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Final Project Report

April 1, 2005 to March 31, 2010

Connecticut Lobster (*Homarus americanus*) Population Studies

JOB 1: Fishery Dependent Monitoring

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.

Methods

Commercial lobster fishery sea-sampling trips (24 trips annually) are scheduled seasonally to be proportional to the average landings from 2001-2004 and are equally divided among the three basins of the Sound (eastern, central, western); (Figure 1.1). Carapace lengths (CL) for all lobsters are measured 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 (Figure 1.2).

Modifications

None

Objective 2

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

Methods

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 2008 estimates are compared with monthly averages for a period of high abundance (1995-1999) and for a period of declining abundance (2000-2007). Commercial catch from Connecticut waters of Long Island Sound and total landings recorded for Connecticut ports are also given for 2009. Totals include all license types including landing permits.

Trends in fishing effort are examined using three annual measures. The number of licenses issued is tallied for resident and nonresident commercial license holders from 1979 through 2009. Total trap hauls are tallied for resident and nonresident commercial license holders and total traps fished were

computed from 1979 through 2008 (Figure 1.3). Data from 2009 continue to be entered and quality analysis / quality control procedures performed for data accuracy. These data were not available for analysis at the time this report was compiled.

Modifications

Trends in fishing effort were examined for Connecticut state waters from 1979 through 2009. The same measures of effort used in basin analyses were examined: trap hauls, catch and catch per unit effort; as well as the number of active licenses in each area and the total number of trips taken.

Results and Discussion

From 2005 to 2009, up to 30 sea-sampling trips were made annually with anywhere from 6,615 (2005) to 13,720 (2009) lobsters measured annually (Table 1.1). Though efforts were made to achieve the scheduled number of trips during each season, noncooperation among some license holders and low fishing effort resulted in fewer sampling trips completed in 2005 and 2006.

Long Island Sound Fishery Participation and Performance

The years 2005 to 2009 saw the lowest number of lobster licenses issued by the state since 1979, falling from 277 to 220 resident commercial lobster licenses over the period (Figure 1.3). The reported number of annual trap hauls made in Long Island Sound also fell to the lowest value in the time series in 2008, the last year of available data (Figure 1.3). Likewise, the calculated number of traps actively fished by CT resident license holders in 2008 fell to 56,355, which is not only the lowest value in the available time series (1984-2008) but is 31% lower than 2007 (81,792; Figure 1.3) and 65% lower than the highest value recorded in 1999 (162,149 traps).

While Connecticut landings peaked at 3.72 million pounds in 1998, the total reported landings at all Connecticut ports in 2009 (from all commercial gears) were a record low 436,081 lbs (Figure 1.4). The total reported landings in CT for 2008 were 427,168 though fishermen participating in the Connecticut Cooperative Lobster Restoration V-Notch Program released 25,193 harvestable lobsters. Those lobsters v-notched and released in 2008 weighed an estimated 30,232 lbs (1.2 lbs / lobster), which would have put CT's 2008 landings at a total of 457,400 lbs.

Lobster landings in the eastern basin of LIS fell slightly from 2008 to 2009 while landings increased in the central and western basins by 15% and 17% respectively. Though the eastern basin showed a slight decline, landings from this area accounted for 65% of the state-wide landings (Figure 1.5). Landings from the eastern basin in 2009 were 40% of the average from this area from 1984 – 2008 (688,093 lbs) and were a record low in the time series. Landings from the central basin rose to 51,385 lbs in 2009, a 15% increase from 2008, but is just 13% of the average landings from this basin between 1984 and 2008 (382,825 lbs). Landings from the western basin steadily declined from 1998 to 2005 and have fluctuated since 2005 with 103,289 lbs landed in 2009. This level of landings is 14% of the average landings from this area seen between 1984 and 2008 (729,086 lbs).

Connecticut Waters Only

Monthly catch, effort (trap-hauls) and catch per-unit-effort (cpue) from Connecticut waters were analyzed (Figure 1.6 A-C). The summer (June - August) run in 2008 peaked at very low levels in July (75,924 lbs), while the fall run (November and December) was essentially absent. Catch per unit effort in 2008 mimicked levels seen in 2007, with the average catch per unit effort being 0.3 lbs per pot for the year with the highest catch rate occurring in July at 0.5 lbs per pot. There were a total of

715,462 trap hauls in Connecticut waters in 2008, which is 69% of the total trap hauls made in 2007 (1,042,846) and just 45% of the average number of trap hauls made in the years following the die-off of 1999, 2000 – 2007 (mean = 1,584,887 trap hauls).

To determine the level of effort exerted by the resident commercial pot fishery in Connecticut state waters from 1979 to 2007, the number of active resident licenses, of the total issued each year, was determined. For example, in 2007 there were 161 out of a total of 251(64%) resident license holders who reported fishing activity in state waters (Figure 1.7). Additionally, the number of trips taken in state waters, catch totals from those trips, number of trap hauls and geometric mean catch per trap haul in state waters from 1979 to 2007. The geometric mean was used to address the variability in catch per unit effort in calculated values derived from daily trip reports.

Analysis of variance was completed using a general linear model (GLM Procedure least squares means, SAS V9.1) applied to three time periods (1981-1989, 1990-1998 and 1999-2007) to examine the pattern of change in cpue among the three logbook areas. Results showed that cpue changed significantly in all three areas over the three time periods ($p<0.001$, $f= 3.63$ area 1; $p<0.04$, $f=3.63$ area 2; and $p<0.001$, $f=3.63$ for area 3), and that the pattern of change in the east (area 1) was significantly different ($p=0.004$) than the change in the west (area 3). The details for each area are given below.

Connecticut Logbook Area 1

Eighty license holders reported fishing in the waters of logbook area 1 (east) in 2007. These license holders took a total of 2,854 trips in this area and made a total of 255,776 trap hauls (Figures 1.8 and 1.9). This level of effort represents a 23% decline in trap hauls compared to average levels for 1979-2006 and a 42% drop compared to average levels for 1990-2000, a period of time when catches of lobster increased steadily in this area (Figure 1.10). Catches in CT logbook area 1 peaked in 1998 at 428,817 pounds and have historically (1979-1999) accounted for an average of 17% of the total state-wide catch. Since 2000, catches from the east have accounted for an average of 27% of the state-wide landings, as the state-wide total declined more in the central and western basins than it declined in the eastern basin. In 2007, the catch from area 1 was 39% lower than the 1979-2006 average and 58% lower than the average catch from 1990-2000.

The geometric mean catch per trap haul (cpue) from this area has ranged from 0.4 to 0.8 over the 29-year time series, with a mean of 0.46 in 2007 (Figure 1.11). At the onset of the time-series (1979), eastern Connecticut waters yielded the lowest cpue compared to that of the central and western state waters. Eastern waters saw a gradual increase in cpue beginning in 1989, peaking at 0.81 in 1997. Since 2004, area 1 has reported the greatest mean annual cpue of the three areas.

Connecticut Logbook Area 2

There were 43 active license holders who fished the waters of logbook area 2 (central) in 2007. These license holders took a total of 1,546 trips in this area and made a total of 217,261 trap hauls (Figures 1.8 and 1.9). This level of effort represents a 53% decline in trap hauls compared to average levels from 1979-2006 and a 63% drop compared to average levels for 1990-2000, a period of time when catches of lobster increased steadily in this area (Figure 1.10). Catches in CT logbook area 2 peaked in 1998 at 803,296 pounds, and have historically (1979-1999) accounted for an average of 30% of the total state-wide catch. Since 2000, catches from the central waters have accounted for an average of 37% of the state-wide catch. Though this area has shown an increase in the percent of the average catch it contributes to the total, in recent years (2003 to 2007), catches are lower than those seen prior

to 2002, totaling just 100,814 pounds in 2007. The 2007 catch from area 2 is 74% lower than the 1979-2006 average from this area and 82% lower than the average catch from 1990-2000.

The geometric mean catch per trap haul (cpue) from this area has ranged from 0.4 to 0.9 over the 29-year time series. Beginning in 1979 annual cpue showed small increases and decreases, holding steady at 0.45 from 2003 to 2006, before falling to the lowest level seen for this area (0.39) in 2007 (Figure 1.11).

Connecticut Logbook Area 3

There were 35 active license holders who fished the waters of logbook area 3 (west) in 2007. These license holders took a total of 1,383 trips in this area and made a total of 386,812 trap hauls (Figures 1.8 and 1.9). This level of effort represents a 45% decline in trap hauls compared to average levels from 1979-2006 and a 61% drop compared to the average for 1990-2000, a period of time when catches of lobster increased steadily in this area (Figure 1.10). Catches in CT logbook area 3 peaked in 1998 at 1,698,903 pounds. Catches from area 3 have historically (1979-1999) accounted for an average of 53% of the state-wide catch. Since 2000, catches from the western waters of Connecticut have accounted for an average of 35% of the state-wide catch. The catch from area 3 has been less than 260,000 pounds since 2002 and fell to just 109,568 pounds in 2007, the lowest catch from this area since 1979. The 2007 catch represents an 83% decline from the 1979-2006 average, and a 90% decline from average catches seen from 1990-2000.

The geometric mean catch per trap haul (cpue) from this area has ranged from 0.3 to 1.1 over the 29-year time series, with the lowest value of 0.30 occurring in 2007 (Figure 1.11). At the onset of the time-series (1979), western Connecticut waters yielded the highest cpue compared to that of the central and eastern state waters. Western waters saw a gradual increase in cpue beginning in 1985, peaking at 1.1 in 1997 and has seen significant changes ($p<0.0001$) in the mean catch per unit effort over time, when examined across three time periods, 1981-1989, 1990-1998 and 1999-2007. Since 2000, area 3 has had the lowest mean catch per unit effort (≤ 0.45) in Connecticut waters.

Length Frequency in the Commercial Catch from Long Island Sound

Length frequencies for the Connecticut commercial catch observed during sea-sampling trips taken from 1984 through 2009 were calculated (Figure 1.12) in order to discern changes in the length composition of the observed catch over 26 years of monitoring. Changes observed are likely the response to management measures which increased the minimum legal length and escape vent size requirements over the given time frames. The average length frequencies for four time periods were calculated: 1984 – 1988 (minimum legal length = 80.9 mm or 3 3/16” CL); 1989-1999 (minimum legal length = 81.8 mm or 3 7/32” in 1989 and increased to 82.6 mm or 3 ¼” CL in 1991); 2000-2006 (minimum legal length increased to 83.3 mm or 3 9/32” CL in August 2005), 2007-2009 (minimum legal length increased to 84.1 mm or 3 5/16” CL in July 2006 and instituted a maximum carapace length of 133.4 mm or 5 1/4" CL on July 01, 2008). The most recent increase in minimum length became effective January 01, 2010, increasing the minimum size to 85.7 mm or 3 3/8” (Table 1.2). The escape vent requirement from 1984 through 1994 was for one horizontal or rectangular opening at least 1 ¾” by 6” or two circular vents at least 2 ¼” in diameter. The escape vent requirement increased to at least 1 7/8” by 5 ¾” horizontal or rectangular or two circular openings at least 2 3/8” in diameter on January 1, 1995 and were in place until May 1, 1998 when the horizontal or rectangular opening increased to at least 1 5/16” by 5 ¾” or two circular openings at least 2 7/16”. Coincident with the most recent increase in minimum legal length, the escape vent regulations in CT

waters changed to a rectangular opening at least 2" by 5 ¾" or two 2 5/8" circular escape vents. The time period of 2000 through 2006 was chosen to examine changes in the catch that may have occurred due to changes in the population structure in Long Island Sound following the large scale die-off of 1999.

For all time periods examined, the length intervals with the highest frequencies occur just below the minimum legal size for the time period to which they correspond, indicating that the majority of the lobsters observed were one molt (up to 6 mm increment) away from reaching harvestable size. The length interval one increment below legal size from 1984 - 1988 was between 74.0 and 79.9 mm with 48.9% of the animals observed falling within these lengths. The length intervals below legal size from 1989 – 1999 was between 76.0 and 81.9 mm with 48.3% of the animals observed between these lengths. The length intervals below legal size from 2000–2006 was between 77.0 and 82.9 mm with 41.2% of the animals observed falling within these lengths. The length interval below legal size from 2007 – 2009 was between 78.0 and 83.9 mm with 44.3% of the animals observed falling within these lengths.

Length frequencies were broken down for the same four time periods by sex (male and female) and by basin (eastern, central and western) of Long Island Sound (Figures 1.13 – 1.16). The shift in the length frequencies in response to increases in the minimum legal length over the 26-year time period was observed for both males and females (including egg-bearing females) in all three basins. Additionally, a closer look at the composition of the legal-sized catch by basin was attained by calculating the length frequencies of the male and female catches for the group of animals one molt increment above the previous minimum legal length (84.1 mm or 3 5/16" CL – 89.9mm, equivalent to a 6 mm molt increment) and also for the group greater than or equal to 90.0 mm CL.

Eastern Long Island Sound

Analysis of the catch composition one increment below legal size in the eastern basin from 1984 - 1988 (74 - 79 mm) showed that 47.6% of the observed males and 45.0% of the observed females fell within this interval. The average percent of the observed male catch measuring one increment below legal size from 1989 – 1999 and 2000 – 2006 (76 - 81 mm) decreased to 42.0% and 25.6%, respectively while the average percent of the observed female catch was stable, with 48.4% and 42.0% (respectively) measuring within this interval. An increase in the average percent of females and males observed in the length interval one increment below minimum legal size occurred from 2007 - 2009 (78 - 83 mm) with 41.2% of the observed males and 50.2% of the observed females falling within this interval.

The percentage of marketable lobsters in the eastern basin increased from an average of 31.5% of the observed catch from 1984-1988 (range = 27.5% - 63.5%) to 36.9% from 2000 to 2008 (range = 31.5% - 46.3%). Due to limited sampling in 2006, meaningful percentages could not be calculated and data from the eastern basin are not included. From 2007 to 2009, an average of 40.4% of the observed catch was marketable in the eastern basin (Figures 1.17 and 1.18).

The female component (including egg-bearing females) of the observed legal sized catch from this area (1984 through 2009) was examined. Of the animals meeting the minimum legal size requirements for this time frame, the majority (74.0%) of the legal sized catch occurred within one 5 mm length interval (84.0 – 89.9) between 1986 and 2002. In this time period, an average of 26.0% of the remaining legal size catch measured 90.0 mm or greater (Figure 1.14). Between 2003 and 2009, a small increase in the number of animals falling within that interval (84.0 and 89.9 mm) was observed, with an average of 79.4% just above minimum legal length and 20.6% on average, measuring 90.0

mm or greater. The composition of the male harvest in the eastern basin has remained more constant, on a percentage basis, in the distribution across legal lengths. From 1986 through 2002, 65.7% of the male harvest fell within the 84.0 to 89.9 mm interval and the remaining 34.4% measured greater than 90.0 mm. Analyses of data collected from 2003 through 2009 show only a slight deviation in the percentage of animals in the 84.0 to 89.9 mm range, with 70.2% observed during the time period and the remaining 29.8% measuring greater than 90.0 mm CL (Figure 1.16).

Central Long Island Sound

Sea-sampling in the central basin began in 2000 and the nine year period for which length frequencies are available (2000 – 2009) were analyzed. The same shift in lengths in response to increases in the minimum legal length instituted in 2005 and 2006 was observed for both sexes in this basin (Figures 1.13 – 1.16). Analysis of the catch composition, by sex, one increment below legal size from 2000 - 2006 (76.0 – 81.9 mm) showed that 21.8% of the observed males and 35.5% of the observed females fell within this interval. This is similar to averages observed in recent years, with 27.1% of the observed males and 44.0% of the females observed from 2007 to 2009 measuring one length interval (78.0 – 83.9 mm) below the current minimum legal length.

From 2000 to 2008, on average, 36.5% of the observed catch was marketable in the central basin. This percentage has ranged from 19.9% (2006) to 46.6% which was recorded during the first year of sampling in this basin, 2000 (Figures 1.17 and 1.18).

The female component (including egg-bearing females) of the observed legal size catch from this area (2000 through 2009) was examined. Of the animals meeting the minimum legal size requirements for this period, 72.6% to 86.7% occurred within one 5 mm length interval (84.0 – 89.9), with 19.4% to 27.4% of the remaining legal size catch measuring 90.0mm or greater (Figure 1.14). The composition of the marketable male catch observed in the central basin has, since sampling began in this area in 2000, been more evenly distributed across the legal lengths observed. The male harvest within 84.0 – 89.9 mm CL has ranged from 48.3% to 60.3% while the larger lengths (90.0 mm +) have ranged between 39.7% and 52.7% of the harvest (Figure 1.16).

Western Long Island Sound

A large percentage of the observed catch in the western basin from 1984 - 1988 fell within the length interval one increment below legal size during this time period, with 48.6% of the males and 57.7% of the females measured with carapace lengths ranging from 74.0 – 79.9 mm. Analyses of the composition of observed animals within the length interval one increment below legal size from 1989 – 1999 and 2000 - 2006 (76.0 – 81.9 mm) yielded a smaller percentage of males just below minimum legal length (39.5% and 27.0% respectively) while the majority of females observed (52.1% and 42.9% respectively) fell within the interval. A similar catch composition was observed in the west in recent years, 2007-2009, with 33.4% of the observed males and 55.7% of the observed females falling within lengths one increment below legal size (78.0 – 83.9 mm) (Figures 1.13 – 1.16).

The largest measurement for male lobsters in the western basin shifted over the 26-year series, with the largest recorded male measuring 102 mm from 1984 - 1988, 106 mm from 1989 – 1999 and 108 - 110 mm from 2000 - 2009. This was not observed in the eastern basin for either sex. The largest female recorded in the western basin ranged from 106 to 107 mm over the 26-year time period. The percentage of marketable lobsters over the same time frame increased from an average of 21.9% of the observed catch from 1984-1988 (range = 18.1% - 27.5%) to 34.3% marketable from 1989 to 2005

(range = 22.7% - 67.7%). In recent years (2006 – 2009) the marketable catch averaged 31.7% (range = 24.0% to 41.4%) of the total animals observed in the western basin (Figures 1.17 and 1.18).

The female component (including egg-bearing females) of the observed legal size catch from this area (1984 through 2009) was examined. Of the animals meeting the minimum legal size requirements for this period, the majority (87.3%) of the legal size catch occurred within one 5mm length interval (84.0 – 89.9) between 1986 and 2002, with an average of 12.7% of the remaining legal size catch measuring 90.0 mm or greater (Figure 1.14). Between 2003 and 2009, a small shift occurred with an average of 80.6% of the legal catch occurring between 84.0 and 89.9 mm CL and the remaining legal size catch (19.4%) measuring over 90.0 mm. The composition of the marketable male catch observed in the western basin has also shifted to, on a percentage basis, a greater number of larger animals harvested (90.0 mm CL +). On average, between 1986 and 2002, 68.1% of the male harvest was animals measuring between 84.0 and 89.9 mm CL with the remaining 31.9% measuring greater than 90.0 mm. Analyses of data collected from 2003 through 2009 show that a smaller percent (55.0%) of the harvested males fell within that 5mm interval (84.0 – 89.9) with 45.1% measuring greater than 90.0 mm CL (Figure 1.16).

Changes in Sublegal to Legal Abundance Ratios

To further examine changes in population size structure, all lobsters measured from the commercial catch were grouped into sublegal sizes (70-82.5mm CL) and legal sizes (> 84mm CL) by sex and basin (Figure 1.19). The interim size (82.6-84.0mm CL) was eliminated because those lobsters were legal at the beginning of the time series but sublegal after 2005-2006 gauge increases. The minimum escape vent size also increased in 1994 and 1997, but remained unchanged from 1998 to 2009. From 1998-2009, the ratio of sublegal sizes (70-82.4mm) to sizes always fished (>84mm) declined from over 2:1 to less than 1:1 for both sexes in the eastern basin and males in the western basin; ratios for females in the western basin also declined substantially but remained slightly higher (1.25) in 2009 (Figure 1.20). Ratios for both sexes in central basin also declined to less than 1:1 since sampling began in 2000 through 2009. A population where older animals, whose abundance has already been reduced by fishing, outnumber younger animals not yet exposed to fishing is not stable and will very likely show substantial declines in total abundance in future years.

Sex Ratio and Percent Egg-Bearing Females in the Commercial Catch from Long Island Sound

A complete fishing prohibition on ovigerous females has historically been the core regulatory approach to ensure sustainable reproduction for all American lobster stocks. However, the long term consequences of this additional layer of protection for only the female portion of the population are not well understood. Since severe skews in the sex ratio in favor of either sex have the potential of disrupting each population's reproductive success, sex ratios by basin are detailed in this report. In order to minimize seasonal differences in availability and make data comparable among years, only catches from sea-sampling trips made during July-October were examined.

Eastern Long Island Sound

For animals observed between July and October from 1984 - 2009, the sex ratio of the observed catch in the eastern basin ranged from 62.0% female to 84.9% female (Figure 1.21). Catches in the eastern basin in 2009 were comprised of 77.7% females, which is above the average (75.1%) observed in this area over the time period (1984-2008, note insufficient sampling occurred in the eastern basin in 2006). The percentage of females observed in years before the die-off (1984-1999, average=73.6%)

is lower than what has been observed in subsequent years (2000-2009, average= 78.1%). The percentage of females that were egg-bearing (Figure 1.22) in the east (July-October) also increased following the die-off in 1999 (2000-2009 average = 16.8% note insufficient sampling occurred in the eastern basin in 2006). Though it is important to note that the percentage of females observed from 2007 through 2009 (7.8%, 11.1% and 9.5% respectively) reflect the lowest numbers of egg-bearing females seen in this basin since 1995.

Central Long Island Sound

Sampling in the central basin in 2009 yielded catches that were 57.0% female which is above the average percentage of females seen in this area since sampling began there in 2000 (59.4%, 2000-2008). The percentage of females has ranged from 44.0% observed in 2003 to 68.7% observed in 2002 (Figure 1.21). Additionally, the numbers of females observed with eggs fell to 4.1% in 2008 and 4.7% in 2009. This is down from 33.5% and 22.7% observed in 2006 and 2007, respectively (Figure 1.22). The average percent of females carrying eggs in this area from 2000-2008 was 12.9% and ranged from 0.3% to 33.5% over the available time series.

Western Long Island Sound

Patterns in observed catches (July-October) in the western basin were variable over the time series, ranging from 21.9 to 81.2% of the catch being comprised of females. The percentage of females observed in 2008 (75.2%) and 2009 (75.0%) are above the average observed in this basin between 1984 and 1999, as well as across the time series (1984 through 2008), 64.1% and 60.5% respectively (Figure 1.21). This prevalence of females hadn't previously been observed in this area since 1999. The percentage of females that were egg-bearing in the observed commercial catch in fell to 6.4% in 2008 and 8.1% in 2009, which is below the average of 15.2% seen during 1984 and 1999 and is also below the average (12.1%) observed from 2000-2008 (Figure 1.22). It should be noted that the high prevalence of females in the observed catch varies by location within the western basin. Future analyses will be performed to examine the sex specific distributions within the basin.

Incidence of Shell Disease and Mortality in the Commercial Catch from Long Island Sound

Epizootic shell disease is an opportunistic but chronic disease contracted when environmental conditions favor both external bacterial growth that digest the minerals in a lobster's shell while chronically weakening the immune system of susceptible lobsters. Affected animals may be genetically predisposed to the disease but can rid themselves of diseased shells by molting. However, unless underlying stress conditions which made them vulnerable in the first place are ameliorated, these animals seem to become readily re-infected. And premature molting may cause undetected declines in reproductive success and egg survival. An increase in shell disease prevalence may be an indication of above normal stresses in the lobster populations. The bacterium *Aquimarina homaria* has been determined to be the proximal cause of shell lesions (Chistoserdov *et al.* 2005), but predisposing factors may include inadequate diet (bait only), temperature (rising global trends), contaminants (alkyl phenols and phosphates used in surfactants, pesticides, heavy metals), and low pH due to ocean acidification.

The occurrence of shell disease in the observed commercial catch has been most prominent in the eastern basin since first observed in 1992. Levels in the eastern basin have been elevated since 1999, ranging from 14.4% in 2008 to 35.5% in 2002, the highest rate of the disease documented in this area (Figure 1.23). The occurrence in 2009 dropped from the highs seen from 2002 to 2007 with 22% of

animals observed showing signs of the disease. Consistent with previous years, egg-bearing females showed the highest levels in occurrence and severity of disease, especially in the eastern basin where up to 92.1% of the observed egg-bearing females were afflicted with the disease in 2002 and more recently 68.5% in2009 (Figures 1.24 and 1.25). The highest incidence of diseased animals in the central basin previously occurred in 2002 with 6.9% of the animals showing signs of the disease. The incidence of shell disease rose in the central basin in 2009 with 7.8% of the observed animals affected. Occurrence rates in the western basin have remained extremely low (< 1.0%) with the highest rate documented (2.1% of the observed catch) in 1997.

The frequency of dead lobsters observed in commercial traps sound-wide remained at 0.1% (18 out of 13,720 observed) in 2009. The highest frequency of dead lobsters was observed in the eastern basin between June and August (13 dead of 2,092 observed). The 2009 mortality level is the same as that documented in 2008 (13 out of 12,797 observed) which had previously fallen from the 0.8% observed in 2007 (85 out of 10,552 observed). Mortality levels in previous years were all below 1% of the observed total catch. Note that frequencies had reached 2-3% in the central and western basins, respectively, in 2002.

Cull Rates in the Commercial Catch from Long Island Sound

The level of single or no-clawed animals (culls) in an area can be a general indicator of the health and social structure of the population. Crustaceans drop claws as a survival mechanism to escape predation and limit the severity of wounds resulting from competition between lobsters for food, territory, shelter or mating (Mariappan *et al.* 2000). Commercial fishing gear related injuries also contribute to claw loss and the overall cull rate in a population. Although autonomizing a claw has immediate survival value to the individual, there are long-term negative consequences. Culls have lower survivorship due to an increased difficulty in obtaining food and defending themselves (Atema and Cobb 1980, Lawton and Lavalli 1995). The ecological consequences of missing appendages in decapod crustaceans, including *Homarus americanus*, were examined by Juanes and Smith (1995). These authors concluded that reduced foraging activity led to changes in diet and loss of dimorphism of the chelipeds in some species, which had effects on growth and regeneration. Cheng and Chang (1993) observed reductions in the growth increment in American lobster with missing limbs, as high as 40%, depending on regeneration rates. Injured lobsters have also been observed to be less likely to successfully mate and, due to decreased social dominance, have more difficulty in locating and establishing shelters (O'Neill and Cobb 1979). Juanes and Smith (1995) also noted that wounded lobsters that were unsuccessful in defending their shelters experienced increased levels of predation and could be at a higher risk for infection or disease.

Cull rates in Long Island Sound have been stable since 1982, showing neither a decreasing or increasing trend despite the fact that fishery effort has changed dramatically over the 28-year time series. Cull rates for sublegal (≤ 84.0mm CL) and legal (≥ 84.1mm CL) sized lobsters in Long Island Sound were analyzed by basin (eastern, central, western) from July to October throughout the time series. It is important to note that cull rates for lobsters sampled in the eastern basin were not calculated for 2006 due to small sizes during the July through October period.

Sublegal

The cull rate for sublegal lobsters in the eastern basin (Figure 1.26) fell from 11.9% in 2008 to 9.1% of the observed sublegal catch observed in 2009. Cull rates for this size class in this area have ranged

from 6% (2007) to 21% (1994) over the 28-year time series and have been below the 1982-2008 average (12.8%) since 2000.

The cull rate for sublegal lobsters in the central basin increased (Figure 1.26) to 11.6% in 2009 from 8% observed in 2008. This is slightly higher than the average cull rate in this basin from 2000-2008 (10.9%) but remains in the range of 8% (2008) to 14% (2002) documented 2000-2008.

The cull rate for sublegal lobsters in the western basin was 12.7% of the observed sublegal catch in 2009 (Figure 1.26), the same percentage observed in 2008 and very similar to the average cull rate (12.3%) over the 27-year time series. Cull rates for this size class in the west have ranged from 7.8% (1993) to 16.9% (2004).

Legal

The cull rate for legal lobsters in the eastern basin (Figure 1.27) was 10.2% of all legal animals observed in 2009, similar to the 10.8% observed in 2008 and below the 28-year time-series average of 11.8%. Cull rates for this size class in this area have ranged from 8.5% (1985) to 17.8% (1992) of the legal catch over the 28-year time series.

The cull rate for legal lobsters in the central basin (Figure 1.27) increased to 15.6% of the legal animals in 2009 from 10.6% observed in 2008. Cull rates for this basin have averaged 14% since sampling began in this basin in 2000 and have ranged from 24.4% (2004) to 9.1% (2007).

The cull rate for legal lobsters in the western basin (Figure 1.27) increased slightly in 2009 to 16.2% of the observed legal animals from 14.8% in 2008. This is in line with the average rate of 16.2% observed between 1983 and 2008 in this area, where cull rates for legal animals have ranged from 5.0% (1992) to 24.6% (2005) over the 27-year time series.

JOB 2: Fishery Independent Monitoring

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).

Methods

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 2.1) 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 to the nearest 0.1 mm, 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 mean indices of abundance for lobster are calculated for each survey. 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 mm-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 m3) of Stage IV lobster larvae in western LIS.

Methods

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 2.2). 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 120 bottom trawl tows were completed during the spring (April through June) 2009 survey. The 2009 spring standard survey catch was 455 lobsters with a total weight of 132.4 kg. Biological data were recorded for 423 lobsters (Table 2.1). There were a total of eighteen tows in the spring 2008 survey (15%) that were less than 30 minutes in duration and their catches were expanded.

The spring 2009 abundance index (geometric mean = 1.39 lobsters/tow) decreased from 2008 and ranked 26th in the 26-year time series. The spring 2009 index represents the lowest value for lobster abundance, and marked a record low for total lobsters caught during the spring survey since its onset. Additionally, for the first time since the survey began, less than 50% of the tows taken had lobsters present (Figure 2.3).

A total of 80 bottom trawl tows were completed during the fall (September and October) 2009 survey. The 2009 fall standard survey catch was 384 lobsters with a total weight of 107.3 kg. Biological data were recorded for 352 lobsters (Table 2.1). There were a total of ten tows in the fall 2009 survey (12.5%) that were less than 30 minutes in duration and their catches were expanded.

The fall 2009 abundance index (geometric mean = 1.82 lobster/tow) decreased from 2008 and ranked 24^{th} in the 26-year time series. Since 2002, the fall survey has documented seven years of the lowest levels of lobster abundance in Long Island Sound since the survey began in 1984 (Figure 2.4).

Delta mean catch by sex and size class (Table 2.2 and Figures 2.5 and 2.6) indicated that the abundance of lobsters observed in the spring survey has been at low levels since 2003/2004 for each sex and size category (pre-recruit, recruit and legal) examined. Though the spring 2007 survey showed signs of improvement, particularly for pre-recruits, abundance fell in 2008 and the 2009 survey values were below the 25^{th} percentiles for each sex and size class.

