ANNUAL REPORT
OF THE
BAY SCALLOP PROJECT

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INTRODUCTION

The Florida DEP Marine Research Institute bay scallop research program continues to focus on monitoring the abundance of adult scallops at various sites along the Florida west coast. Surveys are conducted during June just prior to the July 1 opening of the bay scallop recreational fishing season, and during fall just after the September 10 season closure. These surveys are designed to provide an estimate of the effectiveness of bay scallop harvesting regulations implemented prior to the beginning of the 1994 fishing season (Table 1). In particular, we wish to monitor the recovery of depleted scallop populations inhabiting the fishery closure zone south of the Suwanee River. A necessary component of that evaluation is a complementary assessment of relatively stable scallop populations at sites north of the Suwanee River closure zone. Together, those assessments provide a framework for quantifying natural fluctuations in scallop population abundance and for estimating a minimum viable population size necessary for the survival of local scallop populations.

We also continue to monitor recruitment at a subset of our adult monitoring sites to determine if the intensity of recruitment is a function of the abundance of adults at each site (or vice-versa). Recruitment monitoring is a necessary component of our efforts to estimate minimum viable population size. Results from previous years suggest that within-site patterns of recruitment and adult abundance are at least partially correlated

(Arnold et al., 1998a). The existence of this spawner-recruit relationship within local populations of bay scallops underlies our strategy for bay scallop restoration on the west coast of Florida.

ADULT POPULATION SURVEYS

Consistent with previous surveys (e.g., Arnold et al., 1998b), our 1998 adult scallop sampling protocol consisted of diver surveys of 20 randomly-located 300 m transects at each of seven study sites (Figure 1). One diver on each side of a transect line searched the area within 1 m of the line along its length. All scallops within that 2 m x 300 m area were counted and shell height (SH = maximum distance from umbo to ventral margin) determined for a maximum of 30 specimens. The total area surveyed at each transect station was 600 m^2, equivalent to 12,000 m^2 at all but the Cedar Keys study site (where we sampled only 6 stations). With the exception of Pine Island Sound, stations have been repetitively sampled from year to year. At Pine Island Sound, stations were relocated after our initial 1994 survey in response to suggestions from local fishermen that bay scallops in that area were historically restricted to a relatively small subarea of the Sound. We consider interannual samples within each site to be effectively independent, because the scallop life span is only one year so populations are essentially replaced each year.

Surveys of adult bay scallop abundance were conducted in Pine Island Sound, Anclote estuary, Hernando, Homosassa Bay, Steinhatchee, St. Joseph Bay, and St. Andrew Bay/Sound (Figure 1) during June, with follow-up surveys conducted in Anclote, Homosassa Bay, Steinhatchee, and St. Joseph Bay during September and October. Additionally, we conducted our first survey (June only) of adult scallops in the Cedar Keys region to provide a baseline for assessment of increases in adult abundance that may occur in response to our restoration efforts. Due to the limited extent of seagrass beds around Cedar Keys, we sampled only six stations at that site. A discussion of the results of the Cedar Keys survey awaits the development of a more substantial database of adult abundance and recruitment at that site.

Within each study site, the statistical significance of temporal changes in scallop density was determined using the Kruskal-Wallis procedure, a non-parametric equivalent of the one-way analysis of variance (Sokal & Rohlf, 1995). We used the Statistical Analysis System (SAS Institute Inc., 1985) procedure NONPAR1WAY, which provides a Chi-square approximation of the Kruskal-Wallis H statistic that is appropriate when sample size exceeds five per group (Sokal & Rohlf, 1995). This test allows us to evaluate the significance of the overall change in scallop density within each site among years. The Kruskal-Wallis test does not allow for a comparison among means when the overall difference is significant, and most multiple comparison tests are not suited for data such as ours where the median value may be

zero. We are attempting to customize a test statistic that is suitable for this purpose.

June Survey

Pine Island Sound: Relative to previous years, scallop abundance remained low but stable in Pine Island Sound during 1998. We found scallops at six of our 20 survey stations, but only two of those stations (17 and 18; Figure 2) yielded more than five scallops per 600 m^2 transect (Table 2; Figure 3). Scallop abundance remains low in Pine Island Sound and has not changed significantly over the last four years of our study ($\chi^2 = 2.6345$, $p = 0.4515$). We did not include 1994 survey results in our statistical analyses because of the aforementioned change in survey station location after the 1994 survey (we found no scallops in Pine Island Sound during 1994).

Anclote Estuary: Scallop abundance fluctuates substantially and significantly among years at the Anclote study site ($\chi^2 = 46.681$, $p = 0.0001$; Figure 4). During 1998, scallops were absent from most of our northern and central sampling stations but were relatively abundant at the southern sampling stations (Figure 5; Table 3). Mean scallop density at Anclote during 1998 was less than half that recorded during 1997, and whereas scallops were found at all sampling stations during 1997, we found scallops at only six of 20 stations during 1998. Despite the lower number of scallops recorded from Anclote during 1998 relative to 1997, this population appears to have recovered from the red-tide induced

collapse recorded during 1995 and which appears to have resonated through the 1996 year class.

Hernando: Scallop abundance decreased significantly between 1997 and 1998 (χ^2 = 13.406, p = 0.0003); we found scallops at only four stations in 1998 versus 15 stations in 1997 (Table 4). Stations three and four (Figure 6) provide a vivid example of the decrease in numbers between years. Density at those stations averaged 107 scallops per transect during 1997 but averaged only 4.5 scallops per transect during 1998.

Homosassa: Scallop density varies significantly among years at the Homosassa study site (χ^2 = 27.443, p = 0.0001). Our 1997 scallop survey provided some hope of recovery for the Homosassa scallop population. We found scallops at all but three stations (Table 5), and stations with more than ten scallops per 600 m^2 were relatively common (Figure 7). In contrast, during 1998 we found scallops at only seven of our 20 sampling stations, and most of those scallops were recovered from stations 7-11 located around St. Martin's Keys (Figure 8). Thus, the overall abundance of scallops decreased at Homosassa during 1998 relative to 1997, as did the dispersion of those scallops among stations. However, placed within the perspective of six years of scallop density monitoring at Homosassa, scallop abundance during 1998 is not exceptionally low and is reflective of natural variation to be expected in this annual species.

Steinhatchee: Scallop density varies significantly among years at the Steinhatchee study site (χ^2 = 28.330, p = 0.0001). Overall

scallop abundance remained stable among years at the Steinhatchee study site (Table 6), and density generally was similar within stations among those years. Scallops were widely dispersed throughout Steinhatchee waters but were concentrated at the northern and southern ends of the study site (Figure 9). Several station around the mouth of the Steinhatchee River yielded no scallops at all, but otherwise the frequency distribution of scallop abundance was similar between 1997 and 1998 (Figure 10).

St. Joseph Bay: Scallop density varies significantly among years at the St. Joseph Bay study site ($x^2 = 22.558$, $p = 0.0002$). Mean abundance of scallops in St. Joseph Bay during 1998 was less than half that observed during 1997 (Table 7). There was no discernible pattern (Figure 11) to the observed decrease, just fewer scallops at most stations. Additionally, the frequency distribution of scallop abundance was similar between 1997 and 1998 (Figure 12).

St. Andrew Bay and Sound: Scallop density varies significantly among years at the St. Andrew Bay/Sound study site ($x^2 = 35.204$, $p = 0.0001$). Scallop abundance remained low in St. Andrew Bay and Sound during 1998 (Table 8). Mean scallop abundance actually increased slightly in 1998 relative to 1997, but we encountered scallops at fewer stations in 1998 than in 1997 (Figure 13). Station 10 (Figure 14) contributed 72% of the scallops we collected from the St. Andrew Bay study site.

Fall Survey

Scallop abundance decreased by 90% at Anclote, by 75% at Homosassa, by 84% at Steinhatchee, and by 45% at St. Joseph Bay between the June 1998 and fall 1998 surveys (Tables 9-12). Such wide variations in abundance between June and fall surveys are typical of Florida scallop populations (Arnold et al., 1998b) and do not appear to be exclusively the result of recreational fishing pressure. Substantial decreases in abundance are just as likely to occur in unfished as fished populations, and are largely the result of natural mortality in response to reproductive development and spawning in this short-lived (12-18 months) animal (Arnold et al., 1997).

Summary

Scallop abundance recorded during 1998 from various sites along the Floridian Gulf of Mexico coast was low relative to most previous years for which we have conducted surveys. Scallops were less abundant at most sites during 1998 than they were during 1995, the previous low for our annual scallop density estimates. Only at Anclote did scallop density during 1998 exceed that recorded during 1995, but scallops at Anclote were almost obliterated by a red tide during 1995.

A blue-green algal bloom may have been at least partly responsible for decreased scallop abundance during 1998. We first observed this bloom during late spring and the bloom didn't subside until the end of the year. The most noticeable effect of this bloom was a decrease in visibility, from perhaps 5 m during

most years to less than 0.5 m within bloom waters during 1998. The direct or indirect effects of this algal bloom on bay scallops are unknown; our field observations suggest that adult scallops survived exposure to the bloom but that larval and juvenile scallops may have been more seriously affected.

Decreased scallop abundance and the algal bloom may have been separate symptoms of a larger effect. We experienced a relatively strong El Nino during 1998 and a very rainy year. Increased rainfall may have resulted in decreased coastal salinities, possibly to levels that are inimical to the survival of larval, juvenile, or adult scallops. Bay scallop viability decreases substantially below 20 parts per thousand salinity (ppt) and scallops cannot survive in waters of less than 10 ppt salinity (Tettelbach and Rhodes, 1981). High turbidity such as that associated with the observed blue-green algal bloom also is harmful to scallops (Leverone, 1993). Thus, low scallop abundance in the area between Anclote and Crystal River may have resulted from increased turbidity induced by the blue-green algal bloom, from decreased salinity induced by the high rainfall levels incurred during 1998, or from a combination of high turbidity and low salinity. We cannot evaluate these alternatives without better information on the physical environment of the nearshore zone along western Florida, and that information is largely unavailable.

Steinhatchee continues to exhibit inter-annual stability in scallop abundance. Scallop numbers were down in Steinhatchee in

1998 relative to previous years, but not substantially. The nearshore environment around Steinhatchee probably experienced decreased salinity relative to previous years because of the El Nino phenomenon, but we did not detect any evidence of the blue-green algal bloom that was so prevalent in the Anclote-Crystal River area. The relative contribution of these factors to scallop abundance in Steinhatchee is unknown. Scallop abundance data from 1998 and previous years suggest that maintaining a recreational fishery in this area, under the present management regime, is an effective regulatory scheme.

The Pine Island Sound, St. Joseph Bay, and St. Andrew Bay/Sound scallop populations all occur within partially or completely enclosed embayments. Such embayments tend to retain water-borne particles such as bay scallop larvae, but they also tend to be less susceptible to allochthonous larval inputs (Arnold et al., 1998a). Dense scallop populations within these bays may be self-supporting via larval entrainment, but if an embayed population is lost for any reason it may require decades for that population to become re-established.

The scallop population in Pine Island Sound was at one time so dense as to support a commercial fishery (Murdock, 1955), but that population collapsed sometime in the early 1960's and has not recovered. There appears to be plenty of suitable seagrass habitat in Pine Island Sound, suggesting that this population may be recruitment limited and could benefit from a restoration program.

The scallop population in St. Joseph Bay has been relatively stable during our 1994-1998 surveys. Although 1998 was a bad year for scallops in St. Joseph Bay, it was not substantially worse than 1994 or 1997. We found at least a few scallops at all but four of our 1998 survey stations, although at most stations we found fewer scallops in 1998 than we found in 1997. It appears that, in St. Joseph Bay as in other areas of Florida, water quality was less than ideal for bay scallop survival. We anticipate that both water quality and scallop abundance in St. Joseph Bay will rebound in 1999.

