Quantitative estimates of species composition and abundance of fishes, and fish species/habitat associations in St. Croix, U.S. Virgin Islands

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ABSTRACT

Reef fish communities around St. Croix, U.S. Virgin Islands were studied by visual census methods in order to identify fisheries-habitat links, to document the role of local coral reefs as essential fish habitat, and to provide a baseline for monitoring studies. Seven reef sites were surveyed by stationary fish censuses during spring and fall of 2002. In general, the fish communities were similar across sites and survey periods: all reefs supported a diverse and abundant fish assemblage that was largely replicated between spring and fall surveys. Planktivorous fish (primarily labrids and pomacentrids) dominated the fauna numerically. Herbivorous fish (acanthurids and scarids) were common and abundant at all sites. Piscivores and other specialized feeders were least abundant. Serranids were common and relatively diverse, however most observed fish were either diminutive or small species (e.g. harlequin bass, hamlets, coney, and graysby). Lutjanids were of larger size, but less common, less abundant, and less diverse than serranids. Very few large reef-associated piscivorous species were seen, and the significance of this observation is discussed.

Some variation in fish assemblages was observed among reefs. Comparison of species richness and diversity (H') among reefs showed a suggestive positive relationship to vertical relief, but no obvious relation to percentage live coral cover or percentage turf alga cover. Planktivorous pomacentrids predominated at the two reef sites with the highest coral cover. Acanthurids and scarids, while both nearly ubiquitous, showed a reciprocal density relationship, with scarids predominating on well-developed reefs. Chaetodontids were more abundant and diverse near a submarine canyon (Salt River). Lutjanids were not observed at Lang Bank – an offshore platform with sparse coral cover.

These results imply that at least some members of reef fish communities respond to presently unidentified biotic or abiotic differences among the coral reef habitats of St. Croix, and that the source of this variation warrants additional investigation. Additional studies are recommended to monitor changes in these reef fish communities over time, to improve assessments of rare (but recreationally and commercially important) species, and to further elucidate critical fish-habitat links.

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INTRODUCTION

Coral reefs of the U.S. Virgin Islands support a diverse assemblage of fishes. In addition to their ecological roles on reefs, these fish have economic importance to local recreational and commercial fisheries (Appledoorn et al. 1992).

Management of reef fish resources depends upon sound information about the status of local populations, and knowledge of critical links between habitat and fish life-history (i.e. essential fish habitats). Thus a first step is to simply establish the fine-scale patterns of fish distribution among habitats. A descriptive study, such as this one, can provide valuable information about habitat-species associations, which may ultimately lead to identification of critical links.

A second objective of management must be to monitor resources, so that the trajectory of populations through time can be evaluated. A thorough and descriptive baseline survey, whether it represents a natural or disturbed community (Jackson 1997), is the essential starting point for any monitoring program. On St. Croix, for example a proposed Marine Protected Area (MPA) will encompass the nearshore, eastern end of the island. Implementation of a broad "No-Take" zone may conceivably influence the structure of entire reef fish communities located in this area. Monitoring will be instrumental in gauging the effects of this proposed MPA on fish communities. Alternatively, on a scale of individual species, monitoring may allow managers to determine whether specific fisheries regulations, such as localized closures to protect spawning aggregations, are effective at restoring depleted stocks (sensu Tobias et al. 1988).

METHODS

Description of Study Sites

Seven reef sites around the island of St. Croix, U. S. Virgin Islands were selected for this study (see Figure 1): Lang Bank (LB), Jacks and Isaacs Bay (JI), East Wall (EW) of Salt River Canyon, West Wall (WW) of Salt River Canyon, Eagle Ray (ER) on Long Reef, Cane Bay (CB), and Sprat Hole (SH). Each of these reefs is surveyed annually by the Center for Marine and Environmental Studies, University of the Virgin Islands, as part of their coral reef monitoring program. Those studies provide much of the descriptive information on sessile reef biota, as presented in Table 1 (Nemeth and Herzlieb 2002). Detailed geological, biological, and spatial descriptions of these reef sites have been made previously, either in a general sense (Hubbard 1989a), in detail (at CB - Hubbard 1989b; at EW and WW - Hubbard 1989c) or at comparable nearby reefs (at JI - Hubbard 1989d). Briefly, the seven reef sites all represent shallow water (< 15 m depth) hard bottom substrates situated on the insular shelf of St. Croix. Despite geographic proximity, there is considerable variation among reefs in terms of benthic flora and fauna, physical structure, exposure to prevailing currents and wave forces, and adjacent habitats (to name but a few of the variables). For example, the development of scleractinian coral communities varies considerably among sites, from about 5% living coral cover at LB to >24% at SH (Nemeth and Herzlieb 2002). Some of the reefs have previously been classified (Hubbard 1989a-d) as barrier-type reefs (ER), fringing reefs (JI), shelf edge reefs (CB, SH), or submarine

hardgrounds (LB). In the present study, only those attributes presented in Table 1 were considered in relation to reef fish community structure.

Visual Census Methods

The stationary fish census method (Bohnsack and Bannerot 1986) was used to assess reef fish community structure. Compared to other visual census methods (belt transects, timed random swim methods), the stationary count offers the advantage of estimating fish community structure as a function of density per unit area for each observed species, while enabling size (length) estimates of individuals. Generally, results from stationary point counts are comparable to results obtained from belt transects (e.g. Bortone et al. 1989), and the two methods differ primarily in duration (belt transects are faster) and area surveyed per replicate. A typical belt transect of 30 m x 2 m yields 60 m^2 whereas a 15 m wide stationary census (used in this study) yields 176 m^2 per replicate. However neither of these two methods is likely to enumerate all of the species present within a given area (i.e. to generate a species list) - that purpose is best served using replicated timed random diver swims (Kimmel 1985) or related methods (see Rogers et al 2001).

The census protocol is only slightly modified from Bohnsack and Bannerot (1986), and a brief description is provided here. A 15 m diameter census "cylinder" was defined by transect tape with the observer positioned in the center (7.5 m mark). Fish within this cylinder were censused as follows. During an initial 5-minute “listing” period, the names of all observed fish species were recorded onto pre-printed data forms. At the end of the listing period, the observer began enumerating all individuals of each species, working from the bottom of the list upward and making one 360º sweep. Strict adherence was made to the 5-minute listing period. New species observed during the enumeration period (e.g. fish that swam into the cylinder after 5 minutes of listing) were not included in the stationary count data. Divers estimated fish total length to the nearest cm, using a measuring “T-bar” for underwater visual reference. Maximum, minimum, and average size was recorded for each species. Divers also recorded a brief description/sketch of habitat features within the census area. All fish were identified to species, however gobies (Gobiidae) and blennies (Blenniidae) were excluded from census counts. To insure that our fish census areas coincided with ongoing UVI coral surveys, but that replicates did not cover overlapping areas, census stations were marked with a small piece of rebar driven into nonliving reef substrate.

Surveys were conducted during two sampling periods: Spring (May – June, 2002) and Fall (September, 2002). For each reef site, six replicate censuses were made [this is a level of replication thought to adequately sample the species representing > 90% of all individuals at a site (Bohnsack and Bannerot 1986)] except for LB (Spring) where only four replicate censuses were conducted due to unfavorable weather conditions. Six replicate censuses surveyed a total area of 1,056 m^2 per reef site. A summary of census dates, number of replicates, and census duration is presented in Table 2.

Data from this study were analyzed using Microsoft Excel software.

RESULTS

A total of 35,322 fish were sighted during the surveys (Table 3). More fish were observed in fall (16,859) than spring (18,463). The number of fish observed at each site ranged from 1,385 (JI, fall) to 5,443 (CB, fall). A total of 85 fish species representing 27 families were sighted (Table 3; Appendix 1). More species were seen during fall (77 species) than during spring (72 species; Table 3). The number of species observed at each site during spring or fall ranged from 24 (LB, spring) to 42 (WW, ER, CB; all fall) and the cumulative number of species observed at each reef site ranged from 32 (LB) to 52 (ER).

In general, fish assemblages present at each reef site were similar between spring and fall. Average fish abundance (Figure 2A) remained relatively constant at 6 of the reef sites. At CB, an increase in average abundance in fall was due to a large influx of small (~ 3 to 5 cm TL) creole wrasses (*Clepticus parrae*; see Appendix 2F). Average species richness also remained relatively constant between spring and fall (Figure 2B). However the Shannon-Weiner diversity index (H'), computed as an average per census, showed greater variability between survey periods (Figure 2C; LB and ER), suggesting that community composition had changed in some cases. At LB, change was attributed to a large (30%) decrease in abundance of the numerically dominant species, the bluehead wrasse, *Thalassoma bifasciatum*, and a 3-fold increase in bicolor damselfish (*Stegastes partitus*) abundance. At ER, the fall increase in diversity corresponded to a 40% decrease in abundance of the bluehead wrasse and the appearance of large schools of brown chromis, *Chromis multilineata* (an increase from 1.7 to 43.3 fish/census; Appendix 2E).

In contrast to temporal comparisons (i.e. spring vs. fall), comparisons across reef sites showed greater dissimilarity in fish assemblages (Figure 2). Average abundance (Figure 2A) was highest at CB and SH, sites with the highest coral cover, but also at LB where coral cover is sparse. Average species richness varied from ~15 to ~22 species observed/census (Figure 2B) and LB had the fewest species while ER, CB and SH had the most. Diversity indices showed a similar trend (Figure 2C).

The 25 most abundant species observed in this study are present in Table 4. The bluehead wrasse alone accounted for 38.6% of all fish sightings. The five most abundant species were the bluehead wrasse, creole wrasse, bicolor damselfish, brown chromis, and blue chromis (*Chromis cyanea*) - all primarily planktivorous species. Together, they accounted for 87.2% of all fish sightings. Despite comparably high abundance levels shared among these five species, their distribution and frequency of occurrence were different (Table 4). While the strongly reef-associated bluehead wrasse and bicolor damselfish were ubiquitous (present at each reef site) and common (frequency > 97% of censuses), the schooling creole wrasse and brown chromis were more patchy in distribution (Appendix 1) and less common (frequency < 45% of censuses).

A detailed account of species is beyond the scope of the present work (see Appendix 2A to G). Here, an analysis of reef fish community composition is presented based upon taxonomic divisions (families) that delineate eight commercially, recreationally or ecologically important fish groups. These families are: Labridae (wrasses), Pomacentridae (damselfishes), Acanthuridae (surgeonfishes), Scaridae (parrotfishes), Serranidae (groupers), Lutjanidae (snappers), Haemulidae (grunts), Chaetodontidae (butterflyfishes) and Pomacanthidae

(angelfishes). The latter two families were combined as a single group (butterflyfish and angelfish) for these analyses. Use of these taxonomic divisions is justified because: (1) each family loosely represents a trophic (ecological) group, and (2) the families collectively represented over 95% (usually >98%) of fish observed at each reef site (e.g. Table 4; Appendices 2A to G).

Fish abundance by family is summarized in Figure 3, where data were pooled from all seven reef sites. Average fish abundance was similar between spring and fall, however abundance varied considerably among families. Labrids and Pomacentrids were over 10 times more abundant than all other families (~ 100 fish observed/census). Acanthurids and scarids had similar abundance levels of ~ 10 fish/census. The abundance of serranids, lutjanids, haemulids, chaetodontids and pomacanthids was generally low (1 to 4 fish/census) and typically quite variable within and among sites (see below).

To examine fish community structure across the seven reef sites, the same eight fish families were utilized as a basis for analyses (Figure 4). Labrids were abundant at all sites (average 242 fish/census) but highly variable within and among sites (Figure 4a) [as noted above, an exceptionally high abundance of creole wrasses was recorded at CB in spring]. Pomacentrids were also abundant (average 148 fish/census), and showed the greatest variation among sites. The highest abundances were seen at CB and SH, where > 300 fish/census were recorded in spring and fall (Figure 4B). Blue chromis and brown chromis were the most abundant pomacentrids at CB and SH (Appendix 2F and G). Herbivorous fish were less abundant than planktivores. The abundance of acanthurids (average 10.7 fish/census) and scarids (average 9.6 fish/census) was also variable across the reef sites (Figures 4C and D). Acanthurids had their highest abundances at WW, EW, JI, and LB and were least abundant at CB and SH. Scarids had their highest abundance at SH.

