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Jaime M. Greenawalt
Sanibel-Captiva Conservation Foundation

Thomas K. Frazer
University of Florida

Stephanie R. Keller
University of Florida

Charles A. Jacoby
University of Florida

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Abundance and Sizes of Bay Scallops in Heterogeneous Habitats Along the Gulf Coast of Florida

JAIME M. GREENAWALT, THOMAS K. FRAZER, STEPHANIE R. KELLER, AND CHARLES A. JACOBY

Southern bay scallops (*Argopecten irradians concentricus*) form the basis of a recreational fishery along Florida's Gulf Coast. Recent declines in scallop abundances have led to significant harvest restrictions. As a way to gain insight into influences on scallop abundances and size, surveys of bay scallops and coastal habitats were conducted in two relatively undisturbed, shallow estuaries along the north-central Gulf Coast of Florida. Scallop abundances did not vary significantly between years or between locations kilometers apart. Shell heights did vary significantly between years at locations kilometers apart; however, these differences were not consistently related to differences in chlorophyll concentrations in the water column or distributions of benthic habitat classes. At the 100-m scale within locations, scallops were not proportionally distributed across the major habitat classes (i.e., *Syringodium filiforme*, *Thalassia testudinum*, mixed seagrass assemblage, other seagrasses, and areas of no/low seagrass cover). In general, proportionately more scallops were observed in association with *S. filiforme*, *T. testudinum*, and mixed seagrass habitats. Bay scallops collected from *S. filiforme* and areas of no/low grass cover were consistently 1–3 mm larger than those collected from *T. testudinum* and mixed seagrass assemblages. These results suggest the importance of *S. filiforme* and *T. testudinum* as habitats for bay scallops. The results also point to the need for further investigation into possible functional differences among seagrass species that may influence the ecology of bay scallops at a small spatial scale and the need for closer examination of scallop movement that may allow for active habitat selection. The work presented here, plus further efforts to elucidate the drivers of small-scale differences in scallop abundances and sizes, will benefit managers who seek to enhance scallop fisheries or protect and restore coastal habitats.

Seagrass beds generally harbor higher numbers of animal species and individuals than adjacent soft-bottom habitats (Orth et al., 1984; Williams and Heck, 2001 and references therein), and they are often considered essential to the ecological health and integrity of many estuarine and shallow coastal ecosystems. The structure afforded by seagrasses provides many organisms both a partial refuge from predation and increased access to food resources (Eckman, 1987; Peterson et al., 1989; Prescott, 1990; Irlandi and Peterson, 1991; Orth, 1992; Irlandi et al., 1995, 1999; Bologna and Heck, 2000).

However, interactions between animals and their habitats are complex, producing a variety of influences on the size, abundance, and species composition of organisms within seagrass beds (Orth, 1992). For example, voluntary or directed movements by animals (e.g., microhabitat selection) can create significant differences in size, abundance, and distribution among seagrass habitats (Winter and Hamilton, 1985; Main, 1987; Pohle et al., 1991; Am-

brose and Irlandi, 1992; Hamilton and Koch, 1996; Bologna and Heck, 1999). In some cases, seagrasses may not provide an optimal or favorable habitat. For example, dense seagrass beds that offer refuge from predation also may significantly reduce water flow and decrease access to food for energy, growth, and reproduction. To maximize energy gain, some species may have to balance risk of predation with resource availability (Orth et al., 1984; Bologna and Heck, 1999). In fact, Bologna and Heck (1999) found higher densities of bay scallops at the edges of seagrass beds, where growth was maximized even though predation pressure was high.

The Atlantic bay scallop, *Argopecten irradians* (Lamarck), inhabits nearshore, shallow seagrass habitats along the Atlantic and Gulf coasts of the United States (Gutsell, 1930; Thayer and Stuart, 1974). *Argopecten irradians* is an epibenthic, suspension feeder that recruits to seagrass blades and other forms of elevated substrate, apparently receiving refuge from benthic predators (Pohle et al., 1991; Ambrose

and Irlandi, 1992; Garcia-Esquivel and Bricelj, 1993). As bay scallops mature, they gain the ability to avoid predation through burst swimming, drop off of seagrass blades, and settle closer to the bottom, where food particles are generally more abundant (Judge et al., 1993) and growth rates are increased (Ambrose and Irlandi, 1992; Garcia-Esquivel and Bricelj, 1993).

