STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-53-R-14

Study No.: 466

Title: Fish Community status in Saginaw Bay, Lake Huron

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: To collect growth, abundance and other biological data with which to assess responses of the Saginaw Bay fish community to changing environmental and biological conditions.

Summary: Between 1989 and 1997, 379 trawl tows and 143 gill net sets were performed. Data collection has been standardized among years to allow comparisons. Data was analyzed for trends and as indicators of the effects of management actions and environmental changes. During the nine years of data collection, relative abundance of walleye in the gill-net catch has declined. Similar declines, however, have not occurred in the sport angler catch rate. It is believed that declines in gill-net catch rate may be due to gear avoidance resulting from increased water clarity. Another possible reason for a lack of decline in angler catch rates is compensating immigration to the bay from Lakes Erie and St. Clair during the summer months. Frequency of gizzard shad in walleye diet has declined in recent years and alewife became more common. The gill-net catch rate of walleye was a record low in 1997. Of that catch, only 2.5% was yearlings indicating a weak 1996 year class. There were no walleye fingerlings stocked that year as part of the alternate year stocking evaluation. Mean age of the walleye population increased in 1997 partially reflecting the lack of yearlings. Growth of walleye in Saginaw Bay remains excellent, substantially exceeding the average for Michigan in all age categories except the very oldest (age 9). Abundance of yellow perch in the gill net catch declined in 1997 but still exceeded 1994 and 1995. Yellow perch growth continued to improve in 1997 nearing the state average for some age groups. Condition, as indicated by relative weight, remained good for both walleye and yellow perch and did not change appreciably from 1996. In 1997, trawling on Saginaw Bay included 37 tows in July and 31 tows in September. This report summarizes the results of the September trawl tows and compares them with fall trawl data from previous years. The 1997 catch rates for several species were the highest observed during this time period. In particular, rainbow smelt and spottail shiner CPUE values were much higher than for any other year. Trawling indicated the yellow perch recruitment improved from 1996 and remained well above the poor recruitment period of 1992-94. Growth rates of yellow perch caught in the trawl remained well above those observed before 1993. No tubenose gobies or Eurasian ruffe have appeared yet in the trawl catch. A nine year summary research report is scheduled for summer 1998.

Job 1. Title: **Relative abundance and community structure.**

Findings: A total of 18 gillnet sets were performed in 1997 (Table 1). Netting was divided between inner and outer bay environments (Table 2).

The overall abundance of walleye (see Table 3 for a complete list of scientific names for all species mentioned in this report) in 1997, as indicated by the gillnet catch, declined slightly from

1996 to the lowest level since the partial recovery of the species in the 1980s (Table 4). The significance of this decline since the greater values of the early 1990s continues to be discussed. It is unclear if these declines are reflective of true changes of walleye abundance. Trends in the sport fishery have not fully mirrored these declines. Based on the expanded sampling conducted in previous years, it does not appear that greater concentrations of walleye occur in shallow depths nor the outer bay environments, although those areas were not appreciably sampled prior to 1995 and their usage was not fully known. The continued trends in increased water clarity due to zebra mussel (*Dreissena polymorpha*) colonization may be increasing gear avoidance by walleye. Also, tag returns indicate substantial immigration from Lakes Erie and St. Clair during the summer months. This may dilute or confound trends in abundance of local walleye, however, the timing of this survey may still include the presence of non-local walleye.

Analysis of the walleye catch by age indicates three weak year classes (1992, 1993 and 1996) (Table 5). The first two year classes are now fully recruited to the fishery and may be partially accounting for both declines in the gillnet CPUE. The percentage of yearling walleye is one measure of recruitment and was only 2.5% in 1997. This suggests a weak 1996 year class. There has now been two non-stocked years in the alternate year stocking evaluation conducted under Study 468 (1993 and 1996) and both are weak. However, the weak year class of 1992 was stocked. The 1997 stocking was performed with fingerlings marked with oxytetracycline. Based on age-0 walleye, it appears that the 1997 year class is strong but only 19% of it can be attributed to natural reproduction (see Study 468). Walleye mean age increased in 1997 probably reflecting the low abundance of yearlings (Table 5).