Predatory fishes (piscivores, carnivores) are represented by the serranids, lutjanids and haemulids. As a family, serranids had low abundance (average 4 fish/census) that showed little variation among reef sites (Figure 4E). Serranid diversity was variable among reef sites. The coney, *Cephalopholis fulvus*, was uniformly distributed across reefs (Appendix 1) and relatively common (Appendix 2A-G), however the graysby, *C. cruentatus*, was more frequent in habitats of high topographic complexity (ER, CB, SH). The red hind, *Epinephelus guttatus*, was observed only infrequently at 4 sites (Appendices 1 and 2). Hamlets (genus *Hypoplectrus*) also showed highest diversity levels at SH, ER, EW and WW but not CB. In contrast to serranids, lutjanids showed greater variation in abundance and distribution. The yellowtail snapper, *Ocyurus chrysurus*, and the mahogany snapper, *Lutjanus mahogoni*, were the most common and abundant snappers, however the schoolmaster, *L. apodus*, and the mutton snapper, *L. analis*, were also observed (Appendix 1). No lutjanids were recorded at LB. Haemulid abundance was relatively uniform (average 2.4 fish/census) across reef sites (Figure 4G).

The combined group of Chaetodontidae and Pomacanthidae represent long-lived reef residents with specialized feeding habits (e.g. feeding on cnidarians, sponges). Abundance and diversity of this group varied among reef sites (Figure 4H) and was generally low (2.3 fish/census). Chaetodontids were most frequent and abundant at EW, WW and ER. It is interesting that EW and WW had the highest diversity of butterflyfish (4 and 3 species, respectively) whereas other

reef sites had 2 or 1 species. Only the banded butterflyfish, *Chaetodon striatus*, was recorded from LB and JI, whereas only the foureye butterflyfish, *C. capistratus*, was recorded from CB and SH (Appendix 2).

DISCUSSION

The reefs investigated in this study supported diverse and abundant fish communities. This is not surprising - previous studies have documented well over 200 reef-associated species in St. Croix waters (Clavijo et al. 1980), and over 100 species may occur on a single patch reef (Gladfelter and Gladfelter 1978). For the following discussion, it is important to note that the stationary visual census method does not capture total reef fish diversity (i.e. Appendices 2A to G do not represent complete species lists). Rather, these are quantitative data on the most conspicuous and abundant components of each fish community. The absence of a given species from our observations should be considered "relative" absence. Nonetheless, the average number of species observed per census is a quantitative estimate of community species richness, and a useful measure for comparing reef sites.

The goal of the present study was to document, in an exploratory manner, species-habitat links of coral reef fish populations. This experimental design allows only a preliminary analysis of the relationship between individual fish species (or fish communities) and specific reef attributes (e.g. % live coral, vertical relief, benthic invertebrate community composition, wave exposure, prevailing currents, etc). When fish communities were compared across the seven reef sites, there was no obvious relation of average fish abundance to percentage live coral nor percentage turf algal cover (not shown). Planktivore abundance (blue chromis and brown chromis), on the other hand, may be positively related to percentage live coral cover (e.g. CB and SH; Figure 4B). Species richness showed a more suggestive positive relation to coral cover, although ER represents an important exception. At ER, coral cover is relatively low, but vertical relief is high (a spur and groove area formed of *Montastraea* skeletons). A relatively high number of fish species was observed at ER. This suggests that the richness of St. Croix reef fish communities may be influenced more by three-dimensional architecture (topographic complexity) of the reef than by the presence of living (versus dead) corals. This idea is not new (Roberts and Ormond 1987), and it has been suggested by results from long-term studies of fish populations at Buck Island, St. Croix (Gladfelter et al. 1992), where hurricane damage and disease permanently reduced live coral cover (*Acropora palmata*), but left habitat structural complexity relatively intact. Despite the loss of living coral, resident fish populations recovered to pre-hurricane densities.

Nemeth and Herzlieb (2002) suggested that reef sites along St. Croix's northern coast harbor a greater abundance of reef fish than the other reef sites. Our results did not corroborate this finding (see Figure 2 and Figure 4). Neither that study nor this one included sufficient replication of reef sites, adequate spatial coverage of insular reefs, nor control over confounding variables (e.g. topographic complexity) to reach a definitive conclusion. Nonetheless, previous studies indicate that recruitment patterns are highest on St. Croix's northwestern and southeastern shores (Caselle and Warner 1996, and Swearer 2002). Recruitment studies, in

conjunction with community assessments, may clarify a postulated relationship between larval supply and resident reef fish abundance.

Planktivores:

The reef fish communities were numerically dominated by labrids (bluehead wrasse, creole wrasse) and planktivorous pomacentrids (bicolor damselfish, blue chromis, and brown chromis), which were collectively 10 to 100-fold more abundant than all other species. The bluehead wrasse, perhaps the most abundant of all West Indian reef fishes, is a facultative planktivore, and the remaining species feed primarily on zooplankton (Randall 1968).

Large populations of planktivores form a major trophic link between coral reef habitats and open–water communities (e.g. Hobson 1991). Undoubtedly, a large number of these fish fall prey to resident and reef associated predatory fishes. Between spring and fall, bluehead wrasse abundance decreased by ~ 20%, which is suggestive of heavy predation. However we found no relation between planktivore abundance and piscivore abundance (compare Figure 4A and B with 4E and F). Some authors have argued that, rather than predation, the primary trophic link between planktivores and coral reefs is through production of feces, which is then consumed by a wide variety of reef fish and invertebrates (Robertson 1982). Nonetheless, the role of planktivores as forage for commercially and recreationally important species should be investigated further.

Herbivores:

Herbivorous fish were common, moderately abundant, and relatively diverse on all seven reefs. For acanthurids and scarids, average abundance was similar (9.6 fish/176 m^2 census and 10.7 fish /176 m^2 census, respectively). In 2001, Nemeth and Herzlieb (2002) censused fish from the same sites using belt transects. When normalized to 100m^2, the density of acanthurids observed in our study was slightly lower than in theirs (6.0 vs 9.0 fish/100 m^2) and the density of scarids observed in this study was substantially lower (5.5 vs 13 fish/100m^2). The apparent decline in parrotfish populations is unexplained. Methodological differences between the studies may account for this discrepancy. Alternatively, scarid populations may be in decline due to overfishing – parrotfishes are actively sought by a local gillnet fishery. Given the important trophic role that scarids play in maintaining scleractinian coral growth and diversity (e.g. Pennings 1997), local parrotfish populations should be monitored carefully in the future.

In this study, parrotfishes (especially the redband parrotfish, *Sparisoma aurofrenatum*, and the princess parrotfish, *Scarus taeniopterus*) and surgeonfishes (ocean surgeonfish, *Acanthurus bahianus*, and blue tang, *A. coeruleus*) were nearly ubiquitous among the reef sites. Analysis of their abundance patterns (Figure 4C and D) suggests that their densities were reciprocal. Acanthurids were more abundant on low relief, low coral cover sites (LB, JI, EW, WW) while Scarids were more abundant on reefs with greater topographic complexity (ER, CB, SH). This pattern may arise from differences in feeding mode: acanthurids tend to browse over soft bottoms while scarids are scrapers of hardbottom substrates (e.g. Choat 1991).

Piscivores, Carnivores and Specialized Invertebrate Feeders:

A diversity of predatory fishes was recorded during censuses. The observed species varied in their degree of reef association. For example carangids (bar jack, *Carynx ruber*, and blue runner, *C. crysos*) and scombrids (cero mackerel, *Scomberomorus regalis*) were infrequently observed, in part due to their highly mobility and their loose association with reefs. On the other hand, the coney appears to represent a strongly reef-associated resident species that displayed no habitat preference. This species was the most abundant serranid, occurring with moderate to high frequency at all studied reef sites. The coney is important to both the recreational and commercial fishery of the USVI (Appledoorn et al. 1992; Bolden 1994). The graysby, another frequently observed serranid, showed habitat preference for reefs with a high degree of topographic complexity.

As adults, lutjanids are largely residents of reef habitats. However, the juveniles of many lutjanid species, as well as haemulids and chaetodontids, depend upon "nursery habitats" during their early post-settlement life. On St. Croix for example, Adams and Tobias (1993) documented the importance of an estuarine environment (Salt River) for juvenile schoolmasters (*L. apodus*), french grunts (*Haemulon flavolineatum*), and foureye butterflyfish (*C. capistratus*). Likewise, St. Croix embayments (comprised of patch reef, sand and seagrass habitats) appear to function as important nursery habitats for French grunts and yellowtail snapper (Mateo and Tobias 2001). In our study, adults of these species (but not juveniles) were commonly observed on reefs. For example, adult French grunts were among the most frequently observed fish (~ 80% of all censuses), but no juveniles were observed at these reef sites. For such species, these results serve to underscore the connectivity between adult populations on reefs and juvenile populations residing in nursery habitats.

Nonetheless, it is clear that many of the long-lived reef species were relatively rare. Commercially and recreationally important species such as the red hind (*E. guttatus*) or mutton snapper (*L. analis*) were observed only infrequently (6.1% and 3.7% of censuses, respectively). Some of the larger non-piscivorous reef species such as the french angelfish (*Pomacanthus paru*), queen angelfish (*Holacanthus ciliaris*), or puddingwife (*Halichoeres radiatus*) were also rare in our studies. Formerly, all of the above species were considered "common" on St. Croix reefs (Clavijo et al 1980). Overfishing is the likely explanation for the relative rarity of these species. Establishment of a marine protected area should augment populations of long-lived fish species with high susceptibility to fishing pressures (Bohnsack 1993), such as those discussed above.

Crosby and Reese (1996) have suggested that butterflyfish density is an indicator of reef health. In our study, butterflyfish reached their greatest abundance and diversity at Salt River canyon. This distribution pattern was unique among fishes in our study. Localized abundance at Salt River Canyon may be due to reduced fishing pressure in the immediate vicinity - chaetodontids are readily caught in fish traps (DFW, unpubl. SEAMAP study) or to the proximity of nursery habitat (Salt River Estuary; see Adams and Tobias 1993), which may augment local butterflyfish populations. Alternatively, the chaetodontids species may share a habitat preference for some unidentified feature of the submarine canyon itself.

Recommendations:

Continued monitoring of these seven reef sites should be conducted semi-annually. One or two additional reef sites should be added to include reef fish communities along the southern insular shelf of St. Croix. The visual census method used here is robust and reproducible and should therefore be used in future monitoring efforts. However, a second assessment method, such as the timed random diver swim (TRDS) method, should also be included in the protocol. Sufficient TRDS replicates (performed on an annual or biannual basis) would establish a species lists for each reef site and enable more powerful inferences regarding rare species.

Population assessments of large, resident reef fishes were compromised by the rarity of these fish. This is particularly troublesome because many are commercially and recreationally important species. However, for species such as the Nassau grouper (*Epinephelus striata*), goliath grouper (*E. itajara*), tiger grouper (*Mycteroperca tigris*), black grouper (*M. bonaci*), yellowfin grouper (*M. venenosa*), mutton snapper (*Lutjanus analis*), and cubera snapper (*L. cyanopterus*), populations are probably too low to adequately assess them by any of the aforementioned visual census methods. Instead, future monitoring efforts should be directed towards censusing these species during their annual spawning aggregations (e.g. Colin 1996). Aggregation sites are already known for at least two species on St. Croix (*L. analis* and *E. guttatus*) and these could be monitored using diver surveys or ROV.

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Figure 1. Map of St. Croix showing the seven reef sites where fish visual censuses were conducted. Abbreviations are as follows: Lang Bank (LB), Jacks and Isaacs Bay (JI), East Wall (EW) of Salt River Canyon, West Wall (WW) of Salt River Canyon, Eagle Ray (ER) on Long Reef, Cane Bay (CB), and Sprat Hole (SH).

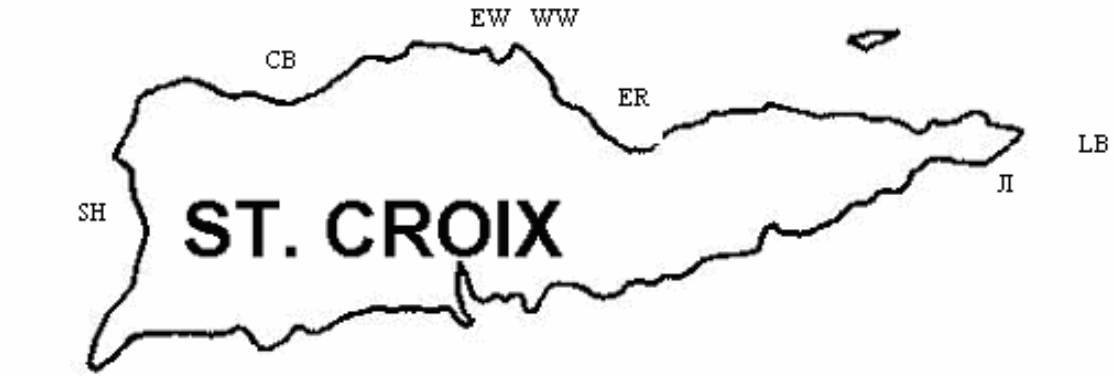
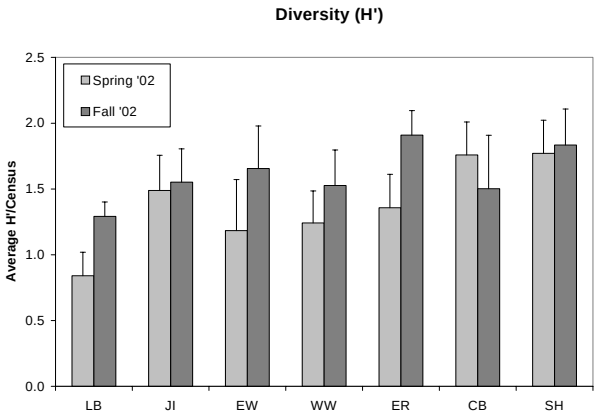


Figure 2. Summary of fish community structure at seven St. Croix reef sites.

