CHAPTER 7

RESOURCE SURVEY OF FISHES WITHIN LOOE KEY NATIONAL MARINE SANCTUARY

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Introduction

Coral reefs have the highest concentration and diversity of fish species found on Earth. Coral reef fishes can be defined as fishes that spend part of their life cycle in close association with coral reefs. Defining a coral reef fish more precisely is probably not a useful scientific endeavor. Starck (1968) divided species into primary and secondary reef fish species depending, respectively, on whether they were closely associated with reef habitats or whether they were more closely associated with some other habitat. In reality, the definition of a coral reef fish is arbitrary because reef fishes are distributed in a continuous gradient ranging from obligate species, almost completely associated with corals, to opportunistic species, whose occurrence on a reef is incidental or accidental. Probably all Caribbean reef fishes spend part of their life cycle away from reefs in the plankton as eggs or larvae.

Coral reefs provide food and shelter for reef fishes (Plate 7.1). Unfortunately, little is known about the dynamics and community structure of coral reef fishes and their microhabitat requirements. Few quantitative studies of reef fish community structure on large reefs are reported (Talbot and Goldman, 1973; Jones and Chase, 1975; Alevizon and Brooks, 1975; Goldman and Talbot, 1976; Gladfelter and Gladfelter, 1978; Smith, 1979; Gladfelter *et al.,* 1980). Most quantitative studies have concentrated on small sections of reef, on sparsely populated reefs, or on small isolated patch reefs or coral heads (Randall, 1963; Risk, 1972; Smith and Tyler, 1972, 1973a, 1973b, 1975; Reese, 1973; Smith, 1973, 1978; Russell *et al.,* 1974; Sale, 1974, 1975, 1976a, 1976b, 1977, 1978; Sale and Dybdahl, 1975, 1978; Nolan, 1975; Luckhurst and Luckhurst, 1977, 1978; Russell *et al.*, 1977; Itzkowitz, 1977; Molles, 1978; Talbot *et al.,* 1978; Bohnsack, 1979). With one exception (Alevizon and Brooks, 1975), no quantitative data exist from large reefs in the Florida Keys except for frequency data (Thompson and Schmidt, 1977; Jones and Thompson, 1978; Bohnsack, 1979; Colton and Alevizon, 1979; Tilmant, 1981; Bannerot and Schmale, 1983). Unfortunately, frequency data have only limited value.

This research was designed to provide quantitative data on reef fish populations in different habitats at Looe Key National Marine Sanctuary (LKNMS), Florida, The intent of this study is to provide a detailed baseline for future comparisons and to provide a better understanding of reef

fish distribution and ecology. No studies of reef fish zonation have been published for Caribbean fishes although several studies have been done in the Indo-Pacific region (e.g. Hiatt and Strasburg, 1960; Talbot and Goldman, 1973; Harmelin-Vivien, 1981; and others). Also, the effects of a marine sanctuary on biotic resources, including fishes, has never been documented. Antonius (1978) conducted a qualitative preliminary survey of Looe Key Reef, however, no quantitative data were provided.

Methods

Study area

Looe Key Reef (LKR) is located on the outer reef tract (Lat 24° 33' N and Long 81° 24' W), 12.9 km south of the Newfound Harbor Keys and Big Pine Key, Florida, in the 5.3 nmi^2 Looe Key National Marine Sanctuary (LKNMS). LKR is a large reef with well developed spur and groove formations which provide high vertical relief. The Sanctuary also includes several reef-associated habitats. We divided the Sanctuary into nine habitats for investigation: deep live bottom, deep sand, buttress zone, forereef, rubble zone, lagoon sand, lagoon seagrass beds, shallow sand, seagrass beds, and shallow live bottom. Detailed descriptions of basic habitats were provided in Chapter 3. We decided to separate sand and live bottom habitats into shallow and deep zones because it appeared that depth and location inshore or offshore may have influenced fish composition more that habitat type alone. The lagoon sand and seagrass beds were also treated separately because of their proximity to the main reef and their shallow depth (1 to 3 m). All observations were taken in LKNMS.

Field methods

Reef fishes were censused with SCUBA using a random point visual census method described below. Management considerations required a non-destructive quantitative sampling method that could be repeated without harm to the sanctuary resources. Visual censusing methods were ideal because of the predominately clear waters in the Sanctuary and the ease with which coral reef fishes could be identified. Visual sampling was non-destructive and provided data suitable for statistical treatment. Traditional sampling techniques utilizing ichthyocides, trawls or blasting were not possible or were undesirable because of potential damage to the reefs. Data were collected between 0930 and 1630 hours from May through October 1983 using a team of four divers.

Random point censuses

All observable fishes were censused by a diver standing on the bottom at randomly selected points in each habitat in the Sanctuary. At each point we recorded all species observed in 5 min within an imaginary cylinder extending from the surface to the bottom with an 8 m radius from the observer. Numbers of observed individuals of each species were counted and the mean and range of fork lengths were estimated for each species. A ruler held out perpendicularly at the end of a meter stick aided in making size estimates by reducing apparent magnification errors. Size estimates of large fishes were made relative to the meter stick. Bohnsack (1979) found a significant correlation ($r^2 = 0.99$, $p < 0.01$) between estimated and measured fish lengths.

A rigorous sampling regime was used to avoid bias and prevent counting the same individuals more than once. All sample points were selected using a table of random numbers. Divers began each sample by facing seaward and listing all species within the field of view in the sample radius. When no new species were noted, new sectors were scanned by rotating to the left. New species were listed as observed. This process was continued for five minutes. Several complete rotations usually were made for each sample. Individuals were counted and size estimated immediately for species with few individuals (e.g. pomacanthids, chaetodontids,

scarids) or for species not likely to remain in the sample area (e.g. carangids and *Clepticus parrai*). Species that were always present in the sample area (e.g. *Thalassoma bifasciatum* and *Abudefduf saxatilis*) and species not likely to leave the sample area (e.g. damselfishes) were initially listed as observed and counted after the initial five minute sample period. At the end of the initial five minute sample period, divers would make one 360° revolution for each species in the latter two groups, during which data were collected. To avoid bias, divers would always work back up the list counting and measuring each species in reverse order to their initial sighting. This procedure eliminated the bias towards counting species which were particularly noticeable and abundant. With the addition of the last procedure, each point census took approximately 20 min to complete. At each sample point, bottom features were recorded.

Rapid visual samples

A total of 16 rapid visual samples (Thompson and Schmidt, 1977; Jones and Thompson, 1978) were taken to provide comparative data for surveys done at other reefs in southern Florida (Jones and Thompson, 1977; Bannerot and Schmale 1983). In this method divers attempt to find all observable species in 50 minute periods. Each species is given a score from 5 to 1 depending on which sequential 10 min interval the species was first observed. The survey area for this method only included the buttress, forereef, and lagoon areas. The same divers that collected data in the Bannerot and Schmale (1983) study collected 13 of the 16 samples reported here for Looe Key Reef.

Data analysis

Data were computerized and analyzed on a Burroughs 7800 computer system at the Southeast Fisheries Center, National Marine Fisheries Service, Miami, Florida, USA. Means and standard error estimates were calculated for abundance-data and percent frequency of occurrence with 95% confidence intervals were calculated for each species in each habitat zone. Species were then classified according to activity patterns and trophic characteristics based on published literature about the same or similar species (Hiatt and Strasburg, 1960; Starck and Davis, 1966; Randall, 1967; Smith and Tyler, 1972, 1973a, 1973b; Hobson, 1974, 1975; Hobson and Chess, 1976; Gladfelter and Johnson, 1983). We assigned species to trophic categories based on primary items found in the diet of adults (few juvenile fishes were observed for most species). This classification was used to characterize the trophic ecology of the observed reef fish community structure. Activity patterns were classified as diurnal, nocturnal, crepuscular, and generally active day and night. Trophic classifications used were herbivore, planktivore, carnivorous browser, microinvertivore, macroinvertivore, and piscivore. Feeding activity was characterized as being primarily near the bottom, in midwater, or at the surface.

Results

A total of 189 fish species in 48 families (Table 7.1) were observed during censuses in 9 habitat zones (Table 7.2) in LKNMS between 25 May 1983 and 17 September 1983. A total of 165 species (158 in five minute samples and 7 species after five minutes) were observed in 417 point samples and a total of 147 species were observed in 16 rapid visual samples (Jones and Thompson, 1977). To save space, some tables use a code for each species based on the first three letters of the genus and the first four letters of the trivial name. Full names can be identified in an alphabetical species list (Table 7.3). Six families had 8 or more species: Serranidae (14), Scaridae (13), Pomacentridae (12), Haemulidae (12), Labridae (11), and Gobiidae (8).

