STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-3

Study No.: 695 **Title:** Northern Lake Huron, coolwater fish community assessment.

Period Covered: October 1, 2001 to September 30, 2002

Study Objective: To collect relative abundance, growth rate, and other biological data with which to assess responses of the Les Cheneaux Islands region and the St. Marys River coolwater fish communities to exploitation, management initiatives, and changing environmental and biological conditions.

Summary: This study represents two separate fish community investigations; St. Marys River and Les Cheneaux Islands region of Lake Huron. The St. Marys River survey was conducted in August 2002 by fishing 44 gillnets. The survey effort was divided among five different member agencies of the St. Marys River Fisheries Task Group. Data analysis is continuing. The Les Cheneaux Islands Survey collected data on a variety of species but in depth analysis was principally limited to yellow perch, a species of importance to the local sport fishery. The yellow perch catch per unit of effort in the gillnets was lower in 2001 but still greater than levels in the 1990s. The fishery remains depressed and 98% of the yellow perch catch came from a single bay (Muskellunge Bay). Four gears were evaluated for use in developing a yellow perch recruitment index. Electrofishing was selected as optimal with the greatest overall CPUE of age-0 yellow perch. Total annual mortality rate of yellow perch remains high despite the collapse of the sport fishery some years prior. Catch per unit of effort of age-2 yellow perch, which have also been used as an expression of recruitment, was lower in 2001 but follows a record level in 2000. Analysis of 2002 data is continuing and will be reported in 2003.

Findings: Jobs 1, 2, 3, and 4 were active this year, and progress is reported below.

Job 1. Title: Fish Community Survey of the St. Marys River.–This survey work took place in August 2002. This timing was intended to match that of previous surveys in the St. Marys River so as to allow maximum comparability. The survey design followed the protocol put forth in the St. Marys River Assessment Plan (Gebhardt et al. 2002). Forty four nylon gillnet sets were made from above the locks in Sault Ste. Marie, through Potagannissing Bay, to the mouth of the river in De Tour, Michigan (Figure 1). Responsibility for the net sets was divided between five different member agencies of the St. Marys River Fisheries Task Group (Table 1). Nets were variable mesh constructed of 30.4 m by 1.8 m panels of 38, 51, 64, 76, 89, 102, 114,127, 140, and 152 mm stretch measure mesh sizes. Scales &/or spines for aging were collected from walleye, lake herring, northern pike, yellow perch, smallmouth bass, lake sturgeon, muskellunge, and all salmonines. Scale aging is being shared by the participating agencies and will be complete by winter of 2003. Additional data were collected on all species encountered. Michigan DNR (Study principle investigator) is compiling the survey data into a single database, with analysis and interpretation to follow.

Job 2. Title: Fish community survey of the Les Cheneaux Islands region of Lake Huron.–Survey sampling of the Les Cheneaux Islands region began in August, 2001 and was repeated in August 2002. Survey work used nylon gillnets of variable mesh constructed of 30.4 m by 1.8 m panels of 38, 51, 64, 76, 89, 102, 114,127, 140, and 152 mm stretch measure mesh sizes. Survey nets were fished in the same locations as past Michigan DNR surveys to allow comparability. Additional (exploratory) outer-islands locations were added in 2001 and varied by year (Figure 2). Total gillnet effort under this job amounted to eight net sets each year.

A total of 666 fishes were collected representing 17 species during the August netting in 2001. Analysis of 2002 netting data is continuing and will be reported in 2003. Catch-per-unit-of-effort (CPUE) is summarized in Table 2. The CPUE of yellow perch, which are of principle concern in the Les Cheneaux Islands region, was down from 2000 but still well above levels reported since 1990. The vast majority of the yellow perch catch (98%), however, came from Muskellunge Bay indicating a high degree of spatial variability in distribution. Other species of notable abundance in August, 2001 included white and longnose suckers, rock bass, northern pike, lake herring, and brown bullhead. As in previous Les Cheneaux Island surveys, walleyes were not a significant member of the fish community.

