	**3.4**	2.8	9.8	0.6	--	**8.2**	3.3	**4.8**
	7+	**5.3**	3.9	7.5	2.4	--	**6.7**	5.3	**5.7**
	Total	**100.0**	**100.0**	**100.0**	**100.0**	--	**100.0**	**100.0**	**100.0**
2	1	**3.1**	0.0	0.0	--	--	**0.0**	3.0	**2.5**
	2	**7.8**	0.0	2.9	--	--	**2.8**	7.7	**6.9**
	3	**51.2**	4.2	37.0	--	--	**35.9**	50.8	**48.3**
	4	**2.9**	0.0	4.8	--	--	**4.6**	2.9	**3.2**
	5	**12.4**	0.0	16.0	--	--	**15.5**	12.3	**13.0**
	6	**6.0**	12.5	10.5	--	--	**10.6**	6.1	**6.9**
	7+	**16.6**	83.3	28.8	--	--	**30.7**	17.2	**19.2**
	Total	**100.0**	**100.0**	**100.0**	--	--	**100.0**	**100.0**	**100.0**
3	1	**0.5**	0.0	0.0	--	--	**0.0**	0.5	**0.4**
	2	**5.70**	0.0	1.5	--	--	**1.4**	5.6	**4.8**
	3	**31.8**	0.0	30.9	--	--	**29.2**	31.3	**31.2**
	4	**4.0**	0.0	2.6	--	--	**2.4**	3.9	**3.6**
	5	**21.3**	0.0	18.7	--	--	**17.7**	21.0	**20.5**
	6	**7.4**	0.0	6.4	--	--	**6.1**	7.3	**7.1**
	7+	**29.3**	100.00	40.0	--	--	**43.1**	30.4	**32.3**
	Total	**100.0**	**100.0**	**100.0**	--	--	**100.0**	**100.0**	**100.0**
4	1	**2.8**	0.0	--	--	0.0	**0.0**	2.2	**1.8**
	2	**2.1**	0.0	--	--	0.0	**0.0**	1.7	**1.3**
	3	**7.1**	4.4	--	--	11.4	**8.2**	6.5	**7.5**
	4	**1.7**	3.3	--	--	0.0	**1.5**	2.1	**1.6**
	5	**22.3**	10.5	--	--	12.1	**11.4**	19.7	**18.1**
	6	**10.0**	13.2	--	--	3.7	**8.0**	10.7	**9.3**
	7+	**53.9**	68.6	--	--	72.8	**70.9**	57.1	**60.4**
	Total	**100.0**	**100.0**	--	--	**100.0**	**100.0**	**100.0**	**100.0**
All	1	**3.3**	0.0	0.4	0.0	0.0	**0.3**	3.3	**2.5**
	2	**16.3**	8.0	17.1	27.5	0.0	**17.5**	16.2	**16.6**
	3	**49.7**	34.8	43.3	47.8	11.4	**42.8**	49.4	**47.9**
	4	**2.8**	6.8	4.1	17.3	0.0	**5.7**	2.8	**3.5**
	5	**13.0**	7.0	12.4	4.4	12.1	**11.2**	12.9	**12.6**
	6	**4.3**	6.5	9.6	0.6	3.7	**8.4**	4.4	**5.4**
	7+	**10.5**	36.9	13.0	2.4	72.8	**14.1**	11.0	**11.5**
	Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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**
75	2.53	2.53	3.26	**2.59**	1.53	--	**1.53**	--	--	**--**	--	--	**2.48**	--	--	--	--	--	**2.48**
76	2.49	2.49	2.35	**2.48**	2.05	--	**2.05**	--	--	**--**	--	--	**2.46**	1.51	1.51	--	--	**1.51**	**2.29**
77	3.29	3.29	2.64	**3.27**	2.44	--	**2.44**	--	--	**--**	--	--	**3.26**	2.74	2.74	--	--	**2.74**	**3.20**
78	3.50	3.62	3.07	**3.48**	3.33	--	**3.33**	--	--	**--**	--	--	**3.48**	2.69	2.69	--	--	**2.69**	**3.35**
79	2.71	2.71	2.67	**2.71**	2.29	--	**2.29**	--	--	**--**	--	--	**2.70**	2.83	2.83	--	--	**2.83**	**2.72**
80	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**
81	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**
82	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**
83	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**
84	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**
85	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**
86	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**
87	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**
88	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**
89	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**
90	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**
91	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**
92	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**
93	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**
94	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**
95	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**
96	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**
97	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**
98	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**
99	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**
Mean	3.69	3.46	3.68	**3.65**	3.81	6.32	**3.83**	4.68	6.39	**4.69**	10.45	6.47	**3.80**	3.28	3.43	4.34	7.00	**3.40**	**3.61**

Mean = long-term mean of all reported values through 1998.

Table 8. Estimated abundance at age, survival (S), and exploitation (*u*) for Lake Erie walleye, 1984 - 1999 (from CAGEAN, M=0.32, Walleye Task Group 2000)

