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Hydrological and Biological Monitoring Program

Brayton Point Station
Somerset, Massachusetts

7 Beach Seine Studies

7.1 INTRODUCTION

A sampling program using 60- and 300-ft beach seines has been conducted since 1972 to document the near-shore abundance and community structure of young finfish. In 1992, an additional program using a 50-ft beach seine was initiated; the 50-ft beach seine program focuses specifically on young-of-the-year (YOY) winter flounder (*Pseudopleuronectes americanus*).

7.2 METHODS: 60- AND 300-FT BEACH SEINE PROGRAM

Details of the sampling protocol employed in the 60- and 300-ft (also known as the "core") beach seine program (e.g., station locations, equipment used, and sampling schedule) as well as the analytical techniques applied to the collected data are provided below.

7.2.1 Sampling Protocol

Table 7-1 summarizes the core beach seine program protocol. Figure 7-1 shows the locations of the four fixed stations at which sampling is done: the Brayton Point Station Units 1, 2, and 3 intake, in the Cole and Lee rivers, and at Spar Island (Figure 7-1).

Sampling is done with two different bag seines: one measuring 60 ft (18.3 m) x 6 ft (1.8 m) with 1/8-in (3-mm) mesh, and the other measuring 300 ft (91.4 m) x 8 ft (2.4 m) with 1/2-in (12.5 mm) mesh. Over the years, no changes have been made to the core beach seine nets other than to replace worn gear as needed.

Each seine is hauled during daytime hours once per month at each station from March through October. On the day of sampling, each seine is hauled once off adjacent, non-overlapping areas of beach. The large net is set by boat in as uniform a semicircle as wind and tide will allow. The small net is set by anchoring one end at the shore's edge and then walking offshore to a depth of about 4 ft; from there the seine is walked parallel to the shoreline over a measured distance of 50 ft.

Consistently since the program began, sampling with the 60-ft seine has been done from March through October. Sampling with the 300-ft seine was done from June–August 1972–1980 and March-October 1981–2002. Complementing daytime seining, nighttime hauls were made at all stations during the 1973–1980 period (Table 7-1). While the

program varied from year to year, night sampling typically occurred three times during summer using the 300-ft net at all stations and the 60-ft net at the Intake and Lee sites.

All fish are identified and counted, and total length is measured to the nearest millimeter for up to 50 individuals per species per haul. Surface water temperature is recorded at each station during the sampling event.

7.2.2 Data Analysis

Annual indices of abundance were calculated for the finfish species captured in each of the two seines. The 60-ft seine index specifies mean numbers of fish collected per haul at the four fixed stations during March–October, 1972–2002. For the 300-ft seine collections, two indices of abundance were generated because of the transition in months sampled from June–August to March–October in 1981. The first index covers the entire 1972–2002 period and was calculated as the annual mean June–August catch per haul at the four fixed stations. The second index was calculated in the same way but uses March-October data covering the 1981–2002 period. Only daytime hauls were included in the calculation of the three seine abundance indices.

Sign tests for trends (Sprent 1989; $\alpha = 0.05$) were applied to the three annual average catch-per-haul indices, over their entire respective time periods, to determine whether statistically significant trends were evident.

Long-term stability of the near-shore finfish community was evaluated through calculation of annual dominance diversity values (Whittaker 1965) for both the 300-ft seine (June–August 1972–2002) and the 60-ft seine (March–October 1972–2002). An annual dominance diversity value specifies the slope of the linear relationship between annual abundance expressed on a natural logarithmic scale and species rank. In general, steep slopes indicate that numbers of individuals caught are unevenly distributed among species, whereas shallow slopes generally indicate that the catch is evenly distributed among species. Trends in dominance diversity over time were evaluated with simple linear regression ($\alpha = 0.05$) for the entire 1972–2002 period.

Analysis of variance (ANOVA; $\alpha = 0.05$) was applied to $\log_e$-transformed 300-ft seine catch data aggregated over the 1985–2002 period, with species and station as main effects. As a result of the $\log_e$ transformation, which was performed to meet the assumption of normality in the ANOVA model, this analysis produced geometric mean catch per haul at each station from aggregated 1985–2002 data. When significant differences were detected for the station main effect in the ANOVA model, Newman-Keuls multiple-comparison tests ($\alpha = 0.05$) were completed to identify which station's catches were different from each other.

7.3 METHODS: YOUNG-OF-THE-YEAR WINTER FLOUNDER 50-FT BEACH SEINE PROGRAM

The primary objective of the YOY winter flounder beach seine program is to index spatial and temporal aspects of winter flounder abundance shortly after metamorphosis in the tributaries to Mount Hope Bay. In addition to the collection of winter flounder in hauls of a beach seine, supplementary data on water temperatures, dissolved oxygen, and macroalgae are collected.

An overview of the sampling protocol (station locations, equipment used, and sampling schedule) as well as analytical techniques employed in the YOY winter flounder beach seine program is provided below. Changes made over the years to improve the monitoring program or to be responsive to changing bay conditions are also described.

7.3.1 Sampling Protocol

The YOY winter flounder beach seine sampling program was initiated in 1992, when 10 fixed sampling stations were selected from 23 Mount Hope Bay sites with suitable habitat, as described in Poole (1966) and Saucerman (1990). Habitat features of these saltwater coves include organic substrates with a minimum of 175 linear feet of seinable bottom and a good depth contour. The 10 fixed stations, which have been sampled each year since program inception, include four sites in the lower Taunton River, two each in the lower Lee and Cole rivers, one in the Kickamuit River, and one in the Brayton Point intake embayment (Figure 7-6, Table 7-6).

Beach seine hauls were collected from each of the 10 stations during two sampling surveys in June 1992. Beginning in 1993, the sampling effort was intensified both by increasing the number of annual sampling events from two June surveys to five surveys (two surveys each in June and July and one survey in August), and by increasing the number of stations sampled. Additional sites with suitable habitat were identified, resulting in a pool of 31 additional locations from which it would be possible to randomly select additional sampling stations each year. Between 1993 and 2002, in addition to the 10 fixed stations, between 4 and 11 randomly selected stations were sampled. Beginning in 1997, station 13, initially a random station, was sampled on each occasion because hauls could be completed there independent of tidal stage. Table 7-6 indicates the numbers of stations sampled and sampling frequency from inception of the YOY winter flounder program through 2002.

During 1992 through 1994, triplicate samples were collected at each YOY winter flounder beach seine site. Beginning in 1995, in the interest of maintaining a three-day sampling effort while simultaneously increasing the total number of stations sampled, the number of hauls per station was reduced from three to two in cases where, in the first two hauls, inter-replicate variability had been relatively low. Typically only two replicates were collected if numbers of winter flounder in the first and second hauls varied by 20% or less. Occasionally only two replicates were completed due to shoreline space

limitations, which varied with tide and also with the growth of smooth cordgrass (*Spartina alterniflora*).

The gear used in the YOY winter flounder beach seine program is a 50-ft x 6-ft, ¼-inch mesh bag seine. The bottom line consists of conventional leads spaced one foot apart, with an additional 50-ft length of lead core line secured to it. Each haul covers an estimated 2,300 ft^2 (214 m^2). Occasionally, depending on tidal stage, the net could not be fully stretched offshore due to water depth, and in these cases the catch was scaled upward to the standard 2300 ft^2 (214 m^2) set based on the actual bottom covered.

At each station, winter flounder were held in containers (aerated if necessary) until all replicates were completed. Then each fish was measured to the nearest mm in total length before release. Water temperature (°C), salinity (‰), and dissolved oxygen (mg/l) were recorded near shore and near bottom at each station.

In 2002, in addition to sampling YOY winter flounder, a macroalgae study was performed to assess the possible affects of *Ulva lactuca* on the nursery habitat of winter flounder in Mount Hope Bay and its tributaries. Density and distribution of *U. lactuca* and associated dissolved oxygen levels and benthic winter flounder prey items were measured.

The density and distribution of *U. lactuca* was sampled at the winter flounder beach seine stations on June 24–26, July 8–10, and July 22–24, 2002 using wet and dry weights of macroalgae. Triplicate samples were taken using ¼ m^2 quadrats. Wet weight of macroalgae was determined in the field by placing algae in ¼ inch nylon mesh bags squeezed free of water, and then weighing the bags. Subsamples were collected and returned to the lab, where they were dried at 60° C and then weighed.

In addition to the macroalgae sampling conducted at the seine stations, a survey was conducted on August 8, 9, and 15, 2002 in the four tributaries of Mount Hope Bay in an effort to determine overall percent coverage of macroalgae in each system. Both visual observations and benthic grabs were made.

To assess the potential effects of macroalgae on dissolved oxygen (DO) levels, DO was monitored every 15 minutes over a period of 1–2 weeks at one station in each of the four Mount Hope Bay tributaries. A single pair of YSI data sondes was deployed in each case, one in an *Ulva*-dominated habitat, and the other in a site with bare sediment. Paired meters were placed in close proximity to each other to minimize site variability. Units were relocated periodically to obtain data from each tributary

Benthic grab samples were collected from areas with heavy macroalgal beds and from areas with relatively clear bottom in each Mount Hope Bay tributary to assess differences in the benthic communities associated with each of these habitat types. Benthic samples were collected using a 0.04 m^2 VanVeen benthic grab. The grabs were fixed in formalin and returned to the lab for microscopic analysis.

7.3.2 Data Analysis

Annual indices of winter flounder abundance were generated for the YOY winter flounder captured in the beach seine collections. A 1993–2002 stratified index was calculated as the mean numbers of fish collected per haul during the five June–August sampling events. Additionally, because only June collections were made in 1992, a 1992–2002 stratified index was calculated as the mean numbers of winter flounder collected during the two June sampling events. Stratification in the above indices was performed by river based on the amount of shoreline in the survey area

Estimates of daily instantaneous mortality rates (Z_{day}) were calculated for each year, 1993–2002, from aggregated seine catches between the two July sampling events as:

$$Z_{day} = -\log_e(CPUE_2/CPUE_1)/t$$

where:

$CPUE_2$ = Mean beach seine catch at second July survey
$CPUE_1$ = Mean beach seine catch at first July survey
t = number of days between first and second July surveys.

July samples were used to calculate instantaneous mortality rates because in all years except 1998, a decline in catch was measured for this month. Daily instantaneous mortality rates were converted into monthly instantaneous mortality rates (Z_{month}) for comparison to rates reported in other studies by multiplying the daily rate by thirty. It must be noted that it is not possible to separate actual mortality from movements to and from deeper water, nor can the confounding effects of changes in catchability as individuals grow be isolated and removed from this kind of analysis. Thus these mortality estimates are considered loss rates and are recognized to be approximate.

Additionally, because reductions in winter flounder abundance were approximately linear over the first July series through the single August series (a 34- to 42-day period) during 1993–2002, linear regression on $\log_e$-transformed abundance data was used to calculate daily and 30-day survival rates.

Estimates of daily instantaneous growth rates (G_{day}) for the month of June were calculated for each year, 1992–2002, from aggregated seine catch between the two June sampling events as:

$$G_{day} = -\log_e(Length_2/Length_1)/t$$

where:

$Length_2$ = Mean length of beach seine catch at second June survey
$Length_1$ = Mean length of beach seine catch at first June survey
t = number of days between first and second June surveys.

June samples alone allowed 1992 to be included and were less likely to be biased by movement of larger fish to deeper waters as the season progresses. Additionally, because

growth was approximately linear over the four June and July sampling dates (a 42- to 55-day period) during 1993–2002, daily instantaneous summertime rates of growth were estimated using linear regression equations.

Correlation analysis ($\alpha = 0.05$) of the 1992–2002 data was performed to determine the relationship between water temperature during early June (i.e., June 8-12) and both winter flounder initial length (i.e., the average length on the first date of sampling) and seasonal growth rates, i.e., total growth in mm over the first June and August (1993–2002) sample events.

The relationship between the June YOY winter flounder beach seine index, 1992-2002, and indices of abundance for other Mount Hope Bay winter flounder life stages was evaluated using Pearson correlation analysis ($\alpha = 0.05$). All indices were log-transformed to correct for non-normality. The indices of winter flounder abundance that were examined for correlation with the June index were:

- Geometric mean winter flounder larval abundance calculated from Mount Hope Bay ichthyoplankton data (for more information, see Chapter 4, Ichthyoplankton Studies)
- Age-1 abundance from the Wilcox trawl, expressed as mean number per tow, February–April, in the following year (for more information see Chapter 5, Trawl Studies)

The June YOY winter flounder beach seine index was compared with six late-spring–summer regional YOY winter flounder abundance indices. The six regional YOY winter flounder abundance indices were calculated from data collected in the following sampling programs:

- The **New York State Department of Environmental Conservation** has conducted a small-mesh trawl survey in Peconic Bay weekly at 16 randomly selected locations from May through October since 1985. Survey gear is a 4.9-m, semi-balloon shrimp trawl with 1.3 cm cod-end liner

- **The Connecticut Department of Environmental Protection** has conducted standardized seine sampling (8-m bag seine) for young winter flounder since 1988. Eight intertidal sites are sampled each September, with six hauls taken at each site (Howell and Molnar 1995; Howell 2001).

- **Environmental studies around Millstone Nuclear Power Station** in Waterford, Connecticut include annual assessments of YOY winter flounder in the Niantic River and Niantic Bay (NUSCO 1998). In these assessments, which began in 1983, collections are taken weekly with 1-meter beam trawls at two river locations and two bay locations.

- The **Rhode Island Department of Environmental Management (RIDEM)** multi-species survey employed a 200-ft seine constructed of 1/4-inch mesh and conducted single hauls monthly at 16–18 stations (Powell 1991). YOY winter flounder CPUE

was calculated for the four RIDEM stations nearest Mount Hope Bay: Kickamuit River, Spar Island, Hog Island, and Spectacle Cove. This time series began in 1986.

- **RIDEM** also completed a May–October monthly coastal ponds survey begun in 1993 using a 130-ft seine constructed of 1/4-inch mesh (Temple 2001). Sixteen sampling stations covered Point Judith Pond, Quonochontaug Pond, Winnapaug Pond, Charlestown Pond, and Narrow River.

- The **Massachusetts Division of Marine Fisheries (MDMF)** has sampled winter flounder with a 21-ft net, conducting triplicate shore hauls at 49 stations, between mid-June and mid-July. The 49 stations cover Bass River, Cotuit Bay, Great Pond, Lewis Bay, Stage Harbor, and Waquoit Bay, all on the south shore of Cape Cod. The sampling program began in 1975.

7.4 RESULTS

The tables and figures contained in Sections 7.6 and 7.7 present results for 2002 and the historical sampling period.

7.4.1 60- and 300-Ft Beach Seine Program

Despite the fact that both the 60- and 300-ft seines are hauled at the same sampling stations, catch composition has historically been very different due to differences in seine mesh size and the depth of the water sampled. In 2002, the 60- and 300-ft seines each collected a total of 16 species. Of these, 21 were unique to one of the two nets. The overwhelming majority of the 2002 60-ft seine catch was comprised of silversides (90%), striped killifish (*Fundulus majalis*; 6%), and alewife (*Alosa pseudoharengus*; 2%), while most of the 300-ft seine catch consisted of alewife (73%), bluefish (*Pomatomus saltatrix*; 16%), Atlantic menhaden (4%), and blueback herring (*Alosa aestivalis*; 2%).

Data collected in the 60- and 300-ft beach seine program show that some changes in the Mount Hope Bay near-shore finfish community have occurred over the 1972–2002 period. The majority of these changes are in the direction of increases in abundance of the historically dominant fish species. In fact, no long-term statistically significant declines were apparent for any of the species examined. Alewife, in particular, appears to be doing very well, with abundance at its highest level since the beach seine program began. Other species such as silversides, bluefish, and striped killifish are either increasing in abundance or are varying without trend. Mummichog catches have shown somewhat reduced numbers in recent years, but this reduction is not likely cause for concern since catches are within the historical abundance range for the 60-ft seine, which traditionally has captured most of the mummichog in the beach seine collections.

In addition to the apparent health of individual species, the near-shore fish community as a whole appears to be quite stable, as evidenced by a near-zero trend in the dominance

diversity index calculated for both seines. That is, the distribution of abundance among the species collected has remained stable over the 1972–2002 period.

7.4.2 Young-of-the-Year Winter Flounder 50-Ft Beach Seine Program

The mean catch during the 2002 sampling season (June–August) was 10 winter flounder per haul, the highest value in the 1993–2002 time series (only June samples were collected in 1992). The 2002 value is 45% higher than the average catch of 6.9 fish per haul in 2001, the second highest value on record. When looking at only June collections of YOY winter flounder, the 2002 catch of 12.3 fish per haul ranked the highest since 1992, when the June catch averaged 34.6 fish per haul.

Several factors were evaluated to identify possible explanations for the variability in YOY winter flounder catch in Mount Hope Bay over the time series: water temperatures, dissolved oxygen levels, and the presence of macroalgal beds. Water temperature and dissolved oxygen did not appear to limit the distribution of young winter flounder in Mount Hope Bay tributaries. During 1994 and 1995—two of the warmest summers in the program time series (based on cooling degree days)—above-average YOY winter flounder collections were recorded. Dissolved oxygen levels do not appear to affect winter flounder distribution in the bay as shallow water dissolved oxygen readings, at the time of sampling in the Mount Hope Bay surveys, were generally above 5 ppm and often above 100% saturation, with readings of less than 5 ppm being rare. In 2002, a macroalgal sampling program was initiated to determine the effect of macroalgal beds on the distribution of YOY winter flounder in Mount Hope Bay. A slight negative relationship was observed between macroalgal biomass and winter flounder catch rates, although the correlation was not statistically significant.

Consistent with other studies, growth of YOY winter flounder in all years of this study appeared to be most rapid early in summer and to decline in July and in August. While mean lengths attained in Mount Hope Bay tributaries over the past 11 seasons are similar to mean lengths recorded in the Niantic River and in Rhode Island coastal ponds, there appears to have been a slight decreasing trend in the growth rate of YOY winter flounder over the 1993–2002 time series.

Annual YOY winter flounder mortality rates were calculated from the beach seine catches. The calculated mortality rates are estimated loss rates that include both actual mortality and loss of fish from the sampling area due to movement. Calculated mortality rates were consistent with those reported for similar studies conducted in the region. Overall, it appears that YOY winter flounder mortality rates in Mount Hope Bay have been decreasing in recent years.

Overall, the changes documented in Mount Hope Bay YOY winter flounder appear to be positive. For example, 2002 average June–August catches were the highest on record, and the YOY winter flounder mortality rate appears to have decreased since 1996.

7.5 REFERENCES

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7.6 TABLES

Table 7-1. 60- and 300-ft seine (core beach seine program) sampling protocol, 1972-2002

Stations Sampled	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Cole																															
Lee																															
Intake																															
Spar																															
Months Sampled																															
60-ft seine																															
March-October																															
300-ft seine																															
June-August																															
March-October																															
Sampling Time of Day																															
Daytime																															
Nighttime																															

Table 7-2. Number of individuals collected (by species) and temperature readings for 300- and 60-ft beach seine hauls at four fixed stations in Mount Hope Bay, March–October 2002 (page 1 of 4)

April 2, 2002 (for March)

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (10.9 °C)	Spar Is. (8.8 °C)	Cole R. (10.5 °C)	Lee R. (10.2 °C)	
NO FISH COLLECTED						

April 25, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (12.5 °C)	Spar Is. (11.6 °C)	Cole R. (12.5 °C)	Lee R.* (10.2 °C)	
Alosa pseudoharengus	Alewife	1/0**				1/0
Fundulus majalis	Striped killifish	2/4		35/15		37/19
Menidia spp.	silverside	10/70		31/42		41/112
Syngnathus fuscus	Northern pipefish	1/0				1/0
Tautoga onitis	Tautog			0/1		0/1
Pleuronectes americanus	Winter flounder	1/0				1/0

*Too rough to land net.

** Throughout Table 7-2, all catch numbers are specified as follows: first value is 300-ft seine catch; second value (following slash) is 60-ft seine catch.

May 24, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (14.5 °C)	Spar Is. (16.0 °C)	Cole R. (16.5 °C)	Lee R. (16.5 °C)	
Microgadus tomcod	Atlantic tomcod		0/1			0/1
Fundulus heteroclitus	Mummichog	0/35				0/35
Fundulus majalis	Striped killifish	1/10		4/3		5/13
Menidia spp.	silverside	14/73		7/15	29/69	50/157
Gasterosteus aculeatus	Threespine stickleback			0/2		0/2
Tautoga onitis	Tautog		4/2		3/0	7/2
Gobiosoma ginsburgi	Seaboard goby			0/1		0/1
Pleuronectes americanus	Winter flounder			0/3	0/1	0/4

Table 7-2. Number of individuals collected (by species) and temperature readings for 300- and 60-ft beach seine hauls at four fixed stations in Mount Hope Bay, March–October 2002 (page 2 of 4)

June 26, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (23.9 °C)	Spar Is. (21.8 °C)	Cole R. (22.0 °C)	Lee R. (24.8 °C)	
Alosa aestivalis	Blueback herring	0/22*		109/0	1/3	110/25
A. pseudoharengus	Alewife	0/403		2071/0	15/57	2086/460
Brevoortia tyrannus	Atlantic menhaden			3/0	3/0	6/0
Anchoa sp.	Anchovy			1/0		1/0
Fundulus heteroclitus	Mummichog			0/1		0/1
Fundulus majalis	Striped killifish	5/0	0/3	16/141		21/144
Menidia spp.	silverside	0/5	1/105	7/574	0/3	8/687
Gasterosteus aculeatus	Threespine stickleback				0/1	0/1
Morone saxatilis	Striped bass	1/0				1/0
Pomatomus saltratrix	Bluefish	1/0		1/0		2/0
Tautoga onitis	Tautog	2/0				2/0
Pleuronectes americanus	Winter flounder	0/3		0/3		0/6

* Throughout Table 7-2, all catch numbers are specified as follows: first value is 300-ft seine catch; second value (following slash) is 60-ft seine catch.

July 12, 2002

Species		Station (Water Temp. in °C)				All Stations Combined (300ft/60ft)
Scientific Name	Common Name	Intake (23.4 °C)	Spar Is. (22.7 °C)	Cole R. (23.0 °C)	Lee R. (24.5 °C)	
A. pseudoharengus	Alewife	0/83	0/5	13/0		13/88
Cyprinodon variegatus	Sheepshead minnow				1/6	1/6
Fundulus heteroclitus	Mummichog	3/31		0/2		3/33
Fundulus majalis	Striped killifish	0/21		0/756	0/165	0/942
Menidia spp.	silverside	0/1312	0/875	0/695	0/15457	0/18339
Gasterosteus aculeatus	Threespine stickleback				0/41	0/41
Pungitius pungitius	Ninespine stickleback				0/1	0/1
Syngnathus fuscus	Northern pipefish	0/1			0/3	0/4
Morone saxatilis	Striped bass				2/0	2/0
Pomatomus saltratrix	Bluefish	57/0			1/0	58/0
Tautoga onitis	Tautog	0/8			0/14	0/22
Pleuronectes americanus	Winter flounder	0/3				0/3

Table 7-2. Number of individuals collected (by species) and temperature readings for 300- and 60-ft beach seine hauls at four fixed stations in Mount Hope Bay, March–October 2002 (page 3 of 4)

August 12, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (28.6 °C)	Spar Is. (25.0 °C)	Cole R. (25.0 °C)	Lee R. (26.0 °C)	
Alosa aestivalis	Blueback herring			0/1*		0/1
A. pseudoharengus	Alewife		2/0		1982/0	1984/0
Brevoortia tyrannus	Atlantic menhaden				136/0	136/0
Anchoa sp.	Anchovy		0/4			0/4
Cyprinodon variegatus	Sheepshead minnow			0/1		0/1
Fundulus heteroclitus	Mummichog	0/1		0/16		0/17
Fundulus majalis	Striped killifish	0/8		7/178	0/5	7/191
Menidia spp.	silverside	0/104	0/50	0/401	0/106	0/661
Gasterosteus aculeatus	Threespine stickleback			0/1		0/1
Morone saxatilis	Striped bass			2/0	1/0	3/0
Pomatomus saltratrix	Bluefish	122/1			8/0	130/1
Menticirrhus saxatilis	Northern kingfish	0/1		13/79		13/80
Tautoga onitis	Tautog		2/8			2/8

* Throughout Table 7-2, all catch numbers are specified as follows: first value is 300-ft seine catch; second value (following slash) is 60-ft seine catch.