A total of 31 trawl hauls were performed in September 1997 (Table 6). Trawling collected over 125,000 fish in 1997. Trawl CPUE is summarized in Table 7. Rainbow smelt, spottail shiner, trout-perch, and white sucker catch rates were higher in 1997 than for any other year in the time period. In addition, alewife and emerald shiner CPUE increased to near the highest level for the period. Johnny darter CPUE remained high relative to the early 1990's. Yellow perch CPUE increased from 1996, mainly due to an increase in age-0 CPUE, which was the third highest index value since 1990 (Table 8). White perch CPUE increased in 1997, but remained well below the record high in 1989 (Table 9). Notably absent from the trawl catch were round gobies as well as Eurasian ruffe. Both of these exotic species have been reported from other locations in Lake Huron, and are expected to colonize Saginaw Bay in the near future.

Mean length at age for yellow perch captured in trawls indicate growth has improved substantially (Table 10). Both males and females of all ages have experienced faster growth since 1993. This improvement in growth is likely a density dependent response to the dramatic decline in yellow perch abundance since 1989. An improvement in food resources may also be involved. Zebra mussels first became abundant throughout Saginaw Bay in 1992. The subsequent redirection of energy into benthic production may be contributing to improved yellow perch growth. Rautio (1995) demonstrated that yellow perch experienced improved growth in the presence of zebra mussels, likely as a result of a more diverse benthic macrovinvertebrate community.

Growth rates of walleye collected in the gillnet samples remains very fast compared to the state average (Table 11). This is ongoing confirmation that the walleye population in Saginaw Bay is well below carrying capacity. Gill net caught yellow perch also indicate the improved growth as revealed by the trawling (Table 11). Condition of walleye and yellow perch, as indicated by relative weight, did not change appreciably from 1996 and remains good (Table 12). The proportional stock density (PSD) of walleye in Saginaw Bay remained high in 1996 indicative of the fast growth rates and low exploitation rates (see Study 436) (Table 13). The walleye population in Saginaw Bay continues to function like a trophy fishery where abundance is low and growth rates are fast. Walleye food habits continue to show utilization of gizzard shad and alewife as principle dietary components in 1997 (Table 14).

Yellow perch abundance, as indicated by the 1997 gillnet CPUE, decreased from 1996 but was still greater than 1994 and 1995 (Table 4). the year classes of 1994 and 1995 appear strong (Tables 11 and 15). Yellow perch growth rates continued to improve but care still below the state average for all except age 1 in 1997 (Table 11). Population size structure, as indicated by proportional stock density, continues to be dominated by smaller individuals. This too may be a result of increased recruitment. White perch age structure indicates continued recruitment (Table 15). The length / weight relationship for select species is presented in Table 16.

Job 2. Title: Process and analyze the data.

Findings: Analysis of the study data has been performed by Michigan Department of Natural Resources Fisheries Division personnel from the Alpena Great Lakes Fisheries Research Station, Mt. Clemens Great Lakes Fisheries Research Station and the Bay City District Office.

Job 3. Title: Prepare annual, final and other reports.

Findings: This annual report summarizes data from 1997 and those reported previously in performance reports since 1991 and fulfills the requirements of Job 3. A nine year project summary research report is anticipated for completion during the summer of 1998.

Literature Cited:

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Haas, R. C. and J. S. Schaeffer. 1992. Predator-prey and competitive interactions among walleye, perch, and forage species in Saginaw Bay, Lake Huron. Research report number 1984, Michigan Department of Natural Resources, Fisheries Division, Ann Arbor.

Merna, J.W., J. C. Schneider, G. R. Alexander, W. D. Alward, and R. L. Eshenroder. 1981. Manual of fisheries survey methods. Fisheries Management Report No. 9. Fisheries Division, Michigan Department of Natural Resources, Ann Arbor.

Rautio, S.A. 1995. Zebra mussel effects on diet and growth of adult yellow perch and predatory impact of freshwater drum on zebra mussels in pond enclosures. Michigan Department of Natural Resources Fisheries Research Report #2015, Ann Arbor.

Table 1.–Fall gill-net sampling locations for Saginaw Bay, Lake Huron, 1990-97.