The species composition of seagrass habitats available to bay scallops varies along the Atlantic and Gulf coasts of the United States. In the shallow coastal areas along the Atlantic coast north of Georgia, *Zostera marina* (Linnaeus) is the dominant seagrass species and the primary habitat for bay scallops (Thayer and Stuart, 1974; Phillips and Menez, 1988). However, along the Gulf Coast of Florida and in our study areas, *Z. marina* is absent, and both *Thalassia testudinum* (Banks ex König) and *Syringodium filiforme* (Kützing) provide abundant habitat for bay scallops. Although *T. testudinum* and *S. filiforme* often exist as extensive monospecific stands, they also co-occur in complex mixed assemblages with each other or with three other common seagrasses found in the area, *Halodule wrightii* (Ascherson), *Halophila engelmannii* (Ascherson), and *Ruppia maritima* (Linnaeus) (Hale et al., 2004). These five seagrass species differ in structure as measured by the surface area to biomass ratio, blade shape, and blades per shoot (Phillips and Menez, 1988). These differences in structure may affect levels of predation and create different hydrodynamic conditions (Fonseca and Fisher, 1986) that, in turn, may influence patterns of recruitment and food availability for bay scallops and other seagrass-associated species.

Recent declines in the abundance of southern bay scallops, *A. i. concentricus* (Say), along the Gulf Coast of Florida (Arnold et al., 1998) underscore the importance of understanding the ecological relationships between bay scallops and the habitats they occupy. Scallop abundances have decreased significantly at several locations since the early 1990s (Arnold et al., 1998). Although the specific causes of these declines are unknown, the most likely causes include overharvesting, habitat degradation, recruitment failure, or interactions among these processes (Blake, 1996; Arnold et al., 1998). In an attempt to reduce the fishing pressure on areas that have experienced significant declines in scallop numbers, harvest in Florida has been largely limited to areas north and west of the Suwannee River, and the bag limit and length of the harvest season have been significantly reduced throughout the

state (Florida Department of State, 1998). In addition, bay scallops have been transplanted into some estuarine areas where populations have collapsed, in an effort to increase recruitment and improve fishery stocks (Arnold et al., 1996; Blake, 1996). Future management decisions regarding harvest and restoration of bay scallops and conservation and management of seagrasses along Florida's Gulf Coast would benefit from a more comprehensive understanding of interactions between scallops and heterogeneous habitats. For example, an understanding of differential settlement, growth, survival, or preference for certain habitats would be useful in deciding where to transplant scallops to maximize growth rate, reproduction, and survival. Furthermore, identifying the composition of primary habitats for scallops should improve management of seagrasses, a key habitat. The objective of this study was to gain such insights by describing patterns in size and abundance of bay scallops in relation to dominant habitat classes in two estuaries along Florida's central Gulf Coast.

MATERIALS AND METHODS

Study locations.—Surveys were conducted at 45 stations in the estuaries associated with the Steinhatchee and Homosassa rivers along the Big Bend region of Florida's west coast (Fig. 1). Extensive seagrass beds characterize both estuarine locations, and both estuaries have recently supported high densities of scallops relative to other Gulf Coast locations (>13 per 50 m²; Greenawalt, 2002).

At each estuarine location and during each sampling period, sampling stations were located with a hand-held global positioning system unit. All stations were located between the 0.6- and 3.7-m-depth (mean lower low water) contours. In the Steinhatchee estuary 25 stations were sampled. Ten stations had been established previously and are routinely sampled for scallops by the Florida Marine Research Institute (FMRI; Arnold et al., 1998) between latitudes 29°40.050'N and 29°32.004'N, eight stations were part of a grid (2.5-km spacing) where water quality data are routinely collected (see Frazer et al., 1998), and seven stations were added to the grid between latitudes 29°40.050'N and 29°32.004'N. Surveys in the Homosassa estuary were conducted between latitudes 28°52.725'N and 28°40.845'N at all 20 randomly chosen stations that are routinely sampled for scallops by the FMRI (Arnold et al., 1998).

