The Lobster Conservancy
Juvenile Lobster Monitoring Program
Report to the Lobster Advisory Council
April 2008

The Lobster Conservancy's (TLC) Juvenile Lobster Monitoring Program (JLMP) tracks the abundance and distribution of postlarval, yearling, and juvenile American lobster, *Homarus americanus*, along the Gulf of Maine coastline. The census began in Casco Bay in 1993 and represents the only uninterrupted year-round time series of postlarval settlement and juvenile lobster abundance. Volunteers were recruited in 1995 to expand the program to sites throughout coastal Maine, New Hampshire and Massachusetts. Currently, 110 volunteers monitor 22 sites from April through November and TLC scientists census 2 additional locations year-round. There is a consistent seasonal cycle in abundance that correlates with mean monthly sea surface temperature. In addition, recent increases in juvenile lobster abundance correspond with an increase in mean annual sea surface temperature.

Mission and History of The Lobster Conservancy

Mission

Founded in 1996, The Lobster Conservancy's mission is to strive to sustain a thriving lobster fishery through science and community.

Lobsters and lobstering are a significant part of the history, culture and economy of the Gulf of Maine. More than that, the lobster fishery binds coastal communities together. The goal of The Lobster Conservancy is to sustain the lobster industry as an integral part of the Gulf of Maine's heritage. One way to sustain lobstering as a way of life is through improved scientific understanding. In comparison to other commercially valuable species, we know relatively little about lobsters. So TLC is doing science.

But science alone is not enough. In order for science to help sustain the resource we also need to have the confidence of the lobster industry and the communities that depend upon it. Therefore, TLC involves men and women of lobster communities in Maine, New Hampshire and Massachusetts in scientific research. Industry members thereby gain confidence in and understanding of science, and scientists gain from fishermen's and local knowledge of both the resource and the industry. Our very existence is a consequence of our integration with community-based industry participants, their families, friends and neighbors.

Timeline of The Lobster Conservancy's History

1993 – Begin juvenile lobster census and mark/recapture
1994 – Survey lobster nurseries from Long Island Sound, CT to Canadian border
1995 – Involve community volunteers in Juvenile Lobster Monitoring Program (JLMP)
1996 – Create TLC by building board of directors, website and applying for tax exemption
1997 – IRS determination, begin advanced ruling period functioning as 501(c)(3)
1998 – Receive island property donation including three lobster pounds
1999 – Create research and educational facilities at donated properties
2000 – Strategic planning; purchase mainland office
2001 – Add new multi-year programs/hire new staff; publish results (3 scientific papers; popular press)
2002 – Advance ruling period ends; permanent status as 501(c)(3); continue programs
2003 – Add service learning projects with academic and non-governmental organizations

2004 – Hire Executive Transition Consultant; work on policies and board development
2005 – Dissemination of results, strategic planning, reorganization of administration
2006 – Dissemination of results, scientific publications in international journals and production of lobster nursery habitat maps
2007 – Expand mark/recapture to subadults; distribute lobster habitat maps and reports from 138 sites surveyed from 1993-2006 to resource managers at local, state and federal agencies; complete and distribute "Lobster Larvae in the Classroom" Handbook; continue established research and education programs
2008 – 16th year of juvenile lobster census; site visits, meetings and volunteer training for data quality assurance; dissemination of results; form new collaborations

Vital to the economy and character of coastal communities, the American lobster fishery is the Northeast's most productive fishery. In 2006, 73 million pounds of lobster valued at $298 million were harvested in Maine alone. Hundreds of coastal communities depend on this traditional, family-oriented fishery, but scientists and policy makers admit that the biological factors that have sustained it are poorly understood. To safeguard the lobster fishery from the population crashes that have decimated other New England fisheries, it is imperative to improve biological knowledge of the American lobster and put it to work in fishery and environmental management.