Random point samples included a total of 73,981 censused individuals. Families that included more than 1% of the observed individuals were Pomacentridae (29%), Labridae (27%), Haemulidae (20%), Gobiidae (6%), Scaridae (5%), Lutjanidae (3%), Acanthuridae (3%),

Carangidae (1%), and Chaetodontidae (1%). For each observed species, total observed abundance and frequency of occurrence in all random point samples and the total scores and frequency of occurrence in rapid visual samples are reported (Table 7.3). Random point data are summarized by species and habitat for abundance (Table 7.4) and frequency of occurrence (Table 7.5). Graphical presentations are provided for selected species that were particularly abundant or ecologically important (Appendix 7.A).

All observed species were classified according to trophic level, major periods of feeding activity, and the depth zone in which they normally feed (Table 7.6). From this data a summary of the trophic ecology of observed reef fishes was produced (Table 7.7). Trophic classification of 189 species observed yielded 33 herbivores (14% of all individuals); 31 planktivores (48% of individuals); 14 browsers (2% of individuals); 32 microinvertivores (10% of individuals); 52 macroinvertivores (24% of individuals); and 27 piscivores (2% of individuals). Herbivorous species were dominated by scarids, pomacentrids (i.e. *Pomacentrus*), acanthurids, and kyphosids (Plates 7.2, 7.3, 7.4). Carniverous browsers, dominated by pomacanthids, chaetodontids, ostraciids, and tetradontids (Plate 7.5, 7.7), fed by taking bites out of animals such as sponges, tunicates, and polychaete worms. Microinvertivores (Plate 7.7, 7.8), dominated by clinids, labrids, and smaller serranids, were mostly active during the day. Planktivores were usually found just above the reef in midwater and were dominated by pomacentrids (i.e. *Chromis* and *Abudefduf*) and labrids during the day (Plate 7.6, 7.8) and by apogonids and phompherids (Plate 7.9) at night. Macroinvertivores, dominated by haemulids, holocentrids, mullids, and some lutjanids (Plates 7.10, 7.11, 7.12, 7.13) tended to feed actively at night although some fed at other times (Plate 7.14). Piscivores varied greatly in size (Plates 7.15 to 7.19), were dominated by crepuscularly active species, and included resident, visiting, and transient species. Piscivores were dominated by lutjanids (Plate 7.13, 7,16), muraenids (Plate 7.15), serranids (Plate 7.15, 7.18), carangids (Plate 7.16), sphyraenids (Plate 7.17) and elopids (Plate 7.8), Carcharhinids (requiem sharks), the largest predators known to occur in the sanctuary, tend to be crepuscularly or nocturnally active and were not observed during censuses.

Discussion and conclusions

The 189 total species observed in LKNMS is consistent with other reef fish studies from the Florida Keys based on visual techniques. Jones and Thompson (1978) found a total 165 species (146 species on reefs in Key Largo and 134 species on reefs in the Dry Tortugas). Bannerot and Schmale (1983) recorded a total of 228 species from 18 sites (including non-reef habitats) in Key Largo.

Longley and Hildebrand (1941) reported a total of 440 species of fishes from the Dry Tortugas region of Florida and Starck (1968) reported a total of 517 species of fishes from the Alligator Reef region of the Florida Keys. Only 389 species, however, were associated with reefs of which 253 species were primarily associated with reefs and 134 were more characteristic of other habitats (Starck 1968). Differences in sampling methods explain the greater number of species found by Longley and Hildebrand (1941) and Starck (1968). These two studies were based on sampling for many years in a variety of habitats and used a variety of sampling techniques which collected fishes not easily observed by visual sampling. This study did not sample deeper reef areas which would certainly have added additional species.

Rapid visual census data

Comparison of rapid visual census data with previous studies using the same methods indicates that Looe Key Reef is comparable to other outer reefs in Key Largo, Florida. We found a total of 128 species in each of two independent sets of 8 rapid visual samples at Looe Key Reef (147 species in 16 samples). Jones and Thompson (1989) and Bannerot and Schmale (1983),

respectively, reported 120 and 123 species from Molasses Reef, 118 and 126 species from French Reef, and 104 and 131 (n = 12 samples) species from Carysfort Reef in eight rapid visual samples. Elbow Reef had 118 species (Bannerot and Schmale, 1983). The slightly higher number of species reported for Looe Key Reef is not statistically significant ($p > 0.05$). More detailed comparisons were not undertaken for this report because they would not serve any useful purpose. Clearly, the reef fish fauna in LKNMS is well developed and cannot be considered marginal.

This study was not intended to be a comparison of rapid visual censusing with random point sampling methods. Data from the two methods presented in Table 7.3 are not directly comparable because the two methods sampled different habitat zones. Although both methods census similar species, the rapid visual censusing method probably is better at detecting rare and some cryptic and secretive species (e.g., apogonidae). The random point census method, however, is probably better at providing more precise quantitative data on abundance, size, and habitat specificity. Bannerot and Schmale (1983) and DeMartini and Roberts (1982) document and discuss several problems and biases associated with the rapid visual censusing technique.

Random point data

Abundance data reported from random point samples is an index of abundance that probably underestimates the true abundance of most species because some individuals are not likely to be seen from any one vantage point. Thus, calculations of absolute density are inappropriate. However, the data do provide an estimate of relative abundance and should be quantitatively comparable when contrasting similar habitats between reefs or the same locations through time, Bohnsack and Bannerot (in prep) provide further discussion on the random point census technique.

Data presented here provide a static description (or snapshot) of reef fish community structure at LKNMS because they only apply to the time period from May through September 1983, Data presented (Table 7.4 and 7.5) do not show seasonal changes (intrayear) or normal between year (interyear) variation. Natural occurrences such as storms (Kaufman, 1983), epidemic diseases, cold kills (Bohnsack, 1983a; see Plate 7.20), and variations in recruitment can affect reef fish communities. Betweem 18 June and 9 July 1980 one of us (JAB) documented large numbers of fishes killed at Looe Key Reef and other reefs by an unknown disease. Species most effected included pomacanthids, lutjanids, balistids, and holocentrids. Nothing is known about the causes or ecological impacts of such epidemics of reef fishes at Looe Key reef.

Little is known about natural seasonal or yearly dynamic changes in reef fish populations although a major controversy exists regarding the stability of reef fish populations and communities. One group considers reef fish fauna on large reefs essentially stable while another considers the fauna quite variable (e.g. Gladfelter and Gladfelter, 1978; Smith 1978, Gladfelter *et al.,* 1980; Sale, 1980a, 1980b; Ogden and Ebersole, 1981; Williams and Sale, 1981; Bohnsack, 1983b). Results reported here, however, can be used as basis for detecting any future changes, whether from natural or human causes. We should point out that 1983 turned out to be an unusual year for weather because of El Niño conditions that affected much of the world's weather and the Caribbean and Eastern Pacific regions in particular (Canby, 1984). We did not, however, note any unusual phenomena involving reef fishes that could have been directly attributed to unusual weather conditions.

One important result of this survey is the documentation of variation in species occurrence and abundance between different reef habitat zones (Tables 7.4, 7.5 and Appendix 7.A). A reef is an association of several different habitats. Many past studies have reported population values from reefs based on censuses which lumped different habitat zones (Jones and Thompson,

1978; Bannerot and Schmale, 1983). Results presented here suggest that such figures may be misleading without taking into account the relative effort in different zones and the absolute amount of different habitat comprising a reef. Patterns of species distribution between habitat zones over a distance of a couple of km in this study is similar to patterns found along distances well over 100 km in the Great Barrier Reef (Anderson, *et al.,* 1981; Williams, 1982). Each species tends to have its unique patterns of abundance and frequency of occurrence (Appendix 7.A) although there is a clear trend for planktivores to be associated with the forereef zone where plankton resources are abundant and can be easily exploited.

Data for all observed species are presented for future reference purposes. Too often only common, abundant, or economically important species are treated while other species are ignored. However, rare species can be important because they are often more sensitive to environmental changes. Over time rare species can become abundant and showing these changes may be as important as showing declines for abundant species.

Trophic ecology

Average numbers of species and individuals observed per sample (Figure 7.1) show that fishes are closely associated with the presence of reef habitat. Whether this close association with coral habitat is a consequence of availability of food, shelter, or both cannot be ascertained from this study.

We have attempted to examine the trophic ecology of observed reef fishes instead of simply reporting abundance and frequency of occurrence. Our intent is only to show general community patterns, Assigning species into trophic or ecological categories is imprecise and often arbitrary. Most species are food generalists and will eat a wide variety of items available (Randall, 1967; Sale, 1977) (see Plate 7.20). Diets often change greatly depending on habitat and individual size (Starck 1968). Despite these misgivings, trophic and activity analysis provides some insight into the ecology of the reef fish fauna in LKNMS.