Station	1990	1991	1992	1993	1994	1995	1996	1997
Pt. Lookout	---	---	1	1	1	4	3	1
AuGres River	---	2	1	---	1	1	1	1
Pt. AuGres	---	2	2	2	2	6	6	2
Black Hole	3	2	2	2	2	6	5	2
Coreyon Reef	2	2	2	2	2	3	2	2
Fish Pt.	---	---	---	2	2	3	5	2
North Island	---	---	---	---	1	6	5	2
Oak Pt.	---	---	---	1	1	6	5	2
Charity Is.	---	---	---	---	---	3	2	2
Tawas	---	---	---	---	---	2	2	2
Total	5	8	8	9	12	40	36	18

Table 2.–Location of fall gill-net sampling effort in Saginaw Bay, Lake Huron, divided by inner and outer bay environments for 1990-97.

Location	1990	1991	1992	1993	1994	1995	1996	1997
Inner	5	8	7	7	10	28	24	11
Outer	0	0	1	2	2	12	12	7
Total	5	8	8	9	12	40	36	18

Table 3.–Common and scientific names of fishes mentioned in this report.

Common name	Scientific name
Alewife	*Alosa pseudoharengus*
Bluegill	*Lepomis macrochirus*
Burbot	*Lota lota*
Channel catfish	*Ictalurus punctatus*
Common carp	*Cyprinus carpio*
Emerald shiner	*Notropis atherinoides*
Eurasian ruffe	*Gymnouphalus cernuus*
Freshwater drum	*Aplodinotus grunniens*
Gizzard shad	*Dorosoma cepedianum*
Johnny darter	*Etheostoma nigrum*
Lake whitefish	*Coregonus clupeaformis*
Ninespine stickleback	*Pungitius pungitius*
Northern pike	*Esox lucius*
Pumpkinseed	*Lepomis gibbosus*
Quillback	*Carpiodes cyprinus*
Rainbow smelt	*Osmerus mordax*
Round goby	*Neogobius melanostomus*
Shorthead redhorse	*Moxostoma macrolepidotum*
Spottail shiner	*Notropis hudsonius*
Trout-perch	*Percopsis omiscomaycus*
Walleye	*Stizostedion vitreum*
White bass	*Morone chrysops*
White perch	*Morone americana*
White sucker	*Catostomus commersoni*
Yellow perch	*Perca flavescens*

Table 4.–Catch summary from fall gill-net surveys of Saginaw Bay, Lake Huron, 1991-97. Catch-per-unit of effort (CPUE) is expressed as catch per 1000 m of net. Total effort in parentheses.

	1991 (2,438m)		1992 (2,438m)		1993 (2,745m)		1994 (3,353m)		1995 (3,658m)		1996 (4,267m)		1997 (4,267m)	
Species	Total catch	CPUE	Total catch	CPUE	Total catch	CPUE	Total catch	CPUE	Total catch	CPUE	Total catch	CPUE	Total catch	CPUE
Gizzard shad	420	172.1	21	8.6	92	33.51	45	13.42	47	12.85	207	48.52	31	7.26
Carp	1	0.4	17	7	5	1.82	13	3.88	3	0.82	9	2.10	1	0.25
Quillback	8	3.3	3	1.2	3	1.09	4	1.19	10	2.73	16	3.74	1	0.23
White sucker	499	205	975	399.6	358	130.4	443	132.1	218	59.6	464	108.73	263	61.6
White perch	229	93.9	15	6.1	31	11.31	318	94.84	105	28.71	398	93.27	266	62.33
White bass	26	10.7	14	5.7	10	3.65	1	0.3	13	3.55	7	1.64	9	2.11
Freshwater drum	27	11.06	89	36.05	53	19.31	86	25.65	38	10.39	59	13.81	66	15.47
Yellow perch	427	175	267	109.4	646	235.4	343	102.3	313	85.57	832	194.98	430	100.77
Walleye	689	283.4	171	70.1	381	138.8	163	48.61	161	45.11	180	42.19	158	37.02
Northern pike	4	1.64	6	2.5	0	0	5	1.49	4	1.09	1	0.23	1	0.23
Channel catfish	122	50	26	10.7	58	21.13	40	11.93	17	4.65	123	28.84	68	15.93

Table 5.–Catch and percent contribution of year classes of walleye from fall gill-net surveys, Saginaw Bay, Lake Huron, 1991-97.