Year	2	3	4	5	6	7+	Total	S	*u*
1984	99,995,857	8,498,687	6,176,076	2,223,253	1,330,905	1,723,777	**119,948,555**	0.6834	0.0505
1985	10,463,821	69,436,348	5,359,484	3,847,879	1,385,153	1,939,934	**92,432,619**	0.6697	0.0667
1986	28,777,500	7,400,908	46,206,835	3,537,290	2,539,622	2,217,611	**90,679,766**	0.6624	0.0754
1987	30,915,734	19,758,444	4,905,578	29,977,417	2,294,873	3,127,067	**90,979,113**	0.6648	0.0725
1988	64,934,808	21,203,078	13,124,356	3,177,741	19,418,809	3,557,706	**125,416,498**	0.6605	0.0775
1989	17,356,228	44,041,767	13,854,633	8,316,083	2,013,536	14,615,886	**100,198,133**	0.6591	0.0792
1990	17,709,600	11,851,656	29,048,666	8,896,397	5,339,959	10,908,908	**83,755,186**	0.6720	0.0640
1991	8,854,762	12,347,228	7,921,643	19,286,573	5,937,810	10,788,926	**65,136,942**	0.6767	0.0584
1992	21,632,476	6,199,535	8,322,617	5,310,517	12,974,157	11,273,428	**65,712,730**	0.6664	0.0705
1993	27,092,698	14,961,111	4,075,661	5,430,856	3,482,589	15,843,291	**70,886,206**	0.6475	0.0930
1994	4,784,313	18,323,642	9,396,633	2,533,280	3,396,807	12,247,431	**50,682,106**	0.6487	0.0916
1995	22,723,045	3,275,133	11,794,975	5,998,981	1,624,225	10,184,521	**55,600,880**	0.6542	0.0851
1996	29,406,916	15,449,332	2,078,893	7,419,851	3,790,041	7,635,323	**65,780,356**	0.6425	0.0989
1997	2,500,880	19,741,105	9,555,596	1,271,728	4,565,370	7,131,740	**44,766,419**	0.6453	0.0956
1998	36,438,650	1,710,784	12,688,196	6,092,369	813,808	7,581,054	**65,324,861**	0.6393	0.1027
1999	16,105,544	24,239,003	1,038,606	7,607,442	3,677,944	5,199,971	**57,868,510**	0.6554	0.0836

Table 9. Predicted age-2 walleye abundance from age-1 gill net and interagency age-0 trawl indices at M=0.32. The index is the geometric mean of catch per unit effort (standard 1,300 foot graded mesh multifilament gill net) from 1999 fall surveys. Ontario values were converted using a 1.45:1 monofilament to multifilament ratio. Trawl indices are the geometric mean catch/10 minute tow from August 1998 surveys. Residuals are observed minus predicted abundance from CAGEAN. The historical mean residual is based on year classes 1982 - 1997. Minimum and maximum values are the mean +/- one standard error. All values are in millions of fish.

	OMNR Partnership Gill Nets	**Interagency August Trawls**
1999 Predicted [a]	14.476	13.905
1999 Observed [b]	16.105	16.105
1999 Residual	1.629	2.200
Historic Mean [c] Residual	5.425	3.278
1999 Index	6.336	1.087
2000 Equation	$Y = 1.5818x+8.8312$ $R^2 = 0.918$	$\ln(Y)=0.7366\ln(x)+2.4157$ $R^2 = 0.901$
2000 Predicted	**18.854**	**11.902**
2000 Minimum	16.388	10.821
2000 Maximum	21.983	12.916
2001 Predicted	---	**34.894**
2001 Minimum	---	34.107
2001 Maximum	---	35.674

[a] From WTG Report, 1999
[b] From 2000 Cagean (see Table 8)
[c] From updated 2000 equations and Cagean

Table 10. Projection of Lake Erie walleye stock size estimates (M=0.32, F_t=0.2) to 2000 and recommended total allowable harvest.

	1999 PARAMETERS FROM CAGEAN									PROJECTED 2000 PARAMETERS			
	Stock Size (millions)				Mortality Rates				Survival Rate		Stock Size (millions)		
Age	**Mean**	**SE**	**Min**	**Max**	**(F)**	**(Z)**	**(A)**	**(*u*)**	**(S)**	**Age**	**Mean**	**Min**	**Max**
2	**16.105**	4.346	11.759	20.451	0.059	0.379	0.315	0.049	0.685	2	**11.902**	10.821	12.916
3	**24.239**	6.541	17.698	30.780	0.120	0.440	0.356	0.097	0.644	3	**11.027**	8.051	14.003
4	**1.039**	0.280	0.759	1.319	0.128	0.448	0.361	0.103	0.639	4	**15.606**	11.395	19.818
5	**7.607**	2.053	5.554	9.660	0.125	0.445	0.359	0.101	0.641	5	**0.664**	0.485	0.843
6	**3.678**	0.993	2.685	4.671	0.136	0.456	0.366	0.109	0.634	6	**4.877**	3.561	6.193
7+	**5.200**	1.403	3.797	6.603	0.098	0.418	0.342	0.080	0.658	7+	**5.754**	4.202	7.307
Total	**57.868**		**42.252**	**73.484**	**0.103**	**0.423**	**0.345**	**0.084**	**0.655**	**Total**	**49.830**	**38.514**	**61.079**

	2000 RECOMMENDED ALLOWABLE HARVEST CALCULATION									
								Yield at Scaled F-opt		
	Projected Stock Size (millions)			Exploitation Rate				Catch (millions)		
Age	**Mean**	**Min**	**Max**	**F-opt [c]**	**s [a]**	**F [b]**	**(*u*)**	**Mean**	**Min**	**Max**
2	**11.902**	10.821	12.916	0.326	0.433	0.141	0.113	**1.346**	**1.224**	**1.461**
3	**11.027**	8.051	14.003	0.326	0.886	0.289	0.216	**2.385**	**1.742**	**3.029**
4	**15.606**	11.395	19.818	0.326	0.945	0.308	0.229	**3.569**	**2.606**	**4.533**
5	**0.664**	0.485	0.843	0.326	0.917	0.299	0.223	**0.148**	**0.108**	**0.188**
6	**4.877**	3.561	6.193	0.326	1.000	0.326	0.240	**1.171**	**0.855**	**1.487**
7+	**5.754**	4.202	7.307	0.326	0.723	0.236	0.181	**1.041**	**0.760**	**1.322**
Total	**49.830**	**38.514**	**61.079**				**0.194**	**9.660**	**7.294**	**12.019**