A.



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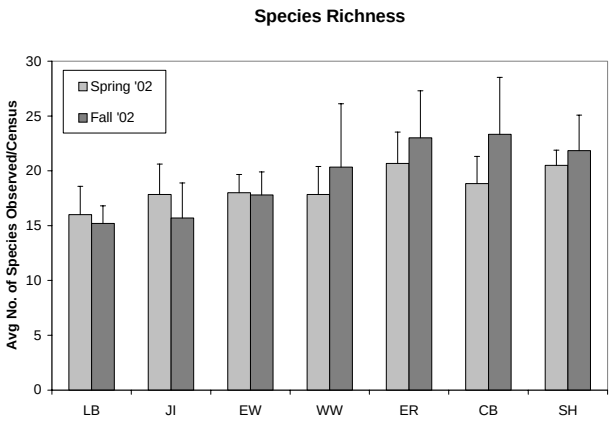

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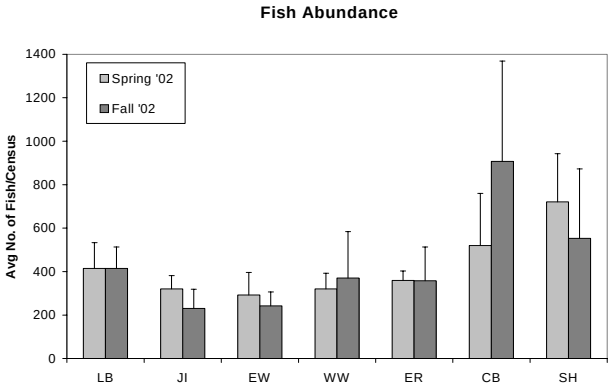


Figure 3. Fish abundance by family at seven St. Croix reef sites. Error bars show range of average abundance values across sites.

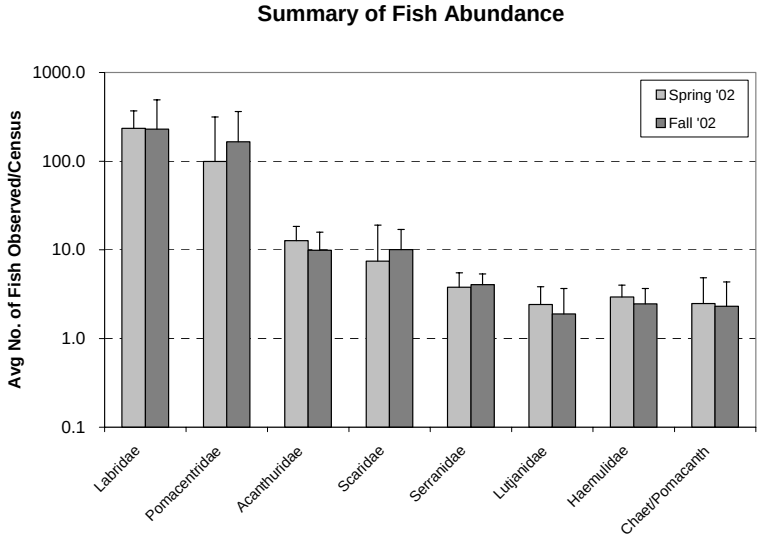
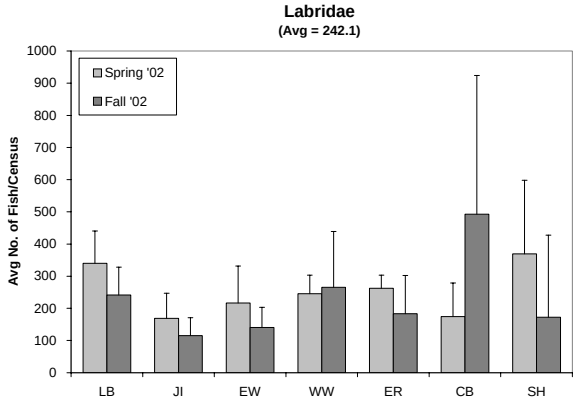


Figure 4. Abundance of fishes representing 8 families at 7 St. Croix reef sites. Families are: A. Labridae (wrasses), B. Pomacentridae (damselfishes), C. Acanthuridae (surgeonfishes), D. Scaridae (parrotfishes), E. Serranidae (groupers), F. Lutjanidae (snappers), G. Haemulidae (grunts), and H. Chaetodontidae (butterflyfishes) and Pomacanthidae (anglefishes). Error bars represent standard deviation.

A



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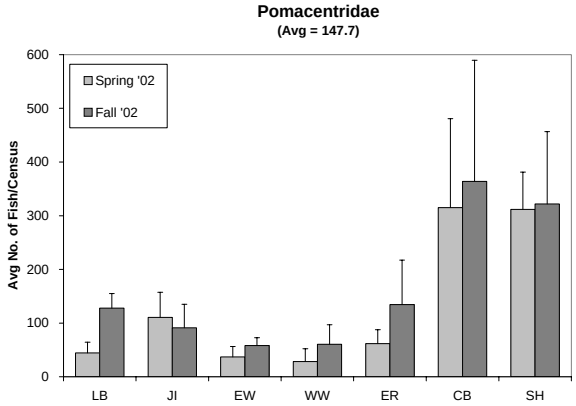

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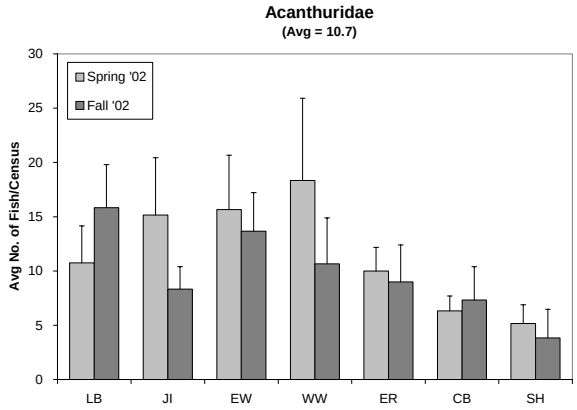

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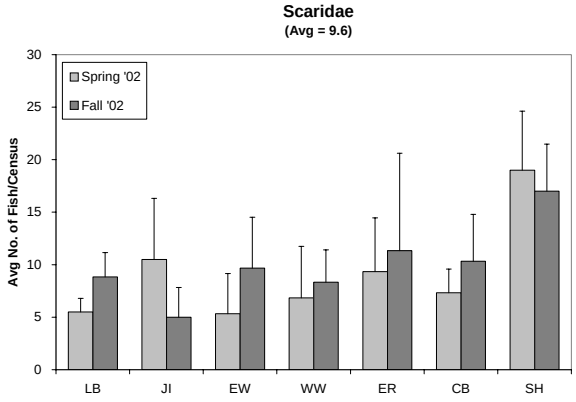
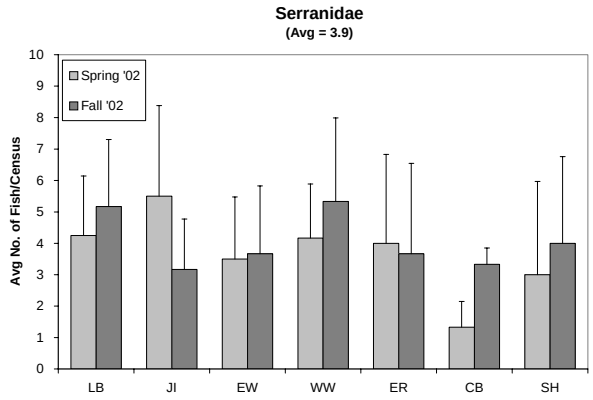
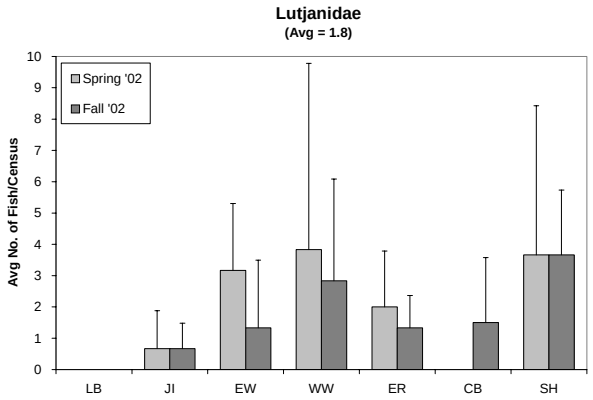


Figure 4 (continued). Abundance of fishes representing 8 families at 7 St. Croix reef sites. Families are: A. Labridae (wrasses), B. Pomacentridae (damselfishes), C. Acanthuridae (surgeonfishes), D. Scaridae (parrotfishes), E. Serranidae (groupers), F. Lutjanidae (snappers), G. Haemulidae (grunts), and H. Chaetodontidae (butterflyfishes) and Pomacanthidae (anglefishes). Error bars represent standard deviation.

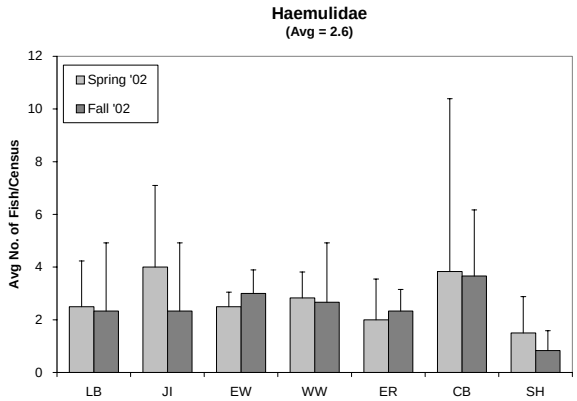
E.



F.



G.



H.

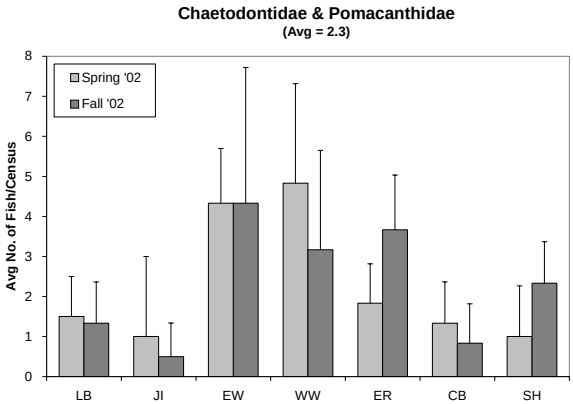


Table 1. Description of St. Croix reef sites for fish census study.