Based in Friendship, Maine, The Lobster Conservancy addresses this important need by involving communities in Maine, New Hampshire and Massachusetts in lobster population monitoring, scientific research and education.

Summary of Major Accomplishments in 2007

1. Juvenile Lobster Census: Continued to collect, analyze and disseminate data for time series on abundance of lobsters at 24 juvenile lobster nursery habitats. 2 sites monthly January to December 2007; 22 additional sites April to November 2007.
2. Continued working with citizen scientists, maintained personal contact with volunteers, shared information and maintained volunteer commitment. Three annual events allowed us to achieve these goals:
    a. Pre-season Kick-off Meetings in Maine and New Hampshire (Apr 2007)
    b. Volunteer Appreciation Day (Aug 2007)
    c. Site visits (Jun – Nov 2007)
3. Initiated new project to track early benthic phase lobsters tagged as part of the Juvenile Lobster Census into their adolescent phase (data collection Jun – Oct 2007; analysis and dissemination Jan – Mar 2008). This project allowed us to collect the first data following the progress of individual lobsters after they left nursery habitats. (Data submitted to DMR Jan 2008. Report available upon request).
4. Continued outreach and education that spreads lobster literacy throughout New England by visiting classrooms, hosting field trips, maintaining and updating website and writing quarterly newsletters (Jun 2007 – Mar 2008)
5. Identified and sought new funding sources to support JLMP (ongoing)
6. Continued working with consultant on organizational development and strategic planning
7. Identified new opportunities for partnering with other organizations
8. Shared data and wrote scientific papers
9. Continued to disseminate results of the Lobster Nursery Habitat Mapping Project (Report submitted to DMR Mar 2007)
10. Completed and distributed Lobster Larvae in the Classroom Handbook

2007 Results by Zone

The Lobster Conservancy samples lobster densities on a monthly basis during the spring low tides by overturning rocks in square meter quadrats placed along fixed transects running parallel to the water's edge 0.2-0.4 m below mean low water. Data recorded from each lobster includes carapace length, total length, sex, molt stage, which side of the body the crusher claw is on and if there are any missing appendages or shell damage. Environmental data including air, substrate and water temperature, salinity and weather conditions such as wind speed and direction, cloud cover and wave height are also taken at the time of sampling. Hourly site temperatures are recorded using Onset TidbiT data loggers.

This report presents time series of monthly densities, size range and size frequency of individuals sampled April through November of each year for each zone. At one site in Zone D and another in Zone F, the lobster census takes place year-round for several days per month from January through December.

Settlement (defined as postlarval and 5th stage lobsters measuring from 4-6.4 mm CL) was reported at all sites sampled in 2007. Location of sampling sites is shown in Figure 1.