An objective of the 2001 August survey was to develop an index of yellow perch recruitment. Four gear types were fished in the same areas to compare catch. The gears were (1) small-mesh (25 mm stretch measure) gillnetting, (2) electrofishing, (3) bottom trawling, and (4) shoreline seining. The small-mesh gillnet was 30.4 m by 1.8 m, attached to the regular survey gillnets, and fished on the bottom overnight. The trawling was conducted with a 4.9 m otter trawl equipped with a 6 mm stretch measure cod-end liner, towed for 10 minutes at a time. The shoreline seining was performed with a 91.4 m by 1.8 m seine consisting of 6 mm mesh, pulled in approximately a quarter-arc haul. Electrofishing was performed at night from an AC boom-shocking boat with two persons dip netting off the bow, typically for 1,800 seconds of generator time. Effort by area is depicted in Table 3. The amount of effort was selected to be approximately equivalent to the other gear types in terms of person hours so as to maintain comparability in the selection of the optimal yellow perch recruitment index.

Comparison of the catches took two forms; analysis of age structure of perch caught and the relative number of age-0 perch among gears. The highest proportion of age-0 yellow perch catch (100%) was obtained by shoreline seining (Table 4). That overall collection (45 specimens), however, was eclipsed by the age-0 take of 107 specimens with electrofishing. While the overall proportion of age-0 yellow perch collected by electrofishing (65%) was not as great as seining, it produced the greatest CPUE (Figure 3). Therefore annual electrofishing will be the yellow perch recruitment index for the remainder of the study.

Yellow perch data from both the August and October collection efforts (pooled) were used to describe population parameters. Total annual mortality of yellow perch has fluctuated over the years since measurement began in the late 1960s (Figure 4). That estimate of mortality rate was determined using the Robson/Chapman method (Van Den Avyle and Hayward 1999). The assumptions of constant recruitment for this method were all most certainly not met every year in the yellow perch data set. Still, however, these estimates provided some indication of trends in total annual mortality. From these estimates, it is apparent that total annual mortality has remained high even after collapse of the yellow perch sport fishery in the area. This disparity (high mortality rate, little fishery harvest) is among questions yet to be explained.

Age structure of the yellow perch population indicated a lower level of age-2 fish relative to the abundance of age 1s and age 3s in 2001 (Table 5). The abundance of age-1 perch in 2001 is largely by virtue of the addition of the experimental 25-mm mesh in August. Prior to the development of yellow perch recruitment index based on the electrofishing, recruitment was tracked by examining survey net CPUE of age-2 fish (Figure 5). Age-2 fish are believed to be the first age fully recruited to the survey nets. Based on this measure, recruitment was down in 2001 relative to the record level in 2000. The age-2 survey net catch rate in 2001 was still within the range measured for other years. It is not unusual for year class strength to be weaker (1999) immediately following a very strong one (1998). This same pattern of percid recruitment was reported for Saginaw Bay for these same years (MDNR, unpublished data).

Growth rate of yellow perch in 2001 was generally good, exceeding the average for Michigan (Table 6). Fast growth is consistent with low density. Yellow perch diet was almost entirely composed of crayfish (Table 7). Crayfish were encountered in abundance in all locations as by-catch in the trawling.

Male and female yellow perch reach sexual maturity at similar sizes (Table 8). Male yellow perch achieved 100% maturity by 18 cm (7.1 inches) in total length and females at 19 cm (7.5 inches). Generally, however, larger proportions of male perch were sexually mature at smaller sizes than were females (Table 8). The sport fishery for yellow perch in the Les Cheneaux Islands is regulated by a 178 mm (7 inch) minimum length limit. This appears adequate for protecting immature fish from exploitation providing there is sufficient escapement to spawning ages.

Job 3. Title: Comparison netting of the Les Cheneaux Islands region and calculation of correction factors.–Past survey work in the Les Cheneaux Islands region was conducted in October. As the survey now switches to August, October netting will be continued for three years in addition to the August netting to determine how the two survey periods compare and if a correction factor is necessary so as to maintain the long term trend monitoring. October netting did not include the outer-island sets (locations). Gear fished was the same as described in Job 2.

