BAY SCALLOP PROJECT 2009 ANNUAL REPORT

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1.0 OVERVIEW OF THE PROGRAM

This report summarizes bay scallop (*Argopecten irradians*) research conducted by the Molluscan Fisheries program at the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute during calendar year 2009. First, we report the results of adult population surveys conducted at sites along the west coast of Florida from Lee County to Escambia County (Figure 2.1). The intent of those surveys is to monitor the status of representative scallop populations in Florida and to assess changes in population abundance that may occur in response to management and restoration efforts instituted by the State of Florida beginning in 1994. Second, we present the results of recruitment monitoring studies that are ongoing in Lee County (San Carlos Bay and Pine Island Sound), Charlotte County (Gasparilla Sound through Lemon Bay), Sarasota County (Lemon bay through southern Sarasota Bay), Manatee County (northern Sarasota Bay through southern Tampa Bay), Hillsborough County and Pinellas County portions of Tampa Bay, Gulf of Mexico waters from Pinellas county through Franklin (including the near shore zone between Anclote and Crystal River, the near shore zone near Steinhatchee and Keaton Beach, and Alligator Harbor), Gulf County (St. Joseph Bay), Bay County (St. Andrew Bay), and Escambia County (Pensacola Bay) (Figure 2.1). Finally, we provide a summary of bay scallop restoration efforts that are underway in state waters.

2.0 METHODS

2.1 Site Selection

The Florida bay scallop population is comprised of many small, discreet, local populations along the Gulf Coast that are in large part limited to the near-shore, shallow-water seagrass beds.

Figure 2.1 Bay scallop sites studied in 2009.

2.2 Adult Abundance Surveys

The 2009 adult scallop sampling protocol consisted of diver transect surveys at replicate stations, initially randomly chosen within local seagrass beds. The methodology was consistent with previous surveys (e.g., Arnold et al., 2009). At each station, we deployed a 300-m transect line and one diver on each side searched within one meter of the line along its length. All scallops within that two by 300 meter area were counted, and the shell height (distance from the hinge to the leading ventral margin) of the first 30 scallops encountered were measured. Ten study sites were surveyed during the spring and summer of 2009: northern and southern Pine Island Sound, Sarasota Bay, Tampa Bay, Anclote, Hernando, Homosassa, Steinhatchee, St. Marks, St. Joseph Bay, and St. Andrew Bay (Figure 2.1) during May through August. All areas open to recreational harvest were surveyed prior to the July 1 opening day. Twenty stations were sampled at each site with the exception of southern Pine Island Sound (N = four), and Sarasota Bay (N = ten). Each station comprised a 600 m^2 survey area, so we sampled 12,000 m^2 of potential bay scallop habitat at most sites. Abundance surveys were discontinued in Pensacola Bay in 2006 and Cedar Key and Crooked Island Sound in 2008 due to the lack of scallops observed during spring surveys at those sites.

We classify the health of the local populations surveyed using the average number of scallops per 600 m^2 area. Populations whose average falls below five scallops per 600 m^2 area are classified as "collapsed"; populations with averages that range between 5 and 25 scallops per transect are classified as "transitional"; and populations with averages greater than 25 scallops per 600 m^2 area are classified as "healthy." We also consider the distribution of scallops among stations when describing local populations. A healthy status has scallops at $\geq$ half of the stations, and a transitional status has scallops at < half of the stations. We use these classifications and distributions as well as the resiliency of a population to determine which local areas may need assistance, most often in the form of restoration efforts, but occasionally in recommendations for management changes. For locations with long term data

sets (St. Andrew Bay, St. Joseph Bay, Steinhatchee, Crystal Bay/Homosassa Bay, Hernando area, Anclote area, and Pine Island Sound) the least-squared means were calculated using a SAS Glimmix procedure (SAS Institute, 1985). Letter designations of the LS means are plotted in the respective graphs. Years with the same letters are not significantly different from each other.

We also assisted as necessary in the local community scallop searches hosted by Tampa Bay Watch, Sarasota Bay Watch, and UF Sea Grant in Charlotte Harbor. These surveys followed a similar procedure as FWRI adult abundance surveys with the exception of transect length and survey method. At each station a 50-m weighted transect line was deployed in shallow-water grassy habitats, and volunteers snorkeled the length, counting all scallops within a one meter path on each side of the transect. No shell heights were recorded.

2.3 Recruitment Monitoring

After adult scallops spawn, the larvae undergo a 2-week planktonic life stage before settling out of the water column onto seagrass blades. These newly settled juvenile scallops, called spat, will grow and become the next year-class. We estimate the recruitment of these spat using collector designed to mimic seagrass blades. The collectors consist of a vexar mesh panel encased within a citrus bag that is tied to a polypropylene rope. The rope is anchored to a cement block and is supported with a round surface float (Arnold et al., 1998; Brand et al., 1980 as modified from a design described in Motada, 1977). Generally a single collector is deployed at each station and allowed to soak for eight weeks prior to retrieval. An additional collector is deployed at the same station, four weeks later, and similarly allowed to soak for eight weeks. This overlapping deployment/recovery schedule ensures that any recruitment event that occurs just prior to recovery of one series of collectors can be detected on the overlapping collector. Upon recovery, collectors are returned to the laboratory for visual examination and enumeration of all recruits.

Collectors are deployed at 13 sites statewide: St. Andrew Bay, St. Joseph Bay, Alligator Harbor, Keaton Beach area, Steinhatchee area, the Crystal Bay/Homosassa Bay area, the near-shore waters off

Hernando County (Bayport), the Anclote Anchorage area, Tampa Bay, Sarasota Bay, the intracoastal waters throughout Sarasota County, the Charlotte Harbor area, and Pine Island Sound (Figure 2.1). Collectors deployed in Tampa Bay and Sarasota Bay are processed immediately upon retrieval and all live recruits collected are returned to the FWRI facility for growout in Bayboro Harbor. These scallops will be used at a later date during our ongoing restoration efforts. The FWRI Molluscan Fisheries group maintains the traps from Anclote, Hernando, and Homosassa. At the St. Andrew Bay, St. Joseph Bay, Alligator Harbor, Steinhatchee and Keaton Beach, Sarasota County, Charlotte Harbor, and Pine Island Sound sites, collectors are retrieved and deployed by a network of fellow FWRI employees, DEP scientists, county scientists, non-profit agency scientists and volunteer organizations. The traps collected by external agencies are shipped or transported to FWRI for processing. All generated data is standardized by dividing the number scallops on a collector by the number of days that the collector was deployed. For reporting purposes these numbers of scallops per collector per day are averaged for each deployment period and graphically reported by retrieval date. Also note that the y-axis scale of the recruitment plots changes from site to site associated with changes in the magnitude of recruitment at each site.

Over the past several years, we have noted an increasing number of calico scallops (*Argopecten gibbus*) recruiting onto our bay scallop recruitment collectors. For each collector the number of calico recruits are noted, as well as the invasive species *Perna virdis* (Asian green mussel) and *Megabalanus coccopoma* (titan acorn barnacle). In Tampa Bay and Sarasota Bay study sites, we count the number of green mussel recruits present on the small round float attached to the collector and measure the shell length (mm) of the first 30 animals.

2.4 Restoration Activities

In 2009, we continued restoration efforts in Pine Island Sound, St. Andrew Bay, Sarasota County waters, and Tampa Bay. We utilized several sources/techniques for restoration, chief among these being the retention and culture of scallop spat (i.e., new recruits) collected during recruitment monitoring efforts

in Tampa Bay, Sarasota Bay, and St. Andrew Bay. Recruits collected in Tampa Bay and Sarasota Bay and cultured in Bayboro harbor waters were used in restoration efforts in Tampa Bay, in Sarasota County community restoration efforts, and in Pine Island Sound community restoration efforts. In September 2008, we deployed 40 additional collectors in St. Andrew Bay to soak over the fall months in order to amplify the number of recruits collected. These collectors consisted of a 2-m length of black netting that was bunched up and stuffed into a citrus bag, adding both surface area and volume to the collector. Once the collectors were retrieved they were immediately processed. Large scallops were given to NOAA and GCCC staff to hang in cages off local docks, and small scallops (<10 mm) were transferred to mesh bags and transported back to the FWRI. After the traps were inspected for visible scallops, and most of the fouling organisms were removed, the traps were redeployed for an additional two months. All scallops returned to FWRI were placed in cages and deployed off the St. Petersburg dock in Bayboro Harbor until they reached a size capable of avoiding predation pressure (>20 mm shell height). Once these scallops were of suitable planting size they were transported back to the target estuary and released into seagrass beds. Supplemental collectors were also planted in St. Andrew Bay in the fall of 2009, but were not retrieved until 2010, and those results will not be reported here, except to indicate the program is ongoing.

We also partnered with Tampa Bay Watch staff to collect adult scallops from Tampa Bay waters near Tarpon Key that were placed in cages and hung off of local volunteer docks. The scallops remained in the cages throughout their short life cycle with the assumption that they spawned before their death.

3.0 RESULTS

3.1 Pensacola Bay

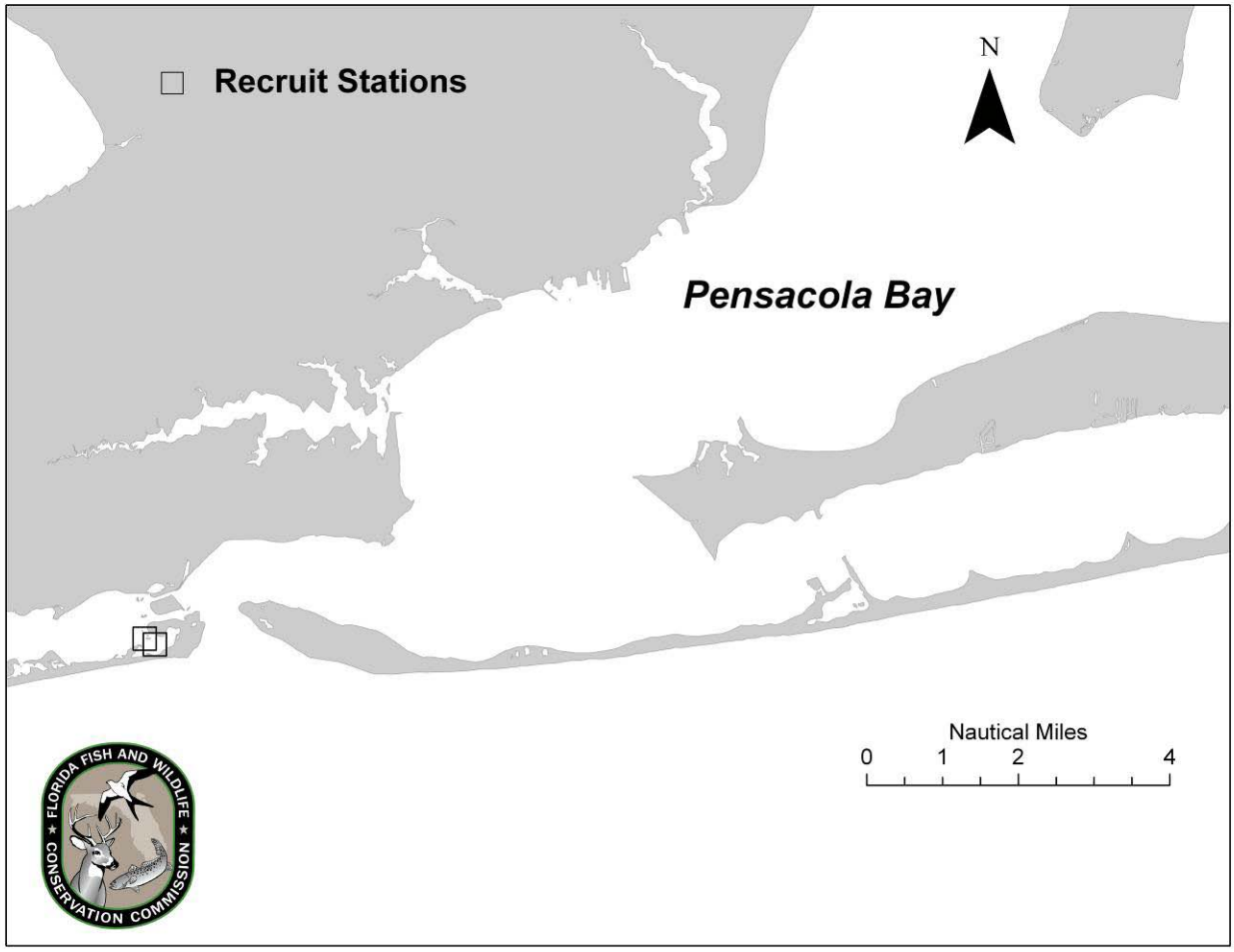

Figure 3.1.1 Pensacola Bay recruitment monitoring stations

3.1.1 Pensacola Bay Recruitment Monitoring

Recruitment monitoring occurred at two stations in Pensacola 2009 (Figure 3.1.1). Of the eight collectors processed, spat were present on two and no scallops were observed on the remaining six collectors. The total spat observed at this site in 2009 was two, the average was 0.25 per collector, and the maximum number found on a single collector was two.

3.2 St. Andrew Bay

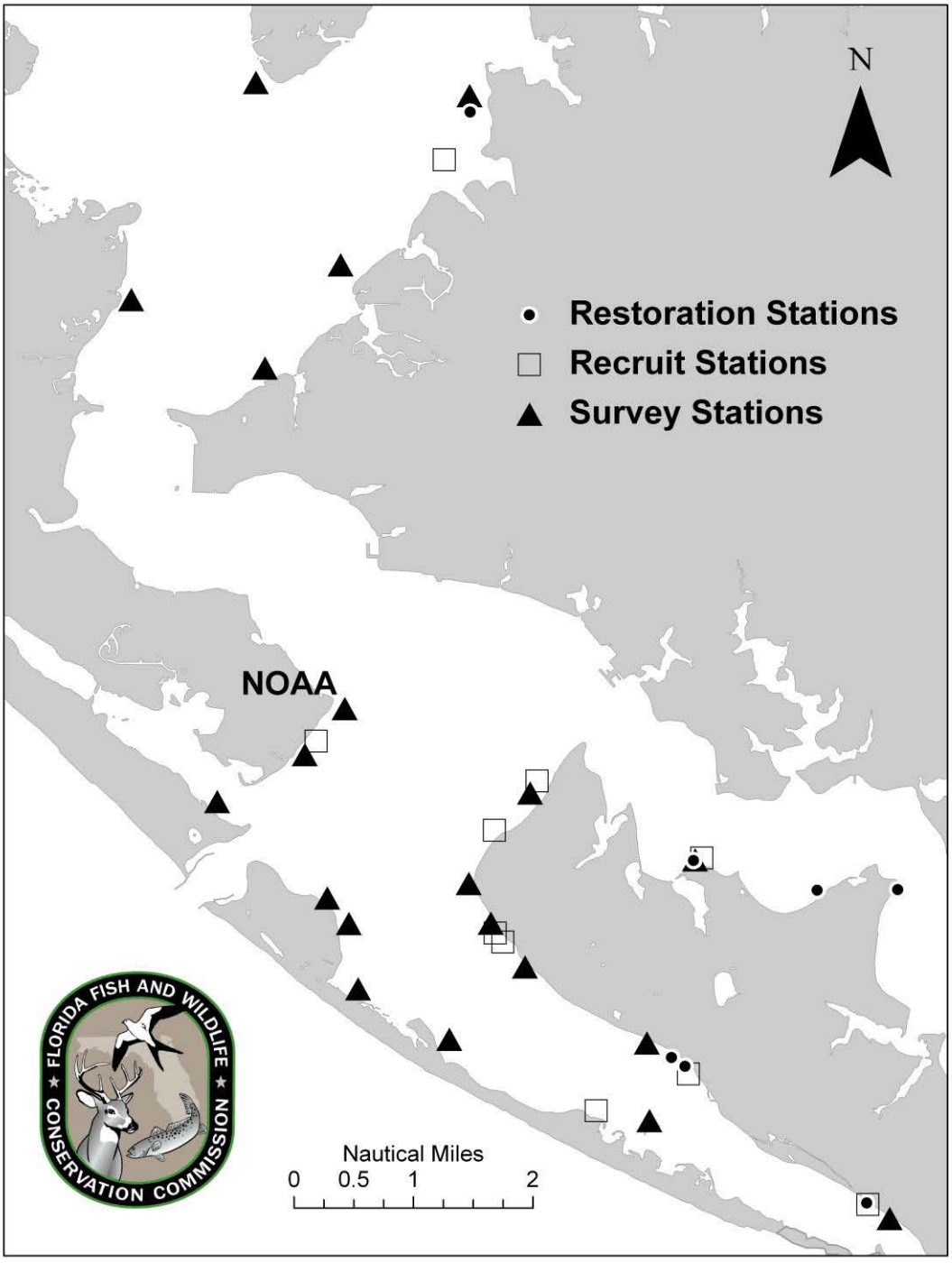

Figure 3.2.1 St. Andrew Bay restoration (●), survey (▲), and recruitment monitoring (□) stations sampled in 2009.

3.2.1 St. Andrew Bay Adult Abundance Surveys

We surveyed 20 stations in St. Andrew Bay in 2009 (Figure 3.2.1). St. Andrew Bay scallop abundance increased in 2009 to 25.8 scallops per 600 m^2. This population reached a healthy status (>25 scallops / 600m^2) for the first time in 13 years. We recorded scallops at 13 of our 20 survey stations, with no scallops found in the north end of the bay (Figure 3.2.2). Of the 261 scallops measured in 2009, shell heights (mm) during the June sampling effort ranged from 14 to 69, the average was 45.5, and the most frequent shell heights recorded were 45 and 48. Even though the population status reached a healthy level, it is not a resilient population. Since the inception of our monitoring program in 1994, there have never been two successive years of healthy bay scallop abundances.

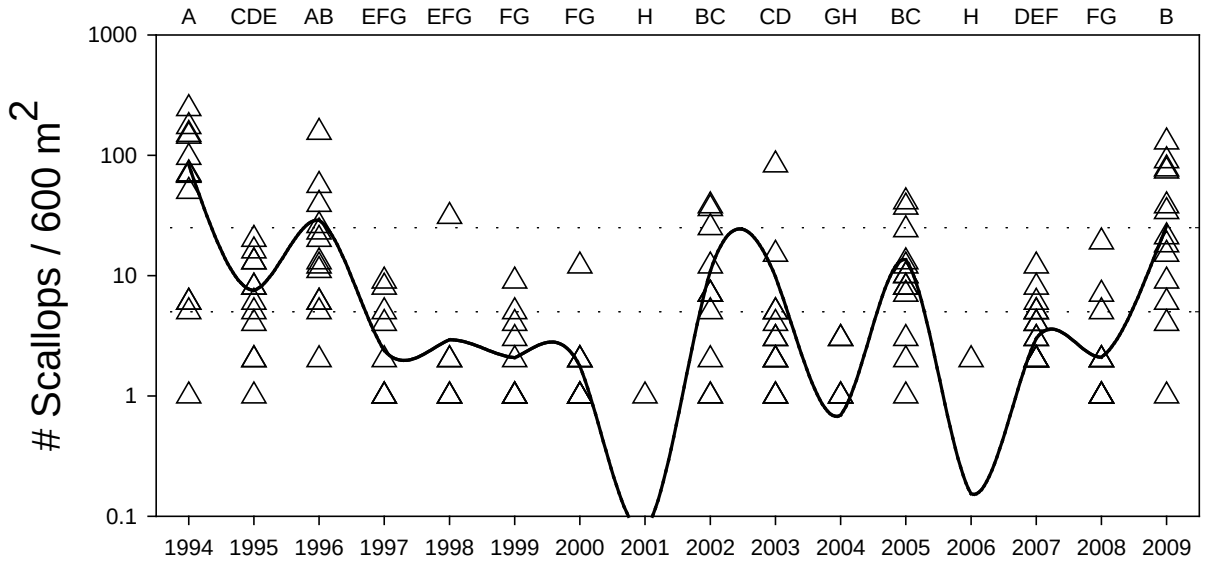

Figure 3.2.2 Annual St. Andrew Bay survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional (5/600 m^2) and healthy (25/600 m^2) population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05.

3.2.2 St. Andrew Bay Recruitment Monitoring

Recruitment monitoring occurred at 10 stations in the St. Andrew Bay area in 2009 (Figure 3.2.1). Of the 110 collectors deployed in 2009, 102 were recovered and processed. Of those 102 collectors, spat were present on 79 (77.5% - the highest rate of monitored sites statewide in 2009) and no scallops were observed on the remaining 23 collectors. The total spat observed at this site in 2009 was 2,639, the average was 25.9 per collector, and the maximum number found on a single collector was 235. The strongest recruitment peak occurred in collectors retrieved in December, and recruitment was observed in 10 of the 11 retrieval dates (Figure 3.2.3). No spat were found in collectors retrieved in April. In 2008 we counted 497 scallops on 81 collectors, for an average of 6.1, so average recruitment increased in 2009.