[a] Selectivity coefficient, calculated as $F_{age} / F_{age(max)}$ for each age group in 1999

[b] Scaled F = F_{opt} x s

[c] Beverton-Holt Y/R parameters for F_{opt} calculations are:

W	1.962	Age at entry to fishery	2.000
K	0.417	Age at recruitment to fishery	2.000
Age at wt. 0	0.000	F_{max}	0.764

M	0.320	F_{opt}	0.326

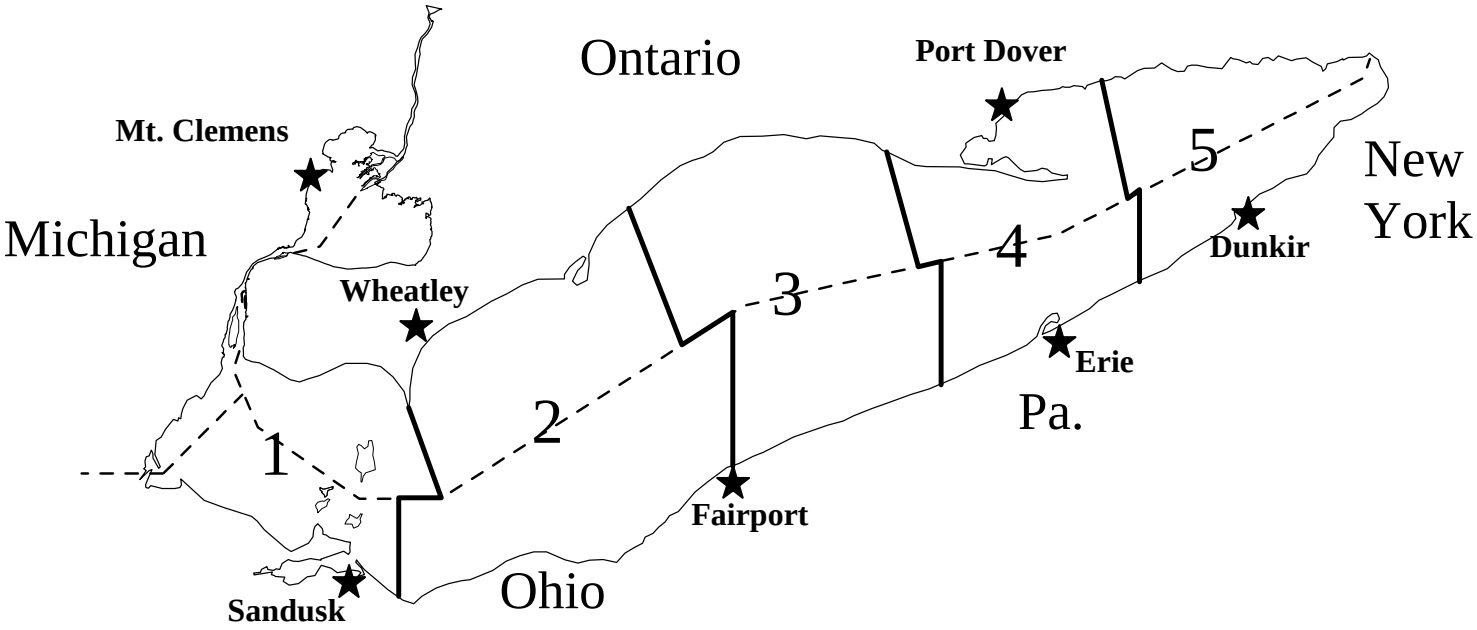

Figure 1. Map of Lake Erie with management units recognized by the Walleye Task Group for interagency management of walleye.