A total of 508 fishes were collected representing 14 species during the October netting in 2001. Catch-per-unit-of-effort is summarized in Table 2. The 2001 October and August CPUEs were not significantly different for yellow perch (T-test; P=0.8700), nor for any other species suggesting that the August survey is an acceptable substitute for the October survey. Two more years of comparison are planned (2002 & 2003), before a final determination is made. Like the August survey, the vast majority of yellow perch were collected from Muskellunge Bay (84%), further affirming the similarity in findings between the two months. Other species of notable abundance in the October survey mirrored that of the August Survey (Job 2) with the exception of longnose suckers. The northern pike CPUE in August was much lower than previous years. The October CPUE was somewhat greater but still represented an overall decline. Analysis of 2002 netting data is continuing and will be reported in 2003.

Job 4. Title: Prepare performance report.–This report was prepared.

Literature Cited:

Gebhardt, K., D. Fielder, S. Greenwood, H. Robbins, and T. Sutton [Editors]. 2002. St. Marys River Fisheries Assessment Plan. Great Lakes Fisheries Commission, Special Report, http://www.glfc.org/lakecom/lhc/lhchome.asp#pub. Ann Arbor.

Schneider, J. C., P. W. Laarman, and H. Gowing. 2000. Age and growth methods and state averages. Chapter 9 in J. Schneider, editor. Manual of fisheries survey methods II: with periodic updates. Michigan Department of Natural Resources, Fisheries Special Report 25, Ann Arbor.

Van Den Avyle, M. V., and R. S. Hayward. 1999. Dynamics of exploited fish populations. Pages 127-166 in C. C. Kohler and W. A. Hubert, editors. Inland fisheries management in North America, 2nd edition. American Fisheries Society, Bethesda, Maryland.

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Date: September 30, 2002

Table 1.–Number of gillnet sets performed by participating agency in the August, 2002 St. Marys River Fish Community Survey.

Participating Agency	No. of sets
Michigan Department of Natural Resources	14
Ontario Ministry of Natural Resources	10
Bay Mills Indian Community	8
U.S. Fish & Wildlife Service	6
Chippewa/Ottawa Resource Authority	6
Total	44

Table 2.–Catch per unit of effort and total effort from traditional netting locations in the Les Cheneaux Islands, 1990 through 2001. All data are from October unless otherwise noted.

Species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Aug 2001	2001
Total effort (in ft. of net)	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Net lifts	3	3	3	3	6	3	3	1	3	6	6	6	6
Alewife	0.0	0.2	0.2	0.7	1.3	0.0	1.7	0.0	1.2	0.2	1.2	0.83	0.5
Black bullhead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Black crappie	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
Bowfin	0.7	1.3	0.3	0.3	0.7	0.0	2.3	0.3	0.0	0.0	0.2	0.3	0.2
Brown bullhead	9.2	8.3	3.7	3.0	1.0	7.2	32.8	2.5	3.2	10.7	6.3	13.7	6.8
Brown trout	0.3	0.3	0.2	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burbot	0.2	0.3	0.3	0.5	0.0	0.0	0.3	0.0	1.0	0.0	0.3	0.3	0.0
Carp	0.2	0.7	2.0	0.5	1.2	0.0	1.3	0.2	1.0	0.3	0.0	0.0	0.2
Channel catfish	0.5	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chinook salmon	0.2	0.0	0.2	0.2	0.0	0.0	0.7	0.2	0.2	0.2	0.3	0.2	0.0
Coho salmon	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Freshwater drum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Gizzard shad	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0
Greater redhorse	0.0	0.0	0.0	0.0	0.5	2.2	0.7	1.7	0.0	0.0	0.0	0.0	0.0
Lake herring	13.7	7.8	1.0	5.2	3.2	1.3	1.7	0.2	0.3	9.0	0.2	8.3	1.3
Lake trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake whitefish	0.3	1.0	0.0	0.0	0.0	0.0	0.3	0.8	1.0	2.8	1.0	0.0	0.0
Largemouth bass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.3
Longnose dace	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Longnose gar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Longnose sucker	0.0	0.2	0.0	0.0	0.2	0.0	0.3	0.0	0.0	0.0	0.0	4.0	0.0
Menominee	0.0	0.2	0.2	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.5	0.8
Muskellunge	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	15.8	13.7	13.7	13.8	11.0	9.2	15.5	10.0	15.3	16.7	8.2	0.8	4.7

Table 2.–Continued.