Of the 102 collectors retrieved in 2009, calico spat were present on seven and no calico scallops were observed on the remaining 95 collectors. The total calico spat observed at this site in 2009 was 23, the average was 0.2 per collector, and the maximum number found on a single collector was 8. The invasive titan acorn barnacle was observed on collectors retrieved in April, May, July and December, and the invasive Asian green mussel was observed on collectors retrieved in December.

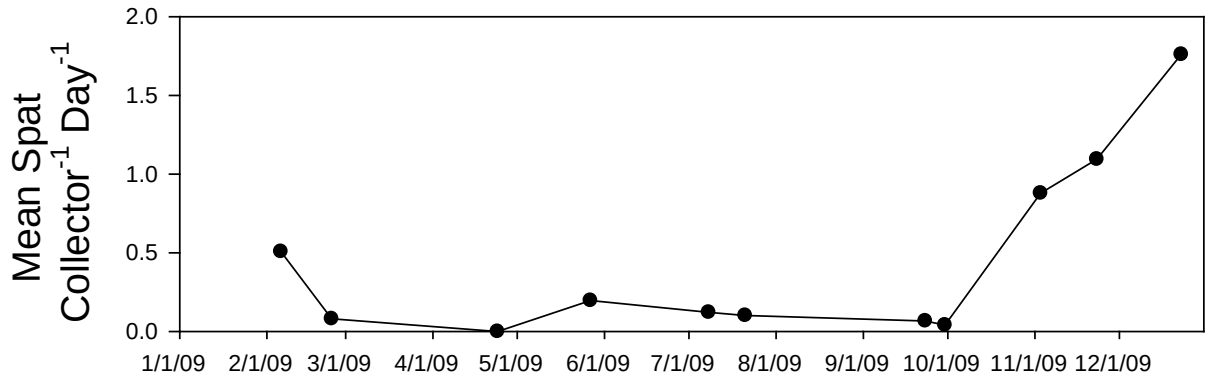

Figure 3.2.3 St. Andrew Bay scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.2.3 St. Andrew Bay Restoration Activities

On December 15 and 16, 2008, FWRI staff collected a total of 129 scallops off six of the ten Vexar collectors regularly deployed and 2,841 off the set of 40 supplemental collectors. Scallops that were above 15 mm in shell height were divided into groups of 25 individuals and placed in mesh bags within plastic cages and hung from docks at the NOAA facility. The remaining scallops were transported back to FWRI for growout. We delivered approximately 500 bay scallop spat to staff of NOAA and Gulf Coast Community College which were then distributed to volunteers and Gulf Coast Community College students and monitored monthly for growth and mortality rates (Figure 3.2.4). The caged scallops were monitored through May 2009 and were then released into seagrass beds in the north end of the bay (Figure 3.2.1). Bay scallop growth rates for this study were approximately 0.77 mm per week.

On February 23 and 24, 2009, FWRI staff released 1,910 scallops that were from the supplemental recruitment collectors retrieved in December 2008 and cultured in Bayboro Harbor at four sites around St. Andrew Bay (Figure 3.2.1). During the same two days FWRI staff collected a total 45 scallops off eight of the ten Vexar collectors regularly deployed and 777 off 38 of the 40 supplemental collectors that were redeployed in December 2008 in St. Andrew Bay. We released approximately 225 of these scallops that were 15mm or greater in shell height into local seagrass beds, and transported the remaining 550 smaller-sized scallops back to FWRI for grow-out. On June 15, 2009, FWRI staff transported 400 scallops from Bayboro Harbor to St. Andrew Bay and released them at two locations in East Bay (Figure 3.2.1).

Scallops collected in St. Andrew Bay and cultured in Bayboro Harbor in St. Petersburg had an average growth rate of 1.47 mm/week.

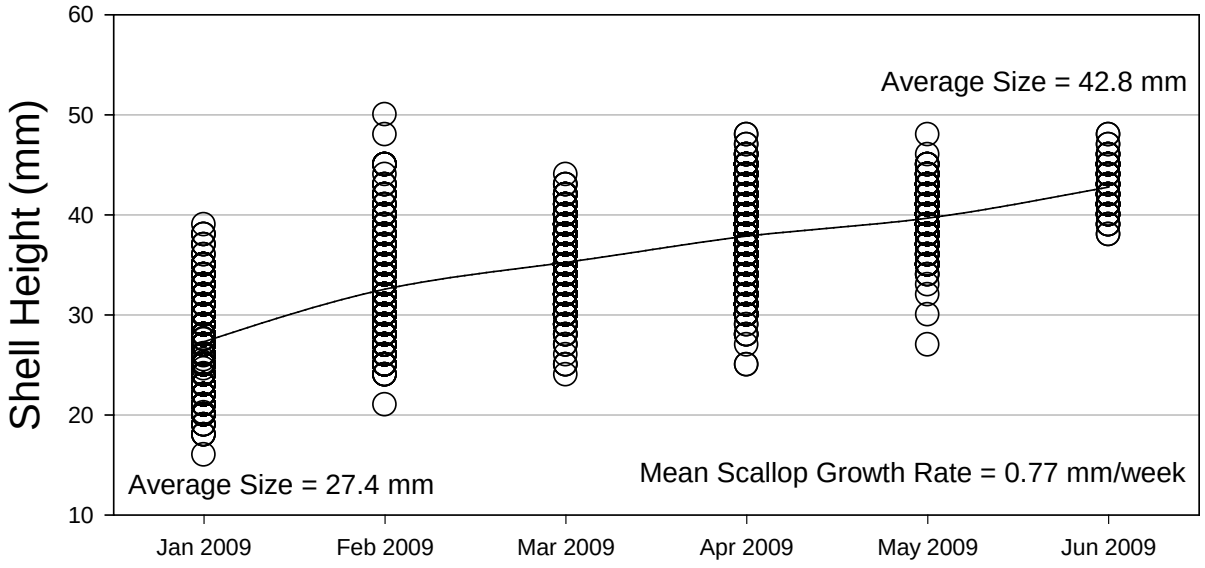

Figure 3.2.4 Actual (○) and average (line) shell heights of caged scallops in St. Andrew Bay.

3.3 St. Joseph Bay

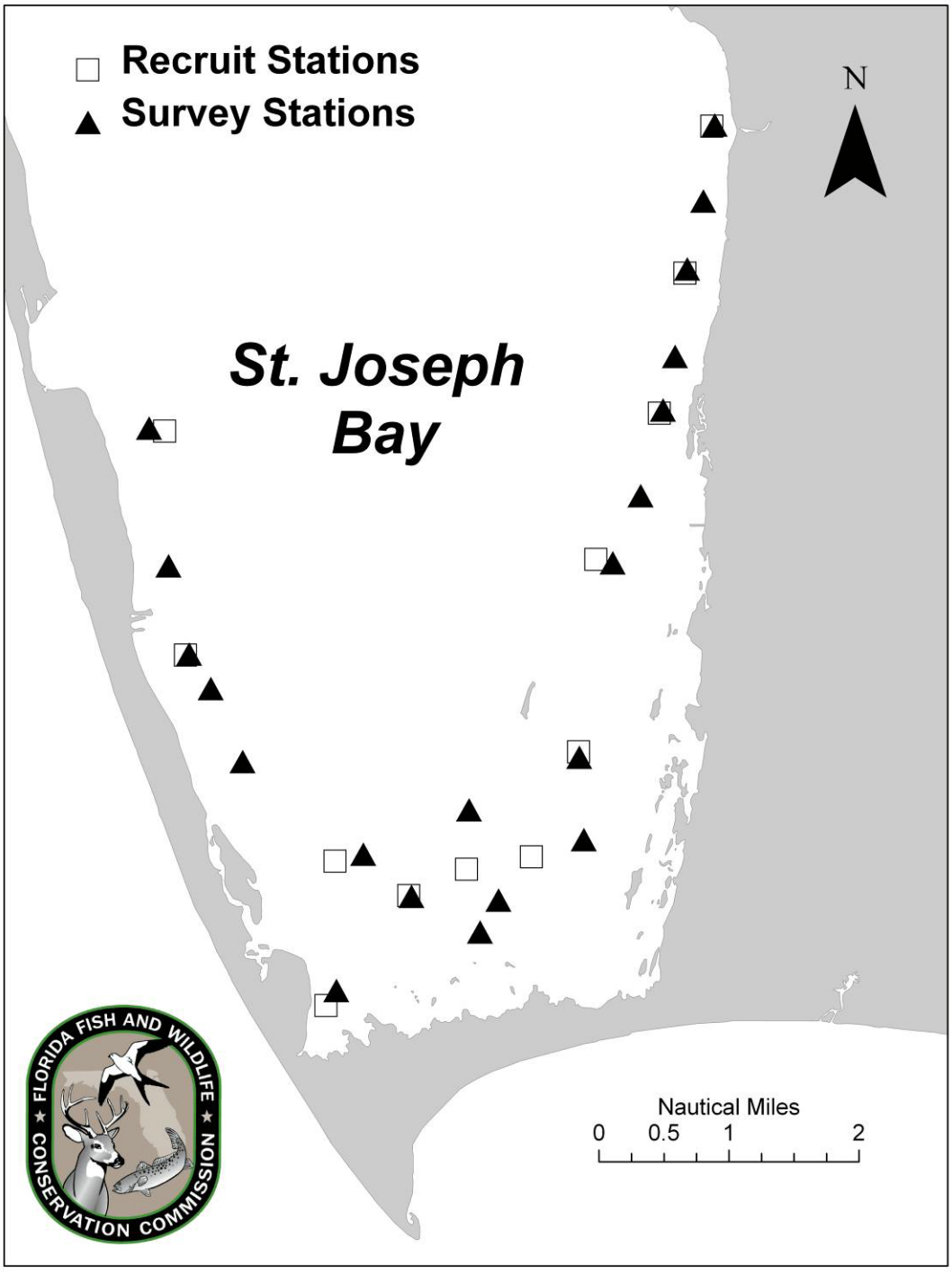

Figure 3.3.1 St. Joseph Bay survey (▲) and recruitment monitoring (□) stations.

3.3.1 St. Joseph Bay Adult Abundance Surveys

We surveyed 20 stations in St. Joseph Bay in 2009 (Figure 3.3.1). The scallop population in St. Joseph Bay increased from a transitional population (5 - 25 scallops / 600 m^2) in 2008, to a healthy one (> 25 scallops / 600 m^2) in 2009, with 97.4 scallops per 600 m^2. Scallops were found at all 20 stations, with almost half of the total number found observed at one station located in slightly deeper water and thinner grass (Figure 3.3.2). Of the 369 scallops measured in 2009, shell heights (mm) during the June sampling effort ranged from 24 to 75, the average was 48.0, and the most frequent shell height recorded was 45.

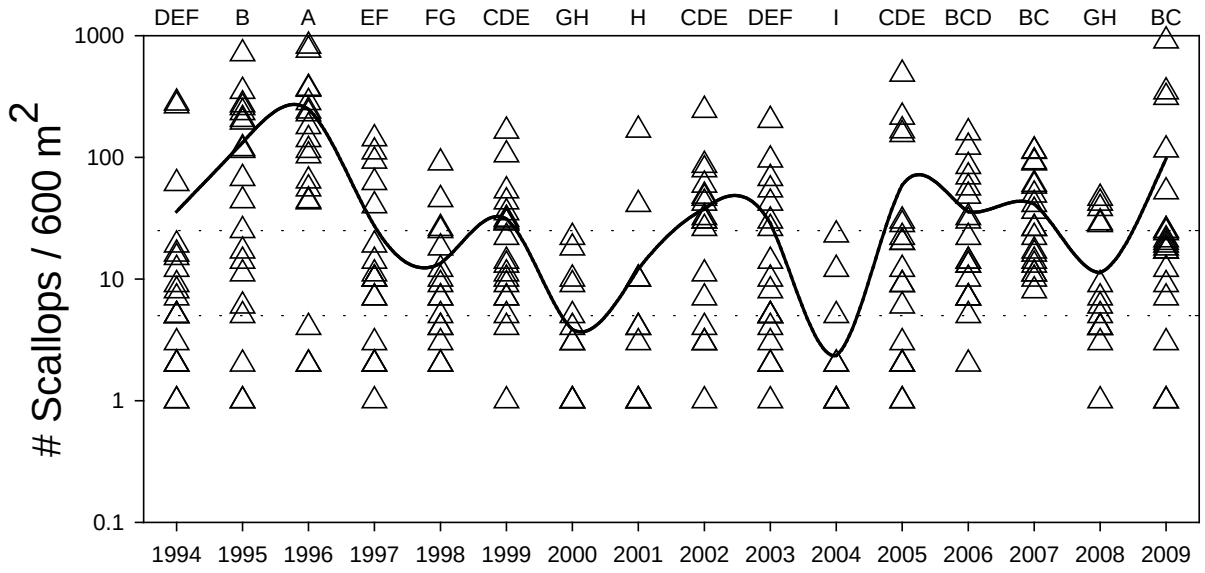

Figure 3.3.2 Annual St. Joseph Bay survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05.

3.3.2 St. Joseph Bay Recruitment Monitoring

Recruitment monitoring in St. Joseph Bay occurred at four stations, each with three replicates, during January - April 2009. Beginning in March a new configuration of 12 stations (including the original four), each with a single replicate, was deployed, positioning the collectors around the bay (Figure

3.3.1). All collectors retrieved in May through December were of the new design. Of the 120 collectors deployed in 2009, 102 were recovered, and 12 were lost during shipment to the Fish and Wildlife Research Institute. Of those 90 collectors processed, spat were present on 64 (71.1%) and no scallops were observed on the remaining 26 collectors. The total spat observed at this site in 2009 was 1,855, the average was 20.6 per collector, and the maximum number found on a single collector was 494. The strongest recruitment peak occurred in collectors retrieved in January, and recruitment was observed in all of the ten retrieval dates, with the exception of the lost collectors that were retrieved in late July (Figure 3.3.3). In 2008 we counted 3,614 scallops on 116 collectors, for an average of 31.2, so average recruitment decreased in 2009.

The invasive titan acorn barnacle was observed on collectors retrieved in April, and the invasive Asian green mussel on collectors retrieved in December. No calico scallops were observed at this site in 2009.

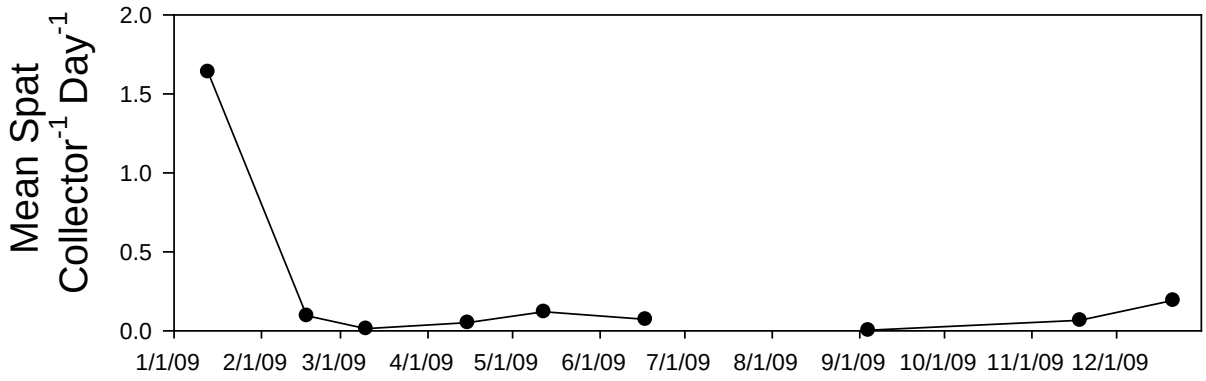

Figure 3.3.3 St. Joseph Bay scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The gap indicates the time period for which the collectors were lost during shipment.

3.4 Apalachee Bay Area

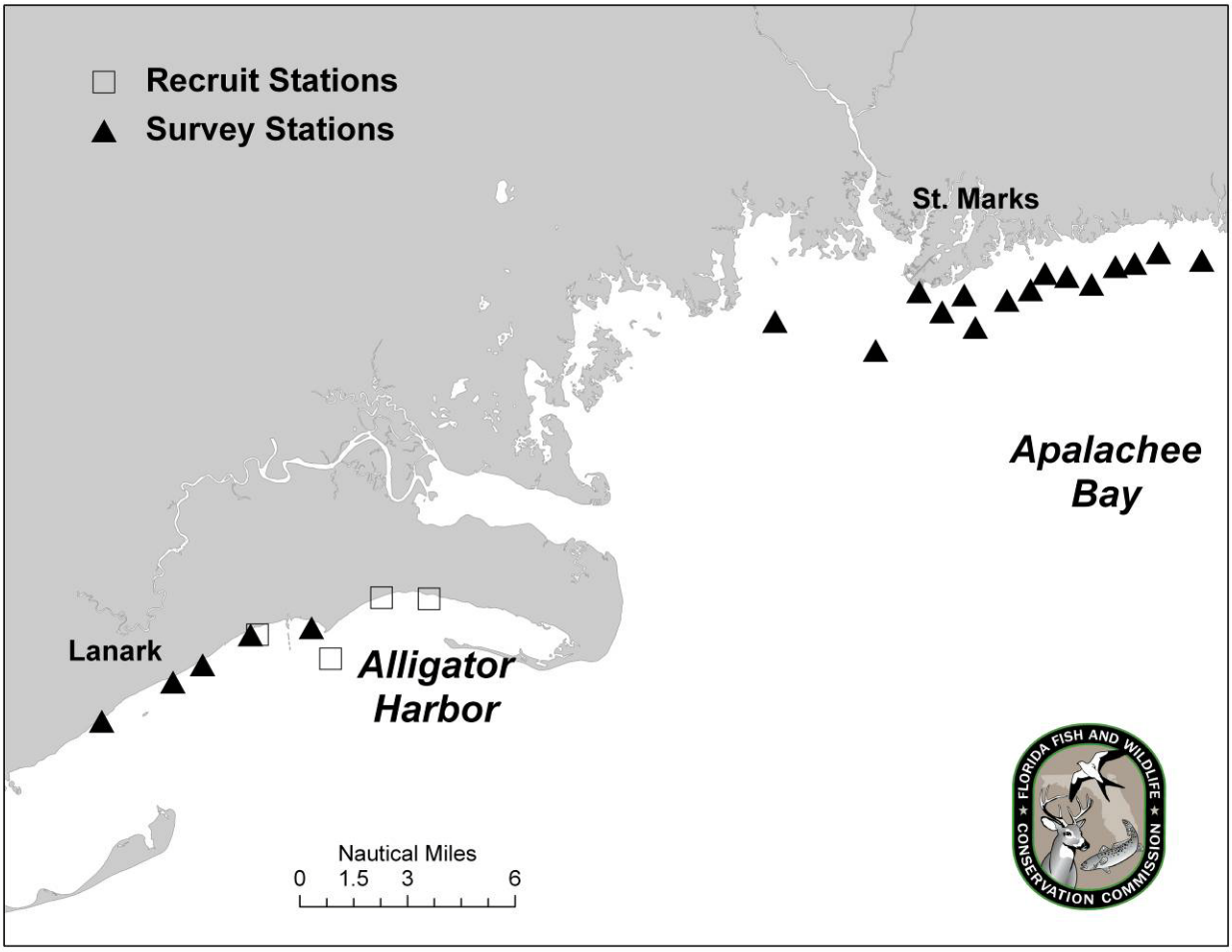

Figure 3.4.1 Apalachee Bay area survey (▲) and recruitment monitoring (□) stations sampled in 2009.

3.4.1 Apalachee Bay Area Adult Abundance Surveys

We surveyed 20 stations in the Apalachee Bay area including five near Lanark and Alligator Harbor, and 15 in the St. Marks area, eight of which were sampled the previous year (Figure 3.4.1). In 2008 the local population was a healthy one (>25 scallops / 600 m^2), but in 2009 the total number found decreased from 170.0 to 10.2 scallops per 600 m^2. Even though more stations were sampled, the 2009 population dropped to a transitional status (5 - 25 scallops / 600 m^2). We found scallops at 15 stations, but in smaller quantities than the year before (Figure 3.4.2). Of the 159 scallops measured in 2009, shell

heights (mm) during the June sampling effort ranged from 10 to 68, the average was 51.8, and the most frequent shell height recorded was 53.

