



Long-Term Population Trends in American Lobster in Long Island Sound

Existing long-term monitoring data and studies initiated in response to the 1998-1999 lobster die-off in Long Island Sound were examined to determine long-term trends that may help to clarify the causes. Data examined included:- time series of commercial lobster catch (i.e., landings and discards) compiled over 28 years; sea-sampling; time series of research trawl indices compiled over two decades; three years of mark-recapture data, time series of bottom water temperature compiled over 13 years; and one year of research trap survey. Movement information was gathered by recapture of 2,309 lobsters at-large in the Sound for more than 30 days.

Approximately 9% of recaptured lobsters traveled more than 10 km from their release point, and 1.3% traveled more than 20 km. This data indicate that most lobsters in Long Island Sound are resident. The abundance of lobsters by size class taken in the trawl survey over the time series shows an increase in abundance of pre-recruits and sub-legal size lobsters <82mm carapace length (CL). Following the die-off, the most conspicuous loss occurred in lobsters 50-70 mm CL, which is the size range that encompasses the onset of sexual maturity. The percentage of females that were egg-bearing in catches from the western Narrows, the area hardest hit by the die-off, was significantly lower compared to other areas in the Sound each year following the die-off. It appears that egg-bearing females and those animals becoming sexually mature were most vulnerable to the mortality factors and/or these factors may have limited their ability to carry eggs. Observed mortality in the commercial catch in the western Sound significantly correlated with mean summer bottom water temperature over the eight years bridging the die-off (1996-2003). Many factors probably played a role in the higher than normal mortality recorded in 1999, however, the long-term monitoring data examined implicate increased bottom water temperatures as a significant contributing factor to the lobster die-off in 1999.

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The Role of Physical/Chemical Conditions in Lobster Mortality in LIS

The lobster mortality event of 1999 raised many questions about the environmental conditions present in western Long Island Sound prior to and during the die-off. Over the past three years, research scientists from several institutions undertook laboratory and field experiments, as well as computer analyses of climate and weather patterns, designed to understand, in detail, the environmental conditions present in 1999. The results of these studies can be grouped into three main headings: hypoxia, temperature, and rainfall. All three of these appear to have played a potentially important role in the 1999 mortality event. Hypoxia (i.e., the presence of low dissolved oxygen in the waters) has been reported in WLIS from as early as 1909. Since the early 1980's, however, hypoxic events in WLIS have become an almost annual phenomenon and numerous fish and lobster kills have been associated with these events. Moderately severe hypoxic waters were present in WLIS from July 2nd to August 21st, 1999. Sediment profile images (SPI) taken in October, 1999 confirmed that the bottom sediments had experienced severe hypoxia and the benthic fauna was reduced or absent at the majority of WLIS stations sampled; these conditions continued into 2000 and 2002. Bottom water samples (within 5 cm of the sediment-water-interface) were obtained during 2000 and 2002. The water samples revealed that a release of sulfides and ammonia from WLIS sediments begins in mid-late August and continues into November, reaching a peak in September to October. Temperature data indicate warmer than normal conditions in both the surface and bottom waters of WLIS during the summer and fall of 1999. Lack of rainfall early in the summer led to the development of a rather strong stratification as well as a sluggish estuarine circulation. The stratification was broken up in August by a strong mixing event, which resulted in bottom water temperatures increasing by 2°C over a 6-hour period. The rainfall associated with Tropical Storm Floyd in mid-September served to re-stratify the Sound and water temperature data from September show very warm water present at depth in WLIS. Laboratory and field studies have confirmed that lobsters experience severe stress and high mortality when exposed to combinations of high temperatures (above 21°C) and dissolved sulfide and/or ammonia (at actual levels measured in WLIS).

While it is not clear what the relationship is between the environmental factors and the parasites present in the dead lobsters, it is now known that the environmental conditions (higher temperatures, low DO, sulfide & ammonia) coupled with the meteorological processes that occurred in August and September of 1999, in light of the research conducted over the past several years, were capable, in and of themselves, of causing high lobster mortality. At a minimum, the environmental conditions present in WLIS in 1999 placed the lobster populations in WLIS under physiological stress, making them extremely susceptible to pathogens or chemical stressors. The probability of this confluence of phenomena occurring again, based on the variability inferred from existing records, is high.

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