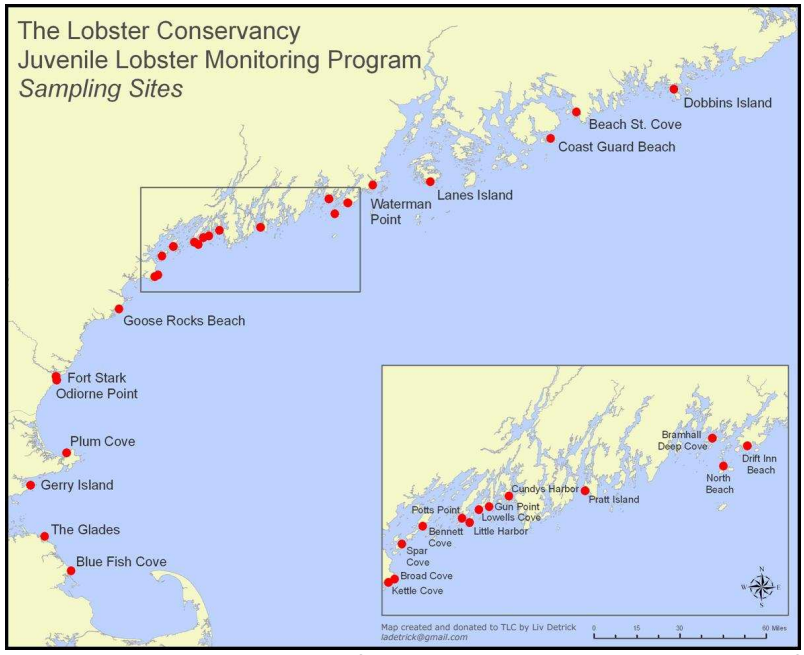

Fig 1. Locations of Juvenile Lobster Monitoring Program field sites censused in 2007. Abundance of lobsters has increased at 21 of 24 sites in recent years.

Additional maps and a report on all 138 lobster nursery sites surveyed since 1993 was submitted March 2007.

Sampling at Zone A began in 2003, since that time, relative abundance of young lobsters has gone up but remains low compared with other zones (Fig. 2). The 2007 census in Zone A was taken in all months from April through November. Peak densities in Zone A are approximately one lobster per square meter as were found in June of 2006 and 2007.

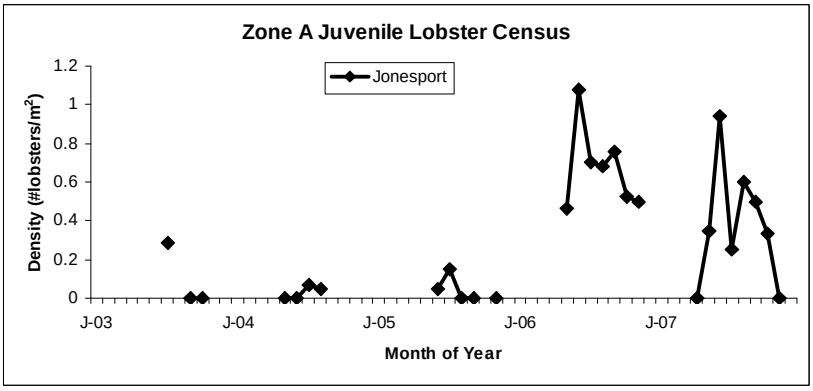

Fig. 2. Zone A time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-03 for January 2003 through J-07 indicating January 2007.

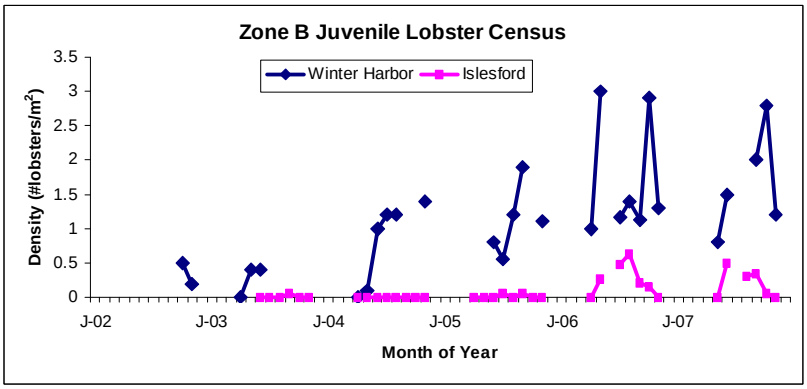

Fig. 3. Zone B time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-02 for January 2002 through J-07 indicating January 2007.

Sampling in Zone B began at Winter Harbor in 2002 and in Islesford in 2003. Relative abundance of recently settled lobsters has increased at both Islesford and Winter Harbor in recent years (Fig. 3). Peak densities are relatively low at Islesford – on the order of 0.5 lobsters per square meter while Winter Harbor hosts relatively high densities peaking at more than 3 lobsters per square meter. In 2007, the peak density at Winter Harbor was found in October.