Classification of the 189 species observed showed 17% were herbivores, 16% planktivores, and the remaining 67% were carnivores (Table 7.6). Harmelin-Vivien (1981) used a slightly different classification but found similar results from reefs in Madagascar: 9% hervivores, 17% omnivores, and 74% carnivores at some level. Almost half (48%) of the 73,981 censused individuals were planktivorous, 14% were herbivorous, while the remaining 38% were carnivorous at some level (Table 7.7). Only about 2% of the observed individuals could be considered primarily piscivores. Harmelin-Vivien (1981) reviewed reports from other reefs and found similar percentages worldwide. Low percentages of herbivores reported here were also reported by Randall (1963, 1967), Goldman and Talbot (1976), Bakus (1967), and Goldman and Talbot (1976), but not by Odum and Odum (1955).

Other studies have reported an inverse pyramid of biomass for reef fishes from other areas (Bardach, 1959; Randall, 1963; Talbot and Goldman 1973). This study gives a similar pattern although data are not directly comparable because we use number of individuals and these previous studies were based on biomass. Most planktivores are small fishes while predators tend to be larger fishes, so biomass would be skewed more in favor of the top carnivores than numbers of individuals alone reflect.

Activity patterns

Harmelin-Vivien (1981) found 60% of reef fish species sampled in Madagascar were diurnally active, 32% nocturnally active, and 8% active by day and night. We found similar results: 61% diurnal, 34% nocturnal (including 10% primarily creprescular), and only 5% active day and night. Harmelin-Vivien (1981), using explosives and rotenone, found 63.5% of individuals were

active during the day. Similarly, using visual methods, we found 73% of the individuals were active during the day. This is surprising similarity considering visual methods are probably greatly biased against detecting nocturnally active species and individuals.

Primary patterns of feeding activity are closely related to trophic structure (Table 7.7). Herbivores and browsers were entirely diurnally and microinvertivores were almost entirely diurnally active. These fishes probably require good light conditions to see their food resources. Planktivorous fishes are divided into diurnally active and nocturnally active species with no overlap. Nocturnally active planktivores have large eyes for nighttime feeding. Macroinvertivores and piscivores have representatives in all classifications of activity, although, most macroinvertivores are nocturnal and most piscivores are creprescular. Most nocturnal macroinvertivores are schooling species that remain in inactive schools on reefs during the day and forage away from the reef at night (Randall, 1965; Ogden and Ehrlich, 1977). This daytime resting behavior is thought to be an adaptation to avoid predation (McFarland *et al.*, 1979). Piscivores have eyes particularly adapted for changing crepuscular light conditions which probably gives them advantages over species that are either diurnally or nocturnally active, All fishes active both day and night are carnivorous as found by Harmelin-Vivien (1981). Most also tend to be large, and thus, may escape predation.

In conclusion, the objective of this investigation was to quantitatively describe reef fish resources in LKNMS using visual methods. This study is the most detailed description of reef fish community structure ever done on a large reef system using nondestructive sampling methods. An index of abundance with standard errors and percent frequency of occurrence with 95% confidence intervals have been provided for observed reef fishes in nine habitat zones. Results demonstrate the usefulness of visual sampling of reef fish populations and provide an insight to reef fish trophic ecology. Results also provide a basis for monitoring and detecting any significant future changes in reef fish distribution or abundance within the Sanctuary. The reef fish fauna at LKNMS is abundant, complex, and similar to reef fish community structure found on well-developed reefs worldwide.

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Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name.

ORECTOLOBIDAE	Carpet Sharks
Ginglymostoma cirratum	Nurse shark
DASYATIDAE	
Dasyatis americana	Southern stingray
Urolophus jamaicensis	Yellow stingray
MYLIOBATIDAE	Eagle rays
Aetobatus narinari	Spotted eagle ray
ELOPIDAE	Tarpons
Megalops atlanticus	Tarpon
MURAENIDAE	Morays
Enchelycore nigricans	Viper moray
Gymnothorax funebris	Green moray
Gymnothorax moringa	Spotted moray
Muraena miliaris	Goldentail moray
CLUPEIDAE	Herrings
Jenkinsia spp.	Unknown herring
Jenkinsia lamprotaenia	Dwarf herring
ENGRAULIDAE	Anchovies
Anchoa lyolepis	Dusky anchovy
SYNODONTIDAE	Lizardfishes
Synodus intermedius	Sand diver
BELONIDAE	Needlefishes
Strongylura notata	Redfin needlefish
Strongylura timucu	Timucu
Tylosurus crocodilus	Houndfish
ATHERINIDAE	Silversides
Atherinomorus stipes	Hardhead silverside

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

HOLOCENTRIDAE	Squirrelfishes
Holocentrus ascensionis	Squirrelfish
Holocentrus coruscus	Reef squirrelfish
Holocentrus rufus	Longspine squirrelfish
Holocentrus vexillarius	Dusky squirrelfish
Myripristis jacobus	Blackbar soldierfish
AULOSTOMIDAE	Trumpetfishes
Aulostomus maculatus	Trumpetfish
SERRANIDAE	Sea Basses
Diplectrum formosum	Sand perch
Epinephelus adscensionis	Rock hind
Epinephelus cruentatus	Graysby
Epinephelus fulvus	Coney
Epinephelus guttatus	Red hind
Epinephelus itajara	Jewfish
Epinephelus morio	Red grouper
Epinephelus striatus	Nassau grouper
Hypoplectrus gemma	Blue hamlet
Hypoplectrus nigricans	Black hamlet
Hypoplectrus puella	Barred hamlet
Hypoplectrus unicolor	Butter hamlet
Mycteroperca bonaci	Black grouper
Paranthias furcifer	Creole-fish
Serranus baldwini	Lantern bass
Serranus tabacarius	Tobaccofish
Serranus tigrinus	Harlequin bass
Serranus tortugarum	Chalk bass
GRAMMISTIDAE	Soapfishes
Rypticus saponaceus	Greater soapfish
PRIACANTHIDAE	Bigeyes
Priacanthus cruentatus	Glasseye snapper
APONGONIDAE	Cardinalfishes
Apogon binotatus	Barred cardinalfish
Apogon maculatus	Flamefish
Apogon pseudomaculatus	Twospot cardinalfish
Apogon quadrisquamatus	Sawcheck cardinalfish

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

MALACANTHIDAE	Tilefishes
Malacanthus plumieri	Sand tilefish
ECHENEIDAE	Remoras
Echeneis naucrates	Sharksucker
CARANGIDAE	Jacks
Alectis ciliaris	African pompano
Caranx bartholomaei	Yellow jack
Caranx crysos	Blue runner
Caranx ruber	Bar jack
Decapterus macarellus	Mackerel scad
Decapterus punctatus	Round scad
Seriola dumerili	Greater amberjack
Trachinotus falcatus	Permit
LUTJANIDAE	Snappers
Lutjanus analis	Mutton snapper
Lutjanus apodus	Schoolmaster snapper
Lutjanus griseus	Gray snapper
Lutjanus jocu	Dog snapper
Lutjanus mahogoni	Mahogony snapper
Lutjanus synagris	Lane snapper
Ocyurus chrysurus	Yellowtail snapper
GERREIDAE	Mojarras
Gerres cinereus	Yellowfin mojarra
HAEMULONIDAE	Grunts
Anisotremus surinamenis	Black margate
Anisotremus virginicus	Porkfish
Haemulon album	Margate
Haemulon aurolineatum.	Tomtate
Haemulon carbonarium	Caesar grunt
Haemulon chrysargyreum	Smallmouth grunt
Haemulon flavolineatum	French grunt
Haemulon macrostomum	Spanish grunt
Haemulon melanurum	Cottonwick
Haemulon parra	Sailors choice
Haemulon plumieri	White grunt
Haemulon sciurus	Bluestriped grunt

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

INERMIIDAE	Bonnetmouths
Inermia vittata	Boga
SPARIDAE	Porgies
Calamus spp.	Unknown porgy
Calamus bajonado	Jolthead porgy
Calamus calamus	Saucereye porgy
Calamus penna	Sheepshead porgy
Pagrus pagrus	Red porgy
SCIAENIDAE	Drums
Equetus acuminatus	High-hat
Equetus lanceolatus	Jackknife-fish
Equetus punctatus	Spotted drum
Odontoscion dentex	Reef croaker
MULLIDAE	Goatfishes
Mulloidichthys martinicus	Yellow goatfish
Pseudupeneus maculatus	Spotted goatfish
PEMPHERIDAE	Sweepers
Pempheris schomburgki	Glassy sweeper
KYPHOSIDAE	Sea chubs
Kyphosus sectatrix	Bermuda chub
EPHIPPIDAE	Spadefishes
Chaetodipterus faber	Atlantic spadefish
CHAETODONTIDAE	Butterflyfishes
Chaetodon capistratus	Foureye butterflyfish
Chaetodon ocellatus	Spotfin butterflyfish
Chaetodon sedentarius	Reef butterflyfish
Chaetodon striatus	Banded butterflyfish