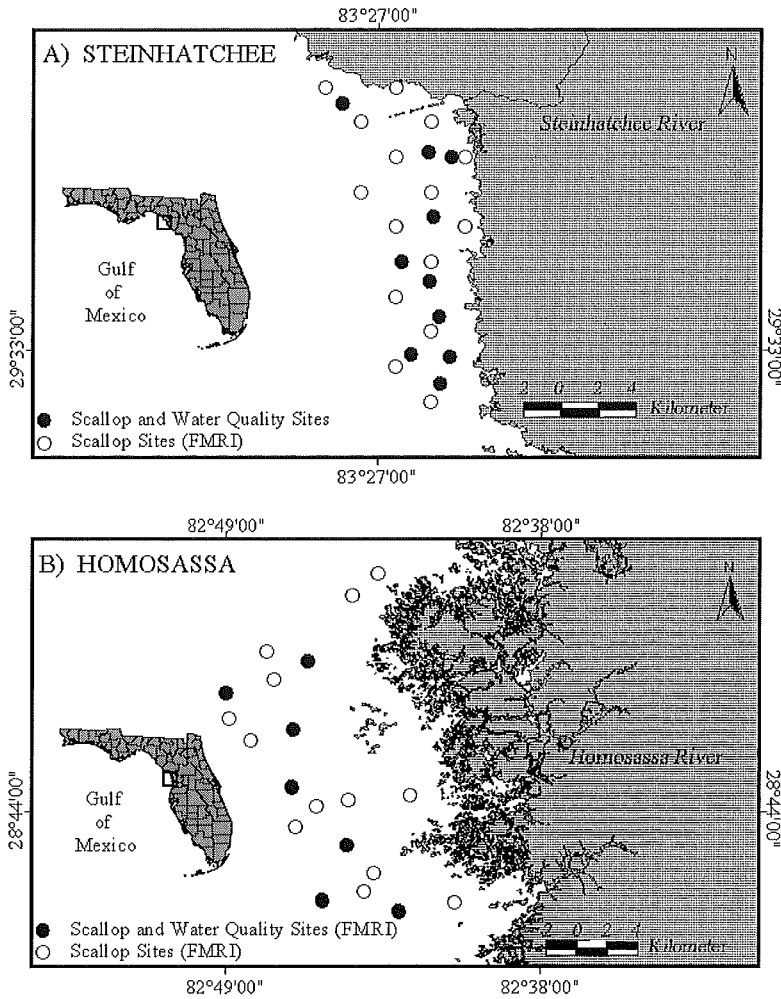


Fig. 1. Stations in the estuaries adjacent to the Steinhatchee River (A) and Homosassa River (B) on the Gulf Coast of Florida.

Field sampling.—Visual surveys were conducted at each sampling station in both estuaries during June 2000 and 2001, just before the annual recreational harvesting seasons. Surveys were conducted along four orthogonal 50- × 1-m transects that originated at the anchor. Stations in less than 1.5 m of water were surveyed using snorkeling gear, and self-contained underwater breathing apparatus was used to sample deeper stations. In each of the fifty 1-m² intervals along the 50-m² transect, all scallops were counted, and their shell heights (distance from the umbo to the ventral margin) were measured in situ to the nearest 0.1 mm with vernier calipers. Shell heights were not measured at Homosassa in 2000.

A rapid visual assessment technique was used to determine the dominant habitat class in

each 1-m² interval where scallops were counted and measured. Dominant habitat class was operationally defined as the fixed habitat that covered at least 50% of the area within each 1-m² interval. In those instances where seagrass was determined to be the dominant habitat class but a single species was not clearly dominant, the habitat was categorized as a mixed seagrass assemblage. When all seagrasses combined covered less than 50% of any 1-m² sampling interval, the interval was classified as “no/low grass.” When attached macroalgae were present, they rarely covered 50% of any 1-m² sampling interval, so the intervals were classified as no/low grass. Overall, the following habitat classes were recorded: *S. filiforme*, *T. testudinum*, *H. wrightii*, *R. maritima*, *H. engelmannii*, mixed seagrass assemblage, and no/low

grass. This method, which is a modified Braun–Blanquet index of vegetative cover, has been shown to yield reliable and repeatable estimates of habitat cover in other field studies covering similar spatial scales (Jupp et al., 1996; Fourqurean et al., 2001).

Water quality data were collected at representative sites (Fig. 1) throughout the Steinhatchee and Homosassa locations (see Frazer et al., 2001, for analytical methods). Salinity, temperature, and dissolved oxygen concentration were measured with an electronic meter (YSI model #85 in 2000 and YSI model #650 in 2001). Water samples, collected just below the surface, were filtered onsite for subsequent determination of chlorophyll concentrations ($\mu\text{g liter}^{-1}$), using a hot 90% ethanol extraction method and color (Pt-Co units). Separate water samples were taken for determination of total nitrogen ($\mu\text{g liter}^{-1}$) and total phosphorus ($\mu\text{g liter}^{-1}$).

Statistical analyses.—Numbers of scallops counted during each sampling event were standardized to numbers per station, i.e., numbers per 200 m^2 . These data were $\log_{10}(\text{count} + 1)$ transformed and tested for normality and homoscedasticity (Anderson–Darling test and Levene’s test, Minitab, Inc., 2000). A two-factor analysis of variance (ANOVA) was performed to test for differences in scallop abundances between locations, between years, and among combinations of location and year (general linear model, Minitab, Inc., 2000).

