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Semi-Annual Performance Report

April 1, 2007 to September 30, 2007

Connecticut Lobster (*Homarus americanus*) Population Studies

JOB 1: Fishery Dependent Monitoring

Methods

Objective 1. Monitor the catch composition of the Long Island Sound (LIS) commercial trap fishery by measuring sex ratio, percentage of females that are ovigerous, incidence of shell disease, biofouling and damage, incidence of mortality, and cull rates of the legal and sublegal commercial catch.

Commercial lobster fishery sea-sampling intensity is scheduled to be proportional to the seasonal magnitude of average landings from 2001-2004, but is equally divided among the three basins of the Sound (east, central, west; Figure 1), for a total of 24 trips annually (Table 1). Data recorded include: carapace length (CL) measured in 1.0 millimeter increments. For animals 81.9 mm or less, length is recorded as the millimeter increment in which it is measured (e.g. 81.9 mm is recorded as 81mm). For animals greater than or equal to 82.0 mm length, length is recorded to the nearest 0.1 mm. Additional data recorded include sex; shell hardness; relative fullness of egg mass (<1/4 complement, 1/4, 1/2, 3/4, full); developmental stage of eggs (green, brown, tan); damage observations to determine cull rates and incidence of damage to claws, carapace, abdomen (tail) and walking legs; incidence of shell fouling organisms and incidence and extent of shell disease (0, 1-10%, 11-50%, >50% of shell surface covered). Care is taken to identify wounds caused by mechanical action so they are not identified incorrectly as shell disease. The incidence of dead lobsters is also recorded. The location of individual trap trawls is recorded using a handheld GPS.

Modifications:

None

Objective 2. Determine catch, landings, and characterization of Connecticut's portion of the LIS commercial trap fishery.

Data recorded in the CT DEP Marine Fisheries Information System are analyzed to obtain monthly lobster trap catch (harvest) in pounds, number of trap hauls and catch/trap haul within LIS. The 2006 estimates are compared with monthly averages for a period of high abundance (1995-1999) and for a period of reduced abundance, following the die-off of lobsters in Long Island Sound in 1999 (2000-2005). Commercial catch from Connecticut waters of Long Island Sound and total landings recorded for Connecticut ports are also given for 2006. Totals include all license types including landing permits.

Trends in fishing effort are examined using three annual measures. The number of licenses issued and total trap-hauls are tallied for resident and non-resident commercial license holders from 1979 through 2006. Total traps fished were computed for the years 1979 through 2006.

Modifications:

None

Results and Discussion

From January through December 2006, 20 sea-sampling trips were made and 11,532 lobsters were measured (Table 1). No trips were made in the central or eastern basins from January through late June 2006 due to a lack of cooperation with commercial license holders attributed to regulatory measures enacted in August 2005. Cooperation among industry members resumed in July 2006 though low catches and early haul out hampered attempts to complete scheduled trips in September and October in these basins. Eighteen of 20 scheduled trips for January through October 2007 have been completed to date (Table 1). The commercial catch from Connecticut waters of Long Island Sound reported in CT DEP logbooks and federal fishing vessel trip reports totaled 695,456 pounds in 2006. This total includes all resident and non-resident license holders who caught lobsters within state waters (logbook areas 1-3) by any licensed gear type, but did not necessarily land their catch in Connecticut. This is slightly higher than catches from 2003 to 2005 catches (average 643,707 lbs) though catches for 2003-2006 are 33-40% lower than 2002 (1,043,404 lbs) and more than 46% lower than 2001 (1,304,663 lbs). Data from 2007 commercial catch reports continues to be collected. Trends in catch and landings from the 2007 lobster fishery will be presented in the next project report.

Total reported landings at Connecticut ports in 2006 (from all commercial gears) were 792,894 lbs with a landed value of $4.03 million (Figure 4). This was the second year annual landings increased since the decline from the historical high of 3.72 million pounds in 1998 and the die-off of 1999 in the western Long Island Sound. The 2006 value is 15-18% higher than total landings reported in 2003 and 2004 (671,119 and 646,994 lbs respectively) but remains 26%-43% lower than landings reported from 2000-2002. The increase in 2006 is largely attributed to a rise in landings from the eastern basin to 414,119 lbs, which is 11% higher than landings reported in 2005 and 27% higher than landings reported in 2004 from that area (Figure 5). A slight increase (total of 120,614 lbs) was also seen in landings from the central basin in 2006. This is up 3.5% from 2005 landings in the central basin (116,515 lbs, the lowest in the 23-year time series) but remains 2-72% lower than landings reported from 2000-2003 from the central basin. Landings from the western basin in 2006 increased for the first time since the sharp decline first seen in 2000. Landings in the western basin in 2006 (258,161 lbs) were 11% higher than those seen in 2005 (228,945) but remain 5 – 30% lower than landings reported from 2000-2003 in the western basin.

Monthly landings (harvest), effort (trap-hauls) and landings-per-unit-effort from Connecticut waters were analyzed (Figure 6A-C). Harvest rates for all months in 2006 were similar to those seen in 2004 and 2005 for both the summer (June through August) and fall (November and December) runs. During the peak of the fall run landings-per-unit effort rose from 0.64 in December of 2005 to 0.71 in December of 2006. On average, landings per trap haul were similar in 2005 and 2006 (0.47 and 0.46 respectively), though the number of trap hauls by CT license holders in 2006 rose 5% from 2005. Numbers of licenses issued in 2006 remained unchanged from 2005, though 3 more resident licenses and 3 fewer non-resident licenses were issued (Figure 7).

Length Frequency in the Commercial Catch

Most male and female lobsters caught in commercial traps in 2006 were just below the minimum legal length of 83.3 mm CL (Jan. 1, 2006 – June 30, 2006) and 84.1 mm (July 1, 2006 – present)

(Figure 8). The most notable change in the length frequencies observed in the commercial catch in 2006 was the increase in the percentage of lobsters observed between 81 and 84 mm CL. This is likely attributed to management measures that increased the minimum legal length of lobsters that could be harvested from Long Island Sound. The first measure occurred in August 2005 and increased the minimum size from 82.6 mm CL to 83.3 mm CL. The next increase occurred in July 2006 and raised the minimum legal size from 83.3mm to 84.1 mm. The shift in the length frequencies for animals above 81 mm CL was observed for females in all 3 basins of Long Island Sound, though was not as pronounced in the western basin.

The percentage of lobsters observed in the eastern basin in 2006 between the lengths of 85 – 95 mm CL (males) and 85 – 91 mm CL (females) was similar to that observed in 2005 (Figures 9 and 10). On average, the highest percentage of males in the East was 81 mm CL from 1999-2004. The highest percentage of males measured in 2005 was 87 mm CL in 2005 and decreased to 82 mm CL in 2006.

Most of the lobsters sampled in the commercial catch from the western basin in 2006 were below the minimum legal length (January 1 – June 30, 2006 = 83.3 mm CL; July 1, 2006 – present = 84.1 mm CL). Of 5,392 lobsters observed in the western basin in 2006, 24.0% were marketable (Figures 11 and 12). This is within the range of marketable lobsters for this area based on a five-year average from 1983-2004 (range = 21.8% – 30.3%). Due to limited sampling in the eastern basin of LIS in 2006, meaningful percentages could not be calculated.

Sex Ratio and Percent Egg-Bearing Females in the Commercial Catch

When all samples from all basins are included, females outnumbered males 2 to 1 (females = 64% of the total catch July-October) in 2006. This is an increase in the female to male ratio observed in 2005 (1.1 to 1) and 2004 (1.2 to 1). The range in the female to male ratio over the 23-year time series is 1.1:1 to 4.1:1.

In the eastern basin the percentage of lobsters that were female based on a five-year average ranged from 67% to 79% from 1984 to 2003. Of the total lobsters observed in this basin 74% were female in 2005 (Figure 13A). The percentage of females that were egg-bearing in the eastern basin rose to 41% of the females observed in 2005, which was the highest percentage seen in the 23-year time series (Figure 13B). The percentage of females bearing eggs based on a five-year average in the eastern basin ranged from 8% to 21% from 1984 to 2003. Due to a limited number of sea-sampling trips available in the eastern basin in 2006, meaningful percentages of females and females bearing eggs could not be calculated

In the western basin the percentage of lobsters that were female based on a five-year average ranged from 48% to 72% from 1984 to 2004. Of the total lobsters observed in this basin, 46% were female in 2005 and 65% in 2006 (Figure 13A). The percentage of egg-bearing females in the western basin increased from 7% of females observed bearing eggs in 2005 to 11% carrying eggs in 2006 (Figure 13B). This is below the long-term average of 15% of females observed bearing eggs in this basin and is at the lower end of the range of egg-bearing females based on a five-year average (range = 11% to 17%) from 1984 to 2003 (Figure 13B).

There is no time series of data available from the central basin to compare to recent samples.

Incidence of Shell Disease and Mortality in the Commercial Catch

The occurrence of shell disease in the observed commercial catch continued to be most prominent in the eastern basin in 2006, with 33.9% (613 of 1,808 lobsters) of the lobsters observed in this area showing signs of the disease. The occurrence in this area is up from 28% observed in 2005 (794 of

2,802). Consistent with previous years, egg-bearing females showed the highest levels in occurrence and severity of disease in the eastern basin. Due to the effects of the sea-sampling boycott enacted in 2006, there may be a temporal bias in the percentage of the disease measured in the eastern basin due to the availability of sampling trips. Millstone Environmental Laboratory studies observed 19.1% occurrence of the disease in the near-shore waters of the eastern basin in 2006, up from 17.6% in 2005 (DRS 2007).

Shell disease in the central basin remained at low levels in 2006 with 1.4% of the lobsters examined (25 of 1,786) afflicted with the disease. This is up from 0.3% (5 of 1,719) observed in 2005 in this area. The percentage of lobsters with the disease in the central and western basins was much lower than those recorded in 2003 and 2004. No shell disease was observed in the commercial catch from the western basin in 2005 (2,094 lobsters examined) or 2006 (7,938 lobsters examined).

The frequency of dead lobsters observed in commercial traps in all three basins fell to less than 0.01% in 2006 (10 dead out of 11,532 observed) from below 0.5% observed in 2005 (21 dead out of 6,615 observed). The low occurrence of dead lobsters in 2006 may be affected by the temporal bias in the schedule of sea-sampling trips. This would be attributed to the reduced number of trips taken during the fall months (September and October) of 2006.

Cull Rates in the Commercial Catch

Cull rates were calculated for sublegal (≤ 84.0mm CL) and legal (≥ 84.1mm CL) sized lobsters in the western basin of Long Island Sound from July to October 2006. Cull rates for both size classes in the western basin were below the 1991-2006 average (17.2% for legals and 13.4% for sublegals).

Cull rates for lobsters in the eastern basin could not be calculated for 2006 due to the availability of sea-sampling trips during this time period. One sampling trip was taken between July and October 2006 in the eastern basin and due to temporal and spatial bias, meaningful cull rates could not be determined.

JOB 2: Fishery Independent Monitoring

Methods

Objective 1. Monitor the annual relative abundance, sex ratio, percentage of females that are ovigerous, incidence of shell disease as well as the general health and condition, and cull rates of the legal and sub-legal length components of the lobster stock in Long Island Sound (LIS).

Lobsters are sampled in Long Island Sound by otter trawl during cruises conducted by the CT DEP Long Island Sound Trawl Survey (LISTS, Gottschall and Pacileo 2003). This survey uses a 14 m sweep trawl towed at 3.5 kts for 30 min from the 15.2 m research vessel *John Dempsey*. Stations are chosen from all trawlable LIS waters between New London and Norwalk, CT (Figure 2) employing a stratified random design with four depth strata (0-9 m, 9.1-18.2 m, 18.3-27.3 m, 27.4+m) and three bottom substrate strata (sand, mud and transitional). Forty stations are sampled monthly during spring (April, May, June) and fall (September and October) surveys. All lobsters collected are counted and a composite weight is recorded (+/- 0.1 kg). Biological data are recorded for all lobsters caught in each tow, or a minimum of 50 when measuring the entire catch is not possible. Data recorded include carapace length (CL) measured in 1.0 millimeter increments for animals less than 81.9 mm (CL). For animals greater than or equal to 82.0 mm length, length is recorded to the nearest 0.1 mm. Additional data recorded include sex, shell hardness, relative fullness of egg mass (<1/4 complement, 1/4, 1/2, 3/4, full), developmental stage of eggs (green, brown, tan), cull status and incidence and extent of shell disease (0, 1-10%, 11-50%, >50% of body covered). The incidence of dead lobsters is also recorded.

Arithmetic and geometric means are calculated for the number of lobsters caught in each survey tow. Catches from tows shorter than 30 minutes are expanded, or standardized to the equivalent 30-minute catches. The arithmetic mean is listed as the simplest measure of average conditions, however it is often skewed by tows with extraordinarily large numbers of lobsters. The geometric mean, which is computed using natural log values, is a more reliable measure of relative abundance when catch densities are skewed (e.g. negative binomial distribution). A delta mean is calculated for the catch per tow of specific size and gender classes, including egger and non-egger females, because of the high number of zero-catches for each class (Pennington 1985, Aitchison and Brown 1957, Aitchison 1955). Three size classes are identified: legal (minimum legal size(s) CL and greater), recruit (73-legal size CL or the size range corresponding to one molt below legal length), and pre-recruit (<73 mm CL).

Modifications:

None

Objective 2. Provide a larval lobster recruitment index by measuring the annual production (number per 1000 m^3) of Stage IV lobster larvae in western LIS.

Neuston samples are collected weekly from May through August at seven stations in western Long Island Sound: three mid-sound sites and two sites each along the Connecticut and Long Island shores (Figure 3). These stations have been sampled in the same manner since 1983 and were originally chosen based on the findings of a previous larval lobster survey (Lund and Stewart 1970). Samples are collected using a neuston net (1 m wide x 0.7 m high mouth, 3.05 m net length, 1 mm mesh) with an effective sampling area of 0.5 m^2 in the top 0.5 m of the water column. The net is towed by an

8.2m boat. Tow duration is fixed at five minutes and tow speed at 3 knots. Three tows are taken during daylight hours within a half-mile radius of each station location, in tidal fronts where visible. The volume (m^3) of water sampled during each tow is recorded by a calibrated flowmeter secured to the mouth of the net frame. Beginning and ending latitude and longitude of each tow is recorded by GPS. Samples are packed in ice at sea immediately following collection and sorted for lobster larvae (stages I-IV) within 24 hours. The four larval stages are identified using characteristics described by Factor (1995).