Reef Site	Lang Bank	Jack's & Isaac's	East Wall (Salt River)	West Wall (Salt River)	Eagle Ray (Long Reef)	Cane Bay	Sprat Hole
Abbreviation	LB	JI	EW	WW	ER	CB	SH
Location	East	Southeast	North	North	North	Northwest	West
Latitude	N 17º 44.448'	N 17º 44.586'	N 17º 47.221'	N 17º 47.116'	N 17º 45.688'	N 17º 46.433'	N 17º 44.038'
Longitude	W 64º 32.186'	W 64º 34.310'	W 64º 45.445'	W 64º 45.564'	W 64º 41.929'	W 64º 48.810'	W 64º 53.722'
Min. Depth	44	36	32	24	22	24	30
Max. Depth	48	49	45	27	35	36	35
Avg. Depth	45.8	41.7	36.8	25.3	28.0	28.8	32.3
Reef Description[1]	Submarine Hardgounds	Fringing Reef	Sloping Cobble, Canyon Wall	Steep Canyon Wall	Barrier Reef	Shelf-Edge Reef	Shelf-Edge Reef
Vertical Relief[2]	Low	Moderate	Moderate	Low & High	High	High	High
% Cover Live Coral[3]	~ 5%	~ 9%	~ 12 %	~ 11%	~ 7%	~ 23%	~ 25%
% Cover Turf Algae[3]	~ 80%	~ 50%	~ 72%	~ 78%	~ 70%	~ 60%	~ 60%

*notes:

1. After Hubbard (1989a-d)
2. From diver observations (this study)
3. From Nemeth and Herzlieb (2002)

Table 2. Fish census effort

	LB	JI	EW	WW	ER	CB	SH
Spring 2002							
Date of Censuses	29-May	11-Jun	23, 28-May	22, 23-May	3--May	15-May	16-May
No. of censuses	4	6	6	6	6	6	6
Total Census Time (min)	91	195	187	190	233	242	255
Avg Time / Census (min)	22.8	32.5	31.2	31.7	38.8	40.3	42.5
Fall 2002							
Date of Censuses	3-Sept	4-Sept	6-Sept	12-Sept	4 & 6-Sept	10-Sept	11-Sept
No. of censuses	6	6	6	6	6	6	6
Total Census Time (min)	197	179	225	254	309	294	285
Avg Time / Census (min)	32.8	29.8	37.5	42.3	51.5	49.0	47.5

Table 3. Total number of fish and species observed during stationary fish censuses[*1]

Reef Site	Survey	LB	JI	EW	WW	ER	CB	SH	Total
No. of Fish	Spring '02	1,659[*2]	1,921	1,755	1,922	2,156	3,120	4,326	16,859
Observed	Fall '02	2,491	1,385	1,456	2,221	2,148	5,443	3,319	18,463
	Total	4,150	3,306	3,211	4,143	4,304	8,563	7,645	35,322
No. of Species	Spring '02	24	39	37	34	40	32	40	72
Observed	Fall '02	28	37	38	42	42	42	40	77
	Cumulative	32	47	47	48	52	44	49	85

Notes:

1. Values reported for Numbers of species are not additive because there is substantial overlap in species compositions among different reef sites and between sampling periods.
2. Total number of fish from 4 replicate censuses.

Table 4. The 25 most abundant fish species observed in this study.

			Spring '02			Fall '02				
Common Name	Species	Family	Total No. of Fish Observed	Avg No. Fish per Census	% Freq (n=40)	Total No. of Fish Observed	Avg No. Fish per Census	% Freq (n=42)	Total No. of Fish	% of All Obs*
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	7,790	194.8	97.5	5,830	138.8	97.6	13,620	38.6
creole wrasse	*Clepticus parrae*	Labridae	2,010	50.3	45	3,635	86.5	38.1	5,645	16.0
bicolor damselfish	*Stegastes partitus*	Pomacentridae	1,466	36.7	100	2,485	59.2	100.0	3,951	11.2
brown chromis	*Chromis multilineata*	Pomacentridae	1,661	41.5	40	2,172	51.7	40.5	3,833	10.9
blue chromis	*Chromis cyanea*	Pomacentridae	1,864	46.6	75	1,880	44.8	76.2	3,744	10.6
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	367	9.2	97.5	287	6.8	97.6	654	1.9
yellowhead wrasse	*Halichoeres garnoti*	Labridae	162	4.1	72.5	149	3.5	81.0	311	0.9
black durgon	*Melichthys niger*	Balistidae	94	2.4	50	201	4.8	52.4	295	0.8
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	144	3.6	90	139	3.3	83.3	283	0.8
princess parrotfish	*Scarus taeniopterus*	Scaridae	138	3.5	87.5	138	3.3	85.7	276	0.8
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	150	3.8	60	100	2.4	50.0	250	0.7
threespot damselfish	*Stegastes planifrons*	Pomacentridae	111	2.8	22.5	94	2.2	21.4	205	0.6
coney	*Cephalopholis fulvus*	Serranidae	97	2.4	72.5	108	2.6	81.0	205	0.6
sergeant major	*Abudefduf saxatilis*	Pomacentridae	47	1.2	32.5	157	3.7	42.9	204	0.6
blue tang	*Acanthurus coeruleus*	Acanthuridae	89	2.2	87.5	106	2.5	90.5	195	0.6
french grunt	*Haemulon flavolineatum*	Haemulidae	93	2.3	82.5	85	2.0	78.6	178	0.5
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	14	0.4	17.5	158	3.8	23.8	172	0.5
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	59	1.5	57.5	61	1.5	54.8	120	0.3
stoplight parrotfish	*Sparisoma viride*	Scaridae	36	0.9	55	62	1.5	64.3	98	0.3
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	46	1.2	60	48	1.1	52.4	94	0.3

Table 4 (continued). The 25 most abundant fish species observed in this study.

			Spring '02			Fall '02				
Common Name	Species	Family	Total No. of Fish Observed	Avg No. Fish per Census	% Freq (n=40)	Total No. of Fish Observed	Avg No. Fish per Census	% Freq (n=42)	Total No. of Fish	% of All Obs*
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	19	0.5	22.5	73	1.7	40.5	92	0.3
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	45	1.1	35	43	1.0	33.3	88	0.2
yellowtail snapper	*Ocyurus chrysurus*	Lutjanidae	49	1.2	32.5	23	0.5	16.7	72	0.2
mahogany snapper	*Lutjanus mahogoni*	Lutjanidae	23	0.6	12.5	27	0.6	23.8	50	0.1
fairy basslet	*Gramma loreto*	Grammatidae	11	0.3	10	37	0.9	16.7	48	0.1
		Subtotal =	16,585		Subtotal =	18,098		Subtotal =	34,683	98.2

* percent of all observations (n = 35,322)

Appendix 1. Distribution of observations on 85 fish species across seven St. Croix reef sites.

			Lang Bank		Jacks		East Wall		West Wall		Eagle Ray		Cane Bay		Sprat Hole	
Common Name	Species	Family	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
doctorfish	*Acanthurus chirurgus*	Acanthuridae	1	1	1	1	1			1		1	1	1		
blue tang	*Acanthurus coeruleus*	Acanthuridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
trumpetfish	*Aulostomus maculatus*	Aulostomidae					1	1				1	1		1	1
queen triggerfish	*Balistes vetula*	Balistidae	1	1												
black durgon	*Melichthys niger*	Balistidae	1	1		1	1	1	1	1	1		1	1		
peacock flounder	*Bothus lunatus*	Bothidae								1						
blue runner	*Caranx crysos (C. fusus)*	Carangidae			1											1
bar jack	*Caranx ruber*	Carangidae			1	1	1	1	1	1		1	1	1	1	1
longsnout butterflyfish	*Chaetodon aculeatus*	Chaetodontidae					1	1	1	1						
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae					1	1	1	1	1	1	1	1	1	1
spotfin butterflyfish	*Chaetodon ocellatus*	Chaetodontidae					1	1								
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	1	1	1	1	1	1	1			1				
yellowfin mojarra	*Gerres cinereus*	Gerreidae								1					1	
fairy basslet	*Gramma loreto*	Grammatidae											1	1	1	1
tomtate	*Haemulon aurolineatum*	Haemulidae			1	1										
caesar grunt	*Haemulon carbonarium*	Haemulidae		1	1	1						1		1	1	
smallmouth grunt	*Haemulon chrysargyreum*	Haemulidae			1									1		
french grunt	*Haemulon flavolineatum*	Haemulidae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
white grunt	*Haemulon plumieri*	Haemulidae					1	1		1	1			1		

Appendix 1 (continued). Distribution of observations on 85 fish species across seven St. Croix reef sites.

			Lang Bank		Jacks		East Wall		West Wall		Eagle Ray		Cane Bay		Sprat Hole	
Common Name	Species	Family	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
bluestriped grunt	*Haemulon sciurus*	Haemulidae	1			1	1						1	1		
squirrelfish	*Holocentrus adcensionis*	Holocentridae		1		1		1	1	1		1	1	1	1	
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	1	1	1	1	1			1	1	1		1		
blackbar soldierfish	*Myripristis jacobus*	Holocentridae			1	1		1	1	1	1	1	1	1	1	1
longjaw squirrelfish	*Neoniphon marianus*	Holocentridae												1		
spanish hogfish	*Bodianus rufus*	Labridae		1	1	1	1				1	1	1	1	1	1
creole wrasse	*Clepticus parrae*	Labridae				1			1	1	1	1	1	1	1	1
slippery dick	*Halichoeres bivittatus*	Labridae	1						1							
yellowcheek wrasse	*Halichoeres cyanocephalus*	Labridae		1								1				
yellowhead wrasse	*Halichoeres garnoti*	Labridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
clown wrasse	*Halichoeres maculipinna*	Labridae	1	1		1										1
puddingwife	*Halichoeres radiatus*	Labridae			1											
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
mutton snapper	*Lutjanus analis*	Lutjanidae										1				1
schoolmaster	*Lutjanus apodus*	Lutjanidae			1	1		1	1	1	1	1		1	1	1
mahogany snapper	*Lutjanus mahogoni*	Lutjanidae			1	1								1	1	1
yellowtail snapper	*Ocyurus Chrysurus*	Lutjanidae					1	1	1	1	1	1				
sand tilefish	*Malacanthus plumieri*	Malacanthidae			1	1									1	
scrawled filefish	*Aluterus scripta*	Monacanthidae			1					1						
orangespotted filefish	*Cantherhines pullus*	Monacanthidae		1			1	1		1			1	1		

Appendix 1 (continued). Distribution of observations on 85 fish species across seven St. Croix reef sites.

			Lang Bank		Jacks		East Wall		West Wall		Eagle Ray		Cane Bay		Sprat Hole	
Common Name	Species	Family	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
yellow goatfish	*Mulloidichthys martinicus*	Mullidae				1	1	1		1	1	1	1	1	1	1
spotted goatfish	*Psuedupeneus maculatus*	Mullidae					1			1	1	1				
spotted moray	*Gymnothorax moringa*	Muraenidae														1
honeycomb cowfish	*Acanthostracion ploygonia*	Ostraciidae			1	1		1			1				1	
scrawled cowfish	*Acanthostracion quadricornis*	Ostraciidae	1													
spotted trunkfish	*Lactophrys bicaudalis*	Ostraciidae										1		1		
smooth trunkfish	*Lactophrys triqueter*	Ostraciidae				1		1				1				1
queen angelfish	*Holacanthus ciliaris*	Pomacanthidae	1													
rock beauty	*Holacanthus tricolor*	Pomacanthidae	1	1	1	1		1	1	1		1			1	1
French angelfish	*Pomacanthus paru*	Pomacanthidae					1									
sergeant major	*Abudefduf saxatilis*	Pomacentridae			1		1	1	1	1	1	1	1	1	1	
blue chromis	*Chromis cyanea*	Pomacentridae	1	1	1	1	1	1	1		1	1	1	1	1	1
brown chromis	*Chromis multilineata*	Pomacentridae			1	1			1	1	1	1	1	1	1	1
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae		1	1	1	1	1	1	1	1	1	1	1	1	
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae			1	1			1	1	1	1	1	1	1	1
beaugregory	*Stegastes leucostictus*	Pomacentridae			1				1		1	1		1		
bicolor damselfish	*Stegastes partitus*	Pomacentridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Appendix 1 (continued). Distribution of observations on 85 fish species across seven St. Croix reef sites.

			Lang Bank		Jacks		East Wall		West Wall		Eagle Ray		Cane Bay		Sprat Hole	
Common Name	Species	Family	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
threespot damselfish	*Stegastes planifrons*	Pomacentridae											1	1	1	1
cocoa damselfish	*Stegastes variabilis*	Pomacentridae									1	1			1	
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	1	1	1	1	1	1	1	1	1	1		1	1	1
princess parrotfish	*Scarus taeniopterus*	Scaridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
queen parrotfish	*Scarus vetula*	Scaridae			1				1	1	1		1		1	1
greenblotch parrotfish	*Sparisoma atomarium*	Scaridae						1								
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
redtail parrotfish	*Sparisoma chrysopterum*	Scaridae		1	1	1				1	1					
yellowtail parrotfish	*Sparisoma rubripinne*	Scaridae								1						
stoplight parrotfish	*Sparisoma viride*	Scaridae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
highhat	*Pareques acuminatus*	Sciaenidae				1										
cero mackerel	*Scomberomorus regalis*	Scombridae								1						
spotted scorpionfish	*Scorpaena plumieri*	Scorpaenidae			1											
graysby	*Cephalopholis cruentatus*	Serranidae					1	1			1	1	1	1	1	1
coney	*Cephalopholis fulvus*	Serranidae	1	1	1	1	1	1	1	1	1	1	1	1	1	1
red hind	*Epinephelus guttatus*	Serranidae		1	1		1	1				1				
yellowtail hamlet	*Hypoplectrus chlorurus*	Serranidae							1		1					1
shy hamlet	*Hypoplectrus guttavarius*	Serranidae					1			1					1	
black hamlet	*Hypoplectrus nigricans*	Serranidae					1				1			1		1

Appendix 1 (continued). Distribution of observations on 85 fish species across seven St. Croix reef sites.