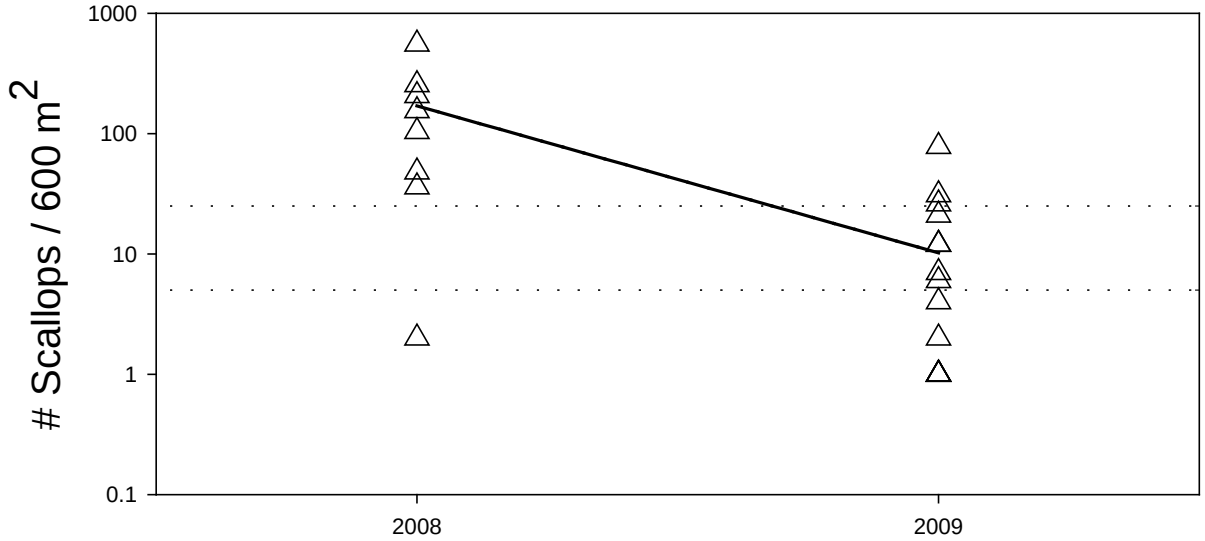

Figure 3.4.2 Annual Apalachee Bay Area survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Mean-comparison groupings were not performed for this site.

3.4.2 Apalachee Bay Area Recruitment Monitoring

Recruitment monitoring occurred at four stations in Alligator Harbor in 2009 (Figure 3.4.1). Of the 40 collectors deployed in 2009, 38 were recovered. Of those 38 collectors recovered, spat were present on 12 (31.6%) and no scallops were observed on the remaining 26 collectors. The total spat observed at this site in 2009 was 48, the average was 1.3 per collector, and the maximum number found on a single collector was 14. The strongest recruitment peak occurred in collectors retrieved in January, and recruitment was observed in eight of the ten retrieval dates (Figure 3.4.3). No spat were found in collectors retrieved in May or August. Recruitment monitoring was initiated at this site in 2008, so we are unable to describe relative changes in average recruitment.

Several (N > 40) of the invasive Asian green mussels were observed in collectors retrieved in December. No calico scallops or titan acorn barnacles were observed at this site in 2009.

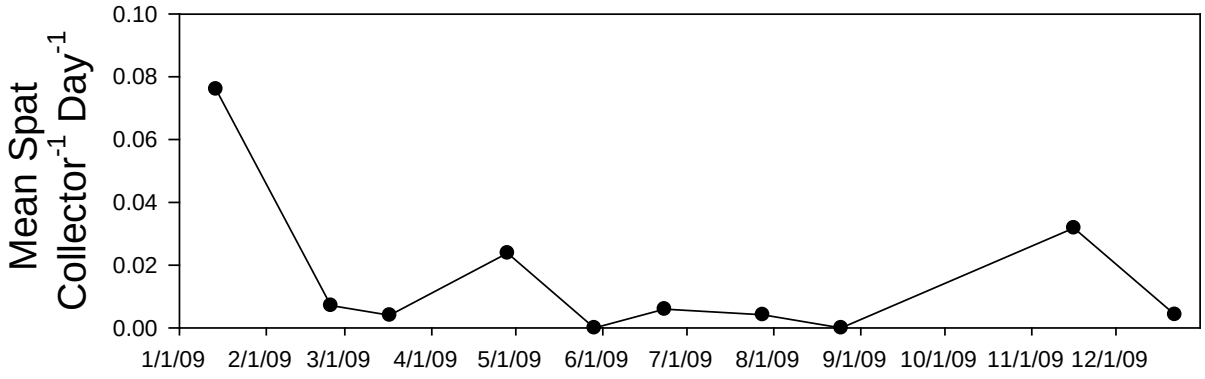

Figure 3.4.3 Apalachee Bay area scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.5 Steinhatchee Area

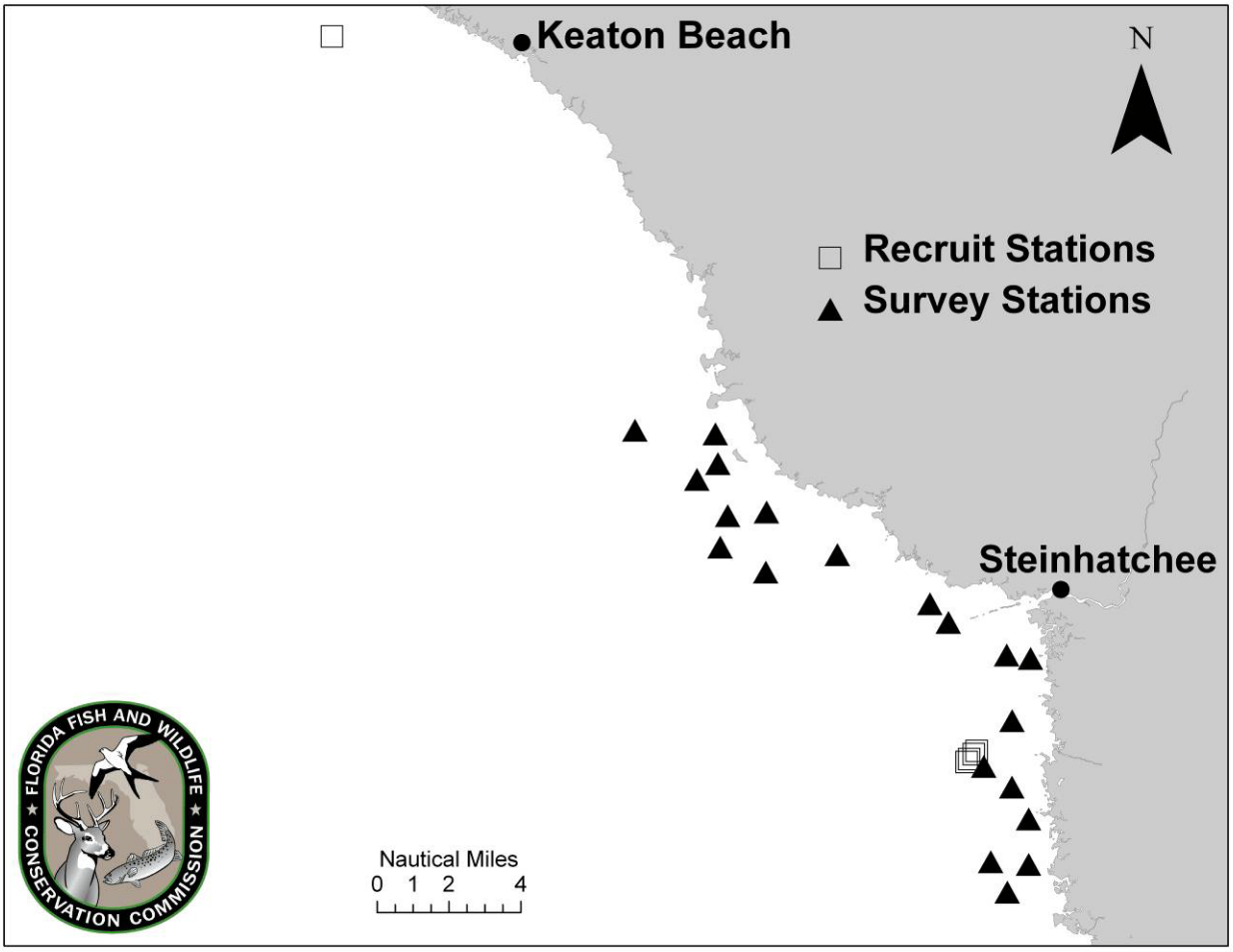

Figure 3.5.1 Steinhatchee area survey (▲) and recruitment monitoring (□) stations sampled in 2009.

3.5.1 Steinhatchee Area Adult Abundance Surveys

We surveyed 20 stations in the Steinhatchee area in 2009 (Figure 3.5.1). The Steinhatchee scallop population remained a healthy one (>25 scallops / 600 m^2) in 2009 with 69.0 scallops per 600 m^2, although the total number of scallops found was less than the number observed in 2008 (140.0 scallops 600 m^{-2}). Scallops were observed at 19 of the stations, with 10 of these supporting 25 or more scallops per transect (Figure 3.5.2). Steinhatchee consistently remains the healthiest and most resilient scallop population we monitor in Florida, with healthy (>25 scallops / 600 m^2) means in 13 out of the 16 years surveyed, and

with transitional means (5 -25 scallops / 600 m^2) in the remaining three years. Of the 368 scallops measured in 2009, shell heights (mm) during the June sampling effort ranged from 23 to 67, the average was 50.4, and the most frequent shell height recorded was 50.

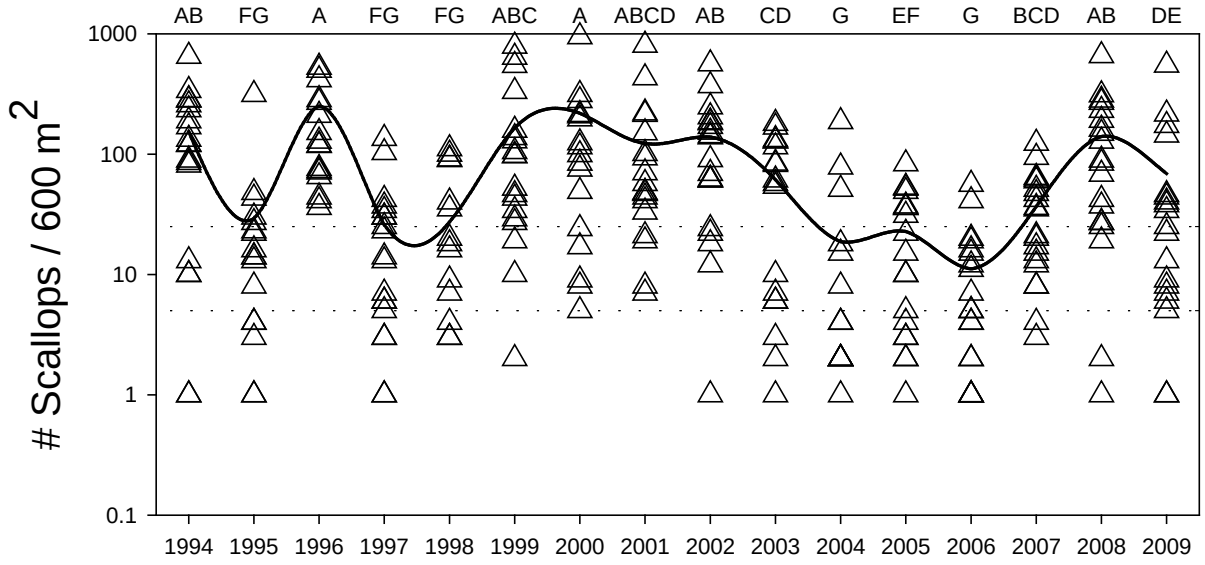

Figure 3.5.2 Annual Steinhatchee survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05.

3.5.2 Steinhatchee Area Recruitment Monitoring

Recruitment monitoring occurred on four replicate collectors at each of one station in the Keaton Beach area, and one station in the Steinhatchee area in 2009 (Figure 3.5.1). Of the 44 collectors deployed in 2009 at the Keaton Beach site, all were recovered. Spat were present on 16 (36.4%) and no scallops were observed on the remaining 28 collectors. The total spat observed at this site in 2009 was 48, the average was 1.1 per collector, and the maximum number found on a single collector was 14. The strongest recruitment peak occurred in collectors retrieved in October, and recruitment was observed in seven of the 11 retrieval dates (Figure 3.5.3). No spat were found in collectors retrieved in March, early April, August or September. Recruitment monitoring was initiated at this site in 2008, so we are unable to describe

relative changes in average recruitment.

Of the 48 collectors deployed in 2009 at the Steinhatchee site, 44 were recovered. Of those 44 collectors recovered, spat were present on nine (20.5%) and no scallops were observed on the remaining 35 collectors. The total spat observed at the Steinhatchee site in 2009 was 12, the average was 0.3 per collector (the lowest in the state), and the maximum number found on a single collector was three. The strongest recruitment peak occurred in collectors retrieved in February, and recruitment was observed in five of the twelve retrieval dates (Figure 3.5.3). No spat were found in collectors retrieved in March, late April, July, October or November. In 2008 we counted 53 scallops on 38 collectors, for an average of 1.4, so average recruitment decreased in 2009.

No calico scallops, Asian green mussels, or titan acorn barnacles were observed at this site in 2009.

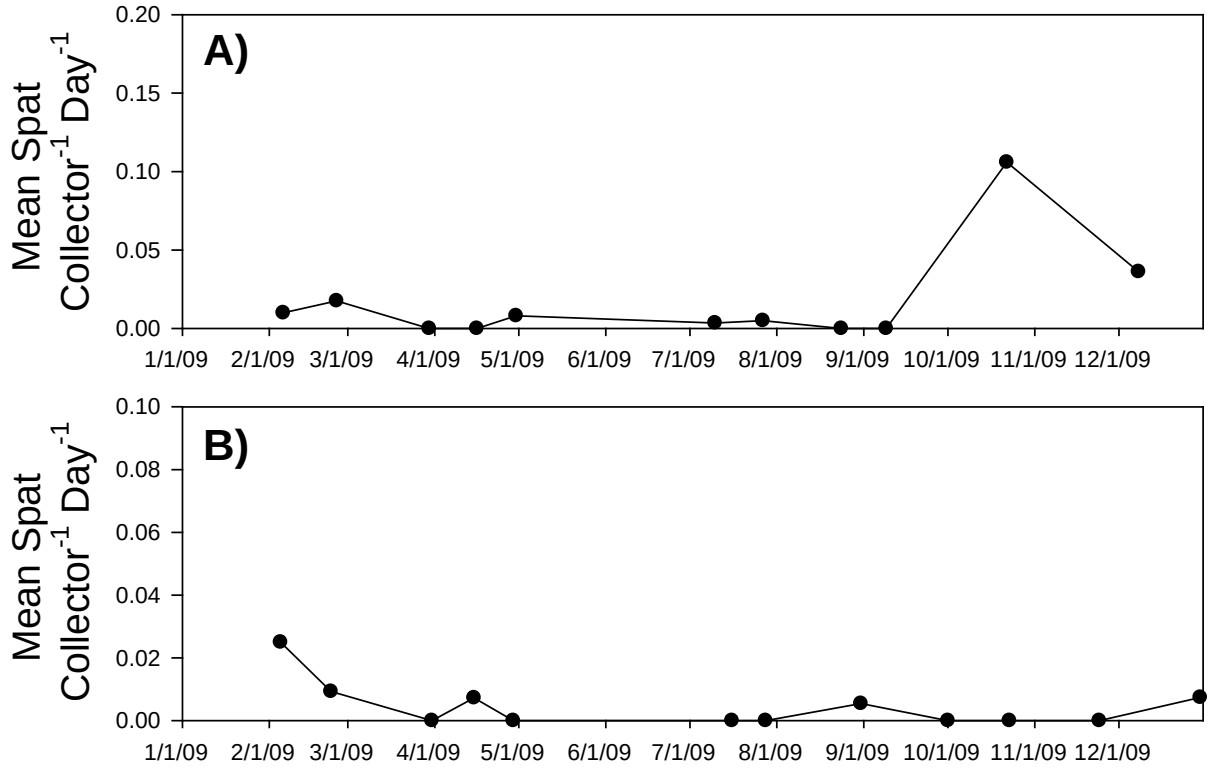

Figure 3.5.3 Keaton Beach (A) and Steinhatchee (B) scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.6 Crystal Bay Area

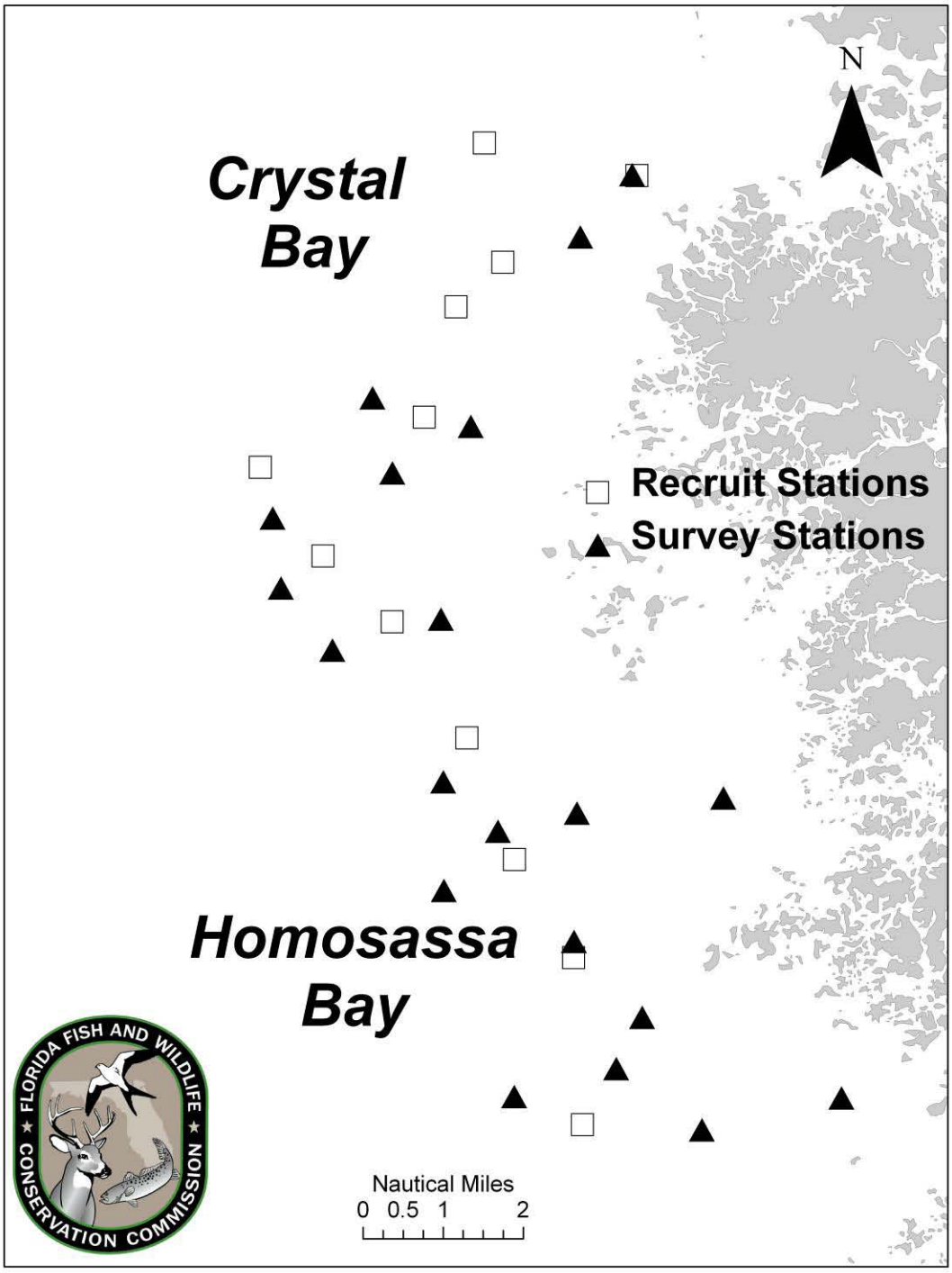

Figure 3.6.1 Crystal Bay area survey (▲) and recruitment monitoring (□) stations sampled in 2009.

3.6.1 Crystal Bay Area Adult Abundance Surveys

We surveyed 20 stations in the Crystal Bay area in 2009 (Figure 3.6.1). The scallop population in the Crystal Bay area decreased from a healthy population (>25 scallops / 600 m^2) to a transitional one (5 - 25 scallops / 600 m^2) in 2009, dropping from 86.2 to 20.7 scallops per 600 m^2. We recorded scallops at 19 of the survey stations (Figure 3.6.2), and the number of stations supporting more than 25 scallops per transect (our criteria for a healthy population) decreased from 16 in 2008 to four in 2009. Of the 331 scallops measured in 2009, shell heights (mm) during the June sampling effort ranged from 25 to 65, the average was 50.2, and the most frequent shell height recorded was 50. This population recovered after years of low abundance in 2004 and 2006, but 2009 was the third year out of the last six years, where the population fell to transitional levels – suggesting some instability in this population that bears monitoring.