Year class	Age	Percent	Catch per 1000 m	Age	Percent	Catch per 1000m	Age	Percent	Catch per 1000m
	1992			1993[1]			1994		
1994	---	---	---	---	---	---	0	1.3	0.6
1993	---	---	---	0	---	0.0	1	4.5	2.2
1992	0	---	---	1	3.8	5.1	2	8.4	4.1
1991	1	18.1	12.7	2	28.6	38.6	3	18.1	8.8
1990	2	25.1	17.6	3	18.1	24.4	4	21.9	10.6
1989	3	14.7	10.3	4	21.0	28.4	5	16.8	8.2
1988	4	11.1	7.8	5	8.1	10.9	6	16.1	7.8
1987	5	10.6	7.4	6	6.5	8.7	7	9.7	4.7
1986	6	7.0	4.9	7	7.8	10.6	8	3.2	1.6
1985	7	8.1	5.7	8	4.8	6.6	9	---	0.0
1984	8	3.6	2.5	9	0.8	1.1	10	---	0.0
1983	9	0.6	0.4	10	---	0.0	11	---	0.0
1982	10	1.1	0.8	11	---	0.0	12	---	0.0
1981	11	---	---	12	0.3	0.4	13	---	0.0
Mean	3.5			3.9			4.4		
Total		100	70.1		100	138.8		100	48.6
	1995[2]			1996[2]			1997[2]		
1997	---	---	---	---	---	---	0	1	0.3
1996	---	---	---	0	---	---	1	2.5	0.8
1995	0	3.3	1.2	1	17.6	6.2	2	16.9	5.6
1994	1	23.5	8.9	2	29.0	9.8	3	28.9	9.6
1993	2	0.7	0.2	3	4.6	1.6	4	4.0	1.3
1992	3	8.6	3.2	4	3.1	1.1	5	5.0	1.6
1991	4	16.9	6.4	5	11.9	4.2	6	10.9	3.6
1990	5	18.5	7.0	6	12.3	4.3	7	8.5	2.8
1989	6	12.9	4.9	7	11.1	3.9	8	10.9	3.6
1988	7	8.3	3.1	8	5.4	1.9	9	8.5	2.8
1987	8	5.6	2.1	9	4.6	1.6	10	2.0	0.7
1986	9	0.7	0.2	10	1.5	0.5	11	0.5	0.2
1985	10	0.3	0.1	11	---	---	12	0.5	0.2
1984	11	0.7	0.2	12	---	---	13	---	---
1983	12	---	---	13	---	---	14	---	---
1982	13	---	---	14	---	---	15	---	---
1981	14	---	---	15	---	---	16	---	---
Mean	4.1			4.1			4.8		
Total		100	37.6			34.9		100	33.3

[1] Age distribution includes one age-13 fish, eleven walleyes were not aged. Percent contribution based on aged fish only.

[2] Data based on expanded netting effort catch to provide a larger sample size. Total catch per 1000m therefore differs slightly from value reported in Table 3 which is based solely on catch from traditional netting locations.

Table 6.–Location of trawl stations and number of tows performed in Saginaw Bay, 1990-97. All sampling was conducted in fall except where indicated otherwise.

Quadrant Location	Site description	1990	1991	1992[1]	1993[2]	1994	1995[3]	1996	1997[5]
Northeast	North Island & Wildfowl Bay	5	4	24	14	6	6	6	13
Southeast t	Fish Point	4	4	19	13	3	9	6	16
Southwest	Pinconning	4	4	27	20	13	9	12	15
Northwest	AuGres	3	4	21	25	10	15	6	23
Total		16	16	91	72	32	39	30	68
Study total									379[4]

[1] Total number of tows includes 27 from each of May and July.
[2] Total number of tows includes 34 from July.
[3] Total for northwest quadrant includes 6 experimental trawls near Charity Islands
[4] Total for study includes 15 tows from 1989.
[5] Total number of tows includes 37 from July.