September 30, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (21.2 °C)	Spar Is. (21.0 °C)	Cole R. (20.5 °C)	Lee R. (21.1 °C)	
A. pseudoharengus	Alewife	8/0				8/0
Brevoortia tyrannus	Atlantic menhaden	1/0		62/0		63/0
Fundulus majalis	Striped killifish	1/5	3/3	10/32		14/40
Menidia spp.	silverside	0/2	0/1194	0/153		0/1349
Pomatomus saltratrix	Bluefish	80/0		454/2	165/*	699/2
Caraanx hippos	Crevalle jack	26/0				26/0
Stenotomus chrysops	Scup	20/0				20/0
Menticirrhus saxatilis	Northern kingfish	0/1		6/0		6/1
Tautoga onitis	Tautog	0/2	0/2			0/4

*1 No set; surf very heavy, wind building, anchor not holding.

Table 7-2. Number of individuals collected (by species) and temperature readings for 300- and 60-ft beach seine hauls at four fixed stations in Mount Hope Bay, March–October 2002 (page 4 of 4)

October 24, 2002

Species		Station (Water Temp. in °C)				All Stations Combined
Scientific Name	Common Name	Intake (°C)*	Spar Is. (°C)*	Cole R. (°C)*	Lee R. (°C)*	
Brevoortia tyrannus	Atlantic menhaden	1/0	1/0			2/0
Fundulus heteroclitus	Mummichog				0/102	0/102
Fundulus majalis	Striped killifish	6/30	0/7	1/6	0/3	7/46
Menidia spp.	silverside	2/50	0/272	0/11		2/333
Sygnathus fuscus	Northern pipefish				1/0	1/0
Caranx hippos	Crevalle jack	37/0				37/0
Tautoga onitis	Tautog	0/1				0/1
Pleuronectes americanus	Winter flounder			1/0		1/0

*Note: No temperatures taken in October – thermometer broken.

** Throughout Table 7-2, all catch numbers are specified as follows: first value is 300-ft seine catch; second value (following slash) is 60-ft seine catch.

Table 7-3. Species and mean numbers per haul collected by 60-ft beach seine at four fixed stations in Mount Hope Bay, March-October 1972-2002 (page 1 of 2)

Scientific Name	Common Name	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Albula vulpes	Bonefish																
Anguilla rostrata	American eel	0.1		0.1	0.1	0.2	0.1	0.2	0.1			P					
Alosa aestivalis	Blueback herring											6.0					P
A. pseudoharengus	Alewife		4.4				11.1	0.1	27.8	0.2		2.7	0.3	38.4			0.4
Brevoortia tyrannus	Atlantic menhaden	0.1	0.2		0.1		0.1			31.9		P			P		
Clupea harengus	Atlantic herring				0.1										1.3		
Anchoa mitchilli	Bay anchovy		0.2	1.7					4.2				P	1.5			
Anchoa spp.	Anchovy	19.7															
Unidentified clupeiforms	Unidentified river herrings			15.0													
Opsanus tao	Oyster toadfish																
Microgadus tomcod	Atlantic tomcod	0.4	0.5		0.1	0.1	0.1	1.9		1.6	P	0.2	0.1		0.5	0.2	3.7
Urophycis regia	Spotted hake					0.1											
Strongylura marina	Atlantic needlefish				0.2		0.2				P						
Cyprinodon variegatus	Sheepshead minnow	0.3								0.1							
Fundulus heteroclitus	Mummichog	3.5	21.9	9.4	0.2	1.5	0.1	15.3	11.4	15.8	5.0	2.9	35.2	4.8	1.2	5.3	11.2
F. majalis	Striped killifish	5.6	5.8	4.8	8.1	6.8	16.4	21.8	21.6	7.3	18.9	13.0	31.3	18.4	11.6	21.0	21.9
Fundulus spp.	Killifishes	2.3		0.8	2.8												
Lucania parva	Rainwater killifish																
Menidia beryllina	Inland silverside											P	0.4				0.5
M. menidia	Atlantic silverside	215.4	379.1	303.3	211.4	69.3	216.7	143.7	57.1	107.2	276.0	468.9	361.8	1051.9	314.8	880.0	908.5
Apeltes quadracus	Fourspine stickleback						0.1	0.2		0.1		P	0.2	0.2		0.1	P
Gasterosteus aculeatus	Threespine stickleback								0.6		P				0.3		
G. wheatlandi	Blackspotted stickleback																
Pungitius pungitius	Ninespine stickleback																
Syngnathus fuscus	Northern pipefish	0.4	0.1	0.6	0.3	0.4		0.3	0.3			0.2	0.3	0.4	0.1	P	0.2
Prionotus carolinus	Northern searobin																
Prionotus evolans	Striped searobin																
Myxocephalus aenaeus	Grubby																
Morone americana	White perch	2.1	0.1		0.1	0.9		0.1									
Lepomis macrochirus	Bluegill								0.1								
Lucania parva	Rainwater killifish																
Pomatomus saltatrix	Bluefish	0.1	0.2	0.4	0.7	0.1	0.1	0.1	0.4	0.1	0.7	0.7	0.1	0.3	0.3	0.1	0.5
Caranx hippos	Crevalle jack	0.1	0.2									P		0.1			
Caranx spp.	Jacks																
Selar crumenophthalmus	Bigeye scad			0.1													
Selene vomer	Lookdown													P			
Trachinotus falcatus	Permit	P					0.1										
Stenotomus chrysops	Scup								0.1								
Cynoscion regalis	Weakfish	P		0.4													
Leiostomus xanthurus	Spot																
Menticirrhus saxatilis	Northern kingfish	0.9	0.2	0.1	1.1			0.1		0.2	P	P	P				P
Mugil cephalus	Striped mullet		0.7											0.2			
M. curema	White mullet												P				
Tautoga onitis	Tautog	0.9		0.1	0.8	0.3	1.0	0.7	0.4			0.2	0.3	P	P		0.1
Tautogolabrus adspersus	Cunner	P										P					
Ammodytes sp.	Sand lance								0.1								P
Gobiosoma ginsburgi	Seaboard goby												P				
Paralichthys dentatus	Summer flounder																
Scophthalmus aquosus	Windowpane flounder																
Pleuronectes americanus	Winter flounder	P		0.4		0.1		0.1	0.1	0.1			P		0.3		P
Sphoeroides maculatus	Northern puffer								0.1								
Number of species		18	13	13	13	11	12	13	15	11	8	16	15	12	11	7	14

Note: P = Species present but < 0.05 fish per haul.

Table 7-3. Species and mean numbers per haul collected by 60-ft beach seine at four fixed stations in Mount Hope Bay, March-October 1972-2002 (page 2 of 2)

Scientific name	Common Name	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1972-2001 mean	2002
Albula vulpes	Bonefish						P									0.001	
Anguilla rostrata	American eel				P											0.026	
Alosa aestivalis	Blueback herring		0.4				2.4					0.2				0.314	1.1
A. pseudoharengus	Alewife		P	P	P	105.2	0.2	0.4		42.1	0.1	7.2	0.5	9.43	18.7	9.283	26
Brevoortia tyrannus	Atlantic menhaden		0.1		0.1	P				P				0.14		1.131	
Clupea harengus	Atlantic herring															0.046	
Anchoa mitchilli	Bay anchovy															0.265	
Anchoa spp.	Anchovy															0.680	0.17
Unidentified clupeiforms	Unidentified herrings															0.517	
Opsanus tao	Oyster toadfish											P				0.001	
Microgadus tomcod	Atlantic tomcod	0.1	P	P		1.2	0.8	1.0	P	0.3	1.0	0.1	0.4	0.32	9.92	0.847	P
Urophycis regia	Spotted hake															0.002	
Strongylura marina	Atlantic needlefish									0.1						0.020	
Cyprinodon variegatus	Sheepshead minnow	0.2	P	P	0.3		8.2		3.0		0.2	0.1	0.2			0.432	0.3
Fundulus heteroclitus	Mummichog	27.6	3.5	11.8	61.7	17.3	54.5	246.0	131.5	58.3	7.5	10.2	5.6	5.36	2.5	27.177	8.2
F. majalis	Striped killifish	51.5	19.1	9.5	74.5	47.4	59.8	31.4	104.0	62.2	17.2	13.2	55.3	27.4	10.3	28.171	61
Fundulus spp.	Killifishes															0.200	
Lucania parva	Rainwater killifish	4.3	P				P		0.3	0.1					0.04	0.166	
Menidia beryllina	Inland silverside	P					0.1			0.1						0.039	
M. menidia	Atlantic silverside	809.4	1330.8	729.5	1308.8	412.1	1408.8	1245.5	194.7	811.6	266.6	396.0	359.5	193.40	594	552.610	941
Apeltes quadracus	Fourspine stickleback		P	0.1				P	P	0.1	0.1			0.04	0.08	0.046	
Gasterosteus aculeatus	Threespine stickleback	0.1	1.8	P		0.1	0.3			0.1	0.1	4.1		0.04	0.67	0.284	2
G. wheatlandi	Blackspotted stickleback		P													0.001	
Pungitius pungitius	Ninespine stickleback	P	P	P		P										0.006	0.17
Syngnathus fuscus	Northern pipefish	0.1	P		0.1	P	0.8	0.2	0.4	0.2	0.1	0.2	0.2	0.63	0.29	0.235	0.17
Prionotus carolinus	Northern searobin										0.1					0.003	
Prionotus evolans	Striped searobin													0.07		0.002	
Myxocephalus aenaeus	Grubby									P				0.04		0.003	
Morone americana	White perch											6.1				0.323	
Lepomis macrochirus	Bluegill											P				0.003	
Lucania parva	Rainwater killifish														P	0.001	
Pomatomus saltatrix	Bluefish	0.4	0.3	1.1	0.2	P		0.2		1.6	0.2	3.2	5.3	0.11	0.71	0.613	0.13
Caranx hippos	Crevalle jack	0.8	P					1.4					0.1			0.094	
Caranx spp.	Jacks										0.1	P				0.005	
Selar crumenophthalmus	Bigeye scad															0.002	
Selene vomer	Lookdown															0.001	
Trachinotus falcatus	Permit	0.3														0.013	
Stenotomus chrysops	Scup			P	P											0.005	
Cynoscion regalis	Weakfish										0.3				0.04	0.023	
Leiostomus xanthurus	Spot	0.1														0.004	
Menticirrhus saxatilis	Northern kingfish				P	0.4	P	0.2		0.9	0.1	3.0	P	0.14		0.260	3.5
Mugil cephalus	Striped mullet															0.030	
M. curema	White mullet	0.5	P	2.9						P			0.4			0.132	
Tautoga onitis	Tautog	P				0.5	1.0	0.1			0.3	0.9	0.8	4.61		0.449	1.4
Tautogolabrus adspersus	Cunner	P		P	0.6	P	0.9	0.1	P	0.2			0.6	0.46		0.109	
Ammodytes sp.	Sand lance													0.18		0.010	
Gobiosoma ginsburgi	Seaboard goby				P		0.3	P				P			P	0.017	P
Paralichthys dentatus	Summer flounder												P			0.001	
Scophthalmus aquosus	Windowpane flounder											0.2				0.007	
Pleuronectes americanus	Winter flounder			0.2	0.1	4.3	0.4	P	0.3	P		0.4	0.3	0.07	P	0.248	0.6
Sphoeroides maculatus	Northern puffer				P									0.04		0.005	
Number of species		17	17	14	15	14	17	14	10	18	15	19	15	18	14	50	16

Note: P = Species present but < 0.05 fish per haul.

Table 7-4. Species and mean numbers per haul collected by 300-ft beach seine at four fixed stations in Mount Hope Bay, June-August, 1972-2002 (page 1 of 2)

Scientific Name	Common Name	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Anguilla rostrata	American eel	2.0	0.2	0.3	0.4	0.3			0.2	0.1	0.1	0.2		2.0			
Alosa aestivalis	Blueback herring	0.4										0.2		2.0		0.4	0.3
A. pseudoharengus	Alewife	0.9	0.2		0.1	0.5	247.5	50.6	1.5	0.3	0.3	6.3		4.6	0.1	4.9	0.3
Alosa spp.	Herring	12.5	0.1			20.8	0.6	1.7									
Brevoortia tyrannus	Atlantic menhaden	0.1	0.1			20.8	0.6	1.7							2.6	0.1	
Clupea harengus	Atlantic herring		0.1					0.8									
Anchoa mitchilli	Bay anchovy		1.5	4.2		1.0					3.8		0.3	1.3	1.3		
Unidentified clupeiforms	Unidentified herrings	0.5		0.3													
Osmerus mordax	Rainbow smelt	0.1									0.1						
Synodus foetens	Inshore lizardfish	P		0.1	0.1				0.1								
Opsanus tau	Oyster toadfish	0.1			0.1				0.1							0.1	
Microgadus tomcod	Atlantic tomcod	0.3		1.0					0.3	0.8	0.3	1.8	0.3	2.0	0.5	0.1	
Hyporhamphus unifasciatus	Halfbeak																
Cyprinodon variegatus	Sheepshead minnow	P															
Fundulus heteroclitus	Mummichog	8.5	8.2	4.2	1.1			3.8	4.8	0.9	4.9	1.5	7.3	17.3	0.3	0.3	1.8
F. majalis	Striped killifish	5.0	2.2	4.5	1.6	4.5	8.0	12.6	4.6	5.4	9.3	4.7	27.8	6.3	1.8	0.3	2.6
Fundulus spp.	Killifishes	2.4															
Menidia beryllina	Inland silverside																
M. menidia	Atlantic silverside	131.8	43.9	73.6	43.1	0.8	156.8	25.6	13.3	27.9	37.2	11.4	7.9	19.3	43.8	15.9	17.9
Apeltes quadracus	Fourspine stickleback	P															
Gasterosteus aculatus	Threespine stickleback																
Pungitius pungitius	Ninespine stickleback																
Syngnathus fuscus	Northern pipefish	0.3	0.1	P	0.3			0.5		0.3		0.2	0.1	0.5		0.2	0.1
Prionotus evolans	Striped searobin																
Morone americana	White perch	1.4	0.2	0.2		3.3						0.1		0.3			
M. saxatilis	Striped bass				0.1												
Lepomis macrochirus	Bluegill														0.2		
Pomatomus saltatrix	Bluefish	5.5	9.5	34.9	12.3		52.8	51.9	5.3	2.5	34.2	32.0	13.7	18.5	21.3	28.1	69.4
Caranx crysos	Blue runner																
C. hippos	Crevalle jack	1.3	0.8											0.3			8.4
Caranx spp.	Jacks																
Trachinotus falcatus	Permit	P															
Lutjanus griseus	Gray snapper																
Stenotomus chrysops	Scup					26.3			5.8	0.9		2.1			0.6		
Cynoscion regalis	Weakfish	2.1	0.3														
Menticirrhus saxatilis	Northern kingfish	9.8	1.5	0.1	0.2							0.2					
Mugil cephalus	Striped mullet	P	0.4														
M. curema	White mullet																
Mugil spp.	Mullets																
Tautoga onitis	Tautog	1.0	0.3	0.6	1.3		2.0	0.8	4.0	1.8	0.1	0.7	1.5	2.3	1.2	1.6	2.7
Tautogolabrus adspersus	Cunner	P							0.1				0.2				
Scomber scombrus	Atlantic mackerel								1.0					1.3			
Peprilus triacanthus	Butterfish																
Scophthalmus aquosus	Windowpane flounder	P			0.1				0.3	0.1		0.4	0.1	0.4		0.1	
Pleuronectes americanus	Winter flounder	2.2	0.5	0.4	0.3			0.1	0.1			0.3	1.7	1.9	1.8	1.3	0.6
Trinectes maculatus	Hogchoker	P							0.4			0.2	0.3		0.3	0.2	0.2
Sphoeroides maculatus	Northern puffer	0.1															
Leiostomus xanthurus	Spot																
Number of species		30	18	14	14	9	7	11	16	11	10	16	12	16	13	14	11

Note: P = Species present but < 0.05 fish per haul.

Table 7-4. Species and mean numbers per haul collected by 300-ft beach seine at four fixed stations in Mount Hope Bay, June-August 1972-2002 (page 2 of 2)

Scientific Name	Common Name	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1972-2001 mean	2002
Anguilla rostrata	American eel															0.2	
Alosa aestivalis	Blueback herring	0.1	4.3	0.1	13.6	0.1										0.7	
A. pseudoharengus	Alewife	0.2	4.3	0.1	13.6	0.1	0.5	46.5	21.3	6.9	1.10	0.50	0.08	3.92	2.42	14.0	340.30
Alosa spp.	Herring															1.2	
Brevoortia tyrannus	Atlantic menhaden	0.3	0.1		462.4	0.1						15.8		170.4	1.3	22.5	12.0
Clupea harengus	Atlantic herring															0.0	
Anchoa mitchilli	Bay anchovy					0.2										0.4	0.1
Unidentified clupeiforms	Unidentified herrings															0.0	
Osmerus mordax	Rainbow smelt															0.0	
Synodus foetens	Inshore lizardfish															0.0	
Opsanus tau	Oyster toadfish			0.1		0.2										0.0	
Microgadus tomcod	Atlantic tomcod	0.8		0.1		0.2	1.5	0.1						0.08		0.3	
Hyporhamphus unifasciatus	Halfbeak															0.0	
Cyprinodon variegatus	Sheepshead minnow															0.0	0.1
Fundulus heteroclitus	Mummichog	0.5	2.3	1.3	9.4	2.5	1.8	2.60	0.80	0.60	1.00	4.90	6.00	0.67	0.42	3.3	0.25
F. majalis	Striped killifish	1.8	4.0	1.3	15.6	3.3	8.4	23.6	10.5	2.8	0.9	8.1	11.4	4.9	8.7	6.9	2.3
Fundulus spp.	Killifishes															0.1	
Menidia beryllina	Inland silverside	0.1														0.0	
M. menidia	Atlantic silverside	52.4	12.2	9.1	31.9	15.4	59.6	7.3	15.3	37.7	123.3	16.1	3.2	2.8	1.4	35.3	0.7
Apeltes quadracus	Fourspine stickleback															0.0	
Gasterosteus aculatus	Threespine stickleback						0.7									0.0	
Pungitius pungitius	Ninespine stickleback	0.1			0.2											0.0	
Syngnathus fuscus	Northern pipefish	0.3	0.3		0.2		0.9	0.1			0.1	0.3			0.3	0.2	
Prionotus evolans	Striped searobin				0.3	0.1								0.1	0.9	0.0	
Morone americana	White perch											5.2				0.4	
M. saxatilis	Striped bass			0.1	0.3		0.4		0.2	0.9	0.3	0.1	0.2		0.08	0.1	0.50
Lepomis macrochirus	Bluegill															0.0	
Pomatomus saltatrix	Bluefish	25.8	26.3	17.1	6.6	13.6	7.2	0.2	22.7	44.7	42.3	3.1	94.9	10.8	32.8	24.7	15.8
Caranx crysos	Blue runner	0.1														0.0	
C. hippos	Crevalle jack	0.2			0.1			1.8					0.8			0.5	
Caranx spp.	Jacks										0.1	0.2				0.0	
Trachinotus falcatus	Permit	0.5	0.1													0.0	
Lutjanus griseus	Gray snapper							0.1								0.0	
Stenotomus chrysops	Scup				38.1		0.1						0.2	0.3		2.5	
Cynoscion regalis	Weakfish															0.1	
Menticirrhus saxatilis	Northern kingfish				1.0	0.8	0.1	0.1		3.3	0.4	17.1	0.3	0.7	0.2	1.2	1.1
Mugil cephalus	Striped mullet				0.4		2.3									0.1	
M. curema	White mullet		2.6													0.1	
Mugil spp.	Mullets												0.1			0.0	
Tautoga onitis	Tautog	1.5	0.3		0.2	0.3	0.3	0.2	0.2	0.3	0.1	1.7	0.9	1.3	2.3	1.0	0.3
Tautogolabrus adspersus	Cunner			0.5	0.2		0.1	0.1		0.3						0.0	
Scomber scombrus	Atlantic mackerel															0.1	
Peprilus triacanthus	Butterfish										0.1		0.1			0.0	
Scophthalmus aquosus	Windowpane flounder		0.1							0.1		0.1				0.1	
Pleuronectes americanus	Winter flounder	0.8	1.8	1.1	3.4	38.5	1.8	0.6	0.1	0.1	0.6	0.7		0.8	0.6	2.1	
Trinectes maculatus	Hogchoker											0.1				0.1	
Sphoeroides maculatus	Northern puffer	0.1			0.8	0.3	0.1						0.2			0.1	
Leiostomus xanthurus	Spot													0.17		0.0	
Number of species		17	13	11	19	15	16	13	8	11	12	15	13	13	12		11

Note: P = Species present but < 0.05 fish per haul.

Table 7-5. Species and mean numbers per haul collected by 300-ft beach seine at four fixed stations in Mount Hope Bay, March-October 1981-2002 (page 1 of 2)

Scientific Name	Common Name	1981	1982	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1972-2001 Mean	2002
Anguilla rostrata	American eel	0.1		P		P																0.01	
Alosa aestivalis	Blueback herring		0.1			0.9	0.1	P			0.1			0.5	0.1	P	0.1	0.5	0.7			0.15	4.8
A. pseudoharengus	Alewife	0.1	2.6	0.2	P	1.8	0.1	0.1	1.6	P	5.4	0.1	0.2	23.1	8.1	2.6	0.8	0.2	P	1.4	1.5	2.50	178.0
Brevoortia tyrannus	Atlantic menhaden				0.1	0.1		0.2	P		203.7	0.1		0.5			P	5.9	0.1	60	0.71	13.57	9
Clupea harengus	Atlantic herring				0.3	0.2		0.7	0.1													0.06	
Anchoa mitchilli	Bay anchovy	1.4	0.1	0.1	0.5																	0.10	
Osmerus mordax	Rainbow smelt	P			P			0.1					P				P					0.01	
Gadus morhua	Atlantic cod																		0.2			0.01	
Microgadus tomcod	Atlantic tomcod	0.3	0.7	0.1	0.3	5.1	P	0.4	5.3	P	P	3.4	0.8	8.2		P	0.1			0.03		1.23	
Pollachius virens	Pollock		0.1					P														0.01	
Urophycis regia	Spotted hake			0.1																		0.01	
Hyporhamphus unifasciatus	Halfbeak					P																0.00	
Opsanus tau	Oyster toadfish	0.1				P														0.03		0.01	
Strongylura marina	Atlantic needlefish	0.2								0.2				P								0.02	
Cyprinodon variegatus	Sheepshead minnow								0.1				0.1									0.01	P
Fundulus heteroclitus	Mummichog	1.8	0.6	3.4	0.1	0.3	0.7	0.3	0.9	0.7	4.3	1.8	1.3	1.3	0.4	0.2	0.4	2.0	2.3	0.23	0.38	1.16	0.13
F. majalis	Striped killifish	3.9	3.6	11.3	0.8	0.2	1.3	2.1	2.3	1.3	9.4	4.3	4.2	15.0	7	2	0.5	5.0	5.0	1.83	5.1	4.31	3.96
Menidia beryllina	Inland silverside				P	P		P														0.00	
M. menidia	Atlantic silverside	36.1	14.2	12.7	18.5	15.2	9.7	48.0	16.7	14.4	60.2	14.3	35.8	20.7	34.4	19.2	60.5	26.7	11.3	7.57	9	24.26	4.4
Apeltes quadracus	Fourspine stickleback				P																0.08	0.01	
Gasterosteus aculatus	Threespine stickleback												0.3			P	P			0.03		0.02	
Pungitius pungitius	Ninespine stickleback							P														0.00	
Syngnathus fuscus	Northern pipefish		0.1	P		0.2	0.1	0.2	0.3	0.0	0.1	0.0	0.4	0.2		P	P	0.1	P		0.13	0.09	0.09
Cyclopterus lumpus	Lumpfish																		P			0.00	
Morone saxatilis	Striped bass																				0.83	0.04	0.22
Prionotus evolans	Striped searobin																				0.46	0.02	

P = Species present but < 0.05 fish per haul.