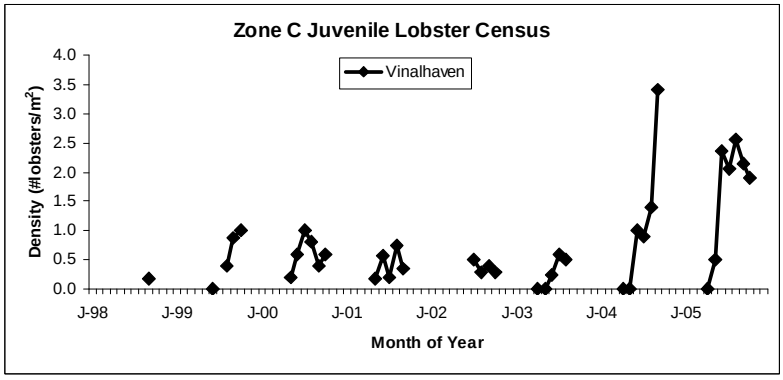

Fig. 4. Zone C time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-98 for January 1998 through J-05 indicating January 2005.

Peak lobster density at Zone C jumped from approximately 1 to more than 3 juvenile lobsters per square meter in 2004 and remained high in 2005 (Fig. 4). During 2007, we trained new volunteers in Zone C where maintaining the census in island communities including Vinalhaven, Matinicus and Isle au Haut – all sites where lobsters settle and grow up – have met with unique challenges.

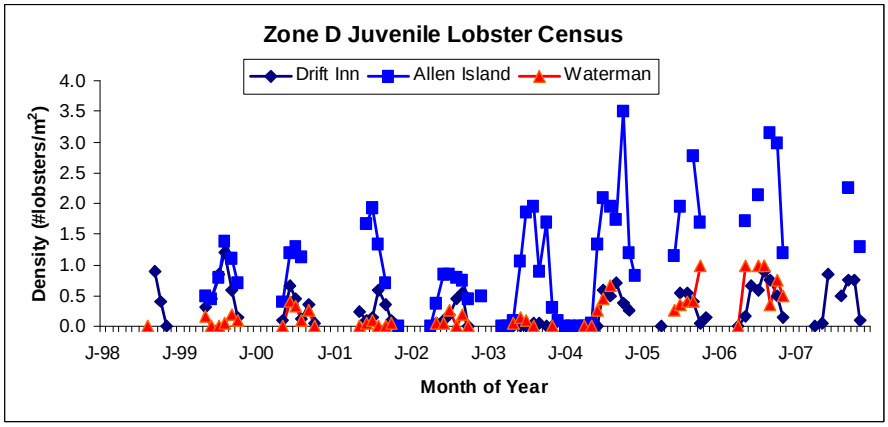

Fig. 5. Zone D time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-98 for January 1998 through J-07 indicating January 2007.

Again, in Zone D, island sampling produces unique challenges. We were able to sample at Allen Island for many months in 2003 and 2004 but only gained access to the island in two months during 2007. Waterman and Drift Inn have experienced problems with sedimentation preventing access to many lobster rocks. We do not feel that these sites are indicative of what Zone D offers in terms of lobster nursery habitats – see Fig. 6. Still, all sites in Zone D have peak abundance of one or more lobsters per square meter (Fig. 5).

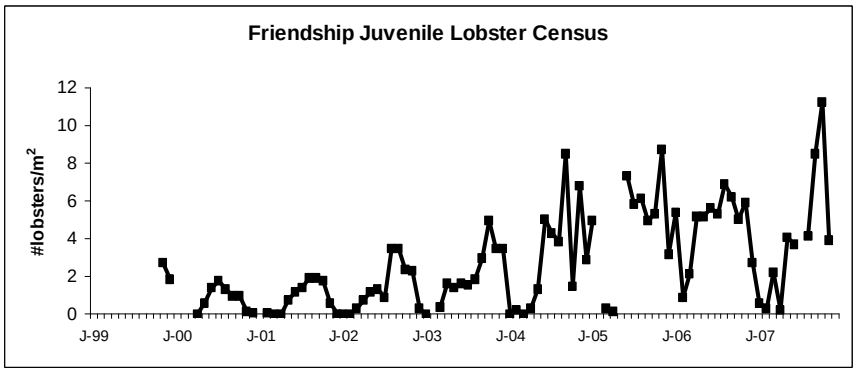

Fig. 6. Zone D year-round time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-99 for January 1999 through J-07 indicating January 2007.