Table 7.–Mean catch-per-unit-of-effort (CPUE) of fish collected from trawling in Saginaw Bay, Lake Huron, 1990 through 1997 based on fall data only. Total number of tows are in parentheses. See Table 4 for complete listing of scientific names for each species.

Species	1990 (16)	1991 (16)	1992 (37)	1993 (38)	1994 (32)	1995 (39)	1996 (30)	1997 (31)
Gizzard shad	45.1	49.4	0.3	19.3	8.5	6.2	22.9	17.8
Alewife	16.1	80.0	302.5	191.2	48.3	306.8	98.7	300.7
Rainbow smelt	47.1	43.7	280.2	467.9	57.9	22.4	15.2	1,584.6
Trout perch	133.1	165.5	199.9	416.4	512.5	513.5	474.1	733.3
Spottail shiner	194.5	124.1	182.0	96.8	203.5	372.6	209.5	808.5
Yellow perch	148.7	176.5	69.3	37.8	24.0	125.8	85.0	121.8
White sucker	11.1	12.3	7.6	10.3	9.8	7.0	7.7	28.3
Johnny darter	1.3	0.5	11.5	10.3	10.8	28.9	20.7	20.0
White perch	671.2	403.9	91.5	27.9	183.0	528.2	277.2	416.4
Walleye	1.5	5.5	1.1	1.3	1.2	0.9	1.3	2.9
White bass	3.6	6.0	0.1	1.8	6.1	1.0	0.4	4.1
Carp	5.3	3.1	2.9	3.3	8.8	6.9	4.4	4.5
Freshwater drum	23.1	24.6	2.8	8.7	27.8	28.3	16.3	4.6
Channel catfish	4.7	0.4	0.3	0.9	6.0	3.3	6.3	2.3
Bluegill	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Quillback	0.3	0.4	0.1	0.6	0.6	0.6	0.6	0.1
Lake whitefish	0.2	0.0	0.1	0.0	0.0	0.8	0.1	1.4
Pumpkinseed	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0
Emerald shiner	44.9	14.8	9.3	0.7	0.0	0.0	0.9	12.6
Burbot	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shorthead redhorse	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0

Table 8.–Number of young-of-the-year yellow perch caught per ten-minute tow (CPUE) from Saginaw Bay, Lake Huron and their mean total length, fall 1970-97[1].

Year	CPUE	Mean total length (mm)
1970	29.5	96.5
1971	20.2	91.4
1972	13.9	83.8
1973	30.6	91.4
1974	27.9	88.9
1975	247.9	88.9
1976	11.1	91.4
1977	52.9	91.4
1978	99.8	86.4
1979	166.7	78.7
1980	39.0	86.4
1981	71.3	83.8
1982	686.7	76.2
1983	251.9	76.2
1984	171.0	78.7
1985	147.8	78.7
1986	71.4	73.7
1987	131.5	81.3
1988	56.6	76.2
1989	252.8	71.1
1990	39.0	79.5
1991	110.8	70.2
1992	7.1	76.2
1993	0.5	90.7
1994	3.9	85.0
1995	98.9	117.3
1996	37.3	81.9
1997	83.3	73.8

[1] Data prior to 1990 from Haas and Schaeffer (1992).

Table 9.–White perch catch from trawling effort, fall 1985-97, Saginaw Bay, Lake Huron.[1]

Year	Total catch	Number of tows	Number of minutes	Number per tow	Number per minute
1985	0	NA	NA	---	---
1986	606	167	1,457	3.6	0.42
1987	7,514	252	2,321	29.8	3.24
1988	41,427	248	2,181	167.0	18.99
1989	34,817	15	150	2,321.1	232.11
1990	10,739	16	158	671.2	68.97
1991	6,463	16	149	403.9	43.52
1992	3,295	36	360	91.5	9.15
1993	1,076	38	419	28.3	2.57
1994	6,062	32	320	189.4	18.94
1995	19,002	36	360	528.2	52.78
1996	8,130	30	306	271.0	26.6
1997	12,873	31	320	415.2	40.2

[1] Data prior to 1990 from Haas and Schaeffer (1992).