Combining male and female pre-recruits as well as recruits and legals (to accommodate changes in the minimum legal size instituted in 2005-2006) shows that combined abundance for these size classes in the spring survey has been at or below the 25th percentiles for the time series (7.32 and 3.66 respectively) since 2004, with the exception of pre-recruit abundance in 2007.

The delta mean catch by sex and size class for the fall survey has also indicated abundance levels below the 25th percentiles for each category since 2004 for pre-recruits and recruits. Abundance of legal sized lobsters was first observed below the 25th percentile for non-eggbearing females in 1999 and then for all females and males in 2000 and 2001, respectively.

Combining sexes for the pre-recruit size class as well as recruits and legals for the fall survey also showed that combined abundance for these size classes in the fall survey has been at or below the 75th percentiles for the time series (49.1 and 15.8 respectively) since 2000, and has since fallen below the 25th percentiles for the time series (8.9 and 4.7 respectively) since 2005.

Length Frequencies of the Research Catch

Spring length frequencies of both females (Table 2.3) and males (Table 2.4) show an increase in abundance of smaller animals indicating recruitment of one or more strong year classes in 2007. Frequencies in 2005-2006 and 2008-2009 show a substantial decline in the smallest sizes. Larger females (>95mm) were absent in spring catches after 2003 although the frequency of larger males has been more consistent.

Fall length frequencies showed a sharp decline in legal-size females (Table 2.5) and males (Table 2.6) beginning in 2007. Large gaps in the frequency of sizes below legal size in 2007- 2009 catches of both sexes indicate that the improved recruitment seen in spring 2007 did not persist.

Spatial Shifts in the Research Catch

The distribution of lobsters captured in LISTS has changed over the 26-year time series. When catches in mud sites, which represent 76% of the total, are compared from 1984-2008 in 8- to 9-year intervals, there is a clear shift to the south away from near-shore areas in the central and western Sound into deep water in the central basin (Figure 2.7). In 1984-1991, the geometric mean catch at mud-bottom sites less than 30ft depth was comparable to the mean catch at mud sites greater than 90ft depth (14.2 versus 12.2 lobsters/tow); in 2000-2008, the mean catch at shallow mud sites was one-tenth the mean catch at deep mud sites (2.3 versus 22.5 lobsters/tow).

Incidence of Shell Disease in the Research Catch

Shell disease continues to be an eastern basin phenomenon with higher rates of occurrence and more severe levels of shell degradation in animals observed in this area. Due to the topography of the eastern basin and the spatial nature of the LISTS, the occurrence of shell disease in the research trawl catch is typically much lower than levels observed in the commercial pot catch.

Since documentation of the disease in the trawl survey began (1992) it has affected an average of 1.1% of the animals observed (5,137) across the spring and fall surveys through 2009. Higher occurrences of the disease were observed during the five year reporting period (2005-2009), with the highest annual percentage (3.3%) occurring in 2008 with the highest incidence recorded in the spring catch (3.4%).

The highest incidence of shell disease in the spring catches occurred in 2007 and 2008, with 2.5% (31 of 1,268) and 3.4% (28 of 828) respectively, of the animals observed showing signs of the disease.

The percentage of animals with shell disease in the spring catch has ranged from 0.2% to 2.5% from 2001 – 2009 with the highest percentage of diseased animals occurring in 2007 (2.5%). The incidence of the disease in the fall has ranged from 0 – 3.7% from 2001 – 2009 with the fall 2007 survey yielding the highest percentage of diseased animals (3.7%).

Cull Rates in the Research Catch

Cull rates were calculated for sublegal (≤ 84.0mm CL) and legal (≥ 84.1mm CL) sized lobsters captured in the spring and fall 2009 surveys. The cull rate for sublegal lobsters was 8.5% in both surveys, within the range of the 1991-2008 average for the spring and fall surveys (8.3% and 9.0% respectively). Since 2005, catches of legal-sized lobsters in the spring and fall surveys were not large enough to calculate meaningful percentages.

Larval Sampling

Annual larval production rates over the five year reporting period remained low. While 2006 was the lowest year of production on record, the 2007 production rate rose above the 27-year median for the first time since 2000 (Figure 2.8).

Weekly sampling began between weeks 21 and 23 (late May to early June) during 2005 to 2009 and ended during weeks 33 and 37 (late August to early September), two weeks after the last stage IV larvae were observed. Larval production for the entire time series was calculated annually, on average, across eight weeks (range 5 – 10 weeks). For all weeks where larvae were observed, three tows were completed at each of the seven stations, with an average of 284 tows made during each year of sampling. Stage IV larvae were first captured during weeks 23 and 26 and last captured during weeks 28 and 34. Peak concentrations of stage IV larvae occurred during weeks 25 and 30 (last week of June to mid July).

A total of 223 stage IV lobster larvae were collected from 14 sampling trips over a total of 294 tows performed in 2009.

JOB 3: Interstate Fisheries Management Participation

Objective 1

Participate on the Atlantic States Marine Fisheries Commission's Lobster Scientific Technical Committee and Stock Assessment Subcommittee. 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.

Methods

CT DEP staff participated in meetings of the ASMFC Lobster Technical Committee (TC) and Stock Assessment Subcommittee (SAS), which were convened several times per year from 2005 through 2010, and chaired the TC in 2006-2007. The purpose of these meetings was to complete two assessments of the three US lobster stocks. As part of the assessment process, staff examined model sensitivity to changes in natural mortality versus fishing mortality, collated length data from coast-wide sea sampling, and prepared a literature review of several aspects of lobster biology relevant to the assessment process. Assessment of the three lobster stocks (Gulf of Maine, Georges Bank, and Southern New England) was completed in August 2005 and March 2009 for outside peer review and presentation to the ASMFC Lobster Management Board.

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.

CT DEP staff provided 'model ready' data sets of LIS Trawl Survey lobster catches and commercial sea-sampling trips taken in 2005-2009. Staff also provided an analysis of the consistency of lobster abundance trends in trawl survey catches from ME, MA, RI, CT, and NJ state waters versus the National Marine Fisheries Service (NMFS) offshore trawl survey catches. Staff completed analyses of trends in relative fishing mortality (landings/abundance index) and relative abundance (landings/fishing mortality) and presented interim status reports for the three lobster stocks to the Management Board in years between the two full stock assessments.

CT DEP staff from several programs (Lobster Project, LISTS, Habitat Conservation and Enhancement, Water Quality) collaborated with Dr. James O'Donnell (UConn, Avery Point) in an analysis of temperature trends in Long Island Sound which was presented to the SAC as an 'environmental proxy' for trends in natural mortality for the southern New England lobster stock.

Modifications

None

Results and Discussion

During the 5-year reporting segment, staff participated in the completion of two assessments of the three US lobster stocks. Both assessments were reviewed by outside scientific peers and accepted as guidance documents by the ASMFC Lobster Management Board. In 2005, the assessment was based

on a catch-survey length-based model (CSA) which was used to generate stock size and total mortality for each stock for comparison with the F10 reference point used in previous stock assessments (ASMFC 2000). Fishing mortality was computed by subtracting an estimate of natural mortality from the total mortality value. Natural mortality was treated as a constant (M=0.15) for the northern two stocks, and biphasic for the Southern New England stock (M=0.15 for 1981-1997, M=0.15-0.9 for 1998-2003) in order to address the effects of lobster die-offs in Long Island Sound which began in 1998. Since no data were available to measure the exact increase in M following the die-off events, a wide range of values were used in the model, resulting in a range of status outcomes.

Because of uncertainty in natural mortality and growth, stock abundance and fishing mortality for each stock were also assessed in terms of relative trends above and below median values for a 22-year time period (1981-2003) for the northern two stocks, and a 20-year time period (1984-2003) for the Southern New England (SNE) stock. Total abundance for the SNE stock was measured by "blending" annual fall research trawl survey abundance indices generated by the states of Rhode Island and Connecticut, and the southern inshore strata of the NMFS trawl survey. Separate CSA model runs were completed using state or federal survey data and fishery catch data from the same survey area. Abundance estimates for the entire stock area were calculated by summing the resulting estimates for each survey area. Fishing mortality rate estimates for the entire stock area were obtained as abundance-weighted averages of the fishing mortality rate estimated for each survey area. This blending methodology, including the bootstrap procedure for estimating variances for the weighted averages, was the same method developed and used in the lobster stock assessment completed in 2000 (ASMFC 2000). Results showed that 3-year mean abundance values (2001-2003) for the northern two stocks were above their long-term median, and below their long-term median for fishing mortality; however the SNE stock was well below its long-term median in abundance, and at or slightly above its long-term median for fishing mortality. The TC concluded that the SNE stock was depleted in terms of its abundance even though fishing mortality was near the median value. Additionally, the TC recommended implementation of a coastwide logbook reporting program to improve collection of landings data for all three stocks.

Updated relative abundance and exploitation estimates for the three lobster stocks were presented to the ASMFC Lobster Management Board each year from 2004 to 2006. This approach was chosen because it avoided the necessity of estimating natural mortality, running the catch-survey model to calculate absolute fishing mortality (F) estimates, and required only the assembly of annual landings and trawl survey indices for each year. The SNE stock abundance estimate for 2004-2006 was 46% below the long-term (1984-2003) median value. The 2004-2006 average Relative Fishing mortality was 25% below the long-term median. The Georges Bank (GBK) stock showed a slight down turn in abundance in 2004-2005 compared to 1996-2003, however annual values for 2004 and 2005 were still approximately 40% above the long-term median. Landings increased in 2004-2005, and the resulting relative exploitation estimates approached the long-term median. The Gulf of Maine (GOM) stock showed a down turn in abundance in 2004 compared to 1996-2003, followed by an increase in 2005. Again, annual abundance values for 2004 and 2005 were well above the long-term median. The resulting relative exploitation estimates exceeded the long-term median in 2004, when landings increased and abundance decreased, but returned to a near-median value in 2005.

In 2007, Addendum 11 to Amendment 3 of the ASMFC Fisheries Management Plan was developed to implement management strategies to rebuild the SNE stock. The Addendum specified a consistent minimum harvest size of 85.7mm (3-3/8") carapace length (CL) for all states fishing the SNE stock by June 2008. CT DEP requested that the TC review an alternative rebuilding strategy centering on a

v-notch program as an equivalent measure to increasing the current minimum size. Although an increased minimum size was implemented in two steps through regulation changes in August 2005 (82.6 mm to 83.3mm CL) and July 2006 (83.3mm to 84.1mm CL), the industry sought an alternative to a further increase. A full proposal describing the v-notch program was written by DEP staff, reviewed by the TC, and approved by the Management Board in October 2006 for implementation in 2007-2009. With funding from the Connecticut legislature, participating Connecticut resident license holders were compensated for each legal non-eggbearing female they v-notched and released. The program also had a provision for notching non-eggbearing females one molt-size below the legal minimum size so that these animals could be handled prior to their summer molt. No lobsters were notched in the summer and fall when water temperatures exceeded the species' stress level of 20^0C. The cornerstone of the program was an industry initiative to employ students from the three state aquaculture schools to carry out the on-board notching. The goal of the program was to reduce the harvest removal rate by approximately 25%-35% from the 2001-2003 value which required releasing 57,740 legal females each year. Although the goal was exceeded in the first year of the program (59,213 legal female equivalents were notched May 2007-July 2008), the program was not fully funded the second year and only 9,061 legal female equivalents (15% of the target) were notched, for a program total of 68,274 legal female equivalents or 59% of the target to be released over both years. Because the target was not achieved, the CT and NY minimum size was increased to the standard 85.7mm CL in January 2010.

In 2008-2009, staff assisted in completing revised stock-specific growth and selection matrices which were used in a newly developed and much more flexible catch-at-length assessment model, named the University of Maine Model (UMM) after the institution whose faculty developed it. Model runs for GOM and SNE stocks demonstrated good statistical fit to empirical data while the fitting process for the GBK stock was more difficult due to a large disparity in trends for the two sexes in that stock. The sex ratio of that stock is largely skewed toward females (~80% from 2005 to 2007), for unknown reasons. However recruitment has remained high in GBK since 1998. Because of continuing uncertainty in the growth data, trends in a suite of non-model-based stock status indicators of mortality, abundance, and fishery performance were also examined using a "traffic light approach" (good, cautionary, bad) to assess stock status.

The 2009 assessment (ASMFC 2010) recommended revisions to the set of reference points used in the previous assessment (ASMFC 2006), establishing threshold and target levels of abundance (adult spawning stock) and effective exploitation (proportion of fishing removals of animals above a standardized size). Revised reference points include median and quartile reference abundance and exploitation rate thresholds and targets for sexes combined over the fixed time period of 1982-2003 in GOM and GBK and1984-2003 in SNE. The assessment further recommended that stock status be determined by comparing the average reference abundance and average exploitation rate for sexes combined during the most recent three years to stock-specific threshold and target values. Effective exploitation for all three stocks was determined to be below threshold levels, and for the two northern stocks (GBK and GOM) below target levels (Table 3.1). However, because the southern section of the GOM stock (NOAA area 514) and the entire SNE stock abundances were approaching their reference low threshold triggers, rebuilding strategies were outlined by the TC to overcome factors impeding the stock's ability to reproduce and grow. Staff completed analyses of increasing trends in bottom water temperature in Long Island Sound from 1988-2008 as a proxy measure for increased natural mortality in the SNE stock after 1997. Based on these analyses, model runs were made that incorporated natural mortality 50%-100% higher after 1997, and results better fit the observed data.

Predicted reference abundances generated from these modified model runs were well below median values.

The completed coastwide assessment document was reviewed and accepted by the ASMFC Management Board in May 2009 although the Peer Reviewer Panel (PRP) recommended more liberal abundance and exploitation targets in light of the consensus that natural mortality rates may continue to rise. At their August 2009 meeting, the Management Board tasked the TC with reconciling the biological reference points recommended by the TC with those recommended by the PRP. The TC was also asked to investigate analyses meeting short-term management objectives which encompass a range of recruitment assumptions. Additional recruitment data collection and synthesis will need to be completed to support these analyses. Both the TC and the PRP agreed that generating improved recruitment indices will be vital to maintaining healthy northern stocks and rebuilding the depleted SNE stock.

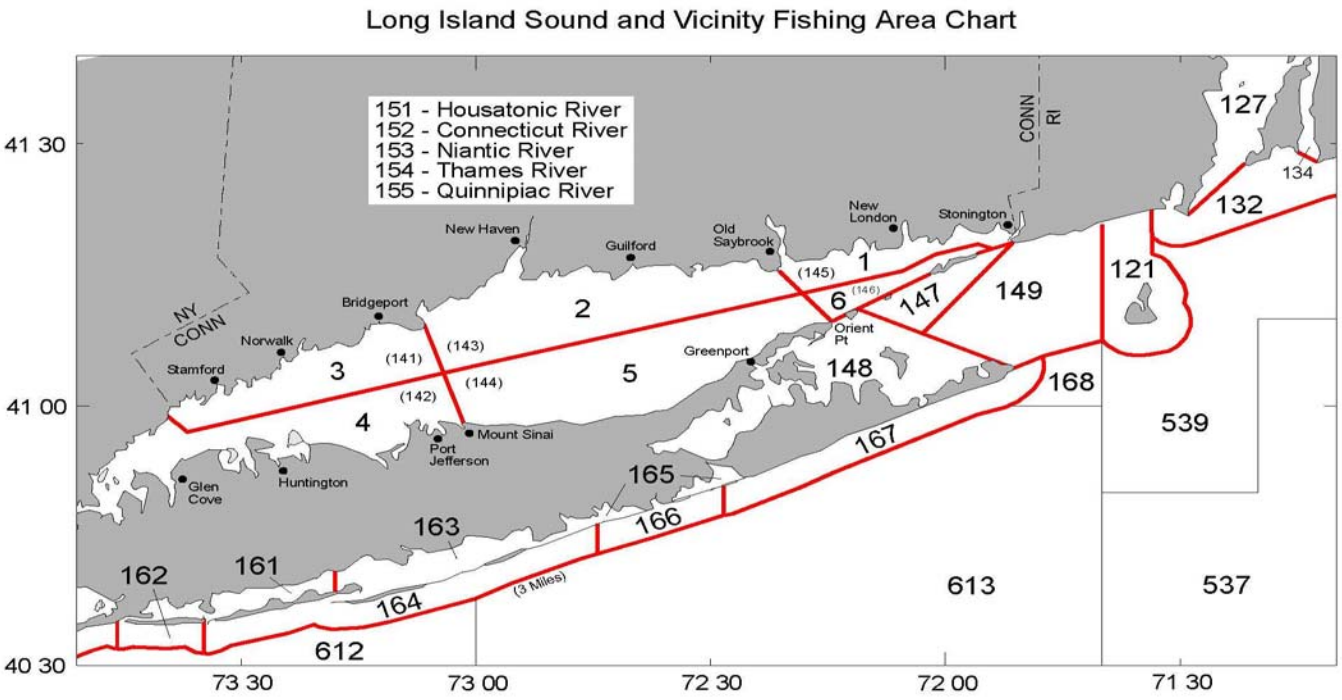


Figure 1.1 Logbook reporting areas for Connecticut commercial catch data. Eastern basin commercial sea sampling trips were made in reporting areas 1, 6, and 147. Central basin sampling trips were made in areas 2 and 5. Western basin trips were made in areas 3 and 4. Connecticut state waters include areas 1, 2 and 3 and the River systems in the state (151, 152, 153, 154 and 155).

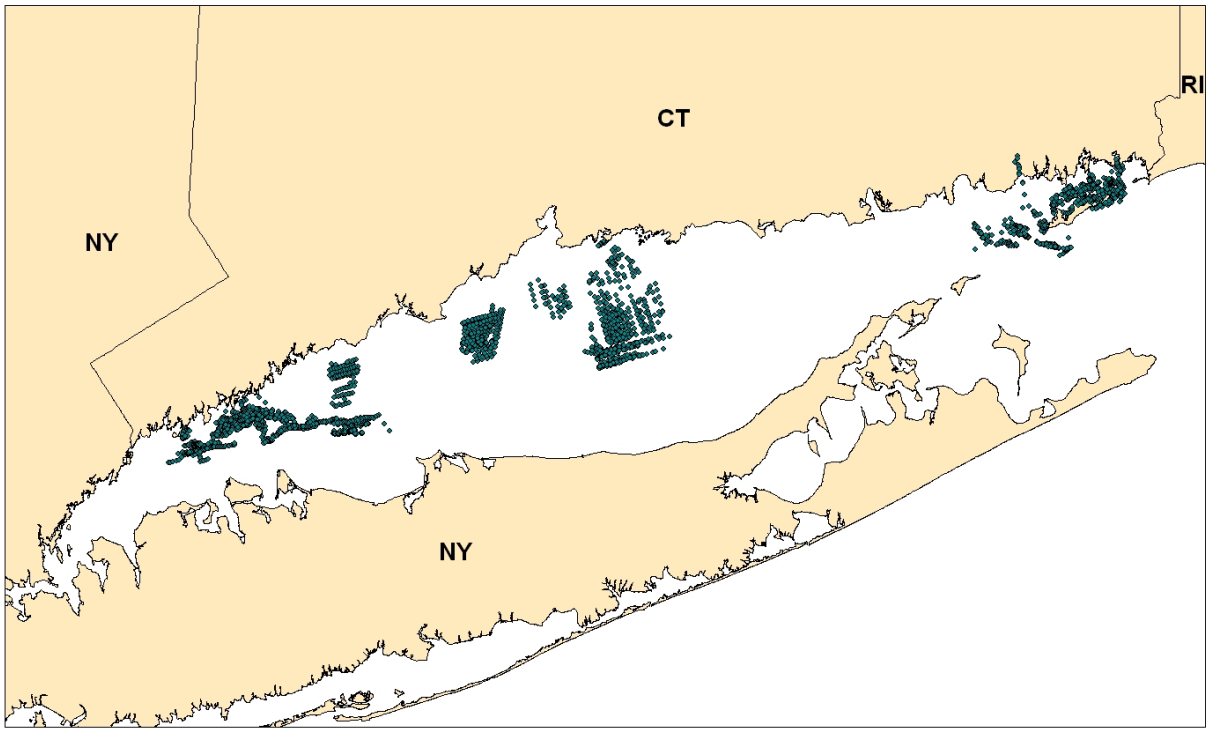


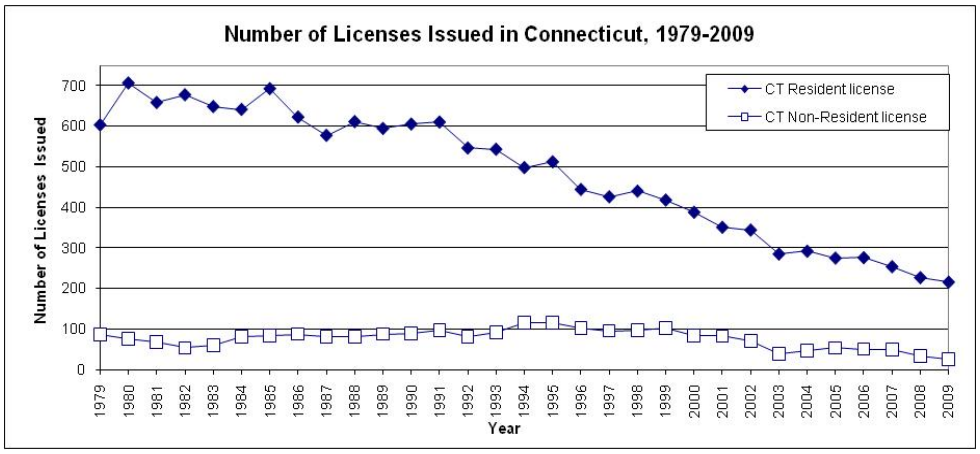
Figure 1.2 Locations of commercial lobster sea-sampling trips taken from CT ports, 2005 – 2009.

	Year										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Period 1: Jan - May	3	6	6	3	3	3	3	3	3	3	3
Scheduled Completed	6	16	19	11	10	3	3	8	8	10	4
Lobsters Measured	1,147	3,829	4,827	3,008	2,705	935	532	3,176	1,109	4,910	
Period 2: June - Aug	12	30	30	12	12	12	12	12	12	12	12
Scheduled Completed	17	29	30	20	14	10	10	17	12	13	4*
Lobsters Measured	8,600	17,163	15,057	8,541	5,399	3,122	6,696	4,770	9,147	5,729	
Period 3: Sept - Oct	3	6	6	3	3	3	3	3	3	3	3
Scheduled Completed	6	13	12	5	2	2	1	1	2	1	
Lobsters Measured	1,283	4,883	1,621	1,219	666	356	260	792	903	77	
Period 4: Nov - Dec	6	12	12	6	6	6	6	6	6	6	6
Scheduled Completed	7	15	16	5	5	4	6	4	3		
Lobsters Measured	1,521	4,851	5,477	2,290	1,262	2,202	4,044	1,630	1,638	3,004	
Total Scheduled	24	54	54	24	24	24	24	24	24	24	24
Total Completed	36	73	77	41	31	19	20	30	25	24	4
Total Lobsters Measured	12,551	30,726	26,982	15,058	10,032	6,615	11,532	10,368	12,797	13,720	0

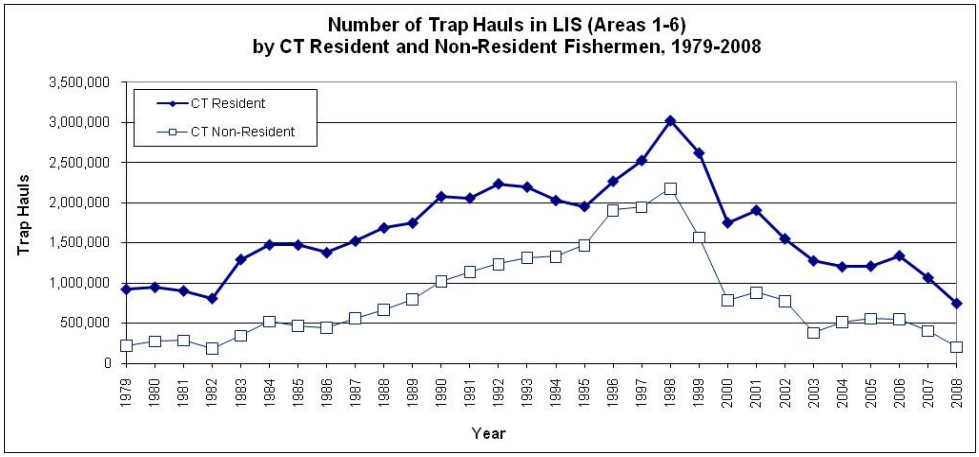
**does not reflect trips taken after June 18, 2010.*

Table 1. 1 Commercial sea sampling effort, trip achievements and lobsters observed from January 2000 through May 2010, by time period.

Year	number of licenses Issued Resident	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	345	70
2003	286	38
2004	293	46
2005	276	53
2006	277	50
2007	255	48
2008	228	34
2009	220	26



Year	number of trap hauls 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	786,688
2001	1,907,920	881,313
2002	1,553,256	777,311
2003	1,279,213	375,713
2004	1,204,880	515,445
2005	1,213,451	556,925
2006	1,342,571	549,482
2007	1,069,318	401,554
2008	750,688	201,116



Year	number of traps fished CT Resident
1984	66,709
1985	65,262
1986	65,826
1987	70,646
1988	79,154
1989	83,915
1990	100,360
1991	101,290
1992	107,668
1993	115,224
1994	110,805
1995	119,983
1996	130,360
1997	133,770
1998	158,527
1999	162,149
2000	122,386
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2003	85,048
2004	84,071
2005	83,946
2006	90,421
2007	81,792
2008	56,355

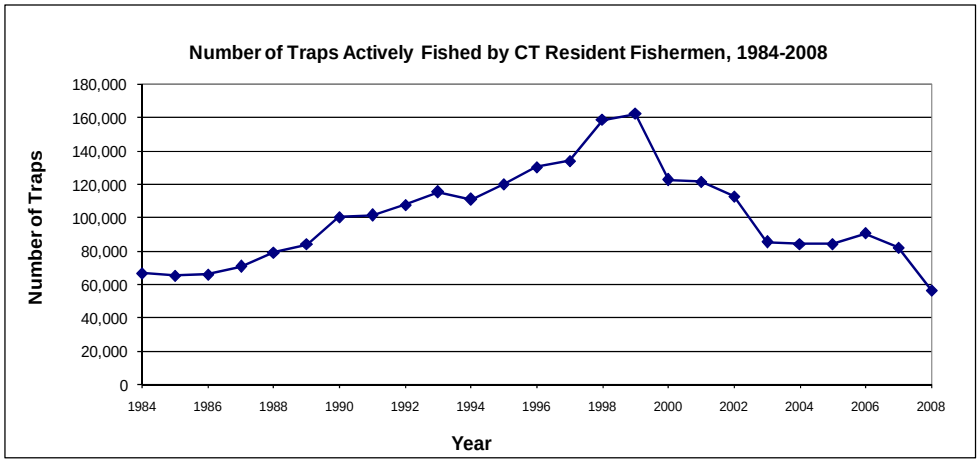


Figure 1.3 Trends in participation and effort for Connecticut license holders.