Scallop populations in the St. Andrew Bay/Sound complex may be habitat limited. Seagrass beds are restricted to the shallow periphery of St. Andrew Bay and in localized areas of St. Andrew Sound, thus limiting the growth potential of this population. Nevertheless, both 1997 and 1998 were poor years for scallops in the St. Andrew Bay/Sound complex relative to the three previous years.

RECRUITMENT

During 1996 and previous years, we conducted recruitment monitoring at Anclote, Homosassa, and Steinhatchee by sampling recruit collectors positioned along a variety of east-west transects at each study site (e.g., Arnold et al., 1998a). During 1997, we modified that protocol by sampling along a north-south transect running between Anclote and Crystal River (Arnold et al., 1998b). The objective of that 1997 effort was to

determine the latitudinal pattern of recruitment in the area between Anclote and Crystal River, and that goal was accomplished. In 1998, we established sampling blocks at each of our Anclote, Hernando, and Homosassa study sites, and we randomly allocated 12 recruit collectors within each block. Thus, we established a randomized block design with 12 replicates per block. That sampling regime is designed to provide a baseline against which we can assay the impact of our restoration efforts. We report those results herein (Figure 15), but the practical and statistical significance of our 1998 recruitment monitoring effort can only be evaluated in comparison with results from future samples. At present, it is sufficient to report that recruitment rates were roughly an order of magnitude greater at Anclote than at either Hernando or Homosassa. However, although adults at Anclote were concentrated at the southern end of the study area, it appears that recruitment events occurred throughout the Anclote study site (Figure 16), suggesting that post-settlement losses contributed to the observed distribution of scallops at Anclote during June, 1998. Potential causes of increased post-settlement mortality may include increased turbidity, decreased salinity, insufficient or inappropriate food availability caused by the blue-green algal bloom, or a combination of these factors.

The results of our recruitment monitoring suggest that most depauperate bay scallop populations in Florida are recruitment limited. We continue to record low levels of recruitment at

sites with low population abundance and relatively high levels of recruitment at areas with relatively dense scallop populations (e.g., Arnold et al., 1998a; 1998b; Figure 15). Only in the St. Andrew Bay/Sound complex do scallop populations appear habitat limited. To test the recruitment limitation theory, we are transplanting cultured scallops into several areas between Anclote and Crystal River. These concentrated scallops, several orders of magnitude more dense than the surrounding natural population, should greatly increase larval production and the availability of recruits. If these populations truly are recruitment limited, this strategy should allow us to overcome the recruitment bottleneck and re-establish viable scallop populations in the Anclote-Crystal River area. Progress in our restoration effort is briefly described below.

RESTORATION

We have initiated a federally-funded effort to restore bay scallops in the area between Crystal River and Tampa Bay. Our approach is to culture scallops in the laboratory and then plant them in protective cages at sites in Tampa Bay, Anclote, Homosassa Bay, and Crystal River. During 1998, we were unable to produce adequate juvenile scallops to stock the Anclote site, but scallops were stocked in 51 cages at each of our Tampa Bay, Homosassa Bay, and Crystal River study sites. During June and July, 1998, scallops were planted in the cages at a mean size of 20-25 mm SH. The growth, reproductive development, and mortality

of those scallops was then monitored for as long as the scallops survived (generally late fall of 1998 or early winter of 1999). As described above, we also monitored scallop recruitment in the areas where the cages were deployed. Finally, we are developing a genetic tag that will enable us to identify parental relationships between the scallops we plant and those we sample as juveniles and adults. We will continue to update the success of our restoration program in future annual reports.

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Figure 1. Map of Florida, showing sample sites and other locations referenced in the text.

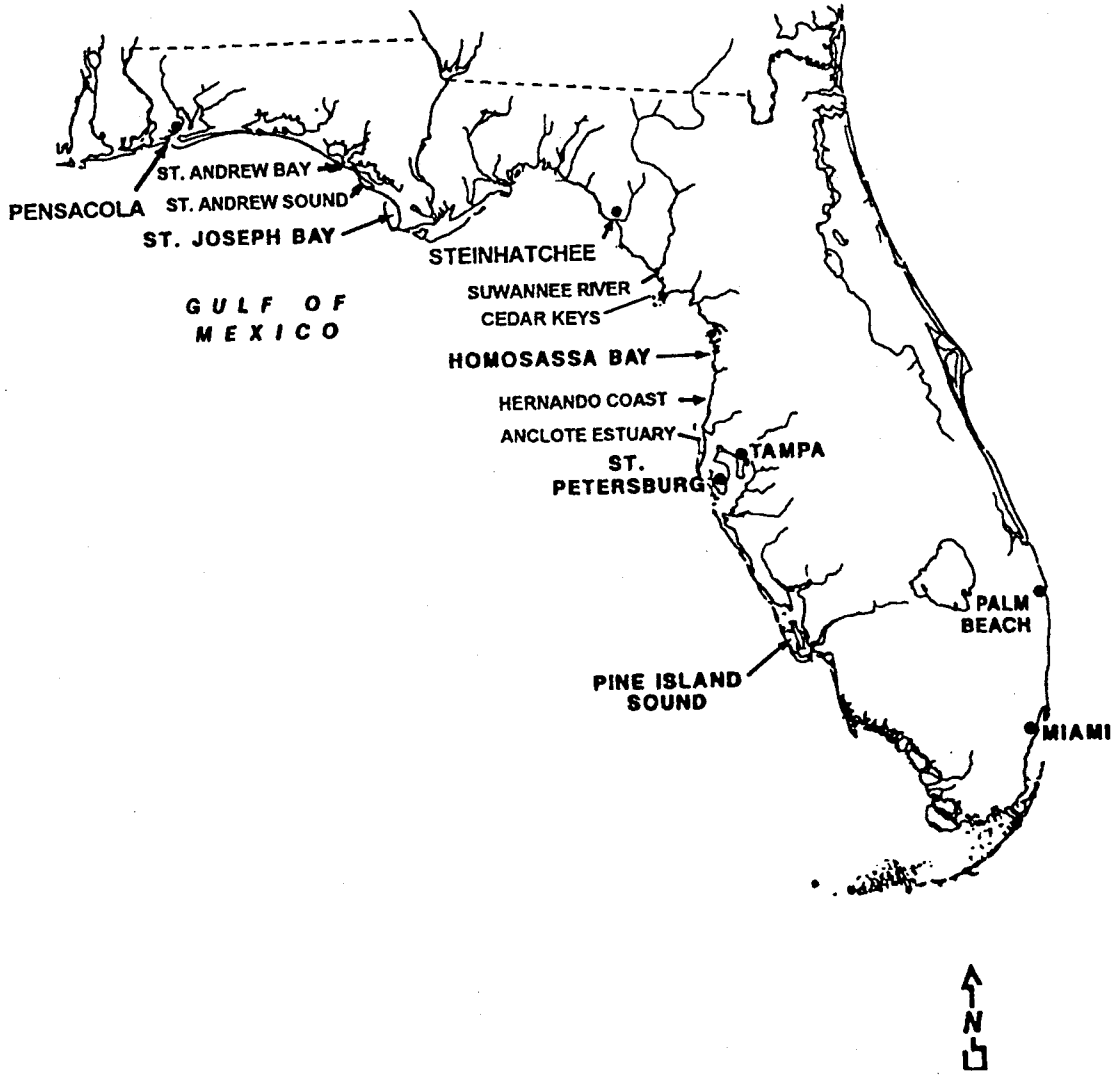
ST. ANDREW BAY
ST. ANDREW SOUND
PENSACOLA
ST. JOSEPH BAY
STEINHATCHEE
SUWANNEE RIVER
CEDAR KEYS
GULF OF MEXICO
HOMOSASSA BAY
HERNANDO COAST
ANCLOTE ESTUARY
TAMPA
ST. PETERSBURG
PALM BEACH
PINE ISLAND SOUND
MIAMI
N

Figure 2. Station locations for sampling adult abundance of bay scallops (*Argopecten irradians*) at the Pine Island Sound, Florida, study site.

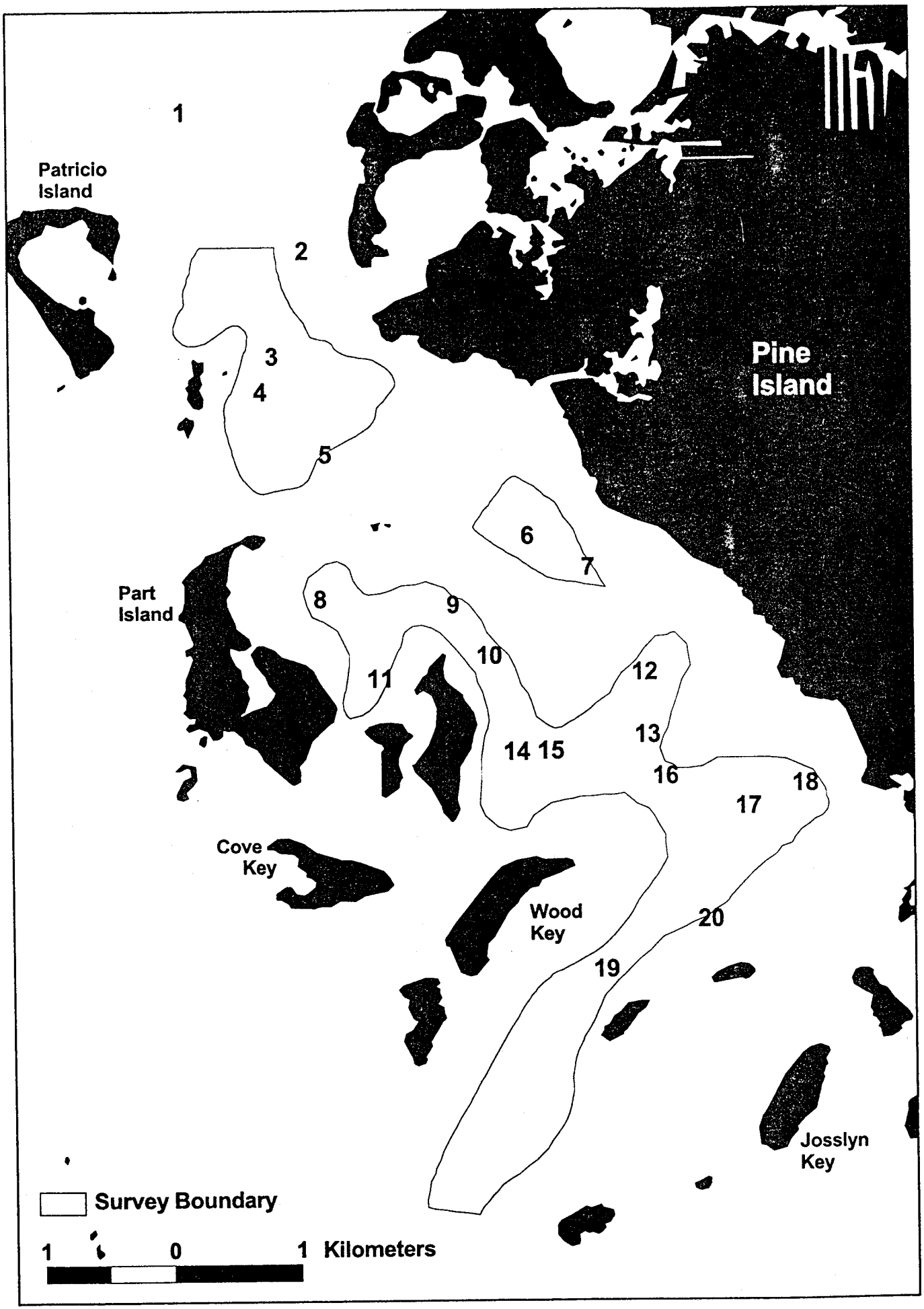
1
Patricio Island
2
3
4
5
Pine Island
6
7
Part Island
8
9
10
11
12
13
14 15
16
17
18
Cove Key
Wood Key
20
19
Josslyn Key
Survey Boundary
1 0 1 Kilometers

Figure 3. Frequency distribution for scallop abundance classes recorded from Pine Island Sound, Florida, during June of each year from 1994 through 1998.