A hand-calculated goodness-of-fit test was used to determine whether scallops were distributed in proportion to the areal coverage of the five dominant habitat classes at Steinhatchee and Homosassa in 2000 and 2001 (G-test; Sokal and Rohlf, 1981). The five dominant habitat classes were *S. filiforme*, *T. testudinum*, other grasses (*H. wrightii*, *R. maritima*, and *H. engelmannii*), mixed seagrass assemblage, and no/low grass.

Shell heights were pooled across habitats within combinations of year and location and across years and locations within habitat classes. The resulting data were transformed in several ways and tested for normality and homoscedasticity (Proc Univariate; hovtest; SAS Institute, 2000). The data did not conform to the assumptions required by standard parametric statistical procedures, so nonparametric tests were used. Differences in the shell height of scallops among combinations of location and year (i.e., Steinhatchee 2000, Steinhatchee 2001, Homosassa 2001) and among habitat classes were determined using Kruskal–Wallis

tests (Proc Npar1way; SAS Institute, 2000). Hand-calculated Nemenyi tests (nonparametric Tukey-type multiple-range tests; Zar, 1996) were used as follow-up comparisons to identify significant differences between pairs of location and year combinations and pairs of habitat classes. Habitat classes that yielded less than 30 scallops overall (e.g., *H. wrightii*, *H. engelmannii*, and *R. maritima*) were not included in these analyses.

RESULTS

The dominant habitat classes at Steinhatchee and Homosassa were *S. filiforme* and *T. testudinum*, which comprised 50% or more of the total area surveyed (Fig. 2). At Steinhatchee, *S. filiforme* and *T. testudinum* were nearly equally represented. At Homosassa, *T. testudinum* covered approximately four times more area than *S. filiforme*.

At Steinhatchee and Homosassa, mixed and no/low seagrass habitats covered from 10% to 24% and from 15% to 28% of the total area surveyed, respectively. In over 99% of all records, mixed seagrass habitats were partly composed of one or both of the two most dominant species (i.e., *S. filiforme* and *T. testudinum*). Occasionally, *H. wrightii*, *R. maritima*, or *H. engelmannii* were also present. Essentially, monospecific stands of these other grasses comprised only a small percentage of the area surveyed, ca. 8% at Steinhatchee and 2% at Homosassa. Transects with no/low grass cover typically traversed areas of sand or hard bottom between larger patches of seagrass. In some cases large clumps of drift algae (e.g., *Gracilaria foliifera* or *Laurencia* spp.) or small patches of attached macroalgae (e.g., *Caulerpa* spp. or *Penicillus capitatus*) were present in these areas. Seagrasses, if present at all, covered only a very small fraction of these areas.

Abundance data for scallops were homoscedastic ($P = 0.142$), but they were not distributed normally ($P < 0.001$). Results from the ANOVA were interpreted cautiously (significance level set at 0.01) because the data were not distributed normally. Using this approach the abundances of bay scallops did not differ significantly between locations, between years, and among combinations of location and year (Table 1). The back-transformed mean abundances per 200 m^2 and 99% confidence limits were Homosassa 2000 = 19.89, lower confidence limit (LCL) = 6.78, upper confidence limit (UCL) = 161.55; Steinhatchee 2000 = 14.49, LCL = 4.18, UCL = 45.34; Homosassa 2001 = 57.88, LCL = 20.93, UCL = 157.12;