Year	CT Landings (Pounds)	Pounds of Legals V-Notched for Restoration Program	Total Value of Landings (Millions of Dollars)
1979	807,809		
1980	825,204		
1981	807,911		
1982	880,636		
1983	1,654,163		
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
2007	568,169	803	3.22
2008	427,168	30,232	
2009	436,081		

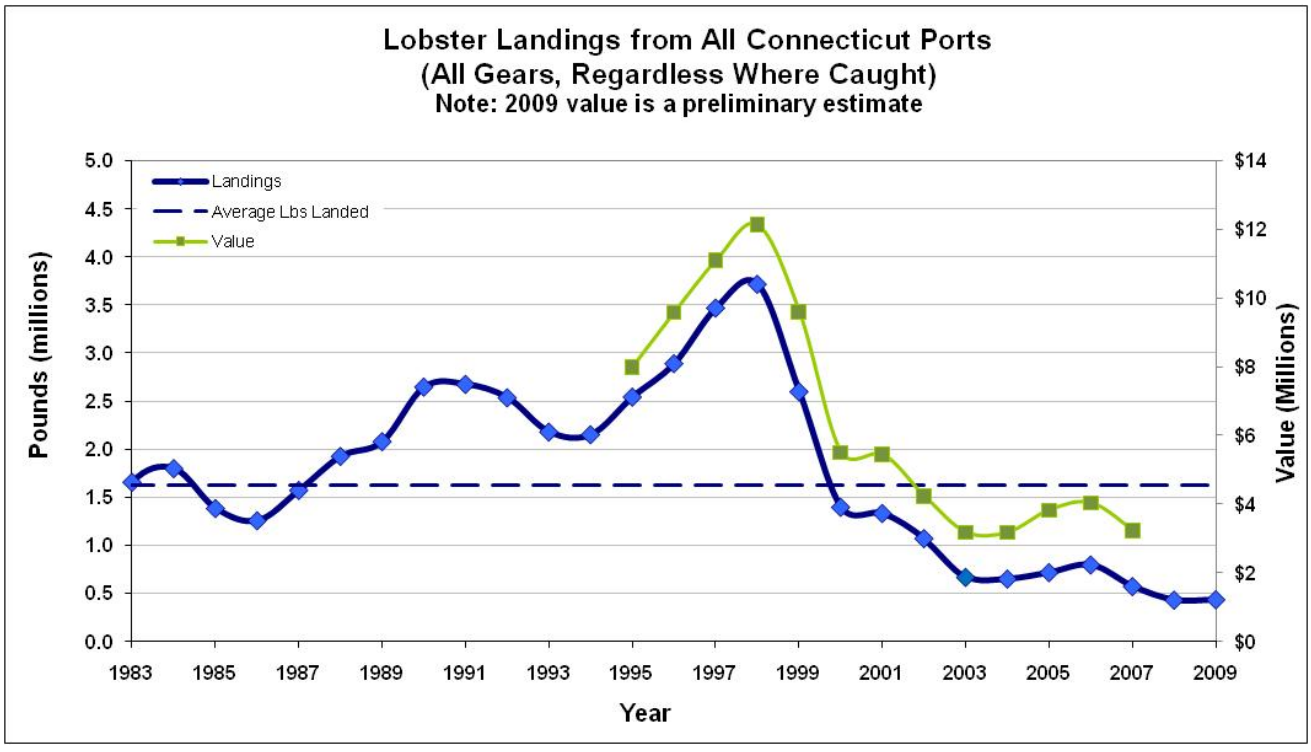


Figure 1.4 Lobster landings and landed value from all Connecticut ports, 1984-2009*. *The time-series average of 1,857,206 pounds is shown by the heavy dashed line. Value data for landings are available from 1995 – 2007.*Note: 2009 value is preliminary.*

Year	ELIS Landings	ELIS Pounds V-Notched	CLIS Landings	CLIS Pounds V-Notched	WLIS Landings	WLIS Pounds V-Notched	Total Landings
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
2007	347,719	694	96,805	81	123,645	28	568,169
2008	291,654	24,488	43,783	1,209	91,731	4,535	427,168
2009	281,407		51,385		103,289		436,081

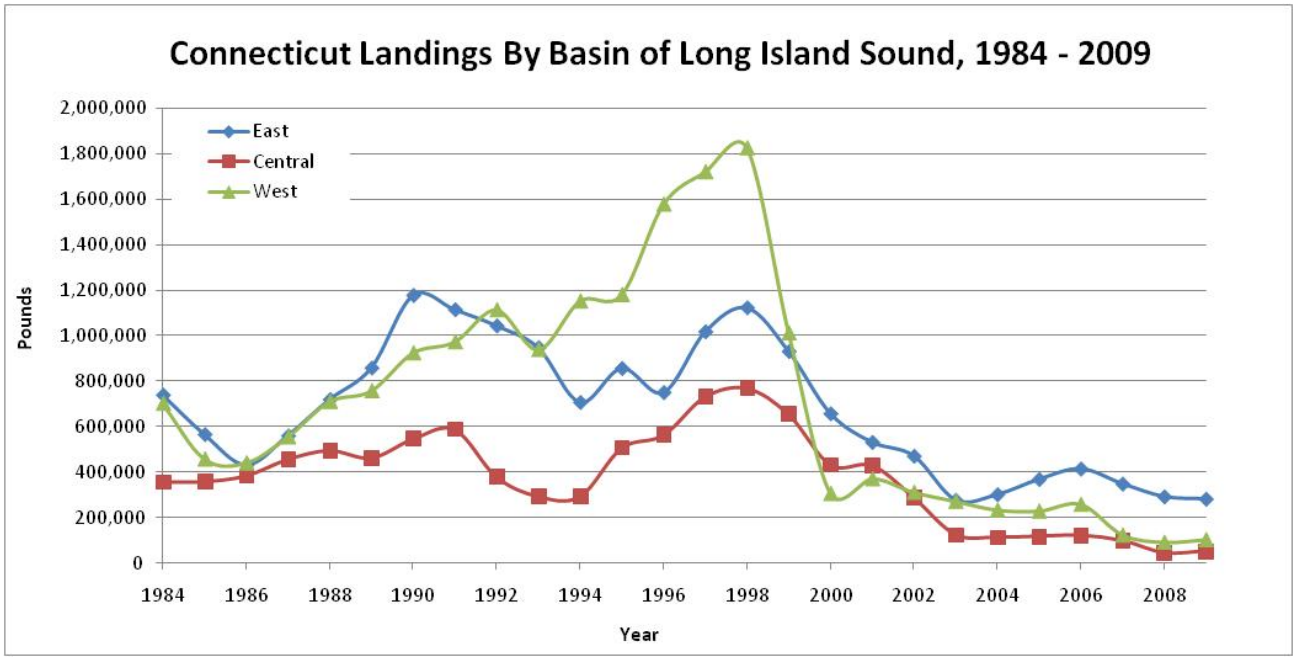
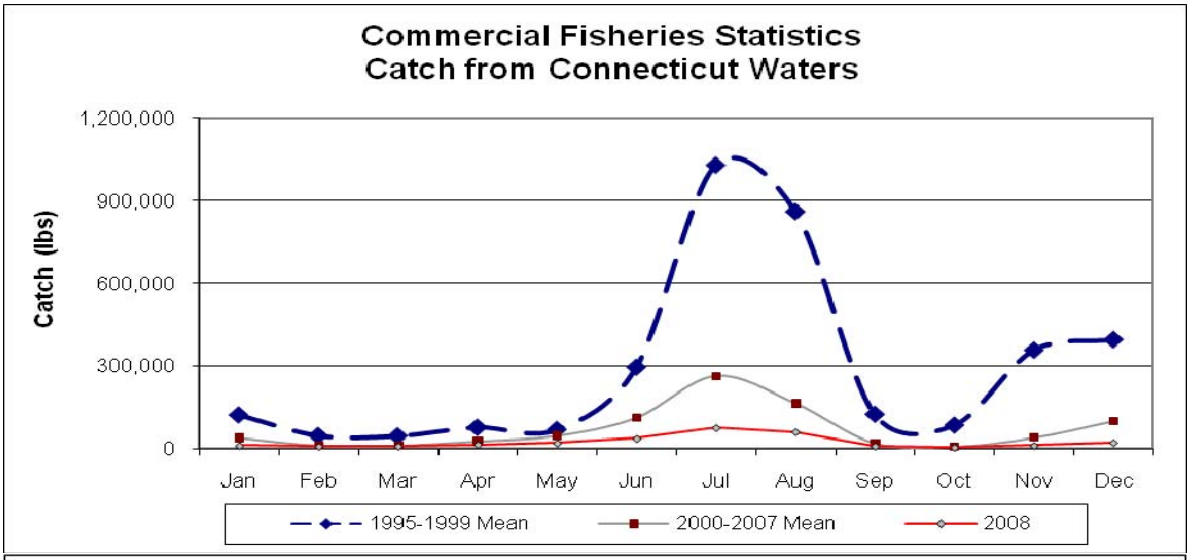
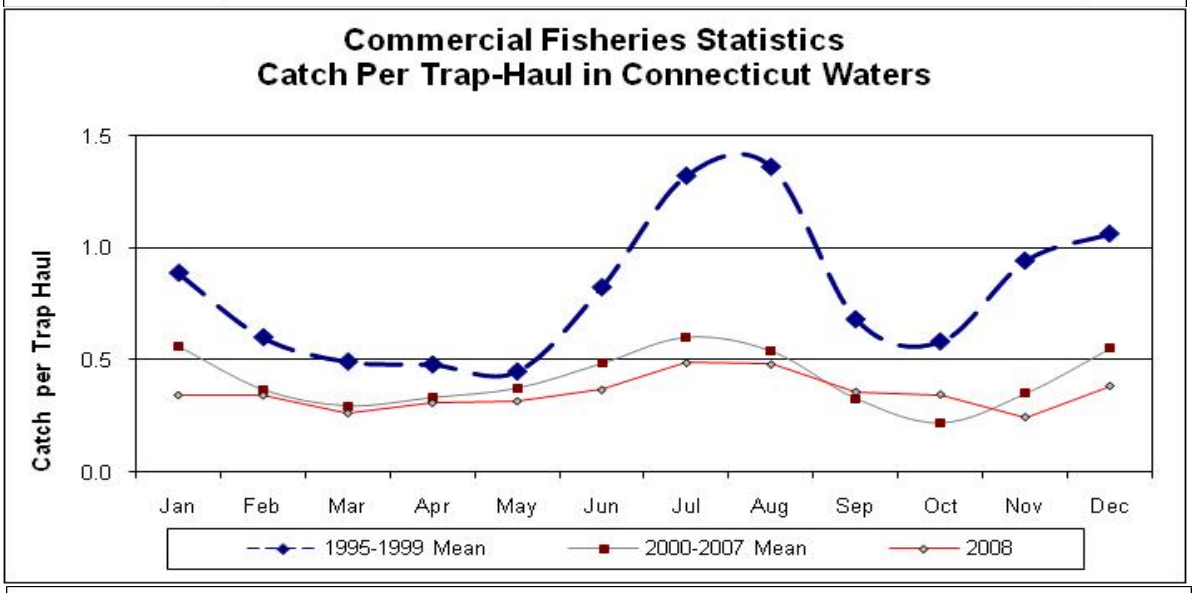


Figure 1.5 Connecticut lobster landings (lbs) by basin of Long Island Sound, 1984-2009*. *Includes landings from all gear types and areas fished. (ELIS=Eastern Long Island Sound, CLIS=Central Long Island Sound and WLIS=Western Long Island Sound). *2009 values are preliminary estimates.*

A



B



C

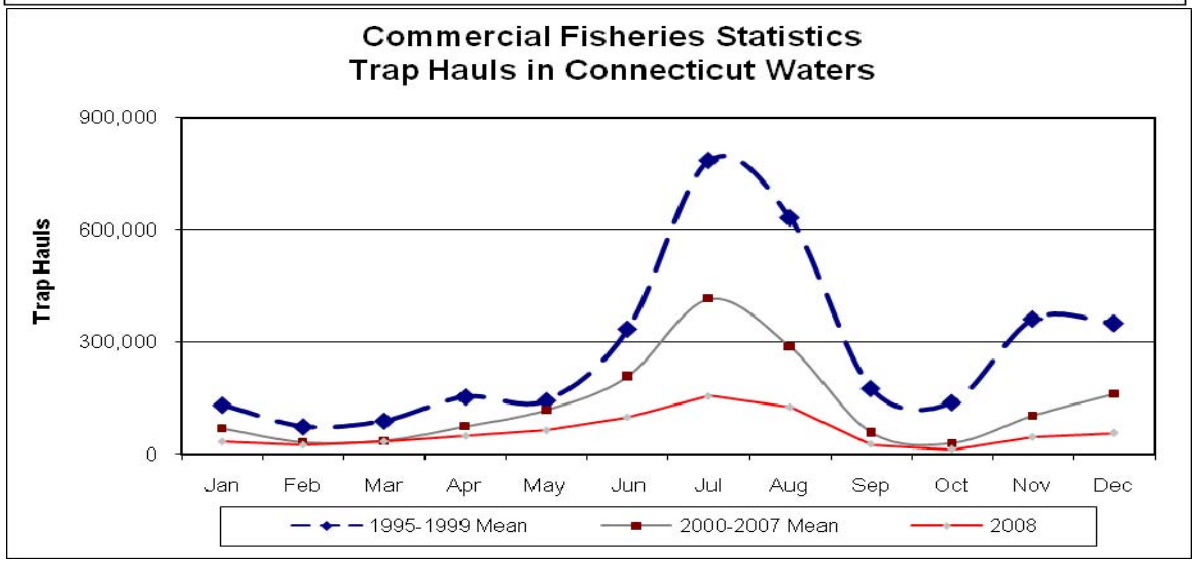


Figure 1.6 Monthly lobster catch, catch per effort, and effort in Connecticut waters. *Catch (A), catch per trap haul (B), and total trap hauls (C) are shown by month for 2008. Mean values for years 1995-1999 and 2000-2007 are shown for comparison.*

Year	1	2	3	Total
1979	150	144	96	390
1980	188	174	105	467
1981	191	161	95	447
1982	202	140	85	427
1983	203	161	92	456
1984	220	130	98	448
1985	246	132	107	485
1986	214	126	90	430
1987	212	111	87	410
1988	207	128	91	426
1989	197	128	87	412
1990	207	141	84	432
1991	193	155	86	434
1992	209	125	76	410
1993	223	105	87	415
1994	207	81	79	367
1995	196	83	83	362
1996	168	74	78	320
1997	152	79	69	300
1998	152	84	70	306
1999	144	89	63	296
2000	128	69	45	242
2001	111	76	44	231
2002	98	63	44	205
2003	74	49	40	165
2004	76	54	41	172
2005	81	50	43	177
2006	85	50	42	179
2007	80	43	35	161
Mean79_06	169	106	75	350

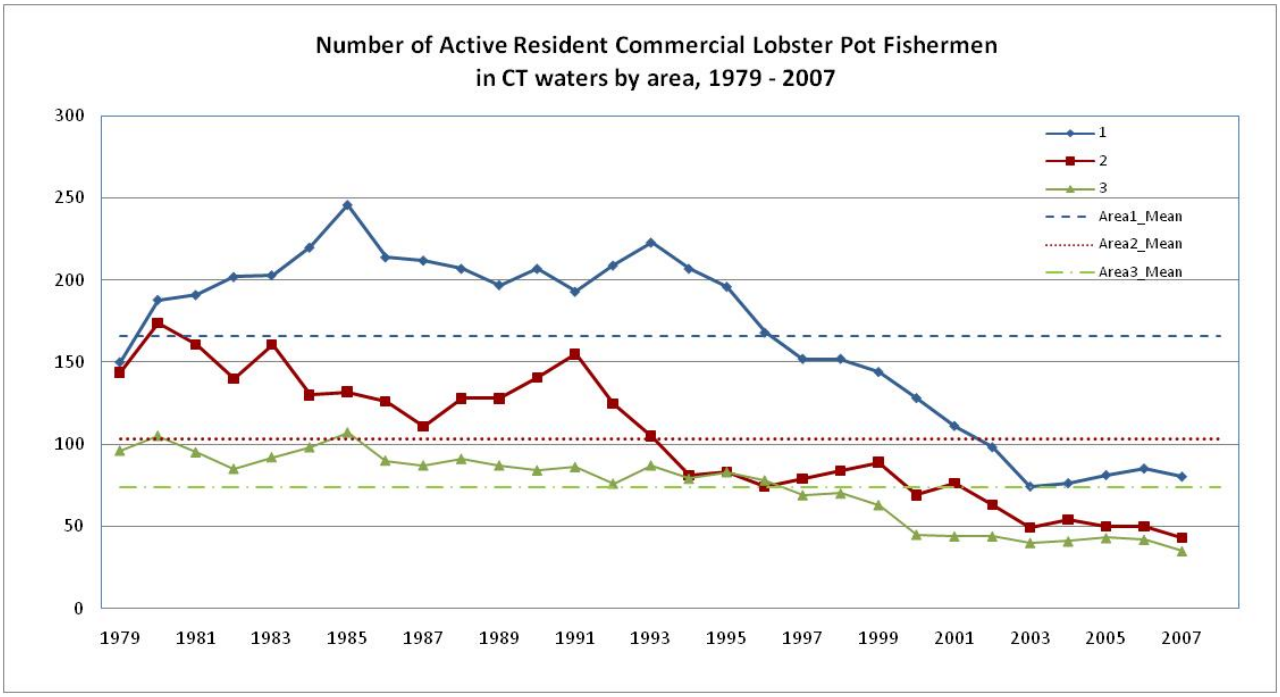


Figure 1.7 Number of active resident commercial lobster pot license holders in the Connecticut waters of Long Island Sound by logbook area, 1979 – 2007. *(1=east, 2=central, 3=west)*

Year	1	2	3	Total
1979	5,352	6,269	4,879	16,500
1980	5,837	6,098	4,944	16,879
1981	6,176	5,423	4,273	15,872
1982	6,231	4,678	3,322	14,231
1983	8,209	6,710	4,740	19,659
1984	8,296	5,653	6,123	20,072
1985	7,961	5,261	5,714	18,936
1986	6,995	5,620	4,609	17,224
1987	7,379	5,897	4,756	18,032
1988	7,759	6,038	4,695	18,492
1989	7,328	6,134	4,934	18,396
1990	8,171	6,985	5,196	20,352
1991	7,578	7,044	5,333	19,955
1992	8,412	4,707	5,248	18,367
1993	8,150	4,265	5,101	17,516
1994	7,434	3,462	4,660	15,556
1995	6,530	3,580	4,706	14,816
1996	6,158	2,919	5,528	14,605
1997	6,304	3,493	5,587	15,384
1998	6,978	3,991	5,738	16,707
1999	5,870	3,637	3,849	13,356
2000	4,518	2,548	1,648	8,714
2001	3,831	2,821	2,035	8,687
2002	3,261	2,100	1,676	7,037
2003	2,788	1,448	1,682	5,918
2004	3,070	1,637	1,749	6,456
2005	2,950	1,814	1,782	6,546
2006	3,290	1,980	1,742	7,012
2007	2,854	1,546	1,383	5,783
Mean79_06	6,172	4,365	4,152	14,688

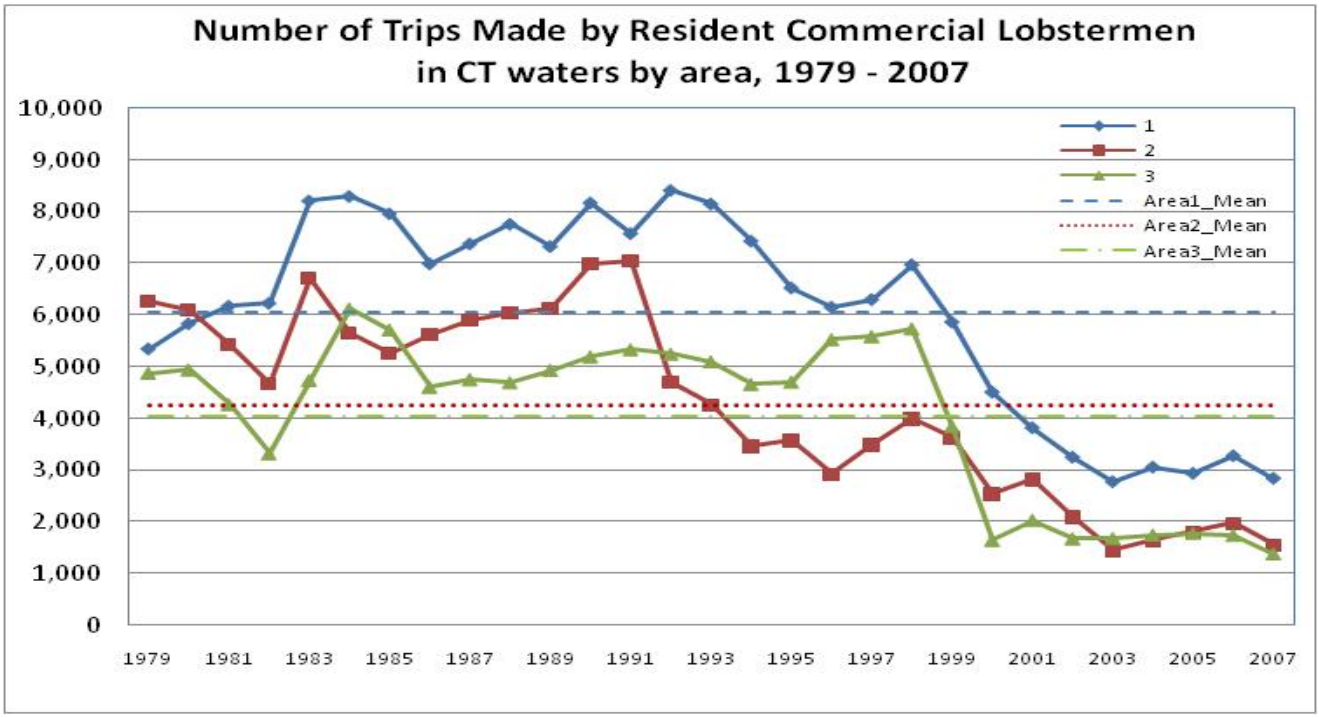


Figure 1.8 Number of resident commercial lobster pot trips made in the Connecticut waters of Long Island Sound by logbook area 1979 – 2007. *(1=east, 2=central, 3=west)*

Year	1	2	3	Total
1979	150,208	306,810	397,763	854,781
1980	160,648	292,639	416,843	870,130
1981	177,178	302,558	355,123	834,859
1982	197,825	269,766	280,538	748,129
1983	299,244	431,186	444,754	1,175,184
1984	300,786	401,825	585,095	1,287,706
1985	309,026	389,244	563,133	1,261,403
1986	279,853	414,378	505,719	1,199,950
1987	297,155	483,861	572,459	1,353,475
1988	324,510	512,036	633,313	1,469,859
1989	282,296	547,325	737,893	1,567,514
1990	368,906	673,985	788,273	1,831,164
1991	371,393	724,273	767,115	1,862,781
1992	490,940	626,377	896,509	2,013,826
1993	487,927	544,127	859,829	1,891,883
1994	492,701	435,081	850,491	1,778,273
1995	379,502	473,146	904,859	1,757,507
1996	386,037	476,863	1,215,790	2,078,690
1997	438,222	553,042	1,320,885	2,312,149
1998	502,666	730,247	1,520,224	2,753,137
1999	507,990	713,814	1,159,666	2,381,470
2000	389,902	559,568	583,335	1,532,805
2001	323,204	618,806	740,895	1,682,905
2002	281,463	443,969	608,586	1,334,018
2003	254,402	299,537	568,615	1,122,554
2004	247,268	290,280	515,033	1,052,581
2005	254,476	258,405	494,983	1,007,864
2006	286,192	294,872	556,926	1,137,990
2007	255,776	217,261	386,812	859,849
Mean79_89	252,612	395,603	499,330	1,147,545
Mean90_00	437,835	591,866	987,907	2,017,608
Mean01_07	271,826	346,161	553,121	1,171,109
Mean79_06	330,069	466,715	708,737	1,505,521
Min	150,208	217,261	280,538	748,129
Max	507,990	730,247	1,520,224	2,753,137

Percent decline from average 1979 - 1989				Percent decline from average 1990 - 2000				Percent decline from average 1979 - 2006			
1	2	3	Total	1	2	3	Total	1	2	3	Total
				0.11	0.05	0.41	0.24			0.18	
				0.26		0.25	0.17	0.02			
				0.36	0.25	0.38	0.34	0.15	0.05	0.14	0.11
	0.24		0.02	0.42	0.49	0.42	0.44	0.23	0.36	0.20	0.25
0.02	0.27		0.08	0.44	0.51	0.48	0.48	0.25	0.38	0.27	0.30
	0.35	0.01	0.12	0.42	0.56	0.50	0.50	0.23	0.45	0.30	0.33
	0.25		0.01	0.35	0.50	0.44	0.44	0.13	0.37	0.21	0.24
	0.45	0.23	0.25	0.42	0.63	0.61	0.57	0.23	0.53	0.45	0.43

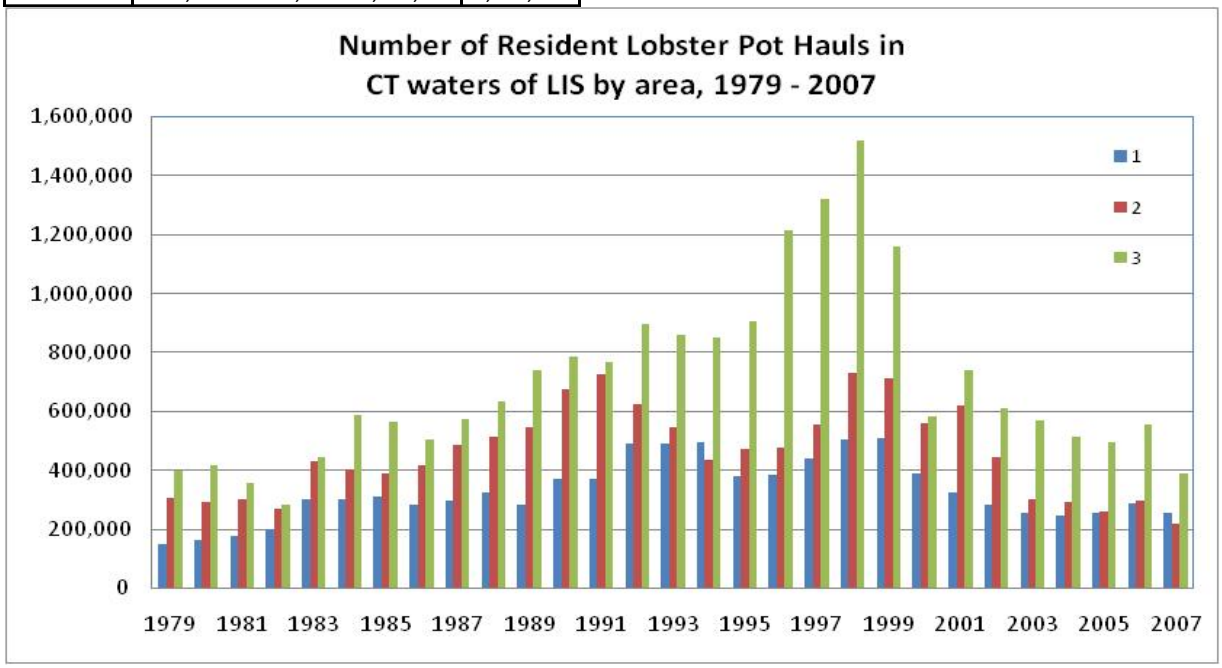


Figure 1.9 Total resident lobster pot hauls in the Connecticut waters of Long Island Sound by logbook area, 1979 – 2007. *(1=east, 2=central, 3=west)*

Year	1	2	3	Total
1979	84,551	183,338	270,780	538,669
1980	80,327	177,488	227,381	485,196
1981	117,786	167,862	196,089	481,737
1982	135,719	203,923	260,451	600,093
1983	187,642	370,240	484,588	1,042,470
1984	236,220	281,316	620,280	1,137,816
1985	175,196	276,906	447,139	899,241
1986	156,990	315,216	422,316	894,522
1987	185,061	431,624	511,684	1,128,369
1988	212,644	468,818	649,148	1,330,610
1989	201,574	458,609	717,763	1,377,946
1990	324,036	573,049	812,451	1,709,536
1991	334,314	619,180	907,420	1,860,914
1992	411,100	423,333	1,012,401	1,846,834
1993	352,962	330,991	839,928	1,523,881
1994	341,814	337,760	1,034,424	1,713,998
1995	306,562	547,963	1,060,588	1,915,113
1996	266,403	569,498	1,442,413	2,278,314
1997	382,477	756,403	1,570,378	2,709,258
1998	428,817	803,296	1,698,903	2,931,016
1999	355,493	695,308	902,909	1,953,710
2000	246,595	468,783	245,644	961,022
2001	213,257	479,376	288,535	981,168
2002	172,888	314,482	256,820	744,190
2003	128,085	147,503	235,442	511,030
2004	147,470	127,343	215,865	490,678
2005	170,996	130,070	206,414	507,480
2006	194,250	149,879	232,331	576,460
2007	142,731	100,814	109,568	353,113
Mean79_89	161,246	303,213	437,056	901,515
Mean90_00	340,961	556,869	1,047,951	1,945,781
Mean01_07	167,097	207,067	220,711	594,874
Mean79_06	233,972	386,056	634,660	1,254,688
Min	80,327	100,814	109,568	353,113
Max	428,817	803,296	1,698,903	2,931,016

	Percent decline from average 1979 - 1989				Percent decline from average 1990 - 2000				Percent decline from average 1979 - 2006			
	1	2	3	Total	1	2	3	Total	1	2	3	Total
1999							0.14					
2000			0.44		0.28	0.16	0.77	0.51			0.61	0.23
2001			0.34		0.37	0.14	0.72	0.50	0.09		0.55	0.22
2002			0.41	0.17	0.49	0.44	0.75	0.62	0.26	0.19	0.60	0.41
2003	0.21	0.51	0.46	0.43	0.62	0.74	0.78	0.74	0.45	0.62	0.63	0.59
2004	0.09	0.58	0.51	0.46	0.57	0.77	0.79	0.75	0.37	0.67	0.66	0.61
2005		0.57	0.53	0.44	0.50	0.77	0.80	0.74	0.27	0.66	0.67	0.60
2006		0.51	0.47	0.36	0.43	0.73	0.78	0.70	0.17	0.61	0.63	0.54
2007	0.11	0.67	0.75	0.61	0.58	0.82	0.90	0.82	0.39	0.74	0.83	0.72

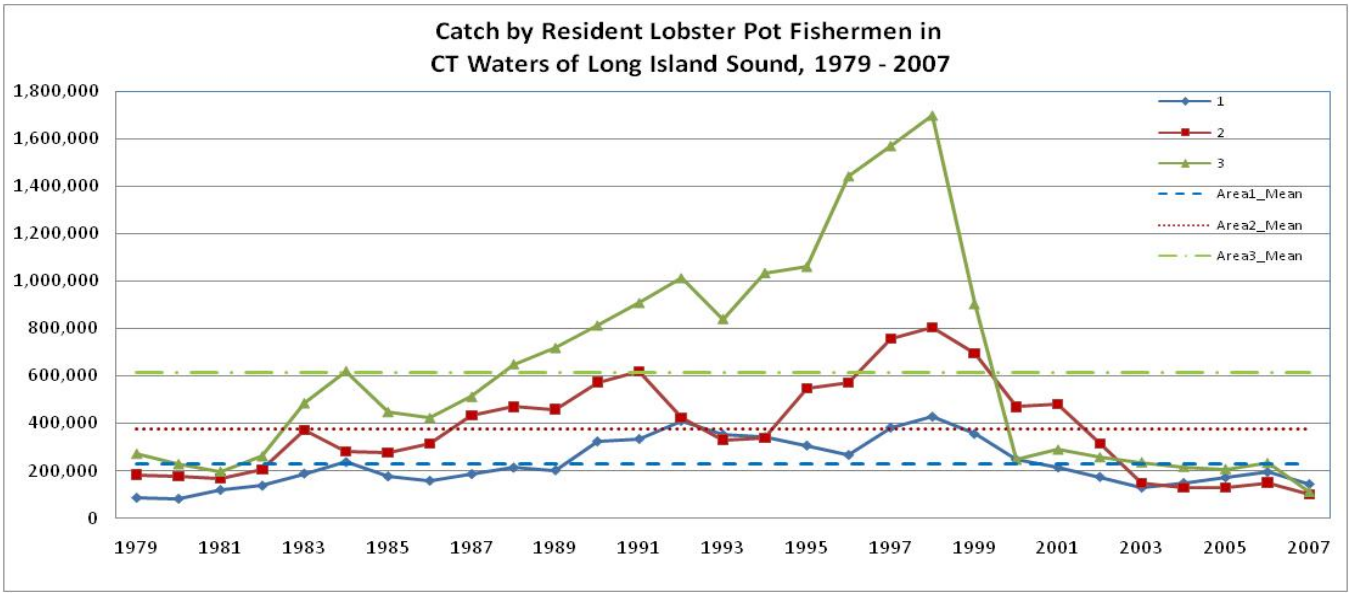


Figure 1.10 Total resident lobster pot catch in the Connecticut waters of Long Island Sound by logbook area, 1979 – 2007. *(1=east, 2=central, 3=west)*

	Year	1	2	3	Total
	1979	0.46	0.53	0.57	1.55
	1980	0.41	0.49	0.48	1.38
1981 - 1989	1981	0.50	0.45	0.50	1.46
	1982	0.58	0.62	0.70	1.90
	1983	0.56	0.65	0.78	1.99
	1984	0.54	0.57	0.73	1.84
	1985	0.47	0.59	0.56	1.62
	1986	0.49	0.62	0.63	1.73
	1987	0.54	0.70	0.67	1.91
	1988	0.56	0.69	0.75	2.00
	1989	0.61	0.66	0.75	2.02
1990 - 1998	1990	0.65	0.69	0.80	2.14
	1991	0.69	0.69	0.86	2.24
	1992	0.66	0.52	0.87	2.04
	1993	0.57	0.51	0.77	1.86
	1994	0.56	0.60	0.91	2.07
	1995	0.69	0.78	1.03	2.50
	1996	0.66	0.74	0.99	2.39
	1997	0.81	0.93	1.09	2.82
	1998	0.74	0.88	0.98	2.60
1999 - 2007	1999	0.65	0.76	0.64	2.06
	2000	0.54	0.66	0.37	1.57
	2001	0.55	0.61	0.37	1.53
	2002	0.49	0.53	0.37	1.39
	2003	0.44	0.44	0.40	1.28
	2004	0.52	0.44	0.40	1.37
	2005	0.55	0.45	0.45	1.45
	2006	0.57	0.45	0.44	1.45
	2007	0.46	0.39	0.30	1.15
	Min	0.41	0.39	0.30	1.15
	Max	0.81	0.93	1.09	2.82