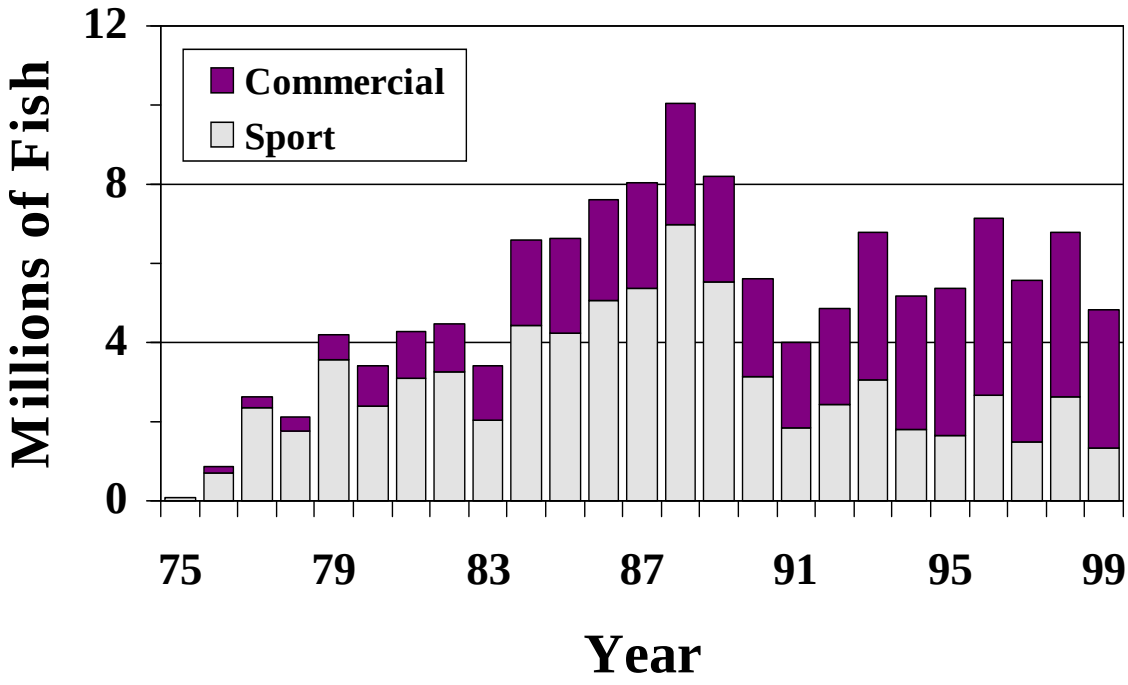

Figure 2. Lakewide harvest of Lake Erie walleye by sport and commercial fisheries, 1975 - 1999.

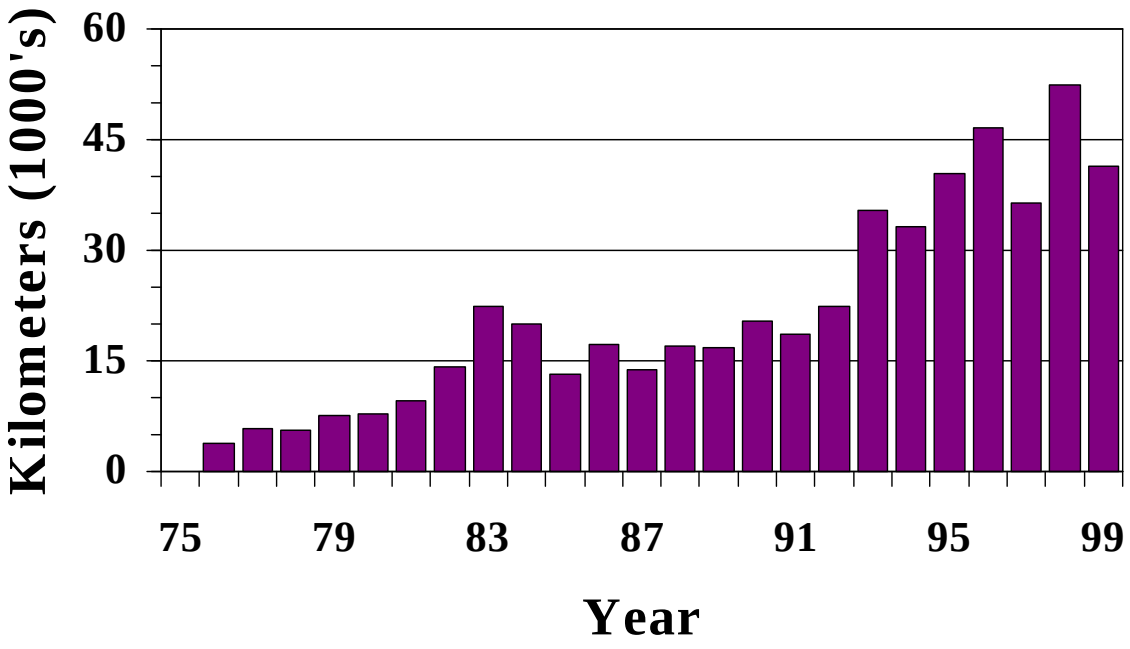

Figure 3. Lakewide total effort (kilometers of gill net) by commercial fisheries on Lake Erie walleye, 1975 - 1999.

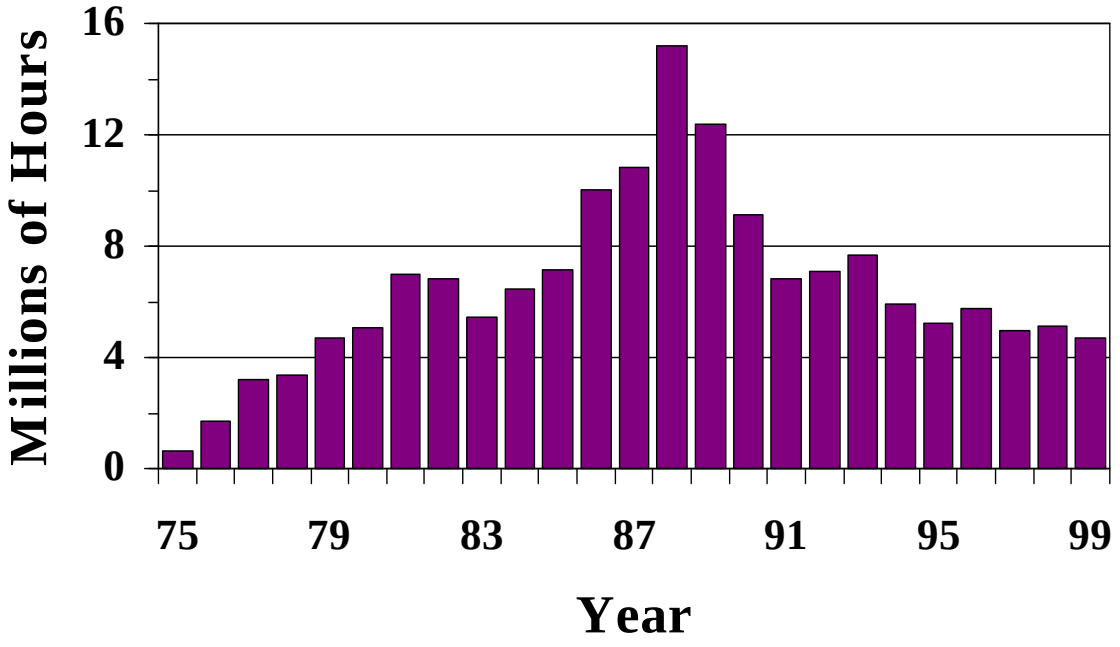

Figure 4. Lakewide total effort (angler hours) by sport fisheries for Lake Erie walleye, 1975 - 1999.