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

POMACANTHIDAE	Angelfishes
Holacanthus bermudensis	Blue angelfish
Holacanthus tricolor	Rock beauty
Holacanthus ciliaris	Queen angelfish
Pomacanthus arcuatus	Gray angelfish
Pomacanthus paru	French angelfish
POMACENTRIDAE	Damselfishes
Abudefduf saxatilis	Sergeant major
Chromis cyaneus	Blue chromis
Chromis insolata	Sunshinefish
Chromis multilineata	Brown chromis
Chromis scotti	Purple reeffish
Microspathodon chrysurus	Yellowtail damselfish
Pomacentrus diencaeus	Longfin damselfish
Pomacentrus fuscus	Dusky damselfish
Pomacentrus leucostictus	Beaugregory
Pomacentrus partitus	Bicolor damselfish
Pomacentrus planifrons	Threespot damselfish
Pomacentrus variabilis	Cocoa damselfish
CIRRHITIDAE	Hawkfishes
Amblycirrhitus pinos	Redspotted hawkfish
LABRIDAE	Wrasses
Bodianus pulchellus	Spotfin hogfish
Bodianus rufus	Spanish hogfish
Clepticus parrai	Creole wrasse
Talichoeres bivattatus	Slippery dick
Halichoeres garnoti	Yellowhead wrasse
Halichoeres maculipinna	Clown wrasse
Halichoeres pictus	Rainbow wrasse
Halichoeres poeyi	Blackear wrasse
Halichoeres radiatus	Puddingwife
Hemipteronotus novacula	Pearly razorfish
Hemipteronotus splendens	Green razorfish
Lachnolaimus maximus	Hogfish
Thalassoma bifasciatum	Bluehead

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

SCARIDAE	Parrotfishes
Cryptotomus roseus	Bluelip parrotfish
Scarus coelestinus	Midnight parrotfish
Scarus coeruleus	Blue parrotfish
Scarus croicensis	Striped parrotfish
Scarus guacamaia	Rainbow parrotfish
Scarus taeniopterus	Princess parrotfish
Scarus vetula	Queen parrotfish
Sparisoma aurofrenatum	Redband parrotfish
Sparisoma chrysopterum	Redtail parrotfish
Sparisoma radians	Bucktooth parrotfish
Sparisoma rubripinne	Redfin parrotfish
Sparisoma viride	Stoplight parrotfish
SPHYRAENIDAE	Barracudas
Sphyraena barracuda	Barracuda
OPISTOGNATHIDAE	Jawfishes
Opistognathus aurifrons	Yellowhead jawfish
CLINIDAE	Clinids
Acanthemblemaria spp.	unknown blenny
Acanthemblemaria aspera	Roughhead blenny
Acanthemblemaria chaplini	Papillose blenny
Hemiemblemaria simulus	Wrasse blenny
Malacoctenus gilli	Dusky blenny
Malacoctenus macropus	Rosy blenny
Malacoctenus triangulatus	Saddled blenny
Malacoctenus versicolor	Barfin blenny
Paraclinus nigripinnis	Blackfin blenny
BLENNIIDAE	Combtooth blennies
Hypleurochilus spp.	unknown blenny
Ophioblennius atlanticus	Redlip blenny
Scartella cristata	Molly miller
GALLIONYMIDAE	Dragonets
Callionymus bairdi	Lancer dragonet

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

GOBIIDAE	Gobies
Coryphopterus dicrus	Colon goby
Coryphopterus glaucofraenum	Bridled goby
Coryphopterus personatus	Masked goby
Coryphopterus sp.	unidentified goby
Gnatholepis thompsoni	Goldspot goby
Gobiosoma macrodon	Tiger goby
Gobiosoma oceanops	Neon goby
Ioglossus calliurus	Blue goby
Microgobius carri	Seminole goby
ACANTHURIDAE	Surgeonfishes
Acanthurus bahianus	Ocean surgeon
Acanthurus chirurgus	Doctorfish
Acanthurus coeruleus	Blue tang
SCOMBRIDAE	Mackerels/Tunas
Scomberomorus cavalla	King mackerel
Scomberomorus maculatus	Spanish mackerel
Scomberomorus regalis	Cero
SCORPAENIDAE	Scorpionfishes
Scorpaena plumieri	Spotted scorpionfish
BALISTIDAE	Triggerfishes/Filefishes
Aluterus schoepfi	Orange filefish
Aluterus scriptus	Scrawled filefish
Balistes capriscus	Gray triggerfish
Balistes vetula	Queen triggerfish
Cantherhines macrocerus	Whitespotted filefish
Cantherhines pullus	Orangespotted filefish
Canthidermis sufflamen	Ocean triggerfish
Monacanthus tuckeri	Slender filefish
OSTRACIIDAE	Trunkfishes
Lactophrys bicaudalis	Spotted trunkfish
Lactophrys polygonia	Honeycomb cowfish
Lactophrys quadricornis	Scrawled cowfish
Lactophrys triqueter	Smooth trunkfish

Table 7.1. Phylogenetic listing of species observed at Looe Key National Marine Sanctuary during surveys. All names used are according to Robins *et al.* (1980). Species codes used elsewhere are derived using the first three letters of the genus and the first four letters of the trivial name (cont.).

TETRADONTIDAE	Puffers
Canthigaster rostrata	Sharpnose puffer
Sphoeroides spengleri	Bandtail puffer
DIODONTIDAE	Porcupinefishes
Diodon hystrix	Balloonfish
Diodon holocanthus	Porcupinefish

Table 7.2. Distribution of numbers of species by family at Looe Key Reef based on censuses of 73,981 individuals.

FAMILY COMMON NAME	TOTAL SPECIES	PERCENT OF TOTAL INDIV.	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	SPUR & GROOVE	LAGOON RUBBLE	LAGOON GRASSES	LAGOON SAND	GRASS FLATS	SHALLOW SAND	SHALOW LIVE BOTTOM
ACANTHURIDAE (Surgeonfishes)	3	2.55		3	2	3	3	3	1	2	2	2	3
APOGONIDAE (cardinalfishes)	1	0.00										1	
ATHERINIDAE (silversides)	*	-											
AULOSTOMIDAE (trumpetfishes)	1	0.04				1	1	1					1
BALISTIDAE (leatherjackets)	7	0.06				3	6	3			1	1	3
BELONIDAE (needlefishes)	2	0.00					1	1		1			
BLENNIIDAE (combtooth blennies)	2	0.09			2		1	2		1	1	1	1
CALLIONYMIDAE (dragonets)	*	-											
CARANGIDAE (jacks)	6	1.30		2	2	3	3	1	2	1	1	5	2
CHAETODONTIDAE (butterflyfishes)	4	1.12		4		4	4	3		1	2		4
CIRRHITIDAE (hawkfishes)	1	0.00		1			1						
CLINIDAE (clinids)	6	0.02			2		1	4					1
CLUPEIDAE (herrings)	*	-											
DASYATIDAE (stingrays)	1	0.01		1							1	1	1
DIDONTIDAE (porcupinefishes)	2	0.00		1			1						
ECHENEIDAE (remoras)	1	0.01		1		1	1						
ELOPIDAE (tarpons)	1	0.00					1						
ENGRAULIDAE (anchovies)	*	-											
EPHIPPIDAE (spadefishes)	1	0.00				1							
GERREIDAE (mojarras)	1	0.92						1					
GOBIIDAE (gobies)	8	6.31		5	4	6	6	5	1	1	5	2	6
GRAMMIDAE (bassists)	*	-											
GRAMMISTIDAE (soapfishes)	*	-											
HAEMULIDAE (grunts)	12	19.86		3	4	7	12	9	5	4	5	5	3
HOLOCENTRIDAE (squirrelfishes)	3	0.05				1	2	1					
INERMIIDAE (bometmouths)	1	0.48					1					1	1
KYPHOSIDAE (sea chubs)	1	0.55				1	1	1					

Table 7.2. Distribution of numbers of species by family at Looe Key Reef based on censuses of 73,981 individuals (cont.).