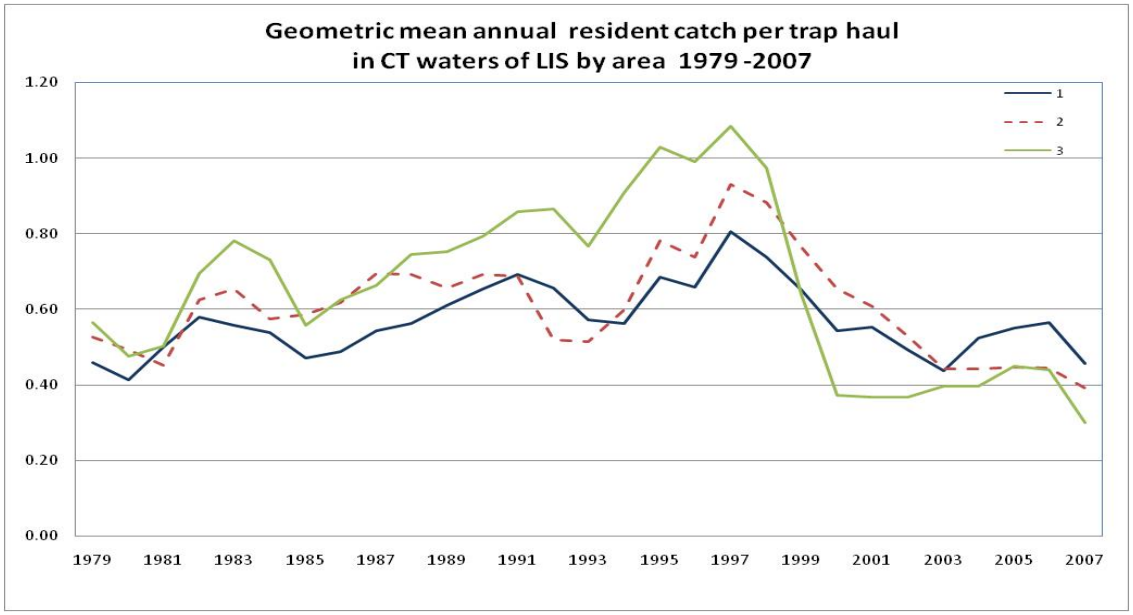


Figure 1.11 Annual resident geometric mean catch per trap haul in the Connecticut waters of Long Island Sound by logbook area, 1979 – 2007. *(1=east, 2=central, 3=west)*

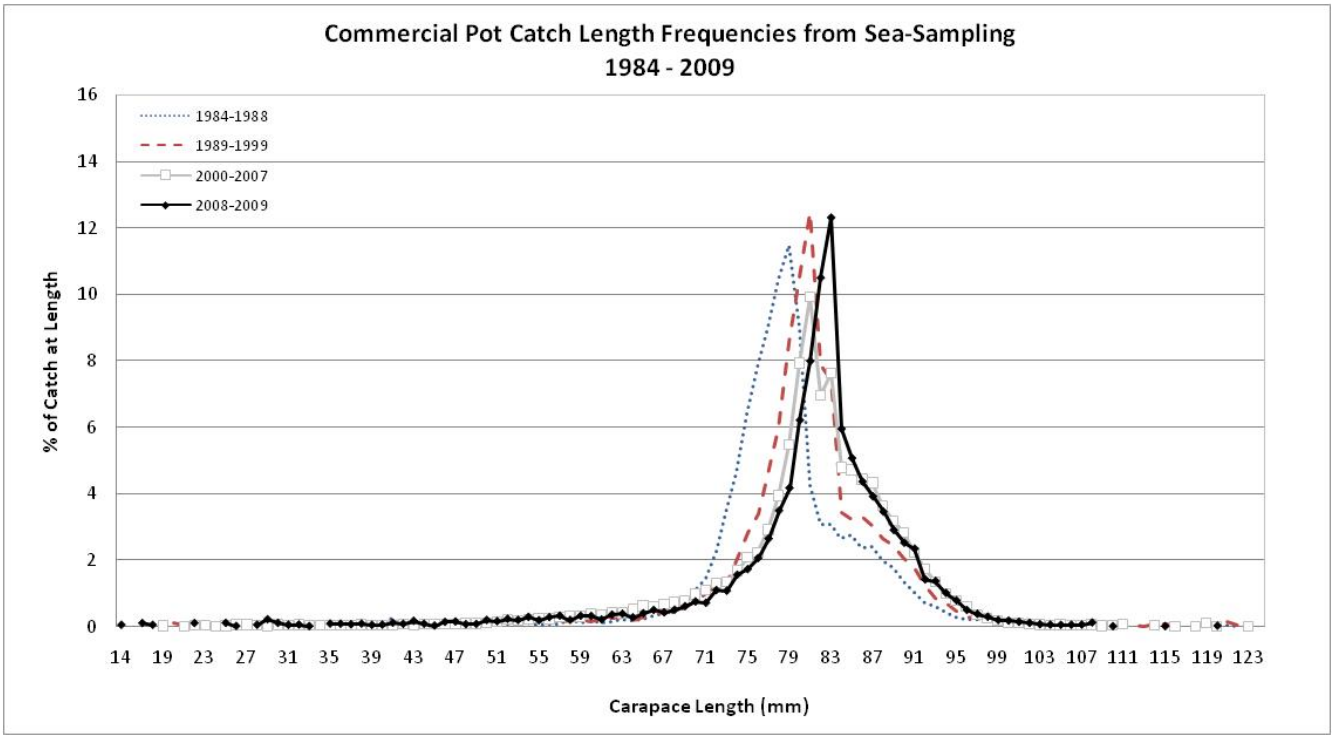


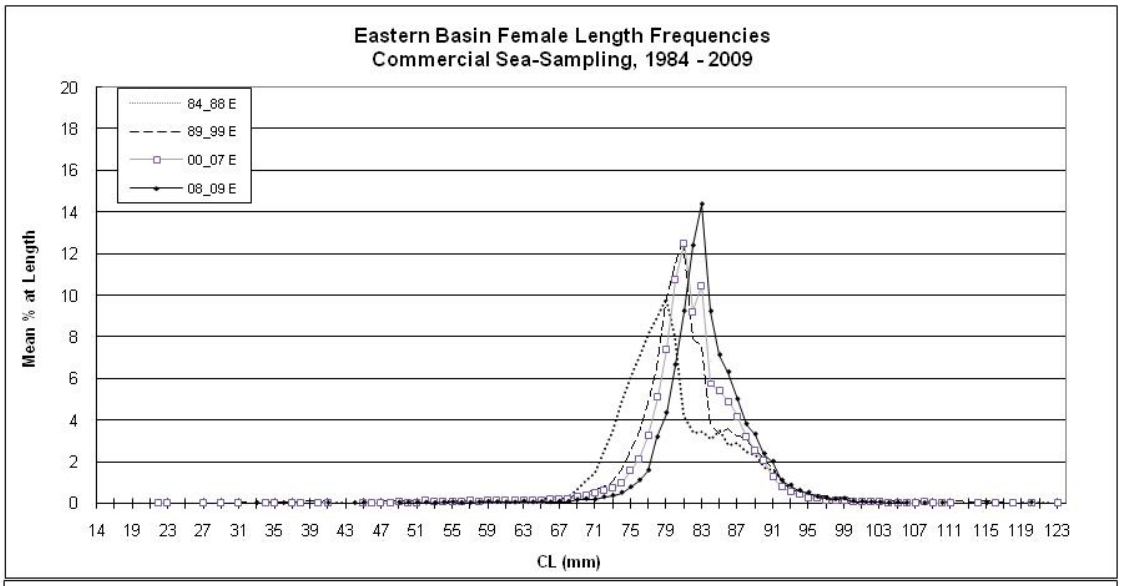
Figure 1.12 Length frequencies of the commercial lobster pot catch, 1984 - 2009. *Mean values for years 1984-1988, 1989-1999, 2000-2007 and 2008-2009 are compared.*

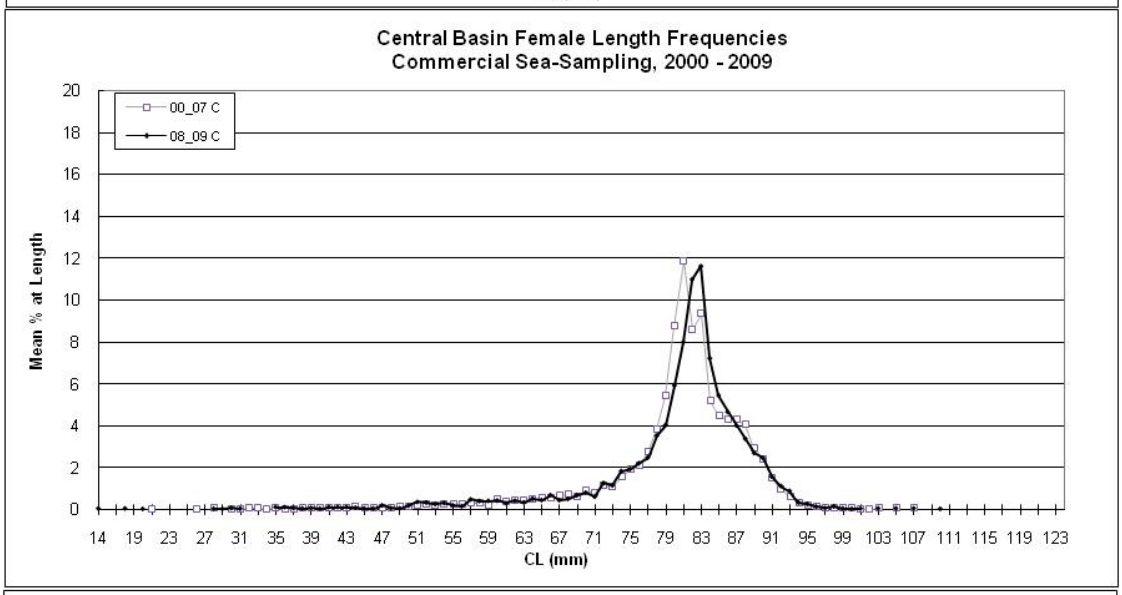
Year	Action
1923	4 1/8" rostrum minimum length (through June 30, 1935)
1935	3 1/16" minimum carapace length (July 01, 1935 through 1939)
1976	1) 3 3/16 inch minimum carapace length (through 1988) 2) Prohibited: a) females with eggs or from which eggs have been removed, b) possession of parts on state waters except as were legally brought onboard from shore or for immediate personal consumption. 3) Fishing more than 10 pots requires a commercial license. 4) Pots cannot be hauled from ½ h after sunset to ½ h before sunrise
1983	1) Effective 7/1/1993: buoyed pots cannot be set within navigation channel as indicated by USCG channel markers
1984	1) Effective 4/1/1984: Escape vents required in all pots, traps and similar devices; can be horizontal, rectangular opening not less than 1 3/4 inch by 6 inch, or (2) two circular vents not less than 2 1/4 inch diameter. 2) Trawl bycatch limit of 100 pieces west of 73 degree longitude (clarified as extending from Griswold Pt, CT through Mulford Pt, NY)
1985	1) Setting or tending pots or use of any other gear to take lobster on leased oyster beds without permission of lease holder is prohibited.
1986	1) Effective 7/1/1986: 100 piece limit west of LORAN C 14810 or approx. from Griswold Pt, CT through Mulford Pt, NY.
1987	1) Prohibition on setting pots in channel extended to mooring areas from May 1 - Oct 15 and fairways as defined by approved Harbor Management Plans.
1988	1) Minimum size for federal license holder of 3 7/32 inch carapace length 2) Escape panel: if wooden pot, lath must not exceed 3/8 inch thickness, non-wood traps must have 3 3/4 inch square panel held closed by uncoated ferrous wire not more than 3/32 inch diameter or with untreated natural fibers.
1989	1) Effective 12/31/1988: 3 7/32 inch minimum carapace length. 2) Buoys must be uniform color and pattern for each license holder.
1990	1) Effective 1/1/1990: 3 1/4 inch minimum carapace length
1991	1) Prohibited: New York residents from taking lobster by trawl since NY prohibits CT residents (anyone) from using trawls to take lobster.
1992	1) Federal license/endorsement holders must have escape vent 1 7/8 inch by 6 inch, or two circular vents 2 3/8 inch diameter
1995	1) Effective 1/1/1995: minimum escape vent size increased to 1 7/8 by 6 inches rectangular or two 2 3/8 inch circular vents. 2) Effective 4/1/1995: minimum escape vent size 1 7/8 by 5 3/4 inch or two 2 3/8 inch circular vents. In wire pots escape panels may also be constructed of wood. 3) Effective 6/2/1995: moratorium on issuance of commercial licenses to take lobster (and other species). 4) Effective 10/27/1995 A Commercial Fishing Vessel Permit required to take or land lobsters or fish for commercial purposes.

Table 1.2 Connecticut's management and regulatory history concerning American lobster harvested in the CT waters of Long Island Sound, 1923 through 1995.

Year	Action
1998	1) Effective 5/1/1998: Escape vent size increased to 1 15/16 by 5 3/4 inches or two 2 7/16 inch circular escape vents 2) Effective 10/30/1998: Possession of 'V'-notched lobsters, females with tails mutilated such as to obscure a 'V'-notch marking, lobsters taken by a method which pierces the shell is prohibited. 3) Use of pots over 22,950 cubic inches prohibited. 4) Fishing methods other than pots limited to 100 pieces per day up to 500 pieces for trips over five days in federal waters. 100 piece limit regardless of trip length in Connecticut waters
2000	Trap limits established to prevent further increase in effort.
2000 – 2004	Federal Fishery Disaster (FFD) declared in LIS (CT receives $3 million federal, state adds $1.2 million). 2001: Economic Assistance to CT commercial lobstermen – Round 1 2002: Trap Buy Back – Round 1 2004: Economic Assistance and Sustaining Aid to CT lobstermen – Round 2 2004: Trap Buy Back – Round 2; program achieves 19% trap reduction 2004: Governor's Office of Workforce Competitiveness - $100k for job retraining
2005	1) Effective 08/22/2005: 3 9/32" minimum carapace length
2006	1) Effective 07/01/2006: 3 5/16" minimum carapace length
2007 - 2009	Minimum carapace length 3 3/8 inch delayed by a "conservation equivalent v-notch program" supported by a $1million appropriation from CT legislature.
01/2008	It is illegal in Connecticut to buy, sell, give away, offer for sale or possess, regardless where taken, any lobster less than 3 5/16" carapace length
07/2008	Effective 07/01/2008 maximum carapace length implemented at 133.4mm or 5 ¼".
2010	1) Effective 01/01/2010: 3 3/8" minimum carapace length implemented when funding ended in mid-2009 for the v-notch restoration program 2) Effective 07/01/2010: Escape vent size increased to 2 inches by 5 3/4 inches or two 2 5/8 inch circular escape vents
2010 - 2011	CT Legislature appropriates $200k in FY 2011 to continue Lobster Restoration Program.

Table 1.2 (*continued*) Connecticut's management and regulatory history concerning American lobster harvested in the CT waters of Long Island Sound, 1923 through 1995.





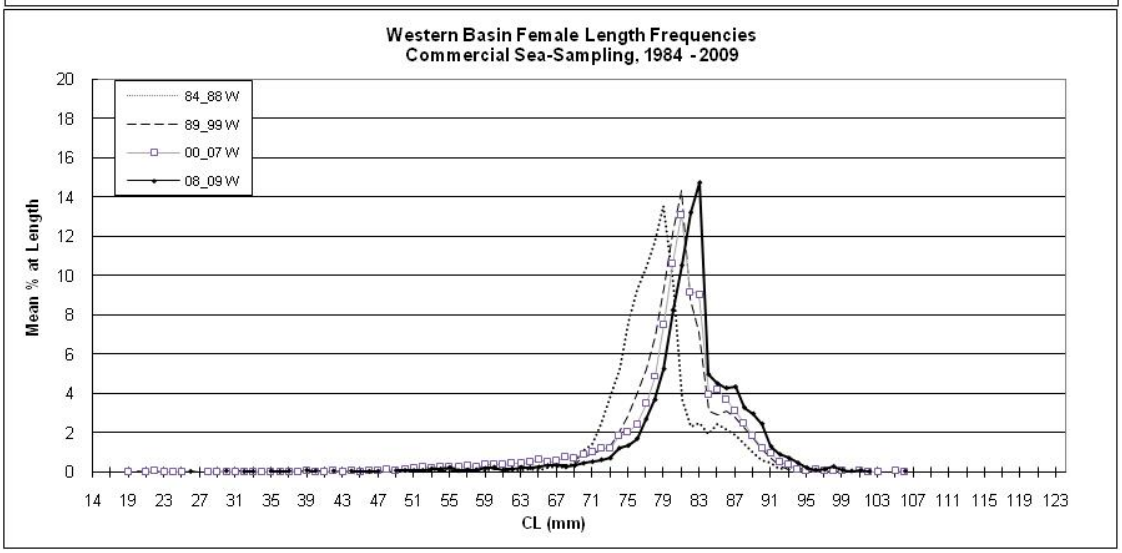


Figure 1.13 Length frequencies of the female commercial lobster pot catch by basin of Long Island Sound, 1984 - 2009. *Mean values for years 1984-1988, 1989-1999, 2000-2007 and 2008-20009 are compared.*

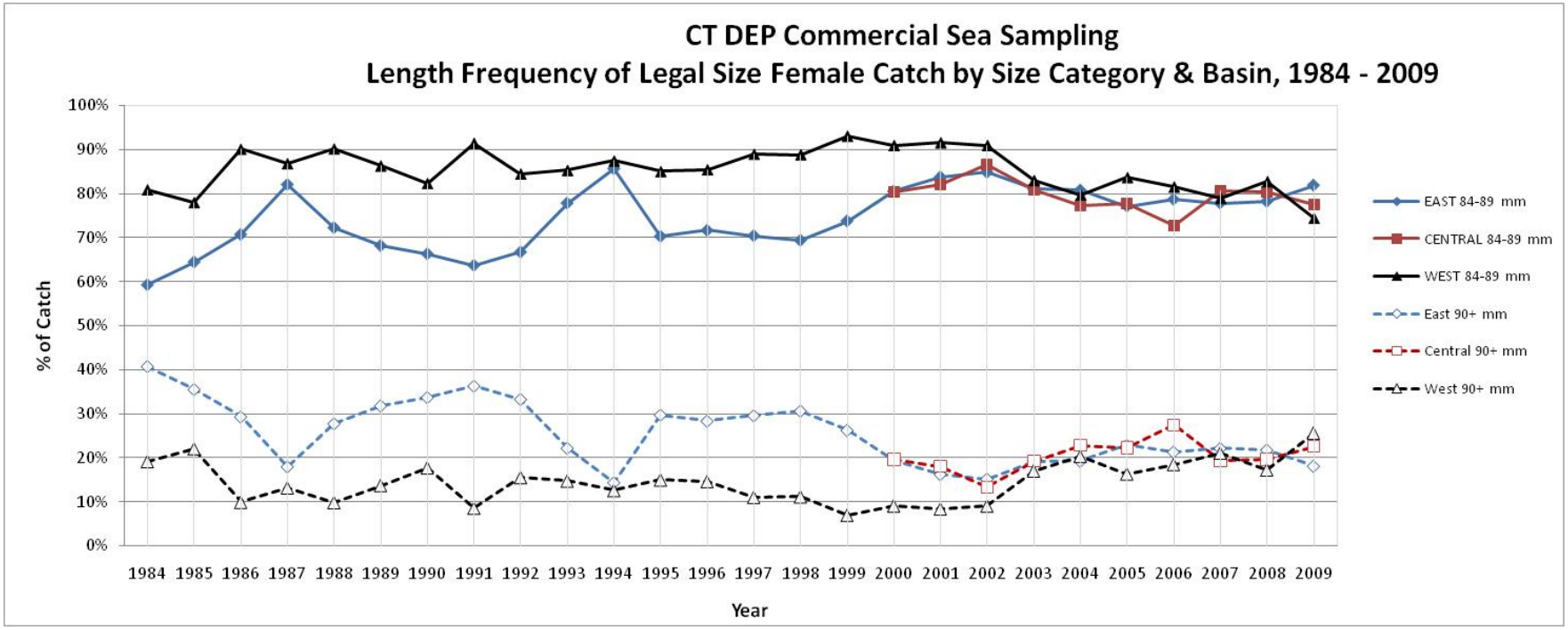


Figure 1.14 Length frequency of the legal size (minimum legal size = 84.1 mm + CL or 3 5/16") female commercial lobster pot catch by size category (84.0-89.9 mm; 90.0+mm CL) and basin (East, Central, West) of Long Island Sound, 1984 - 2009. *These percentages include the presence of egg-bearing females.*

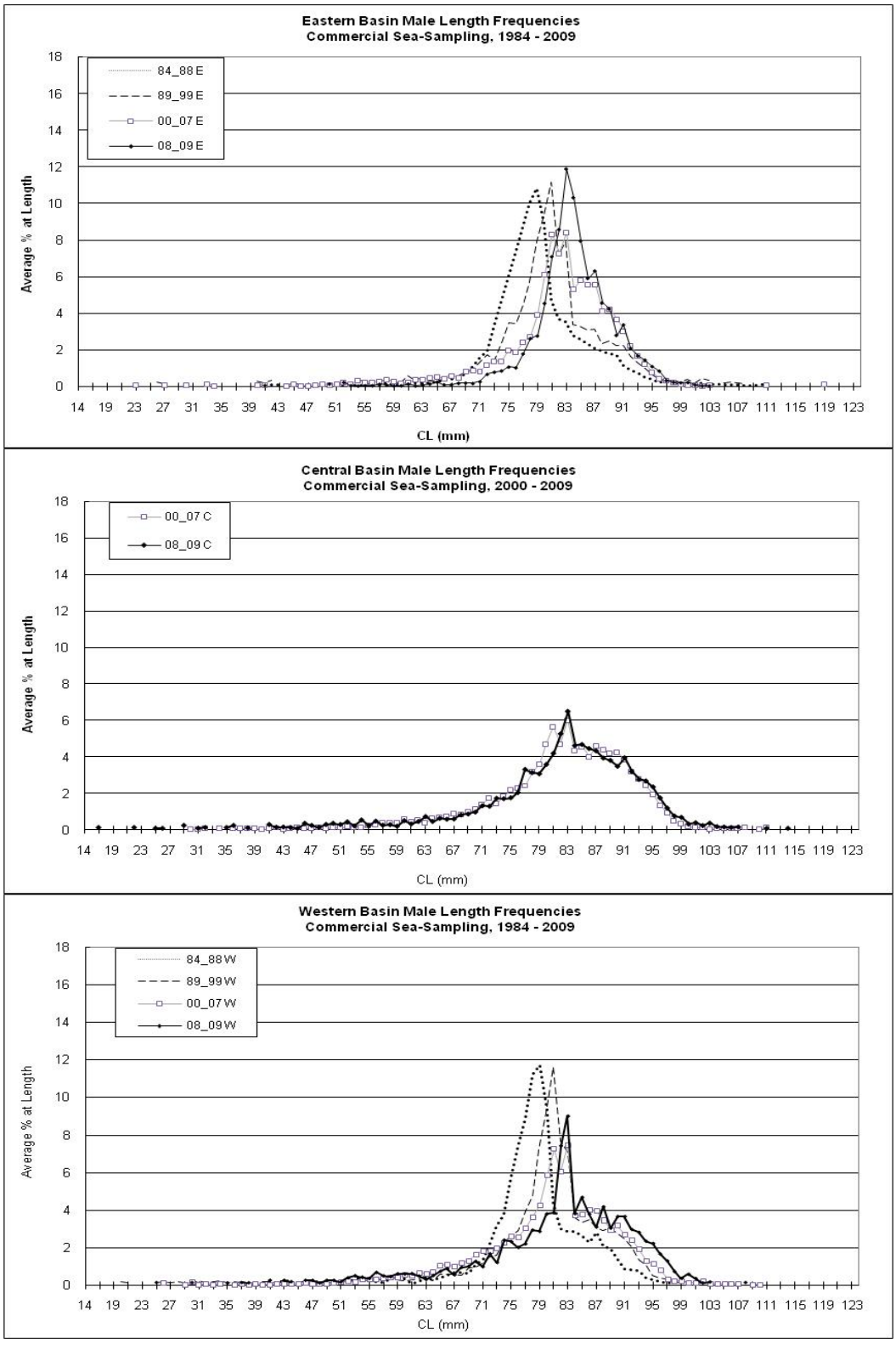


Figure 1.15 Length frequency of the male commercial lobster pot catch by basin of Long Island Sound, 1984 - 2009. *Mean values for years 1984-1988, 1989-1999, 2000-2007 and 2008-2009 are compared.*

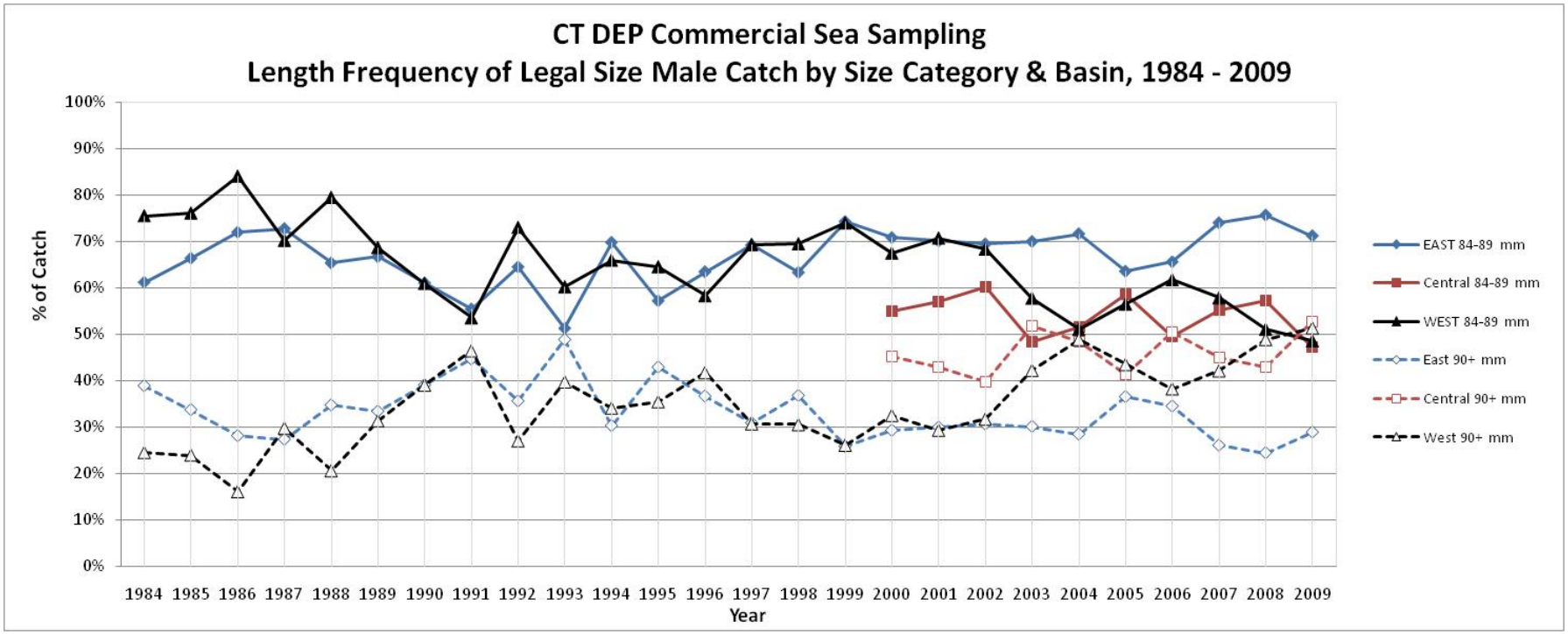
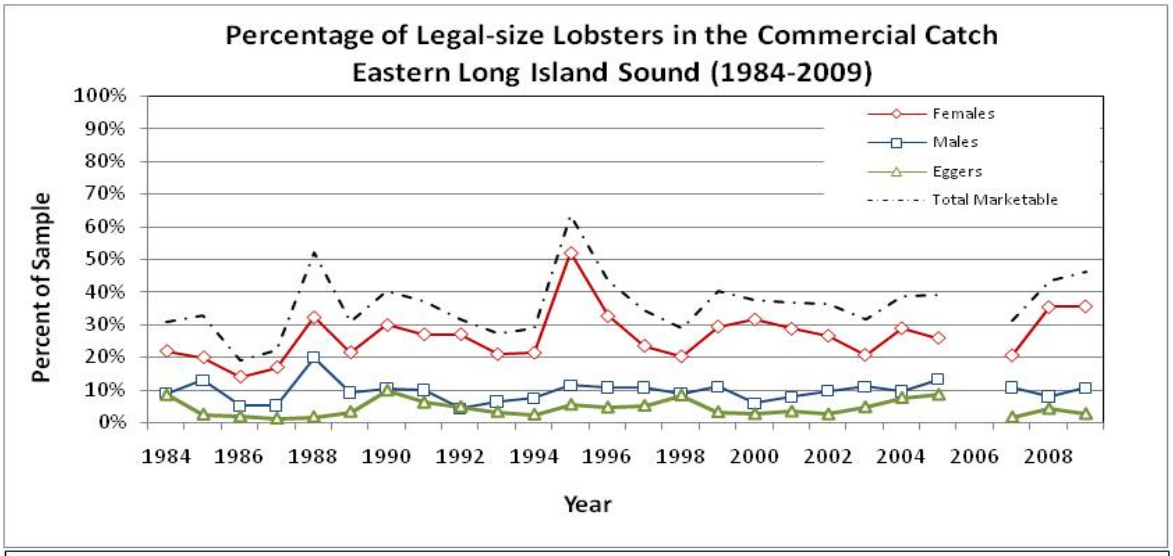
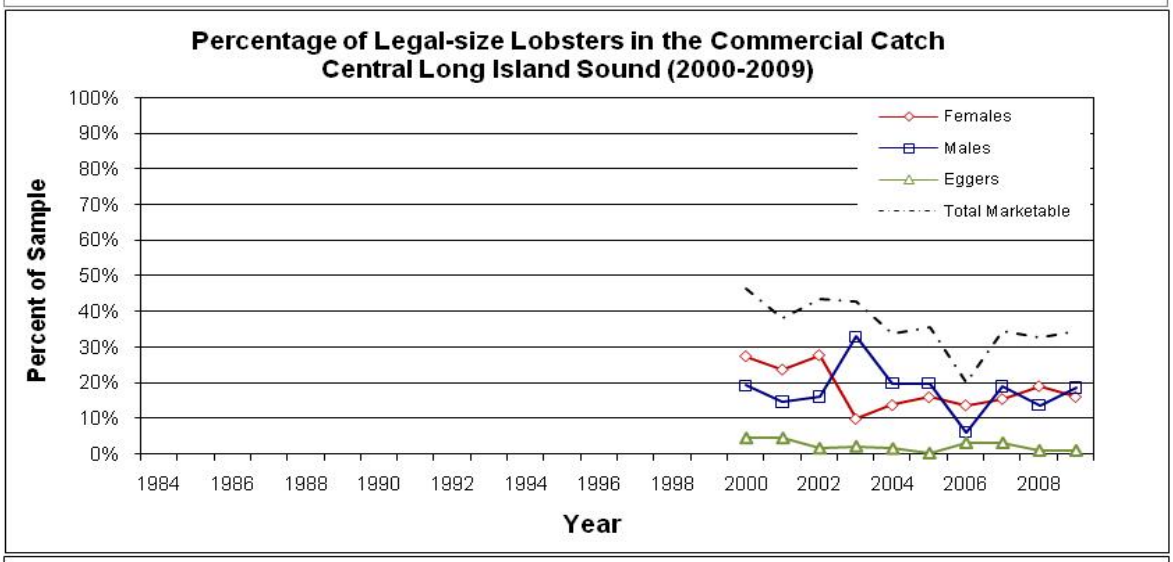


Figure 1.16 Length frequency of the legal size (current minimum legal size = 84.1 mm + CL or 3 5/16") male commercial lobster pot catch by size category (*84.0-89.9 mm; 90.0+mm* CL) and basin (E*ast, Central, West*) of Long Island Sound, 1984 – 2009.