Table 7-5. Species and mean numbers per haul collected by 300-ft beach seine at four fixed stations in Mount Hope Bay, March-October 1981-2002 (page 2 of 2)

Scientific Name	Common Name	1981	1982	1983	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1972-2001 Mean	2002
Morone americana	White perch		P					P	P									1.9				0.10	
Lepomis macrochirus	Bluegill						P															0.00	
Pomatomus saltatrix	Bluefish	13.6	15.4	5.9	10.4	12.8	27.4	10.4	10.0	6.4	13.5	6.1	2.8	6.2	8.8	16.8	10.6	12.7	40.4	3.69	17.3	12.57	38.7
Caranx hippos	Crevalle jack		0.1					3.4	0.1		1.8			2.2				0.6	1.4			0.47	2.7
C. latus	Horse-eye jack							P														0.00	
Caranx spp.	Jacks																0.5	0.1				0.03	
Trachinotus falcatus	Permit							0.4	P													0.02	
Lutjanus gresius	Gray snapper													P								0.00	
Stenotomus chrysops	Scup		0.8		0.2						14.8	0.0	P						0.1	0.11		0.80	0.86
Menticirrhus saxatilis	Northern kingfish		0.9	P							0.4	0.4	P	P		1.2	0.1	6.4	0.1	0.23	0.25	0.51	0.83
Mugil cephalus	Striped mullet			0.3		P							0.9									0.06	
M. curema	White mullet			0.2				1.5											0.5			0.11	
Mugil spp.	Mullet										0.2						0.3		P	1.4		0.09	
Tautoga onitis	Tautog	0.1	0.3	0.8	1.0	0.6	1.5	0.8	0.3	P	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.7	0.5	0.77	1.67	0.49	0.35
Tautogolabrus adspersus	Cunner			0.1						0.2	0.1			P		0.1		P				0.03	
Scomber scombrus	Atlantic mackerel			0.5																		0.03	
Peprilus triacanthus	Butterfish			P													P		P			0.01	
Scophthalmus aquosus	Windowpane flounder	P	0.2	0.1	0.2	P	P	0.1	P							P		P				0.04	
Pleuronectes americanus	Winter flounder	P	0.2	3.8	1.7	0.5	0.3	0.9	0.8	0.4	1.3	17.1	1.3	0.5	P	0.1	0.2	0.3		0.31	0.33	1.50	0.09
Trinectes maculatus	Hogchoker		0.1	0.2		0.1	0.1						P					P				0.02	
Sphoeroides maculatus	Northern puffer	P						P			0.4	0.1							0.1			0.03	
Synodus foetens	Inshore Lizardfish																			0.03		0.00	
Leiostomus xanthurus	Spot																			0.06		0.00	
Number of species		15	18	20	16	19	13	23	16	11	17	13	16	16	9	14	17	17	18	16	13		15

Table 7-6. Mount Hope Bay YOY winter flounder seine survey sampling protocol, 1992-2002

Stations and Sampling Times	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
10 Fixed Stations	■	■	■	■	■	■	■	■	■	■	■
4 Randomly Selected Stations		■									
5 Randomly Selected Stations			■								
8 - 11 Randomly Selected Stations				■	■	■	■	■	■	■	■
Two Surveys in June	■										
Two Surveys in June and July and One in August		■	■	■	■	■	■	■	■	■	■

Note: Two or three replicate hauls completed at each location during each survey.

Table 7-7. Number of young-of-the-year winter flounder collected per standard (2,300ft^2 = 214m^2) seine haul at fixed and random locations in upper Mount Hope Bay tributaries, June-August 2002 (page 1 of 5)

10-12 June 2002

Station	Replicate I	II	III	Mean	River Mean (S.E.)[1]	Temp (o C)	Salinity ‰	D.O. (mg/l)	Percent Saturation
Taunton River[2]									
A	6	14	8	9		19.5	16.5	9.5	114.4
B	3	9	24	12		20.8	17.1	10.9	136.1
C	12	18	9	13					
D	0	0		0		21.1	24.1	11.6	151.9
E	7	3	5	5		19.2	24.0	10.5	131.7
6	0	3	4	2		22.3	18.1	14.5	185.5
9	8	19	28	18		20.4	17.2	12.1	98.7
13	6	6	11	8		20.3	15.3	10.1	127.2
					8.5 (2.1)				
Lee River									
F[3]									
G	1	2	0	1		20.0	25.1	10.7	136.4
5	13	9	5	9		20.3	24.5	9.8	125.6
					5.0 (4.0)				
Cole River									
H	8	15	32	18		20.8	25.2	11.8	153.2
I	15	32	61	36		21.9	20.0	10.4	133.8
					27.2 (8.8)				
Kickamuit River									
J	36	15	12	21		21.6	24.1	10.9	140.5
5	0	6	2	3		19.4	25.8	9.0	113.5
8	0	2	0	1		21.3	24.8	11.2	147.2
9	0	0	0	0		21.9	24.8	11.5	151.9
					6.1 (5.0)				

[1] Standard error based on number of stations

[2] Data missing

[3] Not sampled – too much *Ulva lactuca*

Table 7-7. Number of young-of-the-year winter flounder collected per standard (2,300ft^2 = 214m^2) seine haul at fixed and random locations in upper Mount Hope Bay tributaries, June-August 2002 (page 2 of 5)

24-26 June 2002

Station	Replicate I	Replicate II	Replicate III	Mean	River Mean (S.E.)[1]	Temp (o C)	Salinity ‰	D.O. (mg/l)	Percent Saturation
Taunton River									
A	20	32	21	24.3		24.0	21.0	14.8	197.7
B	6	6	18	10.0		23.7	22.0	13.8	185.6
C	38	58	15	37.0		22.9	25.5	4.7	63.5
D	0	0		0.0		23.5	26.9	13.8	189.7
E	2	14	10	8.7		22.7	26.1	12.3	163.4
8	2	2	23	9.0		23.2	22.7	12.6	168.2
9	11	35	22	22.7		23.8	20.5	14.3	188.0
13	13	28	16	19.0		23.8	20.9	12.6	167.7
Lee River					16.3 (4.1)				
F	23	2		12.5		22.6	26.9	11.5	164.2
G	3	2	2	2.3		24.7	27.1	15.8	222.0
5	11	29	7	15.7		25.5	27.1	6.7	95.8
					10.2 (4.0)				
Cole River									
H	13	26	27	22.0		21.9	27.4	9.8	131.0
I	30	22	57	36.3		26.9	23.9	16.6	236.9
					29.2 (7.2)				
Kickamuit River									
J	8	31	33	24.0		22.6	27.3	10.2	138.2
1	0	6	1	2.3		26.2	26.7	10.0	142.4
5	0	0		0.0		24.6	27.1	12.7	177.0
8	0	1	0	0.3		25.9	26.0	9.1	129.4
					6.7 (5.8)				

[1] Standard error based on number of stations

[2] Not sampled – too much *Ulva lactuca*

Table 7-7. Number of young-of-the-year winter flounder collected per standard (2,300ft^2 = 214m^2) seine haul at fixed and random locations in upper Mount Hope Bay tributaries, June-August 2002 (page 3 of 5)

8-10 July 2002

Station	Replicate I	Replicate II	Replicate III	Mean	River Mean (S.E.)[1]	Temp (o C)	Salinity ‰	D.O. (mg/l)	Percent Saturation
Taunton River									
A	24	13	9	15.3		24.2	26.5	8.5	117.1
B	10	26	20	18.7		24.6	26.1	8.2	114.5
C	33	25	29	29.0		25.0	26.9	8.7	121.5
D	0	5	2	2.3		24.9	27.7	8.1	114.1
E	13	5	19	12.3		28.2	28.4	8.5	127.2
7	3	2	0	1.7		25.2	26.5	7.6	107.4
9	7	20	29	18.7		24.9	26.3	8.6	120.4
13	18	46	20	28.0		24.5	25.7	8.3	115.5
Lee River					15.8 (3.6)				
F	0	0		0.0		26.4	28.3	8.3	121.7
G	8	5	2	5.0		26.7	28.3	7.1	103.4
5	0	0	0	0.0		26.3	28.2	8.4	121.3
					1.7 (1.7)				
Cole River									
H	0	2	0	0.7		26.0	[2]	[2]	[2]
I	0	0		0.0		28.0	[2]	[2]	[2]
					0.3 (0.3)				
Kickamuit River									
J	2	14	30	15.3		25.0	[2]	[2]	[2]
2	1	0	0	0.3		28.0	[2]	[2]	[2]
5	0	0		0.0		27.0	[2]	[2]	[2]
8	0	1	0	0.3		27.0	[2]	[2]	[2]
					4.0 (3.8)				

[1] Standard error based on number of stations.

[2] Instrument malfunction

Table 7-7. Number of young-of-the-year winter flounder collected per standard (2,300ft^2 = 214m^2) seine haul at fixed and random locations in upper Mount Hope Bay tributaries, June-August 2002 (page 4 of 5)

22-24 July 2002

Station	Replicate I	II	III	Mean	River Mean (S.E.)1	Temp (o C)	Salinity ‰	D.O. (mg/l)	Percent Saturation
Taunton River									
A	10	5	9	8.0		25.7	28.3	7.3	104.7
B	20	18	42	26.7		26.2	28.5	7.7	112.0
C	4	14	2	6.7		26.7	28.6	8.2	120.3
D	5	11		8.0		25.0	29.4	6.8	96.1
E	8	4	17	9.7		25.4	30.3	6.6	95.0
6	2	2	3	2.3		25.5	28.3	7.1	102.2
9	1	23	14	12.7		25.9	28.3	7.8	112.2
13	17	2	8	9.0		25.2	27.7	7.1	100.4
					10.4 (2.5)				
Lee River									
F	0	0		0.0		20.6	32.6	6.8	93.8
G	4	3	0	2.3		24.9	[2]	7.6	[2]
5	1	0	4	1.7		23.9	30.3	7.2	92.9
7					1.3 (0.7)				
Cole River									
H	1	8	0	3.0		26.1	30.0	7.4	110.1
I	0	0		0.0		26.7	29.5	8.0	124.0
					1.5 (1.5)				
Kickamuit River									
J	27	19	43	29.7		26.0	30.1	8.1	117.1
5	1	5		3.0		25.4	30.0	7.3	105.4
7	1	5	7	4.3		25.5	30.1	7.5	107.2
8	10	5	2	5.7		25.5	29.9	7.9	144.2
					10.7 (6.4)				

[1] Standard error based on number of stations

[2] Instrument malfunction

[3] Not sampled – too much *Ulva lactuca*

Table 7-7. Number of young-of-the-year winter flounder collected per standard (2,300ft^2 = 214m^2) seine haul at fixed and random locations in upper Mount Hope Bay tributaries, June-August 2002 (page 5 of 5)

19-21 August 2002

Station	Replicate I	II	III	Mean	River Mean (S.E.)[1]	Temp (o C)	Salinity ‰	D.O. (mg/l)	Percent Saturation
Taunton River									
A	4	4	6	4.7		26.6	29.2	6.8	100.4
B	5	8	13	8.7		26.8	29.1	7.0	102.5
C	14	30	10	18.0		26.8	29.0	7.0	104.5
D	6	2	1	3.0		25.8	30.2	8.9	129.5
E	3	4	1	2.7		27.5	30.7	9.6	143.7
4	18	13		15.5		26.7	29.6	7.1	104.8
9	3	6	3	4.0		26.8	28.8	6.7	99.3
13	4	3	6	4.3		27.1	29.7	6.9	101.5
					7.6 (2.1)				
Lee River									
F	0	0		0.0		28.0	31.1	11.4	173.9
G	0	0		0.0		27.9	31.3	14.2	215.7
1[2]									
5	0	0		0.0		27.2	30.2	11.4	171.5
					0.0				
Cole River									
H	1	0	1	0.7		29.7	31.4	9.5	148.9
I	0	0		0.0		30.3	31.1	9.7	152.5
					0.3 (0.3)				
Kickamuit River									
J	5	14	6	8.3		29.0	31.4	8.9	138.6
5	0	0		0.0		28.5	31.5	7.6	116.3
6	0	0		0.0		28.7	31.5	7.9	121.7
8	0	0		0.0		28.4	31.6	6.7	102.0
					2.1 (2.1)				

[1] Standard error based on number of stations

[2] Not sampled – too much *Ulva lactuca*

Table 7-8. Stratified mean number of young-of-the-year winter flounder per haul during two June sampling series, Mount Hope Bay tributaries, 1992-2002

Year	Number of samples	Mean	S.E.	95% confidence limits
1992	20	34.56	7.929	±17.666
1993	24	0.42	0.164	±0.348
1994	30	1.74	0.421	±0.881
1995	36	6.34	0.882	±1.830
1996	41	2.46	0.467	±0.955
1997	37	3.99	0.944	±1.953
1998	41	1.25	0.367	±0.768
1999	38	9.47	0.388	±0.811
2000	40	2.17	0.289	±0.605
2001	37	9.81	1.878	±3.935
2002	33	12.29	1.760	±3.641

Table 7-9. Stratified mean number of young-of-the-year winter flounder per haul during five June–August sampling series, Mount Hope Bay tributaries, 1992–2002

Year	Number of samples	Mean	S.E.	95% confidence limits
1992[1]	-	-	-	-
1993	70	1.60	0.390	±0.788
1994	75	1.83	0.233	±0.469
1995	94	4.82	0.626	±1.251
1996	99	4.13	0.303	±0.606
1997	95	3.48	0.437	±0.874
1998	103	1.92	0.264	±0.529
1999	95	5.74	1.206	±2.424
2000	95	2.50	0.234	±0.467
2001	80	6.89	0.993	±1.844
2002	83	10.01	1.083	±2.167

[1]Sampled in June only.

Table 7-10. July mortality rates for young-of-the-year winter flounder in Mount Hope Bay, 1992–2002

	Survival Rate	Mortality Rate	Z_{mon}
1992	-	-	-
1993	0.445	0.555	0.810
1994	0.487	0.513	0.720
1995	0.407	0.593	0.900
1996	0.162	0.838	1.818
1997	0.259	0.741	1.350
1998[1]	-	-	-
1999	0.657	0.343	0.420
2000	0.533	0.467	0.630
2001	0.822	0.178	0.195
2002	0.703	0.297	0.353

[1]Catch rate did not decline until August; see text.

Table 7-11. Total length data (mm) for young of-the-year (age 0) winter flounder collected by beach seine, 1992-2000 (page 1 of 2)

Date	Mean	s	s.e.	Range	n	Daily Instantaneous Growth (g_I)[1]
1992						
10,11 June	39.0	7.1	0.4	24 - 62	355	
23,24 June	45.9	8.3	0.4	27 - 79	368	0.0125
1993						
8,9 June	41.1	7.0	2.6	33 - 54	7	
22,23 June	51.2	7.5	1.5	36 - 65	26	0.0157 [2]
12,13 July	55.2	8.7	1.1	38 - 75	68	
27,28 July	58.1	9.5	1.3	45 - 85	55	
17,18 August	55.2	10.9	1.0	32 - 81	115	0.0042 [3]
1994						
8-10 June	44.8	7.7	1.1	36 - 53	48	
21-23 June	53.0	5.8	0.4	37 - 69	176	0.0129 [2]
13-15 July	60.2	7.9	0.9	41 - 80	86	
26-27 July	62.3	6.0	0.8	47 - 73	56	
17-19 August	60.4	8.5	1.0	42 - 79	75	0.0043 [3]
1995						
7-9 June	44.4	6.4	0.4	30 - 76	276	
21-23 June	48.7	7.5	0.4	28 - 72	392	0.0066 [2]
12-14 July	52.7	8.2	0.5	31 - 78	326	
26-28 July	55.1	9.7	0.7	34 - 88	205	
21-23 August	51.5	7.1	1.4	35 - 66	25	0.0020 [3]
1996						
10-12 June	47.8	6.6	0.6	30 - 66	126	
25-27 June	57.6	8.3	0.7	29 - 79	129	0.0124 [2]
10-12 July	58.9	10.7	0.6	33 - 87	364	
25-27 July	66.4	11.3	0.7	25 - 94	234	
13-14 August	67.0	11.0	0.9	44 - 94	166	0.0050 [3]
1997						
9-11 June	45.6	7.6	0.6	23-64	162	
24-26 June	52.6	6.9	0.5	37-69	214	0.0095 [2]
14-16 July	53.9	7.7	0.5	29-72	270	
28-30 July	55.8	7.8	0.6	36-74	156	
13-15 August	56.8	8.2	0.8	38-76	117	0.0034 [3]

Table 7-11. Total length data (mm) for young of-the-year (age 0) winter flounder collected by beach seine, 1992-2000 (page 2 of 2)

Date	Mean	s	s.e..	Range	n	Daily Instantaneous Growth (g_I)[1]
1998						
8-10 June	38.6	6.9	1.1	23-57	39	
22-24 June	49.4	11.2	1.2	27-89	94	0.0176
8-10 July	54.4	8.9	0.8	34-80	116	
22-24 July	55.8	11.0	0.8	24-97	178	
17-19 August	60.7	11.0	1.0	33-89	128	0.0065
1999						
9-11 June	51.2	7.7	0.3	30-69	495	
23-25 June	57.3	9.0	0.5	35-81	291	0.0080
12-14 July	55.8	9.4	0.7	35-77	193	
26-28 July	57.3	8.6	0.7	38-81	167	
23-25 August	57.0	8.5	0.7	41-81	128	0.0014
2000						
12-14 June	46.5	11.3	1.2	25-70	98	
26-28 June	48.9	11.4	0.9	22-82	162	0.0036 [2]
11-13 July	53.2	12.4	1.0	26-83	154	
24-26 July	54.7	11.9	1.2	25-85	115	
14-16 August	53.0	14.2	1.3	26-88	115	0.002 [3]
2001						
6-8 June	45.7	6.9	0.4	30-66	270	
19-21 June	50.2	8.2	0.3	15-70	559	0.0078 [2]
16-18 July	55.2	11.2	0.7	23-85	266	
30 July - 1 August	57.3	11.4	0.7	25-81	242	
15-18 August	56.1	12.9	1.1	26-90	145	0.0029 [3]
2002						
11-13 June	48.1	7.9	0.4	25-72	469	
25-27 June	51.3	8.9	0.3	30-96	721	0.0046 [2]
9-11 July	50.8	9.4	0.4	28-74	445	
23-25 July	53.5	11.3	0.6	29-96	385	
20-22 August	55.7	12.8	1.0	33-99	182	0.0021 [3]

[1] $g_I = \frac{\ln(l_t \div l_o)}{t}$

[2] For June only.

[3] June to August.

Table 7-12. Numbers of young-of-the-year winter flounder per 10m² (except New York) collected in Mount Hope Bay, Massachusetts Rhode Island, Connecticut, and New York (page 1 of 3)

	2002		2001		2000		1999		1998	
	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.	Mean	s.e.
Massachusetts										
Mount Hope Bay[1]										
(June)	0.574	0.082	0.458	0.088	0.102	0.014	0.443	0.018	0.059	0.017
(June-Aug)	0.468	0.051	0.322	0.046	0.117	0.011	0.268	0.056	0.099	0.012
MDMF[1]	0.1	0.01	0.21	0.03	0.33	0.4	1.91	0.26	1.57	0.27
Rhode Island										
RIDEM[2]										
(June) 4 stations	0.108	0.069	0.156	0.081	0.065	0.023	0.231	0.131	0.043	0.043
16-18 stations	0.793	0.329	0.476	0.2	2.557	1.385	0.426	0.137	0.054	0.024
(June-Aug) 4 stns	0.366	0.182	0.153	0.056	0.086	0.023	0.31	0.076	0.039	0.018
16-18 stations	0.598	0.141	0.441	0.104	1.23	0.478	0.468	0.091	0.051	0.012
Coastal ponds[3]	0.84	0.26	0.67	0.18	1.29	0.22	1.62	0.37	0.99	0.18
DEP seine (Sept)[4]	0.23 (0.14-0.33)		0.09 (0.06-0.15)		0.31 (0.18-0.52)		0.63 (0.36-1.01)		0.67 (0.43-1.01)	
Niantic River										
(early)[5]	7.63 (5.00 - 13.50)		18.00 (10.75 - 24.75)		3.88 (1.0 - 6.8)		4.75 (2.5-8.0)		4.63 (3.25-6.00)	
(late)	2.67 (1.17 - 3.33)		5.0 (3.67 - 8.25)		2.75 (2.3 - 3.5)		2.92 (1.6-3.5)		1.50 (0.67-2.00)	
New York										
Peconic Bay[6]										
(May-Oct)			2.31		0.90		7.49		3.11	

[1] Stratified means,

[2] Four stations include Kickamuit River, Spar Island, Hog Island, Spectacle Cove – those in or near Mount Hope Bay. Sixteen and 18 stations run throughout Narragansett Bay, [3] Mean number per seine haul, May-October, [4] Mean seine catch = all sites, September. 95% confidence limits in parentheses,

[5] Median values for lower river; early = May-July, late = August-September. 95% confidence limits in parentheses.

[6] Geometric mean number per trawl tow = all sites, May-October. 95% confidence limits in parentheses.