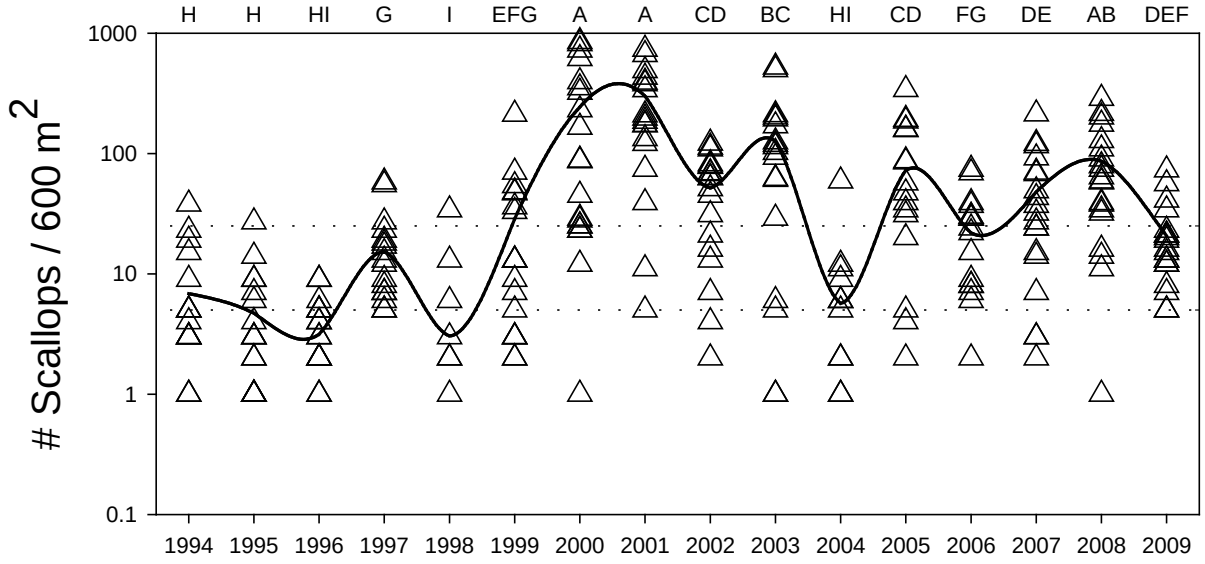

Figure 3.6.2 Annual Crystal Bay area survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05.

3.6.2 Crystal Bay Area Recruitment Monitoring

Recruitment monitoring occurred at 12 stations in the Crystal Bay area in 2009 (Figure 3.6.1). Of the 144 collectors deployed in 2009, 125 were recovered. Of those 125 collectors recovered, spat were present on 13 (10.4% - lowest statewide) and no scallops were observed on the remaining 112 collectors. The total spat observed at this site in 2009 was 46, the average was 0.4 per collector (the 2nd lowest in the state), and the maximum number found on a single collector was nine. The strongest recruitment peak occurred in collectors retrieved in November, and recruitment was observed in five of the 12 retrieval dates (Figure 3.6.3). No spat were found in collectors pulled in January – March, or May - August. In 2008 we counted 41 scallops on 130 collectors, for an average of 0.3, so average recruitment increased slightly in 2009. We continue to observe poor recruitment at this site compared to the number of adults observed during summer surveys, as well as the quantity and quality of available habitat.

No calico scallops, Asian green mussels, or titan acorn barnacles were observed at this site in 2009.

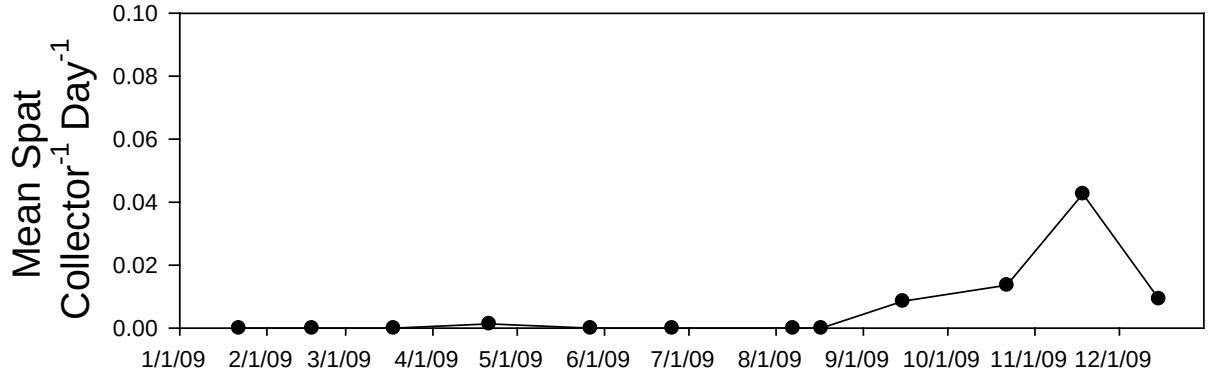

Figure 3.6.3 Crystal Bay area scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.7 Hernando Area

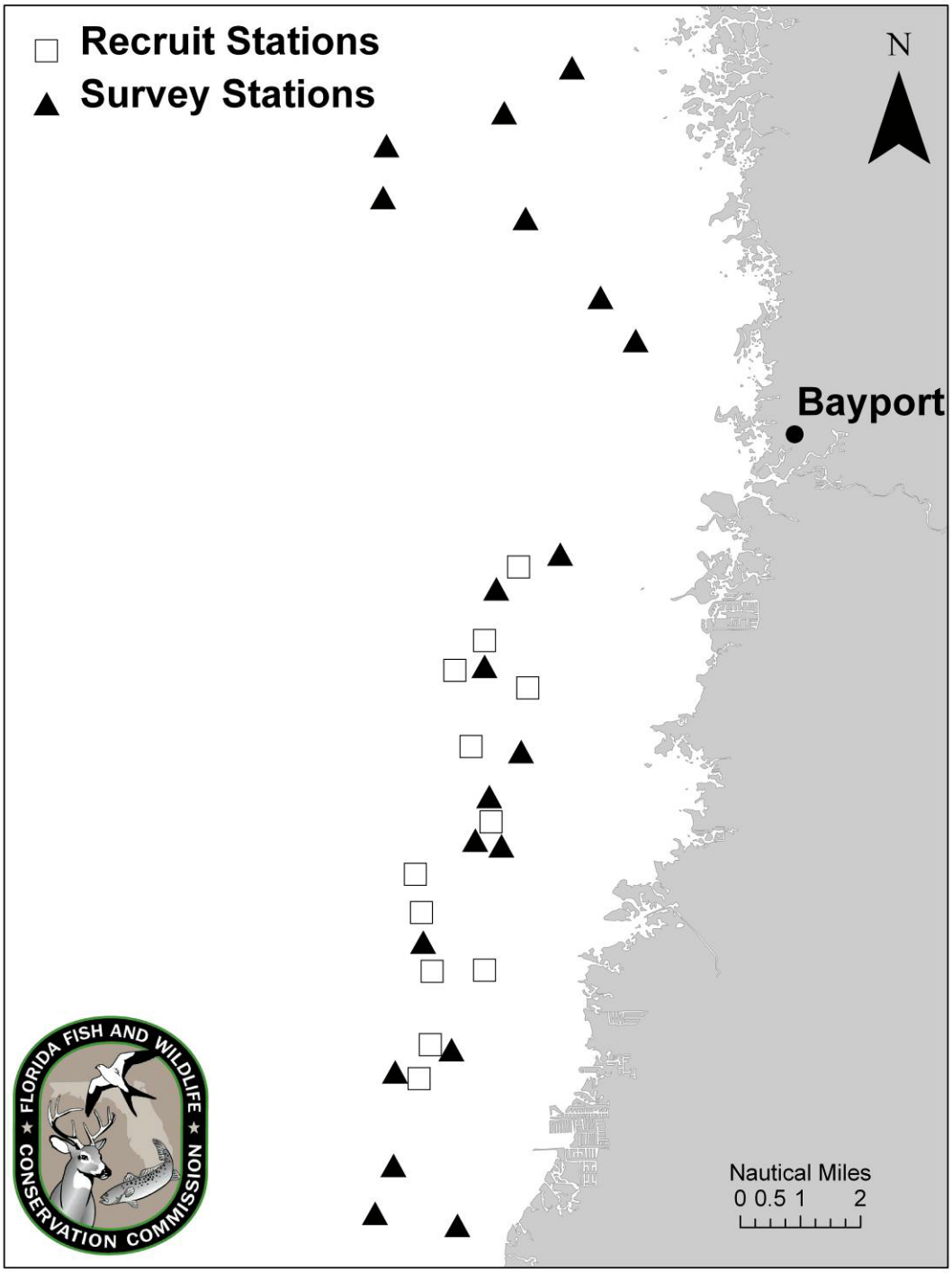

Figure 3.7.1 Hernando area survey (▲) and recruitment monitoring (□) stations sampled in 2009.

3.7.1 Hernando Area Adult Abundance Surveys

We surveyed 20 stations in the nearshore waters of Hernando county in 2009 (Figure 3.7.1). The scallop population in the Hernando area decreased from a healthy population (>25 scallops / 600 m^2) to a transitional one (5 - 25 scallops / 600 m^2) in 2009, falling from an average 79.8 to 13.9 scallops 600 m^{-2}. We recorded scallops at all 20 of the survey stations again in 2009 (Figure 3.7.2). Of the 262 scallops measured in 2009, shell heights (mm) during the June sampling effort ranged from 6 to 70, the average was 50.6, and the most frequent shell height recorded was 55. This population has only been classified as healthy in one of the last eight years. The average in the open harvest regions since the inception of monitoring has been 25.9 per 600 m^2, almost exactly at our healthy criteria limit. The average in the closed harvest regions since the inception of monitoring has been 12.5 per 600 m^2, almost exactly half of our healthy criteria limit.

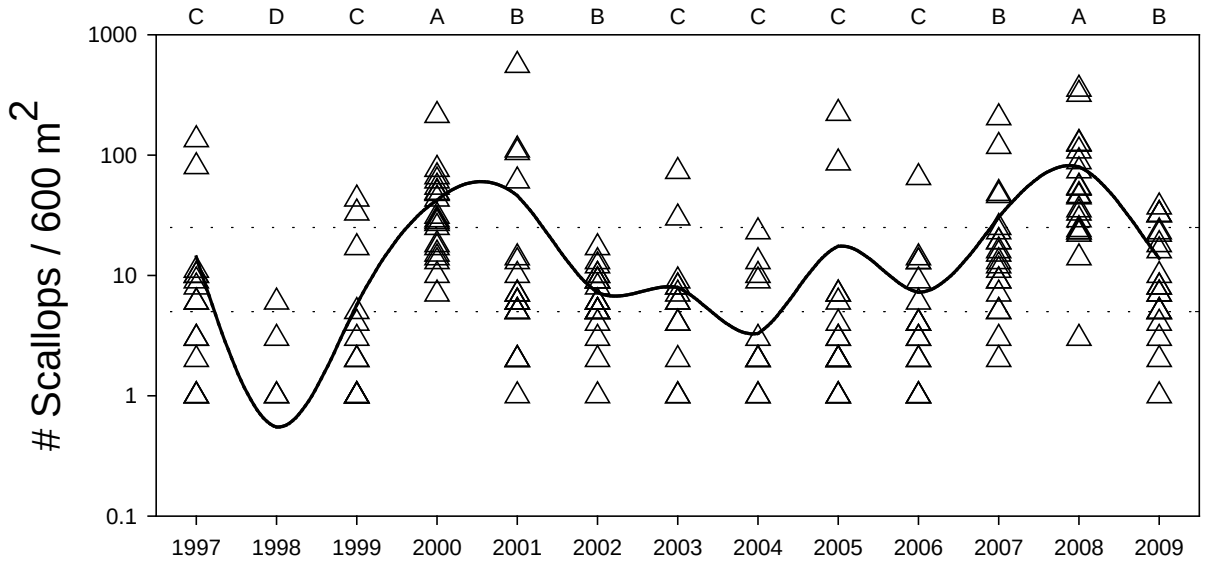

Figure 3.7.2 Annual Hernando area survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05. Hernando survey was initiated in 1997.

3.7.2 Hernando Recruitment Monitoring

Recruitment monitoring occurred at 12 stations in the Hernando area in 2009 (Figure 3.7.1). Of the 144 collectors deployed in 2009, 136 were recovered. Of those 136 collectors recovered, spat were present on 47 (34.6%) and no scallops were observed on the remaining 89 collectors. The total spat observed at this site in 2009 was 280, the average was 2.1 per collector, and the maximum number found on a single collector was 46. The strongest recruitment peak occurred in collectors retrieved in December, and recruitment was observed in 10 of the 12 retrieval dates (Figure 3.7.3). No spat were found in collectors retrieved in late August or September. In 2008 we counted 958 scallops on 138 collectors, for an average of 6.9, so average recruitment decreased in 2009.

In 2009 we observed calico scallop spat on collectors retrieved in December (N = 3). No Asian green mussels or titan acorn barnacles were observed at this site in 2009.

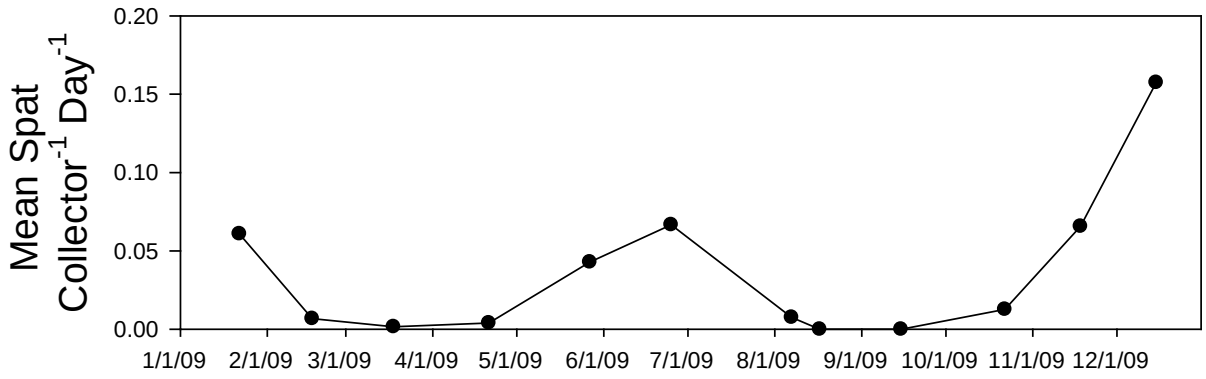

Figure 3.7.3 Hernando area scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.8 Anclote Area

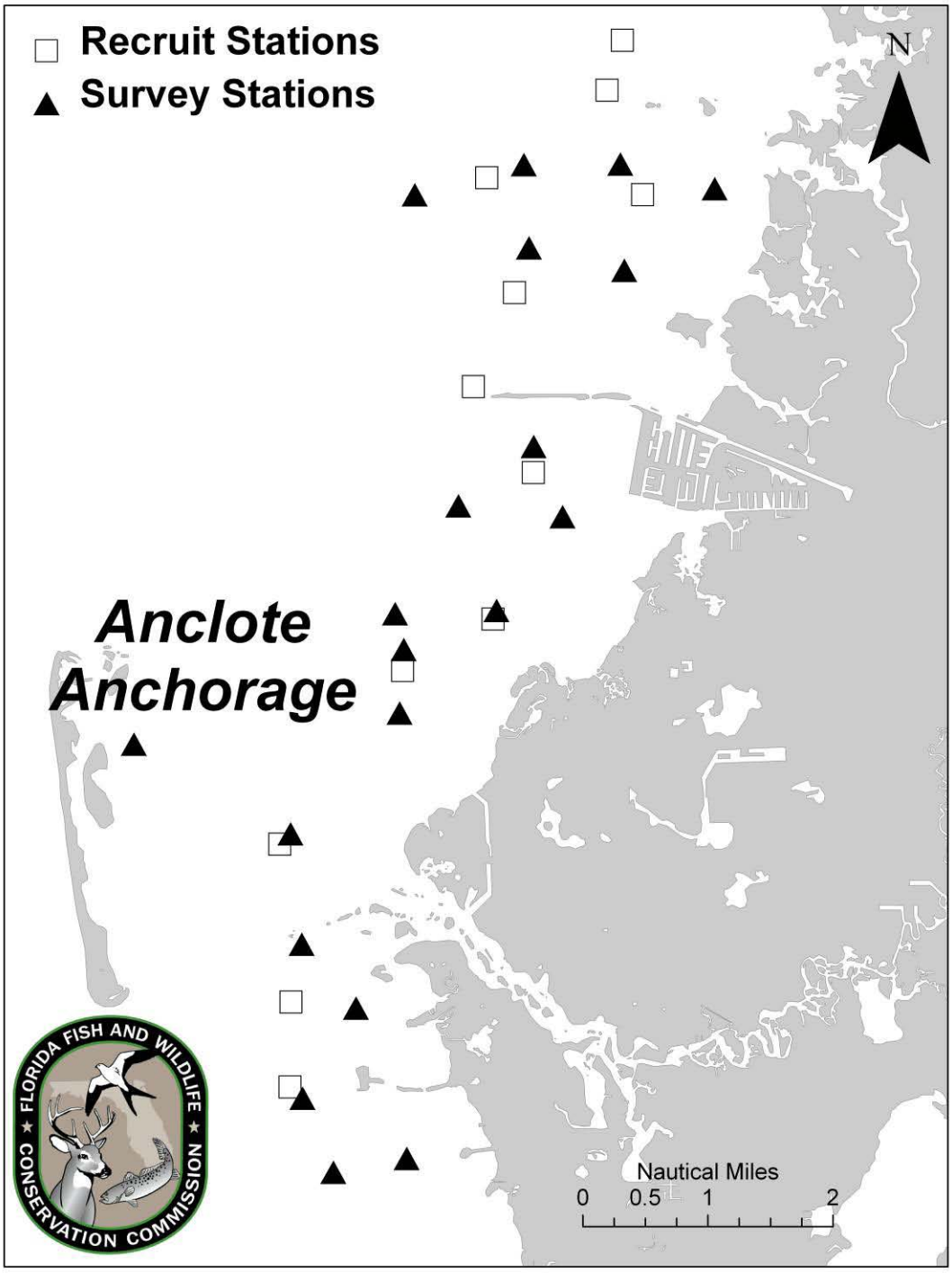

Figure 3.8.1 Anclote area survey (▲), and recruitment monitoring (□) stations sampled in 2009.

3.8.1 Anclote Area Adult Abundance Surveys

We surveyed 20 stations in the Anclote area in 2009 (Figure 3.8.1). The scallop population in the Anclote anchorage area remained healthy (>25 scallops / 600 m^2) in 2009, with a higher total number found that in 2008, and with the highest number of scallops found statewide. The average abundance increased from 137.9 to 152.6 scallops per 600 m^2 area. We recorded scallops at 18 of the 20 survey stations (Figure 3.8.2). Of the 498 scallops measured in 2009, shell heights (mm) during the June to July sampling effort ranged from 29 to 69, the average was 51.9, and the most frequent shell height recorded was 50.

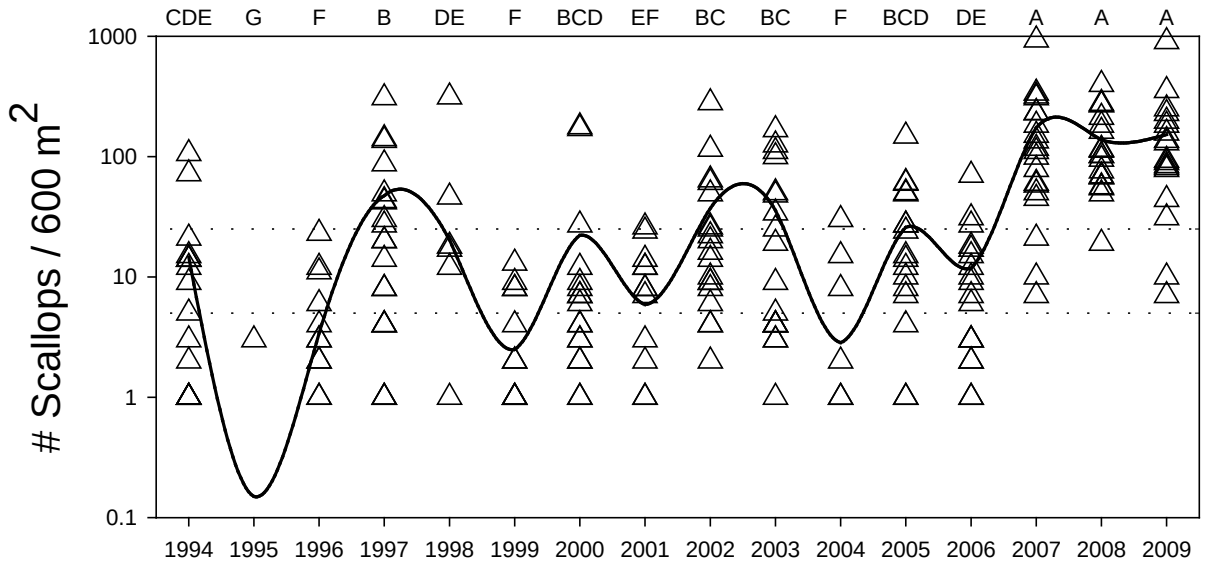

Figure 3.8.2 Annual Anclote area survey abundances. Triangles indicate the scallop density at a given station (per 600 m2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Results of the comparison of means analysis are shown above the graph, where similar letters denote averages that were not different at a significance level of 0.05.