A



B



C

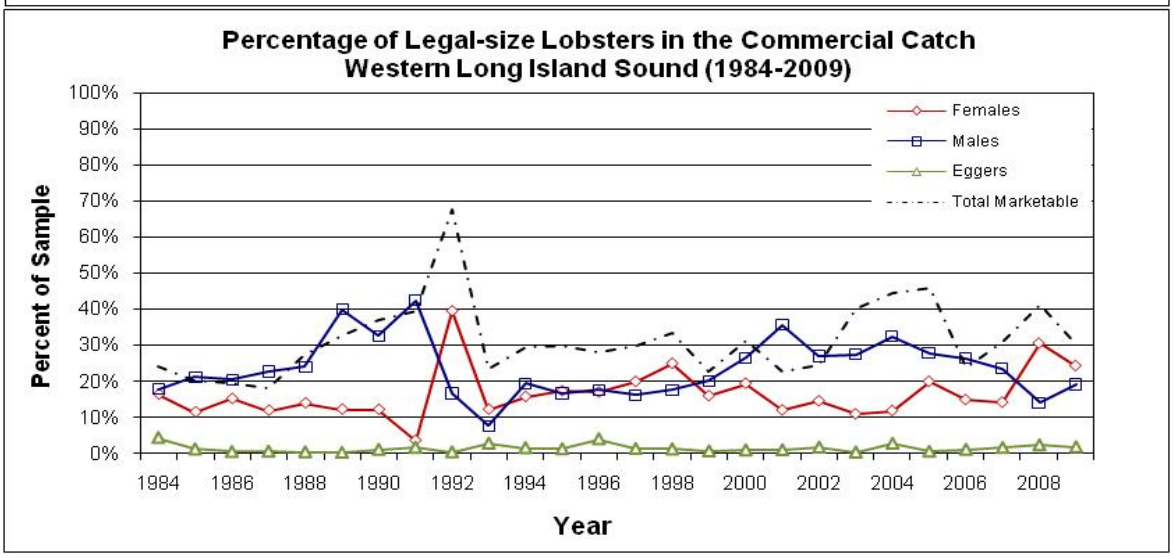
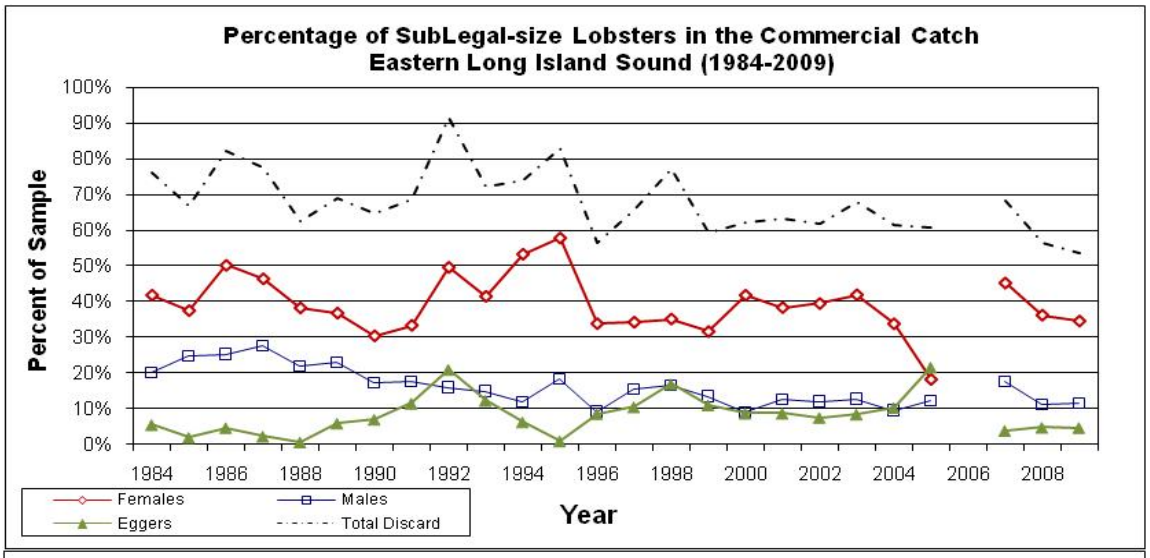
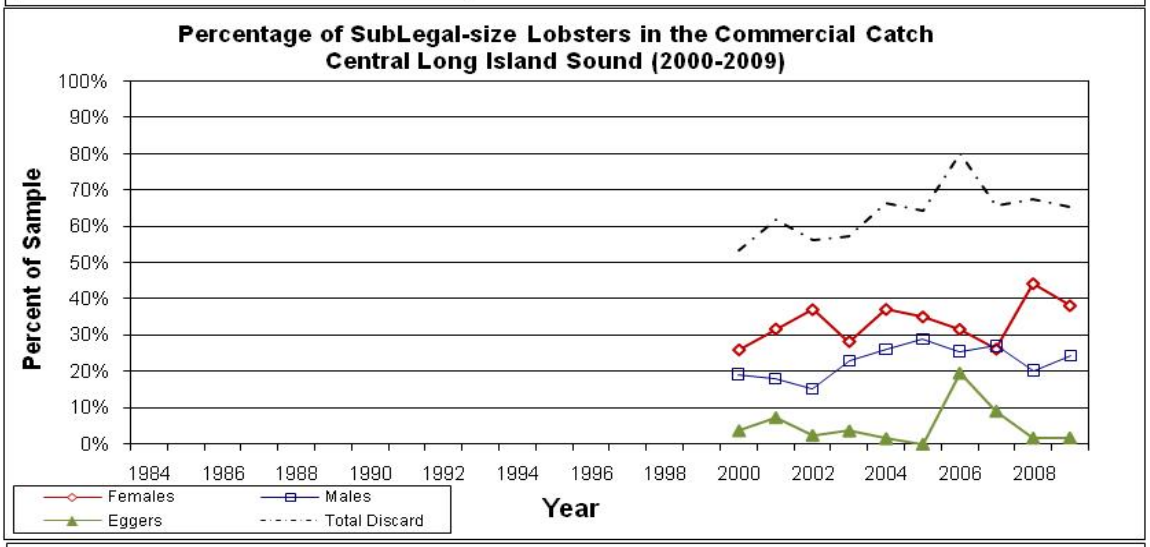


Figure 1.17 Percentage of marketable lobsters in the observed commercial lobster pot catch, July through October, 1984-2009. *Percentage by gender and egg-bearing status is shown for the eastern (A) central (B) and western basins (C). *Due to low sample sizes, data from eastern Long Island Sound in 2006 have not been included. Sampling in the central basin began in 2000.*

A



B



C

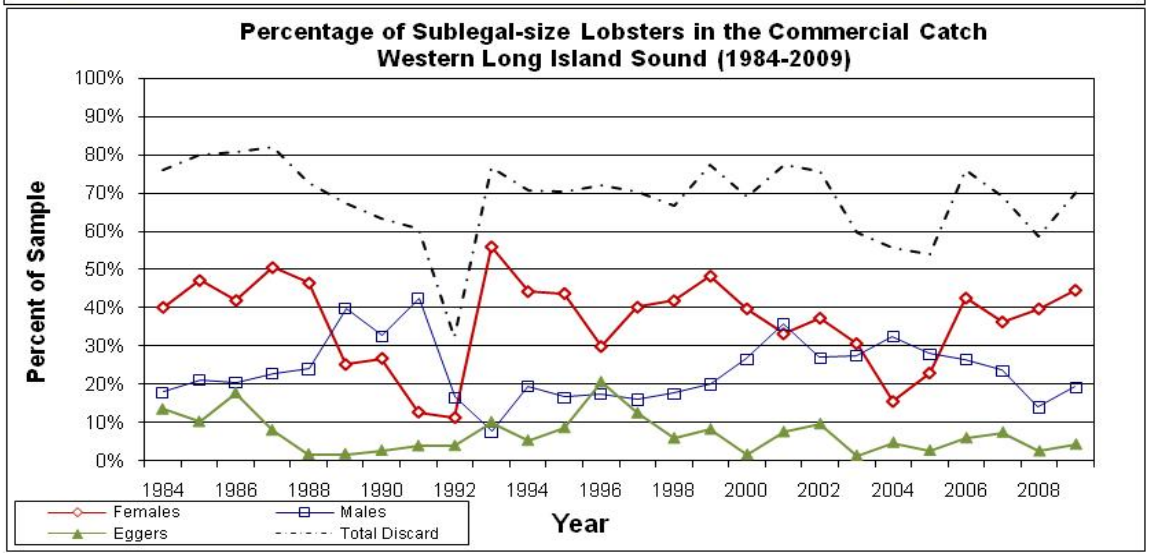


Figure 1.18 Percentage of sublegal lobsters in the observed commercial lobster pot catch, July through October, 1984-2009. *Percentage by gender and egg-bearing status is shown for the eastern (A) central (B) and western basins (C). *Due to low sample sizes, data from eastern Long Island Sound in 2006 have not been included. Sampling in the central basin began in 2000.*

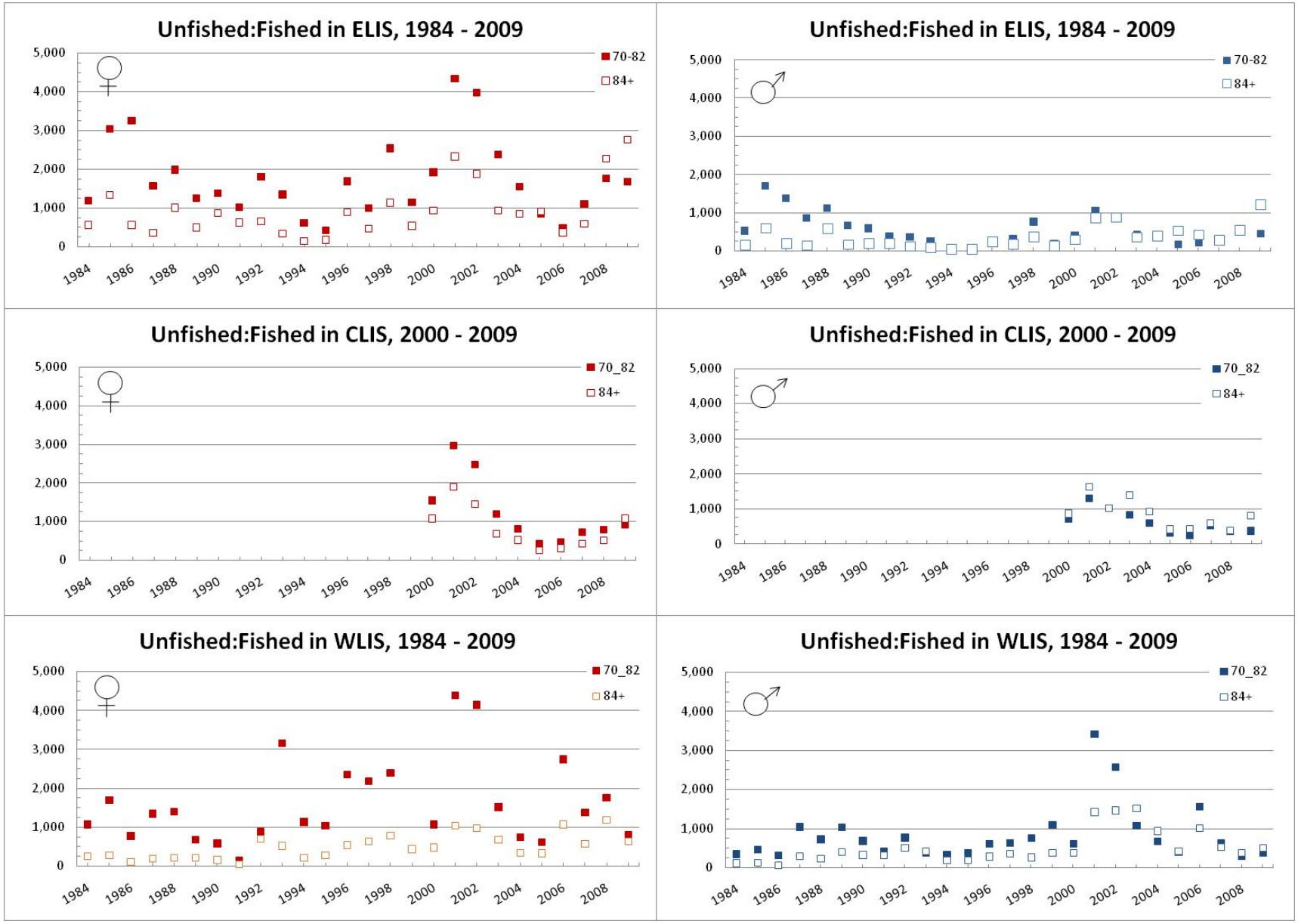
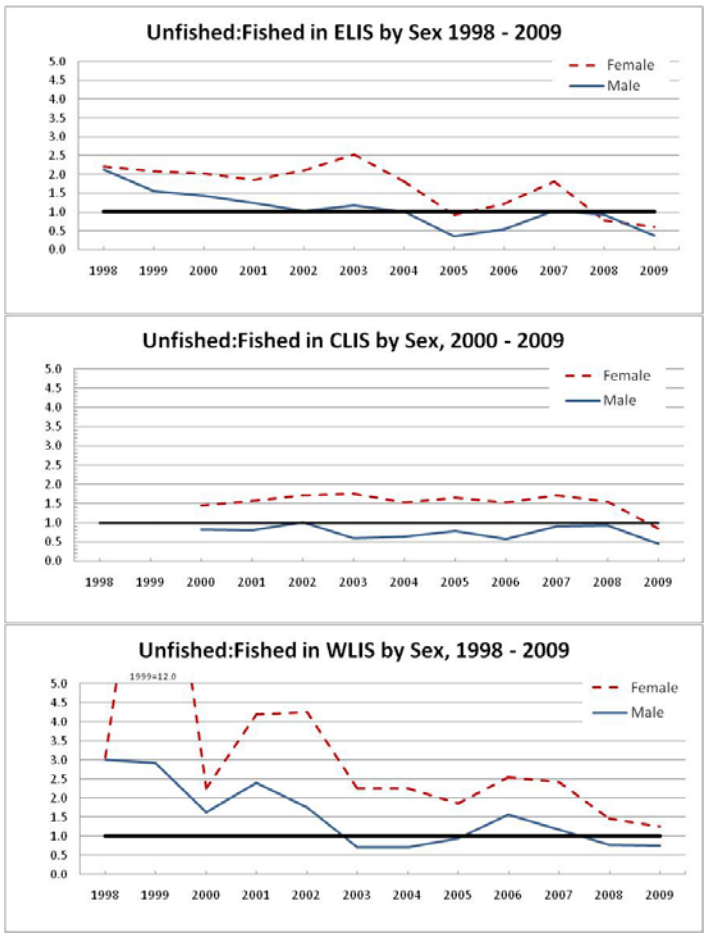


Figure 1.19 Numbers of unfished (70.0 - 82.6 mm CL) to fished (greater than 84.0 mm CL) lobsters observed in commercial catches sampled all months from 1984-2009. *Numbers are represented by sex for each size group by basin of Long Island Sound.*



EASTERN BASIN			
Year	Ratios		N
	female	male	
1998	2.23	2.13	4,806
1999	2.10	1.55	2,026
2000	2.03	1.44	3,570
2001	1.86	1.23	8,573
2002	2.11	1.03	7,629
2003	2.54	1.19	4,092
2004	1.81	1.02	3,166
2005	0.92	0.35	2,481
2006	1.23	0.54	1,496
2007	1.82	1.03	2,267
2008	0.77	0.92	5,083
2009	0.61	0.38	6,094

CENTRAL BASIN			
Year	Ratios		N
	female	male	
1998			
1999			
2000	1.44	0.82	4,173
2001	1.57	0.80	7,764
2002	1.72	1.01	5,942
2003	1.75	0.60	4,099
2004	1.53	0.63	2,828
2005	1.65	0.78	1,417
2006	1.52	0.57	1,432
2007	1.71	0.92	2,261
2008	1.54	0.93	2,033
2009	0.85	0.46	3,144

WESTERN BASIN			
Year	Ratios		N
	female	male	
1998	3.06	3.00	4,166
1999	11.99	2.93	7,056
2000	2.25	1.64	2,504
2001	4.20	2.40	10,257
2002	4.25	1.76	9,150
2003	2.25	0.71	4,764
2004	2.25	0.72	2,654
2005	1.86	0.94	1,720
2006	2.55	1.56	6,368
2007	2.42	1.17	3,071
2008	1.47	0.78	3,584
2009	1.25	0.76	2,311

Figure 1.20 Ratio of unfished (70-82.4mm CL) to fished (greater than 84mm CL) lobster in commercial catches sampled all months from 1998-2009. *Ratios represent relative numbers by sex in each size group for total lobsters measured (N) in each basin.*

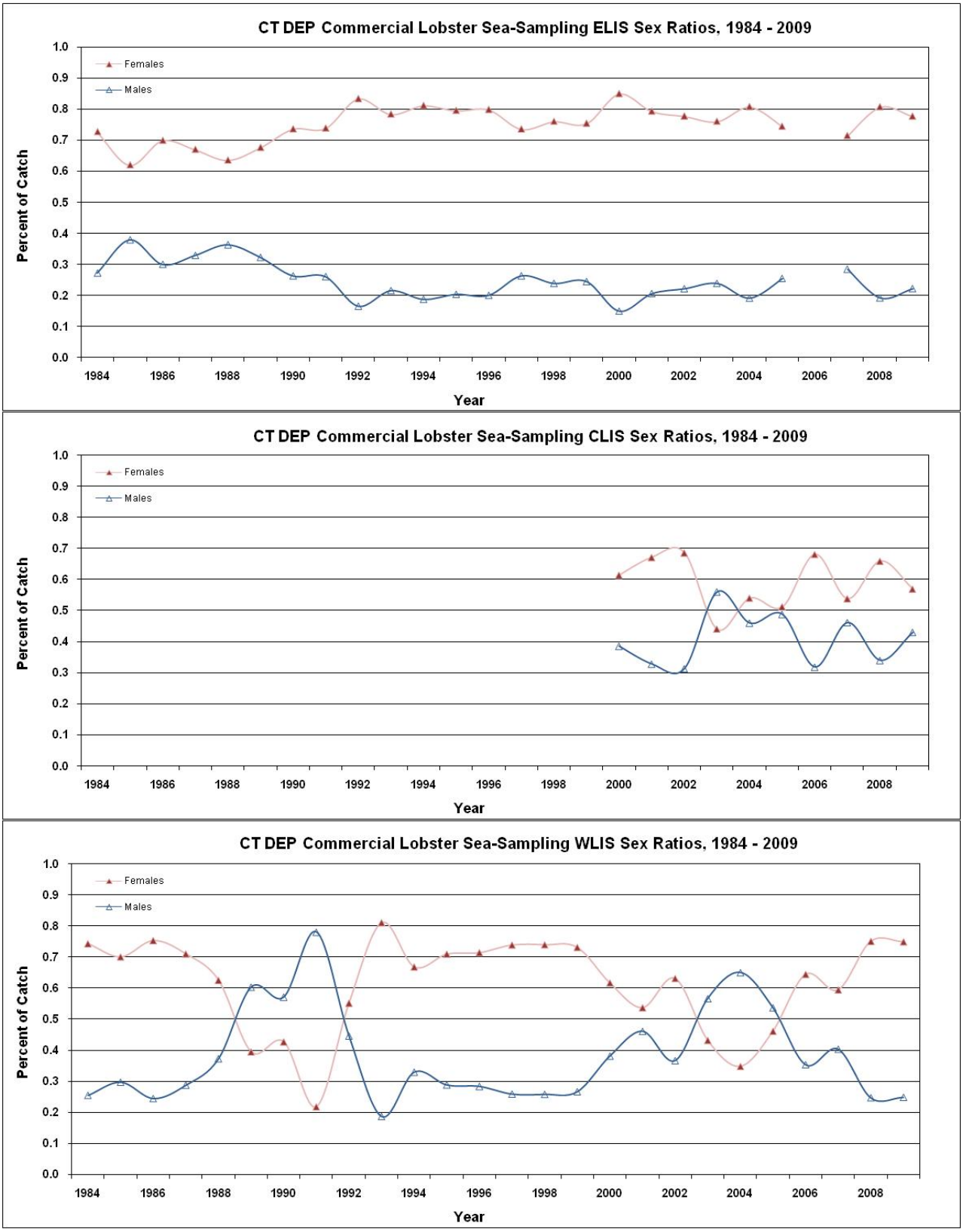
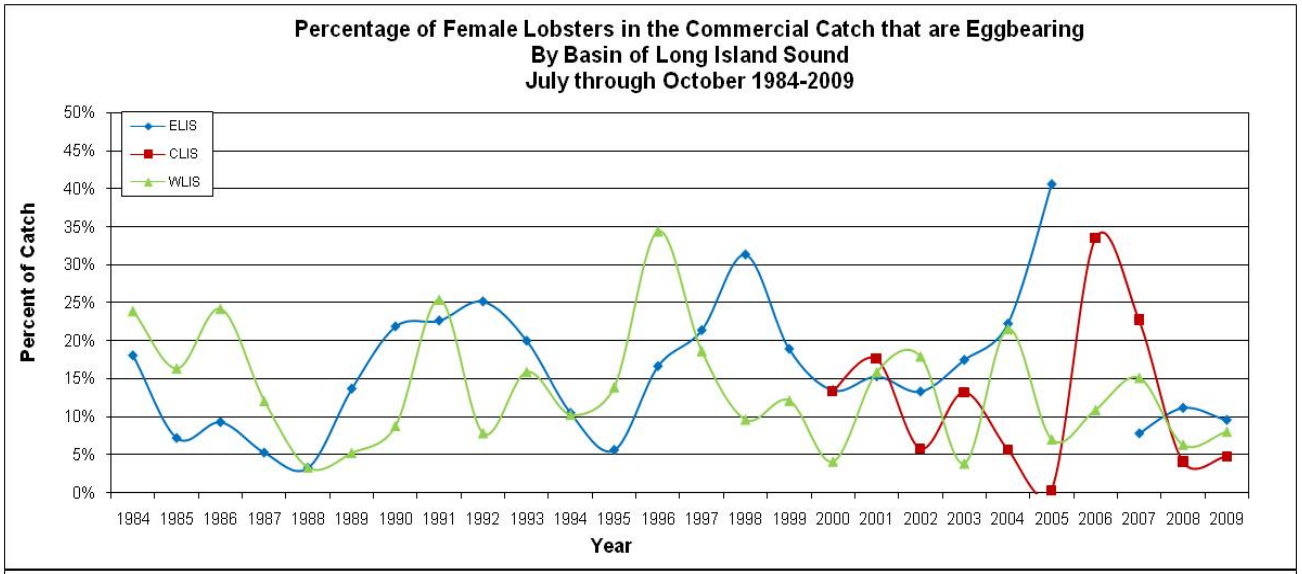


Figure 1.21 Sex ratio in the observed commercial lobster pot catch by basin, July through October, 1984-2009. *Shown for samples taken in the eastern=ELIS, central=CLIS (from 2000 through 2009) and western=WLIS basins. *Due to low sample sizes, data from eastern Long Island Sound in 2006 have not been included.*

A



B

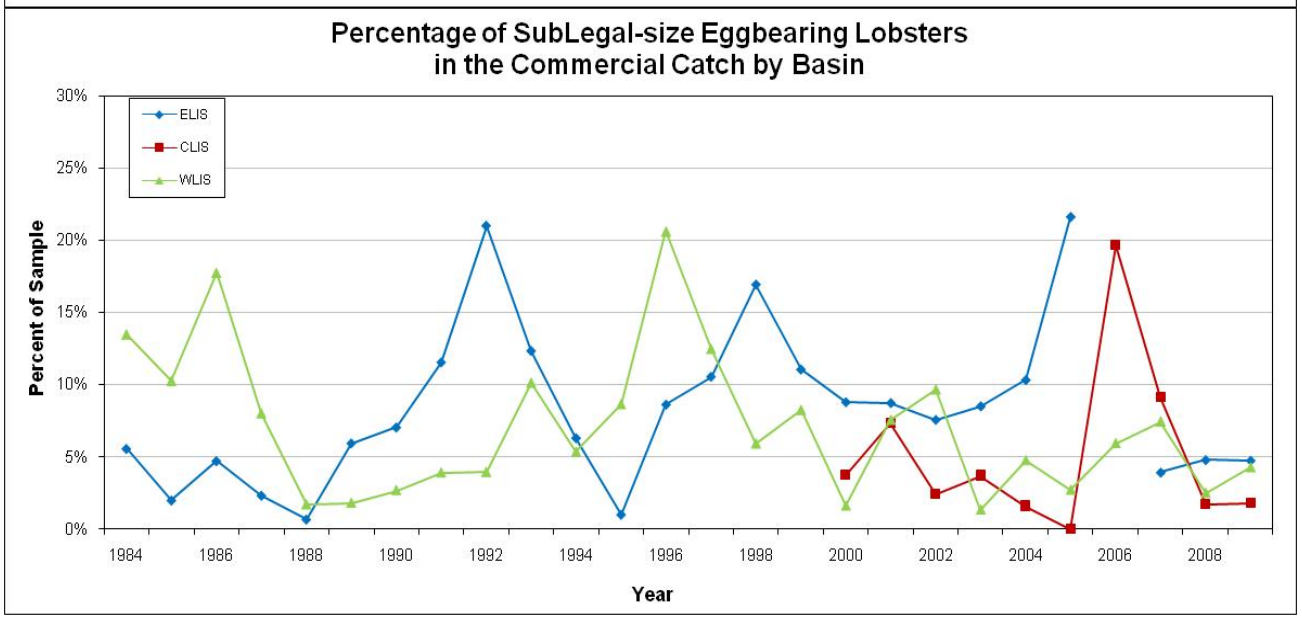


Figure 1.22 Sex ratio in the observed commercial lobster pot catch, July through October, 1984-2009. *The percentage of females in the entire observed catch (A) and percentage of females that are egg-bearing (B) are shown for samples taken in the eastern, central (from 2000 through 2009) and western basins. *Due to low sample sizes data from eastern Long Island Sound in 2006 have not been included.*

Year	Basin of Long Island Sound		
	ELIS	CLIS	WLIS
1992	0.9		0.4
1993	1.2		0.1
1994	1.4		0.8
1995	0.6		1.2
1996	1.1		1.9
1997	2.7		2.1
1998	3.1		1.0
1999	15.4		0.7
2000	17.0	0.8	0.4
2001	18.6	3.6	2.0
2002	35.5	6.5	0.3
2003	31.0	6.9	0.8
2004	26.7	5.4	0.1
2005	28.3	0.2	0.0
2006	33.9	1.4	0.0
2007	30.2	2.4	0.0
2008	14.3	5.5	0.2
2009	22.0	7.8	0.04

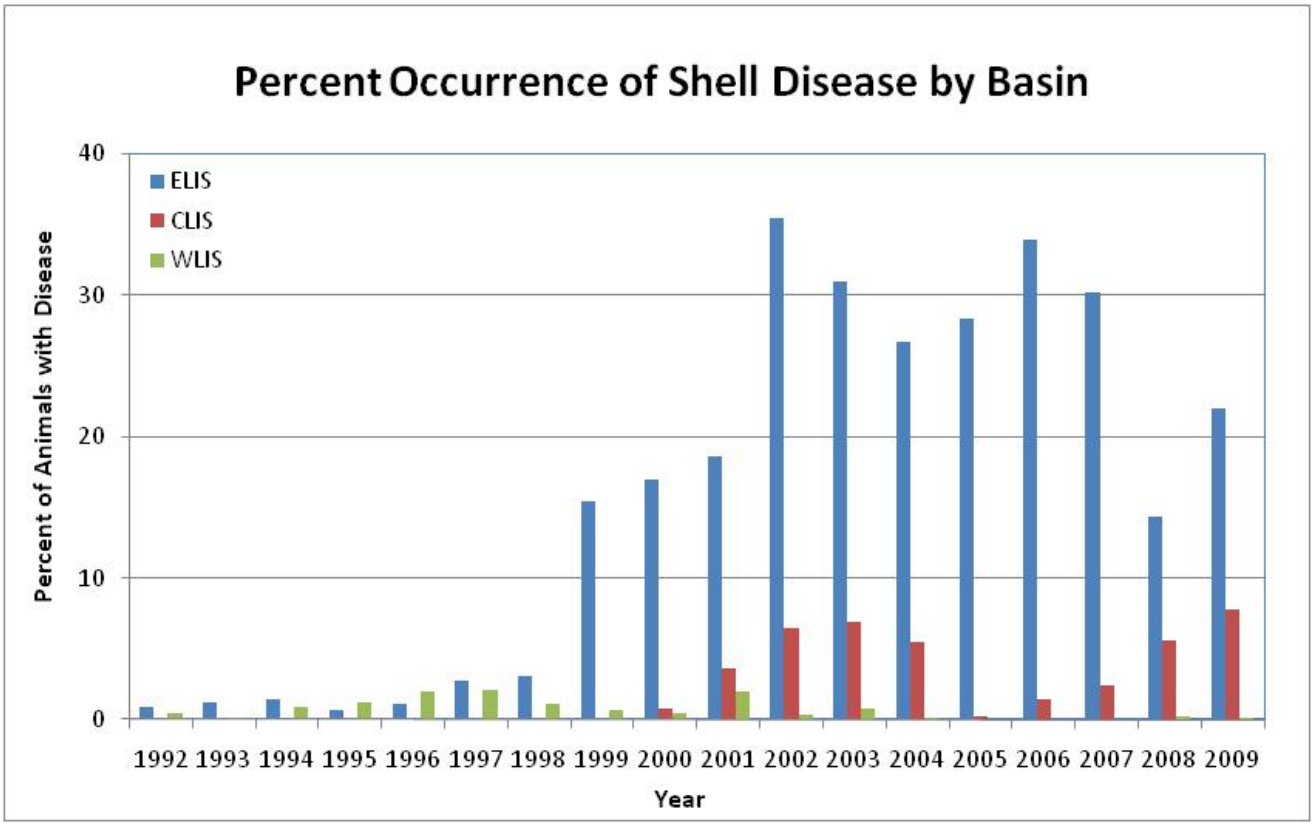


Figure 1.23 Percent occurrence of shell disease by basin of Long Island Sound (LIS) from commercial sea-sampling conducted 1992 – 2009. *(ELIS=eastern, CLIS=central, WLIS=western) *Sea-sampling in the central basin began in 2000. Note: only two sea-sampling trips were taken in the east in 2006. This small sample size may have biased the 2006 percent occurrences.*