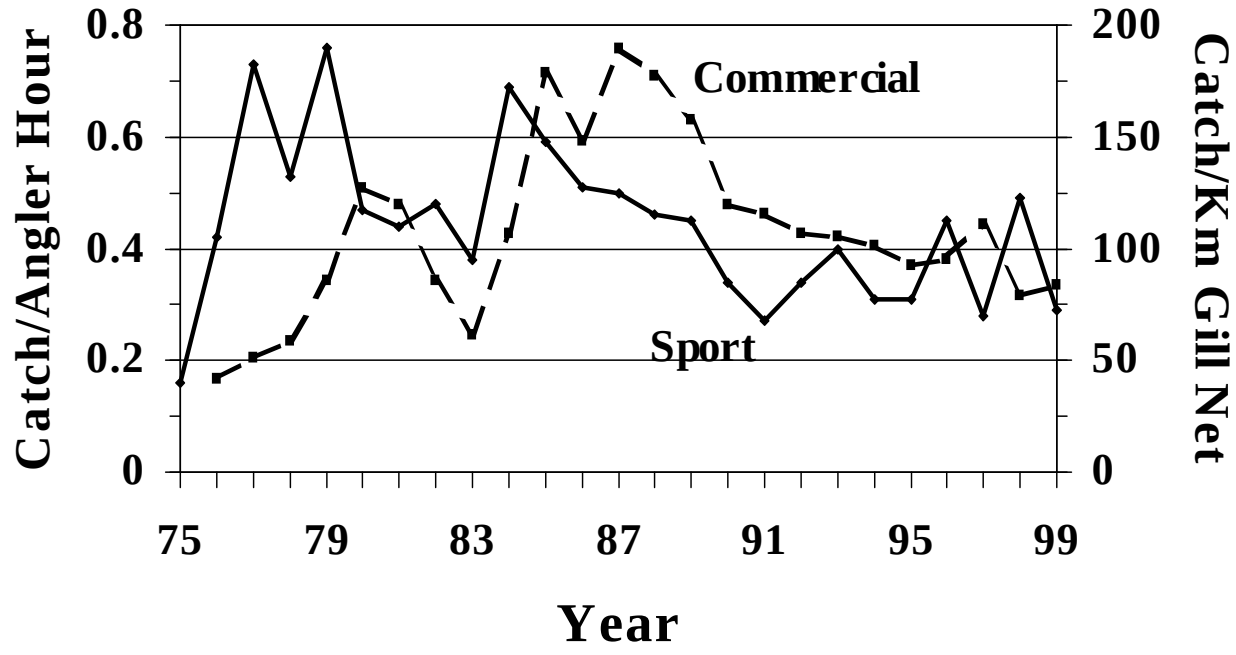

Figure 5. Lakewide CUE for Lake Erie sport and commercial walleye fisheries, 1975 - 1999.

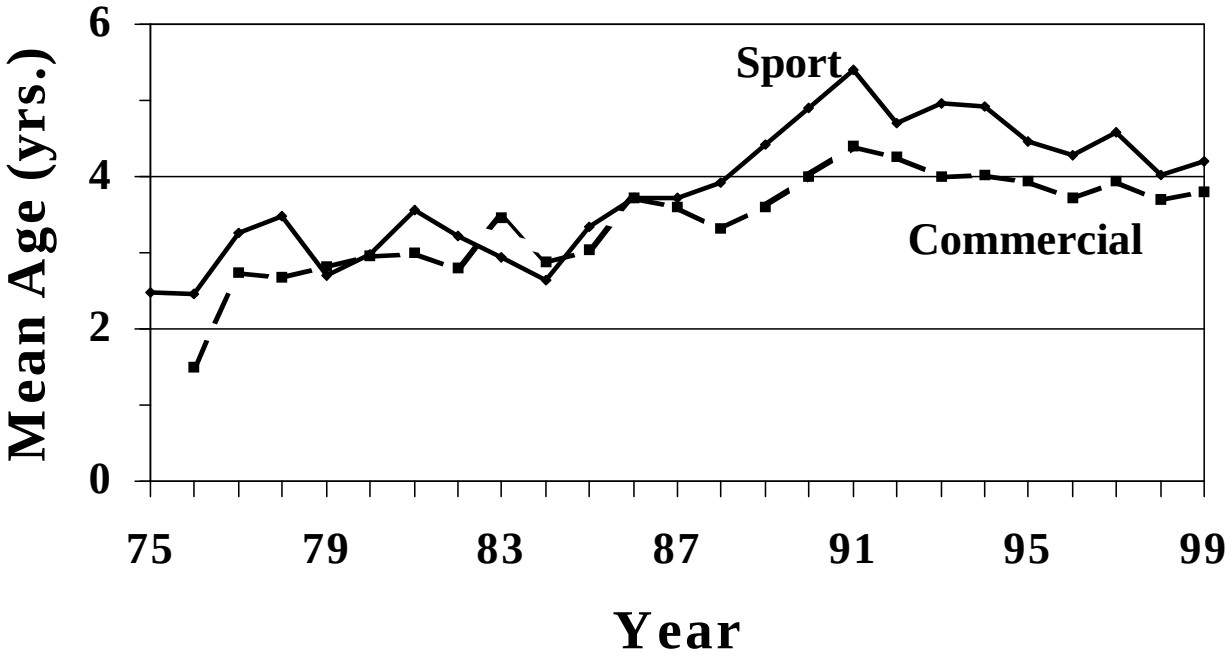

Figure 6. Lakewide mean age of Lake Erie walleye in sport and commercial harvests, 1975 - 1999.