3.8.2 Anclote Area Recruitment Monitoring

Recruitment monitoring occurred at 12 stations in the Anclote area in 2009 (Figure 3.8.1). Of the 144 collectors deployed in 2009, 105 (72.9%) were recovered, remaining the site with the greatest number of collector loss. Of those 105 collectors recovered, spat were present on 75 (71.4%) and no scallops were observed on the remaining 30 collectors. The total spat observed at this site in 2009 was 3821, the average was 36.4 per collector, and the maximum number found on a single collector was 1095. The strongest recruitment peak occurred in collectors retrieved in February, and recruitment was observed in all 12 of the retrieval dates (Figure 3.8.3). This year elevates the number of months of continuous recruitment to collectors in the Anclote area to 49 (54 deployment periods). In 2008 we counted 2,109 scallops on 106 collectors, for an average of 19.9, so average recruitment increased in 2009. This site remains one of the strongest areas for scallop recruitment.

In 2009 we observed calico scallop spat on collectors retrieved in May (N = 7), and Asian green mussels on collectors retrieved in May and December. No titan acorn barnacles were observed at this site in 2009.

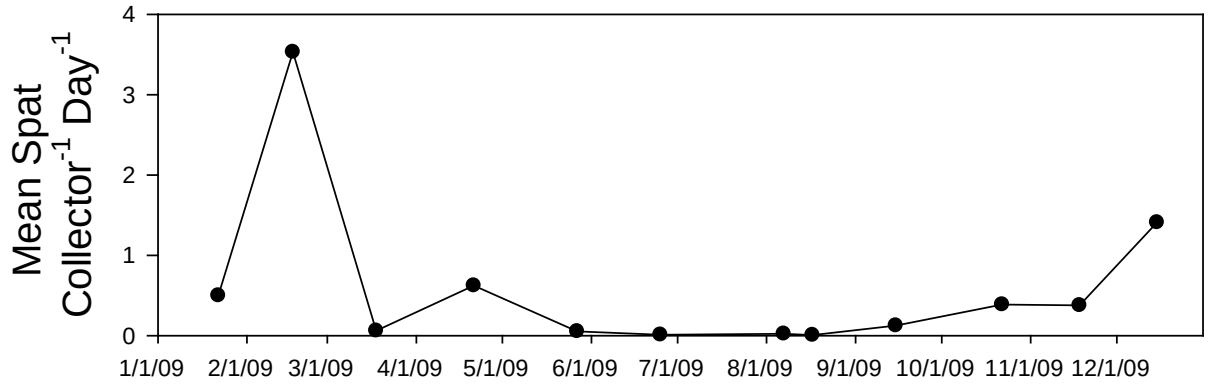

Figure 3.8.3 Anclote scallop recruitment during 2009. The number of scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date.

3.9 Tampa Bay

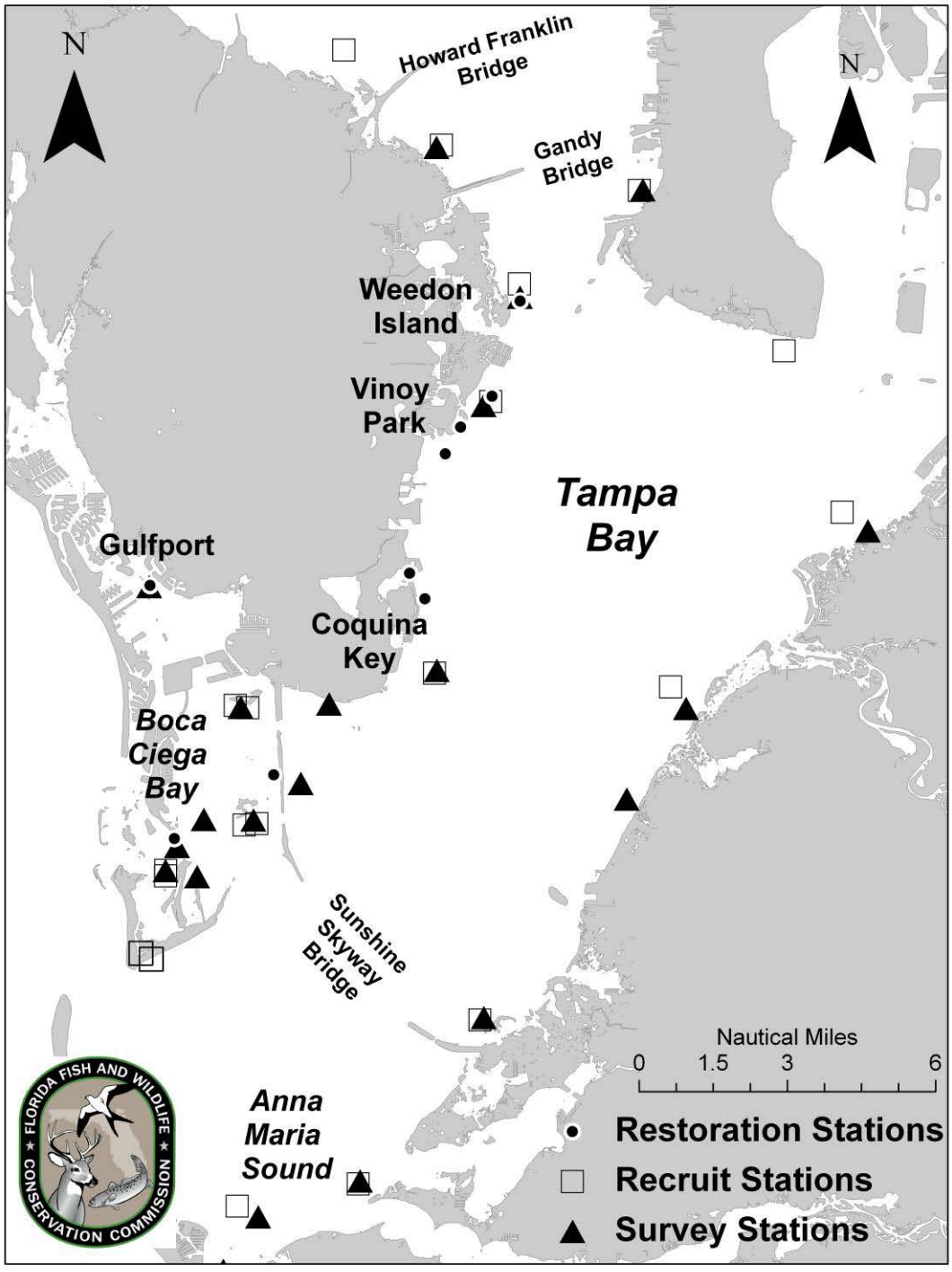

Figure 3.9.1 Tampa Bay restoration (●), survey (▲), and recruitment monitoring (□) stations sampled in 2009.

3.9.1 Tampa Bay Adult Abundance Surveys

We surveyed 20 stations in Tampa bay in 2009 (Figure 3.9.1). The scallop population in the Tampa Bay area remained a healthy (>25 scallops / 600 m^2) population in 2009 with an average 40.4 scallops per 600 m^2, increasing slightly from 2008 (37.0 scallops / 600 m^{-2}). We recorded scallops at 14 of the 20 survey stations (Figure 3.9.2). Of the 215 scallops measured in 2009, shell heights (mm) during the July sampling effort ranged from 30 to 66, the average was 52.5, and the most frequent shell height recorded was 50. Tampa Bay Watch's Great Bay Scallop Search also recorded a higher number of scallops in the Boca Ciega Bay area than any year previous. The yearly number of scallops counted by volunteers can be viewed on Tampa Bay Watch's website: http://tampabaywatch.org/.

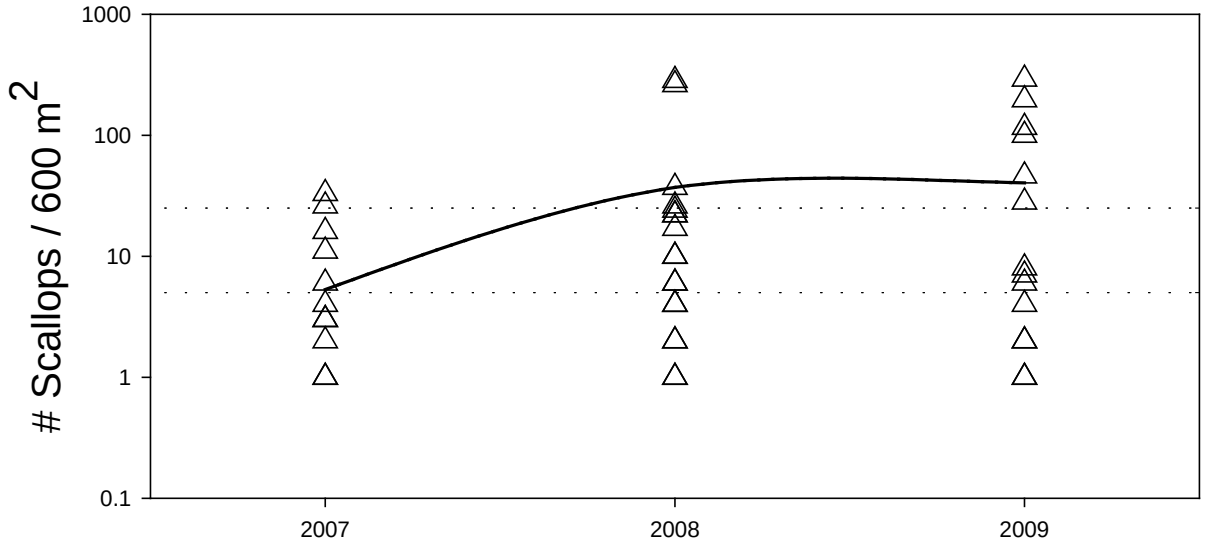

Figure 3.9.2 Annual Tampa Bay survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Mean-comparison groupings were not performed for this site.

3.9.2 Tampa Bay Recruitment Monitoring

Recruitment monitoring occurred year-round at six stations in the Boca Ciega Bay area of Tampa Bay in 2009 (Figure 3.9.1). Of the 72 collectors deployed in Boca Ciega Bay in 2009, 59 were recovered. Of those 59 collectors recovered, bay scallop spat were present on 37 (62.7%), and no scallops were observed on the remaining 22 collectors. The total bay scallop spat observed at this site in 2009 was 3,496, the average was 59.2 per collector (the highest in the state), and the maximum number found on a single collector was 726. The strongest recruitment peak occurred in collectors retrieved in January, and recruitment was observed in 10 of the 12 retrieval dates (Figure 3.9.3A). No bay scallop spat were found in collectors retrieved in September or October. In 2008 we counted 4,666 scallops on 69 collectors, for an average of 67.6, so average recruitment decreased slightly in 2009.

Of those 59 collectors recovered, calico scallop spat were present on 11 (18.6%) of the collectors. The total calico scallop spat observed at this site in 2009 was 53, the average was 0.9 per collector, and the maximum number found on a single collector was 17. The strongest calico scallop recruitment peak occurred in collectors retrieved in May, and recruitment was observed in 5 of the 12 retrieval dates (Figure 3.9.4). On the 58 small round floats processed, green mussel recruits were present on 18. The strongest green mussel recruitment peak occurred in collectors retrieved in June, and recruitment was observed in 6 of the 12 retrieval dates (Figure 3.9.3B). No titan acorn barnacles were observed at this site in 2009.

In October we added an additional 12 stations around Tampa Bay as part of a grant funded project. The collectors were deployed from Coquina Key, north of the Howard Franklin Bridge, and then on the east side of the bay south to Anna Maria Sound area (Figure 3.9.3C). Collectors were deployed in October and November and the first retrieval was in mid-December. All the collectors were retrieved and four bay scallops were observed.

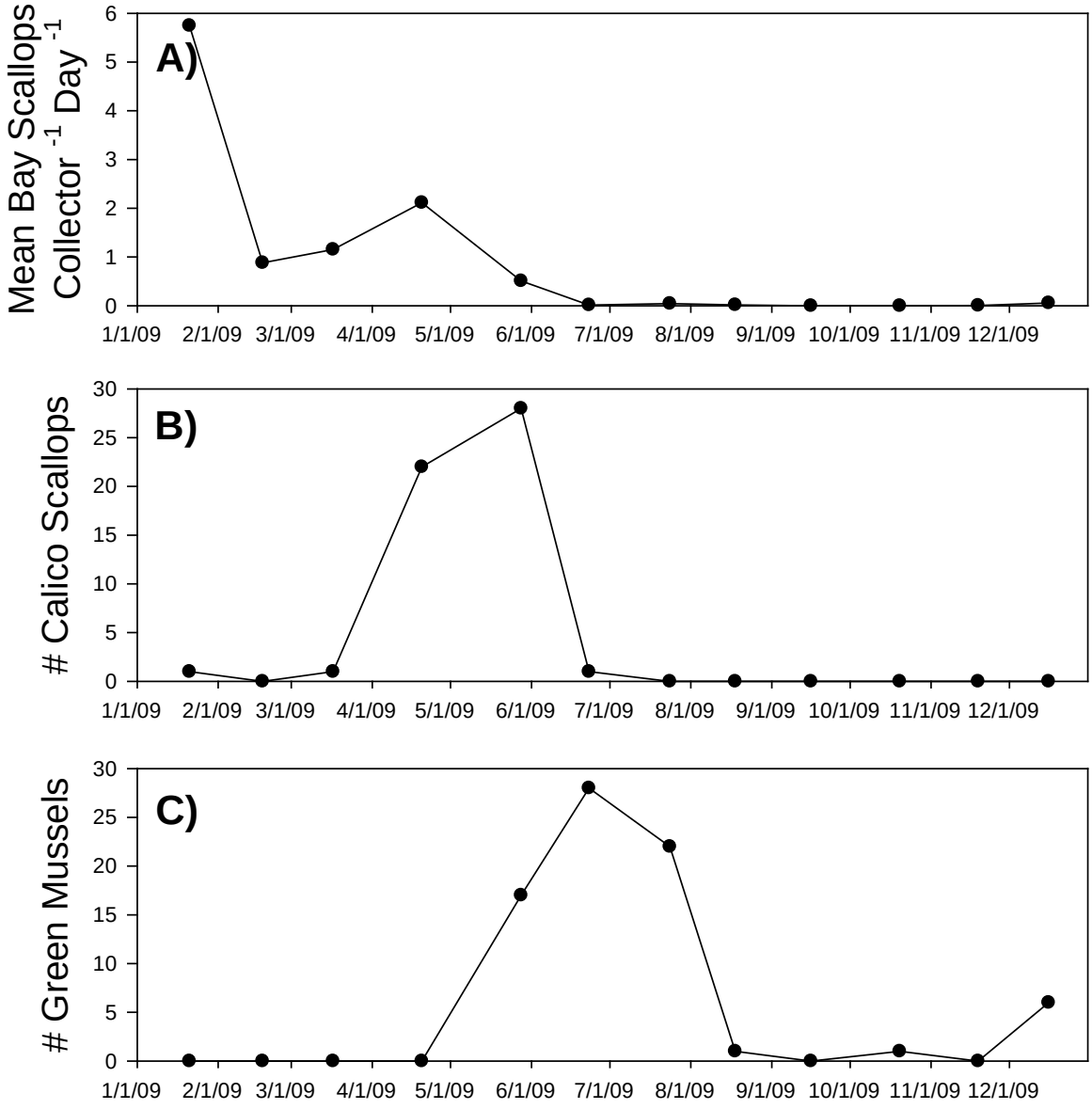

Figure 3.9.3 Tampa Bay bay scallop recruitment (A), Calico scallop recruitment (B), and Asian green mussel recruitment (C) during 2009. The number of bay scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The total number of calico and green mussel recruits per retrieval date are reported.

3.9.3 Tampa Bay Restoration Activities

Using recruitment collectors deployed in Tampa Bay and Sarasota Bay as a spat-collection method we were able to retain 3,491 scallops in December 2008, 3,633 scallops in January, 584 in February, 317 in March, 1,417 in April, and 278 in May, for a total of 9,720 scallops. On March 3, 2009, FWRI staff free- released 1,000 scallops in grass beds near Weedon Island (Figure 3.9.1). On March 17, 2009, FWRI staff free-released scallops in seagrasses near Vinoy Park (N = 500 and 532), Coquina Key (N = 1,500), Boca Ciega Bay (N = 500), and Gulfport (N = 1500). These scallops ranged from approximately 10 to 30 mm, with the majority on the small size. Although we originally collected over 9,700 scallops from Tampa Bay and Sarasota Bay collectors, high water temperatures and heavy rainfall in May and June led to high mortality of the scallops remaining in cages deployed in Bayboro Harbor, so that a second set of free-releases was not an option for further Tampa Bay scallop restoration.

On October 5, 2009, FWRI and Tampa Bay Watch staff and volunteers collected 500 adult scallops from seagrass beds in Boca Ciega Bay. These scallops were transported to three sites in Tampa Bay: Vinoy Park, Coquina Key, and Tampa Bay Watch headquarters in Boca Ciega Bay, and then hung in multiple cages off volunteer and facility docks (Figure 3.9.1). The number of scallops in each cage was counted each month (Figure 3.9.4). This marks the 5^{th} year that this type of volunteer restoration has been in place in Tampa Bay. Just as the previous year's study, scallops survived through the winter and a small percentage was still alive during the early months of the consecutive year.

Bay scallops cultured in Bayboro harbor grew an average of 1.53 mm/week during late January through March, and an average of 2.32 mm/week during late April through June. Calico scallops were measured weekly as well from April through June, and their average growth rate was 2.23 mm/week.

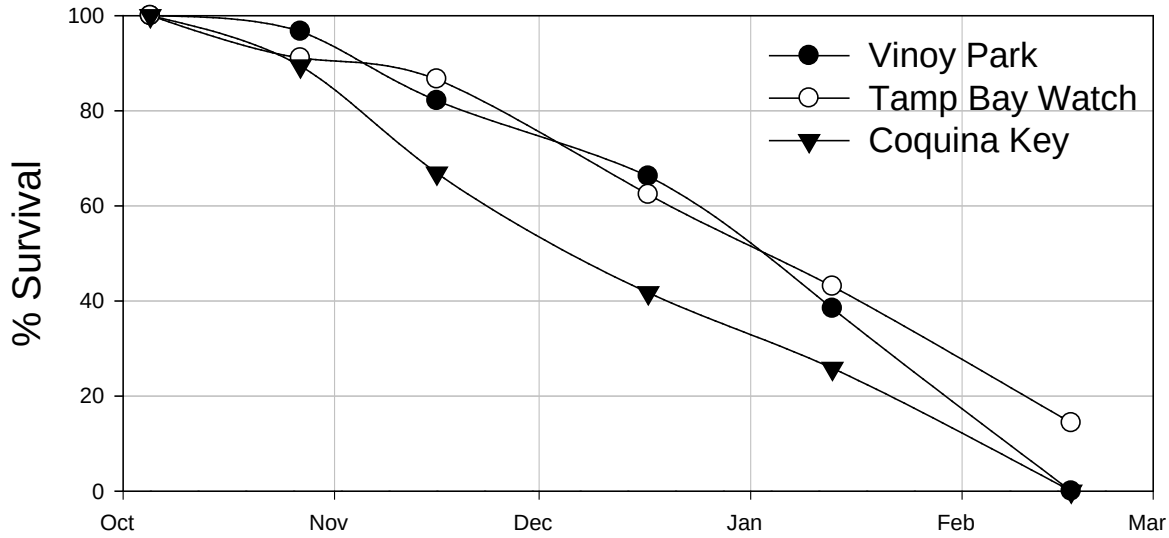

Figure 3.9.4 Survival of cage-planted scallops monitored by Tampa Bay Watch staff.