Species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Aug 2001	2001
Pinook	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumpkinseed	0.0	0.2	0.5	0.0	0.0	0.0	0.3	0.2	0.0	0.2	3.0	0.3	2.8
Rainbow smelt	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.2	0.0	0.0
Rock bass	7.8	2.7	10.2	2.0	10.3	12.8	15.7	10.5	8.2	44.3	11.0	14.3	11.7
Sea lamprey	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smallmouth bass	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.3	0.7	0.7	2.2	0.7
Splake	0.0	0.0	0.0	0.7	0.0	2.5	1.2	2.3	2.0	0.7	0.2	0.0	0.0
Spottail shiner	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Steelhead	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Walleye	1.0	0.3	0.2	0.2	0.3	0.2	1.0	0.7	1.7	0.5	0.7	0.0	0.2
White perch	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.3	0.0	0.0
White sucker	22.2	22.2	14.5	9.2	26.8	6.2	9.8	5.2	2.3	13.5	8.3	10.2	8.7
Yellow perch	23.7	18.0	17.8	15.7	26.3	41.8	20.2	15.3	36.2	21.2	73.5	52.5	45.8

Table 3.–Sample location and amount of effort tested in yellow perch recruitment index gear comparison in the Les Cheneaux Islands, August, 2001.

Location	Electrofishing	Trawling	Seining	Small-mesh gillnetting
Hessel Bay	1,018 seconds	3 tows	3 hauls	1 lift
Muskellunge Bay	1,800 seconds	3 tows	3 hauls	1 lift
Government Bay	1,800 seconds	3 tows	3 hauls	1 lift
Cedarville Bay	1,800 seconds	3 tows	3 hauls	
Flower Bay/Moscoe Channel	1,000 seconds	3 tows	3 hauls	

Table 4.–Proportion (and number in parentheses) of yellow perch collected by gear and ages in the Les Cheneaux Island, August, 2001.

	Age			
Gear	0	1	2	3
Electrofishing	61% (107)	25% (44)	11% (20)	2% (4)
Trawling	75% (6)	25% (2)	–	–
Seining	100% (45)	–	–	–
Small-mesh gillnetting	–	92% (43)	6% (3)	2% (1)

Table 5.–Yellow perch age structure from the Les Cheneaux Islands 1989-2001 based on gillnet catch.

Age	Year 1998	1999	2000	2001
0	–	–	–	2
1	4	8	9	354
2	4	52	168	51
3	46	45	178	124
4	81	9	53	80
5	32	1	22	21
6	16	5	5	2
7	13	5	1	–
8	8	–	1	–
9	8	–	10	–
10	3	1	–	–
11	2	–	–	–
Number aged	218	126	438	634
Mean age	3.75	2.88	2.87	2.00

Table 6.–Mean length-at-age (in mm) for yellow perch from Les Cheneaux Islands, 2001 with the state average (Schneider et al. 2000) for comparison.

Age	Mean Length	Number	State Average
0	136	2	–
1	154	354	127
2	192	51	160
3	218	124	183
4	234	80	208
5	250	21	234
6	237	2	257
7	–	–	277
8	–	–	292
9	–	–	302

Table 7.–Incidence of void stomachs and percent-abundance of food items found in stomachs of yellow perch in Les Cheneaux Islands region, 2001.

Parameter	% Abundance
Void	27
Nonvoid	73
Food item	
Amphipods	0.9
Crayfish	96.7
Dipterians	0.9
Alewives	0.1
Sculpins	0.3
Others	1.1
Total	100.0

Table 8.–Percentage of yellow perch that were scored as sexually mature in the Les Cheneaux Islands region, 2001 by length increment.

	Males		Females	
Length (cm)	Total No.	% Mature	Total No.	% Mature
11	5	0	1	0
12	3	0	3	0
13	5	0	1	0
14	20	0	17	29
15	68	37	39	10
16	28	64	32	44
17	18	89	12	42
18	8	100	12	75
19	20	95	25	100
20	18	83	19	95
21	25	100	13	92
22	23	100	19	95
23	22	95	28	96
24	5	100	19	100
25	3	100	17	100
26	1	0	17	100
27	2	100	7	100