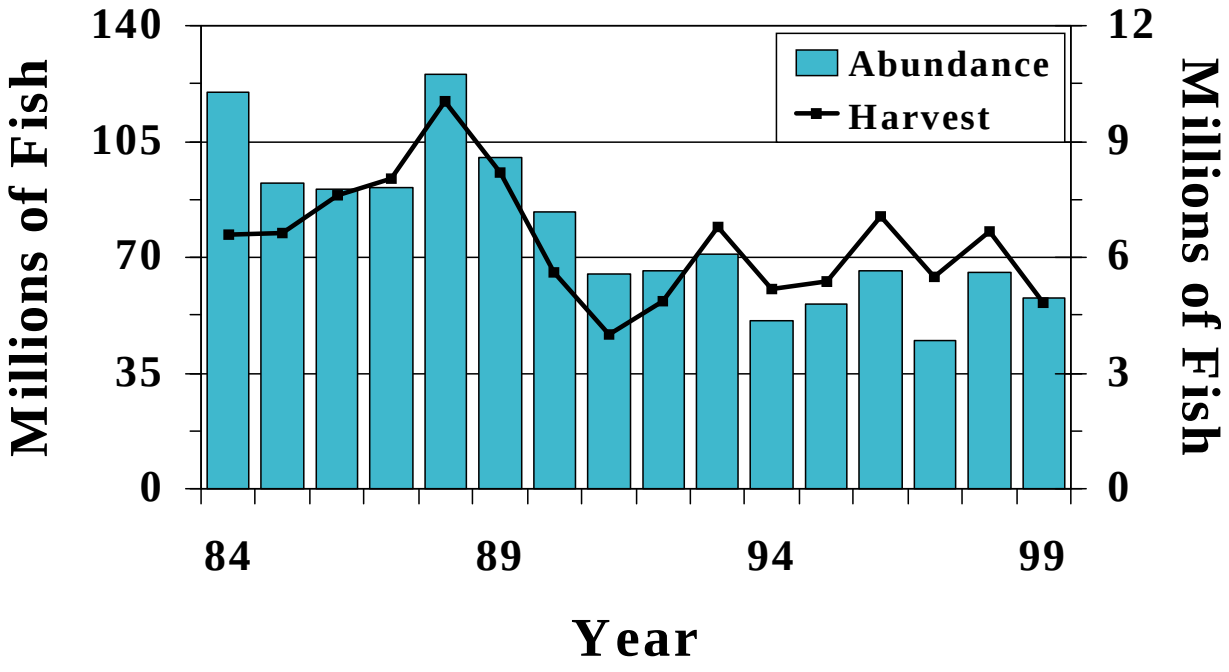

Figure 7. Stock size estimates (left axis) and observed harvest (right axis) of Lake Erie walleye, 1984- 1999.

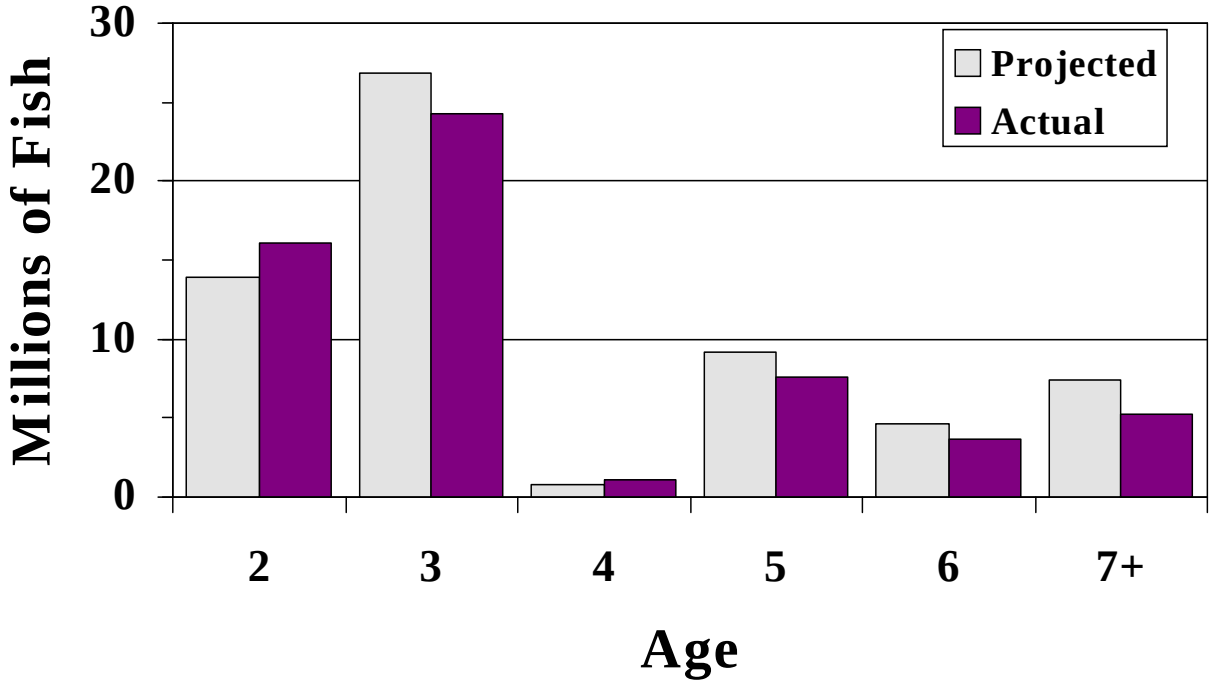

Figure 8. Projected vs. actual abundance of Lake Erie walleye by age group in 1999. Projected values are from the 1999 WTG Report, actual values are from 2000 CAGEAN analysis (Table 8).