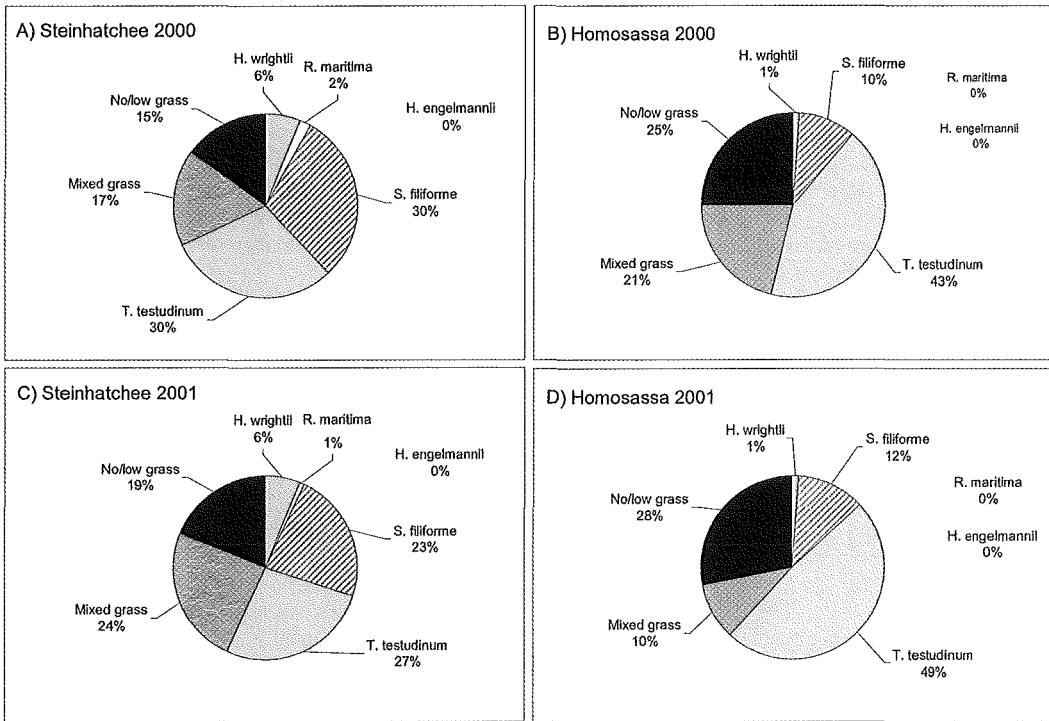


Fig. 2. Relative areal coverage of habitat classes at Steinhathee in 2000 (A) and 2001 (B) and at Homosassa in 2000 (C) and 2001 (D).

Steinhathee 2001 = 13.45, LCL = 3.83, UCL = 42.25.

The abundance of bay scallops was not proportional to the areal coverage of habitat classes at Homosassa in either 2000 (goodness of fit, $G\text{-stat} = 11.36$, $df = 4$, $P < 0.05$) or 2001 (goodness of fit, $G\text{-stat} = 813.71$, $df = 4$, $P < 0.0001$) or at Steinhathee in either 2000 (goodness of fit, $G\text{-stat} = 2,424.30$, $df = 4$, $P < 0.0001$) or 2001 (goodness of fit, $G\text{-stat} = 8,116.36$, $df = 4$, $P < 0.0001$). At Homosassa, there were more scallops than expected in *T. testudinum* in 2000 and 2001 and in mixed grass in 2001 (Fig. 3). At Steinhathee, there were more scallops than expected in *S. filiforme* in 2000 and in *S. filiforme*, *T. testudinum*, and mixed grass in 2001 (Fig. 3). In all cases there

were fewer scallops than expected in other seagrass habitats or in areas of no/low grass coverage.

There were significant differences in shell heights of scallops among the different habitat classes at Steinhathee in 2000 (Kruskal-Wallis, $\chi^2 = 40.28$, $df = 3$, $P < 0.0001$), Steinhathee in 2001 (Kruskal-Wallis, $\chi^2 = 56.94$, $df = 2$, $P < 0.0001$), and Homosassa in 2001 (Kruskal-Wallis, $\chi^2 = 74.31$, $df = 3$, $P < 0.0001$). As noted previously, shell heights were not measured at Homosassa in 2000. Scallops collected from *S. filiforme* during all three sampling events were significantly larger than those from other seagrass habitats (Fig. 4). Where sufficient numbers of scallops were collected from no/low grass habitats, they did not significantly

TABLE 1. Two-way analysis of variance based on log-transformed scallop abundances per 200 m² (significance level set at 0.01).

Factor	df	Sum of squares	Mean square	F-value	P-value
Year	1	1.0196	1.0196	1.68	0.198
Location	1	3.0910	3.0910	5.10	0.026
Year × location	1	1.2789	1.2789	2.11	0.150
Error	86	52.1163	0.6060		