Table 7-12. Numbers of young-of-the-year winter flounder per 10m^2 (except New York) collected in Mount Hope Bay, Massachusetts Rhode Island, Connecticut, and New York (page 2 of 3)

Survey	1997 Mean	s.e.	1996 Mean	s.e.	1995 Mean	s.e.	1994 Mean	s.e.	1993 Mean	s.e.
Massachusetts										
Mount Hope Bay[1]										
(June)	0.185	0.044	0.113	0.022	0.297	0.040	0.083	0.019	0.019	0.007
(June-Aug)	0.163	0.020	0.193	0.014	0.225	0.029	0.101	0.013	0.074	0.018
MDMF[1]	3.91	0.53	2.17	0.04	1.57	0.07	1.48	0.19	0.66	0.09
Rhode Island										
RIDEM[2]										
(June) 4 stations	0.022	0.022	0.032	0.021	0.490	0.284	0.038	0.030	0.194	0.159
16-18 stations	0.109	0.046	0.083	0.038	0.249	0.095	0.059	0.024	0.097	0.020
(June-Aug) 4 stns	0.075	0.046	0.054	0.019	0.167	0.110	0.036	0.009	0.106	0.058
16-18 stations	0.115	0.026	0.077	0.019	0.172	0.057	0.074	0.22	0.163	0.039
Coastal ponds[3]	1.17	0.21	0.83	0.18	0.59	0.14	0.37	0.14	0.27	0.12
Connecticut										
DEP seine (Sept)[4]	0.54 (0.36-0.80)		1.39 (1.01-1.88)		0.73 (0.51-1.09)		1.03 (0.65-1.52)		0.41 (0.28-0.58)	
Niantic River										
(early)[5]	1.92 (1.67-2.50)		0.88 (0.50-1.50)		8.75 (5.25-14.0)		2.88 (12.55-17.2)		1.06 (0.70-1.50)	
(late)	0.70 (0.20-1.00)		0.30 (0.20-0.60)		1.58 (1.20-2.67)		6.29 (3.83-7.50)		0.50 (0.30-0.70)	
New York										
Peconic Bay[6]										
(May-Oct)	4.42		3.80		0.91		2.44 (1.98-2.96)		4.73 (3.96-5.61)	

Table 7-12. Numbers of young-of-the-year winter flounder per $10m^2$ (except New York) collected in Mount Hope Bay, Massachusetts Rhode Island, Connecticut, and New York (page 3 of 3)

Survey	1992 Mean	s.e.
Massachusetts		
Mount Hope Bay[1]		
(June)	1.600	0.400
(June-Aug)	-	-
MDMF[1]	2.92	0.47
Rhode Island		
RIDEM[2]		
(June) 4 stations	0.188	0.010
16-18 stations	1.283	0.586
(June-Aug) 4 stns	0.610	0.297
16-18 stations	1.000	0.246
Coastal ponds[3]	-	-
Connecticut		
DEP seine (Sept)[4]	0.86 (0.54-1.34)	
Niantic River		
(early)[5]	9.00 (5.75-12.25)	
(late)	2.81 (2.38-3.33)	
New York		
Peconic Bay[6]		
(May-Oct)	11.49 (9.14-14.3)	

7.7 FIGURES

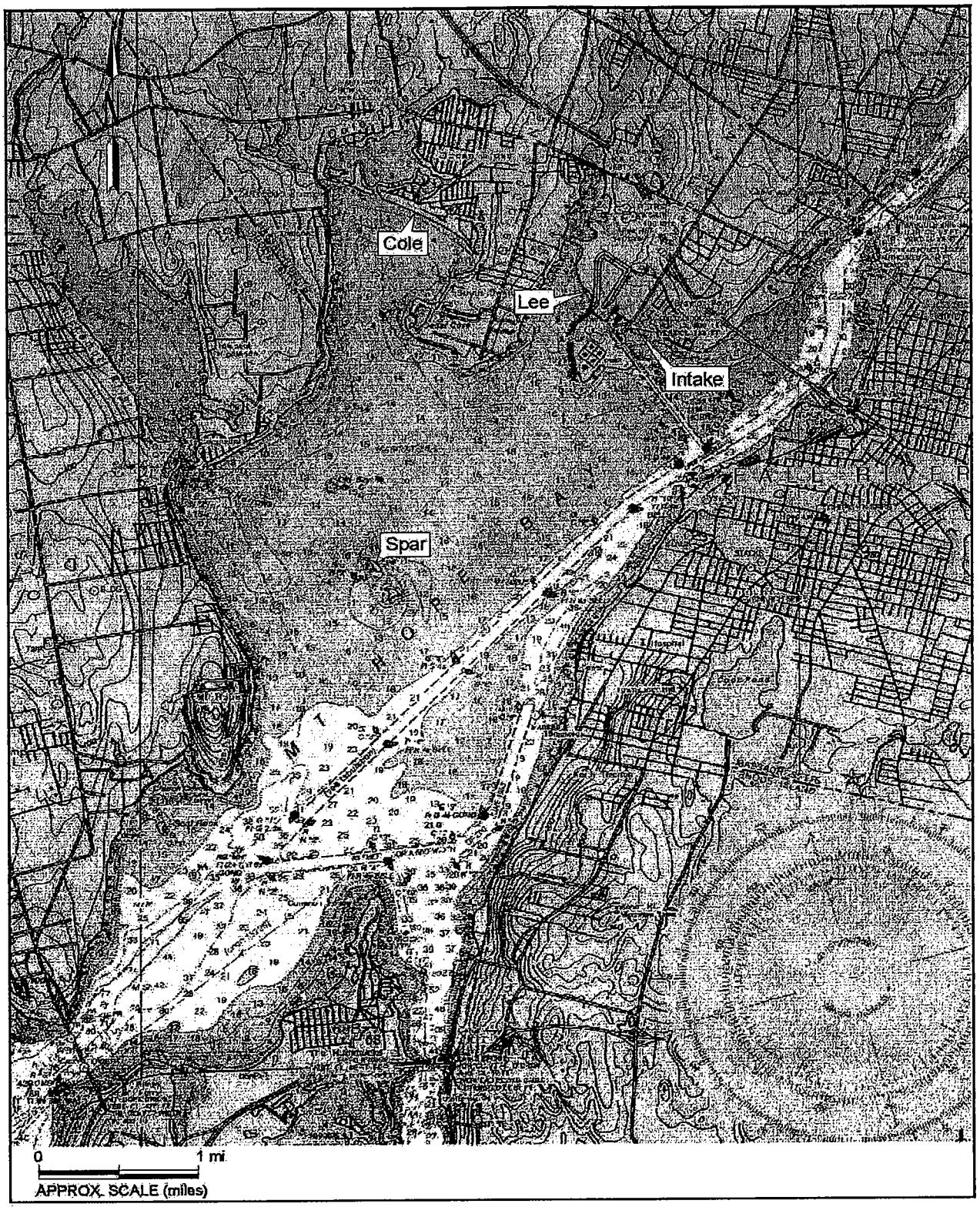


Figure 7-1. Four fixed stations in Mount Hope Bay sampled by 60- and 300-ft beach seines (core beach seine program), 1972–2002

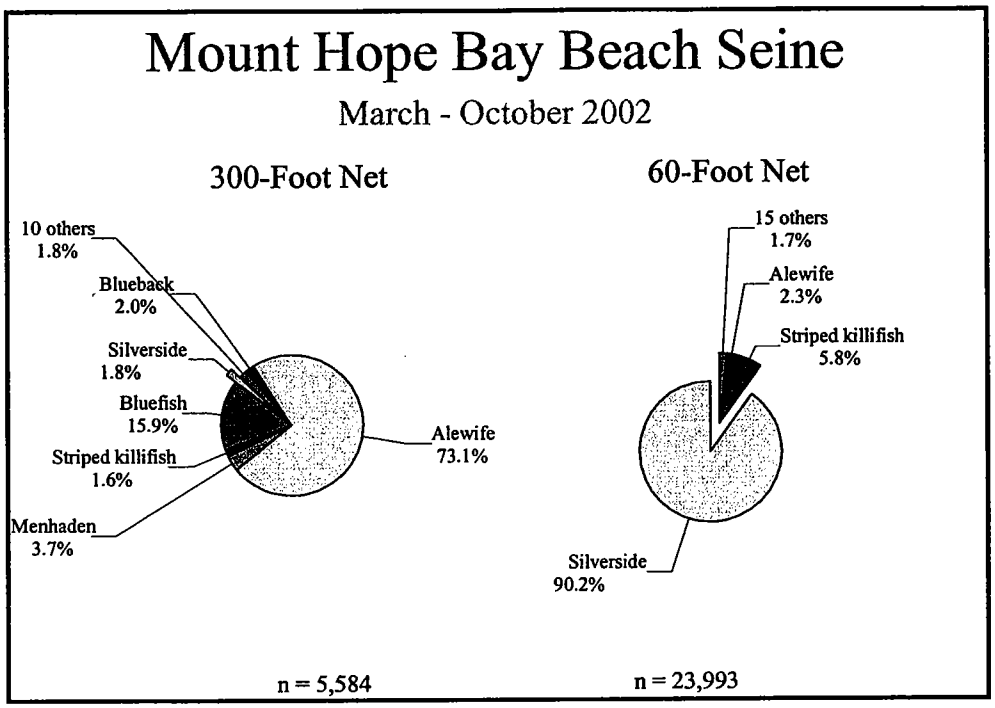
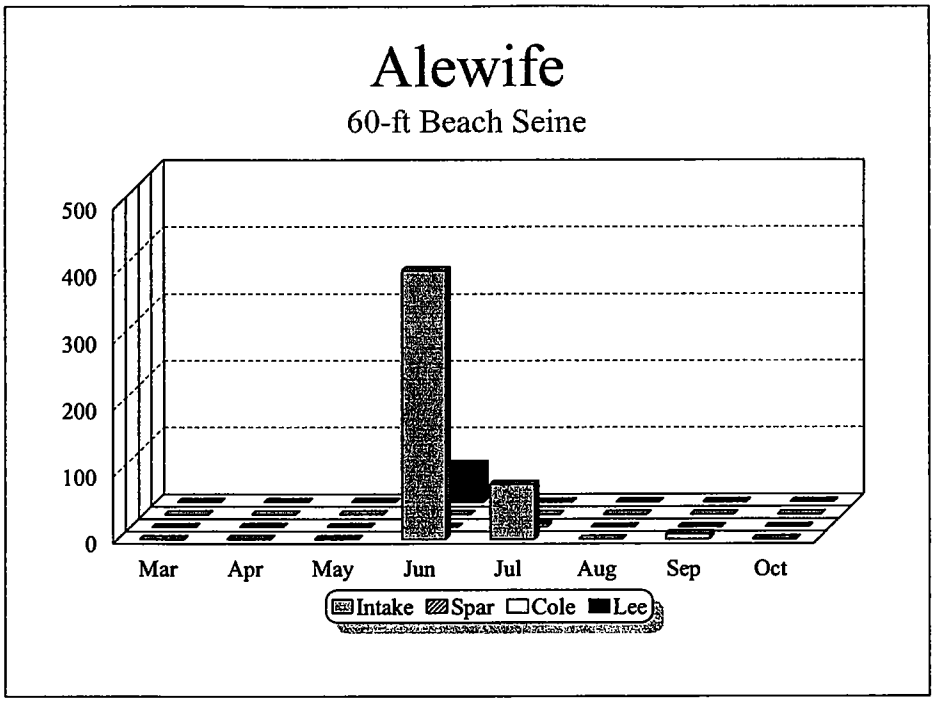


Figure 7-2. Percent contributions of the numerically dominant species of finfish taken in 300- and 60-ft beach seines in Mount Hope Bay, March–October 2002



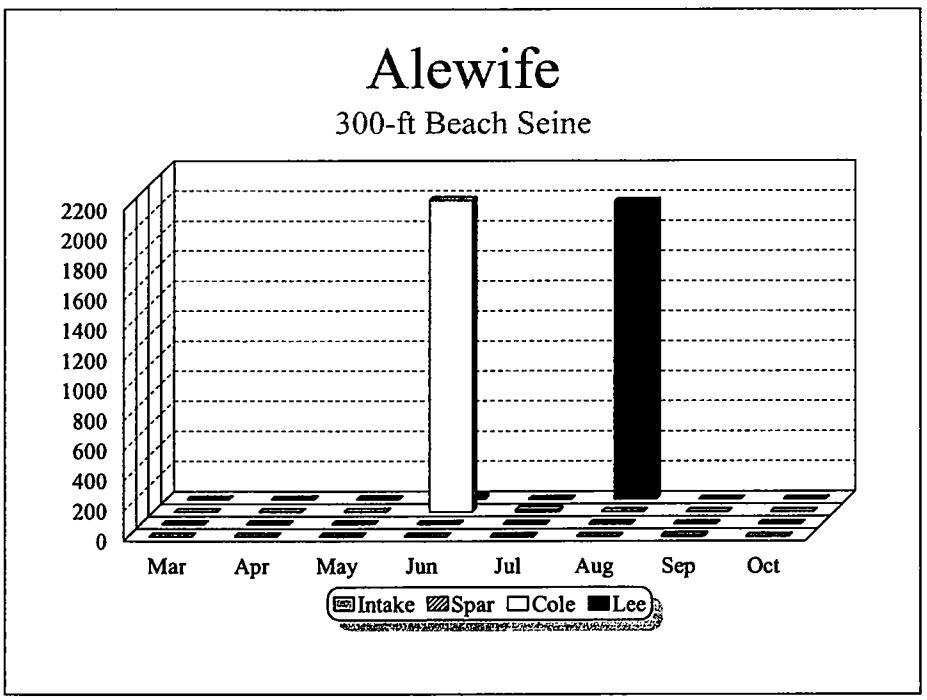
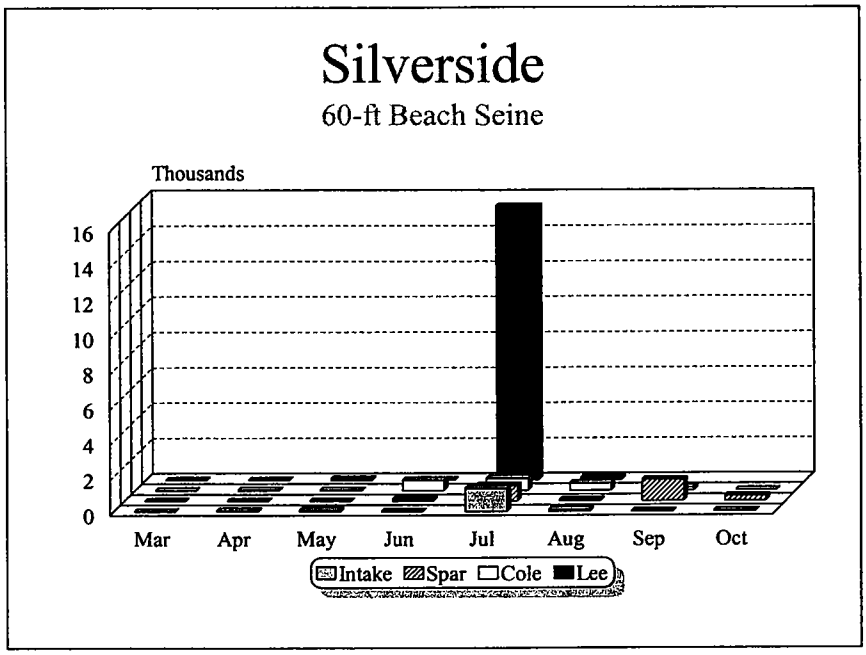


Figure 7-3a. Number of alewife collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



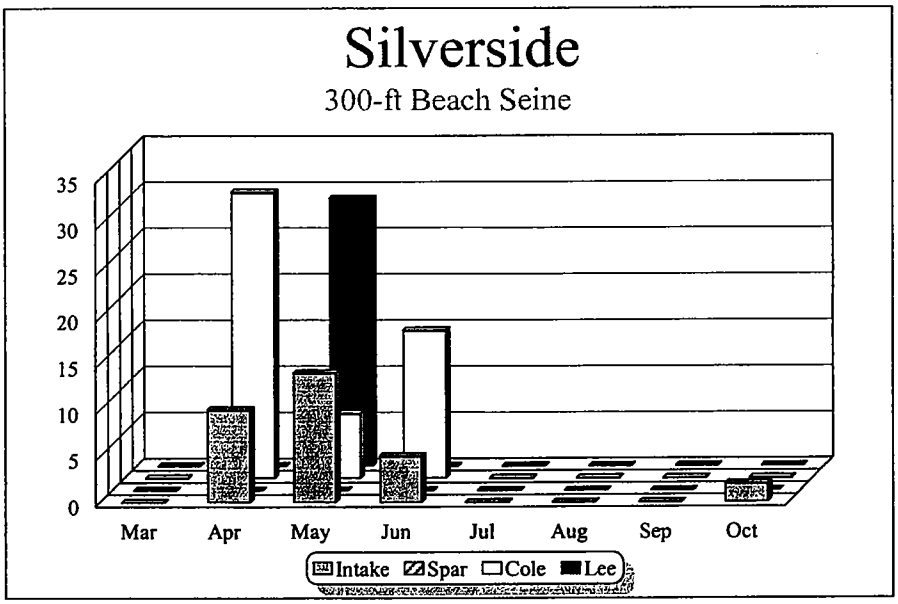
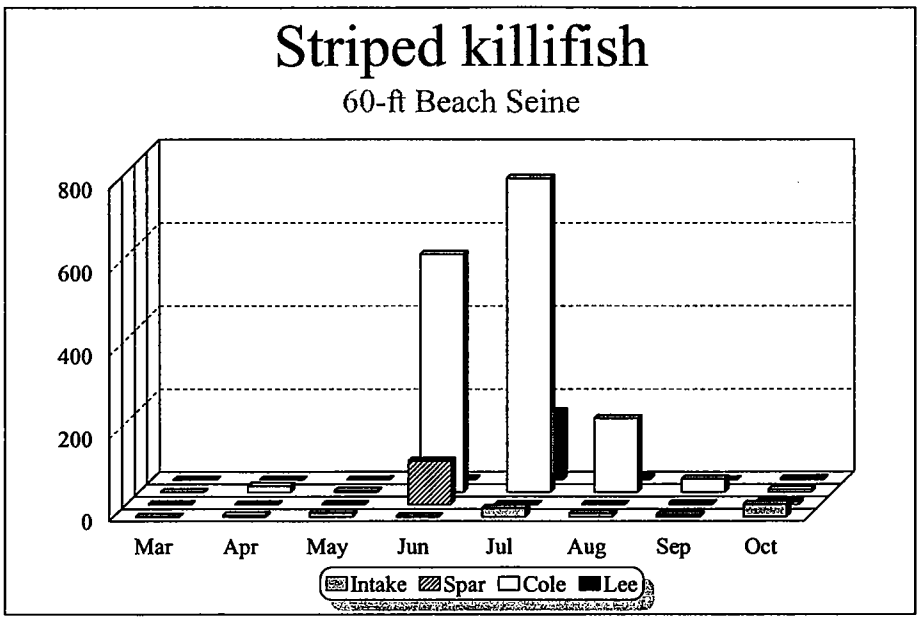


Figure 7-3b. Number of silverside collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



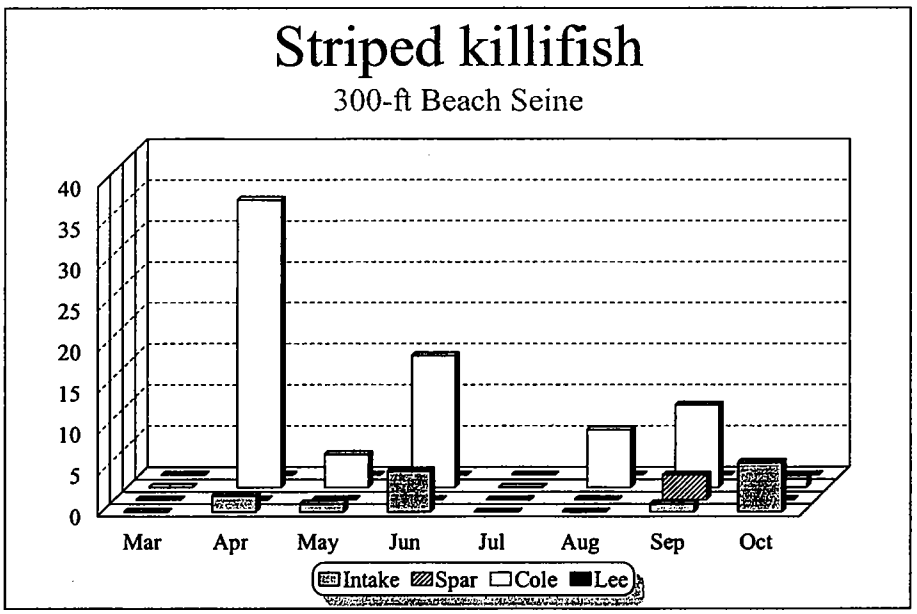
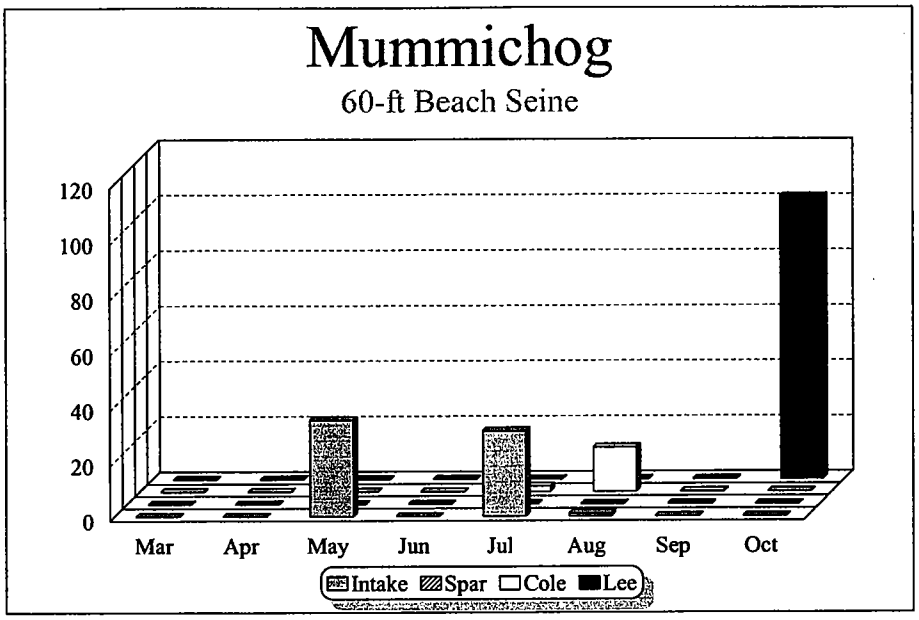


Figure 7-3c. Number of striped killifish collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



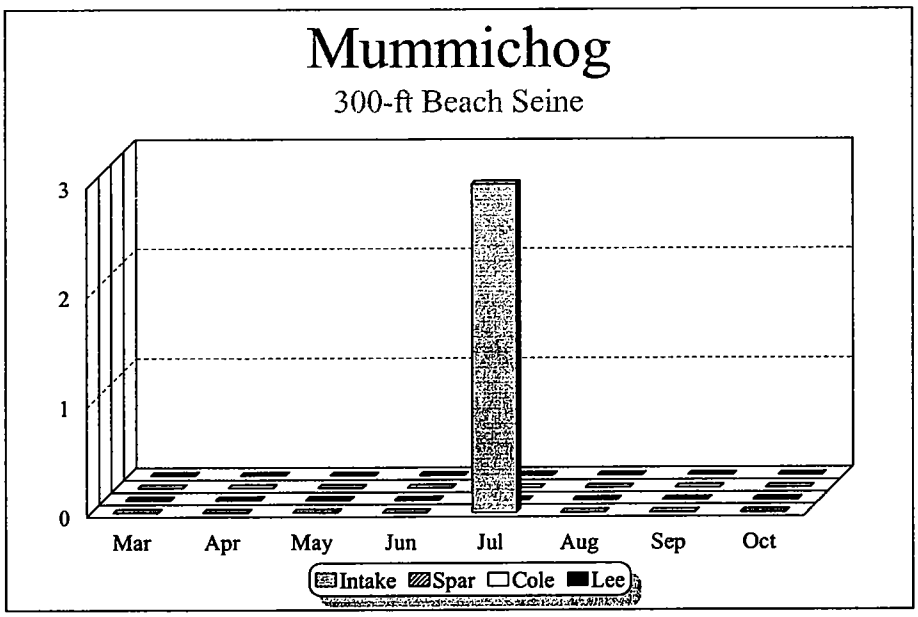
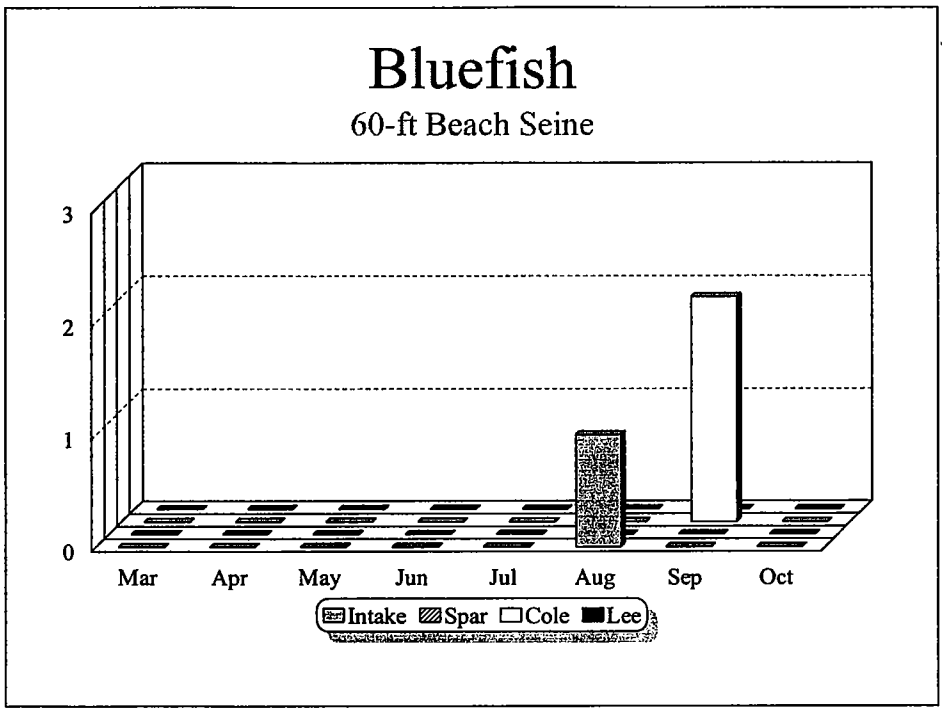