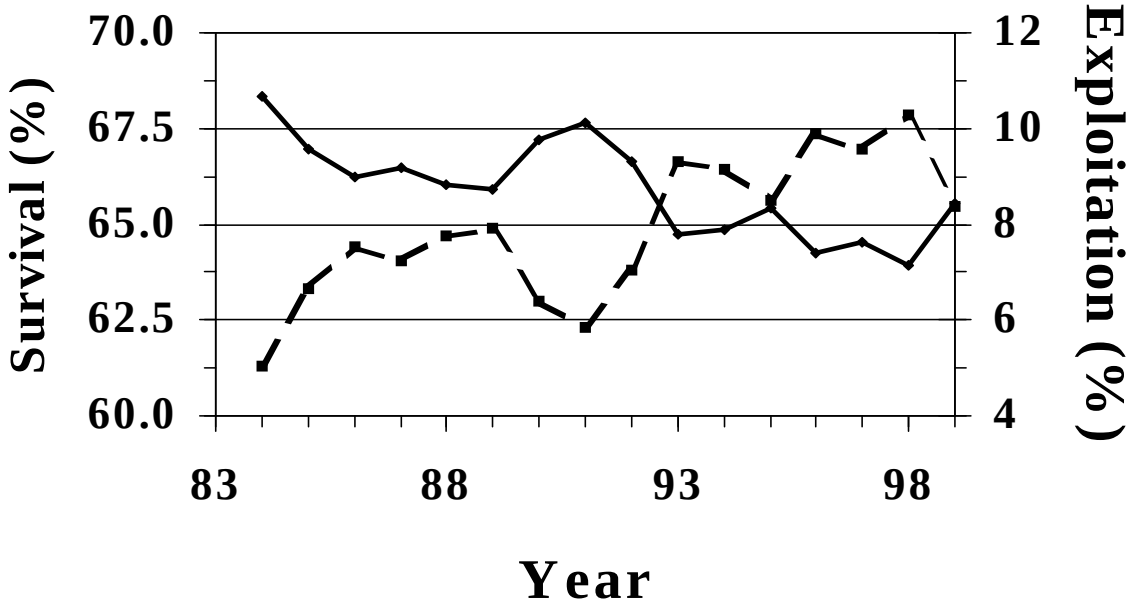

Figure 9. Estimated survival (solid line) and exploitation (dashed line) rates for Lake Erie walleye from CAGEAN for 1984 - 1999.

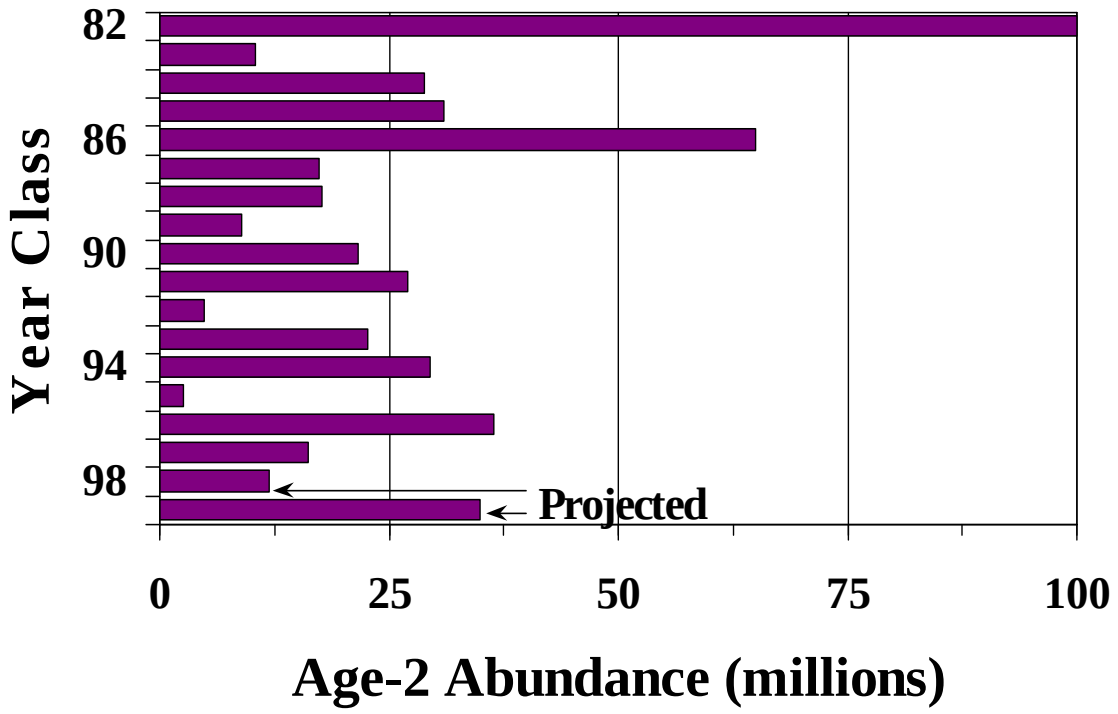

Figure 10. Estimated abundance of age-2 Lake Erie walleye from CAGEAN (M=0.32) and as projected from interagency trawl indices for the 1998 and 1999 year classes.