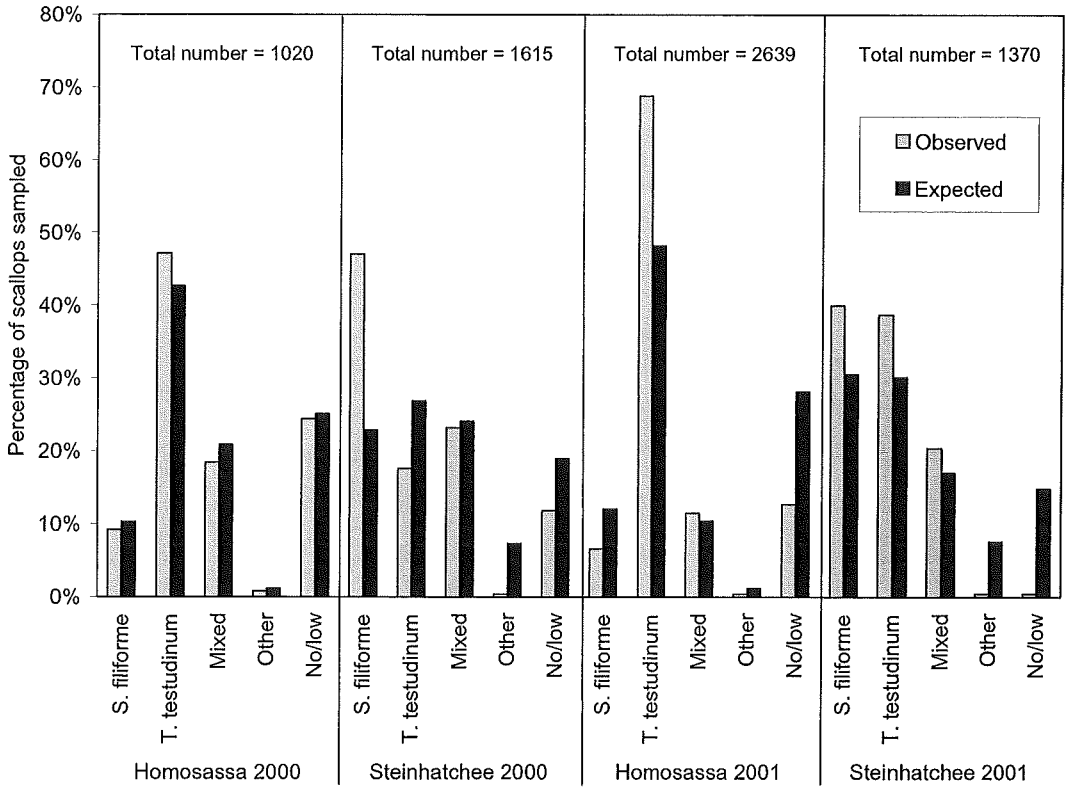


Fig. 3. Comparisons of total counts and observed and expected percentages of scallops found in different habitat classes.

differ in size from scallops collected from *S. filiforme* (Fig. 4). Scallops from mixed seagrass assemblages and *T. testudinum* were not statistically different in size at Steinhatchee, but

scallops from *T. testudinum* were significantly larger at Homosassa (Fig. 4).

Scallop shell heights pooled across habitats varied significantly among combinations of lo-

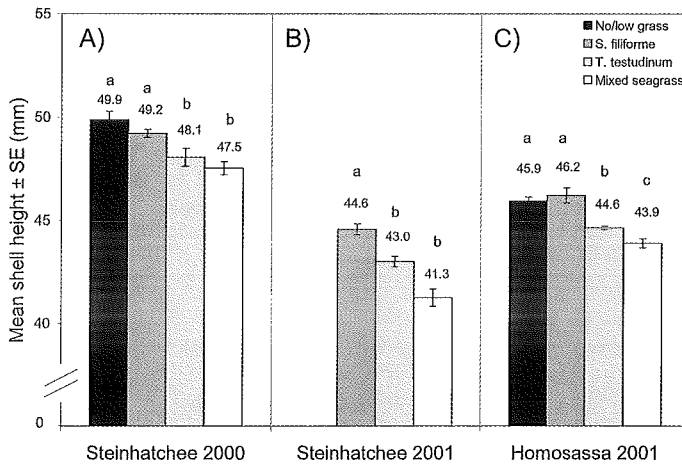


Fig. 4. Mean scallop heights (\pm SE) at Steinhatchee in 2000 (A) and 2001 (B) and at Homosassa in 2001 (C). Different letters represent significant differences between habitats within each sampling period (Nemenyi tests, $P \leq 0.05$).

TABLE 2. Significance values (P -values) for pairwise comparisons (Nemenyi tests) of mean scallop shell heights between habitats at Steinhatchee in 2000 and 2001 and at Homosassa in 2001.

		No/low grass	<i>Syringodium filiforme</i>	<i>Thalassia testudinum</i>
Steinhatchee 2000 ^a	<i>S. filiforme</i>	>0.500	—	—
	<i>T. testudinum</i>	<0.001	<0.001	—
	Mixed	<0.001	<0.001	>0.500
Steinhatchee 2001 ^b	<i>S. filiforme</i>	—	—	—
	<i>T. testudinum</i>	—	<0.001	—
	Mixed	—	<0.001	>0.500
Homosassa 2001 ^c	<i>S. filiforme</i>	>0.500	—	—
	<i>T. testudinum</i>	<0.001	<0.001	—
	Mixed	<0.001	<0.001	<0.005

^a Rank ordering of shell heights in habitats: no/low grass = *S. filiforme* > *T. testudinum* = mixed.

^b Rank ordering of shell heights in habitats: *S. filiforme* > *T. testudinum* = mixed.