Density of Stage IV larvae (number per $1000m^3$) is calculated for each tow correcting for stage duration (Templeman 1936) by dividing by development time at prevailing water temperatures for each sample period. The duration-at-temperature values are halved for stage IV larvae because settlement occurs approximately midway through the fourth stage and the larvae are no longer vulnerable to the gear (Scarratt 1973). Weekly and seasonal mean Stage IV larval density estimates were derived using delta-distribution theory (Fogarty et al. 1983; Pennington 1985; Pennington and Berrien 1984).

Modifications:

None

Results and Discussion

Fishery Independent Abundance Indices

A total of 80 bottom trawl tows were completed during the spring (May and June) 2006 survey. The April component of the spring survey was not sampled due to delays in scheduled over-winter maintenance, including a main engine rebuild. The 2006 spring standard survey catch was 562 lobsters with a total weight of 153 kg. Biological data were recorded for 473 lobsters (Table 2). The fall 2006 survey consisted of one cruise (September) that spanned September and October, with 20 tows taking place in each month. The fall 2006 survey ended early for further vessel maintenance, including sand blasting, painting and installation of a bow thruster. Total catch for the 40 tows taken during the fall 2006 cruise was 186 lobsters (45 kg), with 166 lobsters measured (Table 2). Eleven tows in the spring and six in the fall of 2006 surveys were less than 30 minutes in duration and their catch was expanded.

A total of 120 bottom trawl tows were completed during the spring (April through June) 2007 survey. The 2007 spring standard survey catch was 1,429 lobsters with a total weight of 332 kg. Biological data were recorded for 1,267 lobsters (Table 2). Twenty tows in the spring 2007 survey were less than 30 minutes in duration and their catch was expanded.

While the spring 2006 lobster abundance index (geometric mean = 1.94 lobsters/tow) was the lowest in the time series, the spring 2007 abundance index (geometric mean = 3.22 lobsters/tow) showed an increase in abundance for the first time since peak abundance occurred in 1998. The spring 2007 index broke the declining trend in the spring abundance index observed since 1999 and ranked 18^{th} in the 24-year time series. (Figure 14). The fall 2006 abundance index (geometric mean = 1.48 lobsters/tow) continued the decline seen in 2005 (Figure 15) and is the lowest ranked year of abundance for fall in the 23-year fall time series.

Delta means by size class (Table 3, Figures 16-17) showed that abundance of pre-recruits fell for all sexes in both surveys in 2006 except for egg-bearing females in the spring, which rose from 0.07 in 2004 to 0.11 in 2005 and rose again to 0.14 in 2006. Recruit abundance also fell in 2006 for all sexes with the exception of an increase in the spring survey of egg-bearing females from 0.19 in 2005 to

0.60 in 2006. The largest decrease in recruit abundance was for males in the both the spring (from 1.02 in 2005 to 0.55 in 2006) and fall (1.10 in 2005 to 0.54 in 2006) surveys. The abundance of legal size egg-bearing females increased slightly in the spring (from 0.02 in 2005 to 0.08 in 2006) as did male abundance (0.20 in 2005 to 0.31 in 2006) though the overall abundance of legal females in the spring survey fell from 0.26 in 2005 to 0.18 in 2006. The indices for all legal size females in the fall survey fell from 0.37 in 2005 to 0.06 in 2006. Abundance indices for legal males in fall fell from 0.16 in 2005 to 0.08 in 2006.

Incidence of Shell Disease in the Research Catch

The incidence of shell disease increased to 1.7% in spring 2006 (8 of 473 animals) and 2.5% in spring 2007, which is higher than the 0.2%-0.9% recorded from 2001 to 2005. There was one lobster observed in fall 2006 with shell disease symptoms (166 animals evaluated). Levels of shell disease in the fall from 2001 to 2005 ranged from 0 to 3.2%.

Cull Rates in the Research Catch

Cull rates were calculated for sublegal (≤ 84.0mm CL) and legal (≥ 84.1mm CL) sized lobsters in the central and western basins of Long Island Sound for the spring and fall 2006 surveys. Cull rates for sublegal lobsters in the western basin were below the 1991-2006 average for the spring and fall surveys (7.6% and 8.9% respectively). Cull rates for sublegal lobsters in the central basin increased in the spring 2006 survey to 10.4%, up from 6.3% observed in 2005 and above the 1991-2006 average (8.15%).

Samples of legal-sized lobsters in the western basin were not large enough (<10) in 2006 to calculate meaningful percentages. Nineteen legal sized animals were observed in the central basin in the spring 2006 survey, with a 15.8% occurrence of culls, up from the 1991-2006 average of 8.4%. Sample sizes of legal lobsters in the central basin were also not large enough to provide a meaningful estimate of the cull rate in this area from the fall 2006 survey.

Larval Sampling

Weekly sampling in 2007 began May 23 (week 21) and ended August 28 (week 35) three weeks after the last stage IV larvae were observed. Three tows were completed at all stations each week except for week 32 when 7 of 21 tows were taken due to poor weather conditions. Stage IV larvae were first captured during week 25 and last captured during week 31. A total of 450 stage IV lobster larvae were collected from 15 sampling trips, for a total of 301 tows, during 2007.

Peak concentrations of stage IV larvae occurred during the third week in July (week 30). Stage IV larvae were first captured during week 25 and last captured during week 31. Annual production in 2007 (161.5 larvae per 1000 m^3 water sampled) rose above the long-term median value (94.4) for the first time since 1999. Production levels in 2007 ranked eighth in the 25-year time series (Figure 18) and broke a five-year trend of consecutive low production levels.

JOB 3: Interstate Fisheries Management Participation

Methods

Objective 1. Participate on the Atlantic States Marine Fisheries Commission's Lobster Scientific Technical Committee and Stock Assessment Sub-Committee. This may include: providing technical expertise for developing stock assessments, reviewing state management regulatory proposals, monitoring the status of the stocks and defining mortality rates, and exploring alternative overfishing definitions.

CT DEP staff participated in meetings of the ASMFC Lobster Technical Committee convened July 23-24, 2007. The purpose of this meeting was to review final modifications to the CT DEP proposal to v-notch female lobsters in 2007 and 2008 as a "conservation equivalency" to increasing the minimum legal size as specified in Addendum 11 of Amendment 3 to the ASMFC Lobster Management Plan. The second purpose of the meeting was to begin data compilation for the next assessment of the coast-wide lobster stock, due to be completed by August 2008. Staff also participated in the ASMFC Lobster Management Board meeting on August 13, 2007 where the CT v-notch proposal was reviewed.

Modifications:

None

Objective 2. Provide data and technical expertise from Connecticut's fishery dependent and independent monitoring programs to further enhance the evaluation of coast-wide and regional stock status.

Modifications:

None

CT DEP staff provided landings data, available through the DEP Marine Fisheries Information System (MFIS), and biosampling data, available through Job 1 of this project, to the ASMFC Lobster Database. This database is the primary tool used by the ASMFC Technical Committee and Stock Assessment Committee to complete the coast-wide stock assessment.

Results and Discussion

Addendum 11 was developed to implement management strategies to rebuild the Southern New England stock and calls for increasing in minimum harvest size by June 2008. The Addendum specifies a consistent minimum harvest size of 3 5/16" (3.31" carapace length (CL)) for all lobstermen fishing on the Southern New England stock. CT DEP requested that the ASMFC Lobster Technical Committee review the CT rebuilding strategy centering on a v-notch program as an equivalent alternative measure to increasing the current minimum size (3.31" CL), implemented in July 2006. A full proposal describing the v-notch program was written by DEP staff, reviewed by the ASMFC Lobster Technical Committee, and approved by the Management Board in October 2006. The final v-notch proposal was accepted by the Technical Committee as equivalent to the Plan's gauge increase. The Management Board gave final approval to the proposal in their August 2007 meeting.

	2006					2007			
Sample Period:	**Jan 1 - May 31**	**June 1 - Aug 31**	**Sept 1 - Oct 31**	**Nov 1 - Dec 31**	**Basin Total**	**Jan 1 - May 31**	**June 1 - Aug 31**	**Sept 1 - Oct 31**	**Basin Total**
Eastern Basin –									
Trips scheduled	1	4	1	2	8	1	4	1	6
Trips completed	0	2	0	2	4	0	4		4
Lobsters measured	0	259	0	1,549	1,808	612	1,227	0*	1,839*
Central Basin-									
Trips scheduled	1	4	1	2	8	1	4	1	6
Trips completed	0	1	0	2	3	2	4		6
Lobsters measured	0	798	0	988	1,786	434	1,535	604*	2,573*
Western Basin-									
Trips scheduled	1	4	1	2	8	1	4	1	6
Trips completed	3	7	1	2	13	4	5	1	10
Lobsters measured	532	5,639	260	1,507	7,938	2,125	1,742	0*	3,867*
All Basins-									
Trips scheduled	3	12	3	6	24	3	12	3	18
Trips completed	3	10	1	6	20	6	13	1	20
Lobsters measured	532	6,696	260	4,044	11,532	3,171	4,504	604*	8,279*

*** Data not complete for September - October 2007.**

Table 1: Commercial sea sampling effort January through December 2006 and January through August 2007 by area and time period.

	2006						2007			
Season Month	**Spring April**	**Spring May**	**Spring June**	**Fall September**	**Fall October**	**TOTAL**	**Spring April**	**Spring May**	**Spring June**	**TOTAL**
# Tows scheduled	40	40	40	40	40	200	40	40	40	120
# Tows taken	0	40	40	40	0	120	40	40	40	120
(# tows with lobster)	-	28	21	21	-	70	24	31	29	84
# Lobsters Caught		400	162	186		748	160	971	298	1,429
(Weight kg)	-	(104)	(49)	(45)	-	(198)	(44)	(200)	(88)	(332)
Lobsters Measured	-	319	154	166	-	639	125	866	276	1,267

Table 2: Research trawl sampling effort and lobster catch for spring and fall 2006 and spring 2007 cruises. *Number of lobsters and catch weight are expanded totals. The last column shows the total for the entire year.*

Table 3: Spring (1985-2007) and fall (1985-2006) LIS Trawl Survey lobster catch by size class and gender/ egg-bearing status. *Values given are delta mean catch per standard tow for all survey tows taken over mud or transition bottom types (sand sites omitted). See figures 16 and 17 for graphic presentations.*

Spring	Pre-Recruit				Recruit				Legal			
	Egger		Nonegger	All	Egger		Nonegger	All	Egger		Nonegger	All
Year	Female	Male	Female	Females	Female	Male	Female	Females	Female	Male	Female	Females
1985	0.03	6.97	7.43	7.46	0.13	2.22	2.29	2.42	0.36	0.45	0.74	1.10
1986	0.04	2.55	2.45	2.49	0.43	1.58	1.48	1.91	0.24	0.57	0.42	0.65
1987	0.00	6.33	6.32	6.32	0.38	1.89	1.55	1.93	0.24	1.13	0.70	0.95
1988	0.00	2.05	2.13	2.13	0.13	1.15	0.91	1.04	0.33	0.46	0.48	0.81
1989	0.03	5.72	4.83	4.85	0.37	2.76	2.46	2.83	0.22	1.21	0.68	0.91
1990	0.12	11.07	11.34	11.46	0.97	3.71	4.65	5.61	0.32	0.79	1.30	1.61
1991	0.16	17.69	14.62	14.78	1.26	7.77	5.89	7.16	0.34	3.67	1.00	1.34
1992	0.07	20.13	20.29	20.36	2.87	6.23	7.34	10.21	0.65	1.79	0.87	1.52
1993	0.39	18.31	20.26	20.65	1.24	3.85	4.91	6.15	0.47	0.38	0.43	0.90
1994	0.11	7.81	7.58	7.69	0.85	2.37	2.22	3.07	0.22	0.32	0.39	0.60
1995	0.33	21.72	23.27	23.60	2.68	6.33	6.43	9.10	0.74	2.03	0.81	1.54
1996	0.35	22.73	23.97	24.32	2.98	6.19	6.14	9.12	0.90	1.15	1.43	2.33
1997	0.71	38.84	38.89	39.60	4.89	9.77	10.74	15.63	1.12	4.84	1.90	3.02
1998	1.01	59.95	63.31	64.32	6.61	15.36	16.40	23.01	1.39	4.08	1.46	2.85
1999	1.40	45.58	50.52	51.92	9.50	13.32	15.80	25.29	0.83	4.05	1.63	2.46
2000	1.20	38.76	45.96	47.15	5.74	6.48	6.82	12.57	0.36	3.05	1.16	1.52
2001	0.73	20.73	18.99	19.72	2.02	8.98	6.38	8.40	0.47	2.85	1.19	1.66
2002	0.47	12.72	12.60	13.07	1.33	4.69	4.16	5.49	0.21	1.77	0.73	0.94
2003	0.21	6.81	5.39	5.61	0.86	2.02	1.15	2.01	0.04	0.44	0.19	0.23
2004	0.07	3.88	3.37	3.44	0.38	1.24	0.93	1.31	0.04	0.46	0.20	0.24
2005	0.11	3.04	3.01	3.12	0.19	1.02	1.00	1.19	0.02	0.20	0.24	0.26
2006	0.14	2.68	2.13	2.27	0.60	0.55	0.86	1.46	0.08	0.31	0.10	0.18
2007	0.09	4.52	4.89	4.98	0.42	1.09	1.1	1.52	0.14	0.32	0.21	0.35