The Friendship site in Zone D yields the highest juvenile lobster densities of any site anywhere recorded both intertidally and subtidally (Fig. 6). The size of lobsters found at Friendship is also generally smaller than at other sites (Fig. 7, 15) and the rate of recapture of previously tagged lobsters is unprecedented.

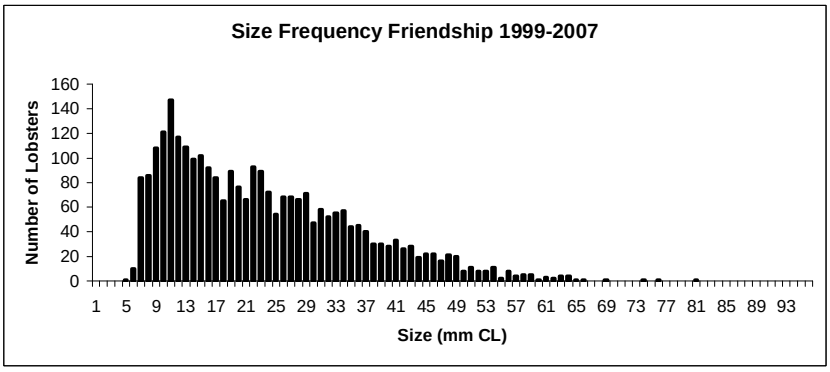

Fig. 7. Number of lobsters of each size sampled at Friendship Long Island in Zone D measuring from 4-95 mm CL in one millimeter size increments.

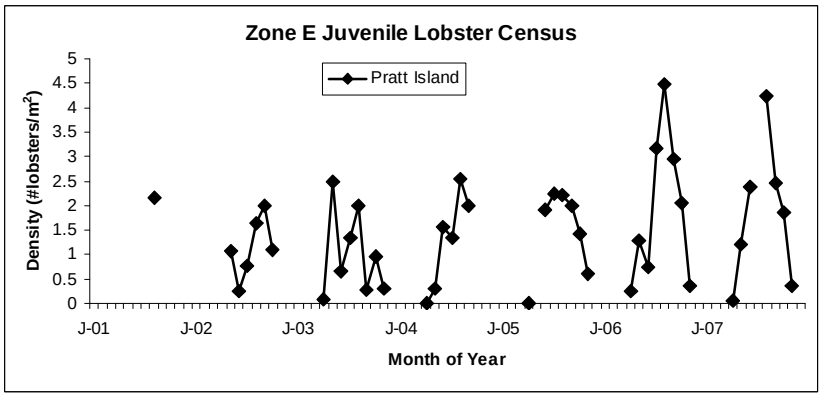

Fig 8. Zone E time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-01 for January 2001 through J-07 indicating January 2007.

The site at Zone E was identified in 1993 and has been censused since 2001. Relative abundance of juvenile lobsters is generally high and has peaked in the last two years (Fig. 8).