			Lang Bank		Jacks		East Wall		West Wall		Eagle Ray		Cane Bay		Sprat Hole	
Common Name	Species	Family	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall
barred hamlet	*Hypoplectrus puella*	Serranidae								1					1	1
butter hamlet	*Hypoplectrus unicolor*	Serranidae					1				1					
greater soapfish	*Rypticus saponaceus*	Serranidae						1								
tobaccofish	*Serranus tabacarius*	Serranidae						1			1					
harlequin bass	*Serranus tigrinus*	Serranidae	1	1			1	1	1	1	1	1		1	1	1
jolthead porgy	*Calamus bajonado*	Sparidae									1					
sand diver	*Synodus intermedius*	Synodontidae							1							1
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae			1			1	1	1	1	1	1	1	1	1
porcupinefish	*Diodon hystrix*	Tetraodontidae														1
Grand Total =	85 species	Subtotal =	24	28	39	37	37	38	34	42	40	42	32	42	40	40

Appendix 2A. Fish census data from Lang Bank

Common Name	Species	Family	Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
			(n=4)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	30	7.5	2.6	14.5	11	17	100.0	64	10.7	2.8	14.8	10	20
doctorfish	*Acanthurus chirurgus*	Acanthuridae	50.0	2	0.5	0.6	18.0	17	19	33.3	7	1.2	2.0	20.5	17	23
blue tang	*Acanthurus coeruleus*	Acanthuridae	100.0	11	2.8	1.7	16.3	14	19	100.0	24	4.0	1.5	14.7	10	19
queen triggerfish	*Balistes vetula*	Balistidae	25.0	1	0.3	0.5	27.0	27	27	16.7	1	0.2	0.4	20.0	20	20
black durgon	*Melichthys niger*	Balistidae	100.0	15	3.8	4.2	22.0	20	26	83.3	58	9.7	11.1	21.0	15	30
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	25.0	2	0.5	1.0	10.5	10	11	33.3	4	0.7	1.0	12.3	11	14
caesar grunt	*Haemulon carbonarium*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	20.0	20	20
french grunt	*Haemulon flavolineatum*	Haemulidae	100.0	9	2.3	1.3	15.8	15	18	66.7	13	2.2	2.2	16.5	14	20
bluestriped grunt	*Haemulon sciurus*	Haemulidae	25.0	1	0.3	0.5	26.0	26	26	0.0	0	0.0	0.0	-	-	-
squirrelfish	*Holocentrus acensionis*	Holocentridae	0.0	0	0.0	0.0	-	-	-	50.0	6	1.0	1.3	15.8	10	20
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	100.0	5	1.3	0.5	17.5	17	20	50.0	5	0.8	1.2	16.5	16	17
spanish hogfish	*Bodianus rufus*	Labridae	0.0	0	0.0	0.0	-	-	-	50.0	3	0.5	0.5	14.3	9	17
slippery dick	*Halichoeres bivittatus*	Labridae	50.0	8	2.0	2.4	6.0	5	9	0.0	0	0.0	0.0	-	-	-
yellowcheek wrasse	*Halichoeres cyanocephalus*	Labridae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	18.5	12	25
yellowhead wrasse	*Halichoeres garnoti*	Labridae	100.0	11	2.8	1.0	10.5	8	16	83.3	25	4.2	3.1	9.1	4	18
clown wrasse	*Halichoeres maculipinna*	Labridae	25.0	2	0.5	1.0	9.5	8	11	33.3	15	2.5	4.0	5.5	3	9

Appendix 2A (continued). Fish census data from Lang Bank

Common Name	Species	Family	Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
			(n=4)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	1340	335.0	102.5	3.0	2	9	100.0	1405	234.2	86.2	4.3	2	10
orangespotted filefish	*Cantherhines pullus*	Monacanthidae	0.0	0	0.0	0.0	-	-	-	33.3	3	0.5	0.8	21.8	17	25
scrawled cowfish	*Acanthostracion quadricornis*	Ostraciidae	25.0	1	0.3	0.5	22.0	22	22	0.0	0	0.0	0.0	-	-	-
queen angelfish	*Holacanthus ciliaris*	Pomacanthidae	25.0	1	0.3	0.5	25.0	25	25	0.0	0	0.0	0.0	-	-	-
rock beauty	*Holacanthus tricolor*	Pomacanthidae	75.0	3	0.8	0.5	17.7	15	22	33.3	4	0.7	1.0	9.0	3	20
blue chromis	*Chromis cyanea*	Pomacentridae	75.0	7	1.8	1.5	4.0	3	7	83.3	45	7.5	4.4	4.8	2	8
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	0	0	0	0	-	-	-	16.7	1	0.2	0.4	12.0	12	12
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	171	42.8	18.6	4.0	2	6	100.0	721	120.2	25.6	3.8	2	6
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	25.0	1	0.3	0.5	24.0	24	24	16.7	1	0.2	0.4	30.0	30	30
princess parrotfish	*Scarus taeniopterus*	Scaridae	100.0	11	2.8	1.3	16.8	12	21	100.0	28	4.7	1.9	17.2	10	30
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	75.0	7	1.8	1.3	14.7	12	18	83.3	16	2.7	1.8	17.0	10	20
redtail parrotfish	*Sparisoma chrysopterum*	Scaridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	22.0	22	22
stoplight parrotfish	*Sparisoma viride*	Scaridae	50.0	3	0.8	1.0	27.8	25	30	50.0	7	1.2	1.5	30.7	25	40
coney	*Cephalopholis fulvus*	Serranidae	100.0	14	3.5	2.4	16.6	14	20	100.0	29	4.8	2.4	15.2	10	22
red hind	*Epinephelus guttatus*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	25.0	25	25
harlequin bass	*Serranus tigrinus*	Serranidae	50.0	3	0.8	1.0	8.3	6	10	16.7	1	0.2	0.4	7.0	7	7
			Total=	1659						Total=	2491					

Appendix 2B. Fish census data from Jacks & Isaacs Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	74	12.3	5.5	15.0	7	20	100.0	32	5.3	1.2	13.7	6	20
doctorfish	*Acanthurus chirurgus*	Acanthuridae	50.0	5	0.8	1.2	19.0	17	21	16.7	1	0.2	0.4	18.0	18	18
blue tang	*Acanthurus coeruleus*	Acanthuridae	100.0	12	2.0	0.9	14.7	8	20	100.0	17	2.8	1.0	11.2	3	17
black durgon	*Melichthys niger*	Balistidae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	17.5	15	20
blue runner	*Caranx crysos (C. fusus)*	Carangidae	16.7	1	0.2	0.4	30.0	30	30	0.0	0	0.0	0.0	-	-	-
bar jack	*Caranx ruber*	Carangidae	16.7	2	0.3	0.8	22.5	21	24	16.7	2	0.3	0.8	20.0	20	20
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	16.7	4	0.7	1.6	11.0	10	12	16.7	2	0.3	0.8	9.0	8	10
tomtate	*Haemulon aurolineatum*	Haemulidae	16.7	1	0.2	0.4	19.0	19	19	16.7	2	0.3	0.8	14.5	14	15
caesar grunt	*Haemulon carbonarium*	Haemulidae	16.7	1	0.2	0.4	19.0	19	19	16.7	1	0.2	0.4	16.0	16	16
smallmouth grunt	*Haemulon chrysargyreum*	Haemulidae	16.7	3	0.5	1.2	12.0	12	12	0.0	0	0.0	0.0	-	-	-
french grunt	*Haemulon flavolineatum*	Haemulidae	83.3	19	3.2	2.9	18.0	14	23	66.7	9	1.5	1.6	15.5	13	16
bluestriped grunt	*Haemulon sciurus*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.8	19.0	18	20
squirrelfish	*Holocentrus acensionis*	Holocentridae	0.0	0	0.0	0.0	-	-	-	33.3	3	0.5	0.8	19.3	19	20
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	83.3	7	1.2	0.8	19.6	18	22	33.3	2	0.3	0.5	16.5	16	17
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	66.7	7	1.2	1.2	16.4	16	18	33.3	6	1.0	2.0	13.5	12	15
spanish hogfish	*Bodianus rufus*	Labridae	33.3	2	0.3	0.5	18.5	17	20	16.7	1	0.2	0.4	6.0	6	6
creole wrasse	*Clepticus parrae*	Labridae	0.0	0	0.0	0.0	-	-	-	33.3	13	2.2	4.8	10.0	4	15

Appendix 2B (continued). Fish census data from Jacks & Isaacs Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
yellowhead wrasse	*Halichoeres garnoti*	Labridae	83.3	13	2.2	1.3	9.8	6	17	83.3	16	2.7	2.6	9.0	4	15
clown wrasse	*Halichoeres maculipinna*	Labridae	0.0	0	0.0	0.0	-	-	-	16.7	20	3.3	8.2	3.5	3	5
puddingwife	*Halichoeres radiatus*	Labridae	16.7	1	0.2	0.4	8.0	8	8	0.0	0	0.0	0.0	-	-	-
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	995	165.8	78.3	5.3	2	12	100.0	640	106.7	59.6	4.0	2	10
schoolmaster	*Lutjanus apodus*	Lutjanidae	16.7	1	0.2	0.4	17.0	17	17	16.7	1	0.2	0.4	20.0	20	20
mahogany snapper	*Lutjanus mahogoni*	Lutjanidae	16.7	3	0.5	1.2	22.0	20	22	33.3	3	0.5	0.8	18.0	15	20
sand tilefish	*Malacanthus plumieri*	Malacanthidae	50.0	3	0.5	0.5	27.3	26	30	16.7	1	0.2	0.4	25.0	25	25
scrawled filefish	*Aluterus scripta*	Monacanthidae	16.7	1	0.2	0.4	25.0	25	25	0.0	0	0.0	0.0	-	-	-
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	0.0	0	0.0	0.0	-	-	-	16.7	5	0.8	2.0	18.0	16	20
honeycomb cowfish	*Acanthostracion ploygonia*	Ostraciidae	33.3	2	0.3	0.5	24.0	22	26	16.7	1	0.2	0.4	20.0	20	20
smooth trunkfish	*Lactophrys triqueter*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	33.3	3	0.5	0.8	17.0	15	20
rock beauty	*Holacanthus tricolor*	Pomacanthidae	33.3	2	0.3	0.5	11.5	8	15	16.7	1	0.2	0.4	18.0	18	18
sergeant major	*Abudefduf saxatilis*	Pomacentridae	16.7	1	0.2	0.4	13.0	13	13	0.0	0	0.0	0.0	-	-	-
blue chromis	*Chromis cyanea*	Pomacentridae	100.0	197	32.8	32.0	5.3	2	8	100.0	139	23.2	19.3	4.3	2	7
brown chromis	*Chromis multilineata*	Pomacentridae	16.7	8	1.3	3.3	5.5	5	6	16.7	2	0.3	0.8	5.5	5	6
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	50.0	6	1.0	1.1	12.2	11	13	66.7	6	1.0	0.9	12.3	12	13
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	33.3	3	0.5	0.8	7.8	6	10	16.7	1	0.2	0.4	8.0	8	8
beaugregory	*Stegastes leucostictus*	Pomacentridae	33.3	3	0.5	0.8	7.0	6	8	0.0	0	0.0	0.0	-	-	-

Appendix 2B (continued). Fish census data from Jacks & Isaacs Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	446	74.3	22.5	5.1	3	7	100.0	400	66.7	31.1	3.8	2	6
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	16.7	2	0.3	0.8	13.0	12	14	16.7	3	0.5	1.2	10.0	6	18
princess parrotfish	*Scarus taeniopterus*	Scaridae	83.3	17	2.8	2.8	15.4	8	22	66.7	5	0.8	0.8	21.5	16	30
queen parrotfish	*Scarus vetula*	Scaridae	16.7	2	0.3	0.8	21.0	20	22	0.0	0	0.0	0.0	-	-	-
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	100.0	24	4.0	1.3	14.2	5	25	100.0	17	2.8	1.6	16.8	10	22
redtail parrotfish	*Sparisoma chrysopterum*	Scaridae	16.7	12	2.0	4.9	23.0	18	24	16.7	1	0.2	0.4	22.0	22	22
stoplight parrotfish	*Sparisoma viride*	Scaridae	66.7	6	1.0	0.9	19.5	15	24	50.0	4	0.7	0.8	22.7	16	30
highhat	*Pareques acuminatus*	Sciaenidae	0.0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.8	11.5	8	15
spotted scorpionfish	*Scorpaena plumieri*	Scorpaenidae	16.7	1	0.2	0.4	27.0	27	27	0.0	0	0.0	0.0	-	-	-
coney	*Cephalopholis fulvus*	Serranidae	100.0	32	5.3	2.7	18.1	12	25	100.0	19	3.2	1.6	16.6	10	25
red hind	*Epinephelus guttatus*	Serranidae	16.7	1	0.2	0.4	22.0	22	22	0.0	0	0.0	0.0	-	-	-
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	16.7	1	0.2	0.4	5.0	5	5	0.0	0	0.0	0.0	-	-	-
			Total =	1921						Total =	1385					