Figure 7-3d. Number of mummichog collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



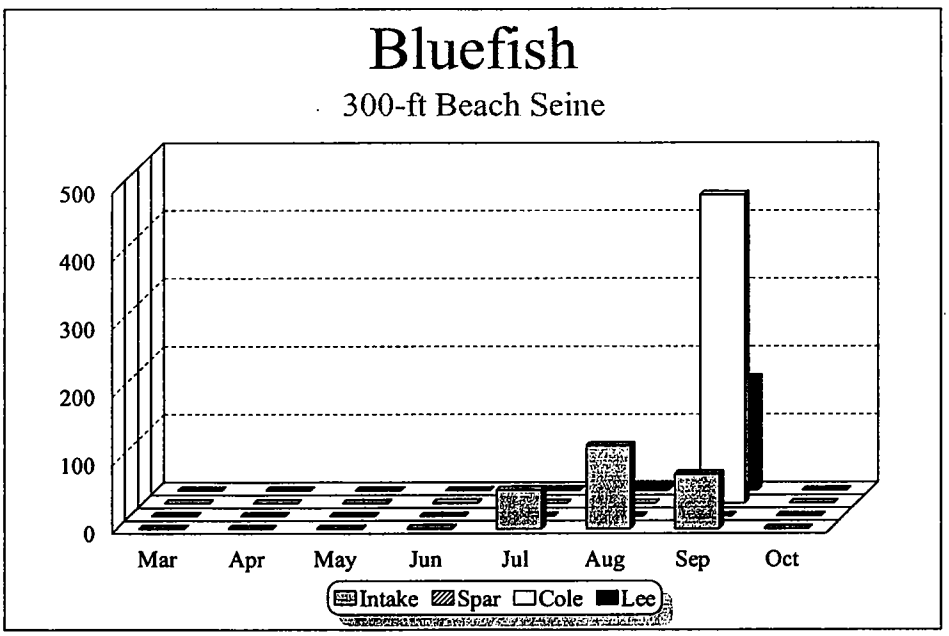
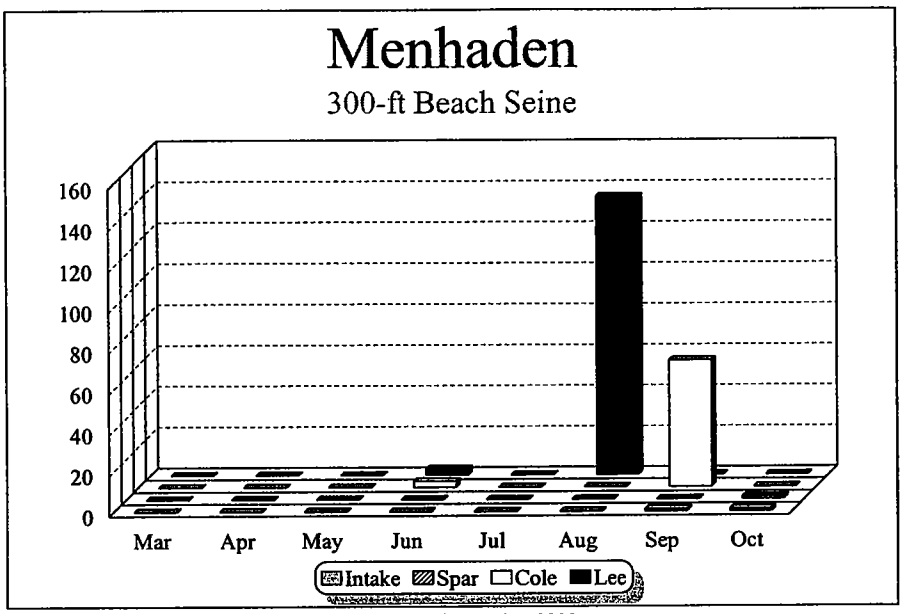
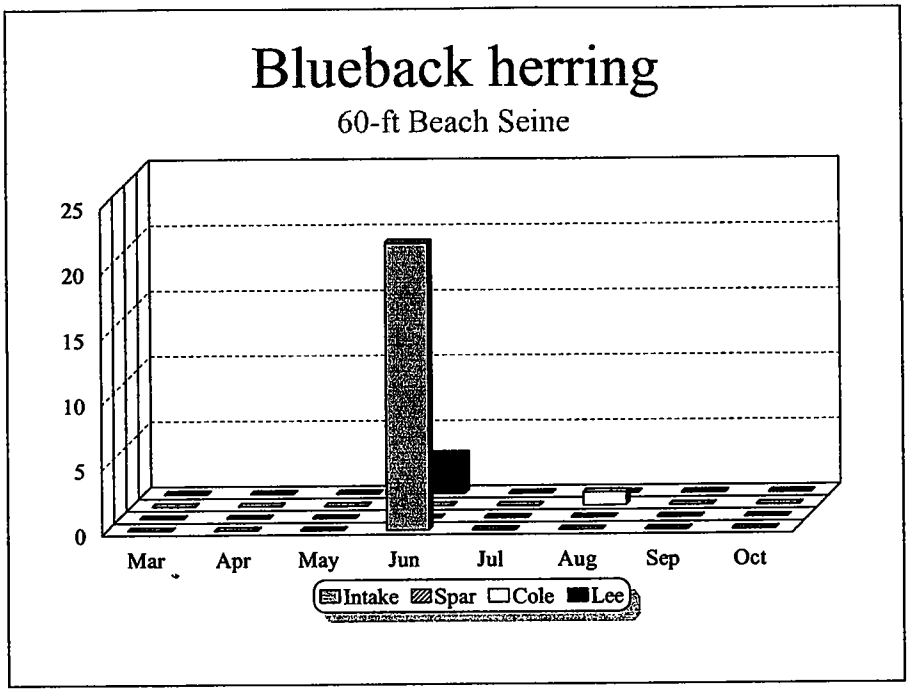


Figure 7-3e. Number of bluefish collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



Note: No menhaden were captured in the 60-ft seine during 2002.

Figure 7-3f. Atlantic menhaden collected in each monthly haul of 300-ft beach seine at four fixed stations in Mount Hope Bay, March–October 2002



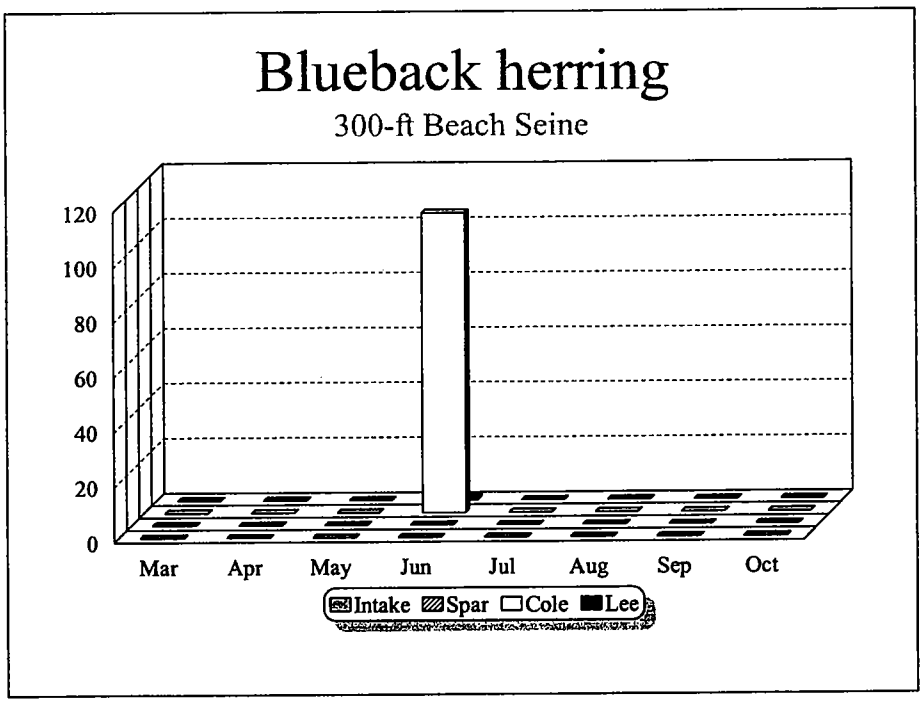
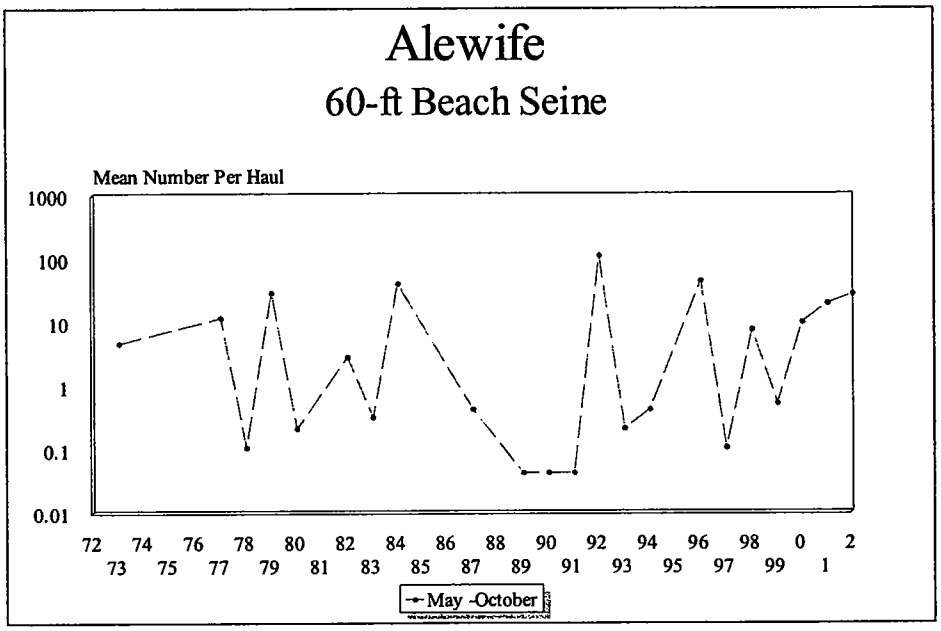


Figure 7-3g. Number of blueback herring collected in each monthly haul of 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, March–October 2002



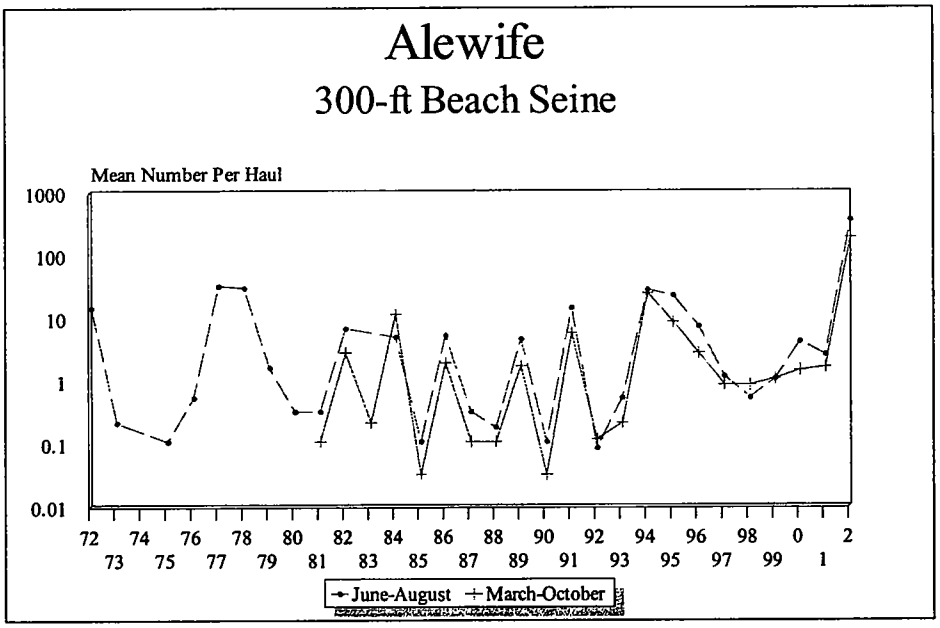
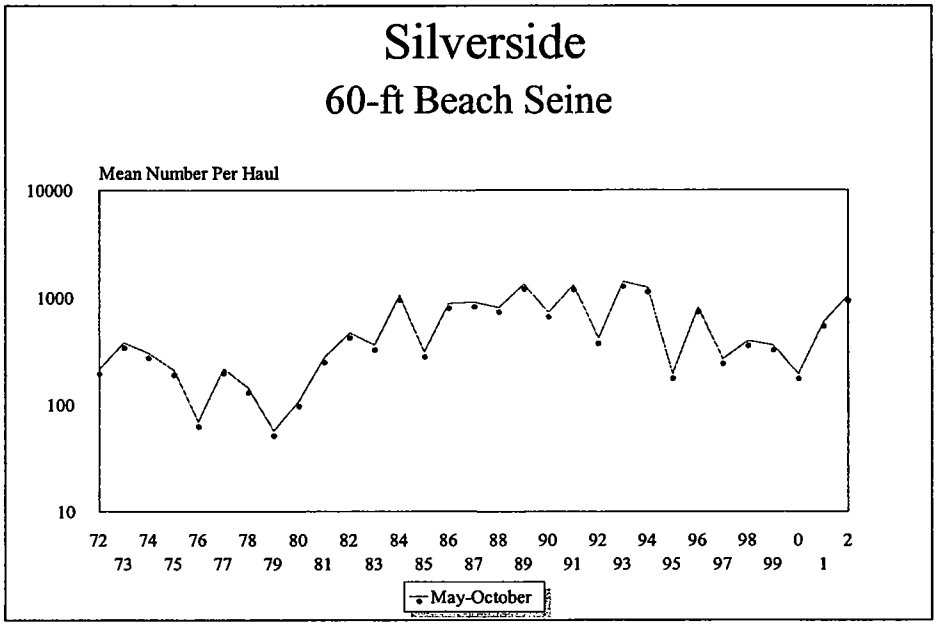


Figure 7-4a. Alewife annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



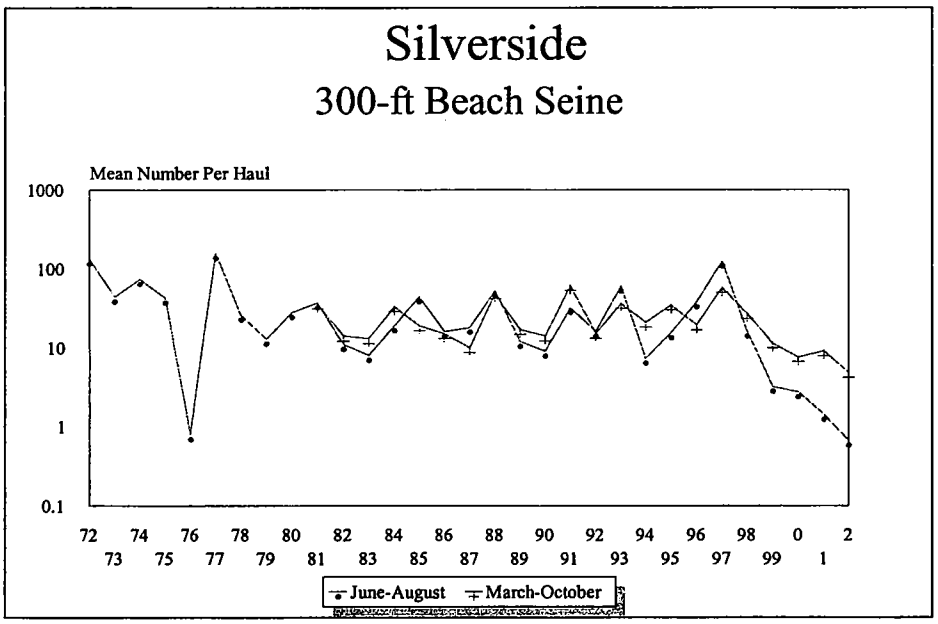
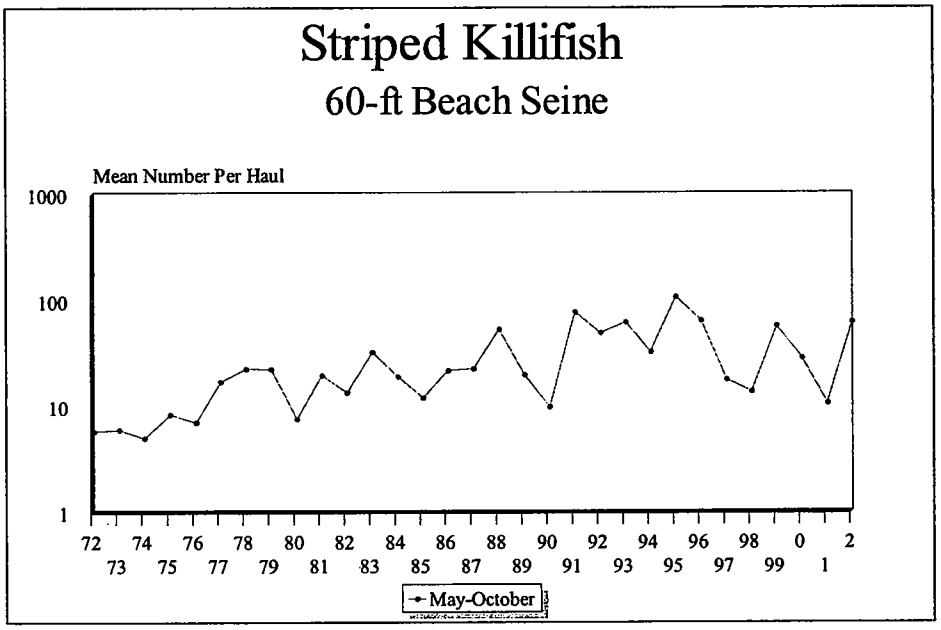


Figure 7-4b. Silverside annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



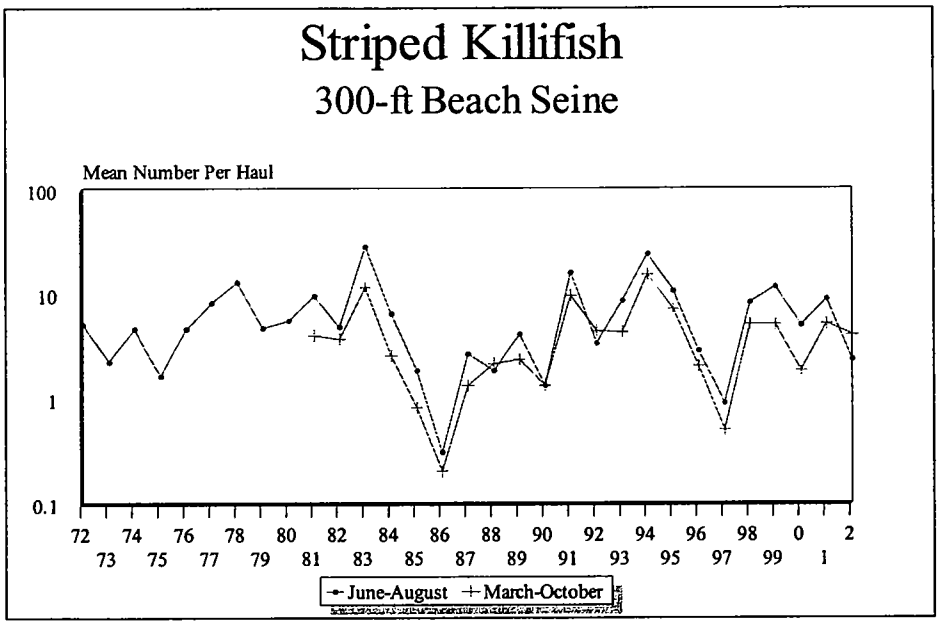
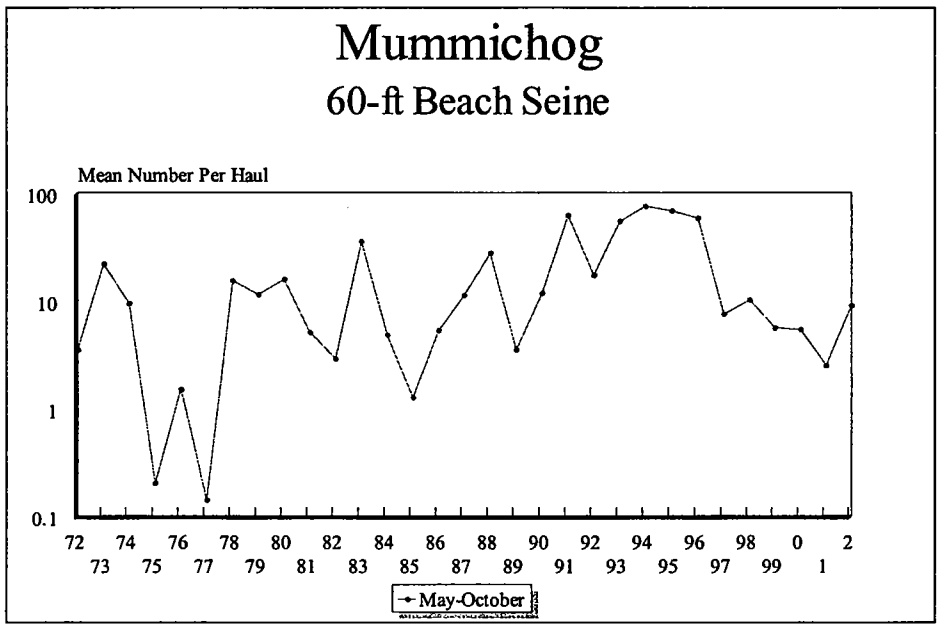


Figure 7-4c. killifish annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



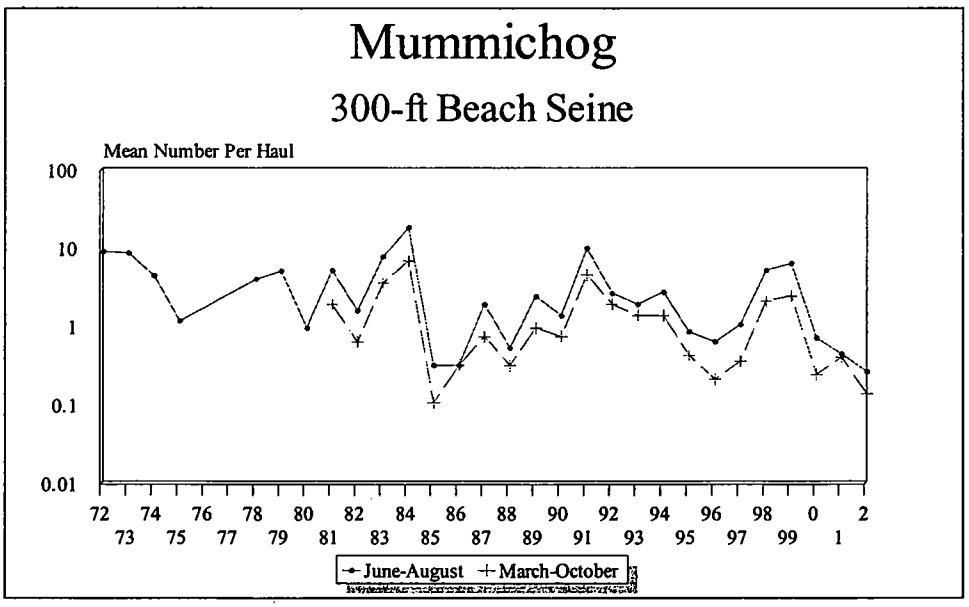
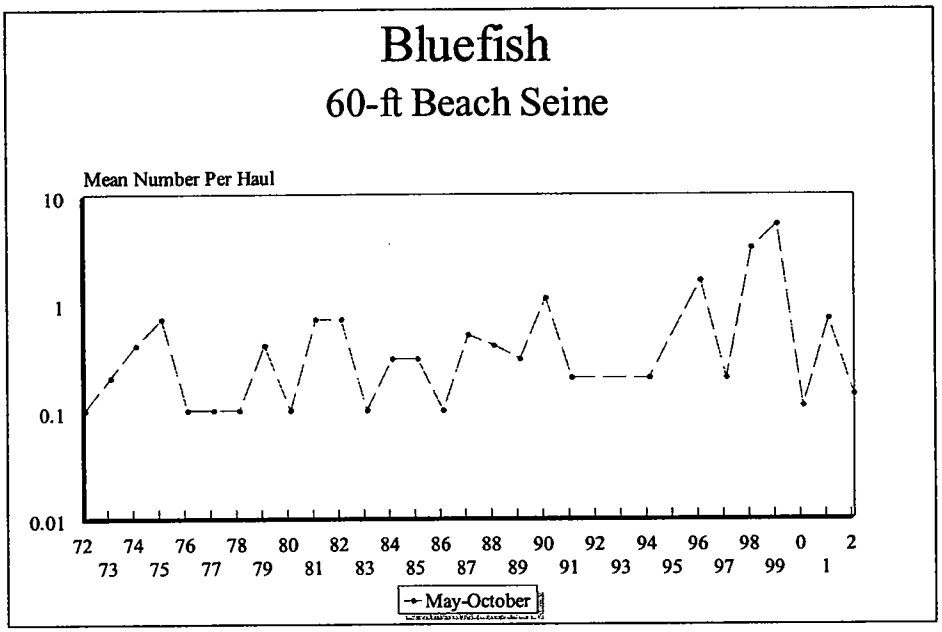