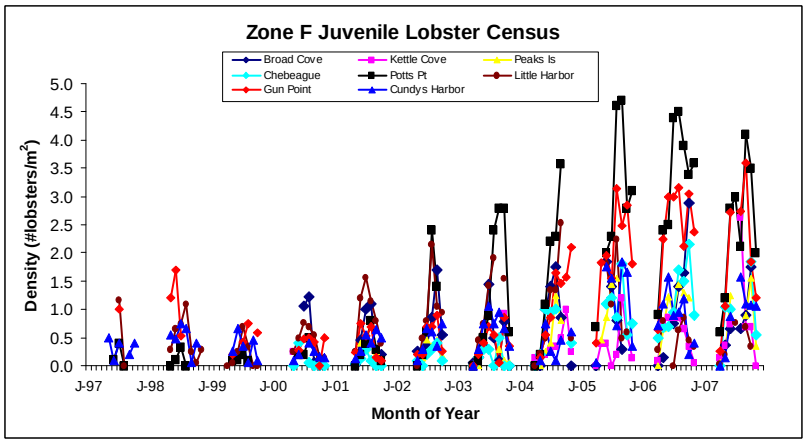

Fig 9. Zone F time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-97 for January 1997 through J-07 indicating January 2007.

The lobster census began in Zone F in 1993. Volunteers started to participate by identifying lobster nursery habitats in 1995 and began sampling their own monitoring sites in 1997. Many veteran volunteers continue to sample the same sites today yielding consistent and reliable data. In general, juvenile lobster abundance in Zone F rose dramatically in 2002 and continues to be high with peak densities approaching 5 lobsters per square meter at sites sampled by volunteers (Fig. 9).

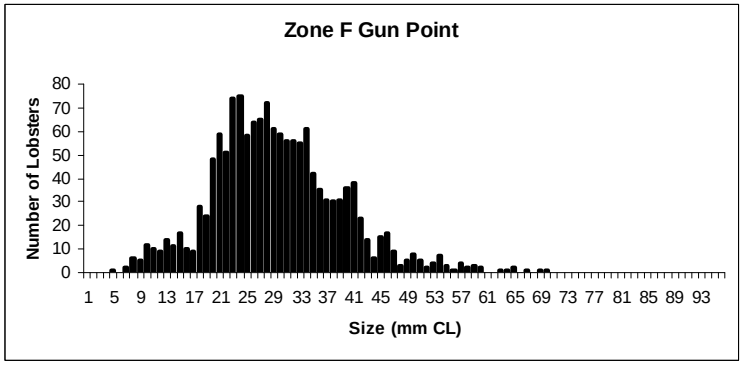

Fig. 10. Number of lobsters of each size sampled at Gun Point in Zone F measuring from 4-95 mm CL in one millimeter size increments.

Size-frequency distributions of lobsters in Zone F varies by site (Fig. 15). Lobsters measuring between 20 and 40 mm CL (2-4 inches in overall length) predominate at Gun Point, a site with relatively high densities (Fig. 10).

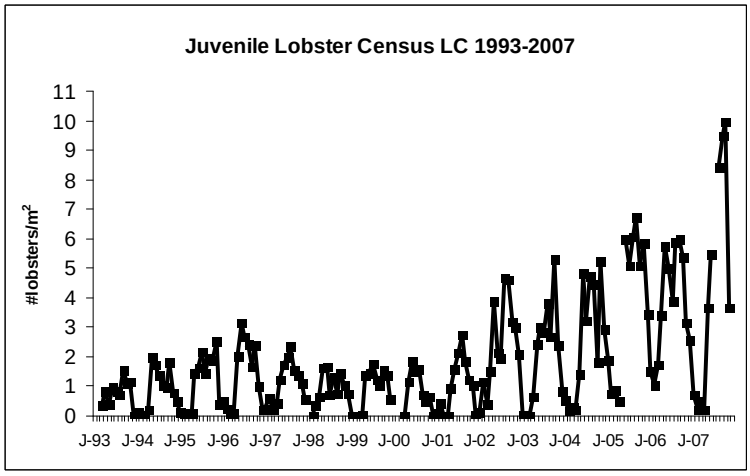

Fig 11. Zone F year-round time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-93 for January 1993 through J-07 indicating January 2007.