Pine Island Sound

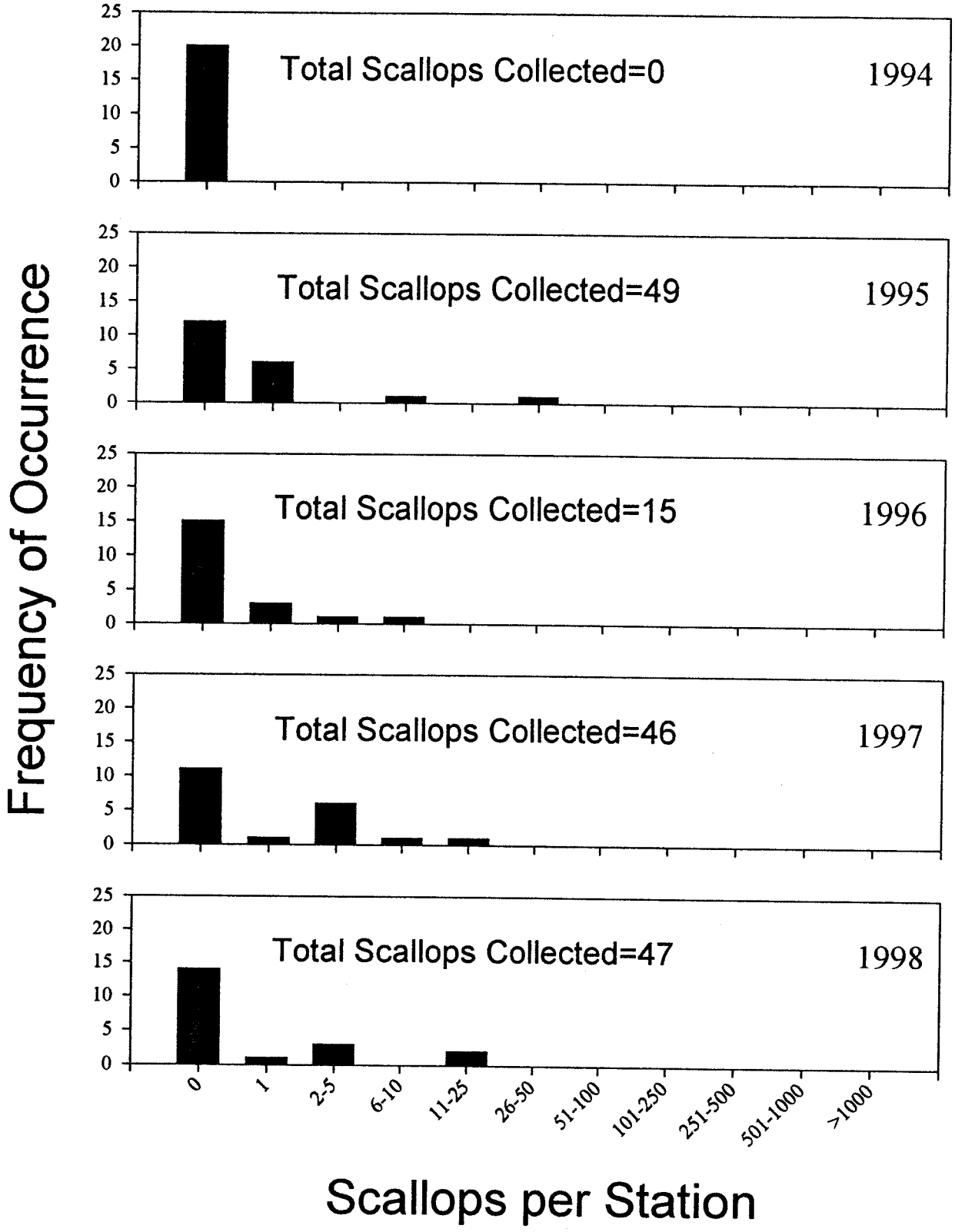

Figure 4. Frequency distribution for scallop abundance classes recorded from Anclote, Florida, during June of each year from 1994 through 1998.

Anclote

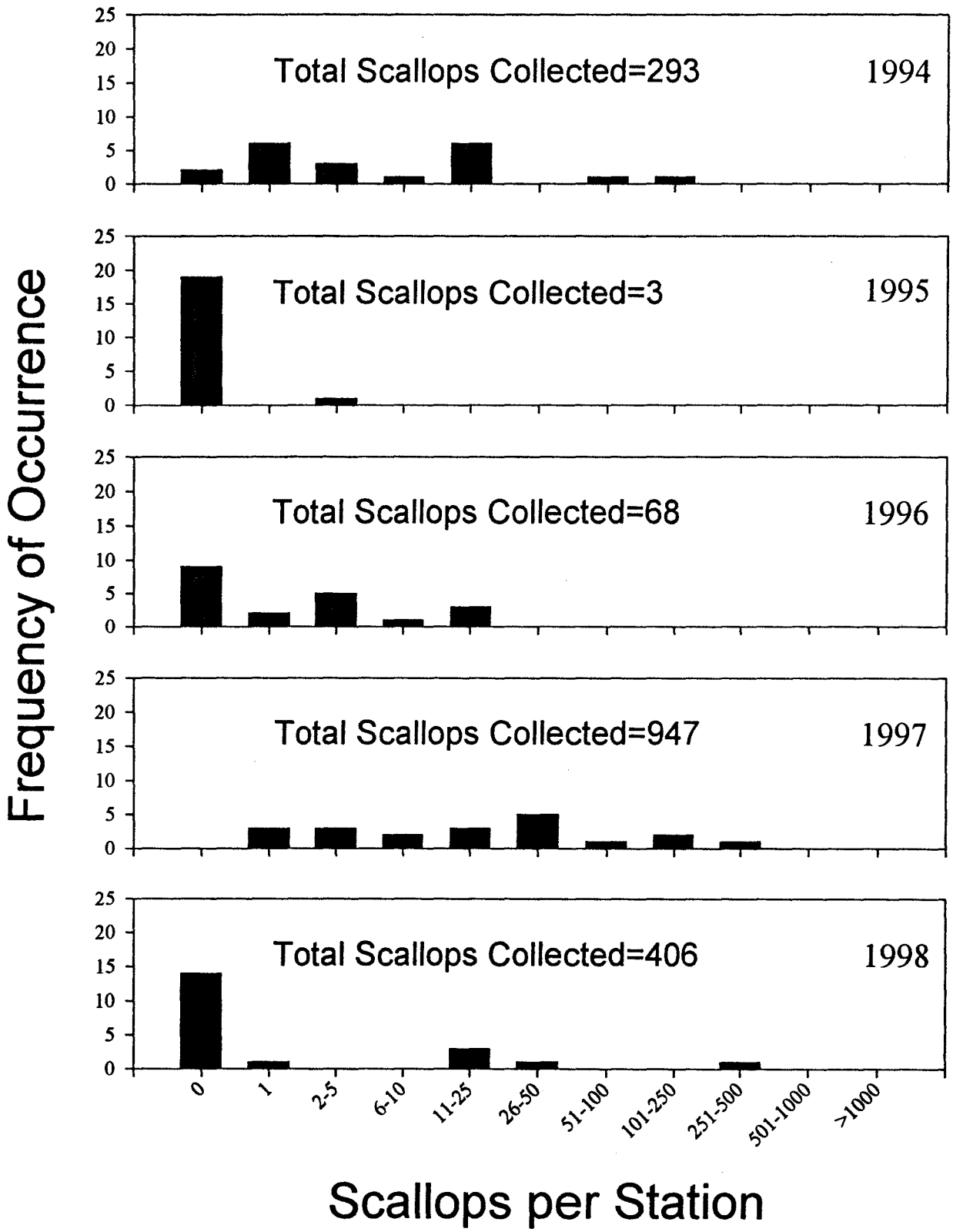
Frequency of Occurrence
Total Scallops Collected=293
1994
Total Scallops Collected=3
1995
Total Scallops Collected=68
1996
Total Scallops Collected=947
1997
Total Scallops Collected=406
1998
0
1
2-5
6-10
11-25
26-50
51-100
101-250
251-500
501-1000
>1000
Scallops per Station

Figure 5. Station locations for sampling juvenile recruitment and adult abundance of bay scallops (*Argopecten irradians*) at the Anclote Estuary, Florida, study site.

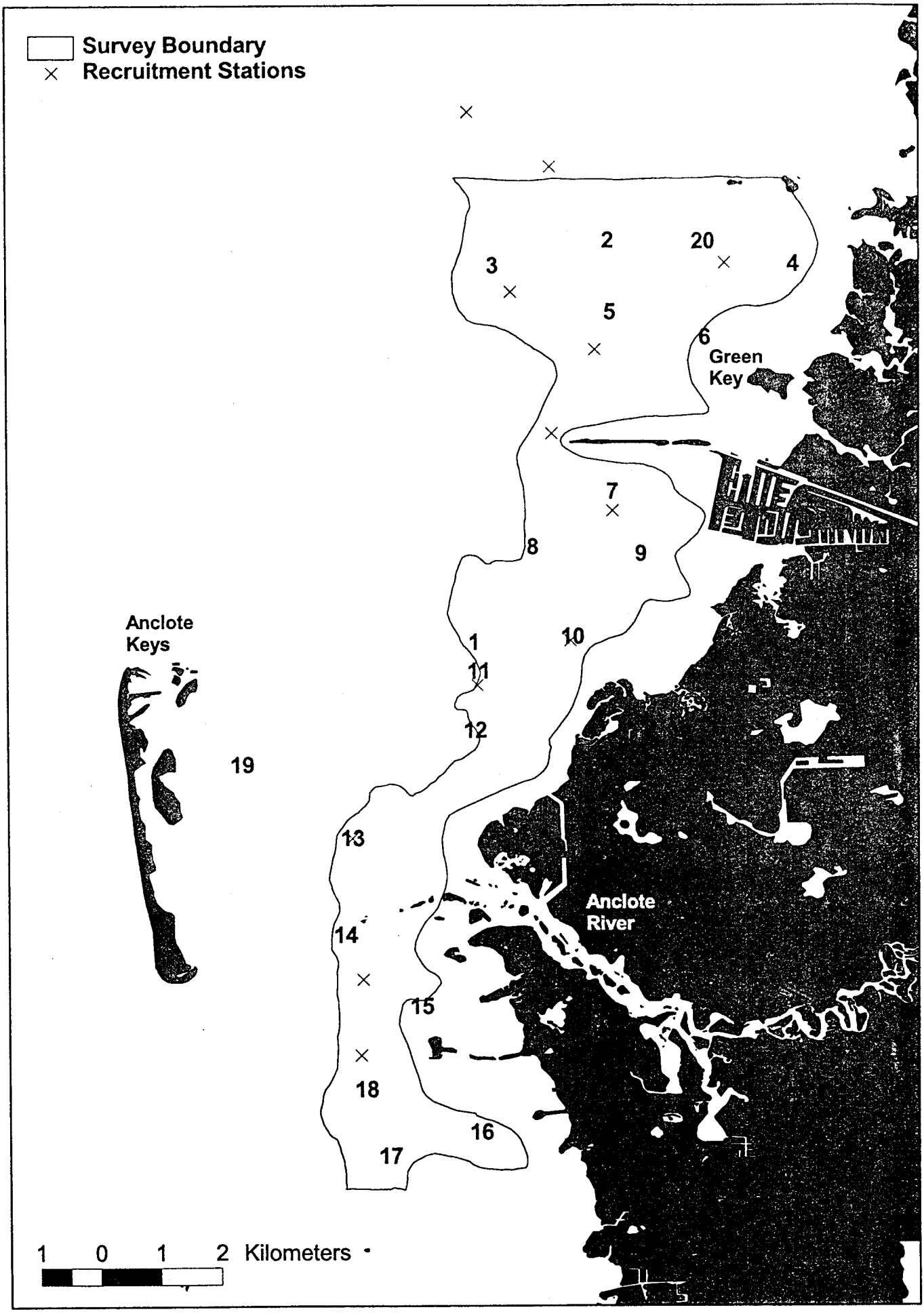
Survey Boundary
Recruitment Stations
2
20
3
4
5
6
Green
Key
7
8
9
Anclote
Keys
1
10
11
12
19
13
Anclote
River
14
15
18
16
17
1 0 1 2 Kilometers

Figure 6. Station locations for sampling juvenile recruitment and adult abundance of bay scallops (*Argopecten irradians*) at the Hernando, Florida, study site.