FALL	Pre-Recruit				Recruit				Legal			
	Egger		Nonegger	All	Egger		Nonegger	All	Egger		Nonegger	All
Year	Female	Male	Female	Females	Female	Male	Female	Females	Female	Male	Female	Females
1984	0.02	11.16	12.43	12.45	0.86	3.61	4.14	5.00	0.83	2.10	1.43	2.26
1985	0.02	3.92	4.80	4.82	0.66	2.21	2.15	2.82	0.44	0.77	0.35	0.80
1986		8.09	6.92	6.92	0.66	4.15	3.45	4.11	0.40	3.37	1.16	1.56
1987	0.05	10.53	8.94	8.99	0.81	4.53	4.08	4.89	0.50	1.44	1.08	1.58
1988	0.01	5.31	4.23	4.24	0.29	2.41	2.17	2.46	0.23	1.14	0.70	0.93
1989	0.04	7.39	7.36	7.41	0.35	3.73	1.90	2.25	0.27	1.22	0.17	0.43
1990	0.12	13.65	13.58	13.70	0.80	5.11	3.60	4.41	0.64	2.13	0.67	1.31
1991	0.34	27.15	26.64	26.98	1.49	7.17	3.47	4.96	0.34	1.56	0.90	1.24
1992	0.29	32.10	28.39	28.68	0.98	7.07	3.22	4.20	0.30	3.03	0.87	1.17
1993	0.51	33.46	31.09	31.60	2.12	10.05	6.84	8.96	0.54	1.62	0.76	1.30
1994	0.27	36.10	32.88	33.15	1.16	9.32	6.57	7.73	0.28	3.26	1.95	2.22
1995	0.34	29.55	23.54	23.88	1.00	8.17	4.99	5.99	0.22	3.30	0.68	0.90
1996	0.67	21.82	23.93	24.60	2.23	5.98	4.48	6.71	0.77	1.26	1.12	1.89
1997	1.83	63.16	61.95	63.78	8.33	16.98	10.92	19.24	1.59	3.78	1.17	2.76
1998	0.35	21.70	16.31	16.67	2.67	9.21	4.66	7.34	0.26	1.82	0.67	0.94
1999	0.83	28.06	21.07	21.90	3.76	11.46	3.83	7.59	0.50	2.47	0.23	0.72
2000	0.72	16.41	12.51	13.23	2.24	6.53	3.11	5.35	0.55	1.34	0.35	0.90
2001	0.59	9.79	6.70	7.29	2.00	5.98	2.30	4.29	0.21	0.53	0.36	0.57
2002	0.24	3.81	2.17	2.41	0.63	2.06	0.45	1.08	0.10	0.15	0.00	0.10
2003	0.33	8.70	8.31	8.63	1.12	1.88	1.84	2.97	0.16	0.44	0.35	0.51
2004	0.20	5.28	3.89	4.09	0.60	1.94	1.29	1.89	0.08	0.39	0.08	0.17
2005	0.11	3.40	2.46	2.57	0.46	1.10	0.57	1.03	0.18	0.16	0.19	0.37
2006	0.09	2.23	1.48	1.57	0.25	0.54	0.44	0.69	0.00	0.08	0.06	0.06

Pre-recruit size class = less than 73mm carapace length
Recruit size class = 73-<legal size carapace length
Legal size class = 82.6mm carapace length and larger through August 13, 2005
= 83.3mm carapace length and larger August 14, 2005- June 30, 2006
= 84.1mm carapace length and larger on or after July 1, 2006

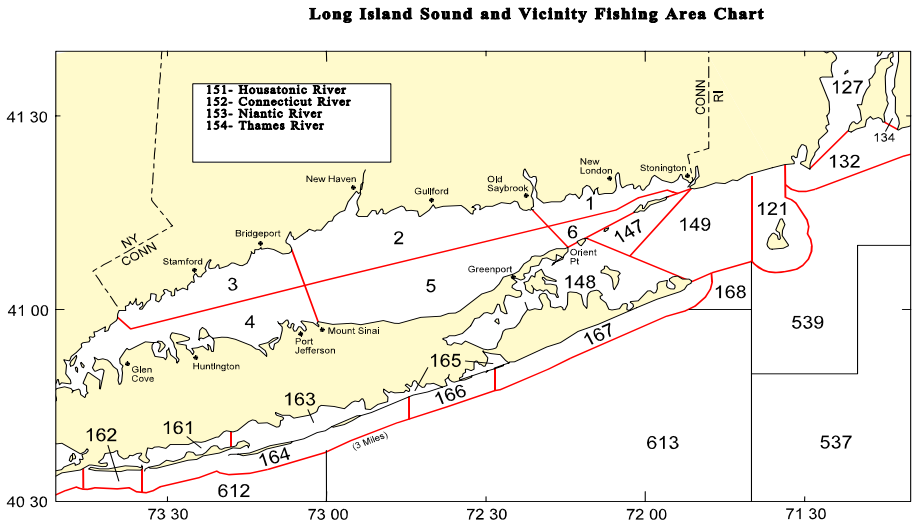


Figure 1: Reporting areas for commercial catch data. *Eastern basin commercial sea sampling trips were made in reporting areas 1, 6, and 147. Central basin sampling trips were made in areas 2 and 5. Western basin trips were made in areas 3 and 4.*

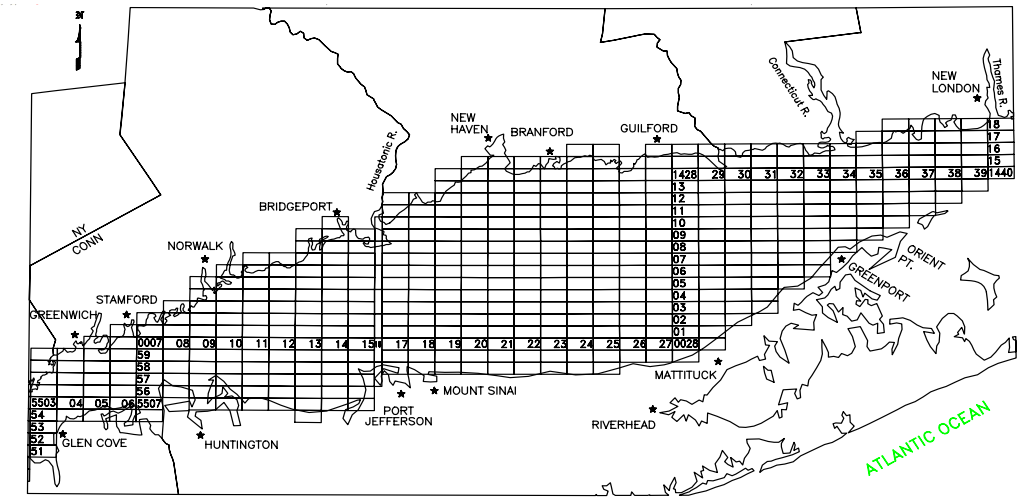


Figure 2: Long Island Sound Trawl Survey sampling area with grid overlay. *Each sampling grid is 1x2 nmi (nautical miles). A four-digit number identifies the grid: the first two digits are minutes of latitude (row number) and the last two digits are the column number. (Note: sites in column 16 are approximately 2x1 nm).*

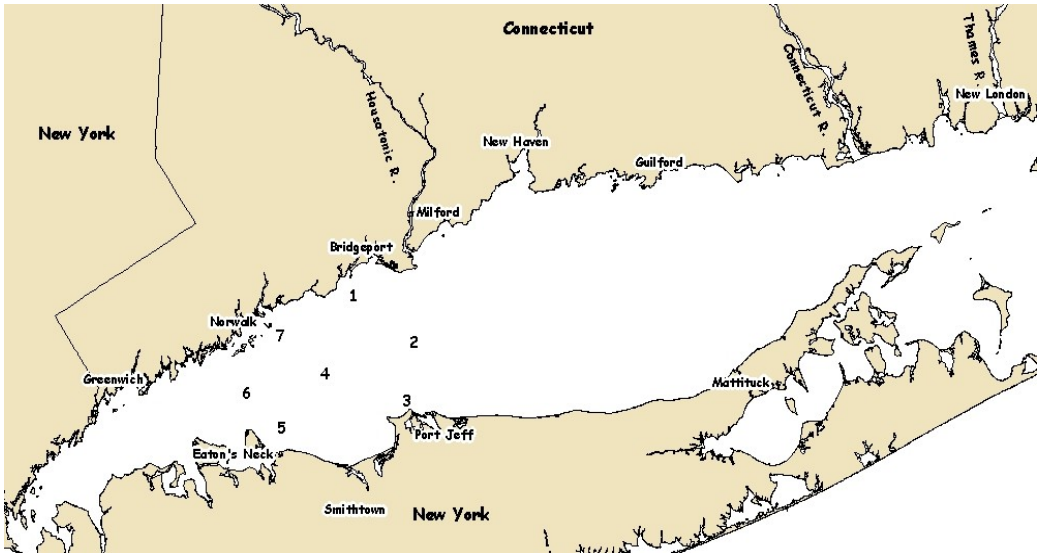


Figure 3: Larval sampling stations in western Long Island Sound, 1983-2007. *Station locations are numerically indicated.*

Year	CT Landings (Millions Pounds)	Total Value (Millions Dollars)
1984	1,796,794	
1985	1,380,818	
1986	1,253,687	
1987	1,569,224	
1988	1,923,283	
1989	2,076,851	
1990	2,645,951	
1991	2,673,674	
1992	2,534,136	
1993	2,177,022	
1994	2,149,086	
1995	2,541,140	7.99
1996	2,888,683	9.58
1997	3,468,051	11.09
1998	3,715,310	12.13
1999	2,595,764	9.60
2000	1,393,565	5.50
2001	1,329,707	5.45
2002	1,067,121	4.23
2003	671,119	3.17
2004	646,994	3.17
2005	713,901	3.82
2006	792,894	4.03

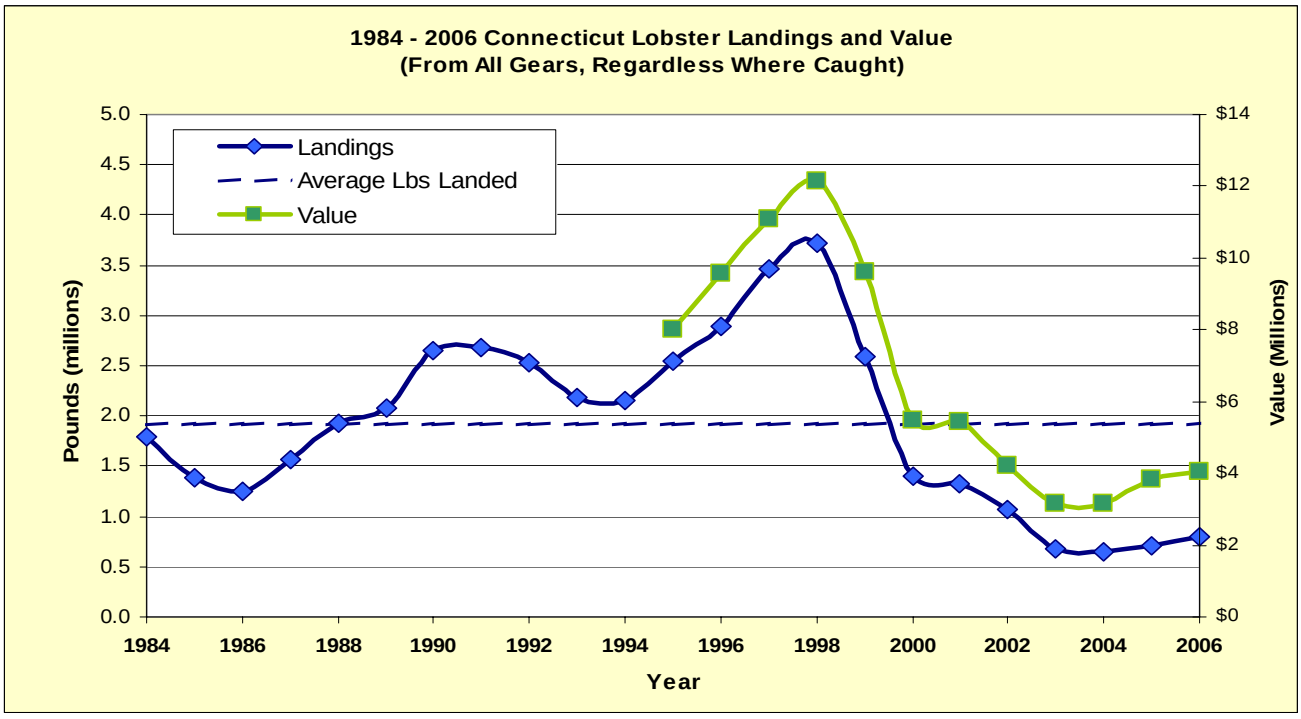


Figure 4: Lobster landings and landed value from all Connecticut ports, 1984-2006. *The time-series average of 1,913,251 pounds is shown by the heavy dashed line. Value data for landings are available from 1995 – present.*

Year	ELIS	CLIS	WLIS	Total
1984	739,093	355,230	702,471	1,796,794
1985	565,767	357,060	457,991	1,380,818
1986	431,024	382,419	440,244	1,253,687
1987	560,084	454,580	554,560	1,569,224
1988	719,355	494,124	709,804	1,923,283
1989	858,408	461,466	756,977	2,076,851
1990	1,177,691	544,666	923,594	2,645,951
1991	1,115,005	586,245	972,424	2,673,674
1992	1,043,934	377,356	1,112,846	2,534,136
1993	947,564	291,116	938,342	2,177,022
1994	706,944	290,905	1,151,237	2,149,086
1995	856,533	504,928	1,179,679	2,541,140
1996	750,303	561,681	1,576,699	2,888,683
1997	1,017,813	730,918	1,719,320	3,468,051
1998	1,123,337	768,057	1,823,916	3,715,310
1999	931,052	653,015	1,011,697	2,595,764
2000	657,193	430,070	306,302	1,393,565
2001	531,047	427,762	370,898	1,329,707
2002	470,438	285,786	310,897	1,067,121
2003	276,606	122,936	271,577	671,119
2004	301,204	112,596	233,194	646,994
2005	368,441	116,515	228,945	713,901
2006	414,119	120,614	258,161	792,894