The original census site at Lowell's Cove in Harpswell, Zone F, rose dramatically in 2002 and made another huge jump in 2007 when peak average densities hit 10 lobsters per square meter in October (Fig. 11). The increase in numbers of lobsters at this site is strongly correlated with increased water temperature (Fig. 12).

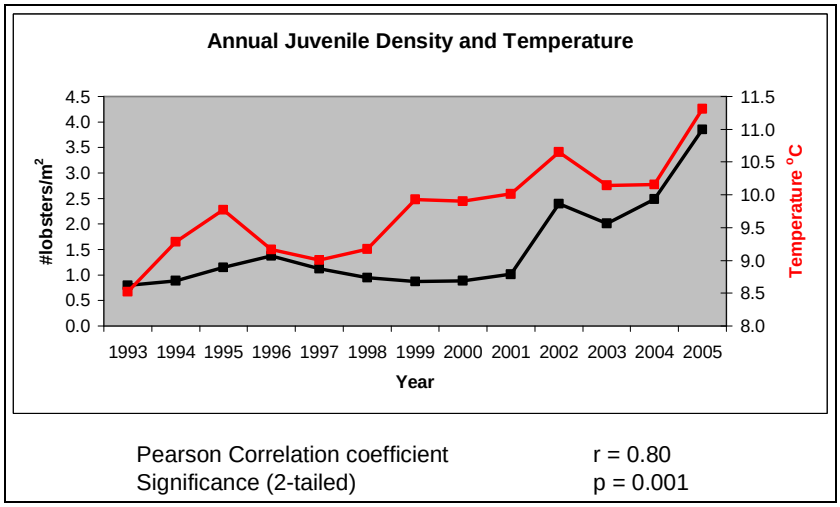

Fig. 12. Average annual lobster abundance (in black) and temperature (in red). Data sources: lobster densities from The Lobster Conservancy's juvenile lobster census, sea surface temperature from Maine Department of Marine Resources in Boothbay Harbor.

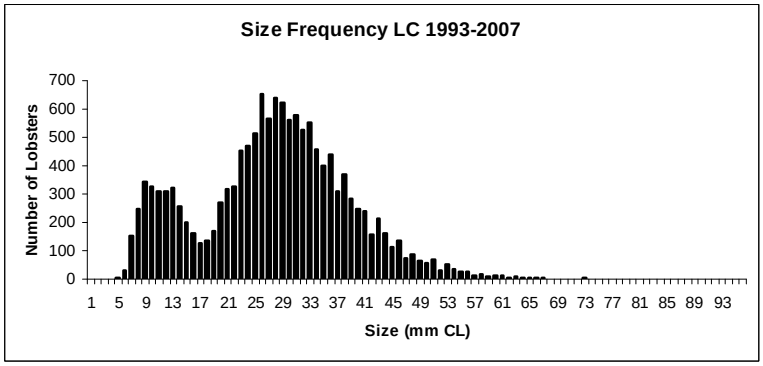

Fig. 13. Number of lobsters of each size at Lowell's Cove in Zone F measuring from 4-95 mm CL in one millimeter size increments.

Two distinct size modes persist at Lowell's Cove in Zone F. The smaller consists of lobsters measuring between 4 and 17 mm CL (less than ¾ to about 1.5 inches in overall length) and the larger 20-40 mm CL (approximately 2 to 4 inches in overall length) (Fig. 13).

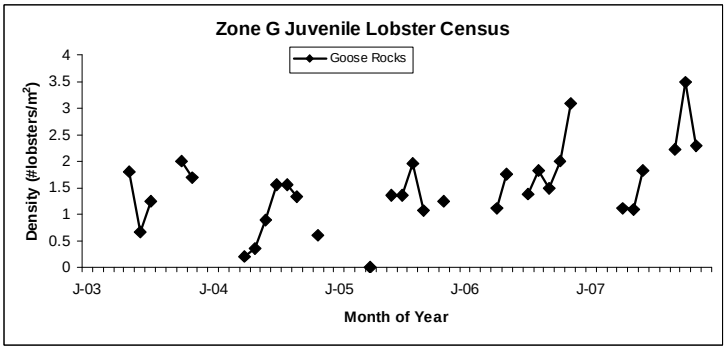

Fig 14. Zone G time series of postlarval and early juvenile lobster abundance. Each point represents the average number of lobsters found per square meter for a given month. Month of year is labeled as J-03 for January 2003 through J-07 indicating January 2007.