FAMILY COMMON NAME	TOTAL SPECIES	PERCENT OF TOTAL INDIV.	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	SPUR & GROOVE	LAGOON RUBBLE	LAGOON GRASSES	LAGOON SAND	GRASS FLATS	SHALLOW SAND	SHALOW LIVE BOTTOM
LABRIDAE (wrasses)	11	26.94		6	8	8	11	9	7	8	8	8	8
LUTJANIDAE (snappers)	7	3.02		1	2	4	6	4	1	2		2	1
MALACANTHIDAE (tilefishes)	1	0.01			1	1	1						
MULLLIDAE (goatfishes)	2	0.57		1	1	2	2	2				1	1
MURAENIDAE (morays)	2	0.01					1	1					
MYLIOBATIDAE (eagle rays)	*	-											
OPISTOGNATHIDAE (jewfishes)	1	0.06			1		1	1			1	1	1
ORECTOLOBIDAE (carpet sharks)	1	0.00						1					
OSTRACIIDAE (boxfishes)	3	0.01		1			2				1		
PEMPHERIDAE (boxfishes)	1	0.67				1	1	1					
POMACANTHIDAE (angelfishes)	5	0.38		5	1	4	5	3				1	5
POMACENTRIDAE (damelfishes)	12	28.95		8	3	9	12	7		7	4	4	6
PRIACANTHIDAE (bigeyes)	1	0.01					1	1				1	
SCARIDAE (parrotfishes)	13	4.77		7	4	10	10	10	3	6	6	8	8
SCIAENIDAE (drums)	3	0.13		1		2	3	1					1
SCOMBRIDAE (mackerels)	3	0.01		1			2					1	
SERRANIDAE (we basses)	14	0.60		7	3	6	9	5		3	3	4	6
SPARIDAE (porgies)	5 Δ	0.18		1	1	2	2				2	2	3
SPHYRAENIDAE (barracudas)	1	0.14		1	1	1	1	1	1		1	1	1
SYNODONTIDAE (lizardfisties)	1	0.00					1				1		
TETRAODONTIDAE (puffers)	2	0.07		2		1	3	1					1

* Observed only in samples using the rapid visual technique.
Δ Includes one unidentified individual as a separate species.

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sanctuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded.

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Maximum Value		16	60	417	N/A
Abudefduf saxatilis	Sergeant major	16	80	185	6799
Acanthemblemaria chaplini	Papillose blenny	4	14	1	5
Acanthemblemaria spp.	Unidentified blenny	6	20		
Acanthurus bahianus	Ocean surgeon	16	80	265	1231
Acanthurus chirurgus	Doctorfish	11	34	53	97
Acanthurus coeruleus	Blue tang	16	77	189	561
Aetobatus narinari	Spotted eagle ray	1	1		
Alectis ciliaris	African pompano	1	4		
Aluterus schoepfi	Orange filefish	2	7	4	6
Aluterus scriptus	Scrawled filefish	7	18	7	7
Amblycirrhitus pinos	Redspotted hawkfish	9	35	2	2
Anchoa lyolepis	Dusky anchovy	1	1		
Anisotremus surinamenis	Black margate	2	9	1	1
Anisotremus virginicus	Porkfish	12	42	20	28
Apogon binotatus	Barred cardinalfish	3	7		
Apogon maculatus	Flamefish	8	24		
Apogon pseudomaculatus	Twospot cardinalfish	3	8	1	2
Apogon quadrisquamatus	Sawcheek cardinalfish	1	1		
Atherinomorus stipes	Hardhead silverside	1	3		
Aulostomus maculatus	Trumpetfish	14	44	23	27
Balistes capriscus	Gray triggerfish	-		3	4
Balistes vetula	Queen triggerfish	-		2	2
Bodianus pulchellus	Spotfin hogfish	1	3		
Bodianus rufus	Spanish hogfish	16	77	129	218
Calamus sp.	Unidentified porgy	1	4	1	1
Calamus bajonado	Jolthead porgy	4	14	27	35
Calamus calamus	Saucereye porgy	7	27	65	94
Calamus penna	Sheepshead porgy	-		2	3
Callionymus bairdi	Lancer dragonet	3	9		
Cantherhines macrocerus	Whitespotted filefish	3	15		
Cantherhines pullus	Orangespotted filefish	9	28	15	17
Canthidermis sufflamen	Ocean triggerfish	1	1	6	7
Canthigaster rostrata	Sharpnose puffer	16	72	42	53
Caranx bartholomaei	Yellow jack	4	14	18	48
Caranx crysos	Blue runner	-		1	28
Caranx ruber	Bar jack	14	65	93	661

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sactuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded (cont.).

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Chaetodipterus faber	Atlantic spadefish			1	1
Chaetodon capistratus	Foureye butterflyfish	16	80	206	555
Chaetodon ocellatus	Spotfin butterflyfish	13	49	90	162
Chaetodon sedentarius	Reef butterflyfish	2	7	12	18
Chaetodon striatus	Banded butterflyfish	11	35	53	92
Chromis cyaneus	Blue chromis	15	74	107	324
Chromis insolata	Sunshinefish	-		1	1
Chromis multilineata	Brown chromis	13	53	59	892
Chromis scotti	Purple reeffish	6	19	12	47
Clepticus parrai	Creole wrasse	15	54	14	274
Coryphopterus dicrus	Colon goby	9	32	45	111
Coryphopterus glaucofraenum	Bridled goby	13	55	119	623
Coryphopterus personatus	Masked goby	12	50	69	3611
Coryphopterus sp.	Unidentified goby	-		*	*
Cryptotomus roseus	Bluelip parrotfish	-		8	22
Dasyatis americana	Southern stingray	1	1		
Decapterus macarellus	Mackerel scad	-		1	70
Decapterus punctatus	Round scad	-		1	150
Diodon holocanthus	Balloonfish	2	4	1	1
Diodon hystrix	Porcupinefish	3	7	1	1
Diplectrum formosum	Sand perch	-		13	59
Echeneis naucrates	Sharksucker	5	13	6	6
Enchelycore nigricans	Viper moray	-		*	*
Epinephelus adscensionis	Rock hind	1	1		
Epinephelus cruentatus	Graysby	15	71	114	133
Epinephelus fulvus	Coney	1	5		
Epinephelus guttatus	Red hind	1	2		
Epinephelus itajara	Jewfish	1	1		
Epinephelus morio	Red grouper			1	1
Epinephelus striatus	Nassau grouper	5	20	2	2
Equetus acuminatus	High-hat	3	9	7	7
Equetus lanceolatus	Jacknife-fish	1	5		
Equetus punctatus	Spotted drum	3	7	1	1
Fry	Unidentified species	-		1	15
Gerres cinereus	Yellowfin mojarra	-		6	681
Ginglymostoma cirratum	Nurse shark	-		1	1

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sactuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded (cont.).

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Gnatholepis thompsoni	Goldspot goby	16	68	39	108
Gobiosoma macrodon	Tiger goby	-		1	3
Gobiosoma oceanops	Neon goby	16	75	60	132
Gymnothorax funebris	Green moray	5	22	2	2
Gymnothorax moringa	Spotted moray	-			
Haemulon album	Margate	-		9	49
Haemulon aurolineatum	Tomitate	16	80	138	10842
Haemalon carbonarium	Caesar grunt	16	51	23	355
Haemulon chrysargyreum	Smallmouth grunt	14	49	21	877
Haemulon flavolineatum	French grunt	16	79	175	714
Haemulon macrostomum	Spanish grunt	9	31	40	90
Haemulon melanurum	Cottonwick	1	5	8	22
Haemulon parrai	Sailor's choice	9	32	11	62
Haemulon plumieri	White grunt	15	70	163	1122
Haemulon sciurus	Bluestriped grunt	15	65	111	542
Halichoeres bivittatus	Slippery dick	15	67	258	3590
Halichoeres garnoti	Yellowhead wrasse	16	80	251	1110
Halichoeres maculipinna	Clown wrasse	16	74	246	1512
Halichoeres pictus	Rainbow wrasse	1	1		
Halichoeres poeyi	Blackear wrasse	-		40	119
Halichoeres radiatus	Puddingwife	16	71	123	252
Hemiemblemaria simulus	Wrasse blenny	-		1	1
Hemipteronotus novacula	Pearly razorfish	1	4	2	2
Hemipteronotus splendens	Green razorfish	1	1	49	267
Holacanthus bermudensis	Blue angelfish	8	29	17	18
Holacanthus ciliaris	Queen angelfish	10	27	23	23
Holacanthus tricolor	Rock beauty	13	61	58	77
Holocentrus ascensionis	Squirrelfish	10	40	6	7
Holocentrus coruscus	Reef squirrelfish	1	4		
Holocentrus rufus	Longspine squirrelfish	14	51	20	32
Holocentrus vexillarius	Dusky squirrelfish	6	19	1	1
Hypleurochilus spp.	unidentified blenny	1	5		
Hypoplectrus gemma $^{\Delta}$	Blue hamlet	2	6	16	18
Hypoplectrus nigricans $^{\Delta}$	Black hamlet	-		1	1
Hypoplectrus unicolor	Butter hamlet	2	5	31	38
Hypoplectrus puella $^{\Delta}$	Barred hamlet	-		3	3
Ioglossus calliurus	Blue goby	-		15	75

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sactuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded (cont.).