Appendix 2C. Fish census data from East Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	73	12.2	4.4	14.5	12	18	100.0	62	10.3	2.8	13.3	8	18
doctorfish	*Acanthurus chirurgus*	Acanthuridae	33.3	3	0.5	0.8	20.3	19	23	0.0	0	0.0	0.0	-	-	-
blue tang	*Acanthurus coeruleus*	Acanthuridae	83.3	18	3.0	0.9	15.4	14	18	100.0	20	3.3	1.6	15.0	10	20
trumpetfish	*Aulostomus maculatus*	Aulostomidae	16.7	2	0.3	0.8	27.5	25	30	33.3	3	0.5	0.8	42.5	30	50
black durgon	*Melichthys niger*	Balistidae	83.3	11	1.8	1.5	23.7	20	25	83.3	31	5.2	7.4	21.2	15	25
bar jack	*Caranx ruber*	Carangidae	33.3	4	0.7	1.0	21.0	14	20	16.7	2	0.3	0.8	19.0	18	20
longsnout butterflyfish	*Chaetodon aculeatus*	Chaetodontidae	16.7	1	0.2	0.4	8.0	8	8	16.7	3	0.5	1.2	9.0	8	10
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	100.0	16	2.7	1.8	9.3	7	11	83.3	18	3.0	2.4	9.0	5	11
spotfin butterflyfish	*Chaetodon ocellatus*	Chaetodontidae	16.7	1	0.2	0.4	16.0	16	16	16.7	1	0.2	0.4	13.0	13	13
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	50.0	6	1.0	1.1	10.5	8	12	16.7	2	0.3	0.8	11.0	11	11
french grunt	*Haemulon flavolineatum*	Haemulidae	100.0	11	1.8	0.8	15.3	12	17	100.0	17	2.8	1.2	15.6	10	20
white grunt	*Haemulon plumieri*	Haemulidae	50.0	3	0.5	0.5	22.3	20	25	16.7	1	0.2	0.4	20.0	20	20
bluestriped grunt	*Haemulon sciurus*	Haemulidae	16.7	1	0.2	0.4	22.0	22	22	0.0	0	0.0	0.0	-	-	-
squirrelfish	*Holocentrus acensionis*	Holocentridae	0.0	0	0.0	0.0	-	-	-	16.7	3	0.5	1.2	19.0	18	20
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	50.0	5	0.8	1.0	16.2	15	17	0.0	0	0.0	0.0	-	-	-
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	18.0	18	18
spanish hogfish	*Bodianus rufus*	Labridae	16.7	2	0.3	0.8	11.5	3	20	0.0	0	0.0	0.0	-	-	-

Appendix 2C (continued). Fish census data from East Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			%Freq	No. of Fish			Size			%Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
yellowhead wrasse	*Halichoeres garnoti*	Labridae	50.0	8	1.3	1.5	9.8	5	14	100.0	22	3.7	2.6	8.6	4	14
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	1290	215.0	114.8	3.2	2	9	100.0	820	136.7	61.5	4.8	2	12
schoolmaster	*Lutjanus apodus*	Lutjanidae	0.0	0	0.0	0.0	-	-	-	16.7	5	0.8	2.0	13.0	10	15
yellowtail snapper	*Ocyurus chrysurus*	Lutjanidae	100.0	19	3.2	2.1	22.6	17	28	16.7	3	0.5	1.2	21.0	18	24
orangespotted filefish	*Cantherhines pullus*	Monacanthidae	16.7	1	0.2	0.4	17.0	17	17	16.7	1	0.2	0.4	16.0	16	16
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	16.7	1	0.2	0.4	20.0	20	20	16.7	3	0.5	1.2	19.0	18	20
spotted goatfish	*Psuedupeneus maculatus*	Mullidae	50.0	3	0.5	0.5	18.7	16	20	0.0	0	0.0	0.0	-	-	-
honeycomb cowfish	*Acanthostracion ploygonia*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	26.0	26	26
smooth trunkfish	*Lactophrys triqueter*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	66.7	4	0.7	0.5	15.8	15	17
rock beauty	*Holacanthus tricolor*	Pomacanthidae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	17.5	13	22
french angelfish	*Pomacanthus paru*	Pomacanthidae	33.3	2	0.3	0.5	24.5	23	26	0.0	0	0.0	0.0	-	-	-
sergeant major	*Abudefduf saxatilis*	Pomacentridae	16.7	2	0.3	0.8	13.0	12	14	83.3	67	11.2	10.7	11.8	8	15
blue chromis	*Chromis cyanea*	Pomacentridae	33.3	71	11.8	24.0	3.0	2	4	50.0	65	10.8	13.9	4.3	3	7
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	83.3	5	0.8	0.4	12.4	12	13	66.7	7	1.2	1.0	11.6	10	13
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	143	23.8	7.8	4.0	2	7	100.0	211	35.2	8.1	4.0	2	6
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	16.7	2	0.3	0.8	8.0	4	12	16.7	6	1.0	2.4	5.0	4	5
princess parrotfish	*Scarus taeniopterus*	Scaridae	83.3	15	2.5	2.1	17.0	14	25	83.3	21	3.5	2.3	17.1	7	25

Appendix 2C (continued). Fish census data from East Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
greenblotch parrotfish	*Sparisoma atomarium*	Scaridae	0.0	0	0.0	0.0	-	-	-	16.7	4	0.7	1.6	14.5	14	15
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	83.3	13	2.2	1.7	16.9	12	21	83.3	21	3.5	1.9	17.2	11	23
stoplight parrotfish	*Sparisoma viride*	Scaridae	33.3	2	0.3	0.5	22.5	15	30	66.7	6	1.0	0.9	19.8	6	32
graysby	*Cephalopholis cruentatus*	Serranidae	16.7	1	0.2	0.4	17.0	17	17	16.7	1	0.2	0.4	18.0	18	18
coney	*Cephalopholis fulvus*	Serranidae	100.0	15	2.5	1.6	16.4	14	19	83.3	15	2.5	1.9	17.8	8	24
red hind	*Epinephelus guttatus*	Serranidae	16.7	1	0.2	0.4	25.0	25	25	16.7	1	0.2	0.4	20.0	20	20
shy hamlet	*Hypoplectrus guttavarius*	Serranidae	16.7	1	0.2	0.4	13.0	13	13	0.0	0	0.0	0.0	-	-	-
black hamlet	*Hypoplectrus nigricans*	Serranidae	16.7	1	0.2	0.4	14.0	14	14	0.0	0	0.0	0.0	-	-	-
butter hamlet	*Hypoplectrus unicolor*	Serranidae	16.7	1	0.2	0.4	10.0	10	10	0.0	0	0.0	0.0	-	-	-
greater soapfish	*Rypticus saponaceus*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	15.0	15	15
tobaccofish	*Serranus tabacarius*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	5.0	5	5
harlequin bass	*Serranus tigrinus*	Serranidae	16.7	1	0.2	0.4	11.0	11	11	50.0	3	0.5	0.5	7.0	5	8
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	6.0	6	6
			Total=	1755						Total=	1456					

Appendix 2D. Fish census data from West Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species Name	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	96	16.0	6.3	13.6	9	17	100.0	49	8.2	4.3	14.8	7	22
doctorfish	*Acanthurus chirurgus*	Acanthuridae	0.0	0	0.0	0.0	-	-	-	33.3	3	0.5	0.8	16.5	12	21
blue tang	*Acanthurus coeruleus*	Acanthuridae	83.3	14	2.3	1.6	16.4	14	20	100.0	12	2.0	0.6	16.8	14	20
black durgon	*Melichthys niger*	Balistidae	66.7	27	4.5	6.3	23.1	20	26	66.7	44	7.3	8.9	23.0	12	25
peacock flounder	*Bothus lunatus*	Bothidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	12.0	12	12
bar jack	*Caranx ruber*	Carangidae	16.7	1	0.2	0.4	22.0	22	22	33.3	3	0.5	0.8	29.5	18	40
longsnout butterflyfish	*Chaetodon aculeatus*	Chaetodontidae	33.3	3	0.5	0.8	6.3	6	7	33.3	3	0.5	0.8	8.0	7	10
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	100.0	20	3.3	2.3	9.5	4	11	83.3	15	2.5	1.6	9.2	7	12
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	50.0	5	0.8	1.0	11.5	11	12	0.0	0	0.00	0.0	-	-	-
yellowfin mojarra	*Gerres cinereus*	Gerreidae	0.0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.8	25.0	24	26
french grunt	*Haemulon flavolineatum*	Haemulidae	100.0	17	2.8	1.0	13.8	9	17	83.3	15	2.5	2.4	17.2	15	20
white grunt	*Haemulon plumieri*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	22.0	22	22
squirrelfish	*Holocentrus adcensionis*	Holocentridae	33.3	3	0.5	0.8	17.3	15	20	16.7	1	0.2	0.4	18.0	18	18
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	16.5	16	17
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	16.7	1	0.2	0.4	14.0	14	14	16.7	1	0.2	0.4	15.0	15	15
creole wrasse	*Clepticus parrae*	Labridae	66.7	136	22.7	27.0	10.5	8	15	66.7	345	57.5	58.8	16.3	10	20

Appendix 2D (continued). Fish census data from West Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species Name	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
slippery dick	*Halichoeres bivittatus*	Labridae	16.7	2	0.3	0.8	2.5	2	3	0.0	0	0.0	0.0	-	-	-
yellowhead wrasse	*Halichoeres garnoti*	Labridae	33.3	2	0.3	0.5	10.0	10	10	83.3	14	2.3	1.2	9.4	5	15
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	1333	222.2	41.8	3.0	1.5	10	100.0	1235	205.8	130.2	4.6	2	10
schoolmaster	*Lutjanus apodus*	Lutjanidae	33.3	3	0.5	0.8	22.0	18	25	33.3	2	0.3	0.5	30.0	30	30
yellowtail snapper	*Ocyurus chrysurus*	Lutjanidae	33.3	20	3.3	5.2	25.0	20	30	50.0	15	2.5	2.8	26.0	21	30
scrawled filefish	*Aluterus scripta*	Monacanthidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	35.0	35	35
orangespotted filefish	*Cantherhines pullus*	Monacanthidae	0.0	0	0.0	0.0	-	-	-	50.0	3	0.5	0.5	15.7	15	16
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	0.0	0	0.0	0.0	-	-	-	16.7	4	0.7	1.6	17.0	16	19
spotted goatfish	*Psuedupeneus maculatus*	Mullidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	20.0	20	20
rock beauty	*Holacanthus tricolor*	Pomacanthidae	16.7	1	0.2	0.4	17.0	17	17	16.7	1	0.2	0.4	6.0	6	6
sergeant major	*Abudefduf saxatilis*	Pomacentridae	50.0	20	3.3	5.9	11.3	10	14	50.0	20	3.3	4.3	12.8	10	14
blue chromis	*Chromis cyanea*	Pomacentridae	16.7	3	0.5	1.2	4.0	3	5	0.0	0	0.0	0.0	-	-	-
brown chromis	*Chromis multilineata*	Pomacentridae	33.3	41	6.8	14.0	5.3	4	7	33.3	90	15.0	23.5	6.0	4	7
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	100.0	14	2.3	0.8	10.0	5	12	100.0	17	2.8	1.2	12.1	2.5	15
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	100.0	39	6.5	10.1	7.9	3	12	83.3	15	2.5	1.8	8.9	7	11
beaugregory	*Stegastes leucostictus*	Pomacentridae	16.7	1	0.2	0.4	9.0	9	9	0.0	0	0.0	0.0	-	-	-