The juvenile lobster census began in Zone G in 2003. Relative abundance of juvenile lobsters has been consistently high in Zone G and peaked in 2007 (Fig. 14).

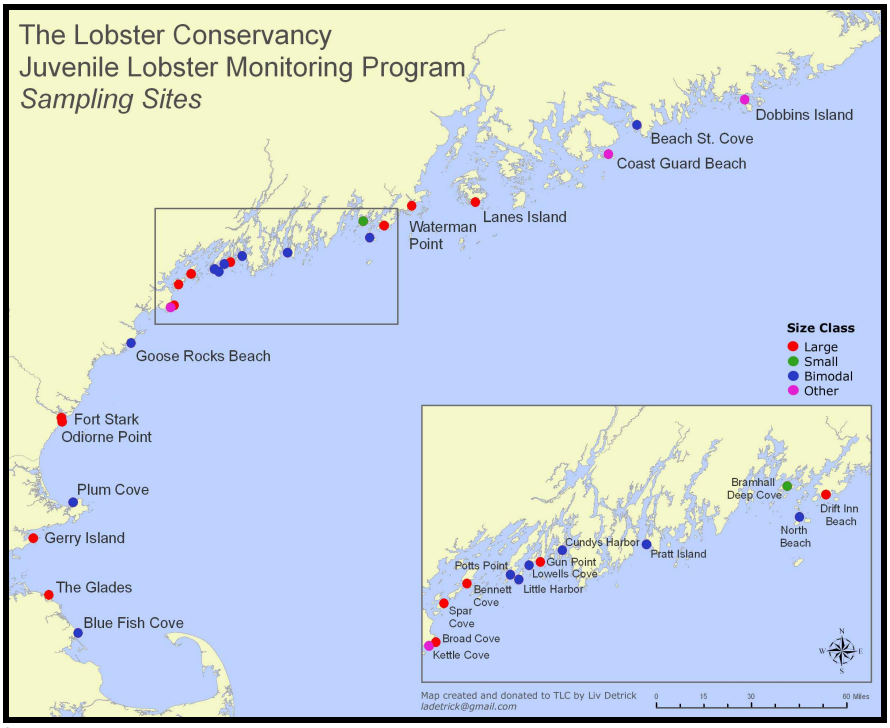

Fig. 15. Locations of Juvenile Lobster Monitoring Program long-term census sites. Colors indicate size class of lobsters that predominates at each site with red representing sites where relatively large juveniles make up the bulk of lobsters sampled (see Fig. 10 for example), green indicates site where the smallest size class predominates (as in Fig. 7), blue is for bimodal distribution (see Fig. 12), and sites indicated in pink show no obvious pattern.

Concluding Remarks

In 2007, settlement was reported at all sites – including Zones A & B. The two year-round sites, Friendship Long Island in Zone D and Lowell's Cove in Zone F, reported the highest densities yet recorded. Both sites peaked in October of 2007 with a record average of more than 11 lobsters per square meter in Zone D and 10 in Zone F. Although many volunteer sites reported high densities in October, none of them showed the magnitude of increase observed at the year-round sites. The overall trend of increased abundance shows up in all zones.

The Lobster Conservancy thanks the Lobster Advisory Council for financial support that helped to make this work possible. It is critically important that we continue to track timing of natural lobster settlement, abundance of juvenile lobsters, growth rates and survival, and monitor environmental conditions that help to explain increases and decreases in abundance.

Respectfully submitted,

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