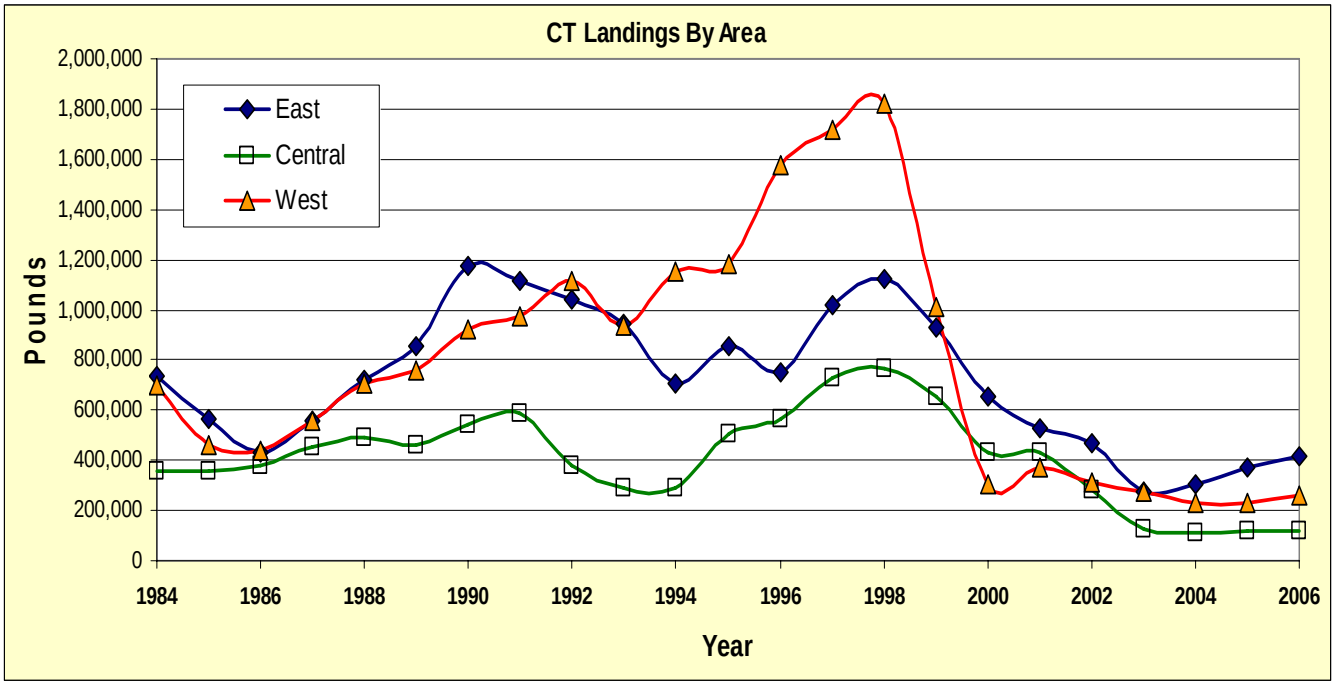
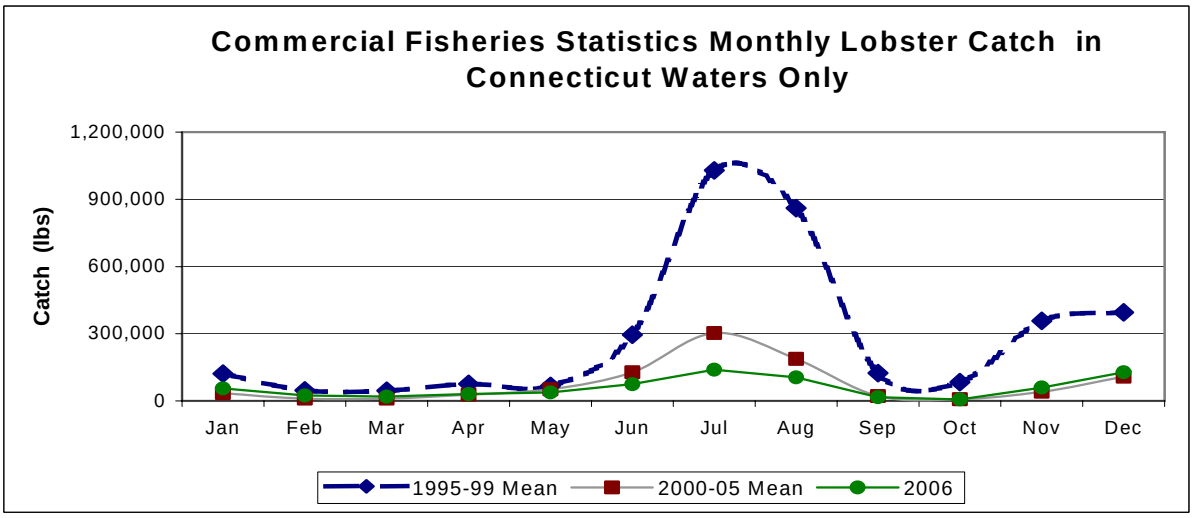
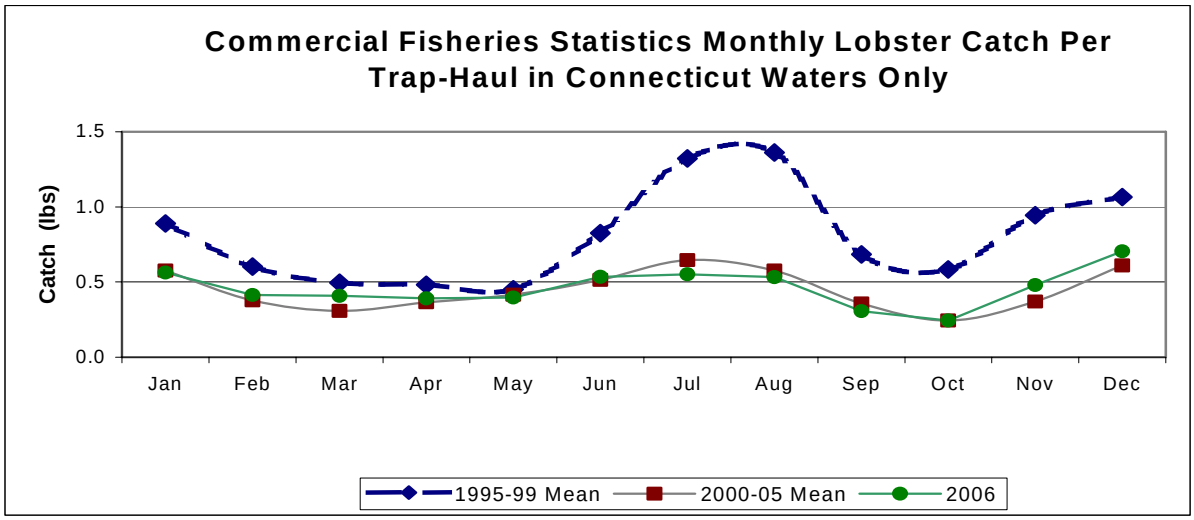


Figure 5: Connecticut lobster landings (lbs) by basin, 1984-2006. *Includes landings from all gear types and areas fished. (ELIS=Eastern Long Island Sound, CLIS=Central Long Island Sound and WLIS=Western Long Island Sound).*

A



B



C

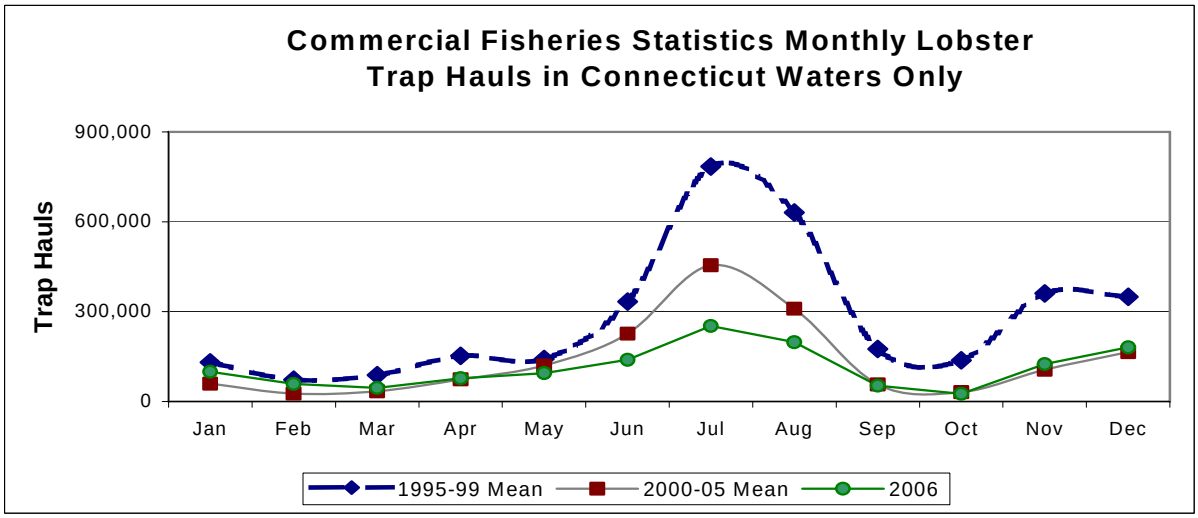
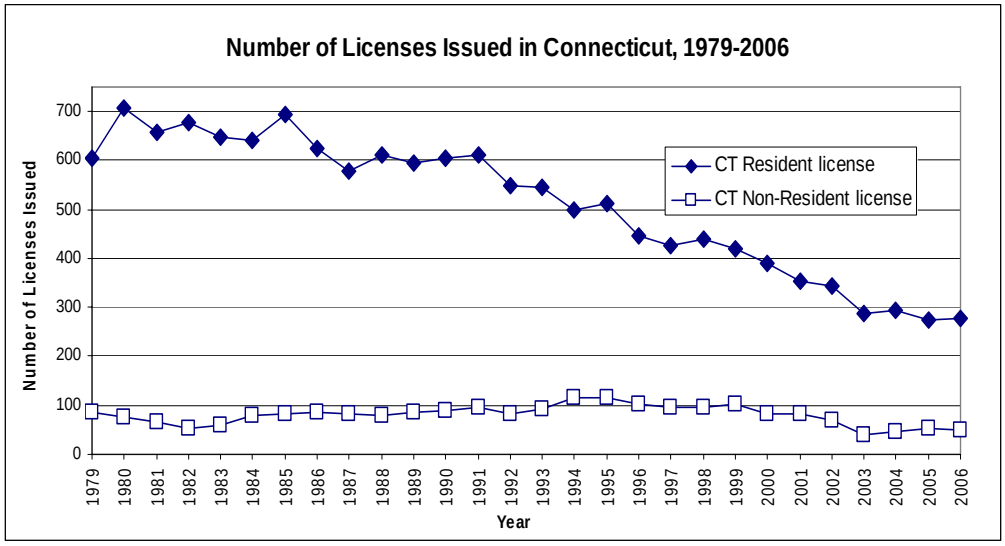
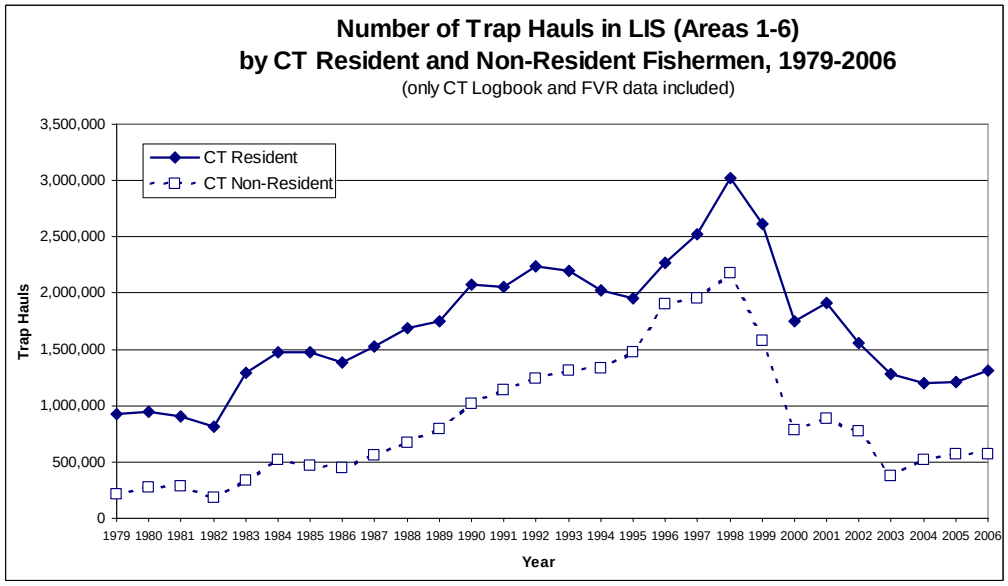


Figure 6: Monthly lobster catch, catch per effort, and effort in Connecticut waters. *Catch (A), catch per trap haul (B), and total trap hauls (C) are shown by month for 2006. Mean values for years 1995-1999 and 2000-2005 are shown for comparison.*

	number of licenses Issued	
Year	CT Resident	CT Non-Resident
1979	604	85
1980	707	76
1981	659	67
1982	678	53
1983	649	59
1984	642	80
1985	693	83
1986	623	87
1987	578	81
1988	612	80
1989	595	87
1990	606	88
1991	611	96
1992	547	81
1993	544	92
1994	499	115
1995	513	115
1996	445	101
1997	427	95
1998	441	97
1999	419	101
2000	389	83
2001	352	82
2002	344	70
2003	286	38
2004	265	44
2005	274	52



	LIS Area 1-6	LIS Area 1-6
	number of trap hauls	
Year	CT Resident	CT Non-Resident
1979	924,635	218,496
1980	950,623	269,835
1981	906,085	281,836
1982	812,129	180,663
1983	1,296,230	340,596
1984	1,477,438	517,687
1985	1,475,350	468,649
1986	1,380,421	442,628
1987	1,524,902	562,793
1988	1,688,491	668,973
1989	1,749,483	797,506
1990	2,078,540	1,022,212
1991	2,057,914	1,139,814
1992	2,235,864	1,237,941
1993	2,196,723	1,315,726
1994	2,029,217	1,329,051
1995	1,954,208	1,471,041
1996	2,267,464	1,907,047
1997	2,526,867	1,948,854
1998	3,020,704	2,182,224
1999	2,619,109	1,572,634
2000	1,752,345	787,188
2001	1,907,920	881,313
2002	1,553,666	777,311
2003	1,279,463	375,713
2004	1,204,880	515,445
2005	1,198,557	557,607



	number of traps fished	
Year	CT Resident	CT Non-Resident
1984	66,709	20,414
1985	65,262	20,129
1986	65,826	17,609
1987	70,646	25,732
1988	79,154	28,637
1989	83,915	34,774
1990	100,360	36,380
1991	101,290	43,308
1992	107,668	47,734
1993	115,224	54,390
1994	110,805	53,334
1995	119,983	57,158
1996	130,360	65,849
1997	133,770	68,229
1998	158,527	72,967
1999	162,149	78,317
2000	122,386	44,813
2001	121,501	46,869
2002	112,731	40,361
2003	85,048	17,304
2004	84,071	24,043
2005	83,946	
2006	89,421	

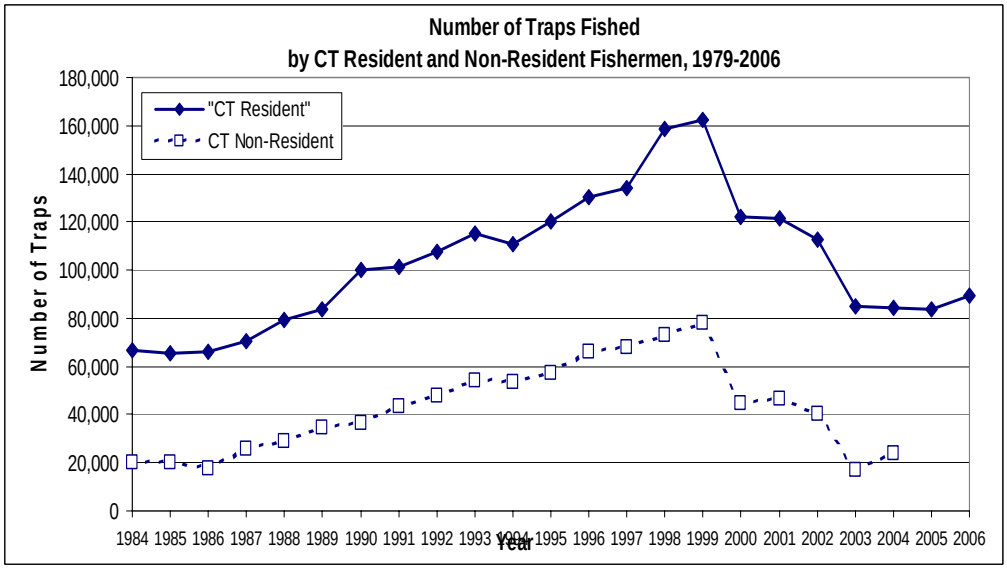


Figure 7: Trends in participation and effort (trap-hauls) for Connecticut resident and non-resident license holders, 1979-2006. Tallies of total traps for 2006 are preliminary.