^c Rank ordering of shell heights in habitats: no/low grass = *S. filiforme* > *T. testudinum* > mixed.

cations and years (Kruskal–Wallis, $\chi^2 = 682.36$, $df = 2$, $P < 0.0001$). Scallops from Steinhatchee in 2000 were larger (mean shell height = 48.66 mm) than scallops from either location in 2001 (Nemenyi tests, $P < 0.001$) (Table 2). In 2001, scallops from Steinhatchee were smaller than those from Homosassa, with mean shell heights of 43.30 and 44.84 mm, respectively (Nemenyi test, $P < 0.001$) (Table 1).

Most physical, chemical, and biological parameters highlighted environmental similarities between the two estuaries and the two years (Table 3). However, total phosphorus concentrations, total chlorophyll concentrations, and color tended to be consistently higher at Steinhatchee.

DISCUSSION

Our results indicate variations in environmental conditions and habitat between the locations of the scallop surveys. Seagrasses covered approximately 75% of the observed substrate at both Steinhatchee and Homosassa during both years. The two most common seagrasses, *T. testudinum* and *S. filiforme*, covered approximately 50% of the substrate at both locations in both years. However, *T. testudinum* covered approximately 30% more of the substrate than *S. filiforme* at Homosassa, whereas in Steinhatchee, both seagrass species covered approximately equal proportions of the substrate. Furthermore, chlorophyll concentrations were higher at Steinhatchee in both 2000 and 2001. However, scallops were not consistently larger or more abundant at any one location. Thus, there was no evidence that differences in chlorophyll concentrations or variation in seagrass cover led to consistent differences in scallop populations.

Shell heights and abundances varied within locations in relation to dominant cover type. Scallops in *S. filiforme* or areas with no/low grass were always significantly larger than those in *T. testudinum* regardless of which species formed the most common habitat type. In general, *T. testudinum* and *S. filiforme* harbored more scallops than other habitat classes, although the pattern was not consistent between years. The differences in shell heights noted during 2000 and 2001 (ca. 1–3 mm) represent approximately 1–3 wk of growth (Irlandi et al., 1999; Shriver et al., 2002), but their full biological significance is unknown. The differences in scallop abundance ranged from 28 to 543 scallops per 200 m². These differences should be significant to managers given that the choice to open an area to fishing relies on surveys that yield 25 scallops per 600 m². Overall, our results suggest the importance of *T. testudinum* and *S. filiforme* habitats. Both seagrasses appear to support higher abundances of scallops, and *S. filiforme* appears to provide a better habitat for rapid growth, early recruitment, or preferential settlement of larger scallops.

Inherent differences in the structural characteristics of habitats may have contributed to differences in shell height. Fonseca and Fisher (1986) found that *S. filiforme* was “hydrodynamically smooth” and did not cause as severe a reduction in water flow as *T. testudinum*. Bay scallops may grow faster in areas where flow is not hindered because they experience an increased flux of food particles. The relationship between flow rate and growth has been tested, with variable results (Kirby-Smith, 1972; Eckman, 1987; Wildish et al., 1987; Cahalan et al., 1989; Eckman et al., 1989; Frechette et al., 1989; Irlandi and Peterson, 1991; Grizzle et al., 1992; Wildish and Saulnier, 1992; Irlandi et al.,

TABLE 3. Physical, chemical, and biological parameters of water quality.

Parameter	Steinhatchee 2000			Homosassa 2000			Steinhatchee 2001			Homosassa 2001		
	n	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD
Depth (m)	60	2.0	1.16	28	1.7	0.43	60	1.7	0.93	28	1.4	0.37
Temperature (°C)	60	29.7	2.07	28	27.1	3.85	57	28.9	1.73	26	28.9	1.85
Salinity (ppt)	60	29.7	5.39	28	32.3	3.02	57	30.3	3.95	26	28.5	4.61
Dissolved oxygen (mg liter ⁻¹)	60	6.8	1.35	28	6.3	1.20	57	7.1	1.42	26	6.0	1.94
Total nitrogen (µg liter ⁻¹)	60	469.7	99.10	28	418.9	125.10	60	428.0	151.50	28	371.4	81.90
Total phosphorus (µg liter ⁻¹)	60	16.5	5.20	28	10.4	3.60	60	16.0	7.90	28	8.8	2.50
Chlorophyll (µg liter ⁻¹)	60	3.0	2.72	28	1.2	0.66	60	2.7	2.05	28	1.0	1.10
Color (Pt-Co units)	60	18.0	12.70	28	8.9	2.80	53	26.7	34.30	28	8.7	2.20

1999), and this hypothesis remains to be tested by field studies in Florida.