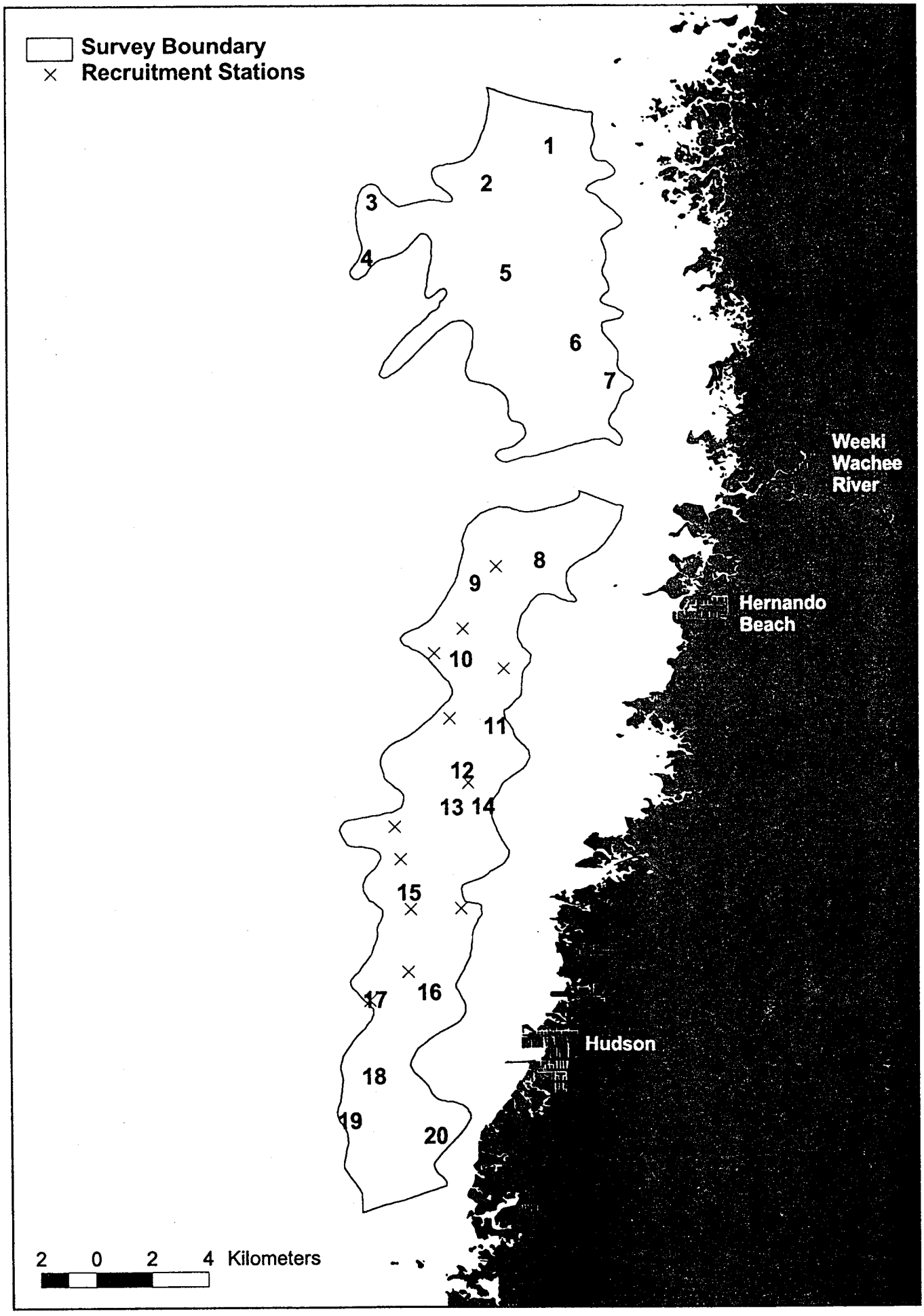
Survey Boundary
Recruitment Stations
1
2
3
4
5
6
7
8
9
10
11
12
13 14
15
16
17
18
19
20
Weeki Wachee River
Hernando Beach
Hudson
2 0 2 4 Kilometers

Figure 7. Frequency distribution for scallop abundance classes recorded from Homosassa Bay, Florida, during June of each year from 1993 through 1998.

Homosassa

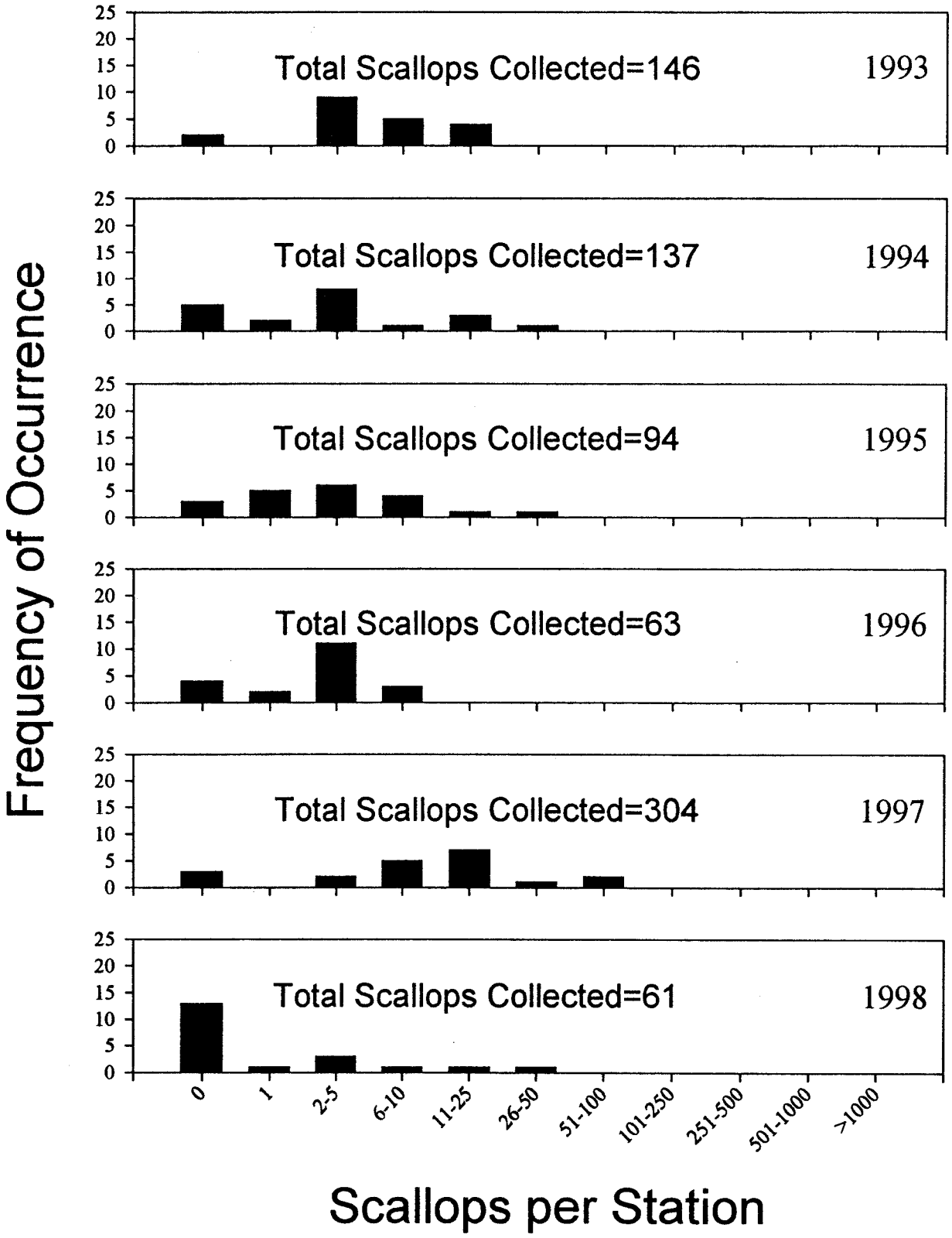
Frequency of Occurrence
Total Scallops Collected=146
1993
Total Scallops Collected=137
1994
Total Scallops Collected=94
1995
Total Scallops Collected=63
1996
Total Scallops Collected=304
1997
Total Scallops Collected=61
1998
0
1
2-5
6-10
11-25
26-50
51-100
101-250
251-500
501-1000
>1000
Scallops per Station

Figure 8. Station locations for sampling juvenile recruitment and adult abundance of bay scallops (*Argopecten irradians*) at the Homosassa Bay, Florida, study site.