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Inermia vittata	Boga	2	6	6	352
Jenkinsia lamprotaenia	Dwarf herring	3	11		
Jenkinsia spp.		1	4		
Kyphosus sectatrix	Bermuda chub	13	44	39	407
Lachnolaimus maximus	Hogfish	12	43	70	98
Lactophrys bicaudalis	Spotted trunkfish	1	5	2	2
Lactophrys polygonia	Honeycomb cowfish	1	4		
Lactophrys quadricornis	Scrawled cowfish	2	7		
Lactophrys triqueter	Smooth trunkfish	9	32	5	5
Liopropoma rubre	Peppermint bass	3	8		
Lutjanus analis	Mutton snapper	1	1	6	6
Lutjanus apodus	Schoolmaster snapper	16	68	42	206
Lutjanus griseus	Gray snapper	11	44	29	157
Lutjanus jocu	Dog snapper	2	8	1	1
Lutjanus mahogoni	Mahogany snapper	3	6	3	9
Lutjanus synagris	Lane snapper	4	19	17	254
Malacanthus plumieri	Sand tilefish	2	6	7	10
Malacoctenus gilli	Dusky blenny	1	4	2	6
Malacoctenus macropus	Rosy blenny	4	10	1	1
Malacoctenus triangulatus	Saddled blenny	5	21	5	5
Malacoctenus versicolor	Barfin blenny	-		*	*
Megalops atlanticus	Tarpon	5	21	2	2
Microgobius carri	Seminole goby	-		3	5
Microspathodon chrysurus	Yellowtail damselfish	16	79	180	974
Monacanthus tuckeri	Slender filefish	-		3	4
Mulloidichthys martinicus	Yellow goatfish	16	73	53	346
Muraena miliaris	Goldentail moray	2	10	2	2
Mycteroperca bonaci	Black grouper	10	28	9	9
Myripristis jacobus	Blackbar soldierfish	1	3		
Ocyurus chrysurus	Yellowtail snapper	16	80	259	1602
Odontoscion dentex	Reef croaker	16	67	37	87
Opistognathus atlanticus	Redlip blenny	13	39	19	38
Opistognathus aurifrons	Yellowhead jawfish	2	9	17	43
Opistognathus maxillosus	Mottled jawfish	-			
Paranthias furcifer	Creole-fish	-		2	2
Paraclinus nigripinnis	Blackfin blenny	-		1	1
Pagrus pagrus	Red Porgy	-		1	1

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sactuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded (cont.).

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Pempheris schomburgki	Glassy sweeper	15	62	15	493
Pomacanthus arcuatus	Gray angelfish	11	47	96	121
Pomacanthus paru	French angelfish	10	40	35	45
Pomacentrus diencaeus	Longfin damselfish	9	33	21	109
Pomacentrus fuscus	Dusky damselfish	10	30	82	692
Pomacentrus leucostictus	Beaugregory	3	11	46	132
Pomacentrus partitus	Bicolor damselfish	16	80	322	10021
Pomacentrus planifrons	Three spot damselfish	14	69	152	1257
Pomacentrus variabilis	Cocoa damselfish	9	29	61	166
Priacanthus cruentatus	Glasseye snapper	9	22	6	6
Pseudupeneus maculatus	Spotted goatfish	11	37	36	78
Rypticus saponaceus	Greater soapfish	2	5		
Scartella cristata	Molly miller	3	6	12	20
Scarus coelestinus	Midnight parrotfish	12	34	14	51
Scarus coeruleus	Blue parrotfish	12	44	30	61
Scarus croicensis	Striped parrotfish	16	74	212	1645
Scarus guacamaia	Rainbow parrotfish	7	23	15	20
Scarus taeniopterus	Princess parrotfish	4	6	84	215
Scarus vetula	Queen parrotfish	14	54	34	57
Scomberomorus cavalla	King mackerel	-		1	1
Scomberomorus maculatus	Spanish mackerel	-		1	1
Scomberomorus regalis	Cero mackerel	3			3
Scorpaena plumieri	Scorpion fish	1	1		
Seriola dumerili	Greater amberjack	-		*	*
Serranus baldwini	Lanternfish	6	16	8	11
Serranus tabacarius	Tobaccofish	-		*	*
Serranus tigrinus	Harlequin bass	15	62	113	185
Serranus tortugarum	Chalk bass	-		2	2
Sparisoma atomarium	Greenblotch parrotfish	-		3	7
Sparisoma aurofrenatum	Redband parrotfish	15	69	160	441
Sparisoma chrysopterum	Redtail parrotfish	3	14	84	190
Sparisoma radians	Bucktooth parrotfish	1	5	43	246
Sparisoma rubripinne	Yellowtail parrotfish	15	65	76	200
Sparisoma viride	Stoplight parrotfish	16	76	167	386
Sphoeroides spengleri	Bandtail puffer	-		1	1
Sphyraena barracuda	Barracuda	15	63	69	107
Strongylura notata	Redfin needlefish	-		*	*

Table 7.3. Alphabetical listing of fishes observed in Looe Key National Marine Sactuary during visual surveys using the Bohnsack and Bannerot (1983) Random Point Visual Technique (RPT) and the Jones and Thompson (1977) Rapid Visual Technique (J-T). The J-T technique only surveyed major reef areas including buttress, forereef and rubble zones. The RPT surveyed all habitats although effort varied between habitats. Dashes indicate that species was not observed by that technique. * indicates that the species was observed during point samples but after the initial 5 minute sample period and thus no abundance estimate data were recorded (cont.).

SCIENTIFIC NAME	COMMON NAME	RAPID VISUAL SAMPLES		RANDOM POINT SAMPLES	
		FREQUENCY	SCORE	FREQUENCY	TOTAL ABUNDANCE
Strongylura timucu	Timucu	-		1	1
Synodus intermedius	Inshore lizardfish	4	7	2	2
Thalassoma bifasciatum	Bluehead wrasse	16	80	328	12484
Trachinotus falcatus	Permit	3	10	6	8
Tylosurus crocodilus	Houndfish	-		3	3
Urolophus jamaicensis	Yellow stingray	-		9	9

- Observed only during random point samples.
∆ Now considered color Forms of H. unicolor (American Fisheries Society, 1980).

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A.

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
N	18	9	34	160	37	16	11	35	41	56
ABU SAXA*	0 -	0.56 (0.29)	22.38 (7.87)	32.20 (4.10)	21.50 (7.40)	5.20 (3.30)	0 -	0 -	0.02 (0.02)	0.18 (0.18)
ACA CHAP	0 -	0 -	0 -	0 -	0.14 (0.14)	0 -	0 -	0 -	0 -	0 -
ACA BAHI*	1.67 (0.24)	1.67 (0.60)	2.38 (0.33)	3.08 (0.49)	10.16 (1.61)	0.19 (0.14)	4.36 (1.65)	1.66 (0.48)	0.46 (0.20)	1.95 (0.31)
ACA CHIR*	0.17 (0.12)	0 -	0.15 (0.15)	0.24 (0.05)	0.11 (0.08)	0 -	0 -	0 -	0.05 (0.05)	0.79 (0.24)
ACA COER*	0.67 (0.20)	0.33 (0.24)	1.12 (0.27)	1.61 (0.21)	3.68 (0.83)	0 -	1.45 (0.62)	0.03 (0.03)	0 -	1.64 (0.77)
ALU SCHO	0 -	0 -	0 -	0.01 (0.11)	0 0	0 0	0 -	0 -	0 -	0.07 (0.06)
ALU SCRI	0 -	0 -	0 -	0.04 (0.02)	0 -	0 -	0 -	0 -	0 -	0.02 (0.02)
AMB PINO	0.06 (0.06)	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
ANI SURI	0 -	0 -	0.29 (0.11)	0.11 (0.04)	0 -	0 -	0 -	0 -	0 -	0 -
ANI VIRG	0 -	0 -	0.29 (0.11)	0.11 (0.04)	0 -	0 -	0 -	0 -	0 -	0 -
APO PSEU	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.15 (0.15)	0 -
AUL MACU	0 -	0 -	0.18 (0.09)	0.12 (0.03)	0 -	0 -	0 -	0 -	0 -	0.02 (0.02)
BAL CAPR	0 -	0 -	0.18 (0.09)	0.01 (0.01)	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
BAL VETU	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.06 (0.04)	0 -	0 -
800 RUFU*	0.22 (0.10)	0 -	1.06 (0.16)	0.99 (0.09)	0.32 (0.10)	0 -	0 -	0 -	0 -	0.07 (0.04)
CAL BAJO*	0 -	0 -	0.29 (0.11)	0.14 (0.03)	0 -	0 -	0 -	0 -	0 -	0.04 (0.03)