3.10 Sarasota Bay Area

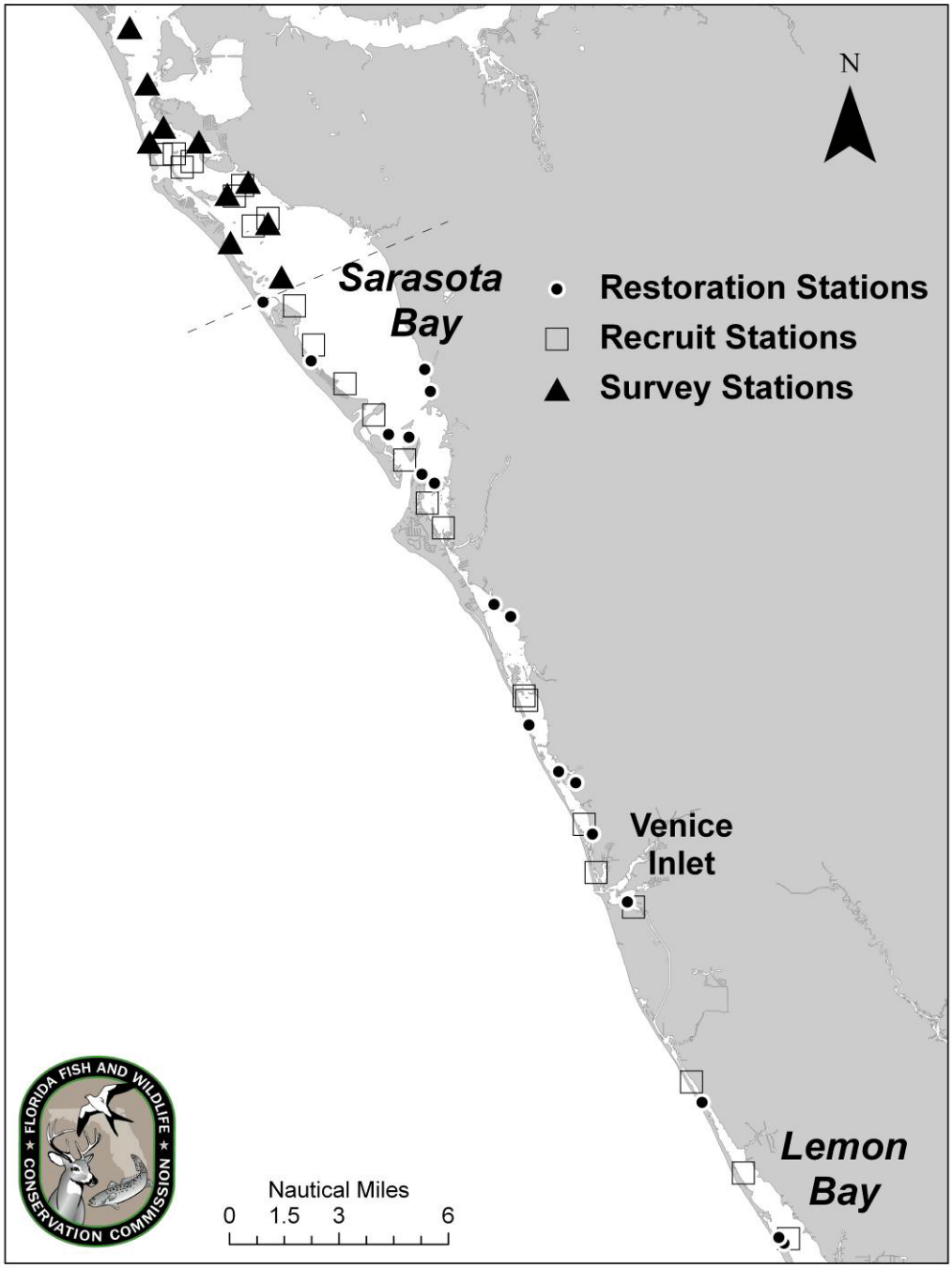

Figure 3.10.1 Sarasota Bay area restoration (●), survey (▲), and recruitment monitoring (□) stations sampled in 2009. Stations to the north of the dashed line are serviced by FWRI staff and those to the south by Sarasota County staff.

3.10.1 Sarasota Bay Area Adult Abundance Surveys

FWRI staff surveyed 10 stations in northern Sarasota Bay in 2009 (Figure 3.10.1). The scallop population in the Sarasota Bay area remained a healthy population (>25 scallops / 600m^2), though numbers were down from last year, dropping from 249.9 scallops/600m^2 to 62.5. We recorded scallops at five of the 10 survey stations, which was half of the distribution of 2008 surveys (Figure 3.10.2). Of the 133 scallops measured in 2009, shell heights (mm) during the July sampling effort ranged from 25 to 69, the average was 54.0, and the most frequent shell height recorded was 60.

The 2nd annual Sarasota Bay Watch scallop search on August 8, 2009 had a good turnout, with volunteers counting 136 scallops. Sarasota Bay Watch information can be found at www.sarasotabaywatch.org. Scallop surveys performed countywide by Sarasota County staff in September 2009 yielded a total count of 123 scallops. Staff scientists performed 27 100-m long visual surveys in seagrass beds throughout the entire Sarasota County waterway system, for an average of 4.6 scallops per 200 m^2 (equivalent to 13.8 per 600m^2 or transitional) Figure 3.10.3 illustrates the total number of scallops observed by both volunteers and Sarasota County staff scientists in 2009.

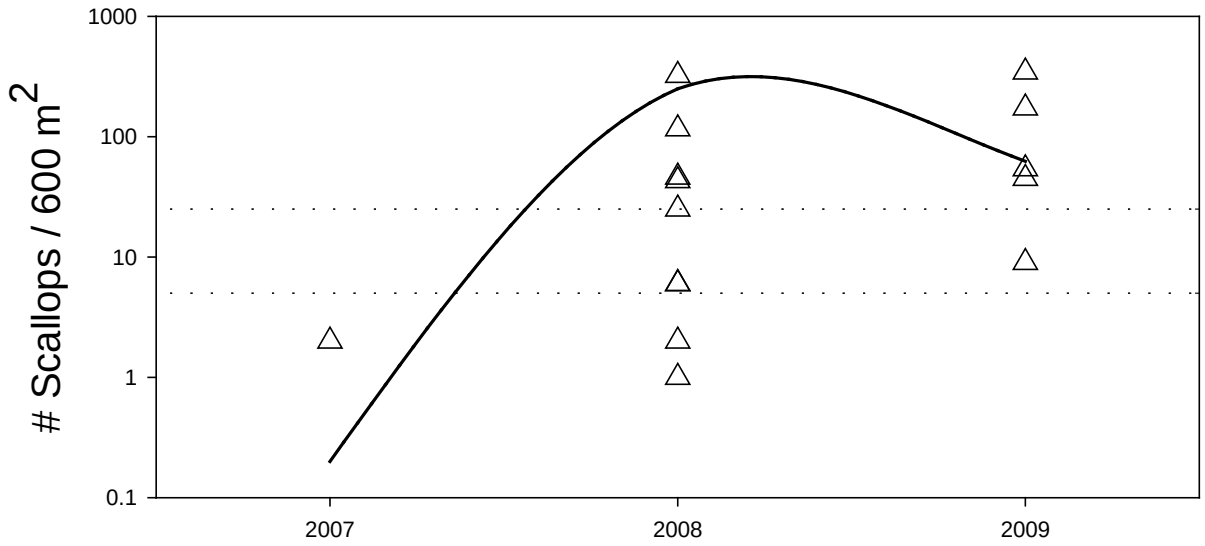

Figure 3.10.2 Annual Sarasota Bay area survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels Mean-comparison groupings were not performed for this site.

3.10.2 Sarasota Bay Area Recruitment Monitoring

Recruitment monitoring occurred at 8 stations in the Manatee County area of Sarasota Bay, and at 15 stations in the Sarasota County area in 2009 (Figure 3.10.1). Of the 96 collectors deployed in 2009 in Manatee County, 87 were recovered. Of those 87 collectors recovered, bay scallop spat were present on 53 (60.9%), and no scallops were observed on the remaining 34 collectors. The total bay scallop spat observed at this site in 2009 was 2823, the average was 32.5 per collector, and the maximum number found on a single collector was 705. The strongest recruitment peak occurred in collectors retrieved in January, and recruitment was observed in 10 of the 12 retrieval dates (Figure 3.10.4A). No bay scallop spat were found in collectors retrieved in August or November. In 2008 we counted 2,522 scallops on 82collectors, for an average of 27.5, so average recruitment increased in 2009.

Of those 87 collectors recovered, calico scallop spat were present on 33 (37.9%) of the collectors. The total calico scallop spat observed at this site in 2009 was 317, the average was 3.6 per collector, and

the maximum number found on a single collector was 84. The strongest calico recruitment peak occurred in collectors retrieved in April, and recruitment was observed in 7 of the 12 retrieval dates (Figure 3.10.4B). The strongest green mussel recruitment peak occurred in collectors retrieved in December, and recruitment was observed in 7 of the 12 retrieval dates (Figure 3.10.4C). No titan acorn barnacles were observed at this site in 2009.

Of the 165 collectors deployed in 2009 in Sarasota County, 161 were recovered. Of those 161 collectors recovered, bay scallop spat were present on 79 (49.1%), and no scallops were observed on the remaining 82 collectors. The total bay scallop spat observed at this site in 2009 was 2144, the average was 13.3 per collector, and the maximum number found on a single collector was 384. The strongest recruitment peak occurred in collectors retrieved in January, and recruitment was observed in 10 of the 11 retrieval dates (Figure 3.10.5A). No bay scallop spat were found in collectors retrieved in November. Recruitment monitoring was initiated at this site in 2008, so we are unable to describe relative changes in average recruitment.

Of those 161 collectors recovered, calico scallop spat were present on 33 (20.5%) of the collectors. The total calico scallop spat observed at this site in 2009 was 360, the average was 2.2 per collector, and the maximum number found on a single collector was 76. The strongest calico recruitment peak occurred in collectors retrieved in April, and recruitment was observed in 7 of the 11 retrieval dates (Figure 3.10.5B). No Asian green mussels or titan acorn barnacles were observed at this site in 2009.

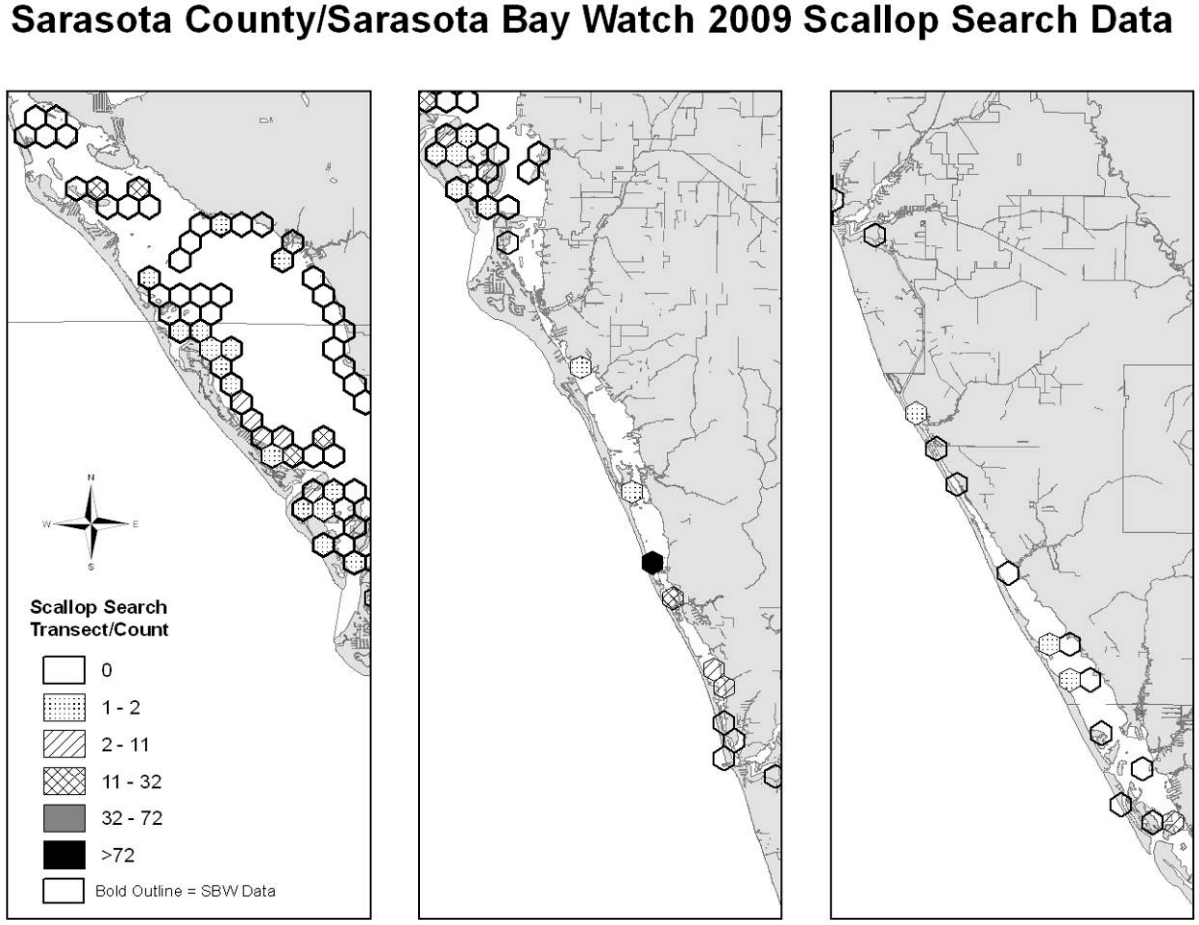

Figure 3.10.3 Bay scallop counts observed in Sarasota Bay and county waters during Sarasota Bay Watch's volunteer event and during transect surveys performed by county scientists in 2009.

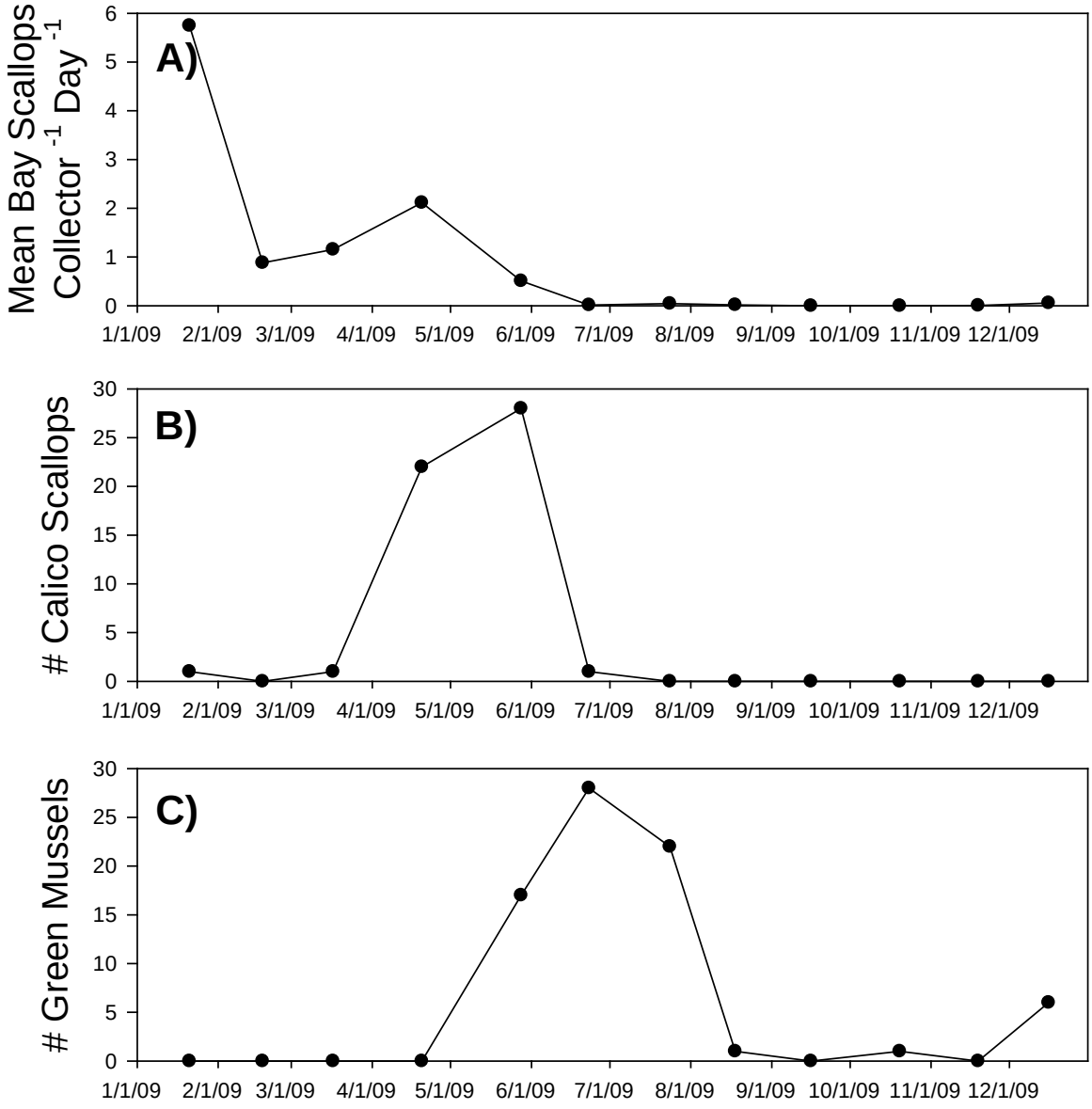

Figure 3.10.4 Northern Sarasota Bay bay scallop (A) recruitment, calico scallop (B) recruitment, and Asian green mussel (C) recruitment during 2009. The number of bay scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The total number of calico and green mussel recruits per retrieval date are reported.

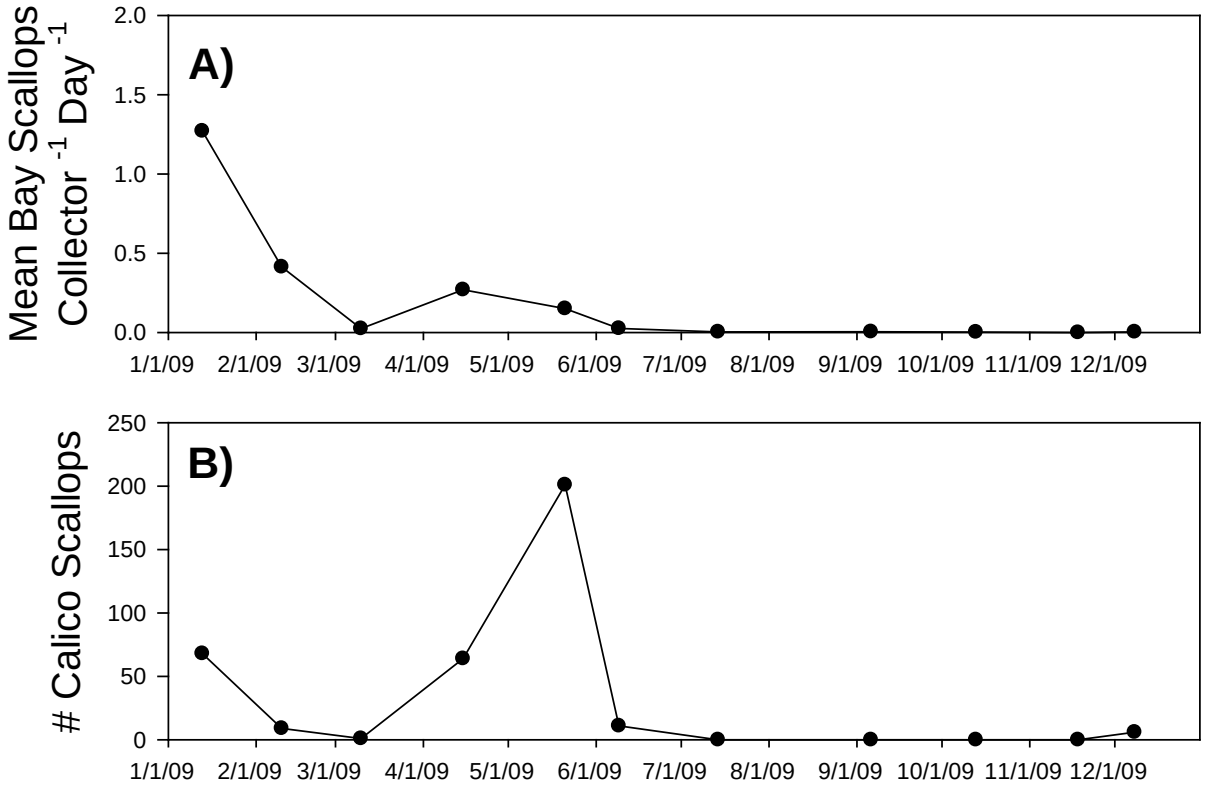

Figure 3.10.5 Southern Sarasota Bay through Lemon Bay bay scallop (A) recruitment and calico scallop (B) recruitment during 2009. The number of bay scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The total number of calico recruits per retrieval date are reported.