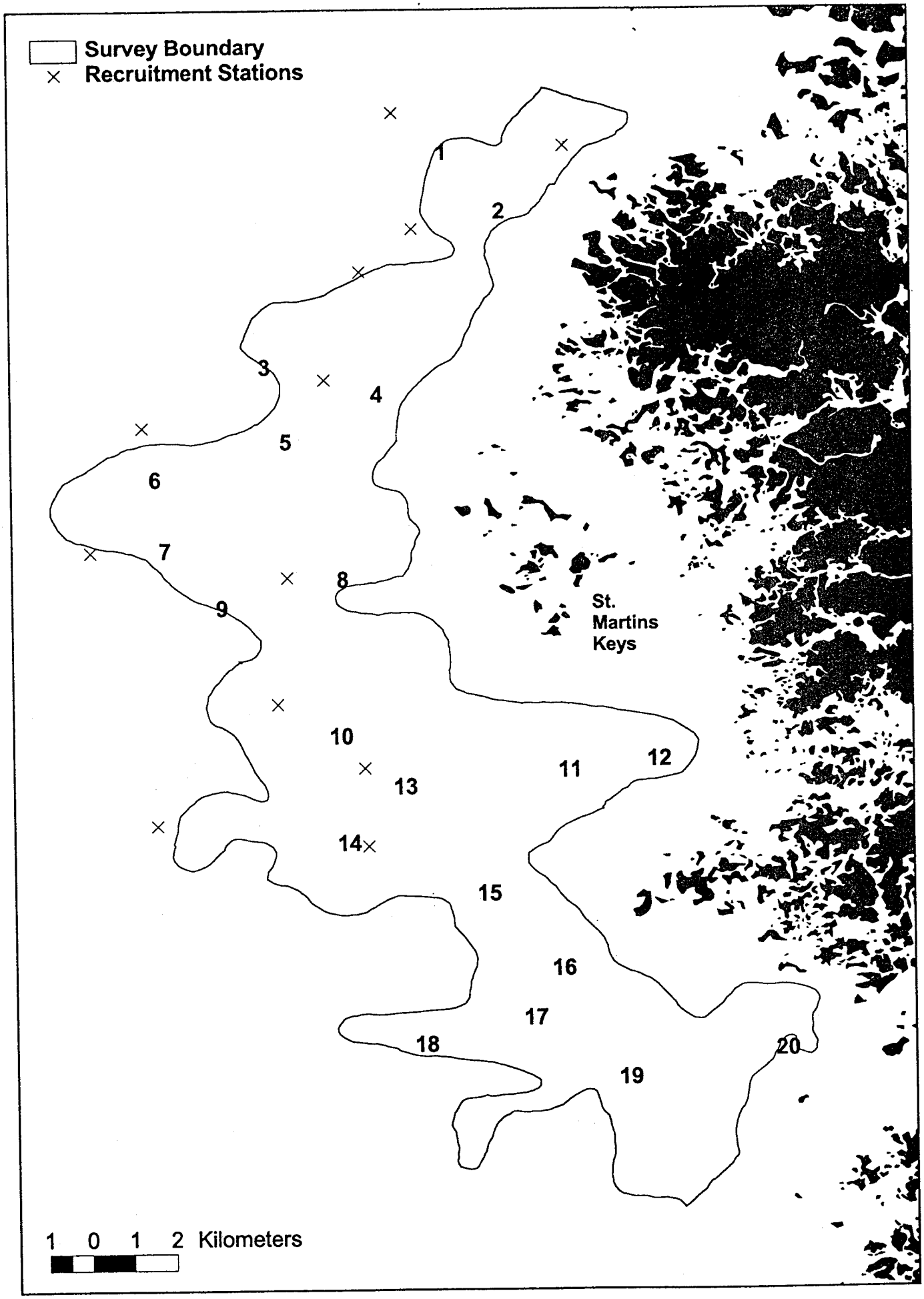
Survey Boundary
Recruitment Stations
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
St.
Martins
Keys
1 0 1 2 Kilometers

Figure 9. Station locations for sampling adult abundance of bay scallops (*Argopecten irradians*) at the Steinhatchee, Florida, study site.

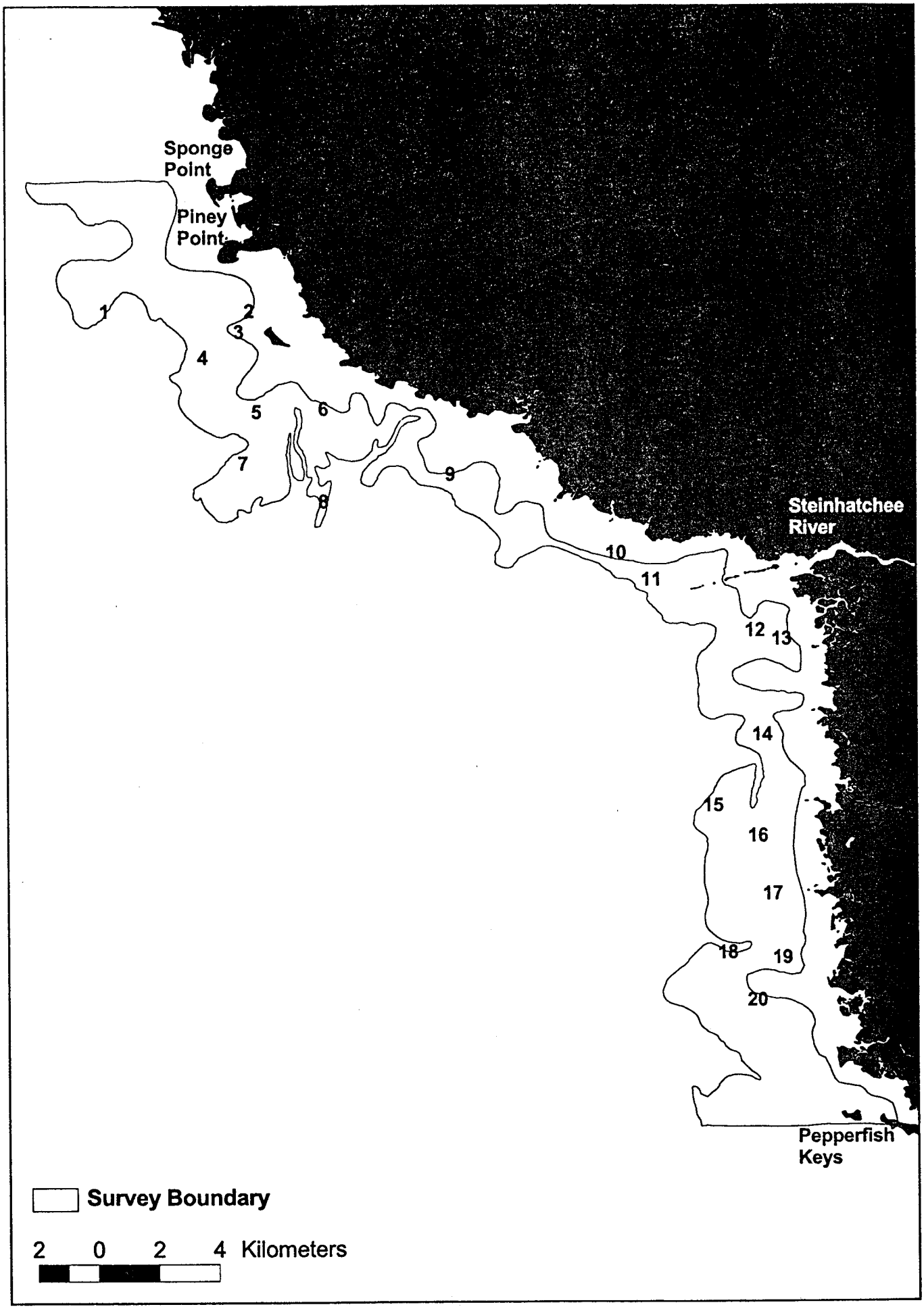
Sponge Point
Piney Point
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Steinhatchee River
Pepperfish Keys
Survey Boundary
2 0 2 4 Kilometers

Figure 10. Frequency distribution for scallop abundance classes recorded from Steinhatchee, Florida, sampled during June of each year from 1994 through 1998.

Steinhatchee

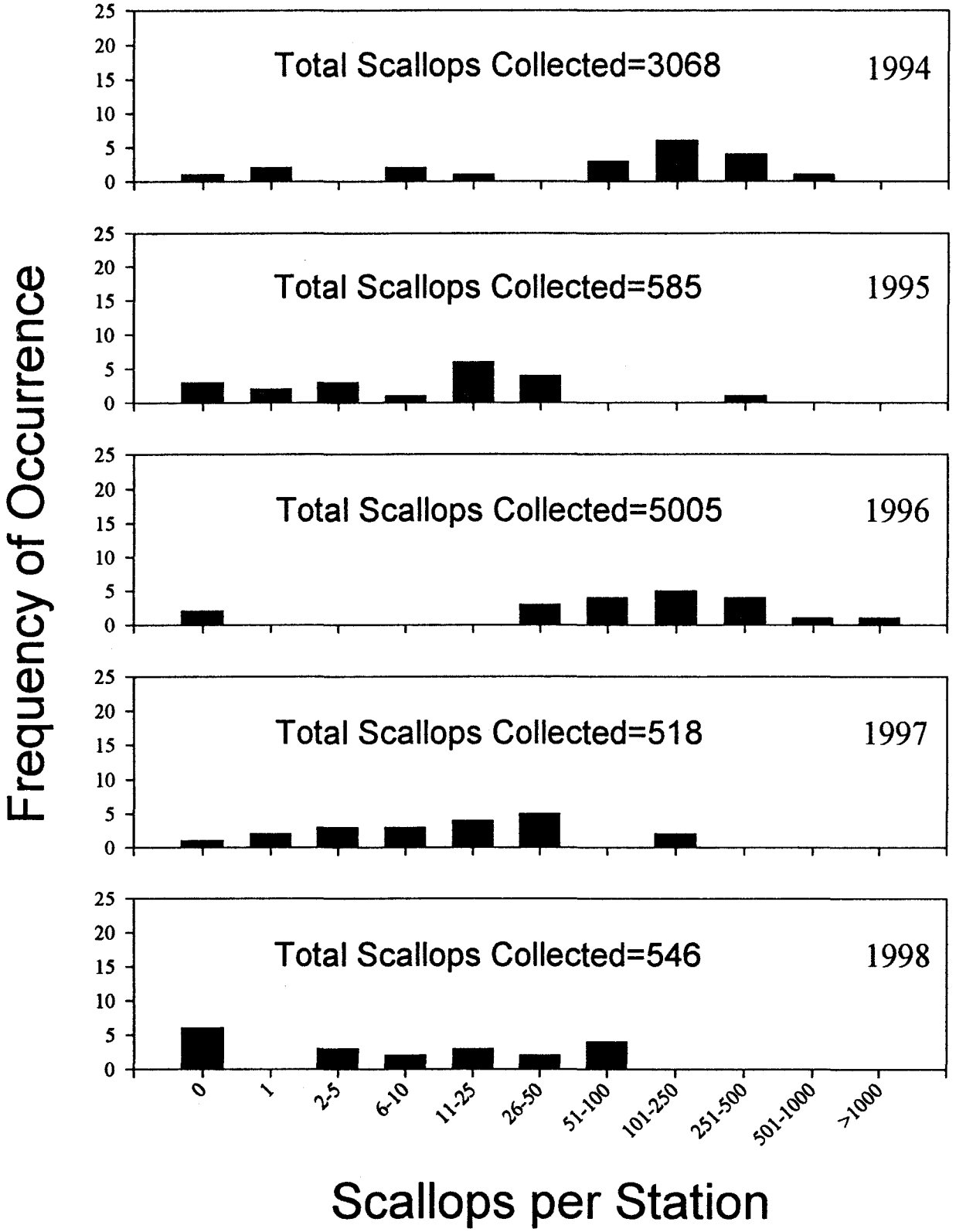

Figure 11. Station locations for sampling adult abundance of bay scallops (*Argopecten irradians*) at the St. Joseph Bay, Florida, study site.