Appendix 2D (continued). Fish census data from West Wall, Salt River Canyon

			Spring '02 Census							Fall '02 Census						
			%Freq	No. of Fish			Size			%Freq	No. of Fish			Size		
Common Name	Species Name	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	52	8.7	8.7	5.3	1	12	100.0	220	36.7	10.8	4.4	2	8
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	33.3	2	0.3	0.5	24.5	24	25	50.0	6	1.0	1.3	20.2	15	23
princess parrotfish	*Scarus taeniopterus*	Scaridae	66.7	16	2.7	2.9	17.8	10	22	100.0	16	2.7	1.6	20.9	14	30
queen parrotfish	*Scarus vetula*	Scaridae	16.7	3	0.5	1.2	24.0	18	31	16.7	1	0.2	0.4	40.0	40	40
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	100.0	18	3.0	1.9	15.5	6	20	83.3	20	3.3	2.8	15.6	5	23
redtail parrotfish	*Sparisoma chrysopterum*	Scaridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	23.0	23	23
yellowtail parrotfish	*Sparisoma rubripinne*	Scaridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	25.0	25	25
stoplight parrotfish	*Sparisoma viride*	Scaridae	16.7	2	0.3	0.8	15.0	10	20	50.0	5	0.8	1.0	26.0	13	32
cero mackerel	*Scomberomorus regalis*	Scombridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	30.0	30	30
coney	*Cephalopholis fulvus*	Serranidae	100.0	19	3.2	1.5	11.5	5	18	100.0	20	3.3	1.0	18.7	12	28
yellowtail hamlet	*Hypoplectrus chlorurus*	Serranidae	16.7	2	0.3	0.8	12.5	10	15	0.0	0	0.0	0.0	-	-	-
shy hamlet	*Hypoplectrus guttavarius*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	11.0	11	11
barred hamlet	*Hypoplectrus puella*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	10.0	10	10
harlequin bass	*Serranus tigrinus*	Serranidae	66.7	4	0.7	0.5	8.0	6	9	66.7	10	1.7	1.6	8.9	7	10
sand diver	*Synodus intermedius*	Synodontidae	16.7	1	0.2	0.4	22.0	22	22	0.0	0	0.0	0.0	-	-	-
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	16.7	1	0.2	0.4	4.0	4	4	50.0	3	0.5	0.5	7.7	4	13
				Total =	1922						Total =	2221				

Appendix 2E. Fish census data from Eagle Ray

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	54	9.0	1.8	15	12	18	100.0	37	6.2	2.6	12.8	7	16
doctorfish	*Acanthurus chirurgus*	Acanthuridae	0.0	0	0.0	0.0	-	-	-	16.7	3	0.5	1.2	18.0	16	20
blue tang	*Acanthurus coeruleus*	Acanthuridae	66.7	6	1.0	0.9	15.625	12	18	83.3	14	2.3	1.8	13.7	8	18
trumpetfish	*Aulostomus maculatus*	Aulostomidae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	41.0	32	50
black durgon	*Melichthys niger*	Balistidae	16.7	2	0.3	0.8	23	22	24	0.0	0	0.0	0.0	-	-	-
bar jack	*Caranx ruber*	Carangidae	0.0	0	0.00	0.0	-	-	-	33.3	7	1.2	2.0	22.5	20	30
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	83.3	11	1.8	1.0	9.2	7	12	83.3	13	2.2	1.2	10.1	9	12
banded butterflyfish	*Chaetodon striatus*	Chaetodontidae	0.0	0	0.00	0.0	-	-	-	66.7	8	1.3	1.0	11.5	10	15
caesar grunt	*Haemulon carbonarium*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	30.0	30	30
french grunt	*Haemulon flavolineatum*	Haemulidae	83.3	10	1.7	1.8	15.8	15	17	100.0	13	2.2	1.0	14.8	12	18
white grunt	*Haemulon plumieri*	Haemulidae	33.3	2	0.3	0.5	23	21	25	0.0	0	0.0	0.0	-	-	-
squirrelfish	*Holocentrus acensionis*	Holocentridae	0.0	0	0.0	0.0	-	-	-	50.0	6	1.0	1.3	19.0	17	31
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	50.0	4	0.7	0.8	18.167	17	20	33.3	2	0.3	0.5	16.0	16	16
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	50.0	19	3.2	4.8	15.167	12	17	83.3	18	3.0	3.6	13.8	10	18
spanish hogfish	*Bodianus rufus*	Labridae	16.7	1	0.2	0.4	20	20	20	66.7	5	0.8	0.8	11.4	5	25
creole wrasse	*Clepticus parrae*	Labridae	66.7	96	16.0	12.9	7	3	12	50.0	260	43.3	70.9	6.3	2	15

Appendix 2E (continued). Fish census data from Eagle Ray

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
yellowcheek wrasse	*Halichoeres cyanocephalus*	Labridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	15.0	15	15
yellowhead wrasse	*Halichoeres garnoti*	Labridae	100.0	18	3.0	1.4	8.3333	3	15	83.3	29	4.8	3.3	8.6	4	16
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	1460	243.3	36.1	4.25	2	10	100.0	805	134.2	75.7	4.6	2	12
mutton snapper	*Lutjanus analis*	Lutjanidae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	35.0	35	35
schoolmaster	*Lutjanus apodus*	Lutjanidae	16.7	2	0.3	0.8	17	17	17	16.7	1	0.2	0.4	17.0	17	17
yellowtail snapper	*Ocyurus chrysurus*	Lutjanidae	83.3	10	1.7	1.8	20.1	15	25	50.0	5	0.8	1.2	20.7	20	25
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	33.3	2	0.3	0.5	23.5	22	25	16.7	7	1.2	2.9	17.0	0	19
spotted goatfish	*Psuedupeneus maculatus*	Mullidae	50.0	3	0.5	0.5	16.333	14	19	83.3	6	1.0	0.6	17.2	15	20
honeycomb cowfish	*Acanthostracion ploygonia*	Ostraciidae	16.7	1	0.2	0.4	24	24	24	0.0	0	0.0	0.0	-	-	-
spotted trunkfish	*Lactophrys bicaudalis*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	13.0	13	13
smooth trunkfish	*Lactophrys triqueter*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	14.0	14	14
rock beauty	*Holacanthus tricolor*	Pomacanthidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	17.0	17	17
sergeant major	*Abudefduf saxatilis*	Pomacentridae	33.3	12	2.0	3.1	11.5	10	14	83.3	57	9.5	7.4	11.7	8	14
blue chromis	*Chromis cyanea*	Pomacentridae	100.0	104	17.3	12.9	4.6667	2	8	100.0	200	33.3	11.1	5.0	3	8
brown chromis	*Chromis multilineata*	Pomacentridae	16.7	10	1.7	4.1	3	3	4	66.7	260	43.3	68.4	3.6	3	6
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	66.7	7	1.2	1.5	11.25	6	12	33.3	4	0.7	1.2	11.0	8	12

Appendix 2E (continued). Fish census data from Eagle Ray

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	83.3	31	5.2	4.0	7.2	5	10	83.3	22	3.7	2.2	8.2	6	12
beaugregory	*Stegastes leucostictus*	Pomacentridae	66.7	9	1.5	1.5	6.5	4	9	33.3	7	1.2	1.8	9.5	10	12
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	192	32.0	8.1	4.3333	2	7	100.0	251	41.8	19.6	3.8	2	6
cocoa damselfish	*Stegastes variabilis*	Pomacentridae	16.7	5	0.8	2.0	6	5	8	33.3	6	1.0	1.7	9.0	5	12
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	50.0	8	1.3	2.0	16.833	10	21	50.0	20	3.3	5.6	14.0	7	21
princess parrotfish	*Scarus taeniopterus*	Scaridae	83.3	15	2.5	1.9	17.7	10	26	66.7	13	2.2	2.2	15.5	10	22
queen parrotfish	*Scarus vetula*	Scaridae	16.7	3	0.5	1.2	30	25	35	0.0	0	0.0	0.0	-	-	-
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	83.3	21	3.5	2.7	16.9	8	24	83.3	26	4.3	3.1	16.9	10	22
redtail parrotfish	*Sparisoma chrysopterum*	Scaridae	50.0	4	0.7	0.8	26.5	20	32	0.0	0	0.0	0.0	-	-	-
stoplight parrotfish	*Sparisoma viride*	Scaridae	66.7	5	0.8	0.8	23	5	35	83.3	9	1.5	1.0	25.9	7	40
graysby	*Cephalopholis cruentatus*	Serranidae	66.7	9	1.5	1.6	16.5	14	25	50.0	4	0.7	0.8	18.7	17	20
coney	*Cephalopholis fulvus*	Serranidae	50.0	7	1.2	1.3	14.667	10	17	66.7	11	1.8	1.6	17.6	12	21
red hind	*Epinephelus guttatus*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	18.0	18	18
yellowtail hamlet	*Hypoplectrus chlorurus*	Serranidae	16.7	1	0.2	0.4	12	12	12	0.0	0	0.0	0.0	-	-	-
black hamlet	*Hypoplectrus nigricans*	Serranidae	16.7	1	0.2	0.4	13	13	13	0.0	0	0.0	0.0	-	-	-
butter hamlet	*Hypoplectrus unicolor*	Serranidae	16.7	1	0.2	0.4	11	11	11	0.0	0	0.0	0.0	-	-	-

Appendix 2E (continued). Fish census data from Eagle Ray

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
tobaccofish	*Serranus tabacarius*	Serranidae	16.7	2	0.3	0.8	4	4	4	0.0	0	0.0	0.0	-	-	-
harlequin bass	*Serranus tigrinus*	Serranidae	16.7	3	0.5	1.2	8	7	9	50.0	6	1.0	1.3	6.3	5	8
jolthead porgy	*Calamus bajonado*	Sparidae	33.3	2	0.3	0.5	25.5	25	26	0.0	0	0.0	0.0	-	-	-
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	33.3	3	0.5	0.8	5.75	5	6	33.3	3	0.5	0.8	5.5	7	7
			Total =	2156						Total =	2148					

Appendix 2F. Fish census data from Cane Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total No.	Avg. No.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	100.0	24	4.0	1.1	14.7	10	20	100.0	29	4.8	2.2	16.0	11	20
doctorfish	*Acanthurus chirurgus*	Acanthuridae	16.7	1	0.2	0.4	15.0	15	15	50.0	5	0.8	1.0	17.0	15	20
blue tang	*Acanthurus coeruleus*	Acanthuridae	100.0	13	2.2	0.4	15.8	10	20	66.7	10	1.7	1.6	15.3	11	18
trumpetfish	*Aulostomus maculatus*	Aulostomidae	16.7	1	0.2	0.4	35.0	35	35	0.0	0	0.0	0.0	-	-	-
orangespotted filefish	*Cantherhines pullus*	Monacanthidae	33.3	3	0.5	0.8	12.8	12	14	33.3	3	0.5	0.9	15.5	14	16
black durgon	*Melichthys niger*	Balistidae	100.0	39	6.5	6.4	22.0	12	28	100.0	66	11.0	6.7	22.7	13	30
bar jack	*Caranx ruber*	Carangidae	16.7	1	0.2	0.4	17.0	17	17	83.3	11	1.8	1.5	22.0	12	30
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	66.7	8	1.3	1.0	11.3	8	15	50.0	5	0.8	1.0	9.7	8	10
fairy basslet	*Gramma loreto*	Grammatidae	50.0	10	1.7	2.1	2.7	1	3	66.7	32	5.3	4.6	4.0	2	5
caesar grunt	*Haemulon carbonarium*	Haemulidae	0.0	0	0.0	0.0	-	-	-	33.3	2	0.3	0.5	21.5	18	25
smallmouth grunt	*Haemulon chrysargyreum*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.9	14.5	14	15
french grunt	*Haemulon flavolineatum*	Haemulidae	50.0	20	3.3	6.7	13.5	12	15	66.7	13	2.2	2.2	16.0	12	20
white grunt	*Haemulon plumieri*	Haemulidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	18.0	18	18
bluestriped grunt	*Haemulon sciurus*	Haemulidae	16.7	3	0.5	1.2	22.0	20	25	16.7	4	0.7	1.6	24.0	20	25
squirrelfish	*Holocentrus adcensionis*	Holocentridae	16.7	1	0.2	0.4	13.0	13	13	16.7	3	0.5	1.3	18.0	16	20
longspine squirrelfish	*Holocentrus rufus*	Holocentridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	15.0	15	15
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	16.7	2	0.3	0.8	15.0	15	15	33.3	5	0.8	1.7	17.0	15	20