3.10.3 Sarasota Bay Area Restoration Activities

On July 30 and 31, 2009, FWRI and Sarasota County staff transported approximately 900 bay scallops from Bayboro Harbor and deployed them in 18 cages off volunteer homeowner docks along Sarasota County (Figure 3.10.1). These volunteers monitored the caged scallops at least once a month, measuring the ten largest scallops out of the original 50, and counting the number of live animals remaining (Figure 3.10.6). The fluctuation within the graph is due to the mortality of the larger individual measured over time. This second year of community based restoration had a high degree of early mortality within the cages. This may be attributed to high water temperatures, especially when transporting scallops from Bayboro to the respective homeowner's dock, as well as heavy rainfall throughout the summer months. Increased rainfall and runoff causes a drop in the salinity which the scallops are extremely sensitive to. Average growth rates in the illustration below are most likely low due to the larger size of the scallops at time of planting.

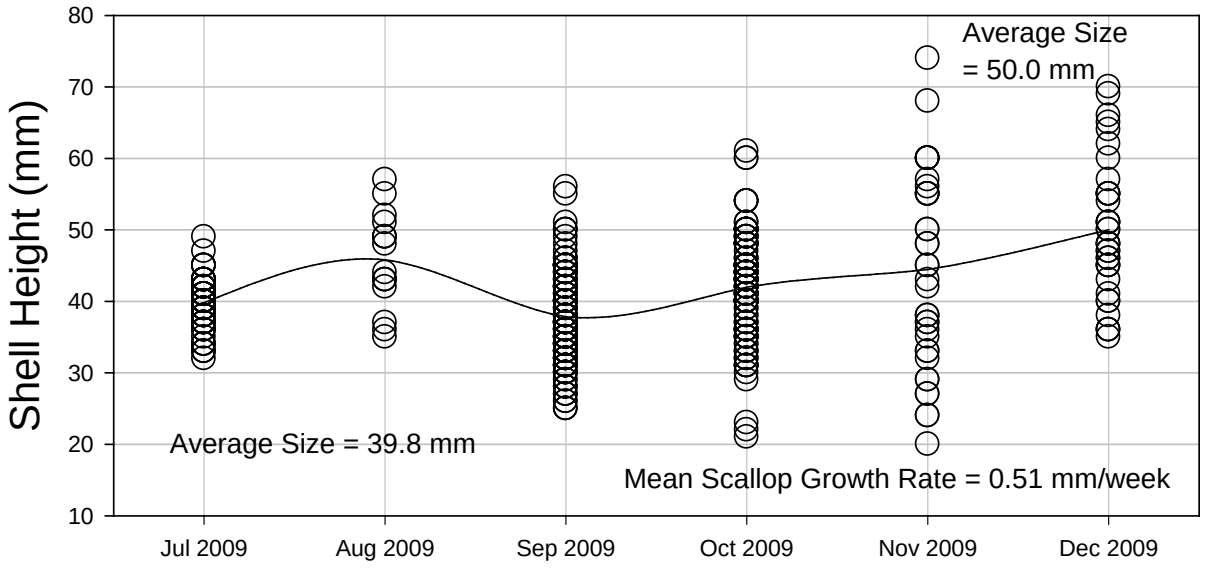

Figure 3.10.6 Actual (○) and average (line) shell heights of caged scallops throughout Sarasota County.

3.11 Charlotte Harbor and Pine Island Sound Area

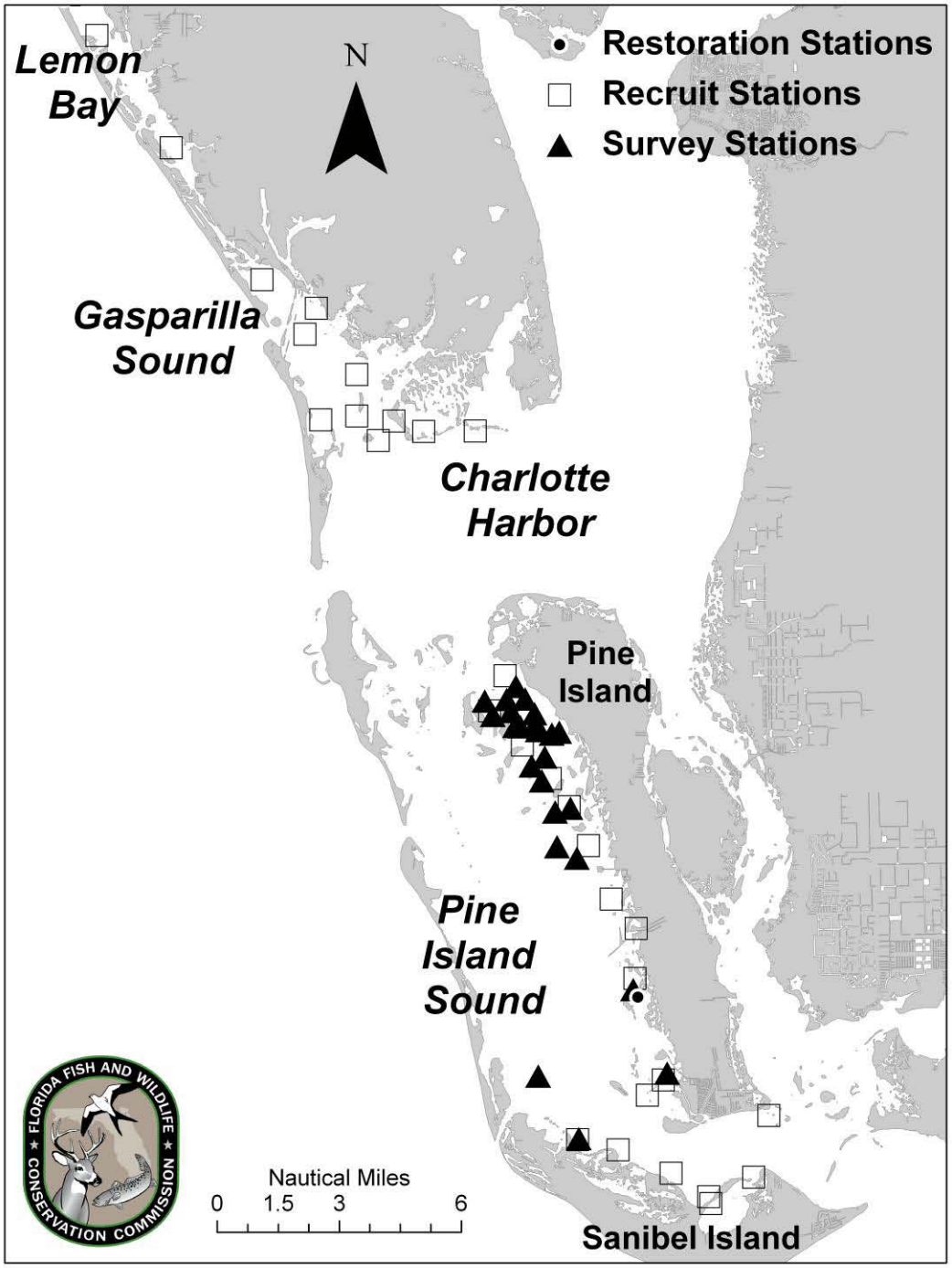

Figure 3.11.1 Charlotte Harbor and Pine Island Sound restoration (●), survey (▲), and recruitment monitoring (□) stations sampled in 2009.

3.11.1 Charlotte Harbor and Pine Island Sound Area Adult Abundance Surveys

We surveyed 20 stations in the northern end of Pine Island Sound in May 2009, and four stations in the southern end (Figure 3.11.1) in August 2009. The scallop population in the north end of Pine Island Sound area increased from a collapsed population (<5 scallops / 600 m^2) to a transitional one (5 - 25 scallops / 600 m^2) in 2009, increasing from an average of 0.1 to 14.1 scallops/600 m^2. We recorded scallops at 19 of the 20 survey stations (Figure 3.11.2), which is a much broader distribution than what was observed in 2008 (two out of 20). This increase in abundance may be a positive sign of our restoration efforts, which are heavy in this area, but in no way indicate a stable population. The observation that there was some recovery after a two-year period where Pine Island Sound was essentially devoid of bay scallops suggests that either the area's resiliency is improving or that the continued restoration and conservative management efforts are having a positive impact. For this reason we will continue restoration efforts in Pine Island Sound. Of the 270 scallops measured in 2009, shell heights (mm) during the May sampling effort ranged from 17 to 64, the average was 45.7, and the most frequent shell height recorded was 42. Only four scallops were observed in the southern end of Pine Island Sound in August, and their shell heights were 42, 43, 55, and 62 mm.

On September 12, 2009, the first annual Great Bay & Sound Scallop Search in the Charlotte Harbor vicinity hosted by the University of Florida Sea Grant program was a success despite the unfavorable weather conditions. Volunteers came out to snorkel local seagrass beds and counted 94 bay scallops. This was a higher number than anticipated and hopefully shows signs of improving habitat and water quality and other contributing factors crucial for bay scallop populations.

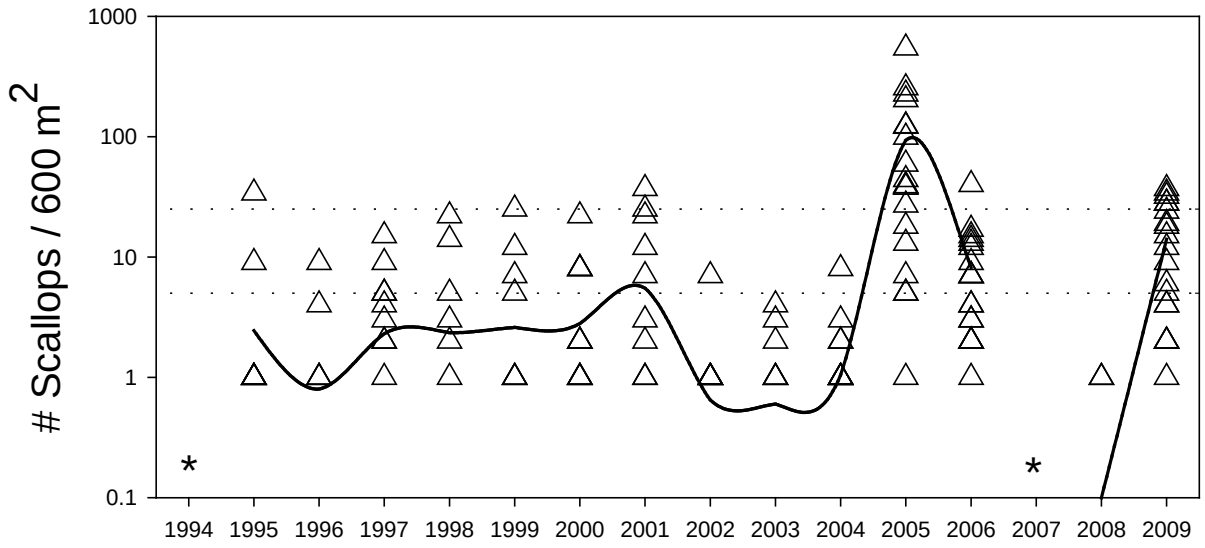

Figure 3.11.2 Annual northern Pine Island Sound area survey abundances. Triangles indicate the scallop density at a given station (per 600 m^2) and the solid line connects annual means. The horizontal dotted lines denote the transitional and healthy population levels. Asterisks denote years where no scallops were observed during surveys. Mean-comparison groupings were not performed for this site.

3.11.2 Charlotte Harbor and Pine Island Sound Recruitment Monitoring

Recruitment monitoring occurred at 12 stations in the Lemon Bay to Charlotte Harbor area of Charlotte County in 2009 (Figure 3.11.1). Of the 156 collectors deployed in 2009, 130 were recovered. Of those 130 collectors recovered, bay scallop spat were present on 51 (39.2%), and no scallops were observed on the remaining 79 collectors. The total bay scallop spat observed at this site in 2009 was 1,292, the average was 9.9 per collector, and the maximum number found on a single collector was 151. The strongest recruitment peak occurred in collectors retrieved in May, and recruitment was observed in 8 of the 13 retrieval dates (Figure 3.11.3A). No bay scallop spat were found in collectors retrieved in May or September through December. Recruitment monitoring was initiated at this site in 2008, so we are unable to describe relative changes in average recruitment.

Of those 130 collectors recovered, calico scallop spat were present on 37 (28.5%) of the collectors.

The total calico scallop spat observed at this site in 2009 was 466, the average was 3.6 per collector, and the maximum number found on a single collector was 98. The strongest recruitment peak occurred in collectors retrieved in April, and recruitment was observed in 10 of the 13 retrieval dates (Figure 3.11.3B). No green mussels or titan acorn barnacles were observed at this site in 2009.

Recruitment monitoring occurred at 18 stations in Pine Island Sound area in 2009 (Figure 3.11.1). Of the 216 collectors deployed in 2009, 194 were recovered. Of those 194 collectors recovered, bay scallop spat were present on 49 (25.3%), and no scallops were observed on the remaining 145 collectors. The total bay scallop spat observed at this site in 2009 was 145, the average was 0.8 per collector, and the maximum number found on a single collector was 16. The strongest recruitment peak occurred in collectors retrieved in December, and recruitment was observed in 11 of the 12 retrieval dates (Figure 3.11.4A). No bay scallop spat were found in collectors retrieved in October. In 2008 we counted 17 scallops on 150 collectors, for an average of 0.1, so average recruitment increased in 2009.

Of those 194 collectors recovered, calico scallop spat were present on 36 (18.6%) of the collectors. The total calico scallop spat observed at this site in 2009 was 351, the average was 1.8 per collector, and the maximum number found on a single collector was 89. The strongest recruitment peak occurred in collectors retrieved in May, and recruitment was observed in 7 of the 12 retrieval dates (Figure 3.11.4B).

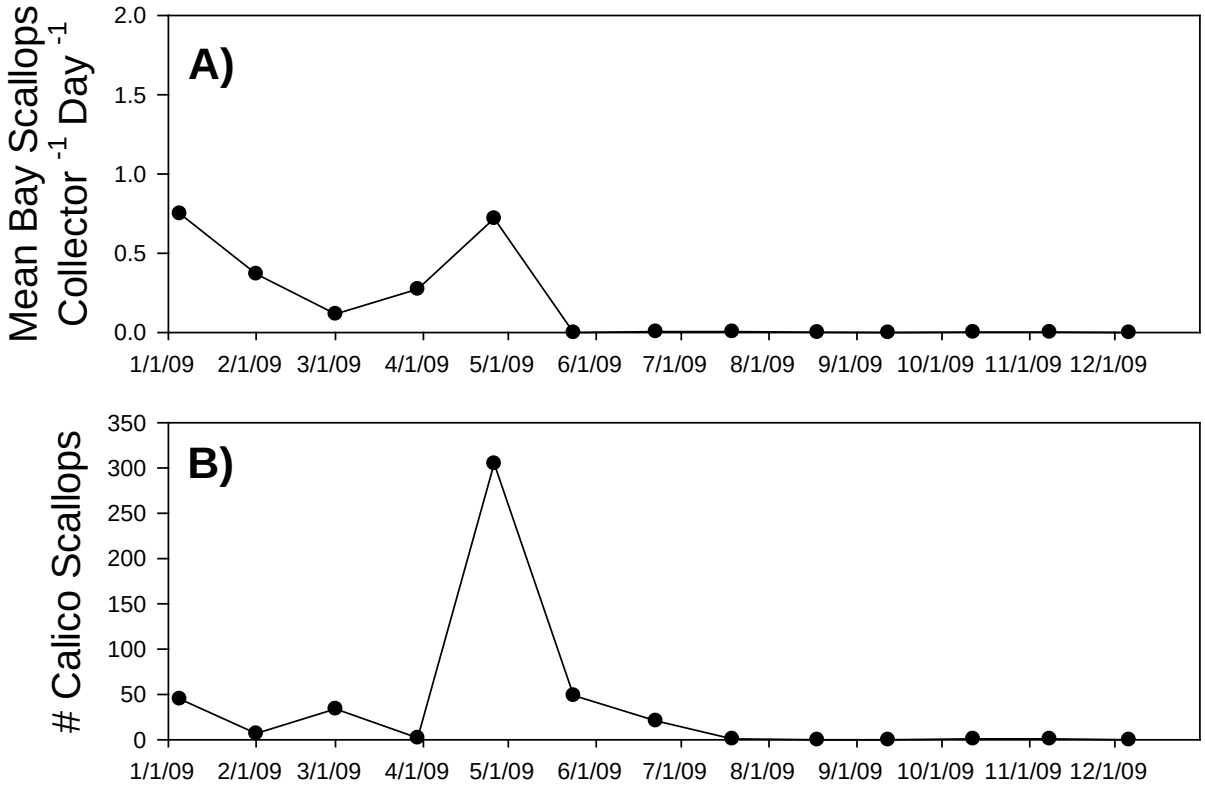

Figure 3.11.3 Charlotte Harbor area bay scallop (A) and calico scallop (B) recruitment during 2009. The number of bay scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The total number of calico recruits per retrieval date are reported.

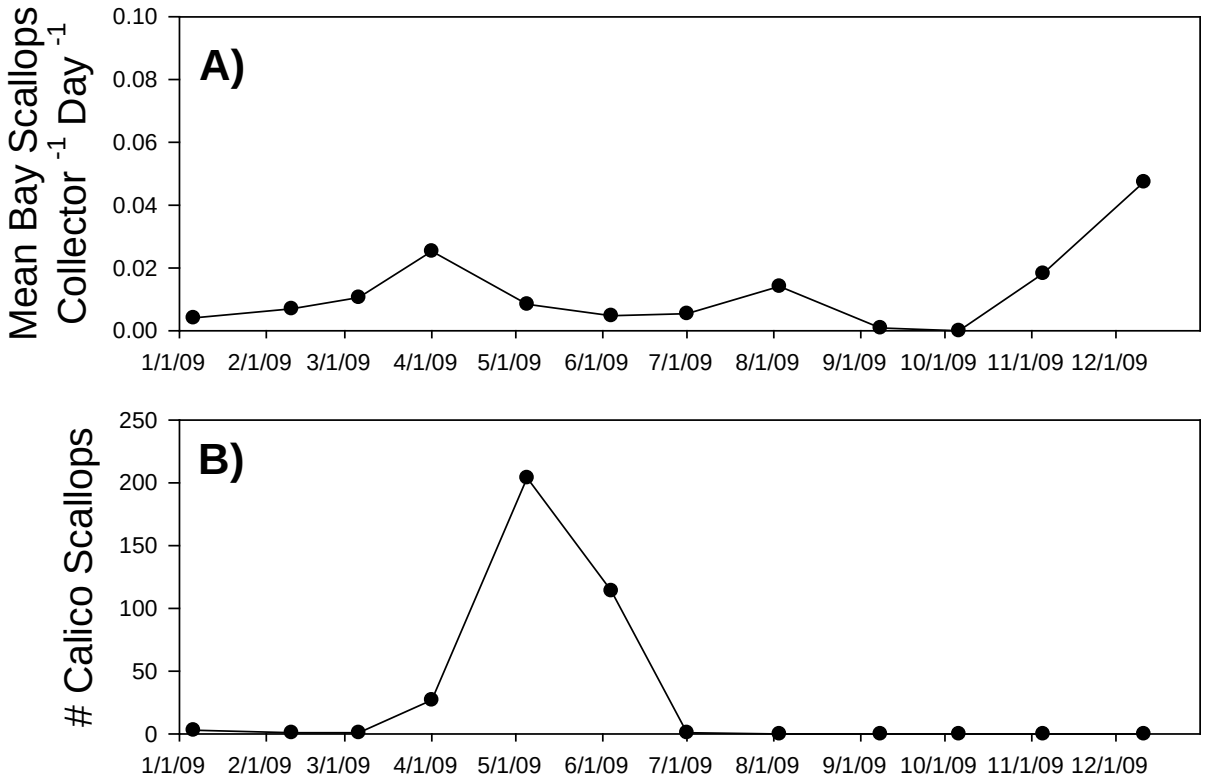

Figure 3.11.4 Pine Island Sound bay scallop (A) and calico scallop (B) recruitment during 2009. The number of bay scallops per collector was standardized by dividing the count by the number of days deployed, then averaged by deployment period and plotted by retrieval date. The total number of calico recruits per retrieval date are reported.