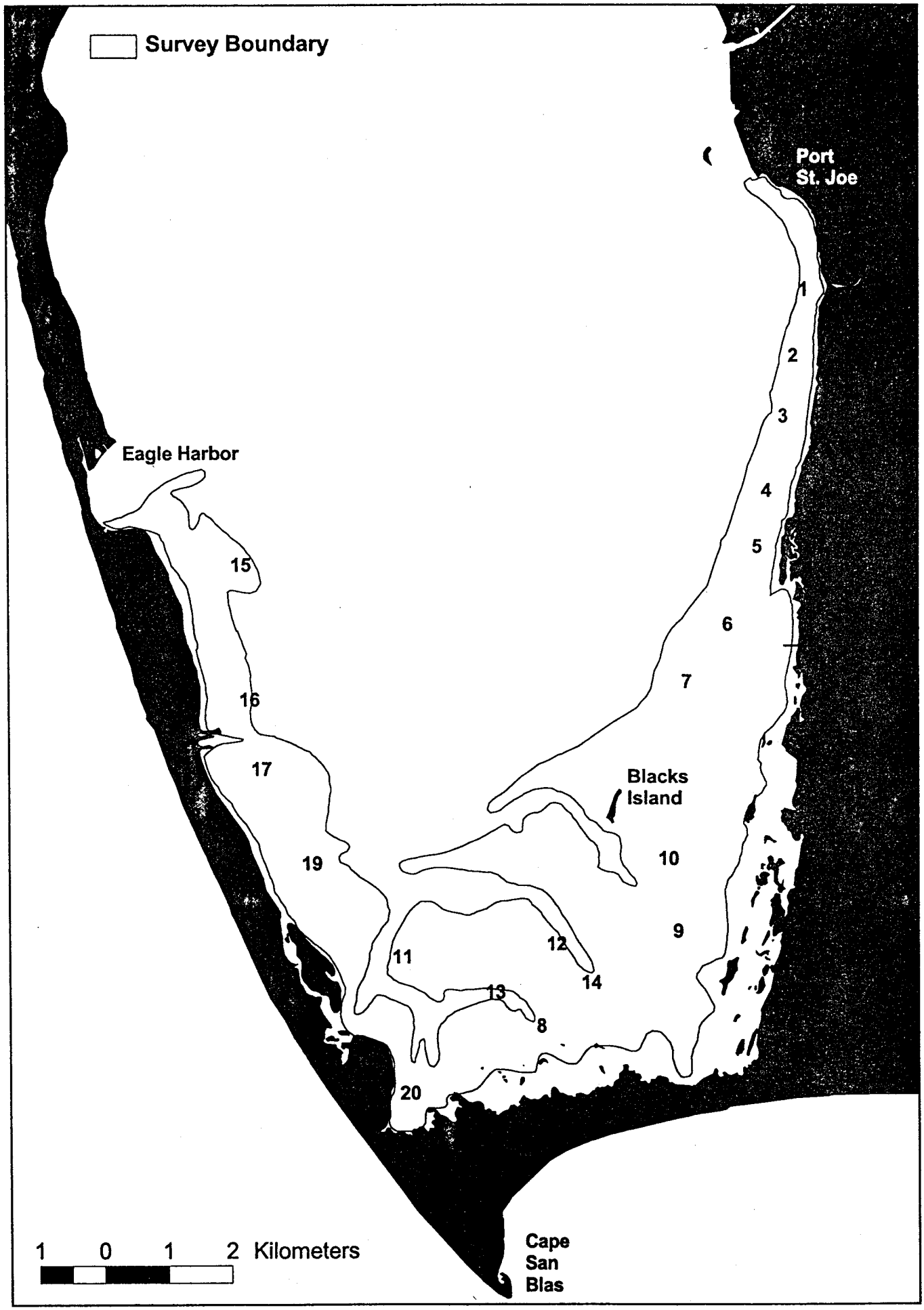
Survey Boundary
Port St. Joe
Eagle Harbor
Blacks Island
Cape San Blas
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
19
20
1 0 1 2 Kilometers

Figure 12. Frequency distribution for scallop abundance classes recorded from St. Joseph Bay, Florida, during June of each year from 1994 through 1998.

St. Joseph Bay

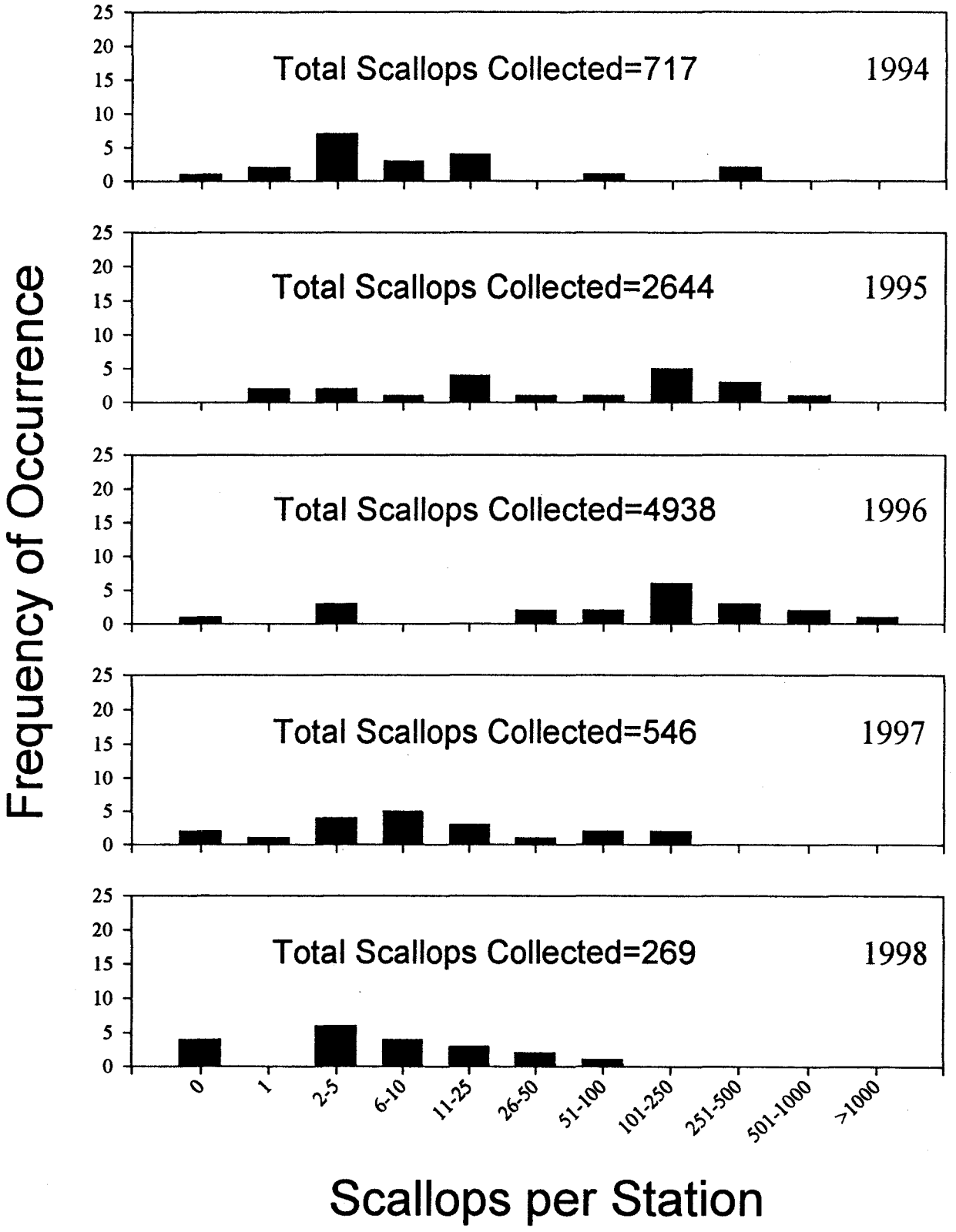

Figure 13. Station locations for sampling adult abundance of bay scallops (*Argopecten irradians*) at (A) the St. Andrew Bay and (B) the St. Andrew Sound, Florida, study sites.

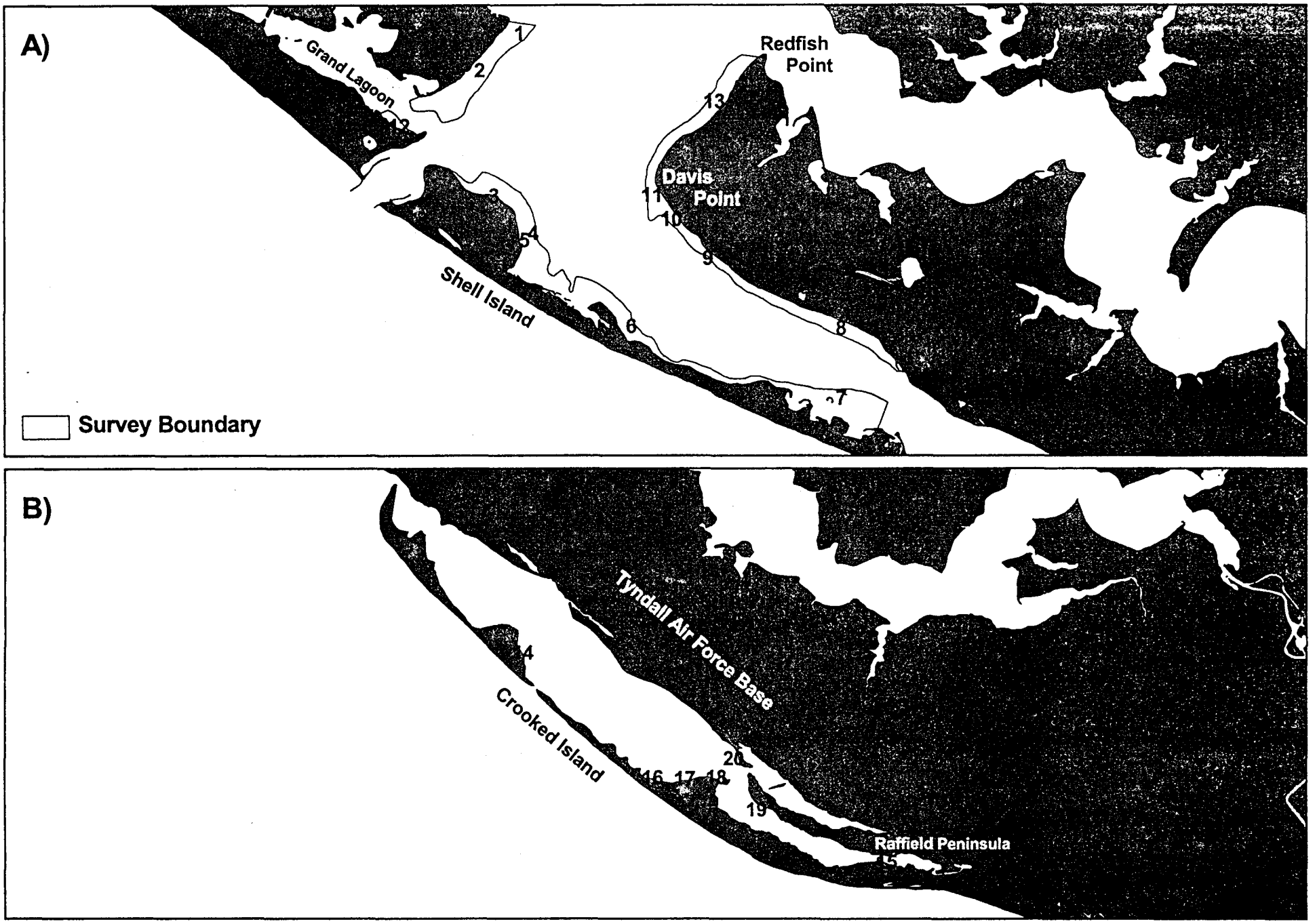
A)
Grand Lagoon
Redfish Point
Davis Point
Shell Island
1
2
3
4
5
6
7
8
9
10
11
13
Survey Boundary
B)
Tyndall Air Force Base
Crooked Island
Raffield Peninsula
16
17
18
19
20

Figure 14. Frequency distribution for scallop abundance classes recorded from St. Andrew Bay/Sound, Florida, during June of each year from 1994 through 1998.