Differences in shell heights may not indicate different growth rates. Variability in shell height among habitat classes may result from preferential recruitment to certain habitats, leading to a "head start" on juvenile growth, ontogenetic microhabitat selection that separates larger and smaller scallops, or habitat-mediated differential size-selective predation. Certainly, differences in flow rate through different seagrass habitats can significantly affect bivalve recruitment (Eckman, 1987; Ambrose et al., 1992; Bologna and Heck, 2000). In addition, habitats with different blade widths, shapes, and surface area to biomass ratios often yield different risks of predation (Heck and Orth, 1980; Orth, 1992). Larger bay scallops may suffer less predation as they become better swimmers, and they may move to and survive in habitats with less shelter and more access to food (Pohle et al., 1991; Garcia-Esquivel and Bricelj, 1993). This study represents a "snapshot" in time. Examining changes in size distributions over time might test for ontogenetic shifts; however, anticipated shifts are likely to be masked at our study sites by losses due to recreational harvesting during the primary period for growth (Bologna, 1998).

Spatial and temporal differences in scallop abundances have been observed previously by Arnold et al. (1998) and are generally accepted to be a result of large-scale stochastic events. In this study, scallop abundance did not vary on the kilometer scale but did vary consistently among the available habitats within each location. More scallops than expected were found in the dominant seagrass habitats. Several factors may have led to these findings. The lower abundances of bay scallops observed in other seagrass habitats (i.e., *H. wrightii*, *R. maritima*, and *H. engelmannii*) might be the result of the spatial distribution of these seagrasses. On the west coast of Florida, *H. wrightii* and *R. maritima* tend to occur inshore of *T. testudinum* and *S. filiforme*, and *H. engelmannii* and *H. wrightii* are found further offshore (Strawn, 1961; Iversen and Bittaker, 1986; Mattson, 2000; Hale et al., 2004). *Halophila engelmannii* is also found in inshore areas with reduced light penetration and higher freshwater inputs (Mattson, 2000). During this study the three less-common seagrasses were found primarily inshore, where salinities may have become suboptimal for bay scallops during periods of high freshwater input. Scallop distributions may also relate to structural differences among the seagrass species.

Scallop distributions may not solely be the result of differential recruitment and survival. Scallops appear to have the ability to actively select seagrass habitat over nonvegetated habitats (Winter and Hamilton, 1985; Hamilton and Koch, 1996; Bologna and Heck, 1999). Like many other animals, juvenile scallops may select habitats and positions within habitats (e.g., vertical position on seagrass blades) that result in enhanced survival, growth, and, ultimately, reproductive output (Orth et al., 1984; Pohle et al., 1991; Ambrose and Irlandi, 1992; Garcia-Esquivel and Bricelj, 1993; Bologna and Heck, 1999). For example, Bologna and Heck (1999) found the highest density of adult scallops in edge habitats, where predation and growth were both high. Drifting macroalgae, although present at both Homosassa and Steinhatchee, were not considered a dominant habitat because of the ephemeral nature of algal habitats. However, algal habitats may prove to be important for scallops, especially for small juveniles (Tettelbach, 1991), and they should be examined in more detail.

The results of this study suggest that differential recruitment, differential predation, differential feeding success and growth, active habitat selection, or some combination of these influences plays a significant role in determining patterns in scallop abundances and sizes. These results suggest that functional differences among seagrass habitats on a small scale can influence scallop abundance and size. Confirming these relationships should clarify the links among broad-scale declines in scallop densities that have occurred along Florida's Gulf Coast during the past decades (Arnold et al., 1998) and coincident broad-scale losses of seagrass, shifts of *T. testudinum* to shallow water, and increases in *S. filiforme* in deeper water (Hale et al., 2004). Results from such studies would improve decisions made by fishery managers striving to restore depleted scallop populations in Florida's estuarine and nearshore coastal waters by optimizing the location of scallop restoration. Managers attempting to restore and protect seagrasses and other habitats would also benefit from a broader understanding of the habitat potential of the various seagrass species. Overall, our results provide insights of value to managers of Florida's scallop fisheries and coastal habitats, and they highlight the need for more work on interactions between scallops and their habitats.

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- (JMG)MARINE LABORATORY, SANIBEL-CAPTIVA CONSERVATION FOUNDATION, 900A TARPON BAY ROAD, SANIBEL, FLORIDA 33957; AND (TKF, SRK, CAJ) DEPARTMENT OF FISHERIES AND AQUATIC SCIENCES, UNIVERSITY OF FLORIDA, 7922 NW 71ST STREET, GAINESVILLE, FLORIDA 32653. Date accepted: December 17, 2003.