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

SPECIES CODE	HABITAT									
	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
CAL CALA	0.44 (0.17)	0.11 (0.11)	0.27 (0.08)	0.08 (0.03)	0 -	0 -	0 -	0.37 (0.24)	0.10 (0.07)	0.71 (0.10)
CAL PENA	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.05 (0.05)	0 -
CAN PULL	0 -	0 -	0.03 (0.03)	0.08 (0.03)	0.05 (0.23)	0 -	0 -	0 -	0.02 (0.02)	0 -
CAN SUFF	0 -	0 -	0.03 (0.03)	0.03 (0.02)	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
CAN ROST	0.39 (0.12)	0 -	0.18 (0.12)	0.17 (0.04)	0.03 (0.03)	0 -	0 -	0 -	0 -	0.21 (0.06)
CAR BART*	0.11 (0.08)	1.56 (1.31)	0.29 (0.29)	0.14 (0.10)	0 -	0.25 (0.19)	0 -	0 -	0.49 (0.03)	0.05 (0.54)
CAR CRYS	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.68 (0.68)	0 -
CAR RUBR*	0.06 (0.06)	1.67 (1.67)	2.03 (1.18)	0.32 (0.69)	0.32 (0.13)	0.31 (0.18)	0.18 (0.12)	2.54 (1.51)	0.10 (0.05)	0.20 (0.10)
CHA FABE	0. -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -	0 -	0 -
CHA CAPI*	3.00 (1.24)	0 -	2.18 (0.25)	1.62 (0.12)	0.84 (0.20)	0 -	0.27 (0.27)	0 -	0 -	2.38 (0.30)
CHA OCEL	4.44 (0.19)	0 -	0.74 (0.14)	0.49 (0.90)	0.16 (0.08)	0 -	0 -	0.06 (0.04)	0 -	0.75 (0.17)
CHA SEDE	0.50 (0.20)	0 -	0.03 (0.03)	0.02 (0.01)	0 -	0 -	0 -	0.03 (0.03)	0 -	0.07 (0.04)
CHA STRI	0.50 (0.26)	0 -	0.27 (0.12)	0.37 (0.06)	0 -	0 -	0 -	0 -	0 -	0.13 (0.06)
CHR CYAN*	3.22 (0.73)	0 -	1.26 (0.39)	1.33 (0.15)	0 -	0 -	0 -	0 -	0 -	0.18 (0.09)
CHR INSO	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
CHR MULT*	0.56 (0.35)	0 -	3.03 (1.57)	4.90 (1.40)	0 -	0 -	0 -	0 -	0 -	0 -
CHR SCOT	0.06 (0.06)	0 -	0.50 (0.28)	0.18 (0.14)	0 -	0 -	0 -	0 -	0 -	0 -

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

SPECIES CODE	HABITAT									
	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
CLE PARR*	0 -	0 -	5.00 (3.70)	0.61 (0.30)	0 -	0 -	0 -	0 -	0 -	0 -
COR DICR*	0.67 (0.39)	0.11 (0.11)	0.09 (0.07)	0.23 (0.06)	0.38 (0.22)	0 0	0 0	0.29 (0.29)	0 -	0.79 (0.29)
COR GLAU*	8.50 (2.10)	0.89 (0.56)	2.82 (0.92)	1.14 (0.19)	0.68 (0.28)	0.06 (0.06)	0.09 (0.09)	0.37 (0.15)	0.32 (0.27)	2.32 (0.48)
COR PERS*	50.20 (14.60)	0 -	2.94 (1.35)	14.60 (6.10)	0 -	0 -	0 -	0 -	0 -	4.10 (1.30)
CRY ROSE	0 -	0.22 (0.22)	0 -	0 -	0 -	0 -	0 -	0.06 (0.06)	0.44 (0.26)	0 -
DEC MACA	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	1.70 (1.70)	0 -
DEC PUNC	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	3.70 (3.70)	0 -
DID HOLD	0.06 (0.06)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0
DID HYST	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
DIP FORM	0 -	0.11 (0.11)	0 -	0.10 (0.10)	0 -	0 -	0 -	0.43 (0.18)	0.49 (0.27)	0 -
ECH NAUC	0.06 (0.06)	0 -	0 -	0.02 (0.01)	0.05 (0.04)	0 -	0 -	0 -	0 -	0 -
EPI CRUE*	0.78 (0.21)	0 -	0.53 (0.10)	0.51 (0.06)	0.11 (0.05)	0 -	(0.09 (0.09)	0 0	0 0	0.25 (0.06)
EPI GUTT	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
EPI MORI	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.02 (0.02)
EPI STRI	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -	0 -	0.02 (0.02)
EQU ACUM	0.11 (0.08)	0 -	0.03 (0.03)	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0.05 (0.03)
EQU PUNC	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

SPECIES CODE	HABITAT									
	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
GER CINE	0 -	0 -	0 -	0 -	18.40 (8.10)	0 -	0 -	0 -	0 -	0 -
GIN CIRR	0 -	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
GNA THOM	0.17 (0.12)	0.67 (0.37)	0.09 (0.07)	0.36 (0.09)	0.62 (0.29)	0 -	0 -	0.03 (0.03)	0 -	0.25 (0.12)
GOB MACR	0 -	0 -	0	0	0.08 (0.08)	0 -	0 -	0 -	0 -	0 -
GOB OCEA	0.94 (0.37)	0 -	0.50 (0.24)	0.39 (0.08)	0.08 (0.06)	0 -	0 -	0 -	0 -	0.59 (0.31)
GYM MORI	0 -	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0.02 (0.02)
HAE ALBU	0 -	0.89 (0.68)	0 -	0.17 (0.16)	0.14 (0.08)	0 -	0 -	0.23 (0.16)	0.02 (0.02)	0 -
HAE AURO*	2.78 (2.78)	0.76 (0.36)	87.97 (19.00)	34.03 (5.70)	2.32 (1.18)	1.81 (1.44)	1.64 (1.35)	61.02 (21.00)	1.98 (1.55)	0 -
HAE CARB	0 -	0 -	0.03 (0.03)	2.20 (1.50)	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
HAE CHRY*	0 -	0 -	0 -	2.89 (1.00)	11.20 (8.80)	0 -	0 -	0 -	0 -	0 -
HAE FLAV*	1.50 (0.99)	0 -	1.62 (0.19)	1.60 (0.15)	7.30 (2.80)	0.13 (0.13)	5.50 (5.10)	0.29 (0.29)	0 -	0.37 (0.15)
HAE MACR	0 -	0 -	0 -	0.35 (0.11)	0.33 (0.09)	0.70 (0.70)	0 -	0 -	0 -	0 -
HAE MELA	0	0.89 (0.68)	0 -	0.01 (0.01)	0 -	0 -	0 -	0.23 (0.23)	0.07 (0.05)	0 -
HAE PARR	0 -	0 -	0 -	0.33 (0.20)	0.11 (0.05)	0.06 (0.06)	0 -	0 -	0.10 (0.10)	0 -
HAE PLUM*	0.67 (0.21)	1.22 (0.52)	0.76 (0.25)	0.85 (0.21)	3.90 (1.70)	0.88 (0.36)	0.36 (0.15)	2.80 (1.53)	5.19 (2.70)	8.25 (2.30)
HAE SCIU*	0 -	0 -	1.29 (0.29)	1.86 (0.46)	2.65 (1.25)	0.13 (0.13)	0 -	0 -	0 -	1.73 (0.68)
HAL BIVI*	0.50 (0.25)	18.00 (4.60)	2.44 (0.77)	3.88 (0.75)	36.50 (4.80)	13.70 (4.00)	10.27 (2.55)	9.86 (1.45)	13.00 (3.30)	2.80 (0.60)
HAL GARN*	4.28 (0.95)	1.56 (0.88)	3.97 (0.61)	3.98 (0.34)	1.32 (0.41)	0.06 (0.06)	0.27 (0.27)	0.47 (0.19)	0.98 (0.06)	3.29 (0.48)