St. Andrew Bay

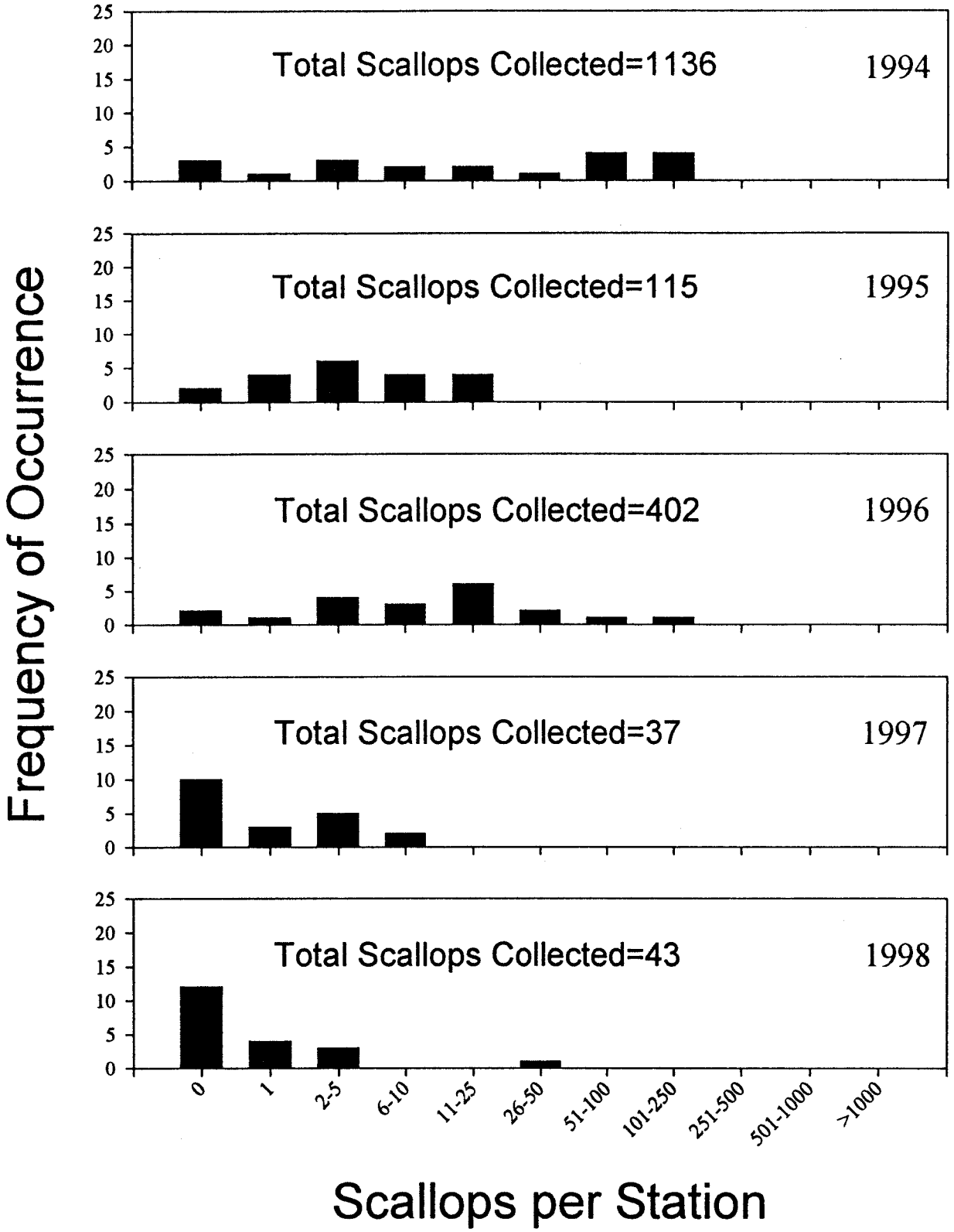

Figure 15. Recruitment of juvenile bay scallops (*Argopecten irradians*) to artificial recruit collectors at the Anclote, Hernando, and Homosassa study sites (see Figures 5, 6, and 8 for station locations). Numbers are the mean from 12 traps randomly located within each of the three study sites, and error bars represent one standard deviation. Collectors were deployed for six weeks per set, and consecutive sets overlapped each other by three weeks.

BAY SCALLOP RECRUITMENT
FLORIDA WEST COAST

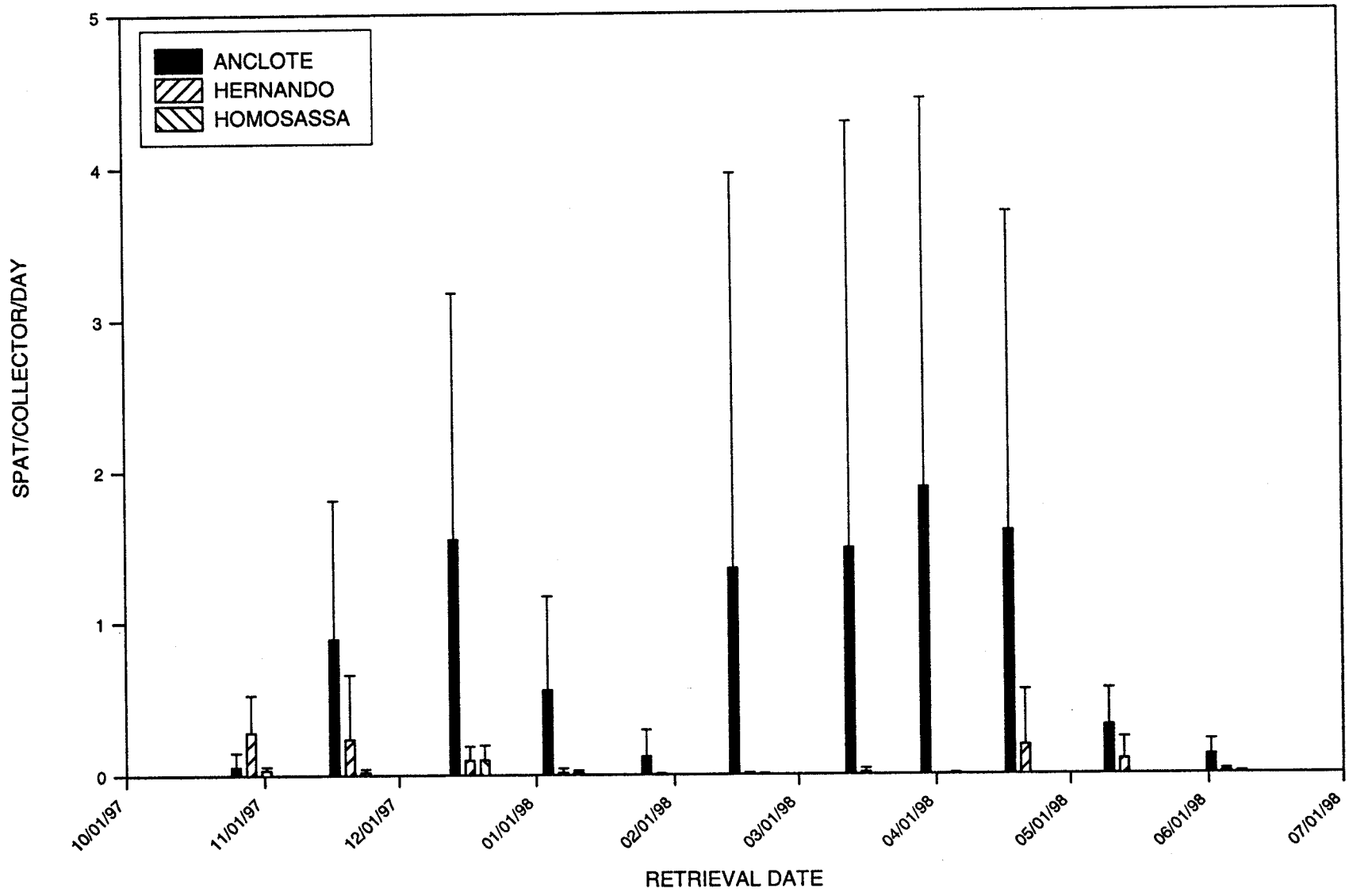

Figure 16. Recruitment of juvenile bay scallops (*Argopecten irradians*) to artificial recruit collectors randomly located within the Anclote study site (see Figure 5 for station locations). Within each retrieval date, bars run from left to right with the leftmost bars representing more northerly stations and the rightmost bars representing more southerly stations. Collectors were deployed for six weeks per set, and consecutive sets overlapped each other by three weeks.

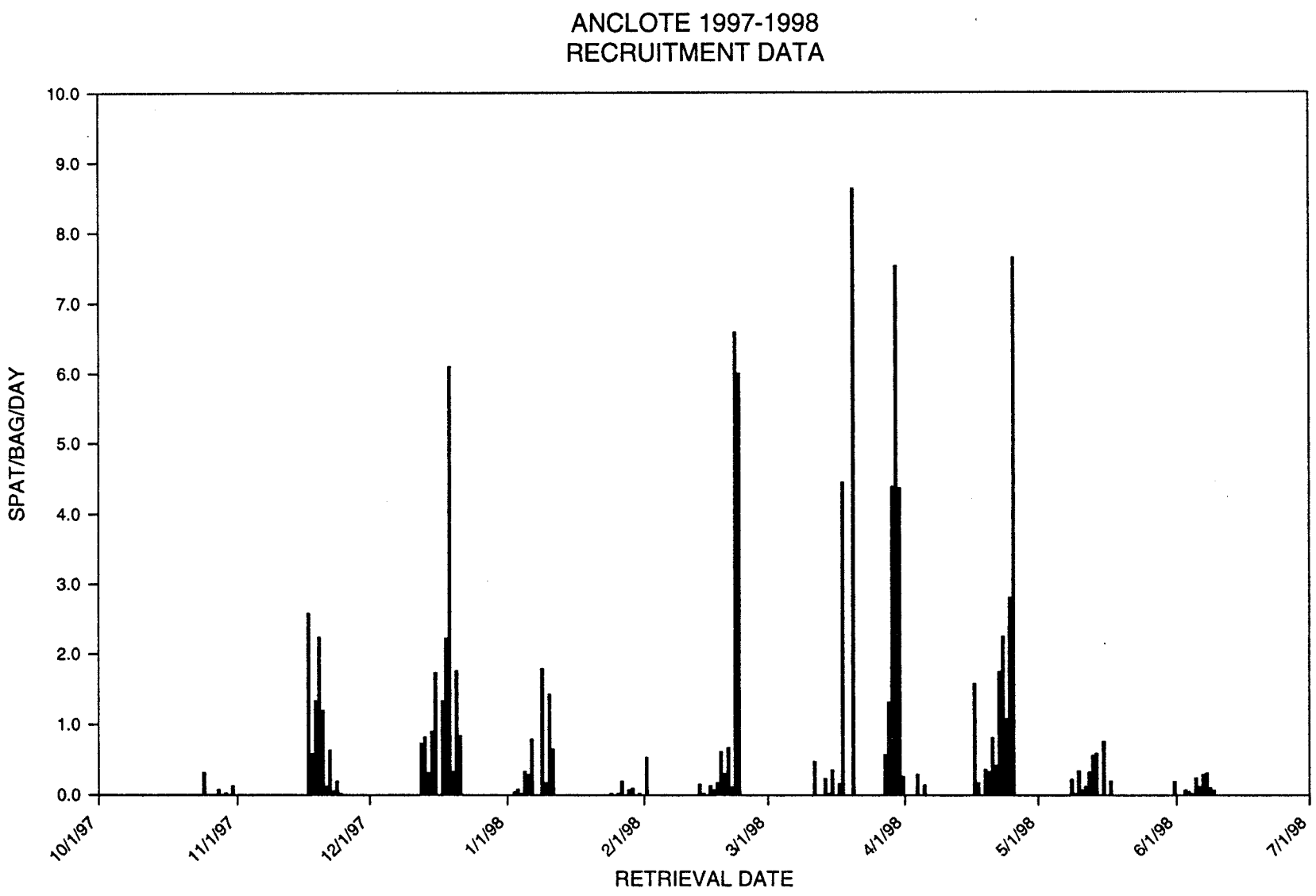
ANCLOTE 1997-1998
RECRUITMENT DATA
SPAT/BAG/DAY
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
10/1/97
11/1/97
12/1/97
1/1/98
2/1/98
3/1/98
4/1/98
5/1/98
6/1/98
7/1/98
RETRIEVAL DATE

Table 1. Bay scallop harvesting regulations in Florida.