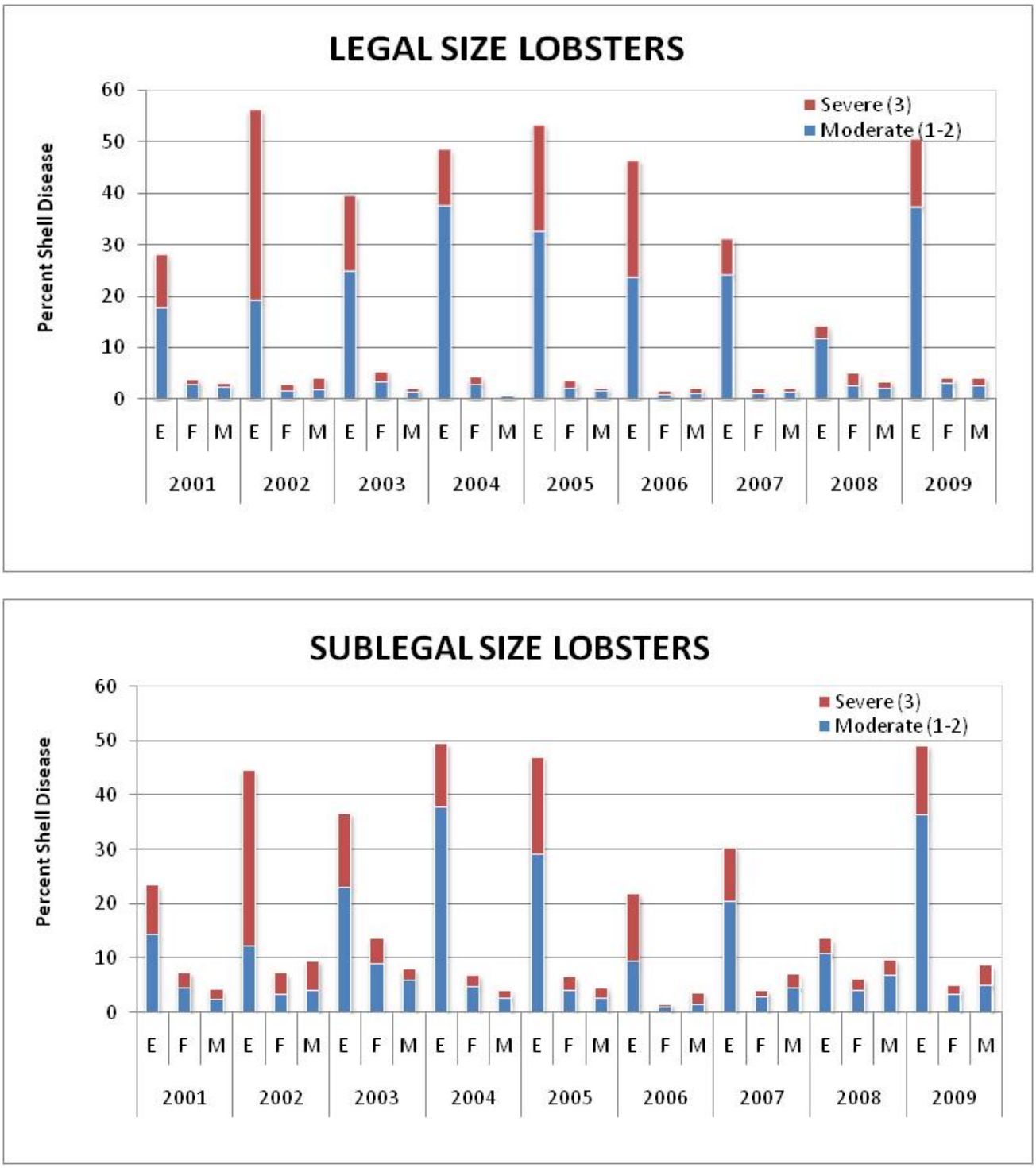


Figure 1.24 Percent occurrence of shell disease by size (Legal, Sublegal) and severity (based on shell disease index developed in 2001) in Long Island Sound (LIS) 2001 – 2009. **Only two sea-sampling trips were taken in the east in 2006. This small sample size in the basin most effected may have biased the 2006 percent occurrences.*

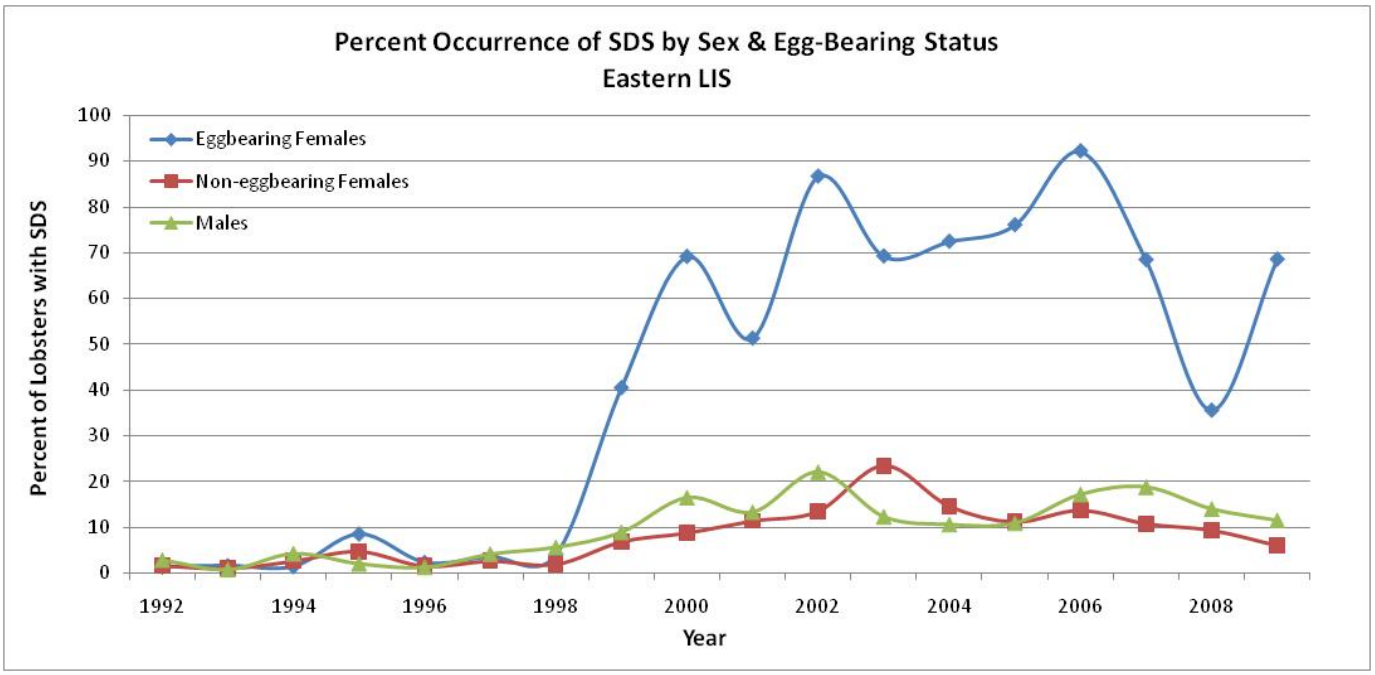


Figure 1.25 Percent occurrence of shell disease by sex (Eggbearing, Non-Eggbearing, Male) in the Eastern basin of Long Island Sound (LIS) 1992 – 2009. **Only two sea-sampling trips were taken in the east in 2006. This small sample size may have biased the 2006 percent occurrences.*

Year	ELIS	CLIS	WLIS
1982	9.5		
1983	12.4		10.3
1984	14.0		9.4
1985	11.0		9.6
1986	12.5		12.5
1987	12.6		10.3
1988	10.5		12.1
1989	11.1		8.2
1990	13.3		9.8
1991	10.4		12.1
1992	17.9		12.9
1993	14.9		7.8
1994	21.2		12.5
1995	12.9		12.9
1996	19.6		14.0
1997	17.3		15.4
1998	13.2		10.1
1999	13.7		15.7
2000	10.9	10.3	12.9
2001	11.7	11.4	13.7
2002	11.3	14.1	12.6
2003	12.0	12.1	16.4
2004	9.2	13.7	16.9
2005	9.6	9.3	15.0
2006		10.3	12.8
2007	6.3	8.8	12.2
2008	11.9	8.0	12.7
2009	9.1	11.6	12.7
MEAN	12.72	10.87	12.34
STDEV	3.30	2.11	2.36

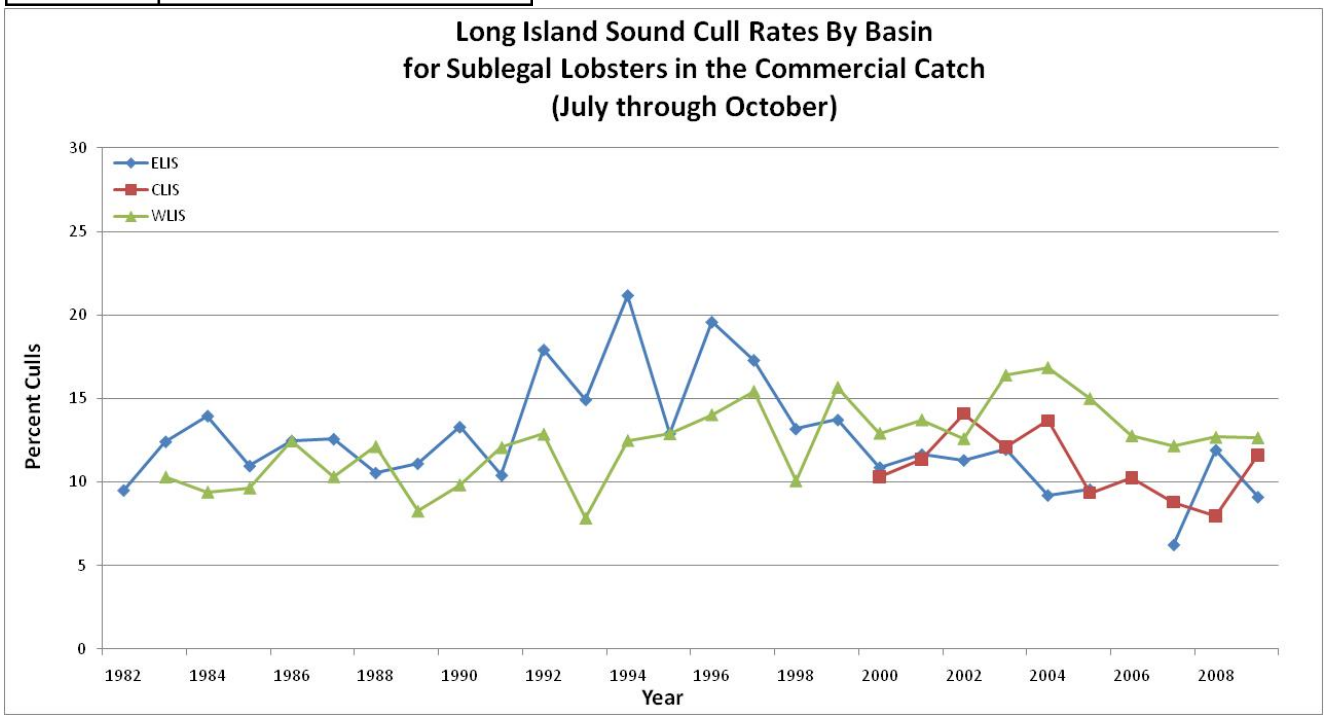


Figure 1.26 Cull rates for sublegal lobsters observed in the commercial sea-sampling catch, by basin of Long Island Sound (LIS) from July through October, 1982 – 2009. *(ELIS=eastern, CLIS=central, WLIS=western) *Due to low sample sizes, data from eastern Long Island Sound in 2006 have not been included.*

Year	ELIS	CLIS	WLIS
1982	9.2		
1983	9.4		11.2
1984	9.6		13.4
1985	8.5		15.4
1986	11.1		17.7
1987	12.0		16.1
1988	9.2		18.1
1989	10.4		13.3
1990	10.5		11.4
1991	13.3		16.4
1992	17.8		5.0
1993	15.3		12.9
1994	11.1		14.4
1995	12.3		17.0
1996	13.9		19.3
1997	14.7		18.5
1998	11.2		14.0
1999	14.3		18.2
2000	12.0	12.7	16.5
2001	12.4	14.2	24.1
2002	12.0	17.0	16.3
2003	13.1	18.6	22.0
2004	9.8	24.4	18.8
2005	8.9	10.0	24.5
2006		9.5	16.5
2007	12.0	9.1	14.9
2008	10.8	10.6	14.8
2009	10.2	15.6	16.2
MEAN	11.72	14.00	16.19
STDEV	2.23	5.16	4.05

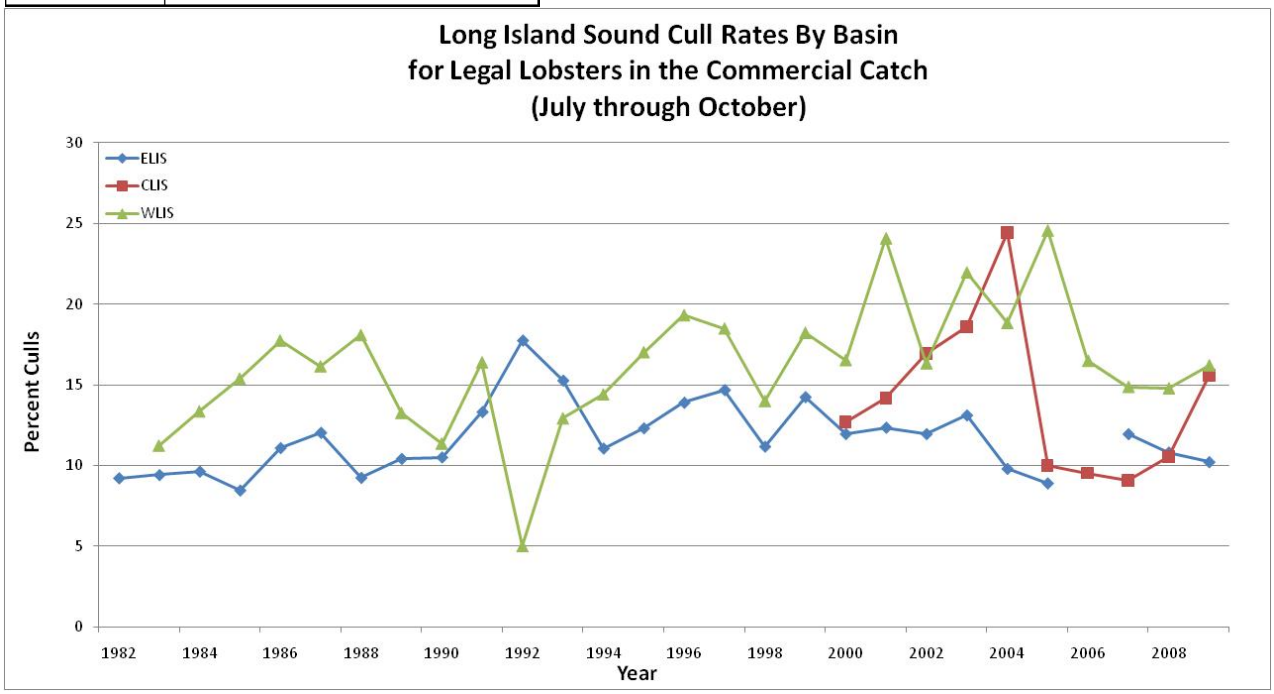


Figure 1.27 Cull rates for legal lobsters observed in the commercial sea-sampling catch, by basin of Long Island Sound (LIS) from July through October, 1982 – 2009. *(ELIS=eastern, CLIS=central, WLIS=western) *Due to low sample sizes, data from eastern Long Island Sound in 2006 have not been included.*

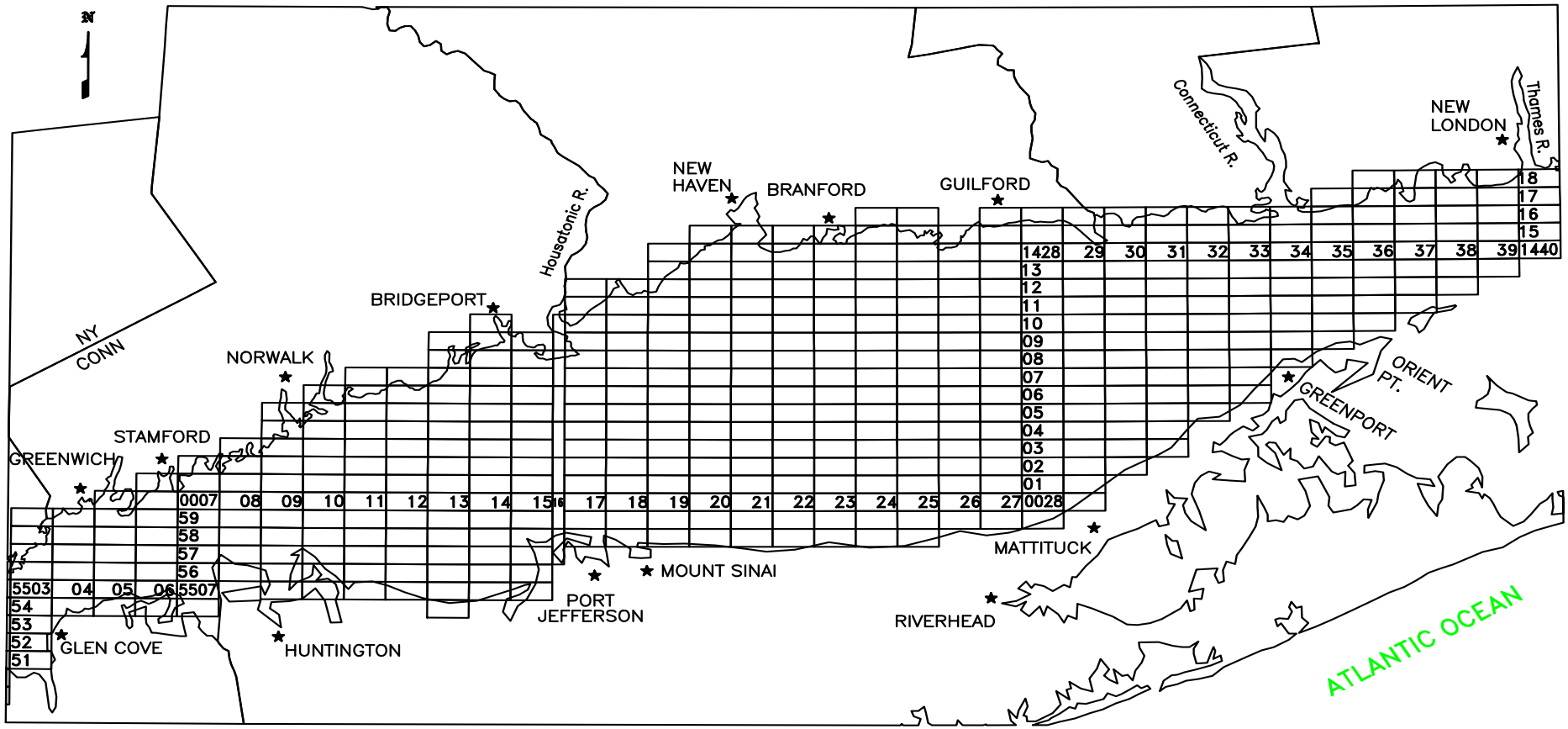


Figure 2.1 Long Island Sound Trawl Survey sampling area with grid overlay. *Each sampling grid is 1x2 nmi (nautical miles). A four-digit number identifies the grid: the first two digits are minutes of latitude (row number) and the last two digits are the column number. (Note: sites in column 16 are approximately 2x1 nm).*

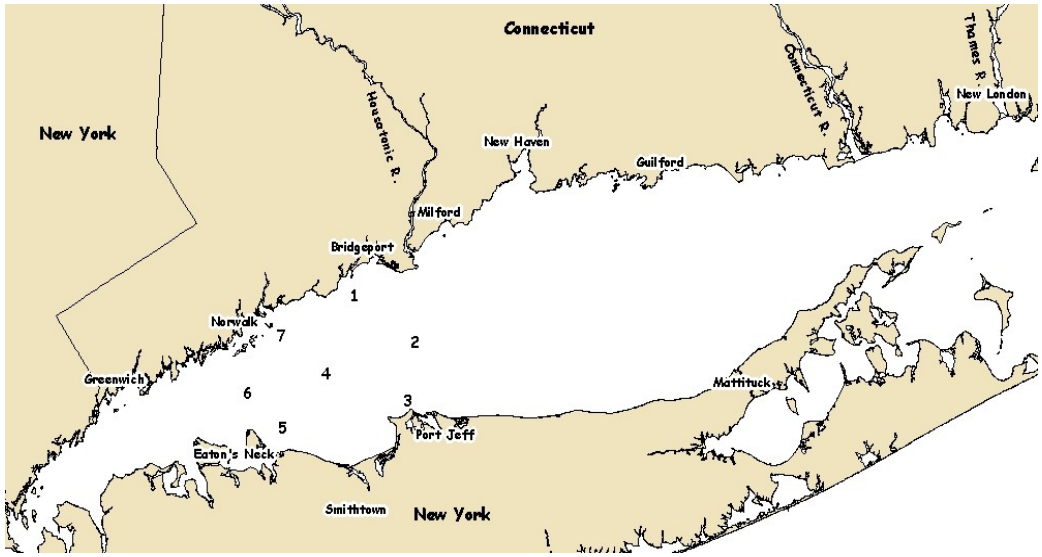


Figure 2.2 Larval sampling stations in western Long Island Sound, 1983 – 2009. *Station locations are numerically indicated.*

	2005						
Season	**Spring**				**Fall**		
Month	**April**	**May**	**June**	**Total**	**September**	**October**	**Total**
# Tows scheduled	40	40	40	120	40	40	80
# Tows taken	40	40	40	120	40	40	80
(# tows with lobster)	25	23	27	75	20	24	44
# Lobsters Caught	151	465	280	896	141	352	493
(Weight kg)	(44)	(114)	(77)	235	(39)	(90)	129
Lobsters Measured	139	453	226	818	120	327	447
	2006						
Season	**Spring**				**Fall**		
Month	**April**	**May**	**June**	**Total**	**September**	**October**	**Total**
# Tows scheduled	40	40	40	120	40	40	80
# Tows taken	0	40	40	80	40	0	40
(# tows with lobster)		28	21	49	21		21
# Lobsters Caught		399	163	562	186		186
(Weight kg)		(104)	(49)	153	(45)		45
Lobsters Measured		330	173	503	186		186
	2007						
Season	**Spring**				**Fall**		
Month	**April**	**May**	**June**	**Total**	**September**	**October**	**Total**
# Tows scheduled	40	40	40	120	40	40	80
# Tows taken	40	40	40	120	40	40	80
(# tows with lobster)	24	31	29	84	19	23	42
# Lobsters Caught	160	970	298	1,428	142	78	220
(Weight kg)	(44)	(200)	(144)	388	(41)	(25)	66
Lobsters Measured	125	866	277	1268	118	70	188
	2008						
Season	**Spring**				**Fall**		
Month	**April**	**May**	**June**	**Total**	**September**	**October**	**Total**
# Tows scheduled	40	40	40	120	40	40	80
# Tows taken	40	40	40	120	0	40	40
(# tows with lobster)	25	24	26	75		26	26
# Lobsters Caught	240	384	276	900		196	196
(Weight kg)	(70)	(101)	(92)	263		(52)	52
Lobsters Measured	230	368	230	828		173	173
	2009						
Season	**Spring**				**Fall**		
Month	**April**	**May**	**June**	**Total**	**September**	**October**	**Total**
# Tows scheduled	40	40	40	120	40	40	80
# Tows taken	40	40	40	120	40	40	80
(# tows with lobster)	21	19	19	59	12	20	32
# Lobsters Caught	101	235	118	454	62	238	300
(Weight kg)	(32)	(63)	(37)	132	(19)	(64)	83
Lobsters Measured	96	218	109	423	141	211	352

Table 2.1 Research trawl sampling effort and lobster catch for spring and fall cruises, 2005 - 2009. *Number of lobsters and catch weight are expanded totals.*

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	24	25
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	22	20
2005	SP	120	897	146	2.43	7.50	0.63	23	22
2006	SP	80	562	114	1.94	7.02	0.61	25	24
2007	SP	120	1,429	251	3.22	11.91	0.70	18	19
2008	SP	120	900	59	2.72	7.50	0.63	21	23
2009	SP	120	455	50	1.39	3.79	0.49	26	26

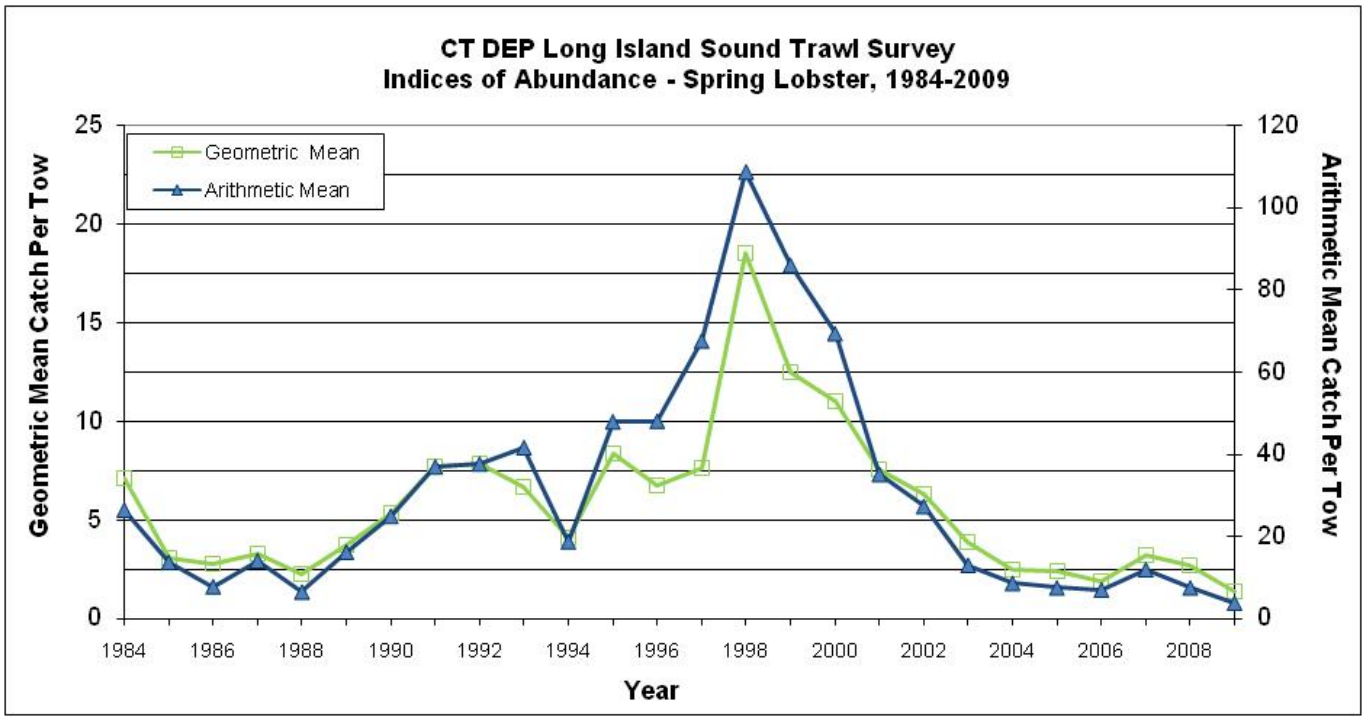


Figure 2.3 Long Island Sound Trawl Survey spring abundance indices for American lobster, 1984-2009. *The number of tows, total catch and percent of tows catching lobsters are shown above for each year.*

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	25	24
2007	FA	80	220	41	1.21	2.75	0.53	26	25
2008	FA	40	196	31	2.07	4.90	0.65	23	23
2009	FA	80	146	28	1.82	1.83	0.55	24	26

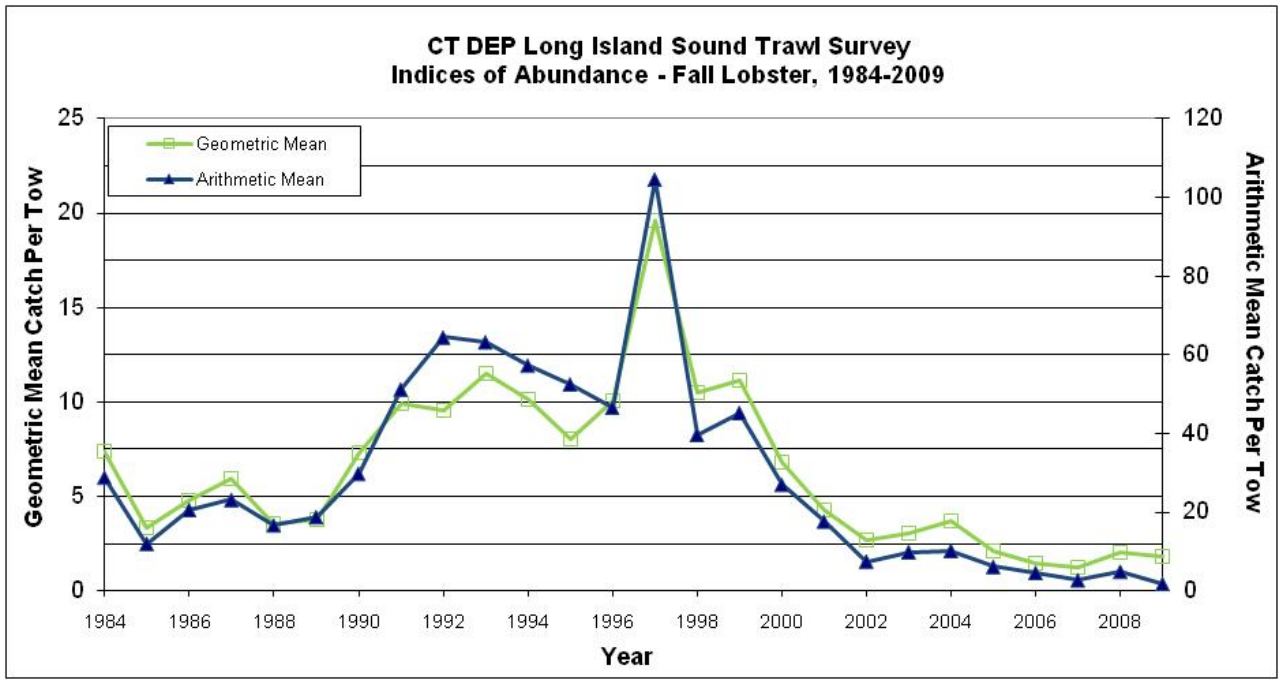


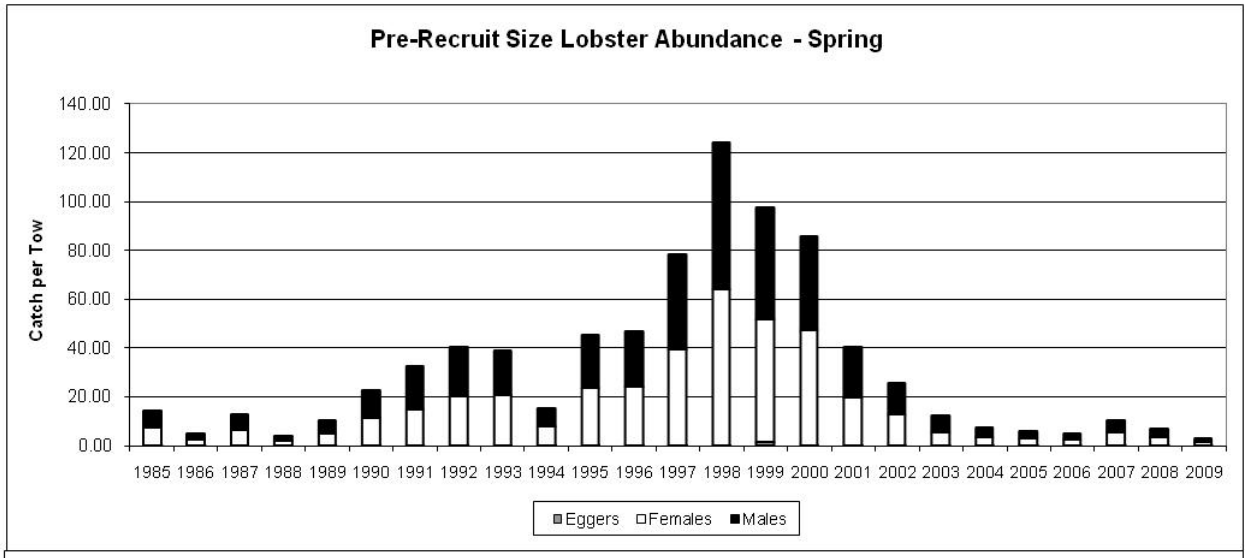
Figure 2.4 Long Island Sound Trawl Survey fall abundance indices for American lobster, 1984-2009. *The number of tows, total catch and percent of tows catching lobsters are shown above for each year.*