Appendix 2F (continued). Fish census data from Cane Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total No.	Avg. No.	StDev	Avg	Min	Max
longjaw squirrelfish	*Neoniphon marianus*	Holocentridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	13.0	13	13
spanish hogfish	*Bodianus rufus*	Labridae	50.0	3	0.5	0.5	19.7	17	22	33.3	2	0.3	0.5	25.0	20	30
creole wrasse	*Clepticus parrae*	Labridae	66.7	311	51.8	84.9	7.0	1	16	50.0	2332	388.7	463.4	4.0	2	18
yellowhead wrasse	*Halichoeres garnoti*	Labridae	66.7	10	1.7	1.6	8.0	5	12	66.7	24	4.0	4.3	6.1	4	15
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	100.0	722	120.3	43.5	2.3	1	6	100.0	600	100.0	91.0	4.4	2	13
schoolmaster	*Lutjanus apodus*	Lutjanidae	0.0	0	0.0	0.0	-	-	-	50.0	5	0.8	1.0	36.2	30	40
mahogany snapper	*Lutjanus mahogoni*	Lutjanidae	0.0	0	0.0	0.0	-	-	-	33.3	4	0.7	1.3	19.5	18	22
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	33.3	5	0.8	1.3	16.8	12	22	50.0	12	2.0	3.4	17.0	12	19
spotted trunkfish	*Lactophrys bicaudalis*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	18.0	18	18
sergeant major	*Abudefduf saxatilis*	Pomacentridae	83.3	10	1.7	1.0	11.8	10	15	83.3	13	2.2	2.1	13.0	10	20
blue chromis	*Chromis cyanea*	Pomacentridae	100.0	682	113.7	79.0	3.7	1	10	100.0	642	107.0	62.3	5.0	2	10
brown chromis	*Chromis multilineata*	Pomacentridae	100.0	901	150.2	101.7	4.3	1	8	83.3	1170	195.0	126.2	5.2	2	10
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	83.3	12	2.0	1.1	9.9	4	14	83.3	13	2.2	1.2	13.3	4	20
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	100.0	48	8.0	5.3	8.2	5	12	100.0	36	6.0	2.8	9.8	5	15
beaugregory	*Stegastes leucostictus*	Pomacentridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	7.0	7	7
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	227	37.8	14.0	3.7	1	7	100.0	285	47.5	26.0	4.5	2	8

Appendix 2F (continued). Fish census data from Cane Bay

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total No.	Avg. No.	StDev	Avg	Min	Max
threespot damselfish	*Stegastes planifrons*	Pomacentridae	50.0	10	1.7	2.0	5.7	3	10	66.7	24	4.0	5.4	7.3	3	11
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	0.0	0	0.0	0.0	-	-	-	50.0	11	1.8	2.4	8.7	5	25
princess parrotfish	*Scarus taeniopterus*	Scaridae	100.0	18	3.0	1.1	16.9	10	22	83.3	20	3.3	3.2	19.3	5	30
queen parrotfish	*Scarus vetula*	Scaridae	16.7	1	0.2	0.4	32.0	32	32	0.0	0	0.0	0.0	-	-	-
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	83.3	20	3.3	2.3	17.4	7	24	66.7	14	2.3	1.6	16.8	10	30
stoplight parrotfish	*Sparisoma viride*	Scaridae	50.0	5	0.8	1.2	20.7	6	35	83.3	17	2.8	2.3	27.0	5	35
graysby	*Cephalopholis cruentatus*	Serranidae	33.3	2	0.3	0.5	20.0	18	22	83.3	11	1.8	0.8	18.3	15	23
coney	*Cephalopholis fulvus*	Serranidae	50.0	6	1.0	1.1	14.8	12	18	50.0	5	0.8	1.2	17.0	15	20
black hamlet	*Hypoplectrus nigricans*	Serranidae	0.0	0	0.0	0.0	-	-	-	50.0	3	0.5	0.5	9.0	6	12
harlequin bass	*Serranus tigrinus*	Serranidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	6.0	6	6
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	16.7	1	0.2	0.4	6.0	6	6	33.3	4	0.7	1.1	5.5	4	7
			Total =	3120						Total =	5443					

Appendix 2G. Fish census data from Sprat Hole

			Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
Common Name	Species Name	Family	(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
ocean surgeonfish	*Acanthurus bahianus*	Acanthuridae	83.3	16	2.7	2.1	15.1	12	18	83.3	14	2.3	2.3	15.1	12	20
blue tang	*Acanthurus coeruleus*	Acanthuridae	83.3	15	2.5	1.5	14.4	10	18	83.3	9	1.5	1.0	16.8	15	20
trumpetfish	*Aulostomus maculatus*	Aulostomidae	16.7	1	0.2	0.4	50.0	50	50	50.0	3	0.5	0.5	24.7	15	34
blue runner	*Caranx crysos (C. fusus)*	Carangidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	30.0	30	30
bar jack	*Caranx ruber*	Carangidae	33.3	5	0.8	1.6	28.0	26	30	16.7	2	0.3	0.8	21.0	20	22
foureye butterflyfish	*Chaetodon capistratus*	Chaetodontidae	33.3	4	0.7	1.0	9.0	7	11	83.3	10	1.7	0.8	9.6	7	12
yellowfin mojarra	*Gerres cinereus*	Gerreidae	16.7	2	0.3	0.8	18.5	17	20	0.0	0	0.0	0.0	-	-	-
fairy basslet	*Gramma loreto*	Grammatidae	16.7	1	0.2	0.4	2.0	2	2	50.0	5	0.8	1.0	4.0	3	5
caesar grunt	*Haemulon carbonarium*	Haemulidae	16.7	2	0.3	0.8	17.5	15	20	0.0	0	0.0	0.0	-	-	-
french grunt	*Haemulon flavolineatum*	Haemulidae	66.7	7	1.2	1.2	15.5	14	17	66.7	5	0.8	0.8	17.0	15	20
squirrelfish	*Holocentrus adcensionis*	Holocentridae	16.7	1	0.2	0.4	17.0	17	17	0.0	0	0.0	0.0	-	-	-
blackbar soldierfish	*Myripristis jacobus*	Holocentridae	83.3	16	2.7	2.9	14.2	10	17	50.0	12	2.0	2.3	15.7	14	21
spanish hogfish	*Bodianus rufus*	Labridae	16.7	1	0.2	0.4	22.0	22	22	50.0	6	1.0	1.3	15.2	5	25
creole wrasse	*Clepticus parrae*	Labridae	100.0	1467	244.5	252.7	5.5	1	14	66.7	685	114.2	240.1	9.0	2	16
yellowhead wrasse	*Halichoeres garnoti*	Labridae	83.3	100	16.7	31.3	6.3	2	14	66.7	19	3.2	3.0	7.6	4	12
clown wrasse	*Halichoeres maculipinna*	Labridae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	11.0	11	11
bluehead wrasse	*Thalassoma bifasciatum*	Labridae	83.3	650	108.3	79.6	2.7	1	10	83.3	325	54.2	31.8	4.0	2	10

Appendix 2G (continued). Fish census data from Sprat Hole

Common Name	Species Name	Family	Spring '02 Census							Fall '02 Census						
			% Freq	No. of Fish			Size			% Freq	No. of Fish			Size		
			(n=6)	Total	Avg.	StDev	Avg	Min	Max	(n=6)	Total	Avg.	StDev	Avg	Min	Max
mutton snapper	*Lutjanus analis*	Lutjanidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	38.0	38	38
schoolmaster	*Lutjanus apodus*	Lutjanidae	16.7	2	0.3	0.8	47.0	40	55	16.7	1	0.2	0.4	40.0	40	40
mahogany snapper	*Lutjanus mahogoni*	Lutjanidae	66.7	20	3.3	5.0	16.3	10	20	100.0	20	3.3	1.6	20.3	15	25
sand tilefish	*Malacanthus plumieri*	Malacanthidae	16.7	1	0.2	0.4	40.0	40	40	0.0	0	0.0	0.0	-	-	-
yellow goatfish	*Mulloidichthys martinicus*	Mullidae	33.3	6	1.0	2.0	14.0	12	16	50.0	127	21.2	31.2	14.3	10	24
spotted moray	*Gymnothorax moringa*	Muraenidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	60.0	60	60
honeycomb cowfish	*Acanthostracion ploygonia*	Ostraciidae	16.7	1	0.2	0.4	30.0	30	30	0.0	0	0.0	0.0	-	-	-
smooth trunkfish	*Lactophrys triqueter*	Ostraciidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	10.0	10	10
rock beauty	*Holacanthus tricolor*	Pomacanthidae	33.3	2	0.3	0.5	13.5	12	15	50.0	4	0.7	0.8	18.7	15	22
sergeant major	*Abudefduf saxatilis*	Pomacentridae	16.7	2	0.3	0.8	13.0	13	13	0.0	0	0.0	0.0	-	-	-
blue chromis	*Chromis cyanea*	Pomacentridae	100.0	800	133.3	48.9	2.8	1	7	100.0	789	131.5	61.9	4.7	2	9
brown chromis	*Chromis multilineata*	Pomacentridae	100.0	701	116.8	32.0	4.5	1	7	83.3	650	108.3	70.3	4.8	2	8
yellowtail damselfish	*Microspathodon chrysurus*	Pomacentridae	16.7	2	0.3	0.8	10.0	10	10	0.0	0	0.0	0.0	-	-	-
dusky damselfish	*Stegastes adustus (S. fuscus)*	Pomacentridae	83.3	29	4.8	3.8	6.4	4	10	66.7	26	4.3	4.4	10.3	7	15
bicolor damselfish	*Stegastes partitus*	Pomacentridae	100.0	235	39.2	13.6	4.1	1	6	100.0	397	66.2	29.6	4.5	2	10
threespot damselfish	*Stegastes planifrons*	Pomacentridae	100.0	101	16.8	5.7	5.5	3	8	83.3	70	11.7	9.2	8.2	4	15

Appendix 2G (continued). Fish census data from Sprat Hole

Common Name	Species Name	Family	Spring '02 Census %Freq (n=6)	Spring '02 Census No. of Fish Total	Spring '02 Census No. of Fish Avg.	Spring '02 Census No. of Fish StDev	Spring '02 Census Size Avg	Spring '02 Census Size Min	Spring '02 Census Size Max	Fall '02 Census % Freq (n=6)	Fall '02 Census No. of Fish Total	Fall '02 Census No. of Fish Avg.	Fall '02 Census No. of Fish StDev	Fall '02 Census Size Avg	Fall '02 Census Size Min	Fall '02 Census Size Max
cocoa damselfish	Stegastes variabilis	Pomacentridae	16.7	1	0.2	0.4	5.0	5	5	0.0	0	0.0	0.0	-	-	-
striped parrotfish	*Scarus iserti (S. croicensis)*	Scaridae	16.7	4	0.7	1.6	5.0	4	6	83.3	26	4.3	2.7	11.6	4	20
princess parrotfish	*Scarus taeniopterus*	Scaridae	100.0	46	7.7	5.0	17.2	6	25	100.0	35	5.8	4.0	18.6	5	30
queen parrotfish	*Scarus vetula*	Scaridae	66.7	10	1.7	1.5	26.8	15	45	33.3	2	0.3	0.5	27.5	25	30
redband parrotfish	*Sparisoma aurofrenatum*	Scaridae	100.0	41	6.8	1.9	16.2	10	25	83.3	25	4.2	2.7	16.0	3	25
stoplight parrotfish	*Sparisoma viride*	Scaridae	100.0	13	2.2	0.8	21.6	6	40	66.7	14	2.3	2.6	13.5	4	25
graysby	*Cephalopholis cruentatus*	Serranidae	66.7	9	1.5	1.4	14.9	12	19	66.7	7	1.2	1.0	16.5	10	22
coney	*Cephalopholis fulvus*	Serranidae	16.7	4	0.7	1.6	17.0	15	20	66.7	9	1.5	1.5	16.1	8	22
yellowtail hamlet	*Hypoplectrus chlorurus*	Serranidae	0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.8	9.0	8	10
shy hamlet	*Hypoplectrus guttavarius*	Serranidae	16.7	1	0.2	0.4	8.0	8	8	0.0	0	0.0	0.0	-	-	-
black hamlet	*Hypoplectrus nigricans*	Serranidae	0.0	0	0.0	0.0	-	-	-	50.0	3	0.5	0.5	10.0	9	11
barred hamlet	*Hypoplectrus puella*	Serranidae	33.3	3	0.5	0.8	13.5	10	15	16.7	1	0.2	0.4	10.0	10	10
harlequin bass	*Serranus tigrinus*	Serranidae	16.7	1	0.2	0.4	10.0	10	10	33.3	2	0.3	0.5	7.0	6	8
sand diver	*Synodus intermedius*	Synodontidae	0.0	0	0.0	0.0	-	-	-	16.7	1	0.2	0.4	32.0	32	32
sharpnose puffer	*Canthigaster rostrata*	Tetraodontidae	33.3	3	0.5	0.8	4.2	3	5	50.0	6	1.0	1.3	4.5	4	6
porcupinefish	*Diodon hystrix*	Tetraodontidae	0.0	0	0.0	0.0	-	-	-	16.7	2	0.3	0.8	35.0	35	35
			Total=	4326						Total =	3319					