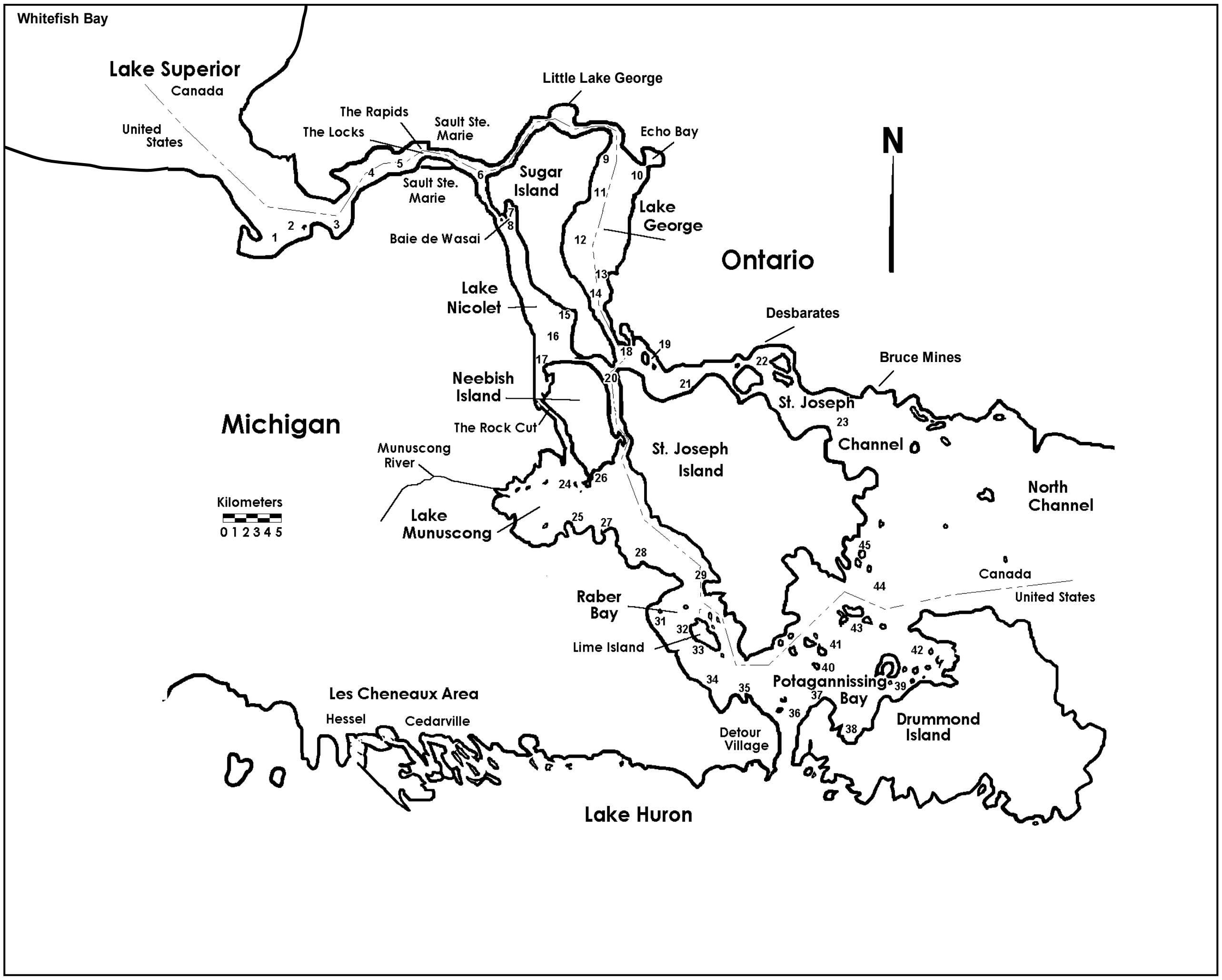

Figure 1.–Netting locations in the St. Marys River in August 2002.