Figure 7-4d. Mummichog annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



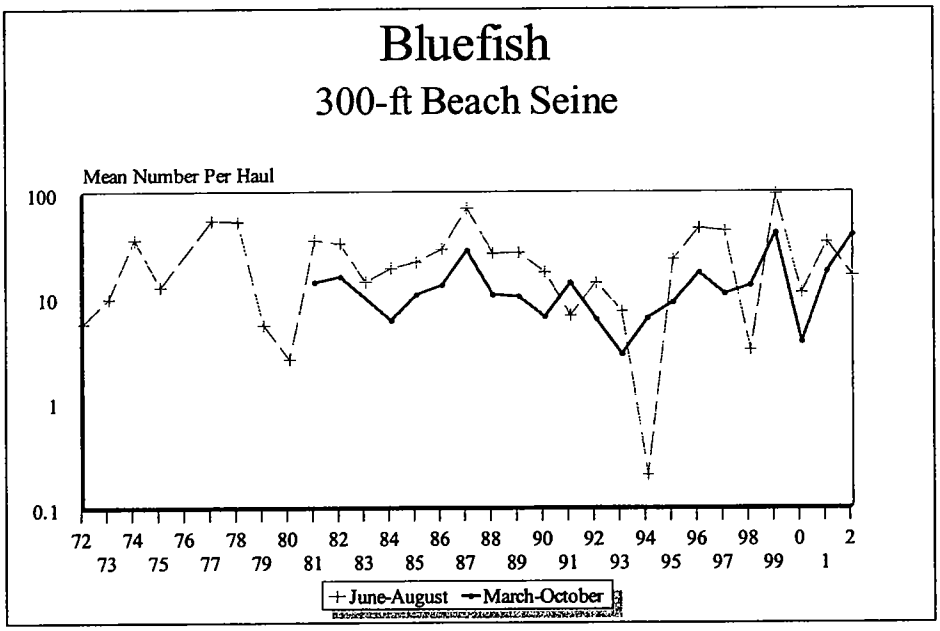
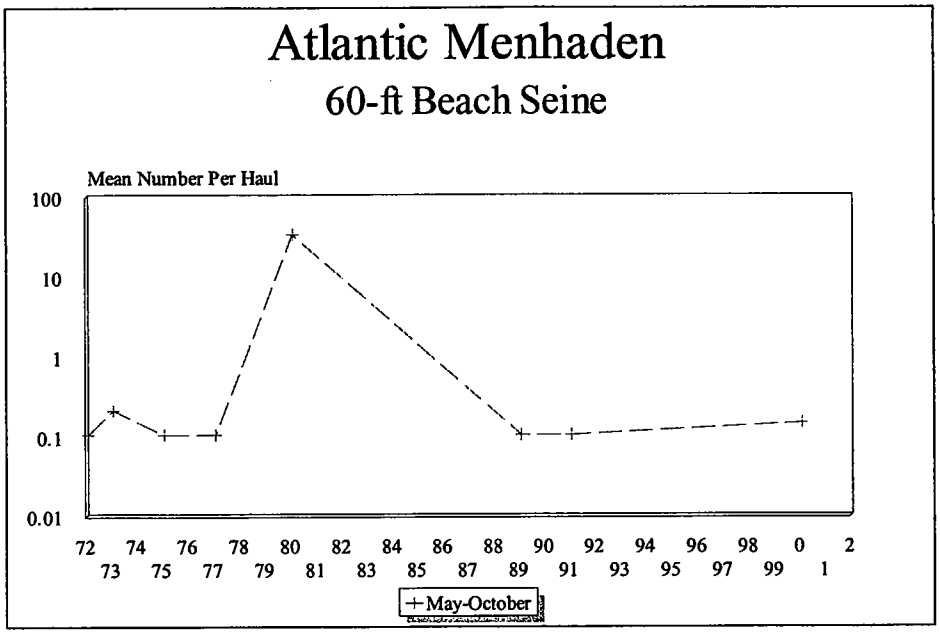


Figure 7-4e. Bluefish annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



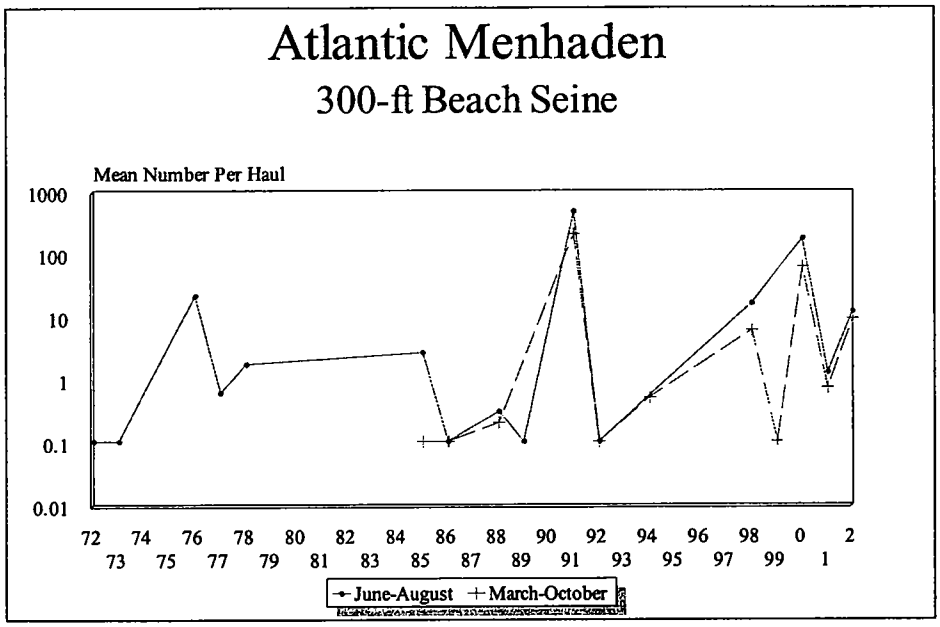
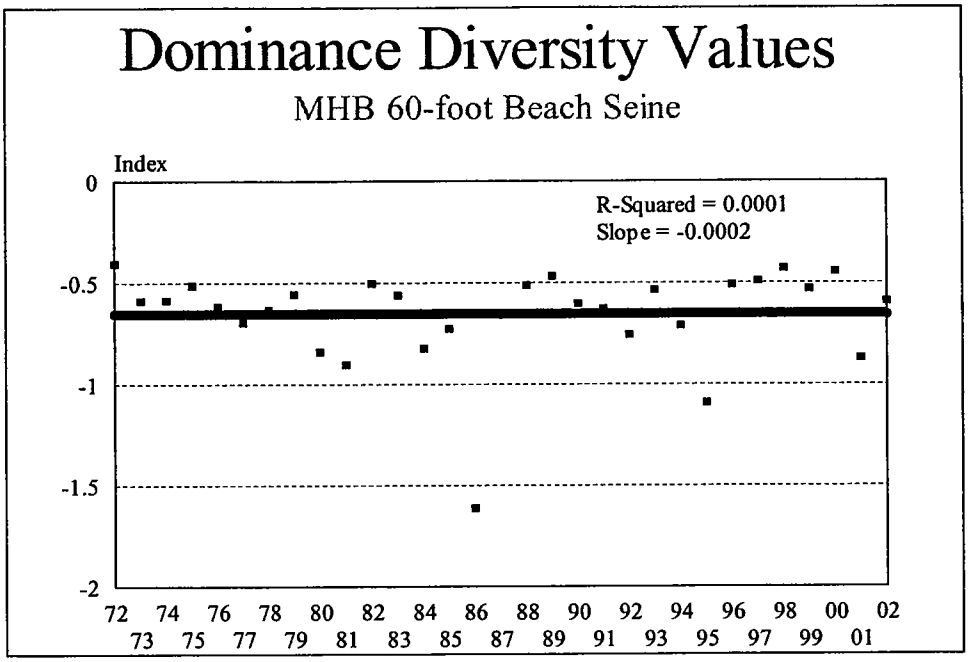


Figure 7-4f. Atlantic menhaden annual mean numbers per haul collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002



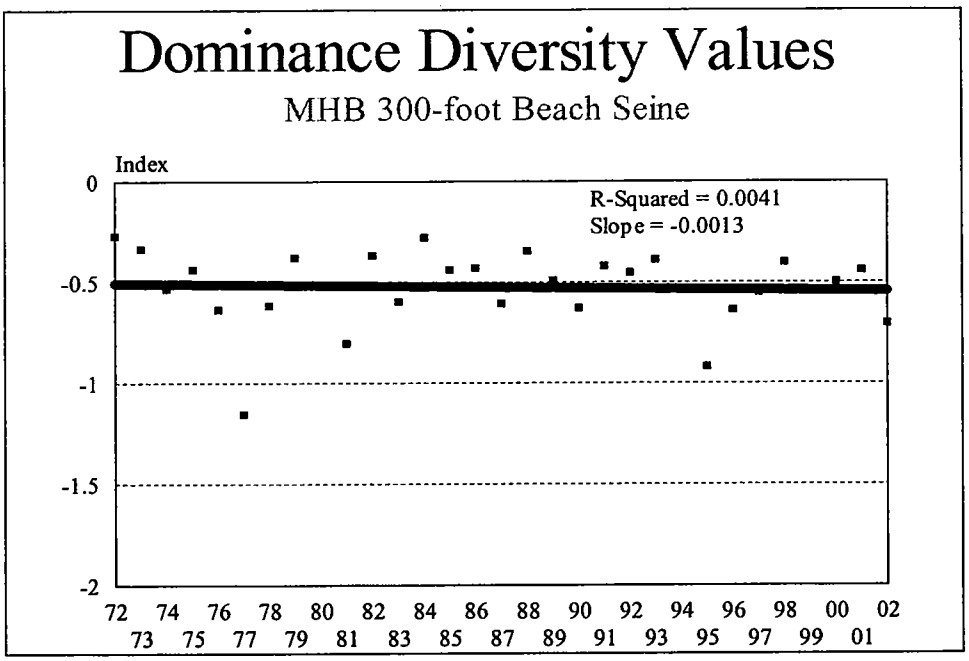


Figure 7-5. Annual dominance diversity values for finfish collected by 60- and 300-ft beach seines at four fixed stations in Mount Hope Bay, 1972–2002

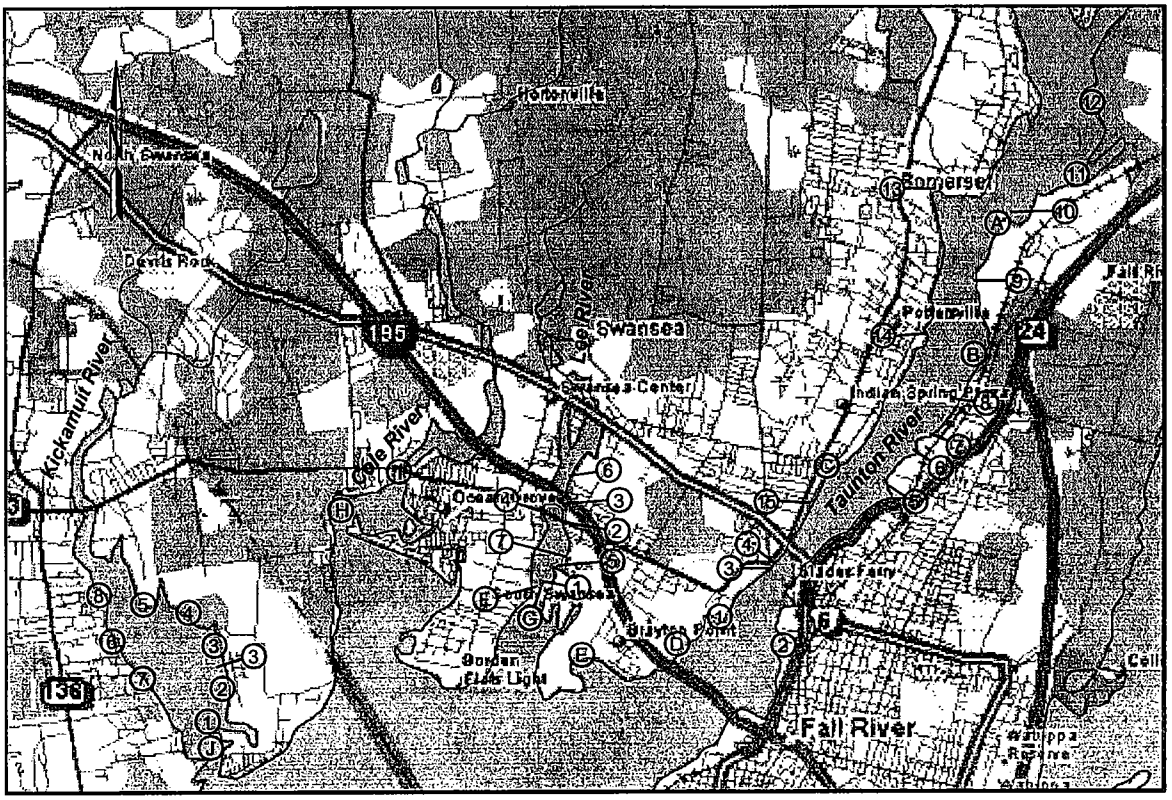
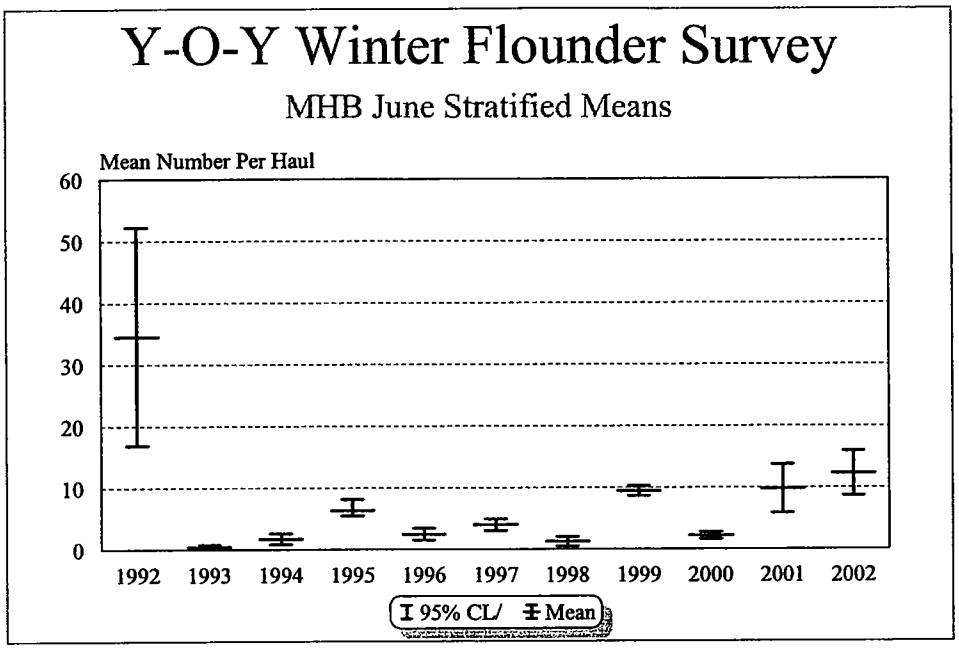


Figure 7-6. Mount Hope Bay YOY winter flounder beach seine stations



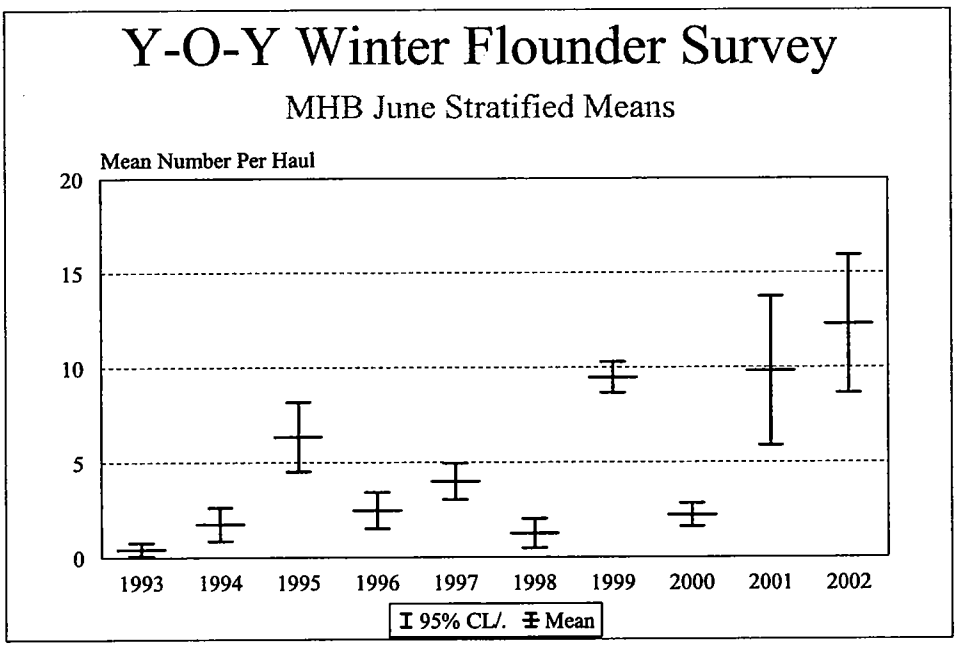


Figure 7-7 Stratified mean number of young-of-the-year winter flounder per seine haul during June 1992-2002 (top) and June 1993-2002

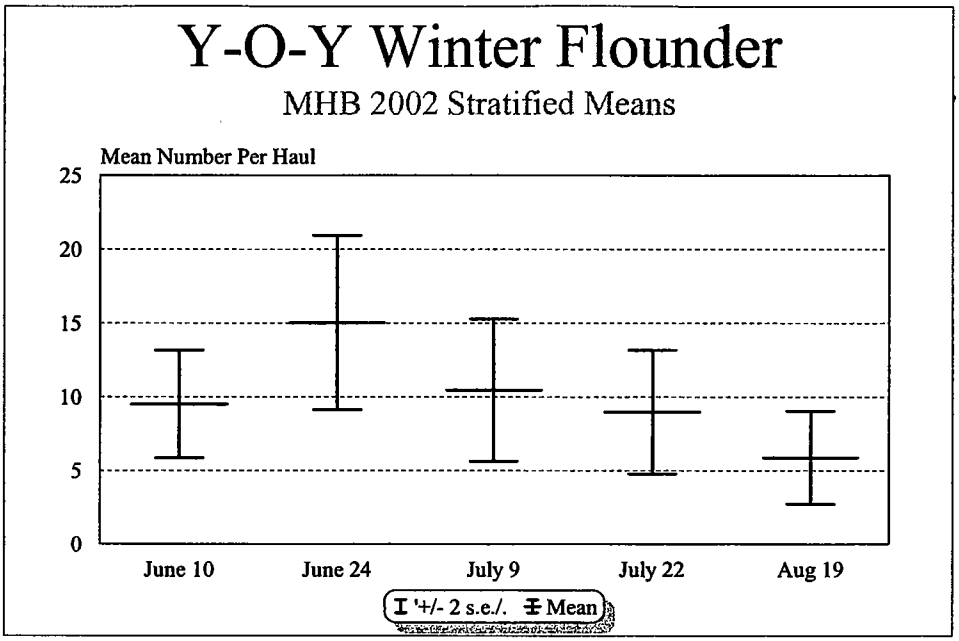


Figure 7-8. Stratified mean number of young-of-the-year winter flounder by sampling date, 2002

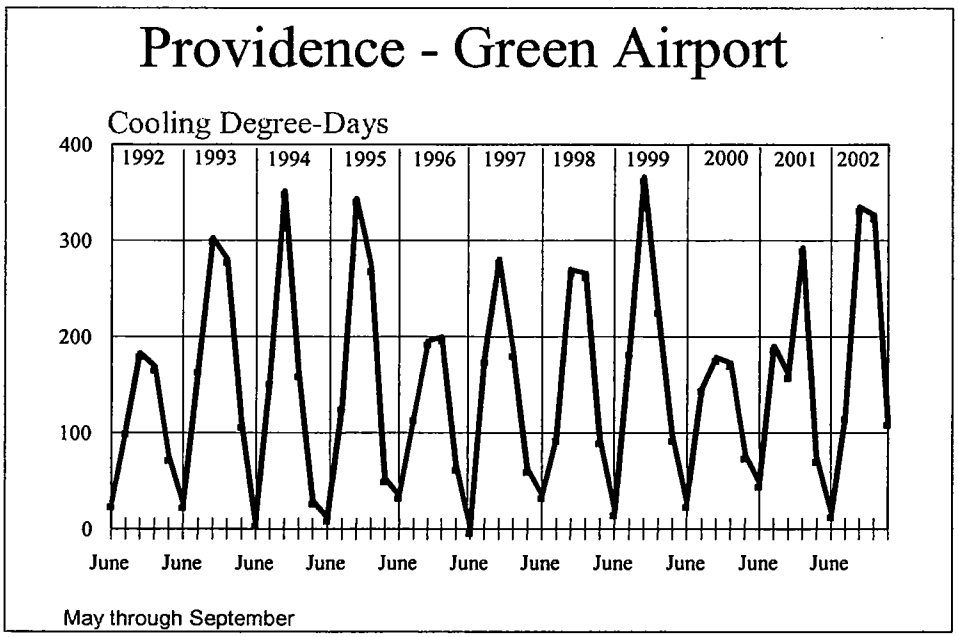


Figure 7-9. Cooling degree days recorded at T.F. Green Airport, 1992-2002

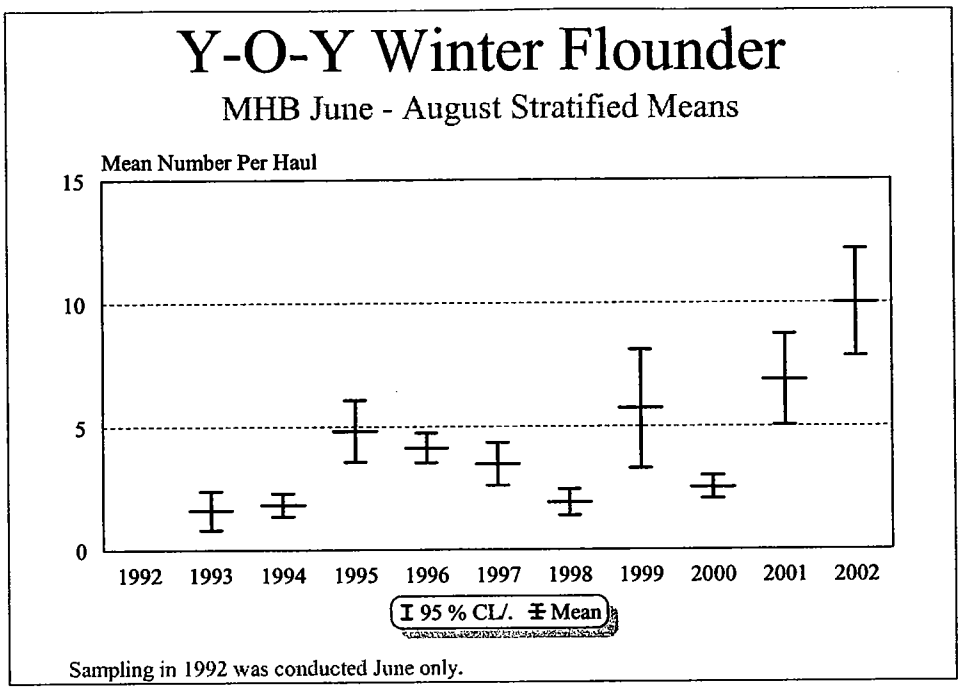


Figure 7-10. Stratified mean number of young-of-the-year winter flounder per seine haul June-August 1992-2002