Table 10.–Mean length (mm) at age for yellow perch from fall Saginaw Bay trawls, 1986-97[1].

	Survey year											
Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	Males											
Age 1	118	120	119	120	124	124	124	131	145	135	132	131
Age 2	137	137	137	141	146	146	149	155	159	169	166	165
Age 3	154	152	150	157	165	167	164	178	176	179	189	195
Age 4	184	168	164	170	175	184	181	194	191	192	200	202
Age 5	199	190	177	185	186	201	187	202	200	203	211	219
Age 6	209	189	201	194	195	212	209	213	200	211	219	219
Age 7	249	223	211	210	210	242	224	262	222	236	247	234
	Females											
Age 1	121	122	123	123	126	127	127	132	148	142	137	136
Age 2	145	143	143	149	157	155	159	169	172	179	183	180
Age 3	173	166	160	169	176	179	173	188	195	193	203	209
Age 4	197	190	183	184	201	202	204	210	214	211	220	232
Age 5	233	214	207	208	215	221	236	242	235	225	233	229
Age 6	265	226	217	222	235	246	249	245	246	247	260	286
Age 7	222	256	245	246	246	273	244	283	296	276		279

[1] Data prior to 1990 from Haas and Schaeffer (1992).

Table 11.–Mean length at age of walleye and yellow perch and by year for walleye from Saginaw Bay, Lake Huron, from fall gill-net data for 1990-97, compared with Michigan average lengths from October -December catches. Bay historic average for 1926-38 also included for walleye[2]. Sample sizes in parentheses.

	Survey year								
Age	1991	1992	1993	1994	1995	1996	1997	Michgan average[1]	Bay average
				Walleye					
0	238 (20)	---	---	---	224 (10)	---	---	180	---
1	361(151)	320 (1)	306 (14)	348 (7)	346 (71)	352 (46)	330 (5)	264	254
2	444(175)	438 (43)	410(106)	426 (13)	---	437 (73)	419 (34)	353	320
3	504 (85)	500 (25)	465 (67)	473 (28)	470 (26)	478 (12)	468 (58)	401	371
4	536 (68)	535 (19)	516 (78)	520 (34)	501 (51)	537 (8)	504 (8)	447	411
5	557 (69)	548 (18)	537 (30)	537 (26)	543 (56)	517(31)	536 (10)	488	457
6	571 (68)	588 (12)	552 (24)	564 (25)	555 (39)	582 (32)	547 (22)	523	483
7	590 (26)	611 (14)	580 (29)	613 (15)	572 (25)	568 (29)	576 (17)	549	505
8	611 (21)	638 (6)	601 (18)	612 (5)	590 (17)	579 (14)	586 (22)	569	533
9	---	---	---	---	---	619 (12)	579 (17)	586	582
Mean	472	483	483	514	480				
				Yellow perch					
0	---	---	---	---	---	---	---	84	---
1	---	---	153 (5)	---	148 (93)	150 (34)	141 (32)	133	---
2	---	176 (8)	185 (11)	148(6)	161 (44)	151(193)	155 (135)	165	---
3	197 (56)	196 (61)	189 (80)	176(29)	187 (47)	184 (91)	189 (164)	191	---
4	208(100)	211 (69)	195 (71)	198(98)	205(101)	196 (85)	202 (66)	216	---
5	220 (52)	235 (37)	208 (28)	214(82)	220 (32)	211 (82)	227 (43)	240	---
6	218 (11)	237 (20)	213 (16)	243(21)	248 (10)	232 (31)	239 (25)	262	---
7	---	---	216 (5)	---	---	244 (12)	247 (14)	282	---
8	---	---	---	---	---	---	256 (6)	295	---

[1] From Merna et al. (1981).
[2] From Hile (1954).

Table 12.–Mean relative weight by length classes[1] and all sizes combined for walleye and yellow perch collected in gill-nets from the falls of 1989 through 1998 from Saginaw Bay, Lake Huron. N=sample size for that year.