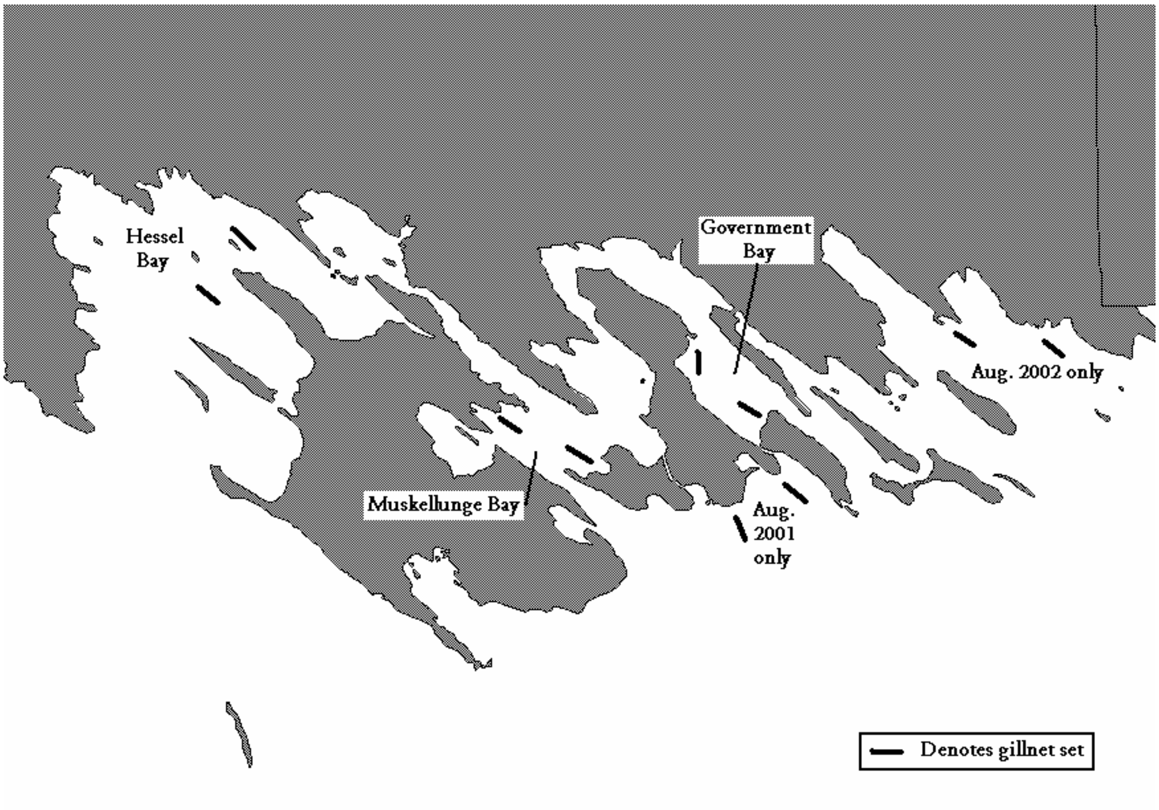

Figure 2.–Gillnet locations in the Les Cheneaux Islands region, set in 2001 and 2002.

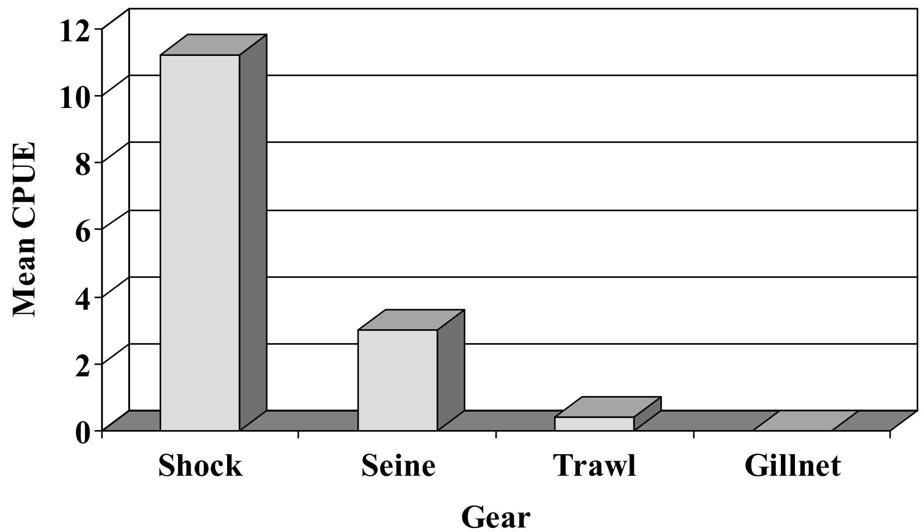

Figure 3.–Mean catch-per-unit-of-effort of age-0 yellow perch by four gears fished in similar locations in the Les Cheneaux Islands in August, 2001.