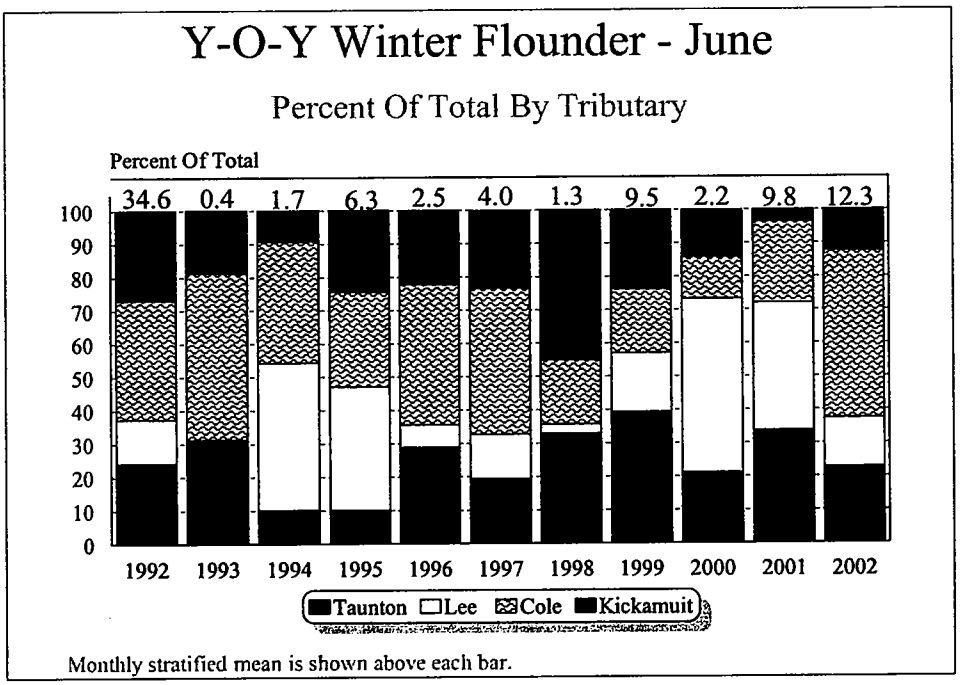


Figure 7-11. Percent of young-of-the-year catch by tributary during June 1992-2002

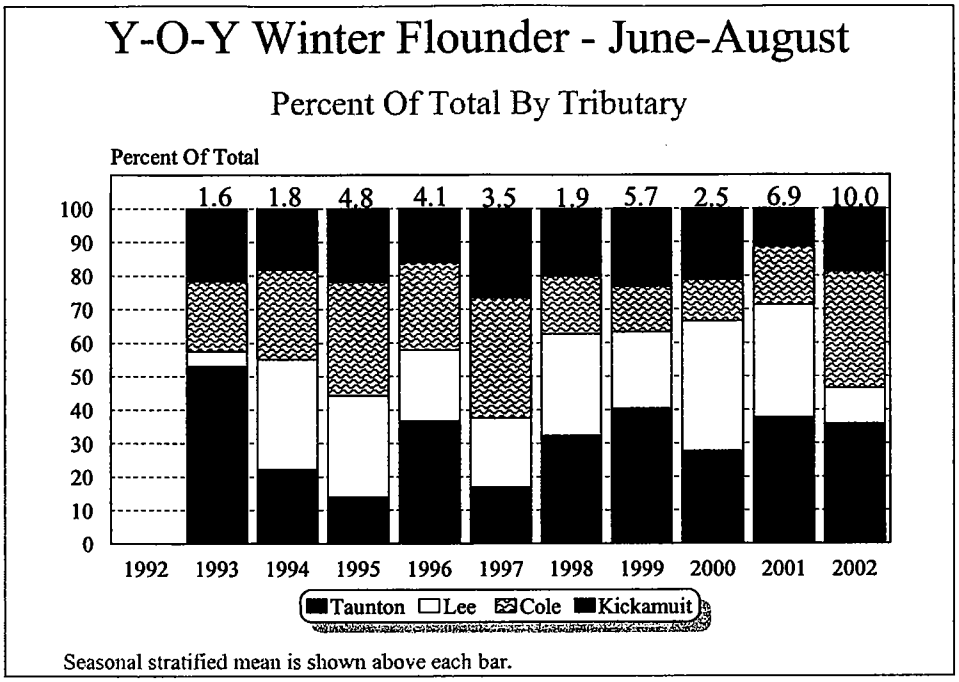


Figure 7-12. Percent of young-of-the-year catch by tributary during June-August, 1993-2002

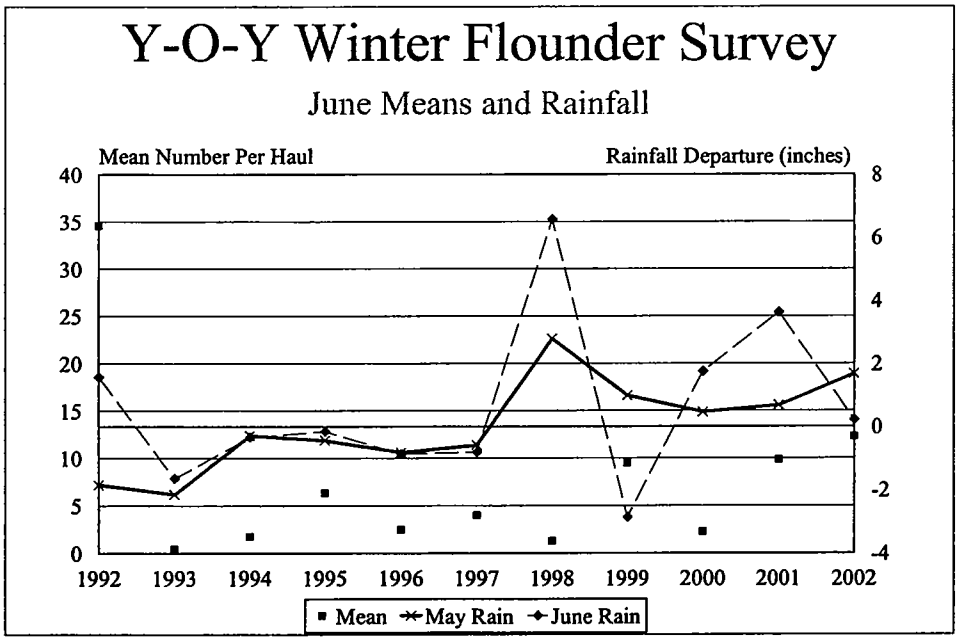


Figure 7-13. Mean number of young-of-the-year winter flounder compared with June rainfall, 1992-2002

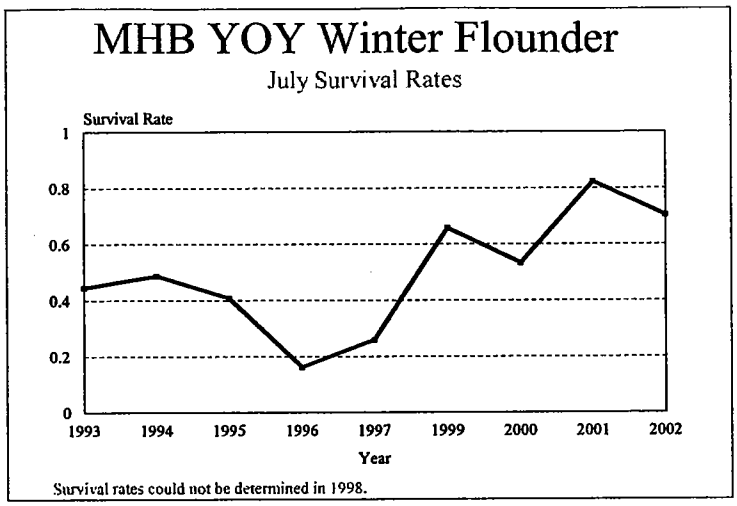


Figure 7-14. Survival rates calculated over 30 days in July, young-of-the-year winter flounder, 1993-2002

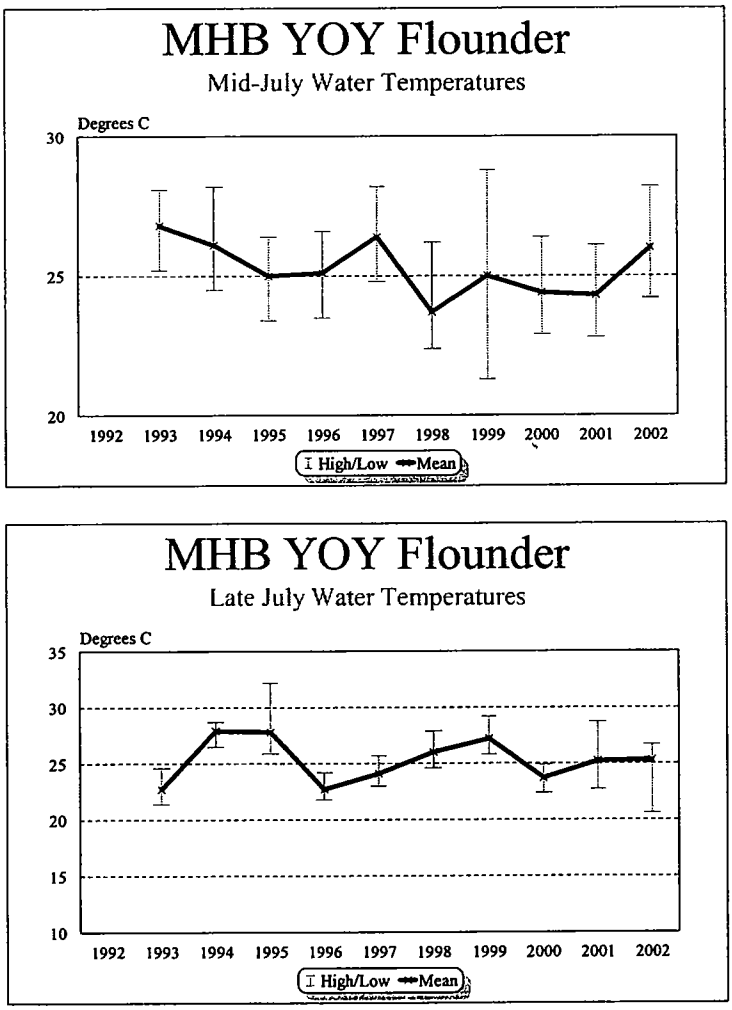
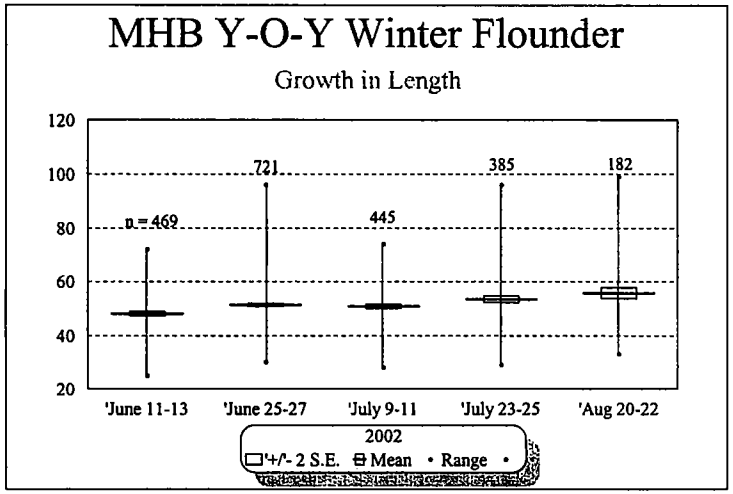
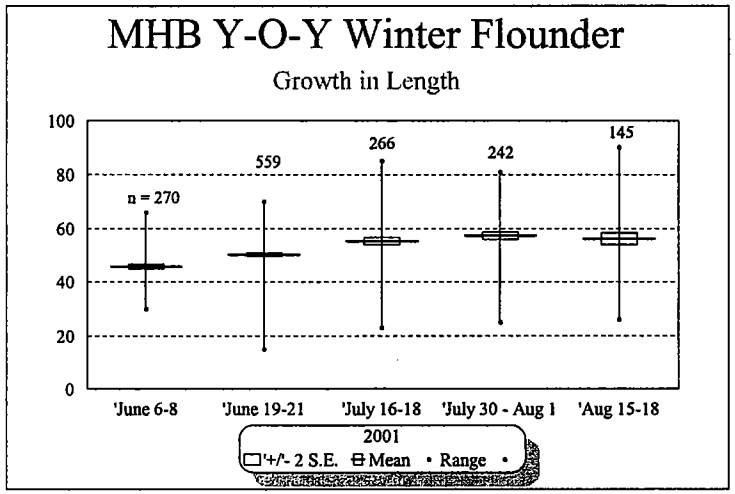
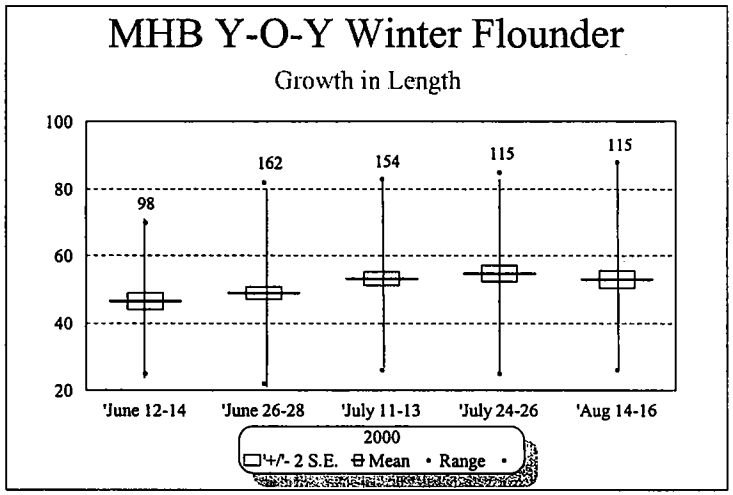


Figure 7-15. Near-shore water temperatures recorded at young-of-the-year sampling sites in mid-July (upper) and late July (lower), Mount Hope Bay, 1992-2002







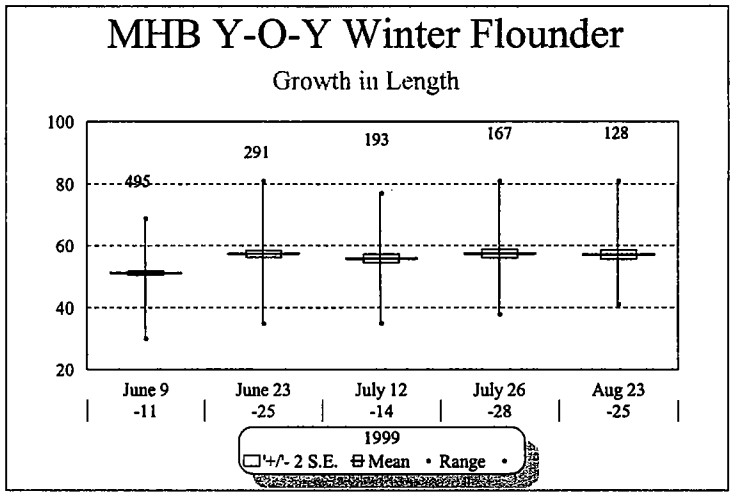


Figure 7-16. Total length data for age 0 winter flounder by sampling sites, 1992–2002 (page 1 of 3)

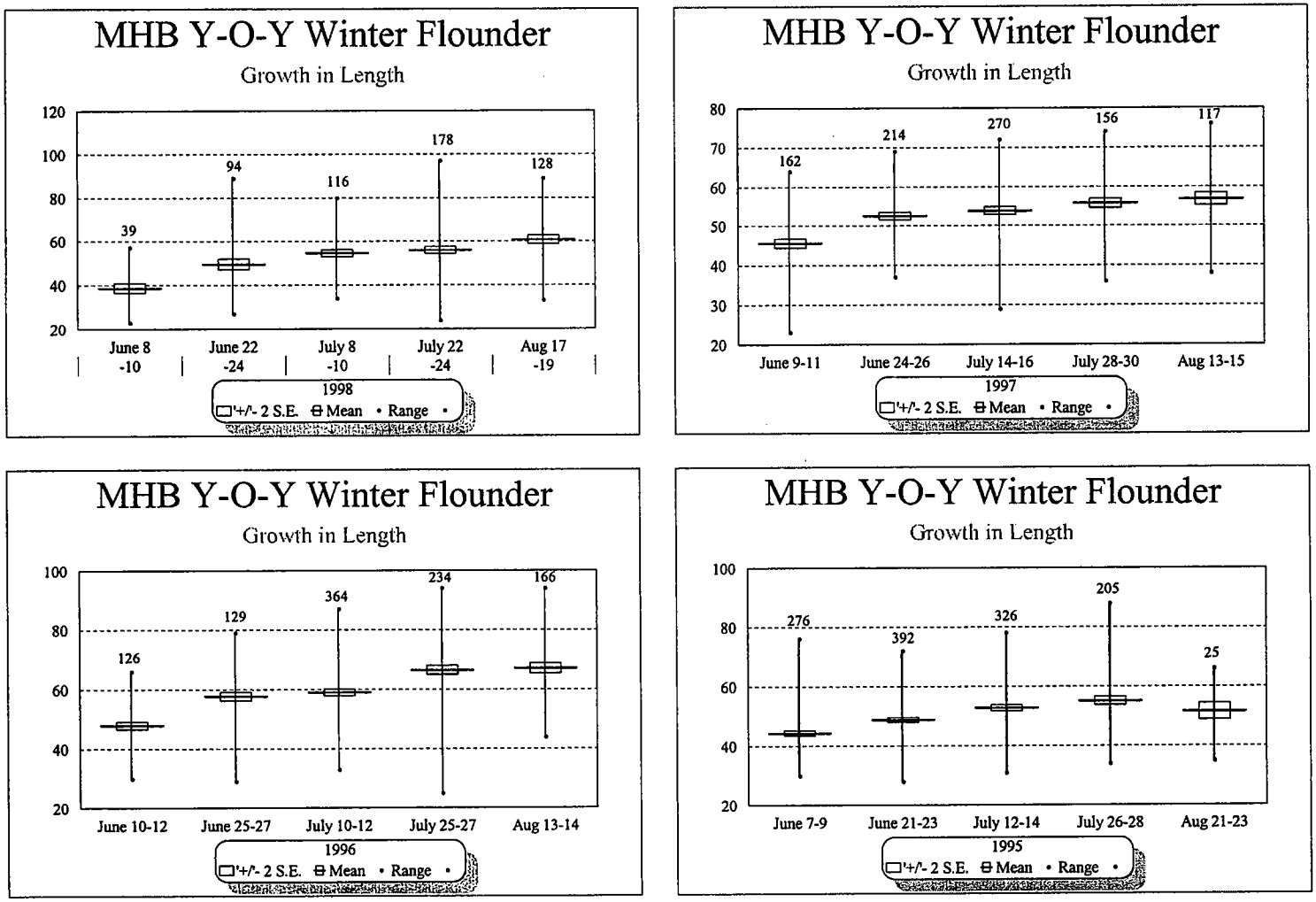
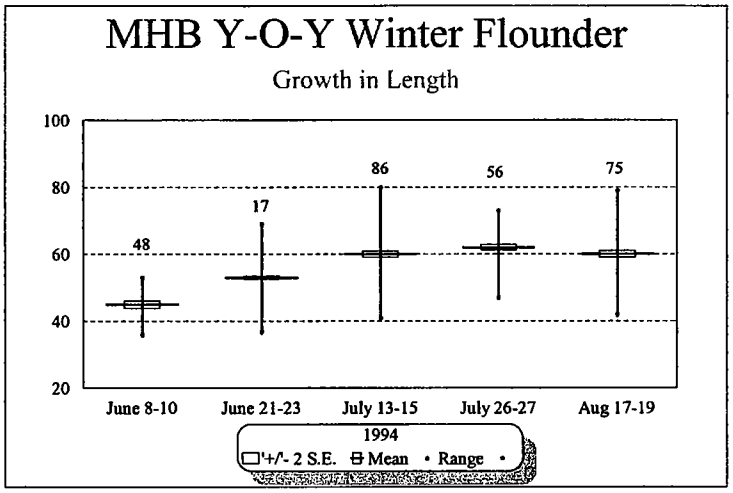
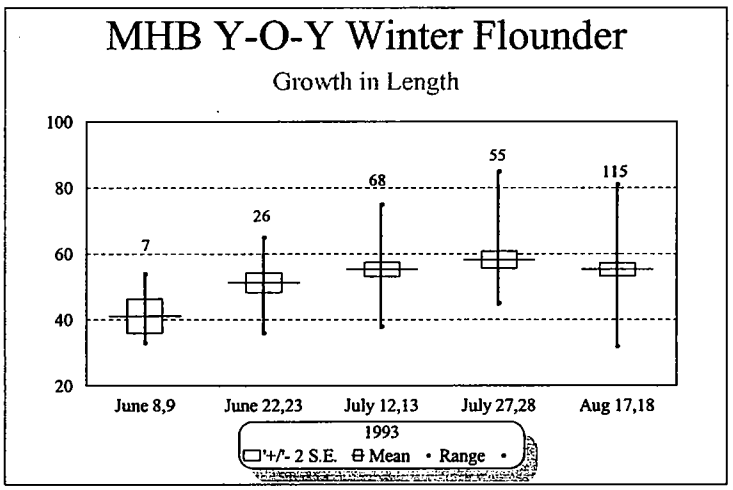


Figure 7-16. Total length data for age 0 winter flounder by sampling sites, 1992–2002 (page 2 of 3)





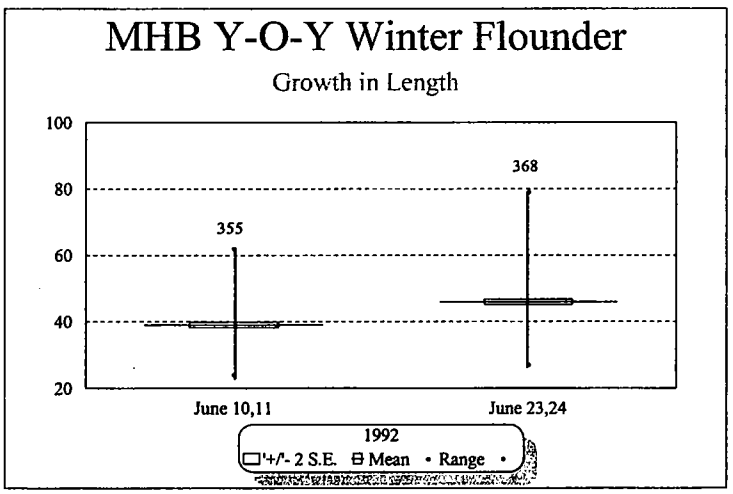


Figure 7-16. Total length data for age 0 winter flounder by sampling sites, 1992–2002 (page 3 of 3)