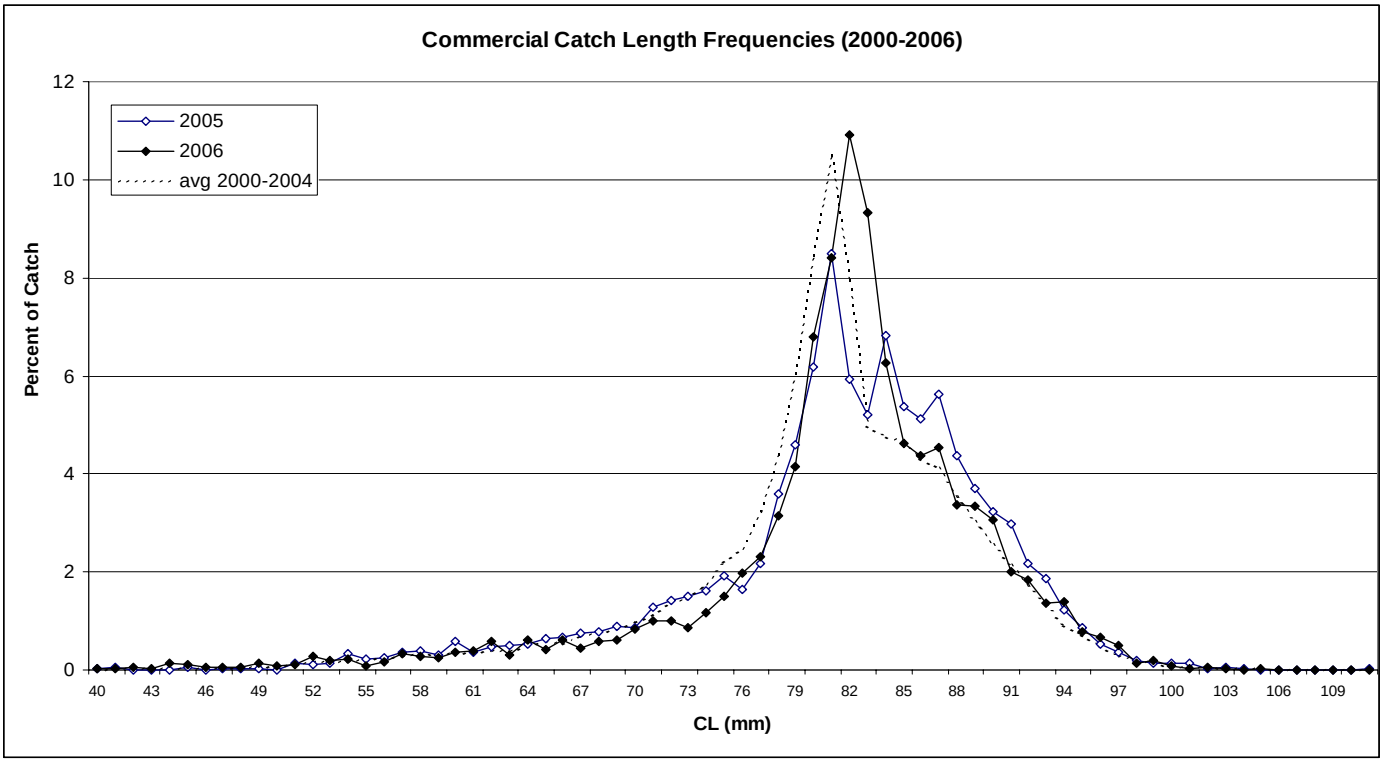
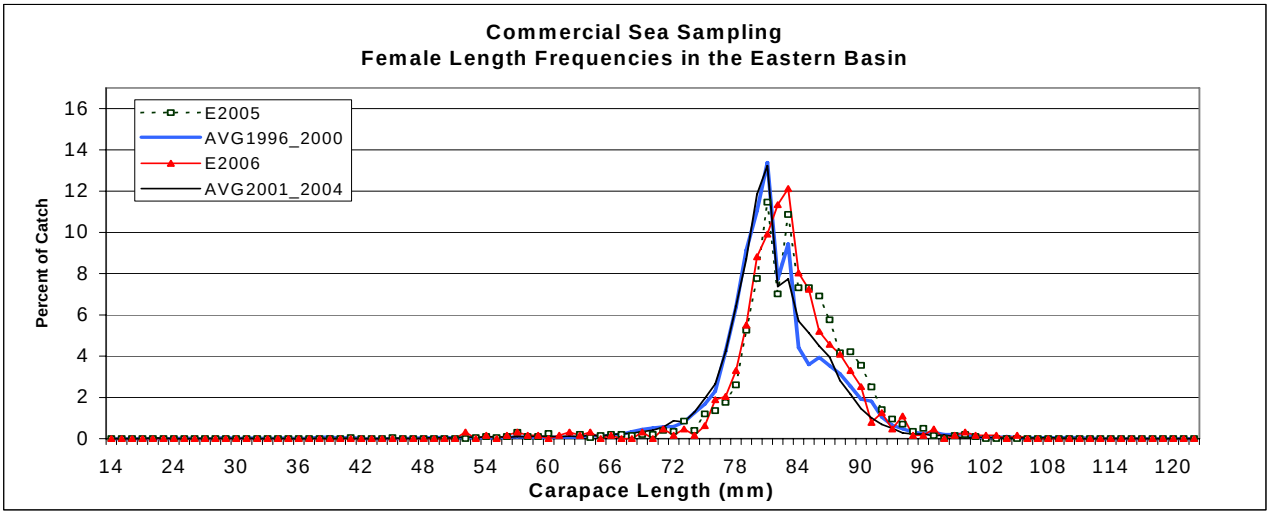
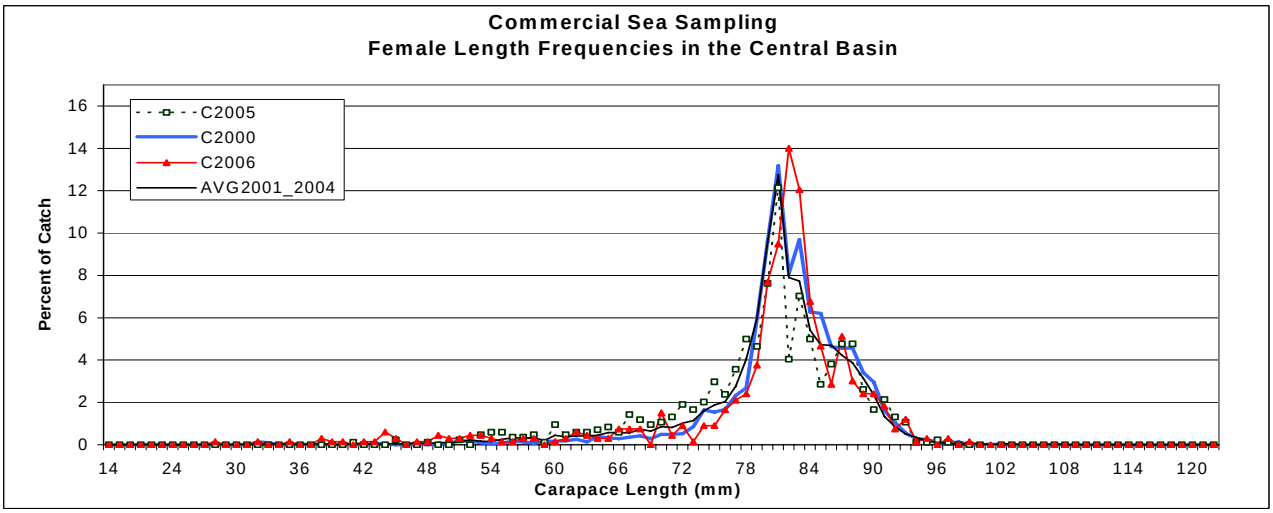


Figure 8: Length frequency of the commercial catch, 2005 and 2006. *Mean values for years 2000-2004 are shown for comparison.*





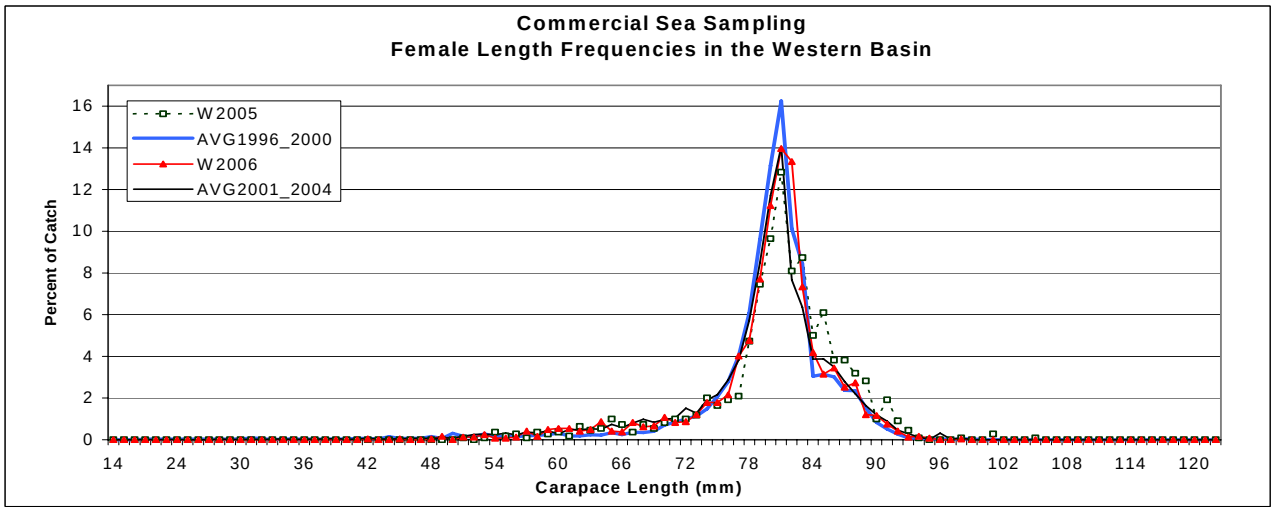
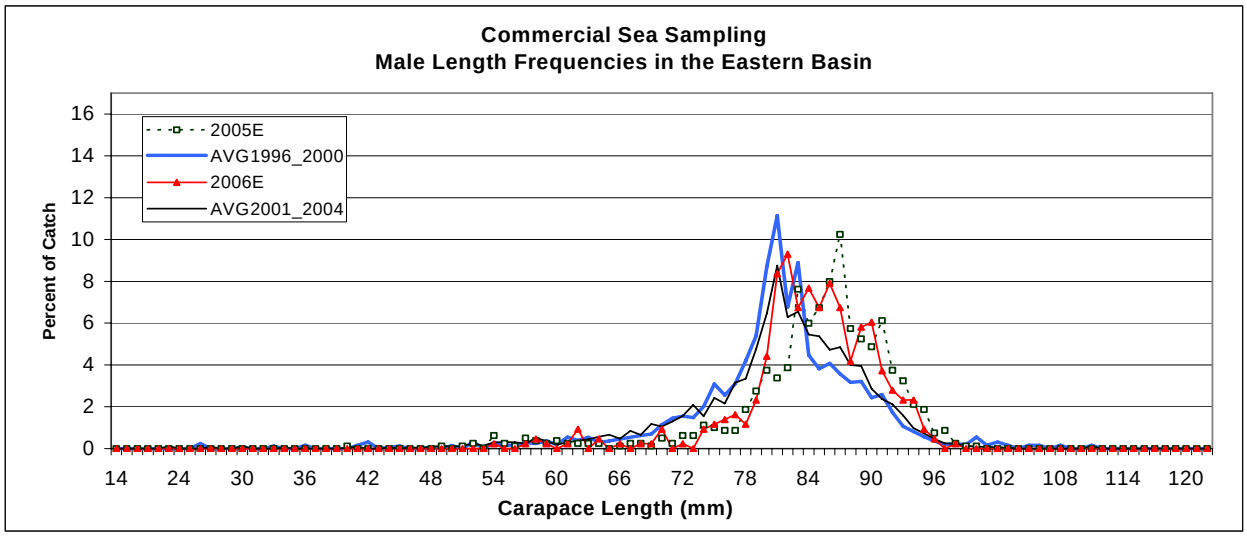
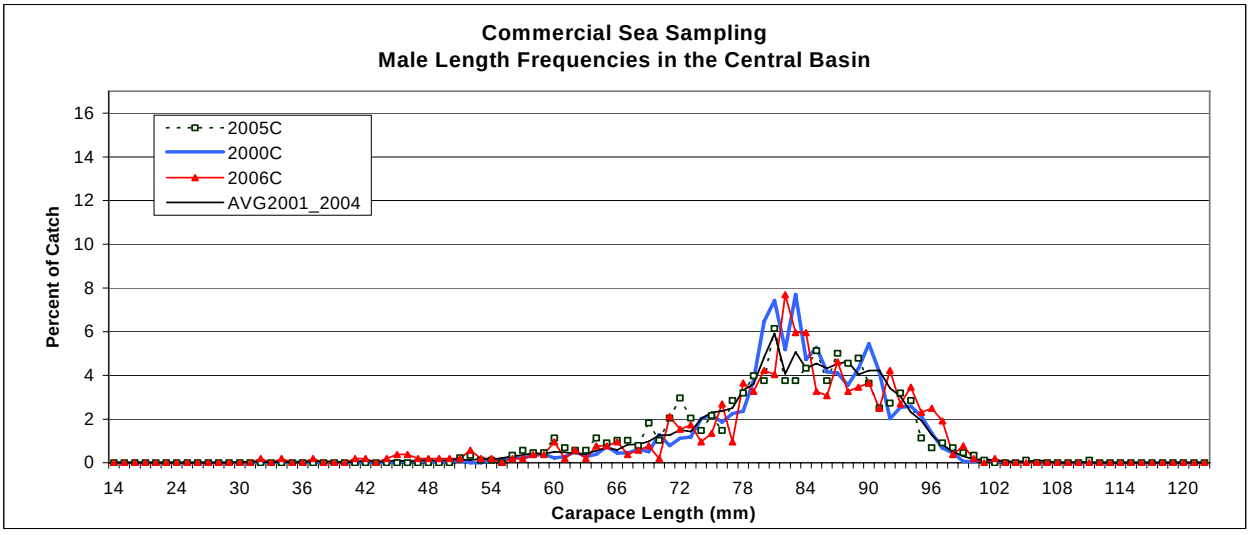