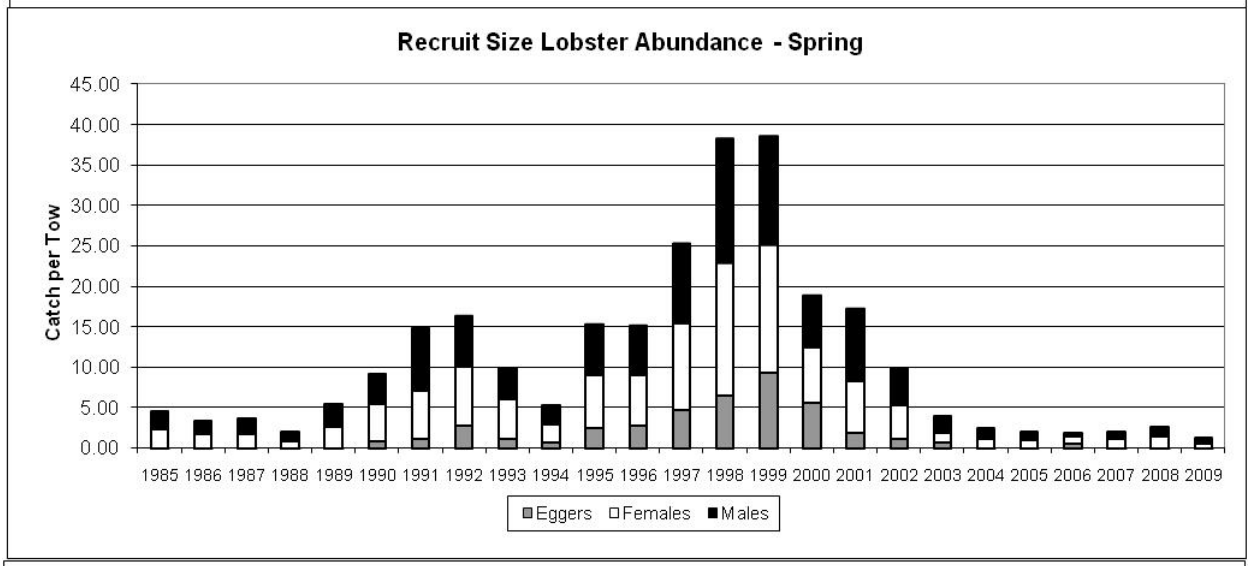
Spring	Pre-Recruit				Recruit				Legal			
Year	Egger Female	Male	Nonegger Female	All Females	Egger Female	Male	Nonegger Female	All Females	Egger Female	Male	Nonegger Female	All Females
1985	0.03	6.97	7.43	7.46	0.13	2.22	2.29	2.42	0.36	0.45	0.74	1.10
1986	0.04	2.55	2.45	2.49	0.43	1.58	1.48	1.91	0.24	0.57	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	12.57	12.47	12.94	1.32	4.64	4.11	5.43	0.21	1.76	0.72	0.93
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	0.62	0.58	0.88	1.51	0.06	0.28	0.07	0.13
2007	0.12	4.78	5.23	5.35	0.43	0.90	0.88	1.31	0.09	0.25	0.09	0.18
2008	0.16	3.59	3.12	3.28	0.43	1.13	1.17	1.6	0.04	0.52	0.37	0.41
2009	0.06	1.50	1.54	1.6	0.18	0.73	0.56	0.74	0.05	0.25	0.18	0.23

FALL	Pre-Recruit				Recruit				Legal			
Year	Egger Female	Male	Nonegger Female	All Females	Egger Female	Male	Nonegger Female	All Females	Egger Female	Male	Nonegger Female	All 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	0.00	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	16.38	12.49	13.21	2.24	6.51	3.11	5.35	0.55	1.33	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	0.57	1.14	0.59	1.16	0.07	0.12	0.17	0.24
2006	0.09	2.36	1.55	1.64	0.25	0.48	0.40	0.65	0.00	0.00	0.03	0.03
2007	0.05	1.10	0.83	0.88	0.21	0.71	0.30	0.51	0.02	0.10	0.00	0.02
2008	0.13	2.00	2.10	2.23	0.18	0.57	0.23	0.41	0.10	0.15	0.06	0.16
2009	0.14	2.78	1.69	1.83	0.20	0.76	0.34	0.54	0.00	0.17	0.16	0.16

Table 2.2 Spring and Fall LIS Trawl Survey lobster catch by size class and gender / egg-bearing status, 1985 - 2009. *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 2.4 and 2.5 for graphic presentations.*

Pre-recruit size class = less than 73mm carapace length
Recruit size class = 73 - < legal size carapace length
Legal size class = 82.6 mm carapace length and larger through August 13, 2005
= 83.3 mm carapace length and larger August 14, 2005 - June 30, 2006
= 84.1 mm carapace length and larger July 1, 2006 - December 31, 2009





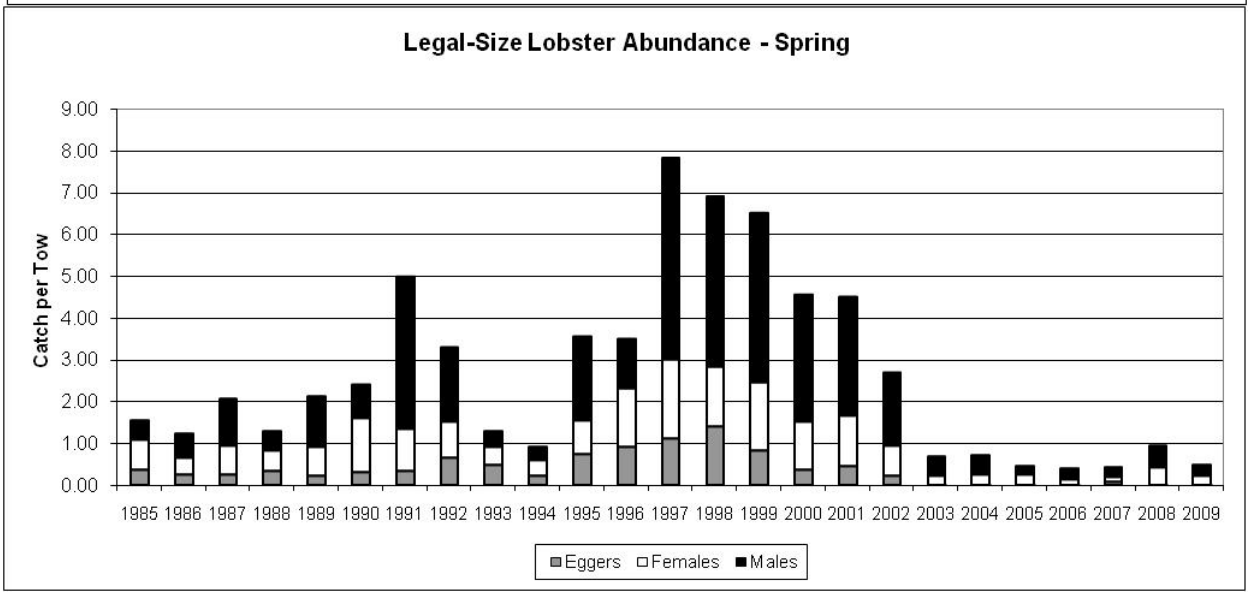


Figure 2.5 Spring LIS Trawl Survey lobster catch by size class and gender/ egg-bearing status, 1985-2009. *Values given are delta mean catch per standard tow for all spring survey tows (April-June) taken over mud or transition bottom types (sand sites omitted). See Table 2.2 for a listing of the data.*

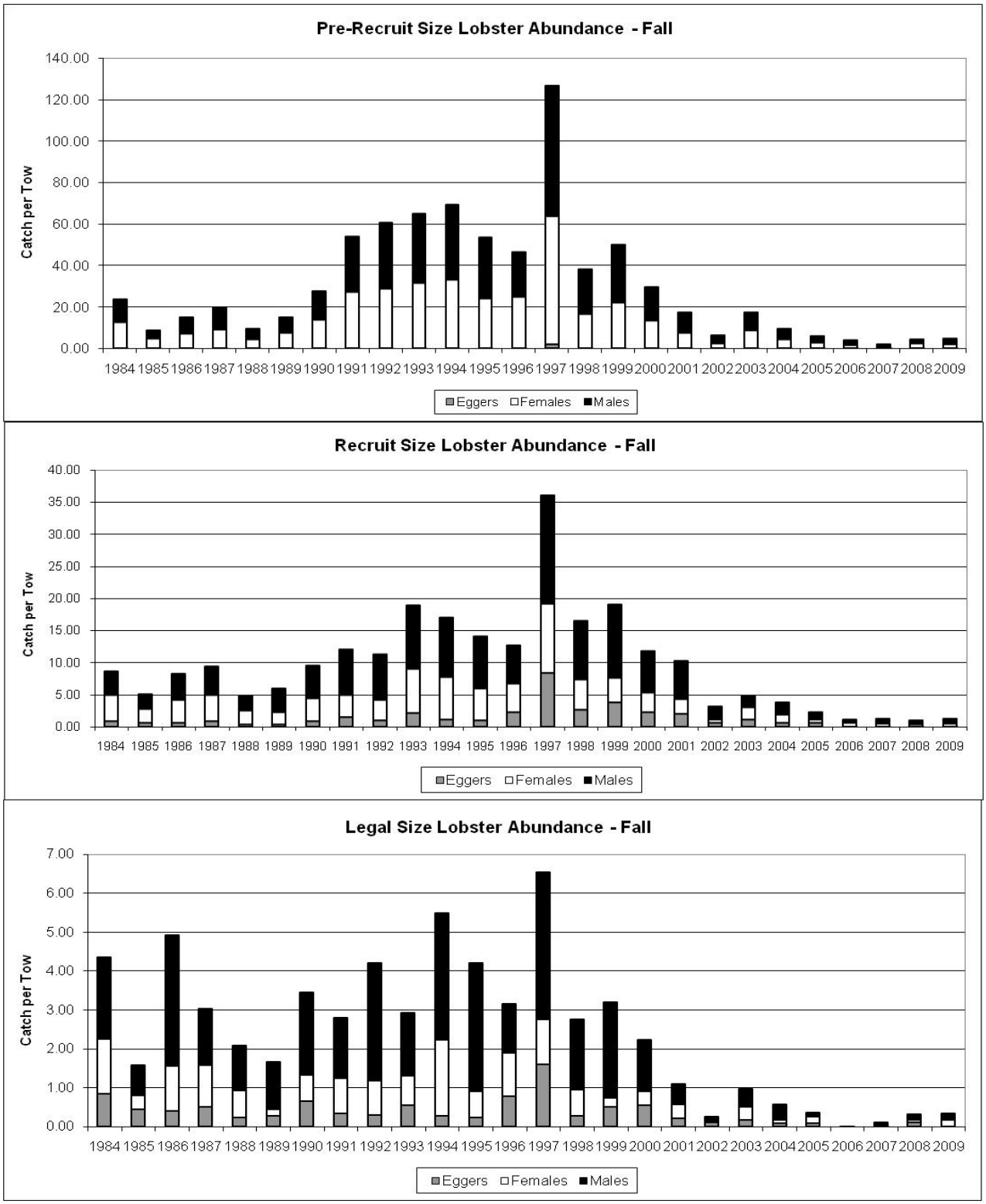


Figure 2.6 Fall LIS Trawl Survey lobster catch by size class and gender/ egg-bearing status, 1984-2009. *Values given are delta mean catch per standard tow for all fall survey tows (September-October) taken over mud or transition bottom types (sand sites omitted). See Table 2.2 for a listing of the data. Note that the 2003 means include catches taken in September and November (overall geometric mean = 4.71) unlike the geometric mean given in Figure 2.3 that includes only September data.*

Female	Spring																										
Length	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	(32)	(46)	(116)	(120)	(120)	(120)	(120)	(120)	(80)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(119)	(120)	(80)	(120)	(120)	(120)
16	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	1	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	2	0	2	0	4	0	0	1	0	0	0	0	0	1	0	0	0
22	0	0	0	0	0	0	0	0	0	1	0	0	3	1	0	2	4	0	0	0	1	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	4	0	1	3	1	1	2	6	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	2	1	8	0	2	0	1	0	0	0	0	2	0	0
25	1	0	0	0	0	0	1	0	0	1	0	1	1	0	3	2	0	0	0	0	0	0	0	0	0	1
26	0	0	0	0	0	0	0	3	5	0	0	0	6	9	3	9	2	0	0	1	0	0	0	0	0	0
27	0	0	0	0	0	0	1	0	0	1	0	5	7	12	4	6	9	0	0	1	0	0	0	0	0	0
28	0	2	0	0	1	0	0	3	0	1	1	0	5	8	6	10	11	1	0	0	0	0	0	1	0	0
29	0	0	1	2	0	0	0	4	0	2	0	0	13	14	7	8	13	3	2	1	1	0	0	0	0	0
30	0	0	0	1	1	0	11	6	0	5	3	0	13	12	95	2	19	2	0	1	0	0	0	1	0	0
31	0	0	0	0	1	1	6	3	6	1	1	4	8	22	19	16	20	1	4	1	0	0	0	0	0	0
32	0	0	0	1	0	0	13	7	2	20	0	2	15	13	18	21	23	2	2	1	1	0	0	0	0	0
33	0	1	0	2	2	6	8	0	5	1	6	21	14	13	35	18	8	3	0	2	1	1	0	5	1	0
34	0	3	0	1	0	0	5	8	15	4	0	18	7	22	64	8	37	4	8	2	3	0	0	4	0	0
35	4	4	3	2	0	0	9	1	4	6	4	22	15	22	59	22	48	3	5	2	1	2	0	4	0	1
36	5	3	2	11	0	0	9	8	6	14	0	8	14	21	41	26	48	3	5	2	0	0	0	0	0	0
37	0	4	1	2	0	0	10	9	6	7	11	27	21	42	58	29	36	2	3	4	0	2	0	3	3	0
38	2	0	0	7	2	4	6	11	13	17	1	49	10	31	72	42	35	7	10	2	3	0	1	5	0	0
39	1	3	0	3	5	1	0	8	12	9	4	22	16	39	73	34	53	7	3	2	3	2	0	10	3	1
40	1	4	2	10	4	4	7	6	17	28	8	41	18	30	98	23	68	8	10	6	5	2	3	11	1	0
41	2	3	1	18	2	3	22	9	10	23	8	18	18	17	71	36	58	11	8	4	2	2	2	13	1	3
42	1	6	3	8	1	3	17	22	9	41	11	46	18	33	143	54	65	11	18	5	6	0	0	5	2	0
43	1	1	1	22	0	11	19	16	11	13	11	53	27	44	59	50	84	9	6	8	6	4	1	7	1	2
44	1	1	2	16	6	2	13	12	14	25	9	61	22	32	43	38	117	19	15	15	4	5	4	9	3	3
45	0	2	1	9	1	12	11	12	5	24	8	38	22	36	135	35	138	9	14	3	3	2	2	9	0	0
46	4	3	1	12	3	8	4	18	26	30	2	34	22	42	88	64	102	15	22	4	0	1	4	3	3	1
47	2	1	4	31	2	14	4	21	8	40	8	59	35	53	70	77	91	18	20	25	7	2	5	11	3	1
48	2	2	2	15	6	20	22	17	28	35	12	54	31	56	104	59	72	11	17	9	7	6	2	7	3	5
49	4	4	4	10	4	7	13	28	19	67	15	37	32	55	198	90	89	8	15	15	5	1	3	7	2	2
50	6	1	6	7	4	7	16	18	5	40	21	51	43	67	139	63	104	13	21	13	6	2	0	10	6	1
51	4	5	6	8	3	15	33	24	22	59	16	58	48	88	133	95	109	31	17	13	5	2	4	16	6	3
52	9	8	3	15	3	14	29	45	32	35	33	58	57	73	165	89	125	40	25	11	6	4	3	13	3	3
53	10	4	4	20	5	19	14	38	31	54	24	53	47	82	167	89	83	32	26	9	6	6	5	14	3	3
54	2	4	6	15	2	22	38	35	18	38	29	44	45	87	140	84	152	30	41	15	6	7	2	9	3	3
55	9	2	8	14	3	9	26	19	26	47	17	59	64	82	191	91	132	34	38	21	8	9	11	20	6	7
56	6	9	11	12	14	15	31	47	16	60	17	64	56	98	152	99	85	44	24	14	10	14	2	20	7	0
57	10	3	6	10	11	23	24	57	61	79	24	46	60	95	159	156	102	44	28	11	7	10	7	17	12	6
58	1	8	7	15	6	25	38	35	27	53	17	56	62	111	144	118	118	38	35	11	12	12	7	15	9	5
59	10	18	7	14	7	29	13	51	28	52	37	70	66	97	144	147	105	45	32	12	12	11	9	15	4	3
60	6	12	11	19	9	25	34	45	43	57	30	91	76	97	114	102	97	60	48	15	16	10	3	24	6	4
61	5	14	11	8	12	15	33	49	31	56	44	62	62	92	181	160	79	46	40	21	6	20	13	28	7	3
62	12	9	5	11	4	12	57	33	34	75	46	61	67	94	118	116	75	59	46	13	11	14	9	22	10	7
63	4	9	10	27	9	27	56	41	25	60	44	60	70	96	133	136	66	43	41	28	14	13	6	23	11	5
64	10	16	9	16	8	13	38	33	41	75	24	64	91	86	176	148	110	75	46	23	11	16	8	25	10	6
65	9	7	9	29	15	25	46	45	26	68	28	72	78	110	169	160	84	63	48	10	16	19	12	16	13	10
66	11	15	18	25	10	21	43	59	48	86	26	84	87	116	147	121	99	55	39	15	19	9	3	21	23	8
67	6	20	22	21	14	31	33	51	41	52	28	67	62	98	148	171	90	72	42	16	23	23	9	17	8	4
68	21	10	12	43	11	14	41	65	37	45	29	76	73	94	142	158	107	49	48	19	20	13	14	21	15	7
69	10	8	18	33	16	16	36	78	56	58	30	71	57	107	148	188	76	79	52	28	16	13	1	13	19	10
70	15	5	14	30	13	29	51	59	37	67	27	79	74	119	157	177	86	67	57	25	21	12	6	23	20	6
71	10	11	12	21	12	13	29	48	49	67	44	92	88	125	117	166	91	74	45	24	15	18	10	23	14	6
72	11	6	20	18	8	24	40	50	48	61	30	77	91	107	157	177	98	75	80	20	13	22	10	30	15	8
73	13	9	18	13	14	20	47	39	54	54	37	97	69	107	171	164	99	59	61	30	17	17	8	23	18	8
74	10	6	17	20	8	24	24	43	52	45	39	60	74	130	153	215	104	66	70	25	11	12	9	17	13	6
75	15	12	17	28	7	20	67	87	56	54	25	83	68	103	181	196	124	80	47	27	16	19	9	17	14	7
76	14	9	20	14	8	25	67	71	41	38	24	78	69	114	229	185	102	59	45	15	9	16	11	13	25	5
77	9	5	15	19	15	32	41	77	69	44	20	102	65	95	160	195	109	52	39	23	16	13	17	16	11	6
78	24	9	15	14	13	49	60	57	63	64	22	90	61	110	177	176	93	48	55	18	7	9	15	16	16	10
79	23	6	24	21	10	55	42	64	35	52	30	77	92	117	179	203	98	51	52	11	10	9	13	14	12	14
80	22	1	18	10	11	35	34	45	31	71	41	71	79	92	180	200	91	63	41	16	15	9	11	15	8	7
81	10	2	7	15	13	19	69	56	49	48	34	72	86	148	170	140	85	62	33	11	15	9	9	12	16	2
82	9	0	3	9	5	15	28	41	36	35	21	71	57	110	108	106	47	40	21	14	8	6	5	14	10	4
83	9	5	5	8	3	7	25	22	16	7	7	15	31	28	65	59	41	25	17	4	4	7	3	9	14	9
84	3	1	7	9	4	11	15	12	7	8	4	11	19	20	7	33	14	18	18	4	4	5	3	5	7	7
85	5	2	5	7	6	3	11	5	7	8	8	17	20	28	22	9	15	9	7	1	5	1	0	5	6	2
86	9	3	6	3	6	8	14	14	3	3	2	11	23	24	23	10	12	8	11	2	0	3	0	2	7	1
87	10	0	3	4	8	13	17	9	7	13	15	16	11	13	12	9	8	7	4	4	1	3	3	0	1	2
88	2	3	8	3	9	9	6	11	3	11	2	7	13	18	17	5	1	9	1	0	1	0	0	2	5	3
89	3	6	5	8	5	8	12	10	12	5	2	16	12	16	13	11	8	9	5	1	1	1	0	3	0	1
90	15	2	4	3	8	4	5	8	11	3	3	9	15	10	11	10	7	10	4	1	4	2	0	1	4	0
91	5	1	1	6	2	5	11	8	1	3	0	5	7	11	6	3	2	4	0	0	0	2	1	0	0	0
92	4	2	0	2	3	2	7	1	0	3	3	3	5	7	7	2	1	2	7	0	1	0	0	0	1	3
93	0	1	2	1	2	1	2	1	0	0	1	0	6	3	0	2	5	0	1	0	0	0	1	0	1	0
94	0	2	1	1	3	1	1	2	0	1	5	1	1	1	4	1	0	1	0	1	0	0	0	1	2	0
95	0	0	1	2	2	3	8	4	0	0	0	0	0	0	6	0	0	1	1	0	0	0	0	1	0	1
96	0	1	0	0	0	2	0	1	0	1	2	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0
97	1	1	1	0	3	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
98	2	2	0	1	0	1	1	0	1	0	0	0	1	3	0	0	0	0	1	0	0	0	0	0	0	0
99	3	0	2	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
102	2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
109	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Total	**451**	**335**	**469**	**838**	**405**	**914**	**1,621**	**1,946**	**1,560**	**2,336**	**1,131**	**3,052**	**2,837**	**4,220**	**6,921**	**5,731**	**4,595**	**2,011**	**1,646**	**709**	**483**	**458**	**296**	**737**	**449**	**238**
legal size			81.0			81.8									82.6								83.3		84.1	

Table 2.3 American lobster length frequencies-spring, female, 1 mm intervals, 1984–2009. Lobsters were measured from each tow.

Male	Spring																								
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Length	(32)	(46)	(116)	(120)	(120)	(120)	(120)	(120)	(80)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(119)	(120)	(80)	(120)	(120)	(120)
16	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	3	0	0	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	1	0	1	0	0	0	1	0	0	0
23	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	0	0	2	0	0	0	0	0
24	0	0	0	0	0	0	0	0	2	0	2	0	1	0	6	0	1	3	0	0	3	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	1	1	0	4	6	4	0	0	0	0	0	0	1	0	0
26	0	0	0	0	0	0	0	0	0	4	0	0	4	3	2	2	2	1	0	0	2	0	0	0	0	0
27	0	0	0	0	0	9	0	0	1	9	2	0	2	1	2	1	1	2	0	1	0	0	0	0	1	0
28	0	0	0	0	0	0	0	0	1	3	1	0	2	1	5	2	12	2	2	0	0	0	0	1	1	0
29	0	0	0	0	0	0	0	0	0	9	0	0	2	3	5	0	9	3	1	0	0	0	0	0	0	0
30	0	0	0	1	0	1	5	0	5	1	0	3	10	5	2	4	15	3	1	2	1	0	0	0	0	0
31	0	1	0	1	1	0	0	8	4	3	2	0	8	13	14	7	18	3	4	0	0	1	1	1	0	0
32	0	0	0	0	3	6	0	6	6	8	1	8	9	12	11	16	17	2	2	5	0	0	0	2	0	0
33	0	2	1	2	0	0	1	9	0	6	4	15	6	9	4	15	16	3	9	3	0	1	0	1	1	0
34	0	0	3	2	0	1	1	5	1	6	0	27	19	16	52	12	25	2	4	1	0	0	0	5	0	0
35	2	0	2	0	0	0	4	5	9	5	1	20	12	22	26	23	33	2	5	2	4	0	1	2	1	0
36	2	4	0	1	1	7	14	4	5	7	3	17	13	24	34	19	26	6	1	3	1	2	0	6	0	0
37	1	1	2	5	0	3	2	23	9	12	4	15	20	32	58	35	32	5	3	2	4	2	0	7	1	0
38	0	1	1	5	2	7	14	9	1	26	3	18	18	21	93	12	28	3	8	4	2	1	2	7	0	0
39	0	0	0	10	0	6	12	5	7	15	4	31	15	20	33	20	35	11	9	4	3	2	3	8	0	1
40	0	2	0	7	2	8	3	5	12	17	7	25	21	41	32	20	52	8	10	2	0	1	2	4	2	0
41	0	2	2	9	1	0	11	8	7	4	10	28	19	41	75	46	55	3	13	7	3	0	1	6	3	0
42	4	2	0	3	1	9	13	10	13	42	7	39	18	46	125	36	63	14	9	10	3	5	0	16	3	2
43	1	2	1	16	0	9	14	9	12	23	5	52	26	24	70	51	32	5	9	10	5	2	2	8	1	1
44	3	0	1	15	1	3	10	11	6	42	9	17	21	50	170	44	110	10	15	9	1	0	4	12	2	1
45	1	5	4	22	3	7	7	20	13	45	6	39	28	46	76	50	65	17	16	20	5	3	2	9	3	1
46	0	2	2	24	2	24	7	12	25	37	9	32	22	66	155	71	74	19	18	18	4	3	2	11	0	4
47	0	1	2	31	7	3	2	17	47	32	9	54	32	66	146	87	65	17	9	4	4	4	1	16	0	2
48	6	6	5	9	1	8	20	17	7	23	6	45	32	78	93	60	57	22	29	6	3	6	5	8	4	2
49	9	3	4	24	4	22	20	45	21	40	19	46	18	82	120	87	69	16	18	8	15	3	4	16	3	3
50	7	3	1	19	4	23	10	21	25	30	21	29	35	61	66	83	110	34	22	16	7	6	4	9	4	2
51	3	4	4	12	2	20	26	42	16	75	16	62	45	57	158	90	65	24	31	19	8	8	9	10	3	5
52	9	5	2	12	2	15	23	21	25	37	31	49	52	75	81	80	100	27	27	14	10	6	2	12	3	2
53	5	9	7	17	4	10	12	33	16	41	26	60	50	56	138	69	66	25	20	11	5	7	5	19	6	4
54	10	3	16	14	7	14	30	45	36	43	29	74	49	74	210	79	110	33	38	26	15	6	5	21	5	4
55	5	3	6	18	7	23	16	42	27	50	27	46	51	82	101	101	114	38	23	18	2	9	6	12	5	3
56	3	12	11	17	10	6	34	38	37	44	14	70	54	83	130	82	95	37	29	19	13	11	9	7	7	6
57	1	7	10	26	11	17	36	30	12	51	27	54	60	68	145	93	95	43	35	22	7	6	5	21	4	3
58	12	7	5	10	4	19	44	71	31	47	35	41	83	96	111	111	99	43	46	11	12	8	5	13	8	1
59	3	13	7	12	14	25	29	57	27	88	34	71	56	67	63	144	89	43	43	13	6	11	10	24	9	7
60	1	9	14	29	8	23	49	50	37	42	34	94	84	156	121	105	105	56	35	24	8	9	6	16	9	6
61	9	14	16	12	10	22	39	56	46	62	34	77	59	102	176	123	83	51	36	28	14	10	14	11	11	6
62	11	10	13	15	6	30	44	78	36	65	54	57	58	127	152	117	84	69	44	20	11	12	7	12	16	12
63	18	15	16	28	8	24	52	65	54	44	36	59	60	101	167	132	73	54	44	24	16	13	13	19	19	5
64	8	16	12	26	8	21	45	72	43	63	27	73	90	95	153	133	98	69	46	26	10	14	8	22	16	4
65	13	8	11	20	15	20	47	55	36	73	33	77	73	97	165	111	96	75	50	30	21	17	8	16	16	8
66	5	10	11	26	16	32	49	71	31	71	23	39	73	107	223	129	64	56	39	23	31	15	6	22	23	2
67	1	5	11	26	11	32	29	57	44	39	21	69	60	118	182	149	66	77	53	24	16	14	6	33	19	1
68	5	10	13	12	7	21	33	80	48	26	34	67	64	100	147	116	81	82	32	36	22	23	11	20	19	10
69	8	9	10	19	24	25	39	71	46	43	32	57	79	101	156	140	77	73	51	25	11	20	8	16	11	4
70	8	11	14	23	7	34	38	50	51	27	24	60	77	99	158	152	85	73	44	27	21	16	9	15	21	11
71	9	5	13	22	13	29	55	66	23	48	42	85	58	91	112	152	62	71	56	20	29	20	7	4	18	5
72	6	17	13	14	17	33	40	93	42	37	41	59	85	111	145	105	72	62	42	23	13	11	8	25	15	7
73	14	5	10	21	11	28	37	94	42	34	27	93	64	82	122	109	61	63	46	15	22	16	6	13	14	3
74	6	9	27	21	11	45	40	74	36	32	33	67	71	92	146	123	74	85	40	35	15	10	2	15	8	9
75	6	3	13	15	10	35	29	63	40	48	21	84	62	73	81	120	52	72	39	21	16	14	6	19	11	5
76	12	3	20	16	18	18	33	79	23	32	23	47	48	67	143	122	49	69	50	25	9	11	4	13	8	3
77	9	7	10	14	7	22	30	69	31	24	12	50	54	66	115	97	57	63	35	24	18	17	2	8	14	10
78	18	3	18	9	11	33	46	37	29	38	20	55	35	46	113	90	37	56	55	14	9	8	4	9	13	8
79	7	9	15	21	15	22	31	77	19	41	30	36	43	64	129	83	43	57	31	14	13	9	7	13	7	12
80	5	6	9	22	5	23	34	49	22	19	32	52	37	57	77	63	47	67	39	19	8	10	6	15	9	4
81	8	0	9	11	1	34	21	53	34	31	19	43	27	70	118	67	44	45	41	11	6	8	5	11	9	10
82	2	3	2	10	4	9	18	39	25	13	13	51	27	62	97	83	23	36	31	10	7	2	1	16	8	2
83	9	0	5	9	7	18	12	33	24	6	7	15	15	47	33	41	37	25	21	4	8	4	7	2	8	6
84	5	1	8	12	2	5	10	33	9	7	3	26	8	34	28	29	24	23	21	8	7	3	3	8	10	2
85	3	2	6	8	4	6	9	28	6	3	0	14	4	49	18	20	26	23	18	2	8	3	5	5	1	2
86	1	3	5	1	6	26	8	28	7	4	2	15	13	12	19	17	30	23	15	1	8	1	1	7	6	1
87	3	0	1	13	8	9	4	31	0	0	6	3	6	30	37	23	11	15	8	3	3	1	2	1	7	4
88	0	0	5	4	1	14	2	21	2	0	4	14	4	32	15	27	12	10	13	2	2	1	1	1	4	1
89	5	0	2	2	3	2	6	21	5	0	2	11	3	33	28	23	13	10	8	2	1	3	2	0	4	4
90	0	0	0	1	5	6	5	24	2	1	0	7	7	30	25	24	16	11	9	3	0	0	1	3	3	4
91	4	0	1	7	4	7	5	26	6	1	0	7	2	25	11	20	11	14	8	3	1	4	0	0	3	2
92	2	0	2	4	2	3	1	24	1	3	0	8	11	23	15	9	8	10	10	1	0	1	1	0	1	0
93	0	0	3	6	1	10	0	5	0	1	0	8	2	6	27	4	13	9	4	0	1	1	0	5	0	0
94	0	2	1	3	0	1	0	9	1	0	0	9	2	7	16	17	11	9	4	3	2	0	1	0	3	0
95	1	0	0	5	0	0	0	1	0	1	2	7	1	4	5	8	7	0	1	2	1	0	0	0	1	1
96	0	0	1	1	0	0	2	8	1	1	0	6	0	1	8	4	5	2	3	0	1	0	0	0	0	0
97	3	3	1	2	1	9	2	2	4	0	0	3	0	6	3	4	1	2	0	1	0	0	0	0	2	1
98	0	0	0	3	0	0	1	1	0	0	1	0	0	2	0	0	1	0	2	1	0	1	1	0	0	0
99	2	0	0	1	0	1	0	2	0	0	0	1	1	1	0	1	2	0	0	0	0	0	0	0	0	
100	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0
101	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3	0	1	0	0	0	0	0	0	0	0
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
104	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
107	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	317	295	436	854	375	1,031	1,362	2,429	1,371	1,906	1,064	2,690	2,389	3,875	6,112	4,554	3,624	2,198	1,633	843	541	439	266	690	451	231
legal size	81.0					81.8		82.6															83.3	84.1		

Table 2.4 American lobster length frequencies-spring, male, 1 mm intervals, 1984–2009.
Lobsters were measured from each tow.