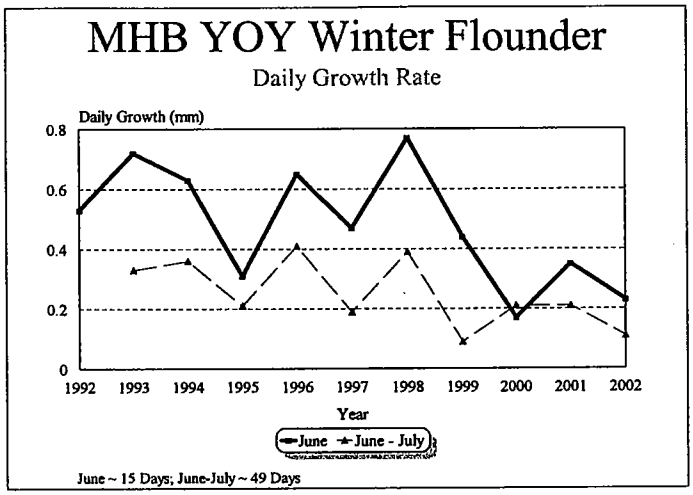


Figure 7-17. Linearized daily growth rates for young-of-the-year winter flounder, June 1992-2002, June-July 1993-2002

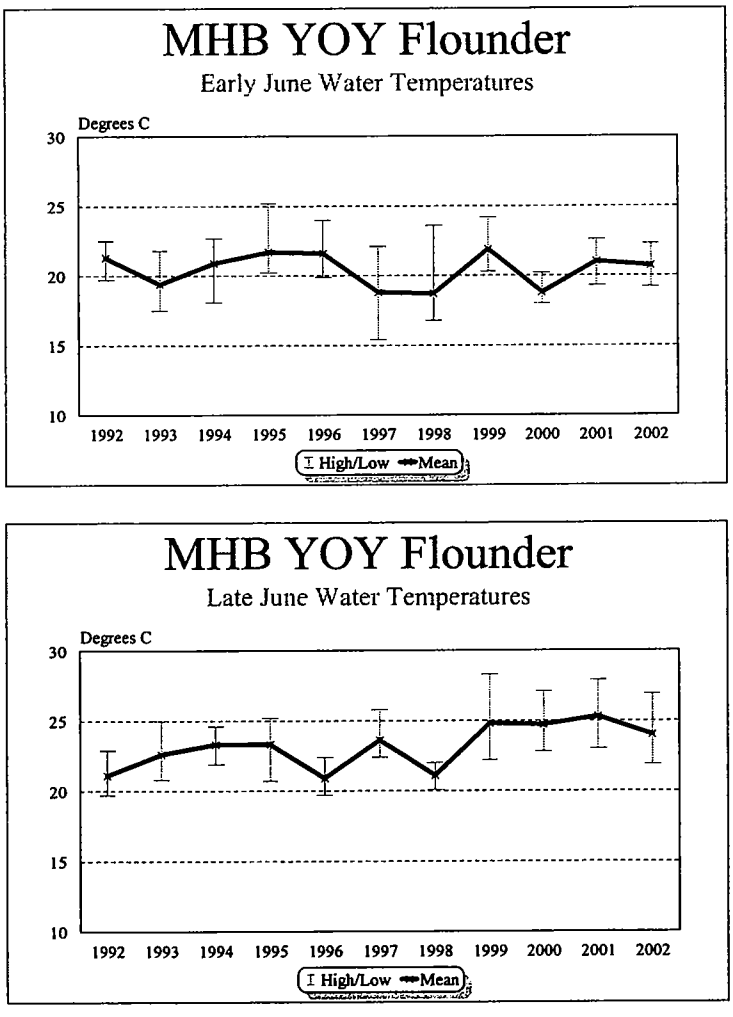


Figure 7-18. Near-shore water temperatures recorded at young-of-the-year sampling sites in early June (upper) and late June (lower), Mount Hope Bay, 1992-2002

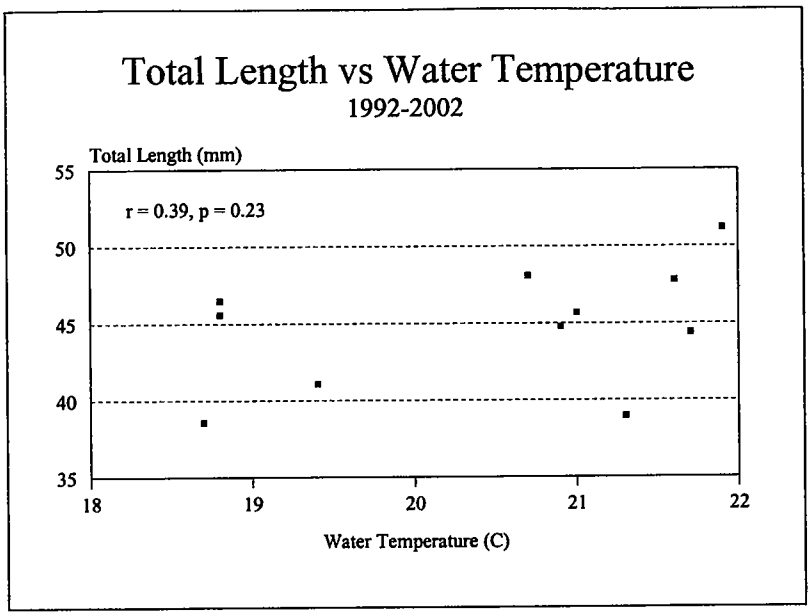


Figure 7-19. Initial size of winter flounder in relation to early June temperature in Mount Hope Bay estuaries

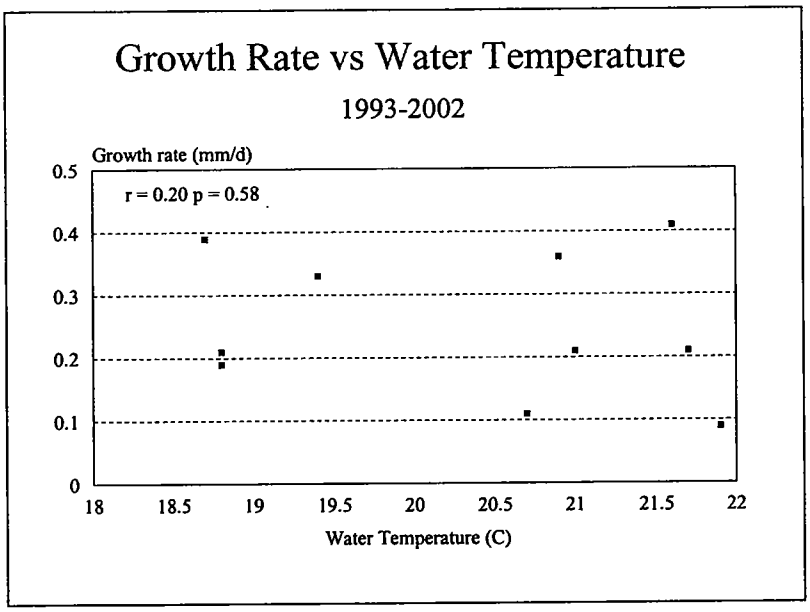


Figure 7-20. Seasonal growth rate of young-of-the-year winter flounder in relation to the early June water temperature recorded in the estuaries of Mount Hope Bay

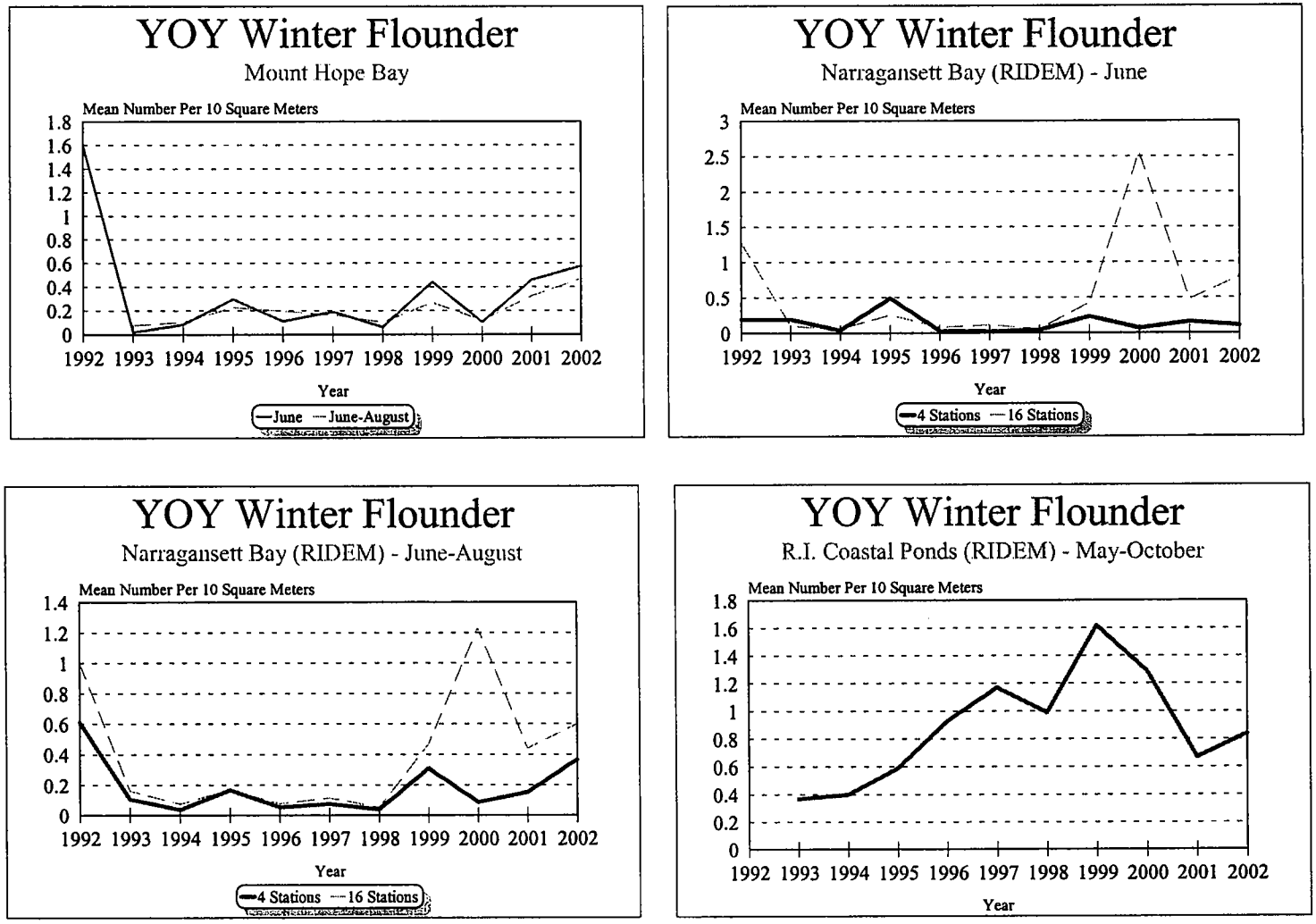


Figure 7-21. Mean number of young-of-the-year winter flounder collected in Mount Hope Bay, Narragansett Bay, Massachusetts, Connecticut, and New York Surveys, 1992-2002 (page 1 of 2)

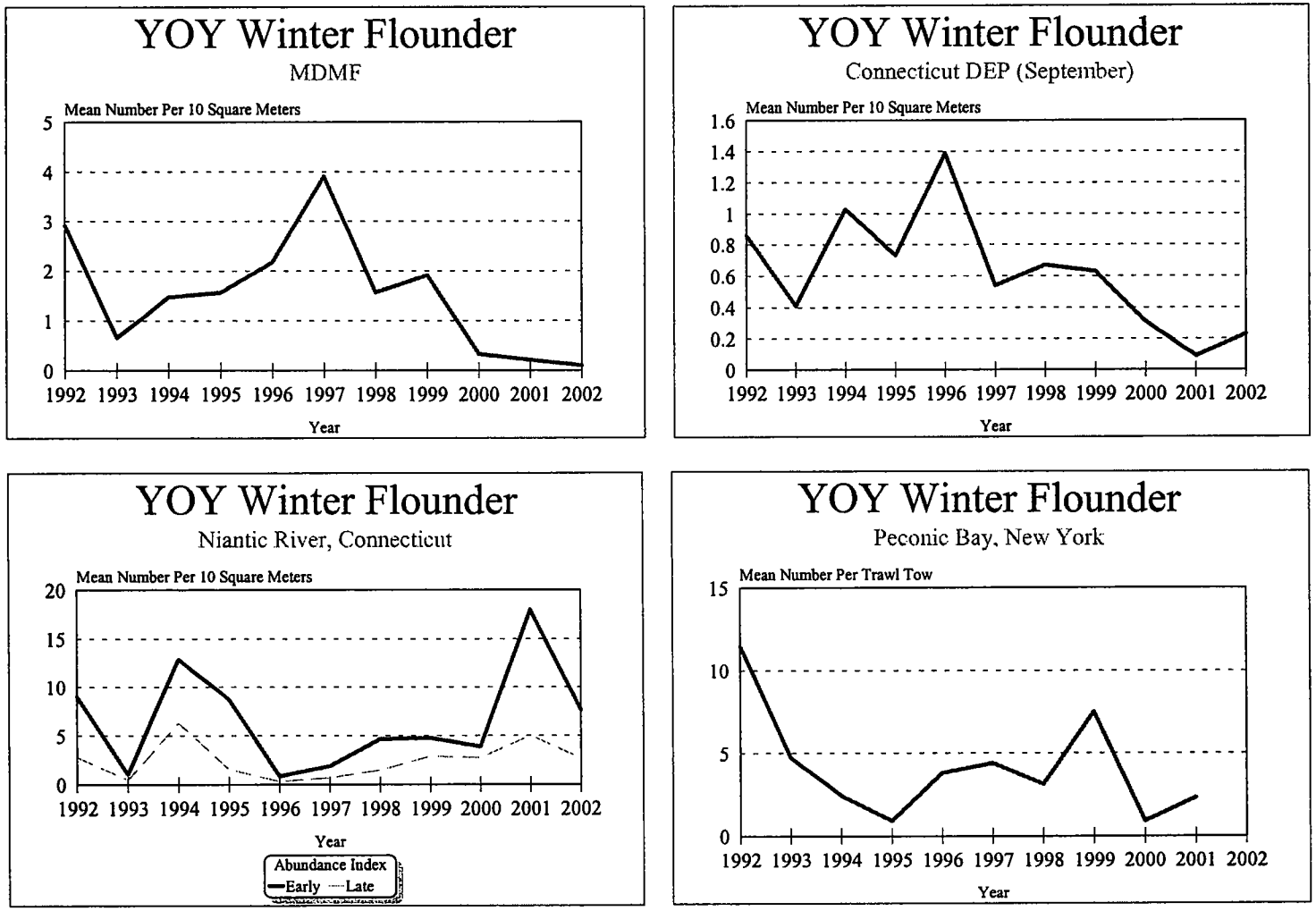


Figure 7-21. Mean number of young-of-the-year winter flounder collected in Mount Hope Bay, Narragansett Bay, Massachusetts, Connecticut, and New York Surveys, 1992-2002 (page 2 of 2)

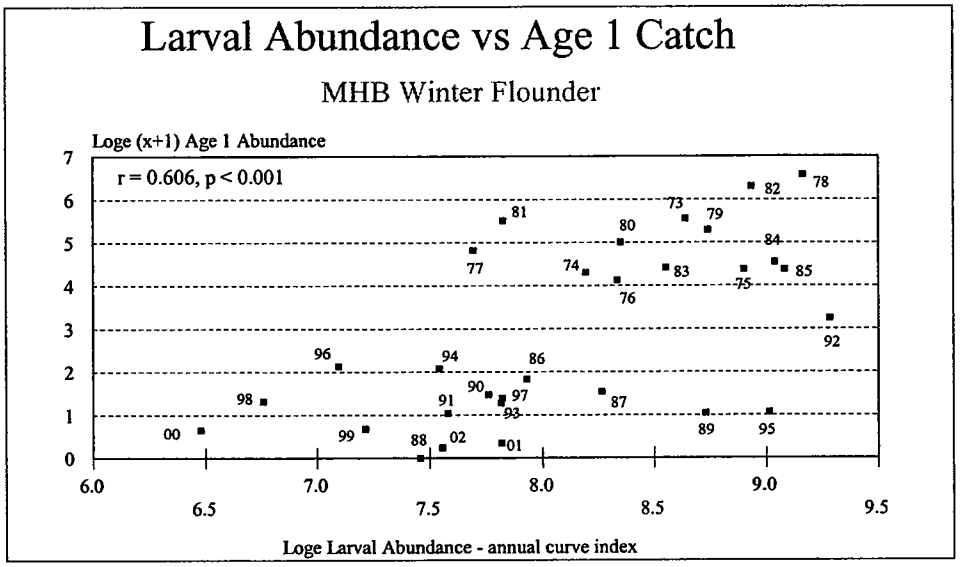


Figure 7-22. Comparison between geometric mean larval winter flounder abundance based on the annual curve-area index and mean number of age 1 winter flounder taken by the trawl, both $\log_e$ transformed

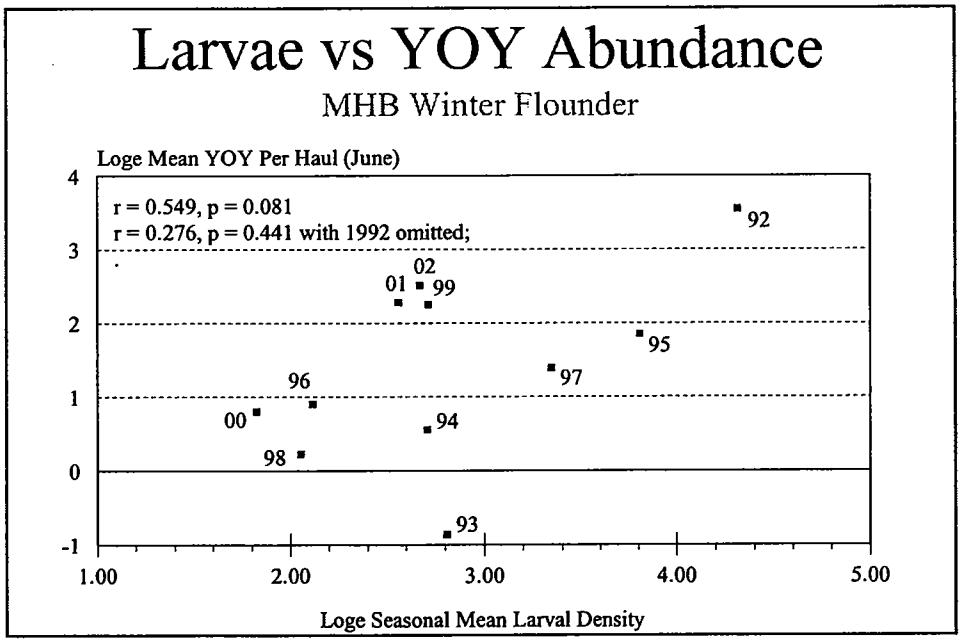


Figure 7-23. Comparison between seasonal geometric mean larval winter flounder abundance and young-of-the-year abundance per seine haul in June; both $\log_e$ transformed

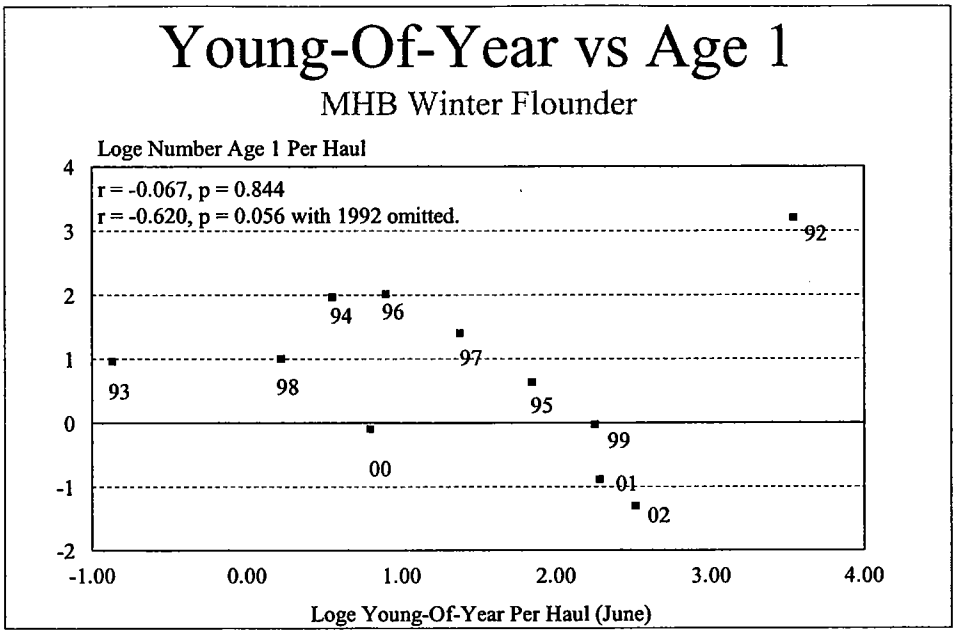


Figure 7-24. Comparison between mean number of young-of-the-year winter flounder per seine haul in June and mean number of age 1 winter flounder taken by the trawl; both $\log_e$ transformed

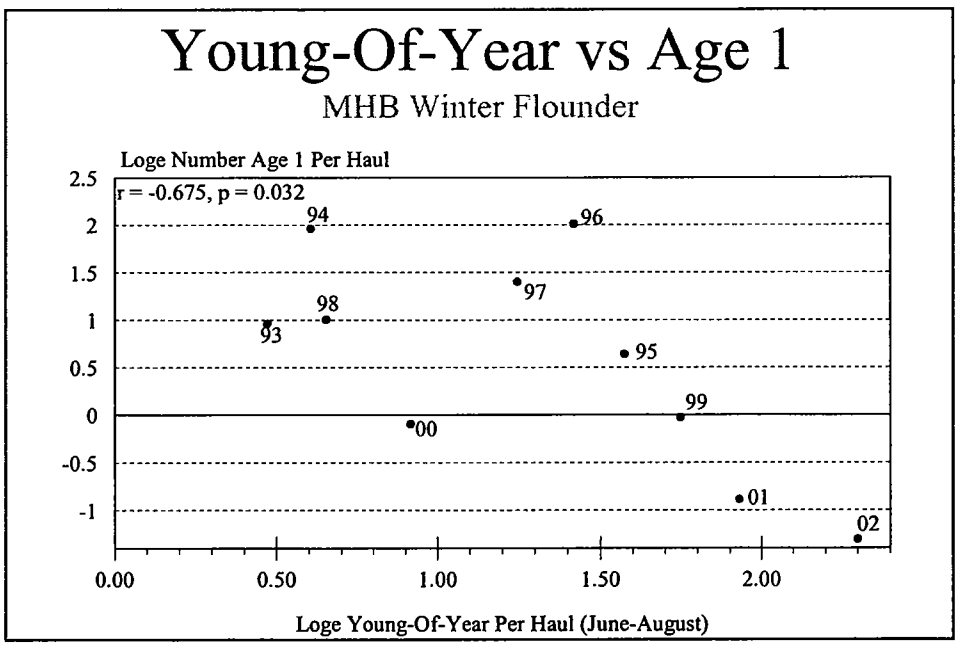


Figure 7-25. Comparison between mean number of young-of-the-year winter flounder per seine haul in June-August and mean number of age 1 winter flounder taken by the trawl; both $\log_e$ transformed