Figure 9: Length frequency of the female commercial catch by basin of Long Island Sound, 2005 - 2006. *Mean values for years 1996-2000 and 2001-2004 are shown for comparison.*





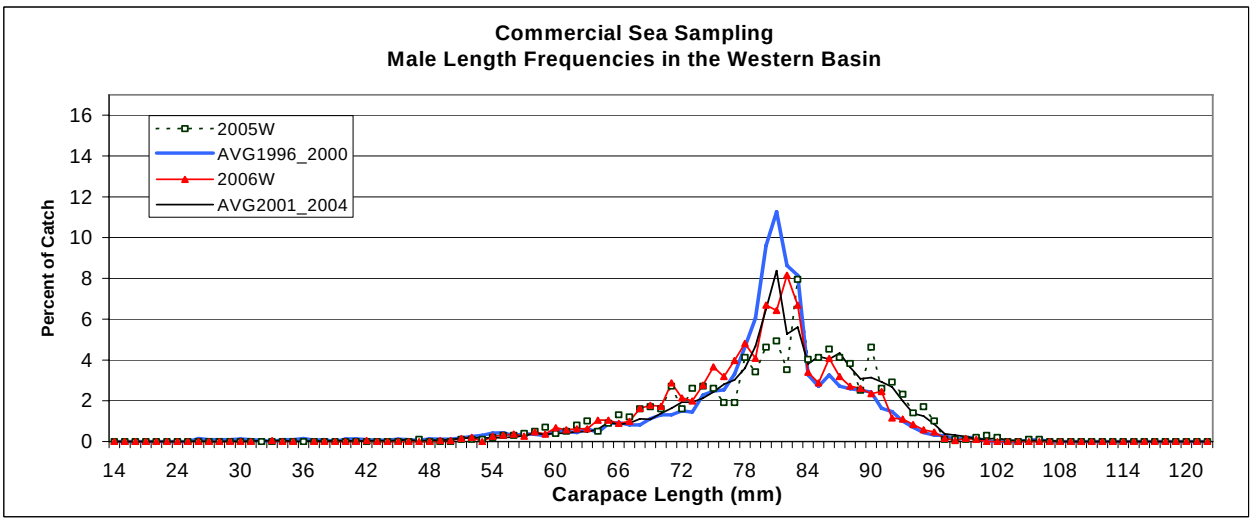
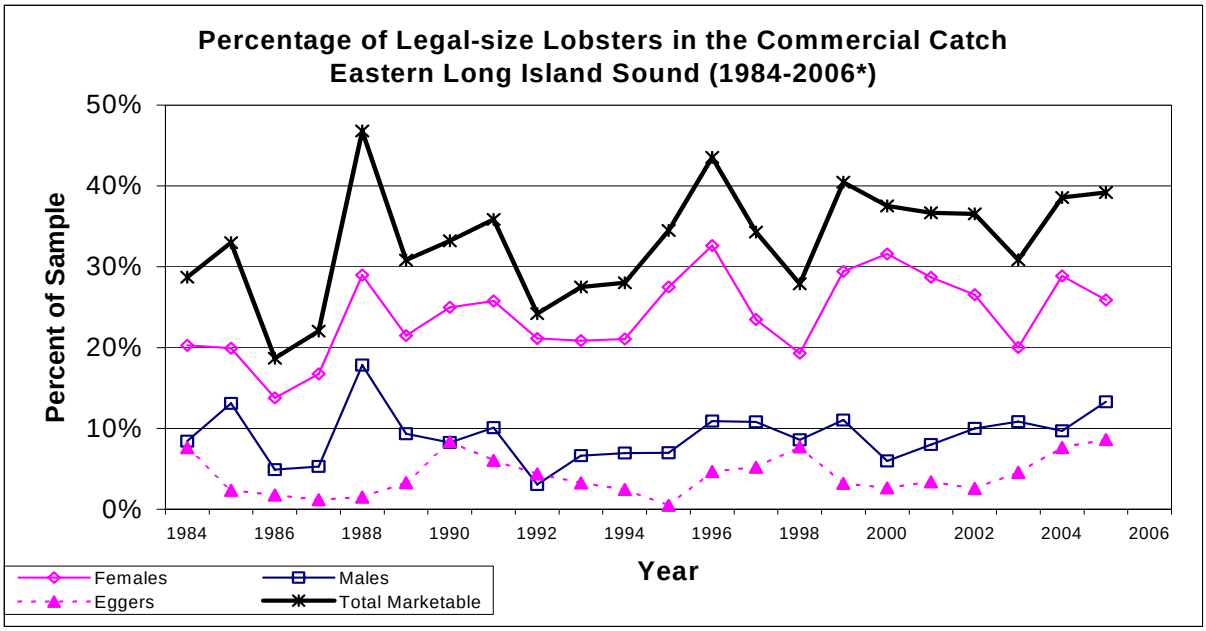


Figure 10: Length frequency of the male commercial catch by basin of Long Island Sound, 2005 - 2006. *Mean values for years 1996-2000 and 2001-2004 are shown for comparison.*

A



B

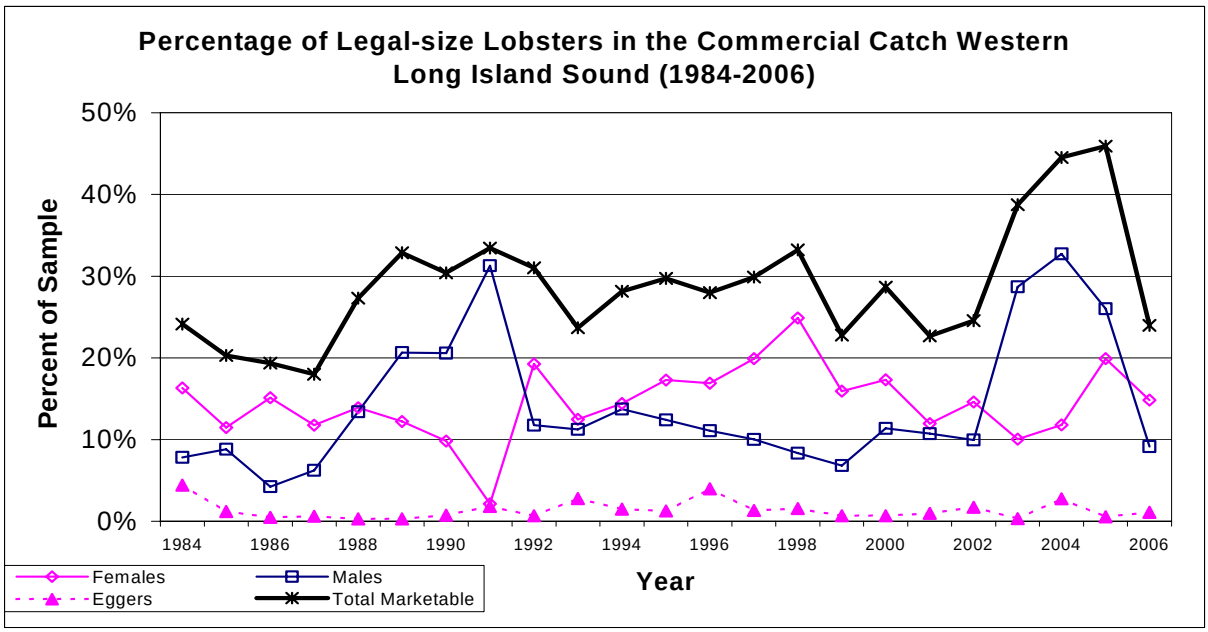
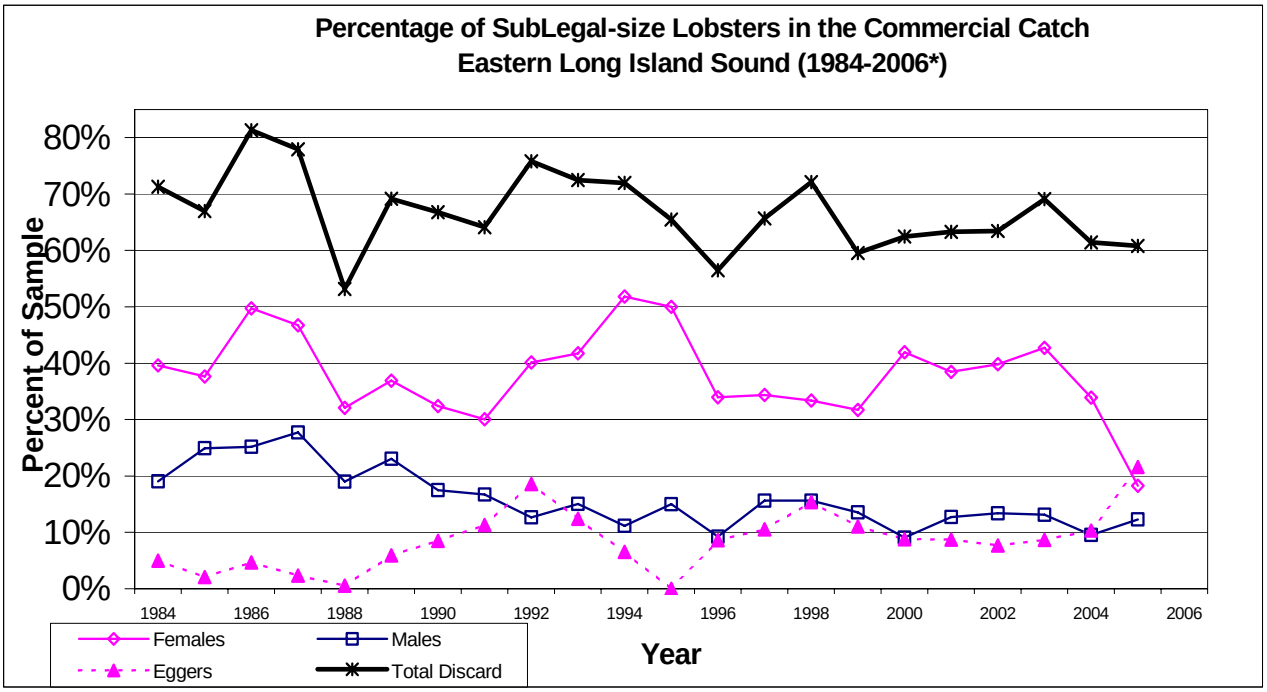


Figure 11: Percentage of marketable lobsters in the observed commercial catch, 1984-2006.
Percentage by gender and egg-bearing status is shown for the eastern (A) and western basins (B).
**Due to low sample sizes, data for Eastern Long Island Sound in 2006 have not been included.*