Female	Fall																											
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Length	(70)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(120)	(120)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(40)	(80)	(80)	(40)	(80)	(40)	(80)
16	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
24	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	1	0	0	0	0	0	1	2	0	0	0	0	1	0	0	1	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	1	4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	1	0	0	0	3	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0
28	0	0	0	0	0	0	1	0	4	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	1	1	0	0	3	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	1	0	4	0	2	5	3	0	5	7	2	0	0	0	0	0	0	0	0	0	0	1
31	0	0	1	0	0	0	3	0	7	11	8	1	5	4	0	0	1	1	0	0	1	0	0	0	0	0
32	1	0	0	0	0	0	3	1	15	4	13	1	4	5	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	2	1	1	3	12	9	2	2	0	0	1	1	5	0	0	0	0	0	0	0	0	0	1
34	1	0	0	0	2	1	0	6	16	3	17	2	6	8	1	8	0	0	0	0	1	0	0	0	0	0
35	0	0	6	1	0	2	3	0	23	5	16	3	8	6	0	2	1	0	0	0	1	0	0	0	0	0
36	4	0	1	1	1	3	1	1	31	7	26	0	8	14	0	5	0	0	0	0	0	0	0	0	1	0
37	4	0	2	0	3	2	10	22	19	2	19	5	5	7	1	8	1	0	1	0	1	1	0	0	0	0
38	3	2	2	3	3	2	8	1	24	9	23	1	18	17	2	13	1	2	0	0	0	1	0	0	0	0
39	6	0	10	1	1	0	9	15	32	6	22	0	7	22	2	4	1	2	1	0	0	0	2	0	0	1
40	0	0	3	1	12	14	14	20	35	16	24	12	23	15	3	8	1	1	0	0	0	0	0	0	0	0
41	3	0	0	5	2	6	19	21	32	22	52	8	39	15	7	13	2	0	0	1	2	1	0	0	0	0
42	7	0	5	0	4	2	3	36	52	21	43	7	24	49	9	17	2	3	0	0	2	0	1	0	0	0
43	5	0	2	4	4	2	16	23	30	39	52	16	20	25	5	15	3	0	1	1	1	4	0	0	0	0
44	29	7	1	8	1	6	11	32	32	29	63	14	46	47	9	17	5	0	2	1	2	1	0	0	0	2
45	18	0	7	3	2	0	12	25	50	17	57	22	38	32	7	27	4	2	2	1	0	1	1	0	0	1
46	10	0	1	11	6	6	26	34	42	43	63	20	33	50	12	18	9	3	2	1	5	2	2	1	0	0
47	21	7	3	12	2	12	18	52	47	44	41	27	32	42	5	16	2	1	0	1	2	0	0	0	0	1
48	10	5	4	14	8	18	19	35	58	52	69	28	33	58	14	15	7	2	6	0	2	2	1	0	1	0
49	29	6	7	14	15	11	15	27	77	58	47	47	19	71	11	27	10	2	4	2	4	1	1	0	0	1
50	27	9	6	21	12	4	31	41	52	38	69	54	28	61	13	31	10	6	2	2	2	4	3	2	3	0
51	35	8	2	12	3	11	10	44	73	72	94	45	41	49	15	30	13	6	3	1	2	2	0	0	1	0
52	26	11	3	15	3	11	21	40	66	54	59	51	42	120	18	34	13	3	6	3	5	2	1	0	0	0
53	33	8	3	22	10	7	22	55	82	94	55	43	43	106	29	18	16	9	3	1	6	10	2	3	1	3
54	16	8	18	11	12	14	20	41	61	83	76	38	58	82	17	45	28	8	1	3	2	2	3	1	2	3
55	23	10	27	21	2	6	22	59	58	59	54	39	45	102	48	32	18	9	1	3	7	8	1	1	3	1
56	45	10	11	36	10	24	22	29	82	87	74	45	41	90	23	32	33	12	1	3	6	0	3	2	1	6
57	16	15	16	18	7	7	15	52	71	71	78	50	44	121	24	39	22	13	5	2	13	5	2	1	10	6
58	23	16	11	19	13	17	36	55	63	119	79	69	47	114	29	31	23	14	6	5	5	8	1	2	2	5
59	21	11	13	26	13	23	30	79	66	110	84	48	46	110	35	36	28	18	5	6	10	4	4	0	2	5
60	30	18	20	18	7	17	16	74	53	115	70	53	51	140	29	35	34	8	6	9	7	6	1	4	5	2
61	10	4	17	24	12	14	37	46	52	91	79	51	56	119	34	37	27	9	5	2	12	7	2	1	2	6
62	27	16	23	21	14	32	41	64	53	107	117	44	53	133	39	44	32	19	3	5	10	3	5	1	2	8
63	31	14	13	22	8	20	22	53	66	130	93	58	41	126	51	45	29	19	6	6	16	12	4	4	4	5
64	25	10	15	29	23	31	26	71	38	100	86	79	38	139	34	44	29	21	9	12	19	5	4	4	4	7
65	17	9	39	24	15	28	26	77	44	93	89	49	43	146	49	42	37	18	9	6	15	9	1	2	3	9
66	24	26	25	23	15	16	42	70	56	90	87	82	53	126	51	43	26	19	5	5	10	7	1	4	1	6
67	17	24	33	11	19	16	29	38	43	78	106	51	38	117	26	53	31	17	8	11	14	6	2	3	3	8
68	15	8	27	18	22	30	36	41	42	94	77	48	55	124	54	44	37	19	7	6	4	8	1	6	4	4
69	13	18	15	27	26	32	21	34	61	104	85	38	50	136	54	47	30	22	4	8	16	12	5	1	4	3
70	63	18	42	27	34	23	20	36	51	122	63	60	55	128	47	35	34	23	17	4	13	5	0	4	3	3
71	26	21	28	34	33	40	30	50	50	94	87	62	87	127	50	40	20	20	3	6	14	2	0	2	3	6
72	27	16	27	32	13	12	39	58	31	81	85	38	49	150	41	53	32	25	11	12	10	3	2	3	6	4
73	21	29	42	24	18	15	58	46	33	74	69	60	40	106	41	47	36	24	9	6	10	5	2	6	4	5
74	31	17	23	29	14	21	36	30	39	85	73	44	38	111	37	49	39	19	12	7	16	9	3	2	3	1
75	39	14	25	24	14	12	21	31	25	66	84	31	58	122	67	50	29	28	7	7	16	5	3	7	3	1
76	31	14	22	36	14	13	35	27	35	112	50	38	57	113	47	43	26	21	10	8	15	5	3	4	2	3
77	17	16	10	26	13	14	17	37	40	74	72	36	23	64	41	31	22	18	2	1	18	5	3	4	0	1
78	27	17	24	27	27	21	22	24	19	57	53	19	34	96	43	38	20	33	6	15	5	8	2	2	0	2
79	26	19	16	37	31	13	29	33	26	72	42	28	28	91	34	28	32	21	2	9	12	6	3	5	3	5
80	33	11	15	20	23	12	6	14	23	65	26	25	44	91	25	32	26	19	14	2	16	4	2	5	1	4
81	13	7	13	14	5	10	12	18	24	36	38	36	41	61	25	28	20	20	2	4	3	4	0	0	2	5
82	9	2	19	6	6	2	10	14	10	39	26	25	21	52	23	23	14	7	2	5	3	8	3	2	0	5
83	10	5	8	12	6	12	8	3	11	17	11	12	31	20	10	6	13	7	4	1	2	9	1	5	0	4
84	5	6	2	7	1	1	4	10	8	17	22	10	7	17	5	4	7	6	0	0	2	1	0	0	1	3
85	9	1	8	6	9	3	6	17	7	8	20	5	5	13	5	2	5	3	1	0	2	1	0	1	2	1
86	11	2	9	10	0	1	10	12	4	10	14	1	6	12	5	2	6	1	0	0	2	1	0	0	0	1
87	11	6	9	8	23	4	18	12	5	16	20	1	8	11	3	5	5	3	0	1	1	2	1	0	1	1
88	9	3	9	9	3	1	3	9	9	13	8	1	20	10	7	5	2	1	0	0	0	1	0	0	0	0
89	3	4	6	2	7	3	5	1	8	8	12	5	13	14	1	3	3	3	0	0	0	4	0	0	1	0
90	8	1	3	6	0	1	6	1	5	1	15	9	5	10	1	2	1	2	1	0	0	1	0	0	0	1
91	3	1	2	5	0	1	1	0	3	0	5	0	9	3	2	1	1	0	0	0	0	0	0	0	0	1
92	8	0	0	2	1	1	4	1	7	1	6	1	3	1	3	0	0	0	0	0	0	0	0	0	0	2
93	2	2	0	3	2	0	0	1	2	1	8	0	1	4	2	1	0	0	0	0	0	0	0	0	0	0
94	0	2	0	1	0	0	0	2	1	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1
95	1	0	0	1	6	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
96	3	0	0	1	1	0	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
97	15	1	0	1	1	0	1	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
98	2	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	1	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
103	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
105	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
107	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	1,089	523	759	907	622	688	1,133	1,917	2,301	3,264	3,198	1,795	1,979	4,196	1,329	1,511	957	596	223	195	365	225	84	94	96	150
legal size:	81.0					81.8		82.6														83.3	84.1			

Table 2.5 American lobster length frequencies-fall, female, 1 mm intervals, 1984–2009.
Lobsters were measured from each tow.

Male	Fall																												
	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Length	(70)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(120)	(120)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(80)	(40)	(80)	(80)	(40)	(80)	(40)	(80)
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	2	0	0	0	0	0	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	2	0	0	1	9	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
28	1	2	0	0	0	0	3	0	0	3	4	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0
29	0	0	0	0	0	1	3	0	0	6	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	3	0	3	0	4	0	3	2	0	0	0	0	0	0	0	1	0	0	0	0
31	0	0	2	0	1	0	2	0	4	2	3	0	6	2	2	0	0	0	0	0	0	1	0	1	0	0
32	4	0	0	4	0	0	0	5	13	2	3	0	4	5	2	2	0	0	0	0	1	0	0	0	0	0
33	1	0	0	2	0	1	0	3	4	0	9	1	11	3	1	5	3	0	0	0	0	0	0	0	0	0
34	1	0	0	2	1	0	2	1	13	4	11	0	4	1	1	1	1	0	0	0	0	0	0	0	1	1
35	3	0	0	1	0	0	3	7	13	15	12	1	8	3	0	4	0	0	0	0	0	0	0	0	0	0
36	3	0	0	1	0	1	5	8	25	8	21	1	7	14	2	1	0	0	0	1	1	0	0	0	0	0
37	3	0	6	0	1	1	7	4	38	4	21	1	11	7	0	2	0	0	0	0	0	1	0	0	0	0
38	2	2	2	3	2	0	0	6	40	6	34	1	17	14	3	5	0	0	0	0	1	4	3	0	0	0
39	0	0	2	1	2	1	5	8	34	5	25	4	16	28	7	17	3	0	1	0	0	1	0	0	1	0
40	3	0	6	2	1	5	10	8	35	21	35	6	15	14	5	7	1	0	2	0	0	0	0	0	0	1
41	6	1	1	3	4	1	12	13	43	14	54	5	11	24	1	6	1	0	1	0	0	1	2	0	1	0
42	4	6	2	0	11	3	12	13	43	34	55	5	29	25	9	8	5	0	1	1	2	1	0	0	1	0
43	1	0	3	3	2	1	7	7	49	17	56	12	23	41	5	21	2	2	0	0	0	1	1	1	1	0
44	4	1	1	5	11	1	6	13	35	13	63	26	16	40	5	19	3	2	1	1	3	0	0	0	0	2
45	7	3	3	3	8	10	11	42	44	34	43	20	44	53	9	18	5	3	2	1	2	2	2	0	0	1
46	2	2	1	7	4	14	10	31	44	19	58	33	18	35	7	16	5	2	3	0	0	2	0	0	2	1
47	13	4	3	10	10	5	16	14	66	60	26	26	33	41	13	20	7	2	2	1	2	3	0	1	1	0
48	15	3	5	7	14	4	16	10	67	49	72	19	49	72	8	20	9	9	1	0	3	2	0	0	0	0
49	4	2	10	8	2	12	18	45	48	100	56	33	30	48	10	37	9	1	0	1	6	3	2	0	1	2
50	13	5	8	21	9	11	16	37	63	56	55	53	28	56	15	44	9	3	2	0	5	4	3	1	0	0
51	51	6	5	17	10	11	24	46	74	30	88	27	22	88	21	37	18	6	3	3	3	0	1	0	0	1
52	15	5	11	17	3	16	31	43	65	78	82	56	30	80	36	42	9	4	2	0	3	4	1	1	1	3
53	13	9	3	30	5	15	22	57	55	83	83	61	37	103	29	29	15	8	3	1	7	1	0	1	0	1
54	24	12	19	26	21	17	25	76	47	59	97	59	30	116	23	43	21	7	2	3	8	5	2	1	3	3
55	23	4	17	23	13	26	25	47	83	84	70	80	32	96	26	46	38	9	2	2	12	3	3	1	0	7
56	18	12	25	18	13	13	13	37	65	104	90	52	43	89	39	39	21	10	3	4	10	3	3	0	2	6
57	9	0	10	30	26	18	36	43	64	101	79	92	27	111	44	42	27	10	5	4	8	8	1	7	2	4
58	29	15	24	23	13	30	34	51	68	68	107	58	48	80	42	57	21	10	8	5	6	7	3	1	1	5
59	47	8	26	31	16	14	23	43	86	109	78	76	40	143	33	54	29	24	10	8	10	13	6	5	1	6
60	16	6	11	26	7	26	39	56	77	103	109	69	30	134	56	61	37	9	9	7	13	7	2	2	0	1
61	23	5	10	25	30	12	24	57	68	138	120	78	59	128	53	64	44	15	8	5	17	8	5	4	1	3
62	50	17	26	23	10	13	36	37	57	125	92	80	42	145	57	49	28	19	10	7	10	6	3	1	4	7
63	14	18	37	20	15	19	28	63	68	144	107	74	41	149	60	63	39	29	15	7	4	9	5	4	1	10
64	28	17	22	24	35	19	25	86	74	87	106	73	77	138	57	68	42	35	9	8	19	12	2	2	2	8
65	36	10	39	31	20	16	39	87	49	107	83	75	73	161	75	48	37	34	17	10	14	14	3	4	6	11
66	22	13	21	41	31	27	22	60	59	81	87	93	40	130	63	61	41	24	12	7	21	6	4	2	6	11
67	14	16	39	28	21	24	30	78	82	108	119	63	46	136	51	38	43	38	13	7	17	12	2	7	7	14
68	16	18	30	31	17	19	42	71	69	107	79	55	34	113	67	61	57	33	21	7	15	12	5	5	4	16
69	46	13	22	32	31	30	24	51	81	131	101	75	28	121	52	54	41	21	20	11	23	10	2	5	5	8
70	32	11	28	31	14	24	26	63	56	117	112	79	36	122	60	78	42	22	12	8	30	7	1	4	3	6
71	8	14	25	23	21	25	24	58	63	115	83	52	63	126	69	75	48	47	21	13	20	6	6	0	4	12
72	23	20	31	36	29	19	33	89	61	86	76	65	66	86	77	64	47	52	13	9	19	10	6	9	2	8
73	40	18	42	29	13	42	40	53	44	85	83	51	44	98	54	70	47	32	6	5	20	9	0	3	4	9
74	36	18	22	25	22	19	39	28	69	130	108	56	42	99	64	65	37	39	21	14	10	4	1	8	6	12
75	9	8	23	18	16	28	33	38	53	101	97	58	35	99	62	63	39	33	14	6	23	12	0	3	1	11
76	21	15	24	25	12	36	20	37	33	75	66	37	32	88	55	66	33	28	14	5	16	4	5	7	0	6
77	13	6	23	19	33	18	32	28	53	79	52	55	37	94	55	60	31	33	17	3	7	9	5	6	2	7
78	28	12	9	32	13	29	24	36	46	70	55	59	33	76	46	54	28	38	11	5	8	3	1	5	4	2
79	5	13	11	33	8	19	19	56	48	61	66	43	47	81	52	59	35	35	17	6	9	4	2	5	4	6
80	15	18	13	20	22	15	38	40	49	102	53	39	29	78	44	51	34	26	7	5	5	7	3	4	0	3
81	23	11	18	10	8	17	16	45	39	47	66	46	32	83	37	52	25	18	14	2	12	5	0	4	0	2
82	7	7	20	10	6	6	21	19	21	46	26	41	15	57	34	29	23	21	10	3	8	5	3	5	4	5
83	6	6	12	5	6	11	14	23	29	26	25	23	10	23	20	20	12	4	3	1	3	2	1	0	4	2
84	4	2	13	5	8	10	6	10	23	12	15	31	8	19	6	15	7	6	1	2	3	2	0	4	1	1
85	7	2	15	8	10	3	14	15	39	11	13	17	5	12	4	10	8	3	1	1	3	2	0	0	0	3
86	7	5	11	5	5	3	8	2	10	10	30	26	14	20	7	10	3	3	0	0	2	0	0	0	2	0
87	5	0	15	5	7	6	17	2	16	8	13	15	4	16	6	17	3	1	0	0	0	3	0	1	0	1
88	3	1	12	7	2	0	26	2	16	9	25	13	8	14	6	7	7	3	0	0	3	0	0	0	0	
89	7	5	9	5	9	7	7	4	19	9	20	17	10	15	8	12	5	0	0	0	0	0	0	0	0	2
90	18	3	13	3	5	7	8	8	10	3	22	10	5	14	3	4	6	0	1	0	4	0	0	0	0	0
91	4	2	14	5	2	11	5	7	12	17	15	6	3	15	4	7	3	0	0	0	1	0	0	1	0	2
92	7	0	8	4	14	1	3	2	10	3	19	6	3	10	4	5	1	0	0	0	0	0	0	0	0	2
93	1	0	0	1	6	0	6	5	7	3	12	12	0	8	3	3	1	0	0	0	1	0	0	0	2	0
94	1	1	2	1	0	1	4	2	3	2	12	2	1	6	0	2	1	0	0	0	1	0	0	0	0	0
95	0	1	5	1	0	0	0	1	3	2	9	1	0	4	5	1	0	0	0	0	0	0	0	0	0	0
96	0	0	3	1	0	14	0	0	1	4	1	2	0	4	4	1	0	0	0	0	0	0	0	0	0	0
97	13	0	4	3	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
98	1	1	0	0	0	0	0	0	0	1	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	0
99	0	1	4	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
100	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
103	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
104	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
105	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
106	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
107	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
111	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	930	436	888	945	712	814	1,198	2,043	2,853	3,563	3,673	2,406	1,750	4,165	1,783	2,107	1,202	814	375	200	454	266	101	126	100	235
legal size:	81.0					81.8		82.6														83.3	84.1			

Table 2.6 American lobster length frequencies-fall, male, 1 mm intervals, 1984–2009.
Lobsters were measured from each tow.

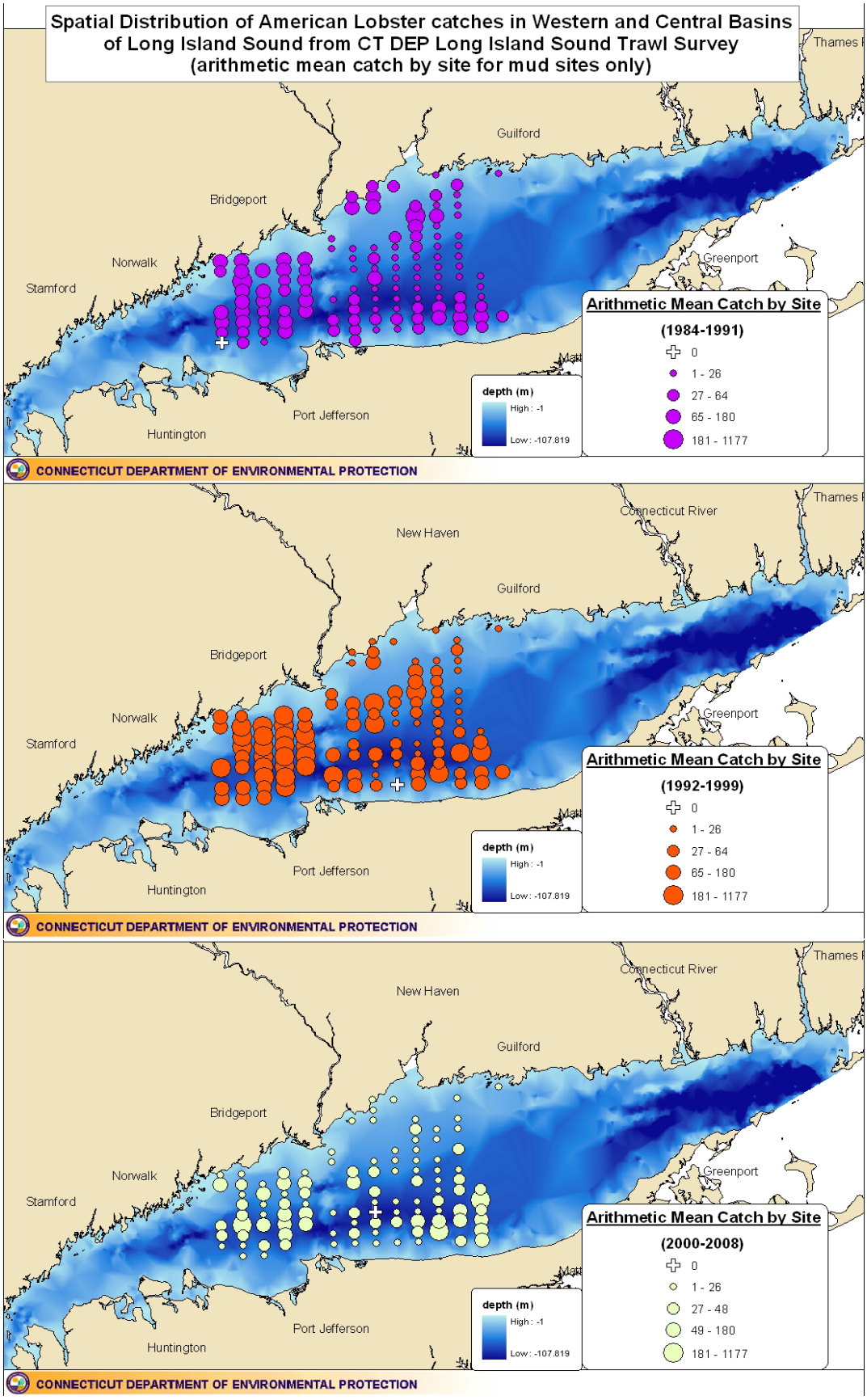


Figure 2.7 Spatial distribution of American lobsters observed in the DEP Long Island Sound Trawl Survey over mud bottom in the western and central basins, 1984-2009.

Year	Annual Production	Rank
1983	75.41	16
1984	33.86	24
1985	1064.00	1
1986	46.46	22
1987	120.51	11
1988	419.85	3
1989	59.43	21
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	23
1999	403.53	4
2000	131.01	10
2001	68.86	17
2002	15.03	26
2003	18.70	25
2004	64.60	20
2005	78.52	15
2006	9.06	27
2007	161.52	8
2008	64.62	19
2009	67.38	18
1983-2009 Mean	170.49	
1983-2009 Median	93.67	
1983-2001 Median	120.51	

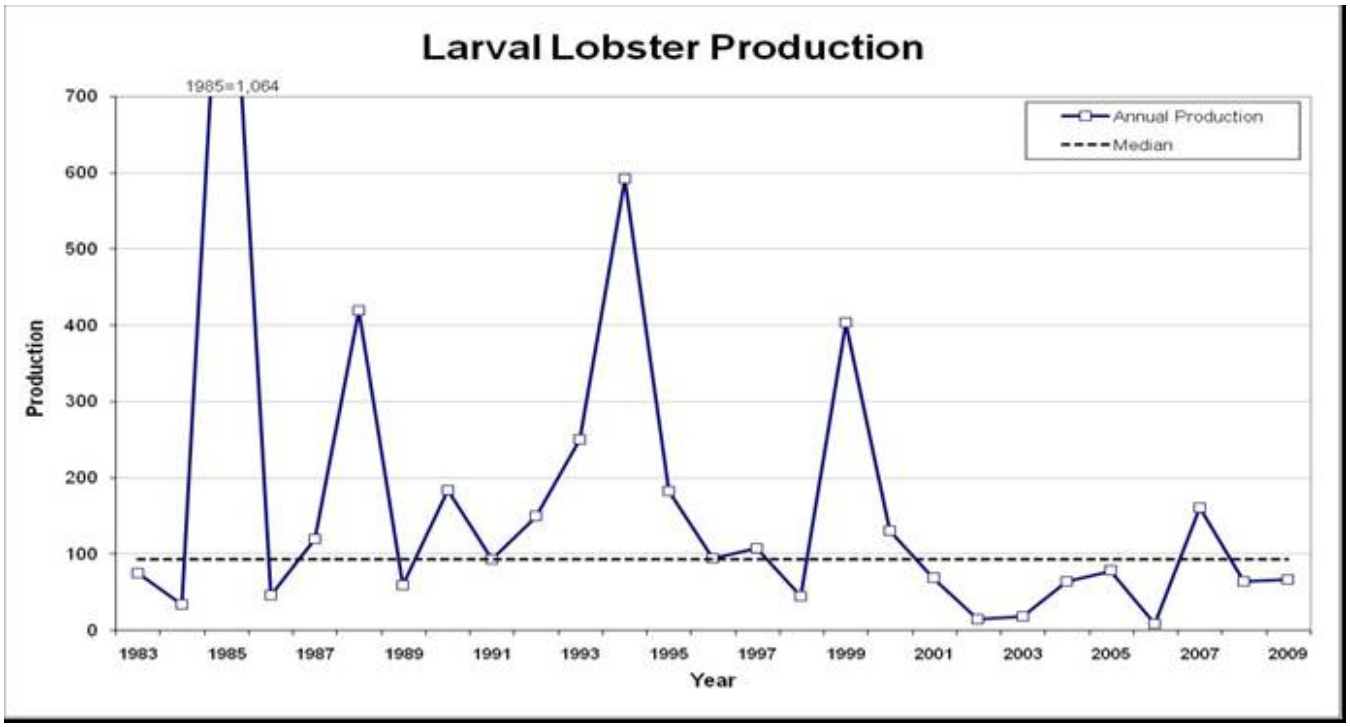


Figure 2.8 Annual lobster larval production (Stage IV) in western Long Island Sound, 1983-2009. *Annual production is the sum of the year's weekly densities.*

LOBSTER STOCK:	Gulf of Maine	Georges Bank	S. New England
Reference Abundance (metric tons)	72 million	1.9 million	25.4 million
Abundance 2005-2007	116 million	4.7million	14.7 million
Reference Exploitation Rate	0.49	0.51	0.44
Exploitation 2005-2007	0.48	0.30	0.32

Table 3.1 Reference abundance and annual exploitation rates compared to 2005-2007 estimates for the three US lobster stocks.

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