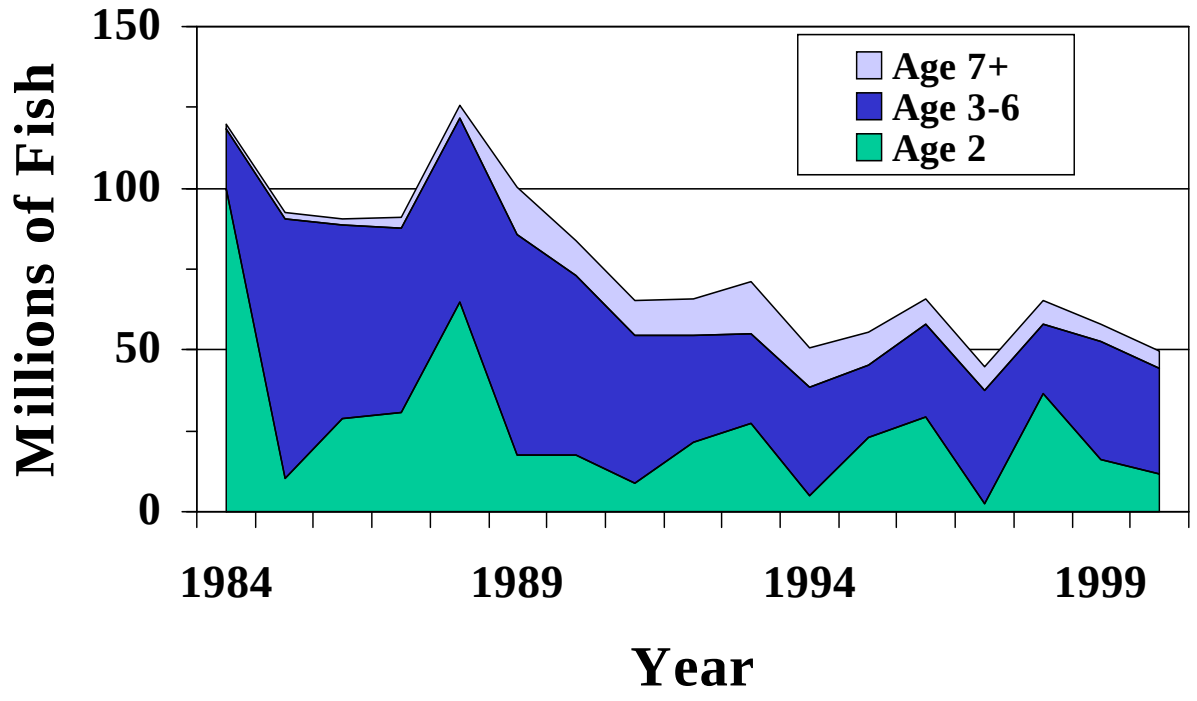

Figure 11. Trends in abundance of Lake Erie walleye by age group from CAGEAN, 1984 - 1999, projected to 2000.

Appendix A. CAGEAN command file used by the WTG in 2000 to estimate stock parameters for age-2 and older walleye in 1984-99.

```
BASE 84-99 3SGCG 2GEAR POOL M=0.32 F(t)=0.174 S=0.61
PARM.OUT
1984 1999          RANGE OF YEARS FOR ANALYSIS
2 7                RANGE OF AGES FOR ANALYSIS
2                  NUMBER OF GEAR TYPES
1                    CODE NUMBER FOR GEAR TYPE 1
2                    CODE NUMBER FOR GEAR TYPE 2
1.0                  LAMBDA FOR GEAR TYPE 2
2                  NUMBER OF SELECTIVITY GROUPS GEAR TYPE 1
1984 1989            RANGE OF YEARS FOR SELGRP 1
 3  6                RANGE OF AGES OF FULL SELECTIVITY SELGRP 1
1990 1999           RANGE OF YEARS FOR SELGRP 2
 4  6                RANGE OF AGES OF FULL SELECTIVITY SELGRP 2
3                  NUMBER OF SELECTIVITY GROUPS GEAR TYPE 2
1984 1985           RANGE OF YEARS SELGRP 1
 4  7                RANGE OF AGES OF FULL SELECTIVITY SELGRP 1
1986 1989            RANGE OF YEARS SELGRP 2
 4  7                RANGE OF AGES OF FULL SELECTIVITY SELGRP 2
1990 1999            RANGE OF YEARS FOR SELGRP 3
 6  7                RANGE OF AGES OF FULL SELECTIVITY SELGRP 3
1                  NUMBER OF CATCHABILITY GROUPS GEAR TYPE 1
1984 1999            RANGE OF YEARS CATGRP 1
3                  NUMBER OF CATCHABILITY GROUPS GEAR TYPE 2
1984 1985           RANGE OF YEARS CATGRP 1
1986 1989            RANGE OF YEARS CATGRP 2
1990 1999            RANGE OF YEARS CATGRP 3
50                  BOOTSTRAP ITERATIONS
0.32               NATURAL MORTALITY
0.0
OK                 OK TO PARAMETERS OK
Y                  FULL LISTING
0                  FIXING OF VARIABLES (1=YES 2=NO)
1                  POOLING OF CATCH DATA (AGES 7-10)
CAGE99.DAT
EFF99.DAT
.62                EFFORT LAMBDA GEAR TYPE 1
.38                 EFFORT LAMBDA GEAR TYPE 2
NONE
WT99.DAT             WEIGHT FILE
COHORT
0.20
ABUN.OUT         OUTPUT FILE
WISH.TNK
PARM.DB3
Y
N
```