Rule	1985-1993	1994	1995-1997	1998
Opening Date	July 1	July 1	July 1	July 1
Closing Date	March 31	September 30	August 31	September 10
Closed Areas	None	South of Suwanee River	South of Suwanee River	South of Suwanee River
Bag Limit In Shell: Shucked:	 5 gallons ½ gallon	 5 gallons ½ gallon	 2 gallons 1 pint	 2 gallons 1 pint
Boat Limit In Shell: Shucked:	 None None	 None None	 10 gallons ½ gallon	 10 gallons ½ gallon
Commercial Limit	4 40" drags	No commercial fishery	No commercial fishery	No commercial fishery
Special Acts	Repealed	None	None	None
Gear	Same as commercial	4 40" drags	None allowed	None allowed

Table 2. Adult bay scallop density at each of 20 stations sampled at the Pine Island Sound, Florida, study site during June surveys of 1994, 1995, 1996, 1997 and 1998.

JUNE BAY SCALLOP SURVEY
PINE ISLAND SOUND
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	1	0	0
7	0	0	1	1	0
8	0	0	0	0	2
9	0	0	0	0	0
10	0	1	0	3	1
11	0	1	0	0	0
12	0	34	1	5	5
13	0	9	0	4	0
14	0	0	0	15	0
15	0	1	0	5	0
16	0	1	0	2	0
17	0	0	9	9	22
18	0	0	3	0	14
19	0	1	0	2	0
20	0	1	0	0	3
MEAN	0.00	2.45	0.75	2.30	2.35
S.D.	0.00	7.69	2.07	3.87	5.66

Table 3. Adult bay scallop density at each of 20 stations sampled at the Anclote, Florida, study site during June of 1994, 1995, 1996, 1997 and 1998.

JUNE BAY SCALLOP SURVEY
ANCLOTE
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	1	0	4	43	0
2	72	0	3	49	0
3	15	0	2	307	0
4	0	0	0	1	0
5	106	0	0	20	0
6	3	0	0	4	0
7	21	0	0	1	0
8	14	0	12	136	0
9	2	3	0	4	0
10	1	0	1	30	0
11	1	0	2	27	0
12	14	0	0	1	0
13	12	0	0	8	0
14	0	0	11	14	1
15	1	0	1	141	17
16	5	0	23	87	46
17	9	0	6	20	313
18	1	0	3	42	17
19	1	0	0	8	12
20	14	0	0	4	0
MEAN	14.65	0.15	3.40	47.35	20.30
S.D.	26.80	0.67	5.82	74.05	69.80

Table 4. Adult bay scallop density at each of 20 stations sampled at the Hernando, Florida, study site during June of 1997 and 1998.

JUNE BAY SCALLOP SURVEY
HERNANDO
1997-1998
#/600M^2

STATION	1997	1998
1	3	0
2	11	0
3	134	3
4	80	6
5	9	0
6	1	0
7	0	0
8	0	0
9	1	0
10	3	0
11	0	0
12	0	0
13	10	0
14	1	0
15	10	1
16	2	1
17	8	0
18	6	0
19	6	0
20	0	0
MEAN	14.25	0.55
S.D.	33.13	1.47

Table 5. Adult bay scallop density at each of 20 stations sampled at the Homosassa Bay, Florida, study site during June of 1993, 1994, 1995, 1996, 1997, and 1998.

JUNE BAY SCALLOP SURVEY
HOMOSASSA
1994-1998
#/600M^2

STATION	1993	1994	1995	1996	1997	1998
1	4	3	0	0	9	0
2	13	38	9	2	17	0
3	4	5	9	5	18	2
4	9	1	4	0	19	0
5	5	0	14	5	15	0
6	4	0	1	9	7	0
7	4	1	2	5	5	34
8	8	5	27	4	27	3
9	3	3	7	4	13	13
10	3	19	3	2	58	6
11	10	0	1	0	5	1
12	0	0	1	3	0	0
13	8	23	6	2	12	0
14	4	15	0	9	23	2
15	24	4	1	2	7	0
16	13	3	3	1	6	0
17	20	3	1	6	0	0
18	8	9	3	3	55	0
19	2	5	2	1	8	0.
20	0	0	0	0	0	0
MEAN	7.30 ✓	6.85 ✓	4.70 ✓	3.15 ✓	15.20 ✓	3.05 ✓
S.D.	6.28 ✓	9.82 ✓	6.43 ✓	2.74 ✓	16.01 ✓	7.92 ✓
TOTAL	146	137	94	63	304	61

Table 6. Adult bay scallop density at each of 20 stations sampled at the Steinhatchee, Florida, study site during June of 1994, 1995, 1996, 1997, and 1998.

JUNE BAY SCALLOP SURVEY
STEINHATCHEE
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	189	13	528	1	9
2	284	48	36	5	100
3	89	16	128	103	90
4	338	14	269	13	18
5	650	14	1879	25	16
6	234	22	210	37	0
7	81	4	73	3	4
8	0	1	0	3	0
9	169	44	498	23	39
10	10	0	76	1	3
11	1	0	0	0	0
12	281	0	415	30	0
13	10	8	41	6	0
14	259	4	119	7	7
15	120	1	65	6	0
16	1	30	71	30	20
17	13	23	118	42	35
18	133	3	44	14	3
19	121	313	284	135	111
20	85	27	151	34	91
MEAN	153.40	29.25	250.25	25.90	27.30
S.D.	159.05	68.31	414.65	34.95	38.17

Table 7. Adult bay scallop density at each of 20 stations sampled at the St. Joseph Bay, Florida, study site during June of 1994, 1995, 1996, 1997, and 1998.

JUNE BAY SCALLOP SURVEY
ST. JOE BAY
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	16	1	4	2	0
2	2	1	64	10	0
3	12	6	2	3	0
4	1	2	0	0	12
5	8	67	2	2	0
6	15	205	114	19	3
7	5	114	55	7	4
8	265	348	156	93	90
9	61	118	43	11	7
10	7	711	363	111	18
11	0	5	759	10	25
12	5	233	1136	40	26
13	3	195	354	62	45
14	19	270	850	10	2
15	5	11	44	1	9
16	9	14	228	14	10
17	2	44	282	2	7
18	1	25	230	0	4
19	2	17	179	7	5
20	279	257	103	142	2
MEAN	35.85	132.20	246.90	27.30	13.45
S.D.	81.87	175.47	312.22	41.53	21.31

Table 8. Adult bay scallop density at each of 20 stations sampled at the St. Andrew Bay/Sound, Florida, study site during June of 1994, 1995, 1996, 1997, and 1998.

JUNE BAY SCALLOP SURVEY
ST. ANDREW BAY
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	1	4	12	1	1
2	5	13	6	5	0
3	70	16	155	9	0
4	244	8	23	0	0
5	50	1	20	2	2
6	96	20	13	0	0
7	144	6	2	0	2
8	173	13	11	0	31
9	149	8	39	1	0
10	68	0	26	1	0
11	69	5	5	0	1
12	6	2	6	4	0
13	6	2	56	8	1
14	24	2	2	0	0
15	0	9	7	0	0
16	0	1	0	0	0
17	2	0	0	0	0
18	5	3	1	0	1
19	24	1	13	3	0
20	0	1	5	3	4
MEAN	56.80	5.75	20.10	1.85	2.15
S.D.	70.77	5.82	34.78	2.74	6.87

Table 9. Adult bay scallop density at each of 20 stations sampled at the Anclote, Florida, study site during fall of 1994, 1997, and 1998.

FALL BAY SCALLOP SURVEY
ANCLOTE
1994-1998
#/600M^2

STATION	1994	1997	1998
1	3	33	0
2	36	4	0
3	22	292	0
4	0	1	0
5	44	22	0
6	0	3	0
7	13	29	0
8	0	88	0
9	0	0	0
10	2	42	0
11	2	41	0
12	0	4	0
13	0	7	2
14	1	9	1
15	9	182	1
16	0	607	23
17	3	47	12
18	5	40	2
19	0	0	0
20	3	5	0
MEAN	7.15	72.8	2.05
S.D.	12.58	144.81	5.61

Table 10. Adult bay scallop density at each of 20 stations sampled at the Homosassa Bay, Florida, study site during fall of 1995, 1996, 1997, and 1998.

FALL BAY SCALLOP SURVEY
HOMOSASSA
1995-1998
#600/M^2

STATION	1995	1996	1997	1998
1	0	0	0	0
2	0	0	9	0
3	0	6	8	3
4	0	0	50	0
5	0	1	38	0
6	2	1	9	5
7	0	0	4	8
8	0	1	28	1
9	1	0	13	4
10	4	1	35	0
11	1	0	2	0
12	1	3	1	0
13	1	0	9	0
14	1	1	29	0
15	3	1	1	0
16	0	1	21	0
17	0	4	4	0
18	0	7	43	0
19	0	0	11	0
20	0	0	1	0
MEAN	~~0.50~~ 0.70	1.35	15.80 ✓	1.05 ✓
S.D.	~~1.15~~ 1.13	2.06	15.77 ✓	2.21 ✓
TOTAL	14	27	316	21

Table 11. Adult bay scallop density at each of 20 stations sampled at the Steinhatchee, Florida, study site during fall of 1994, 1995, 1996, 1997, and 1998.

FALL BAY SCALLOP SURVEY
STEINHATCHEE
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	1	6	439	4	6
2	48	105	60	87	7
3	100	25	65	79	13
4	61	18	139	5	18
5	45	25	767	5	9
6	25	12	48	27	7
7	61	3	183	9	0
8	0	0	0	6	0
9	0	11	3	130	0
10	0	6	29	0	0
11	0	0	0	1	0
12	1	30	62	1	0
13	0	7	31	6	0
14	0	25	39	0	2
15	0	1	46	17	0
16	0	58	69	136	1
17	0	47	33	148	3
18	26	0	35	70	5
19	18	112	176	163	10
20	77	5	197	42	10
MEAN	23.15	24.80	121.05	46.80	4.50
S.D.	31.29	32.74	183.11	57.02	5.29

Table 12. Adult bay scallop density at each of 20 stations sampled at the St. Joseph Bay, Florida, study site during fall of 1994, 1995, 1996, 1997, and 1998.

FALL BAY SCALLOP SURVEY
ST. JOE BAY
1994-1998
#/600M^2

STATION	1994	1995	1996	1997	1998
1	0	1	0	0	0
2	0	0	1	0	0
3	0	1	94	24	0
4	0	0	86	0	1
5	0	1	30	0	7
6	0	0	51	32	6
7	1	1	8	18	1
8	7	150	11	70	25
9	5	2	1	25	0
10	11	21	28	35	0
11	0	3	190	2	26
12	0	37	1534	59	16
13	0	55	1324	61	42
14	1	37	439	44	13
15	0	0	0	5	0
16	0	0	12	6	3
17	1	16	137	4	3
18	0	4	238	4	2
19	0	31	187	4	1
20	0	10	171	0	3
MEAN	1.30	18.50	227.10	19.65	7.45
S.D.	2.94	34.95	426.98	23.17	11.47