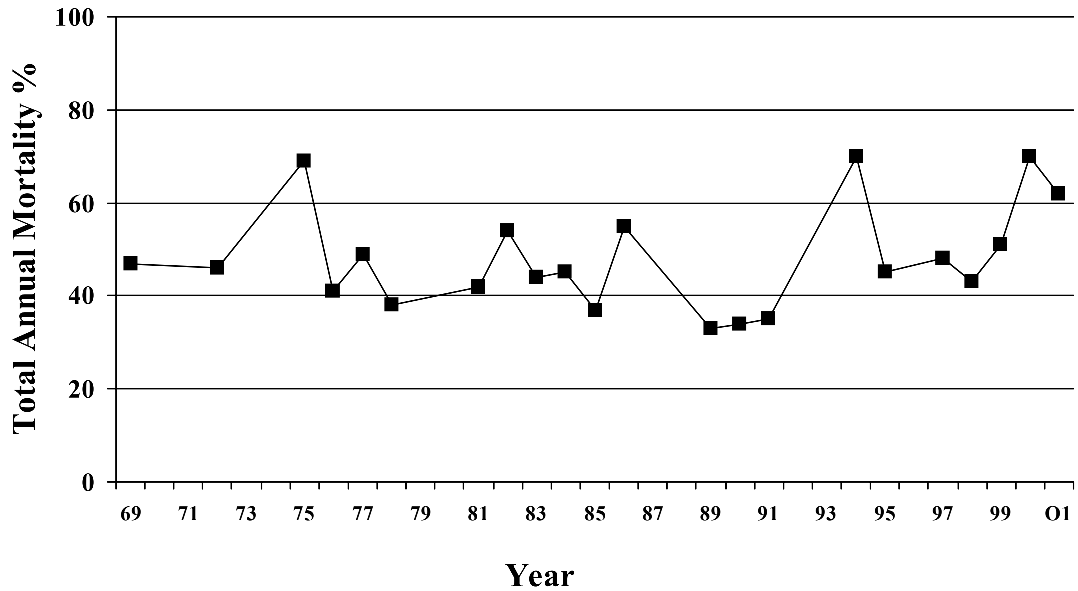

Figure 4.–Total annual mortality of yellow perch in the Les Cheneaux Islands from 1969 through 2001.

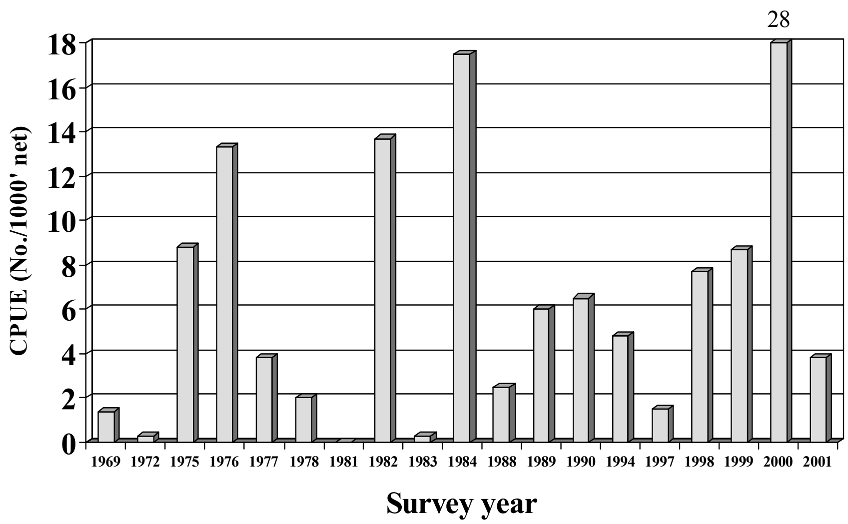

Figure 5.–Catch per unit effort of age-2 yellow perch as in indicator of recruitment in the Les Cheneaux Islands region 1969 through 2001.