Year	Stock-quality	Quality-preferred	Preferred-memorable	All sizes combined	N
			Walleye		
1989	100	95	95	96	259
1990	98	102	97	98	508
1991	95	96	95	96	689
1992	87	88	90	89	171
1993	91	91	88	90	382
1994	88	88	90	88	155
1995	92	93	92	95	302
1996	90	92	90	90	267
1997	95	90	92	91	204
			Yellow perch		
1989	NA	NA	NA	NA	NA
1990	98	97	92	97	101
1991	82	80	83	81	231
1992	82	86	86	84	202
1993	96	95	94	96	218
1994	99	96	92	96	203
1995	91	87	90	89	501
1996	96	93	90	95	1658
1997	94	95	93	94	962

[1] See Table 13 for explanation of size classes.

Table 13.–Walleye and yellow perch proportional stock density (PSD)[1] and relative stock density (RSD-P and RSD-M)[2] in parentheses from fall gill-net data for 1991 through 1997 from Saginaw Bay, Lake Huron.

Species	1991	1992	1993	1994	1995	1996	1997
Walleye	79(40,3)	81(46,8)	93(40,3)	96(58,5)	76(55,3)	83(46,6)	96(51,8)
Yellow perch	69(12,0)	62(18,4)	45(3,0)	73(9,1)	38 (6,1)	22 (2,0)	33 (5,1)

[1] Stock and quality size for walleye is 250mm, 380mm, respectively, yellow perch: 130mm, 200mm. Range of PSD values suggested as indicative of balance when the population supports a substantial fishery is 30-60 for walleye and 30-50 for yellow perch (Anderson and Weithman 1978).
[2] Preferred size for walleye is 510mm, memorable size is 630mm. For yellow perch it is 250mm and 300mm, respectively (Anderson and Gutreuter 1983).

Table 14.–Food habits of walleye from fall gill-nets from Saginaw Bay, Lake Huron, 1989-97. See Table 4 for a complete listing of scientific names for each species.

	Incidence		Frequency								
Year	No. stomachs examined	No. void	Unidentified fish remains	Gizzard shad	Yellow perch	Spottail shiner	Rainbow smelt	Alewife	Ninespine stickleback	White sucker	White perch
1989	257	66	105	242	0	0	1	30	3	0	1
1990	508	190	115	400	0	0	1	5	1	0	1
1991	669	240	199	368	2	2	0	9	0	1	0
1992	171	95	40	1	1	1	9	11	0	1	0
1993	371	195	88	134	0	0	1	4	0	0	0
1994	84	44	17	50	2	2	0	0	0	0	0
1995	291	131	128	115	6	2	0	152	0	2	3
1996	148	91	41	13	2	0	0	1	0	0	0
1997	204	72	90	19	5	9	0	26	0	0	3

Table 15.–Age composition of white perch and yellow perch from the gill-net catch, Saginaw Bay, Lake Huron, 1992-97.[1]

	White perch						Yellow perch					
Age	1992	1993	1994	1995	1996	1997	1992	1993	1994	1995	1996	1997
0	---	---	27	3	---	2	---	---	---	---	---	1
1	13	5	151	57	102	43	1	5	---	93	34	32
2	2	15	15	1	31	55	8	11	6	44	193	135
3	---	4	11	---	3	21	61	80	29	47	91	164
4	---	3	4	---	2	4	69	71	98	101	85	66
5	---	1	6	---	---	1	37	28	82	32	82	43
6	---	---	---	---	---	1	20	16	21	10	31	25
7	---	---	---	---	---	2	4	5	1	---	12	14
8	---	---	---	---	---	---	1	2	23	1	2	8
Number aged	15	28	214	61	138	129	202	218	241	328	531	488
Mean age	1.13	2.29	1.67	0.97	1.31	1.99	4.09	3.84	4.73	3.20	3.26	3.25

Table 16.–Length/weight regression equations for select species based on 1997 fall gill-net collections in Saginaw Bay, Lake Huron. Logs are base 10 and weight (wt) is in grams, 1ength (len) is in mm.

Species	Equation	r^2
Walleye	log(wt)=3.171 log(len)-5.473	0.98
Yellow perch	log(wt)=3.223log(1en)-5.406	0.82
White perch	log(wt)=2.904log(1en)-4.573	0.90

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Date: March 31, 1998