A



B

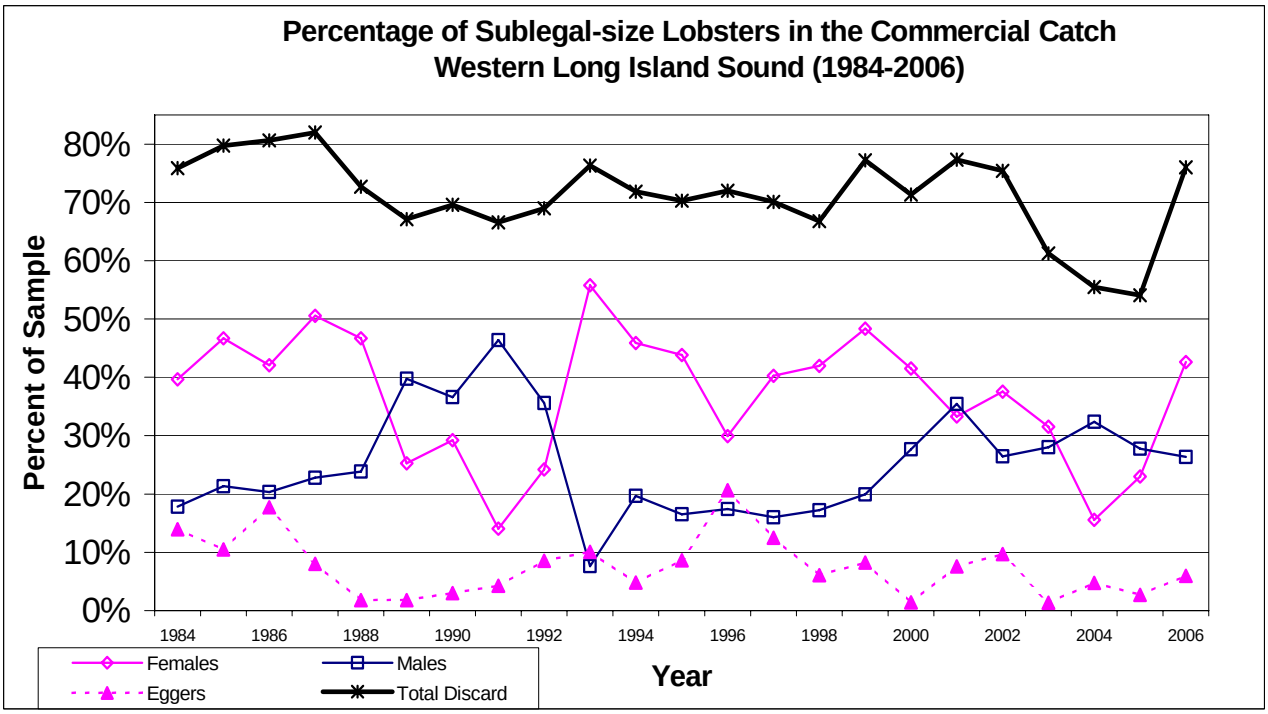
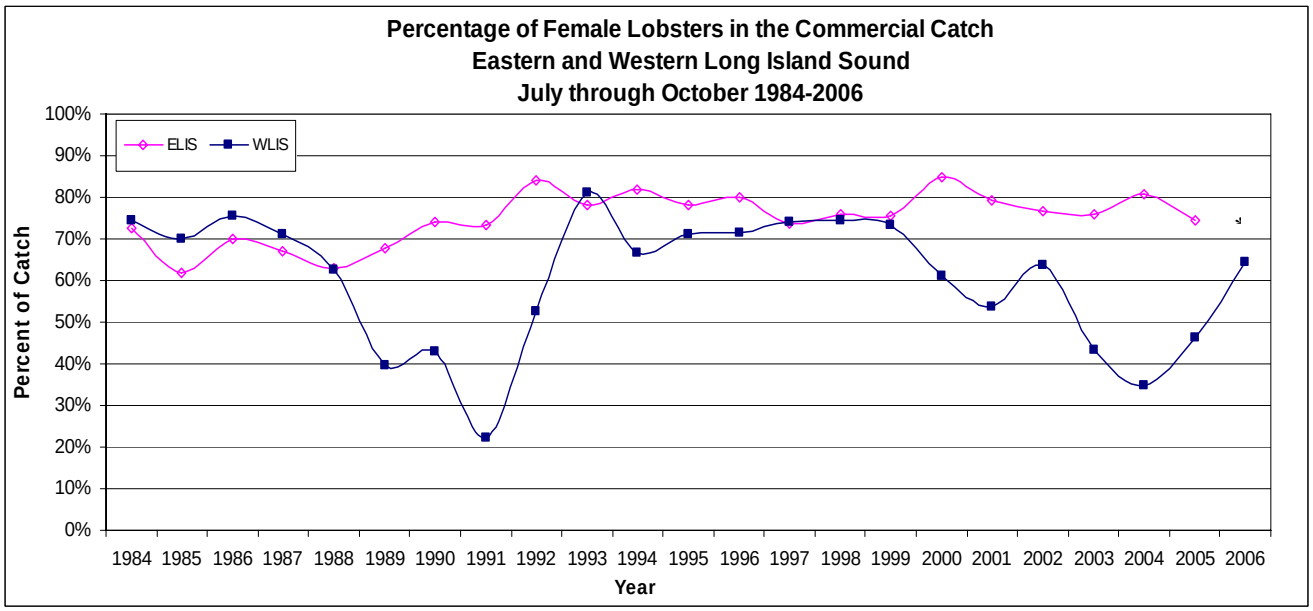


Figure 12: Percentage of sublegal lobsters in the observed commercial catch, 1984-2006. *Percentage by gender and egg-bearing status is shown for the eastern (A) and western basins (B).*
**Due to low sample sizes, data for Eastern Long Island Sound in 2006 have not been included.*

A



B

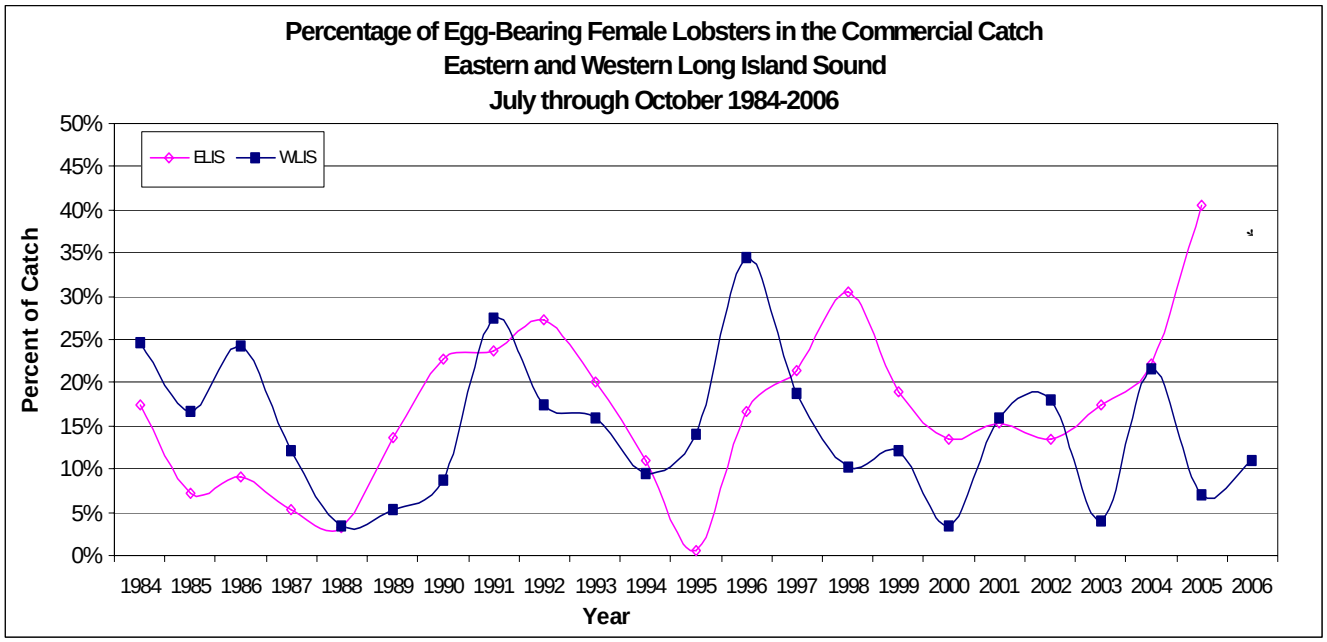


Figure 13: Sex ratio in the observed commercial catch, 1984-2006. *The percentage of females the entire observed catch (A) and percentage of females that are egg-bearing (B) are shown for samples taken in the eastern and western basins. There is no time series for samples taken in the central basin. *Due to low sample sizes from the Eastern basin, 2006 values have been removed.*

YEAR	MONTH	Number of Tows	Total Lobsters	Maximum Catch	Geometric Mean	Arithmetic Mean	% Tows with Lobsters	Geometric Rank	Arithmetic Rank
1984	SP	32	846	125	7.09	26.40	0.72	9	12
1985	SP	46	630	156	3.10	13.70	0.57	19	17
1986	SP	116	905	74	2.76	7.80	0.67	20	21
1987	SP	120	1,692	212	3.30	14.10	0.63	17	16
1988	SP	120	780	66	2.24	6.50	0.65	23	24
1989	SP	120	1,945	396	3.76	16.20	0.75	16	15
1990	SP	120	2,983	545	5.33	24.90	0.73	13	13
1991	SP	120	4,424	373	7.74	36.90	0.81	6	9
1992	SP	80	3,005	351	7.88	37.60	0.78	5	8
1993	SP	120	4,991	486	6.71	41.60	0.74	11	7
1994	SP	120	2,248	278	4.10	18.70	0.73	14	14
1995	SP	120	5,742	1,177	8.36	47.90	0.77	4	6
1996	SP	120	5,761	707	6.77	48.00	0.68	10	5
1997	SP	120	8,100	740	7.67	67.50	0.71	7	4
1998	SP	120	13,034	1,862	18.52	108.60	0.83	1	1
1999	SP	120	10,302	899	12.49	85.90	0.78	2	2
2000	SP	120	8,321	987	11.01	69.30	0.82	3	3
2001	SP	120	4,214	266	7.56	35.10	0.77	8	10
2002	SP	120	3,279	393	6.31	27.30	0.73	12	11
2003	SP	120	1,563	282	3.89	13.00	0.71	15	18
2004	SP	119	1,024	119	2.50	8.60	0.61	21	20
2005	SP	120	897	146	2.43	7.50	0.63	22	22
2006	SP	80	562	114	1.94	7.02	0.61	24	23
2007	SP	120	1,429	251	3.22	11.91	0.70	18	19

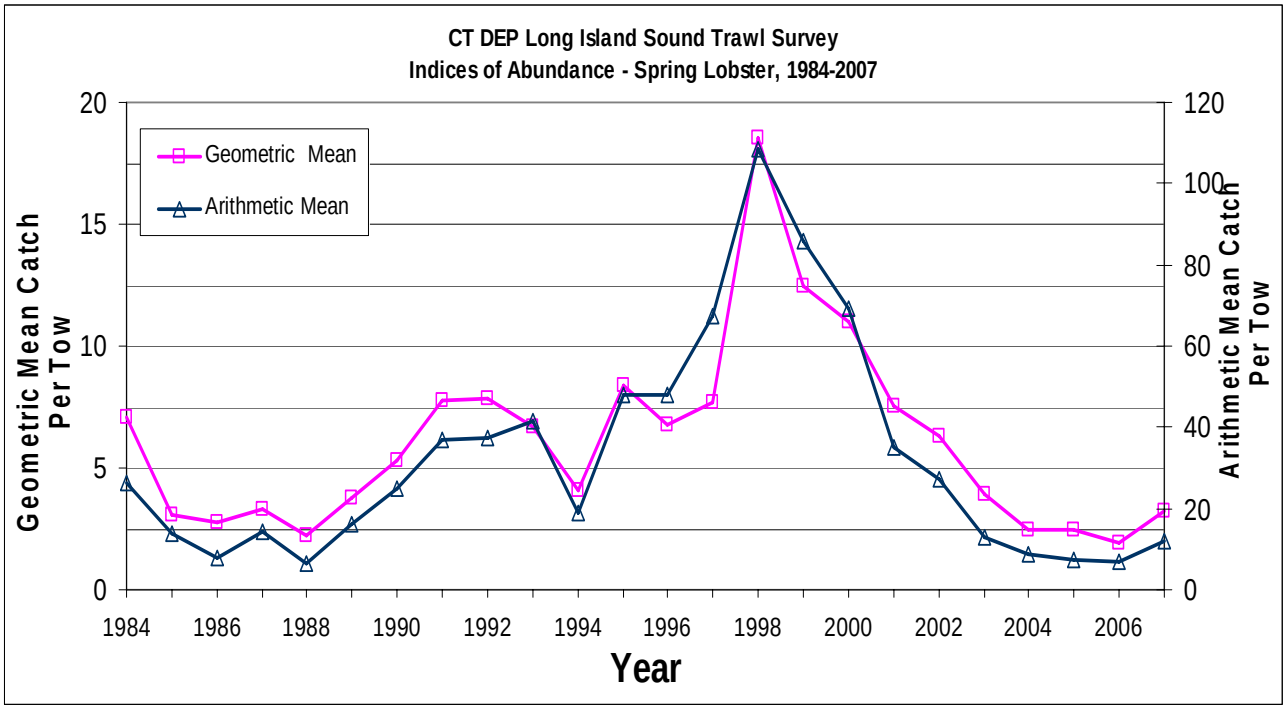


Figure 14: Long Island Sound Trawl Survey spring abundance indices for American lobster, 1984-2007. *The number of tows, total catch and percent of tows catching lobsters are shown above for each year.*

YEAR	MONTH	Number of Tows	Total Lobsters	Maximum Catch	Geometric Mean	Arithmetic Mean	% Tows with Lobsters	Geometric Rank	Arithmetic Rank
1984	FA	70	2,019	562	7.41	28.84	0.76	10	11
1985	FA	80	959	143	3.33	11.99	0.69	19	18
1986	FA	80	1,648	125	4.75	20.60	0.61	14	14
1987	FA	80	1,852	247	5.95	23.15	0.76	13	13
1988	FA	80	1,334	372	3.54	16.68	0.66	18	17
1989	FA	80	1,502	285	3.75	18.78	0.63	16	15
1990	FA	80	2,386	215	7.29	29.83	0.76	11	10
1991	FA	80	4,100	342	9.90	51.25	0.78	7	6
1992	FA	80	5,155	1,022	9.52	64.44	0.69	8	2
1993	FA	120	7,591	735	11.50	63.26	0.77	2	3
1994	FA	120	6,875	613	10.13	57.29	0.74	5	4
1995	FA	80	4,202	516	8.05	52.53	0.68	9	5
1996	FA	80	3,729	431	10.07	46.61	0.78	6	7
1997	FA	80	8,367	1,032	19.60	104.59	0.81	1	1
1998	FA	80	3,177	300	10.47	39.71	0.71	4	9
1999	FA	80	3,620	566	11.18	45.25	0.79	3	8
2000	FA	80	2,160	223	6.83	27.00	0.73	12	12
2001	FA	80	1,413	127	4.28	17.66	0.58	15	16
2002	FA	80	601	68	2.68	7.51	0.59	21	21
2003	FA	40	396	126	3.03	9.89	0.63	20	20
2004	FA	80	818	87	3.68	10.23	0.66	17	19
2005	FA	80	492	49	2.10	6.15	0.55	22	22
2006	FA	40	186	43	1.48	4.65	0.53	23	23