3.11.3 Charlotte Harbor and Pine Island Sound Restoration Activities

On the heels of successful community based restoration efforts in Sarasota County FWRI scientists teamed up with scientists from the Sanibel-Captiva Conservation Foundation (**http://www.sccf.org/**) to try a similar approach for restoring bay scallops to Pine Island Sound. Previous restoration attempts in this area focused on releasing larval and juvenile scallops into the bay, but this method offered no way to assess the survival of the scallops after deployment. On February 26, 2009 FWRI staff transported 1,000 bay scallops from Bayboro Harbor to Sanibel. Scientists Loren Cohen and Mark Thompson of were on hand to distribute the scallops to waiting volunteers, who would in turn place them in cages and hang off their personal docks. Half of the scallop cages were hung in canals and others in the open Sound area. The canal sites were in more developed areas and the salinity values more variable than that of the non-canal sites. Figures 3.11.5 and 3.11.6 illustrate the growth measurements recorded by volunteers and Figure 3.11.7 depicts the survival rates for the two deployment areas over the course of the study.

On March 3, 2009 Jim Culter of Mote Marine Lab planted 60 scallops at each of two spots in Pine Island Sound (Culter et al. in prep). On August 29, 2009, FWRI staff planted the remaining 500 scallops that were grown in Bayboro Harbor in the southern end of Pine Island Sound (Figure 3.11.1).

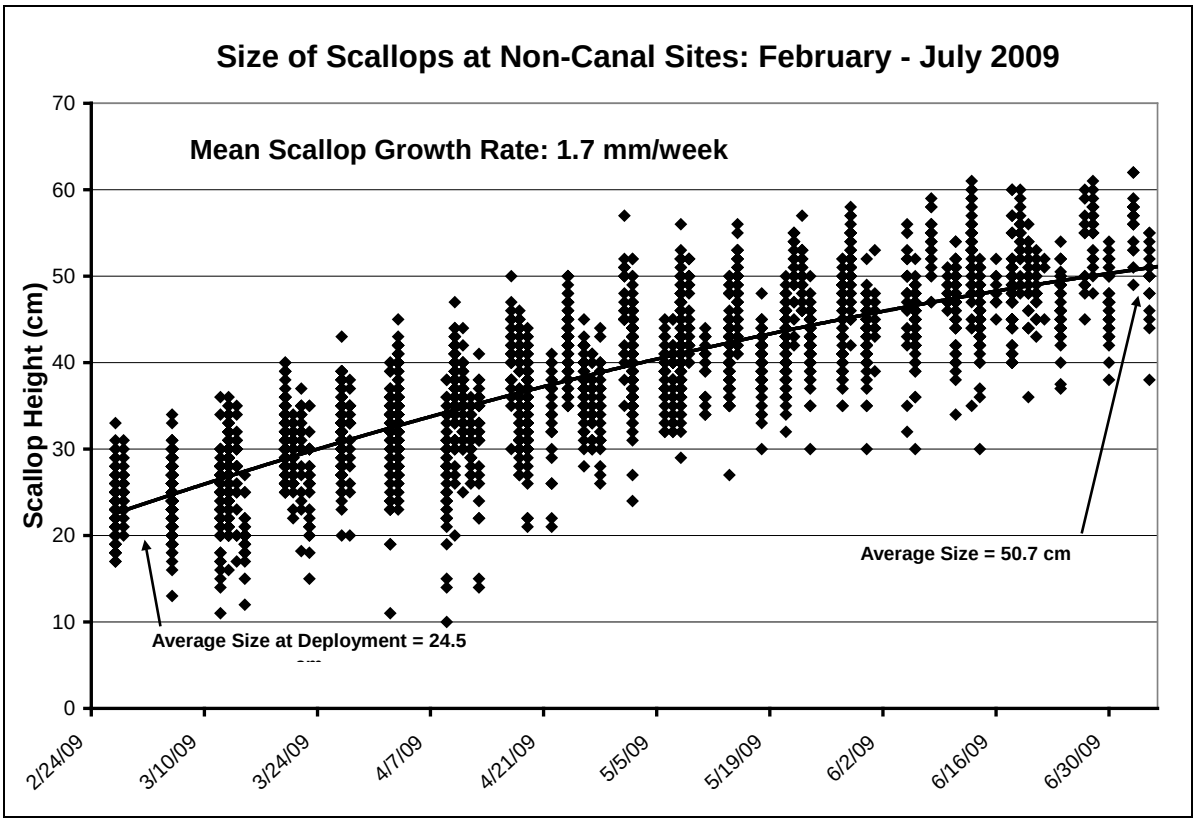

Figure 3.11.5 Figure produced by Sanibel-Captiva Conservation Foundation staff. Shell heights (mm) of caged bay scallops deployed in open water areas in Pine Island Sound in 2009.

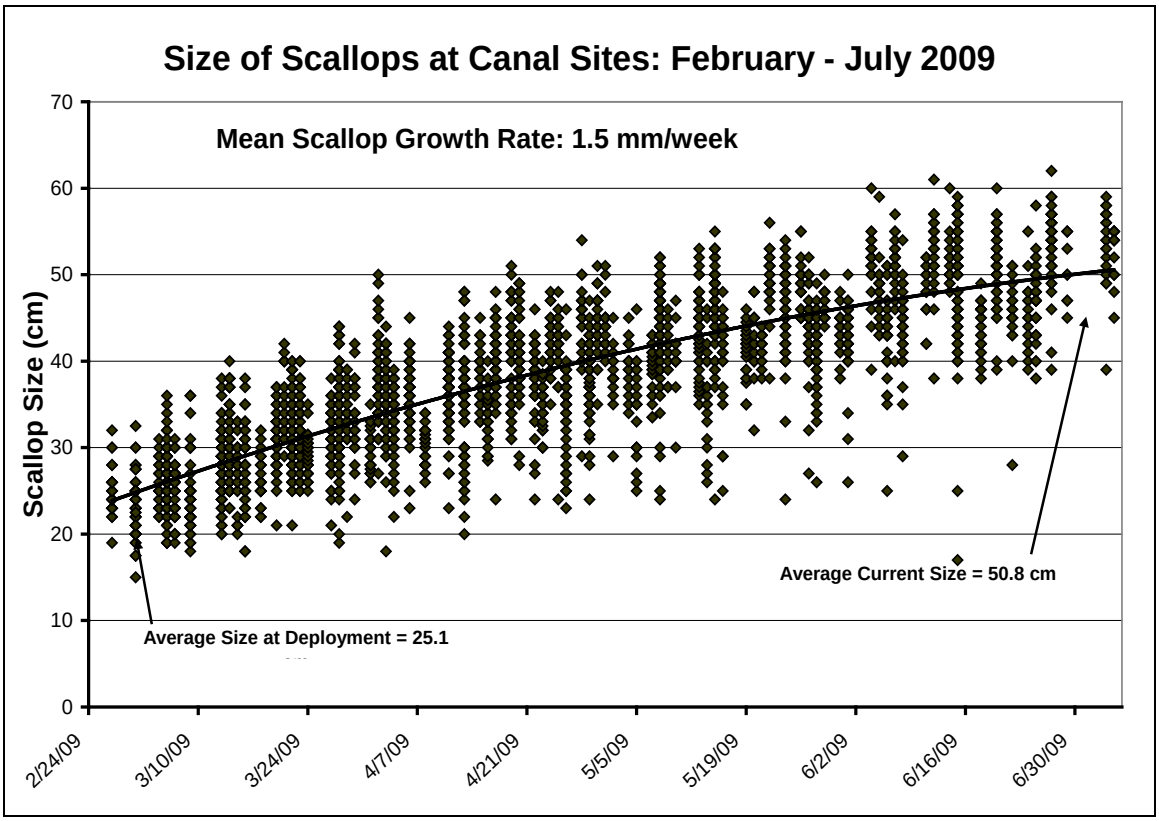

Figure 3.11.6 Figure produced by Sanibel-Captiva Conservation Foundation staff. Shell heights (mm) of caged bay scallops deployed in canal areas in Pine Island Sound in 2009.

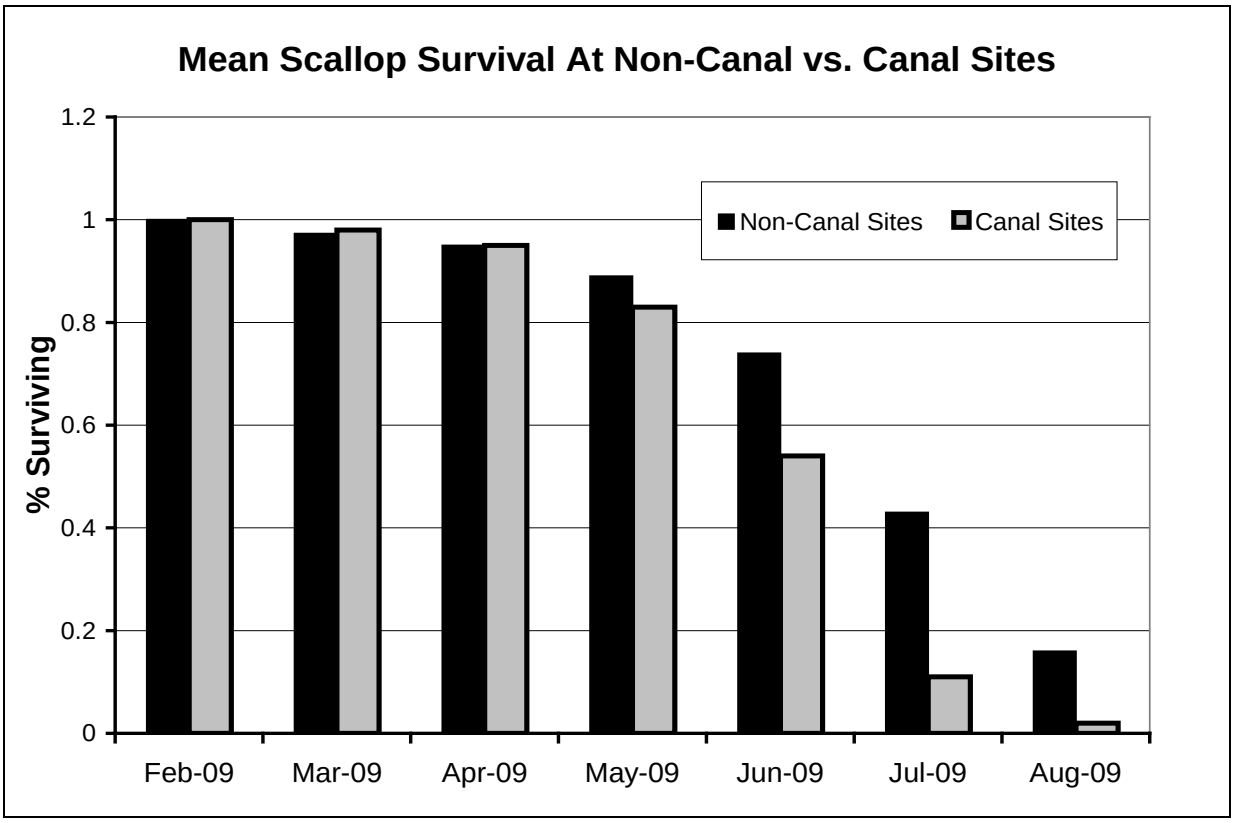

Figure 3.11.7 Figure produced by Sanibel-Captiva Conservation Foundation staff. Percent survival of caged bay scallops deployed in open water and canal areas in Pine Island Sound in 2009.

4.0 SUMMARY

4.1 Adult Abundance

The results of our spring adult abundance suggest that statewide the local bay scallop populations were relatively stable in 2009. Some of the local populations increased in abundance while others decreased, however, there were none categorized as "collapsed" (mean number of scallops < 5 / 600 m^{-2}), with the exception of south Pine Island Sound (Table 4.1.1). This mean was based off of only four stations, and if the data is added to counts for the northern end of the Sound, the overall mean for this site would be 11.9 scallops 600 m^{-2}, which is almost 100 times greater than in 2008. By consolidating the data for Pine Island Sound to one local population instead of two we can then say that out of the ten study sites surveyed in 2009 six were healthy (mean number scallops > 25 / 600 m^{-2}) and four were transitional (mean number scallops between 5 and 25 / 600 m^{-2}). Although the number of healthy populations dropped from seven to six over the course of one year, the two populations that were collapsed in 2008 (St. Andrew Bay and Pine Island Sound) both had substantial increases in abundance, which is a stronger stabilizing factor for the statewide condition of this species.

The distribution of scallops observed per station increased from 79% in 2008 to 85% in 2009. While the overall count was down from 2008 (13,745 to 9,508), this increase in spatial stabilization is a good sign. This percent coverage is the highest recorded since surveys initiated in 1994. Perhaps the key to rebuilding local populations is not just about quantity, but rather dispersion. Local populations are easily affected by water parameters, for example a tropical storm dumped massive amounts of rain on the big bend region of the state and we heard several reports of open shells in the St. Marks area shortly thereafter. These extreme fluctuations in the physical dynamics can rapidly alter the abundance of adult scallops within a local area, and if they are widespread enough, the entire bay scallop population. Something of this nature is most likely what happened in the summer of 1998 and 2004. Abundance counts were low for these two years (N = 1,390 and 709 scallops) as well as the spatial distribution

(scallops at 43.8% and 36.0% of the stations surveyed). Over the past few years the physical conditions have been relatively stable possibly translating to more healthy and stable local bay scallop populations.

The local population with the highest average abundance in 2009 was the Anclote study site (Sarasota Bay was the highest in 2008). For this site, the abundances over the last three years have been an order of magnitude greater than any of the previous 13 years. While exciting, the reason for this phenomenal increase in abundance is unclear. Anclote was an area of focus for bay scallop restoration, and activities were ongoing from summer of 1999 through fall of 2006. So it is possible that the increase in abundance in 2007 was due to these ongoing restoration efforts. There were red tide occurrences over the course of 2004 – 2006 that infiltrated the Anclote area waters, and may have altered the local scallop population or benthic community in some capacity. During the restoration years (2000 – 2006) the distribution of the scallop shell heights that were measured during the annual spring surveys shifted from a mode of 50 to 55 mm, and then returned to 50 mm during the 2007 – 2009 surveys. The percent of shell heights greater than 60 mm increased slightly during this restoration period, possibly indicating a second spawning cohort was occurring each year. Regardless of why it has occurred, this local boom in abundance may be crucial for continued enhancement of the statewide bay scallop population. With a strong, steady bay scallop population to the north (Steinhatchee), this more southern centralized population may be needed to help jumpstart other local populations to within its immediate vicinity, including Tampa Bay. Depending on the local currents, this Anclote population could send bay scallop larvae in either direction, as well as be a local sink for incoming recruits.

Table 4.1.1 Mean adult abundances per 600 m^2 in Pensacola Bay (PE), St. Andrew Bay (SA), Crooked Island Sound (CI), St. Marks (SM), Steinhatchee (ST), Cedar Key (CK), Crystal Bay (CB), Hernando (HE), Anclote (AN), Tampa Bay (TB), Sarasota Bay (SB), northern Pine Island Sound (PI-N), and southern Pine Island Sound (PI-S) observed during annual FWRI spring surveys. Dashes indicate years in which no surveys were performed at that site.

Year	PE	SA	CI	SM	ST	CK	CB	HE	AN	TB	SB	PI-N	PI-S
1994	-	83.2	7.7	-	153.3	-	6.9	-	14.7	-	-	0.0	-
1995	0.0	7.5	2.4	0.5	27.9	-	4.7	-	0.2	-	-	2.5	-
1996	-	28.8	4.0	-	250.2	-	3.2	-	3.4	-	-	0.8	-
1997	-	2.4	0.9	-	25.9	-	15.2	14.3	47.4	-	-	2.3	-
1998	-	2.9	0.7	-	27.4	0.8	3.1	0.6	20.4	-	-	2.4	-
1999	-	2.1	2.9	-	164.5	2.7	28.7	5.7	2.5	-	-	2.6	-
2000	-	1.8	0.1	-	218.3	0.3	242.9	42.2	22.2	-	-	2.8	-
2001	-	0.1	0.0	-	122.8	7.7	299.3	46.1	5.9	-	-	5.5	-
2002	0.2	10.8	2.3	-	138.7	2.3	51.8	7.3	37.2	-	-	0.7	-
2003	0.6	9.8	0.6	-	61.3	6.0	125.7	8.0	35.8	-	-	0.6	-
2004	0.0	0.7	2.7	-	18.8	0.0	5.7	3.3	2.9	-	-	1.1	0.1
2005	0.0	13.5	1.6	-	22.7	4.7	72.3	17.5	25.9	-	-	93.4	2.4
2006	-	0.2	0.9	-	11.2	3.8	21.9	7.3	11.9	-	-	8.2	1.3
2007	-	3.0	1.7	-	36.8	0.7	48.0	30.5	174.0	5.3	0.2	0.0	0.0
2008	-	2.1	-	170.0	140.0	-	86.2	79.8	137.9	37.0	249.9	0.1	0.3
2009	-	25.8	-	10.2	69.0	-	20.7	13.9	152.6	40.4	62.5	14.1	1.0

4.2 Recruitment

Statewide bay scallop recruitment was generally as expected during 2009. Recruits were observed on collectors in 72.1% of the months sampled, which is lower than 2008 (81.6%). For the Anclote area recruitment was recorded was during all sampling months in 2009, elevating the number of continuous retrieval events with bay scallops to 53. Recruitment has been ongoing at this site since December of 2005. The majority of bay scallops are recorded each winter, but our collectors detect a small level of recruitment in the warmer summer months, which is atypical of this species life history. As with the adult abundance phenomenon at this site, we have many theories as to why this may be happening, but no hard conclusions. We will continue to track this trend, and hopefully get enough data gathered to do a through stock assessment model for bay scallops.

4.3 Restoration

Having developed, refined, and assessed our previous restoration strategies for bay scallop populations we continued to rebuild collapsed populations and augment transitional populations. Using natural recruits that were captured on deployed collectors and wild-collected adults, we were able to release scallops in St. Andrew Bay, Tampa Bay, and Pine Island Sound, as well as deploy caged scallops in these areas plus the intercoastal waters of Sarasota County. This later effort depends largely on volunteers and collaborating scientific agencies. These techniques continue to be relatively inexpensive, labor efficient and user-friendly and allow us to focus our efforts on systems that continue to be of concern. In each area where we have attempted to increase natural populations through supplementation with spat, we have also seen gains in the adult populations, though in many cases, the gains have not been self-sustaining.

5.0 2010 PLANS

5.1. Adult Abundance Surveys

For the spring adult abundance surveys in 2010 we plan to modify our sampling stations slightly in the areas of St. Andrew Bay, Steinhatchee, Crystal Bay, the intercoastal waters of Sarasota and Charlotte Counties, and Pine Island Sound. As we continue to work to restore scallops in St. Andrew Bay our knowledge of the local waters increases, and more potential locations to study bay scallops are discovered. If water conditions are conducive to bay scallop health, then we hope to transfer one of our current stations to a grassy spot in East Bay. In the Steinhatchee and Crystal Bay areas, where the seagrass beds are vast, we plan to add up to 10 additional stations to help compliment our current abundance estimates. In Steinhatchee we will most likely expand our range in a north-south direction and in an east-west direction in Crystal Bay. These additional stations will hopefully incorporate more of the local recreational harvest areas, and provide us with a better estimation of the scallop abundances. We plan to add 10

stations in the Lemon Bay – Charlotte Harbor area to better fill in the gap between the northern reaches of Sarasota Bay and Pine Island Sound bay scallop populations. Based on our recruitment monitoring and the success of the local community-based bay scallop searches we have most likely been missing an important portion of these southern local populations. Finally, in Pine Island Sound, we plan to redistribute a portion of our 20 stations in the northern region and 4 stations in the southern region, expanding from the small, localized area near Pineland and Demere Key to western and southern portions of the estuary.

5.2 Restoration Activities

We hope to continue with our volunteer-driven restoration efforts in St. Andrew Bay, Sarasota County waters, and Pine Island Sound. This year the goal is to standardize the number of scallops within a cage statewide, as well as the procedure for measuring shell heights. If scallop stocks are available, we also hope to plant earlier in the summer to avoid temperature and salinity related mortalities. Scientists in the Pensacola Bay area have also expressed the desire to initiate a similar restoration effort in their local waters. If possible we hope to have scallops available for such an undertaking this summer, but we may be forced to wait until enough local recruits can be gathered. This would mean planting the supplemental recruit collectors in Pensacola Bay near locations of previous or current known bay scallops, and using the resultant catch in caged efforts in 2011. We will be working with Curt Hemmel of Bay Shellfish to monitor the success of a PCEF-funded bay scallop restoration grant for Tampa Bay.

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