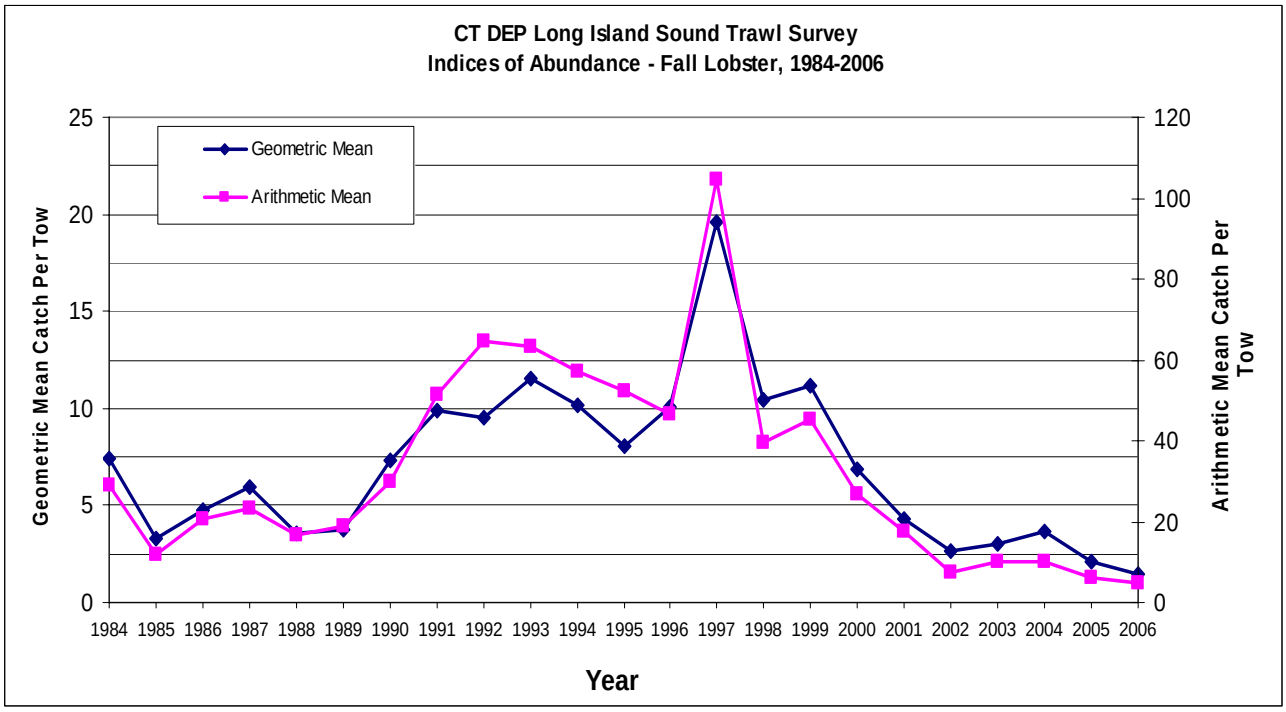


Figure 15: Long Island Sound Trawl Survey fall abundance indices for American lobster, 1984-2006. *The number of tows, total catch and percent of tows catching lobsters are shown above for each year*

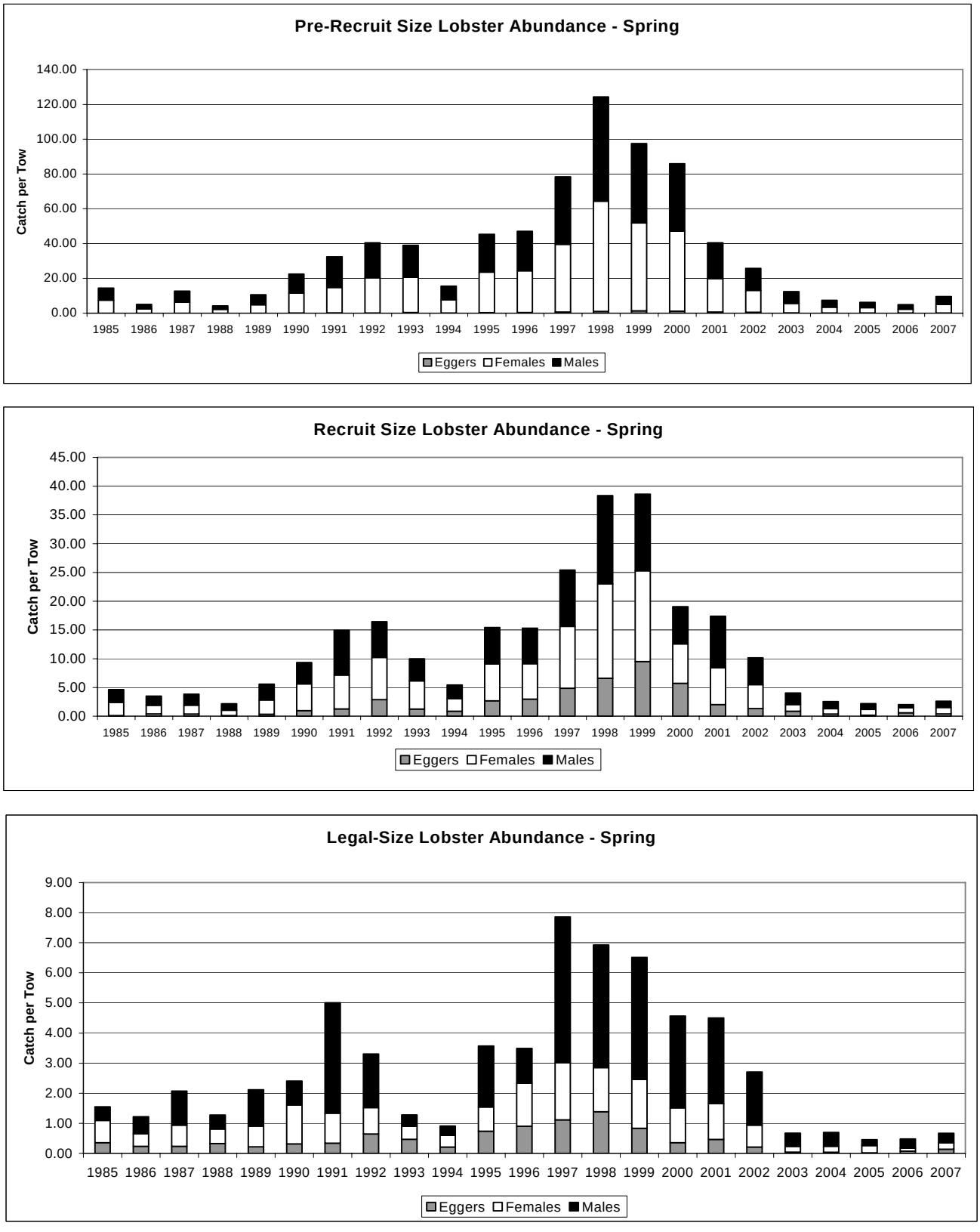


Figure 16: Spring LIS Trawl Survey lobster catch by size class and gender/ egg-bearing status, 1985-2007. *Values given are delta mean catch per standard tow for all spring survey tows (April-June) taken over mud or transition bottom types (sand sites omitted). See Table 3 for a listing of the data.*

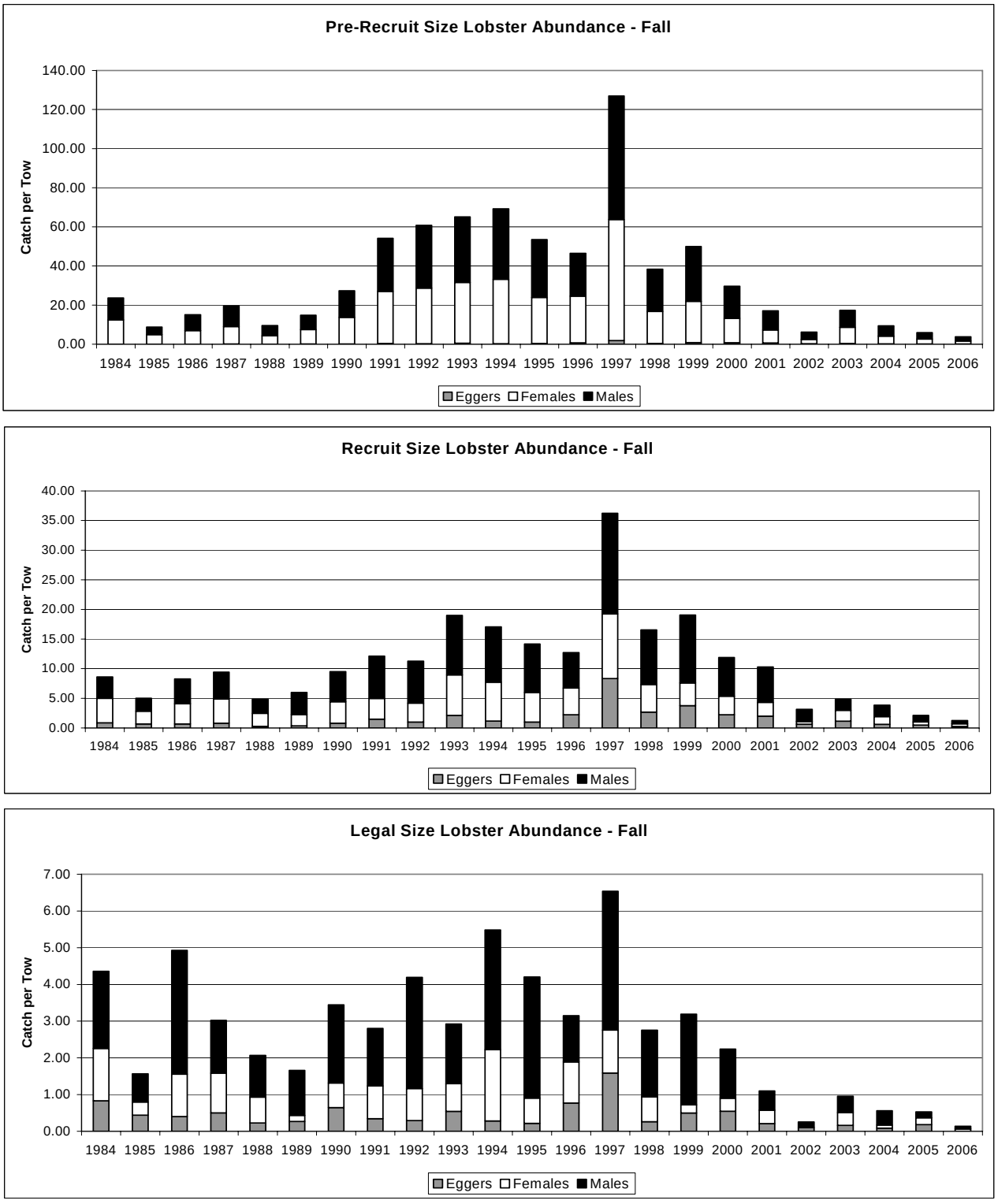


Figure 17: Fall LIS Trawl Survey lobster catch by size class and gender/ egg-bearing status, 1984-2006. *Values given are delta mean catch per standard tow for all fall survey tows (September-October) taken over mud or transition bottom types (sand sites omitted). See Table 3 for a listing of the data. Note that the 2003 means include catches taken in September and November (overall geometric mean = 4.71) unlike the geometric mean given Figure 11 that includes only September data.*

Year	Annual Production	Rank
1983	75.41	16
1984	33.86	22
1985	1064.00	1
1986	46.46	20
1987	120.51	11
1988	419.85	3
1989	59.43	19
1990	184.19	6
1991	93.67	14
1992	149.76	9
1993	250.19	5
1994	592.06	2
1995	183.34	7
1996	94.38	13
1997	107.77	12
1998	45.57	21
1999	403.53	4
2000	131.01	10
2001	68.86	17
2002	15.03	24
2003	18.70	23
2004	64.60	18
2005	78.52	15
2006	9.06	25
2007	161.52	8

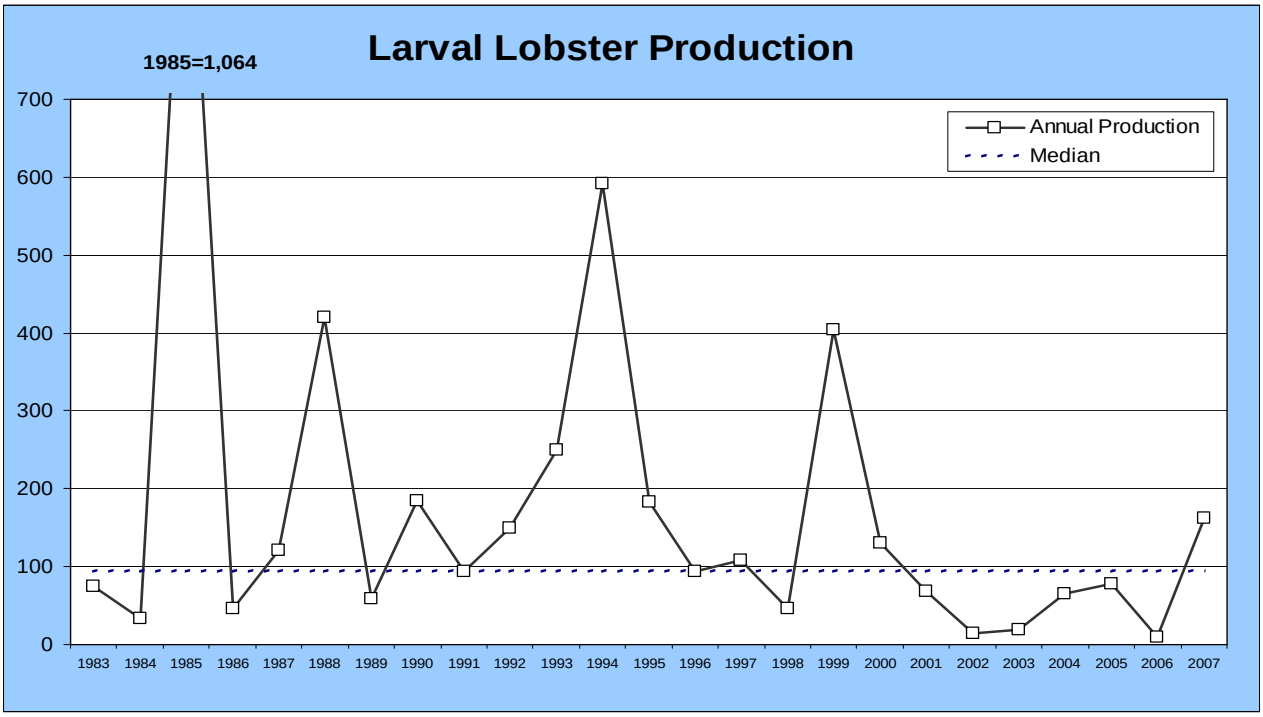


Figure 18: Annual lobster larval production (Stage IV) in western Long Island Sound, 1983-2007. *Annual production is the sum of the year's weekly densities.*

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