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
HAL MACU*	1.56 (0.36)	3.89 (1.20)	2.91 (0.61)	4.58 (0.64)	8.62 (1.35)	0.09 (0.09)	0.55 (0.31)	2.57 (1.04)	2.12 (0.80)	2.04 (0.40)
HAL POEY	0 -	2.11 (1.05)	0 -	0.01 (0.01)	0.41 (0.21)	0.62 (0.27)	0.27 (0.20)	0.31 (0.15)	1.41 (0.63)	0.04 (0.03)
HAL RADI*	0 -	0.33 (0.24)	0.61 0.24)	0.67 (0.10)	1.51 (0.27)	0.81 (0.46)	0.46 (0.28)	0.94 (0.29)	0.15 (0.07)	0.32 (0.09)
HEM SIMU	0 -	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
HEM NOVA	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0.09 (0.09)	0 -	0 -	0 -
HEM SPLE	0 -	0.56 (0.44)	0 -	0.01 (0.01)	0.03 (0.03)	1.19 (0.48)	0.18 (0.18)	3.23 (0.73)	3.07 1.31)	0 -
HOL BERM	0.11 (0.32)	0 -	0 -	0.05 (0.02)	0 -	0 -	0 -	0 -	0 -	0.14 (0.05)
HOL CILI	0.06 (0.06)	0 -	0.09 (0.05)	0.08 (0.02)	0.03 (0.03)	0 -	0 -	0 -	0 -	0.09 (0.04)
HOL TRIC*	0.94 (0.22)	0.44 (0.11)	0.59 (0.04)	0.23 (0.05)	0.14 (0.07)	0 -	0 -	0 -	0 -	0.02 (0.02)
HOL ASCE	0 -	0 -	0 -	0.04 (0.02)	0 -	0 -	0 -	0 -	0 -	0 -
HOL RUFU	0 -	0 -	0.21 (0.11)	0.16 (0.04)	0 -	0 -	0 -	0 -	0 -	0 -
HOL VEXI	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -	0 -
HYP UNIC (all forms)	1.22 (0.21)	0 -	0.03 (0.03)	0.04 (0.02)	0.03 (0.03)	0 -	0 -	0 -	0 -	0.53 (0.10)
H0G CALL	0 -	0.22 (0.15)	0.06 (0.06)	0 -	0 -	0 -	0 -	1.80 (0.87)	0.15 (0.12)	0.04 (0.04)
INE VITT	0 -	0 -	0 -	0.19 (0.17)	0 -	0 -	0 -	0 -	7.80 (5.40)	0.02 (0.02)
KYP SECT	0 -	0 -	0.76 (0.36)	2.23 (0.74)	0.65 (0.54)	0 -	0 -	0 -	0 -	0 -
LAC MAXI	0.33 (0.11)	0.14 (0.73)	0.53 (0.14)	0.19 (0.04)	0.08 (0.05)	0 -	0 -	0.14 (0.07)	0.29 (0.16)	0.41 (0.11)
LAC BICA	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

SPECIES CODE	HABITAT									
	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
LAC QUAD	0.06 (0.06)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -
LAC TRIQ	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -
LUT ANAL*	0 -	0.11 (0.11)	0 -	0.02 (0.01)	0.03 (0.03)	0 -	0 -	0 -	0.02 (0.02)	0 -
LUT APOD*	0 -	0 -	1.76 (0.63)	0.81 (0.22)	0.46 (0.21)	0 -	0.18 (0.12)	0 -	0 -	0 -
LUT GRIS*	0 -	0 -	1.65 (1.47)	0.62 (0.28)	0 -	0 -	0 -	0 -	0 -	0 -
LUT JOCU	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -	0 -	0 -
LUT MAHO	0 -	0 -	0 -	0.06 (0.04)	0 -	0 -	0 -	0 -	0 -	0 -
LUT SYNA*	0 -	0 -	0 -	1.59 (0.50)	0 -	0 -	0 -	0 -	0 -	0 -
MAL PLUM	0 -	0.33 (0.24)	0.15 (0.10)	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
MAL GILL	0 -	0 -	0 -	0.16 (0.12)	0 -	0 -	0 -	0 -	0 -	0 -
MAL MACR	0 -	0.11 (0.11)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -
MAL TRIA	0 -	0 -	0 -	0.02 (0.01)	0.03 (0.03)	0 -	0 -	0 -	0 -	0.02 (0.02)
MEG ATLA	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
MIC CARR	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.14 (0.08)	0 -	0 -
MIC CHRY*	0 -	0 -	2.88 (0.55)	4.92 (0.44)	2.05 (0.43)	0 0	1.00 (0.65)	0 -	0 -	0 -
MON TUCK	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	(0.04) (0.03)
MUL MART*	0 -	0 -	1.59 (0.62	0.81 (0.42)	0 -	0 -	0 -	0 -	0 -	0 -
MUR MILI	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
MYC BONA	0.06 (0.06)	0 -	0.06 (0.24)	0.03 (0.01)	0 -	0 -	0.09 (0.09)	0 -	0 -	0 -
OCY CHRY*	0.39 (0.14)	0.89 (0.39)	9.38 (1.27)	6.92 (0.82)	2.43 (0.69)	1.12 (0.26)	0.36 (0.20)	0 -	0.27 0.13)	0.68 0.14)
ODO DENT	0 -	0 -	0.38 (0.17)	0.45 (0.14)	0.05 (0.04)	0 -	0 -	0 -	0 -	0 -
OPH ATLA	0 -	1.00 (1.00)	0 -	0.15 (0.05)	0.11 (0.07)	0 -	0.09 (0.09)	6 -	0 -	0 -
DPI AURI	0	1.00 (0.60)	0 -	0.05 (0.03)	0.16 (0.09)	0 -	0 -	0.23 (0.13)	0.12 (0.07)	0.13 (0.13)
PAR FURC	0 -	0 -	0.06 (0.04)	0 -	0 -	0 -	0 -	0 -	0 -	0 -
PAR NIGR	0 -	0.11 (0.11)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -
PAG PAGR	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.02 (0.02)
PEM SCHO	0 -	0 -	6.40 (5.90)	1.70 (1.30)	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
POM ARCU*	0.50 (0.51)	0 -	0.76 (0.13)	0.32 (0.05)	0.05 (0.04)	0 -	0 -	0 -	0.02 (0.02)	0.61 (0.11)
POM PARU	0.44 (0.17)	0 -	0.03 (0.03)	0.13 (0.03)	0 -	0 -	0 -	0 -	0 -	0.27 (0.08)
POM DIEN	0 -	0 -	0 -	0.64 (0.17)	0.03 (0.03)	0 -	0.45 (0.45)	0 -	0 -	0 -
POM FUSC*	0.11 (0.08)	0 -	0.91 (0.49)	3.75 (0.69)	1.54 (0.46)	0 -	0.09 (0.09)	0 -	0 -	0 -
POM LEUC	0.39 (0.20)	0.22 (0.22)	0.03 (0.03)	0.09 (0.03)	2.32 (0.66)	0 -	1.1B (0.50)	0.09 (0.05)	0.05 (0.03)	0.07 (0.05)
POM PART*	54.60 (6.70)	13.90 (5.20)	29.70 (4.80)	35.60 (2.30)	24.10 (6.60)	0 -	4.09 (1.56)	6.50 (1.90)	5.10 (1.90)	14.90 (2.30)
POM PLAN*	4.67 (2.16)	0 -	6.15 (1.47)	5.09 (0.65)	0.49 (0.26)	0 -	0 -	0 -	0 -	2.36 (0.53)
POM VARI	0.83 (0.31)	0.76 (0.55)	0 -	0.45 (0.16)	0.70 (0.23)	0 -	0.18 (0.12)	0.17 (0.12)	0.07 (0.05)	0.62 0.19)
PRI CRUE	0 -	0 -	0 -	0.01 (0.01)	0.03 (0.03)	0 -	0 -	0.03 (0.03)	0.05 (0.04)	0 -

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
PSE MACU*	0.22 (0.13)	0.22 (0.15)	0.06 (0.04)	0.11 (0.04)	0.35 (0.12)	0 -	0 -	0 -	0.24 (0.24)	0.54 (0.17)
SCA CRIS	0 -	1.11 (0.48)	0 -	0 -	0.11 (0.09)	0 -	0 -	0.09 (0.05)	0.05 (0.03)	0.02 (0.02)
SCA COEL	0 -	0 -	1.15 (0.91)	0.06 (0.02)	0.05 (0.04)	0 -	0 -	0 -	0 -	0 -
SCA COER	0.06 (0.06)	0 -	0.29 (0.14)	0.30 (0.13)	0.03 (0.03)	0 -	0.09 (0.09)	0 -	0 -	0 -
SCA CROI*	7.44 (0.95)	0.89 (0.89)	4.09 (1.03)	3.50 (0.41)	11.80 (2.60)	0 -	2.45 (1.10)	0.51 (0.27)	0.71 (0.51)	5.23 (0.66)
SCA GUAC	0 -	0 -	0.12 (0.06)	0.06 (0.03)	0.16 (0.11)	0 -	0 -	0 -	0 -	0 -
SCA TAEN	1.33 (0.34)	0 -	0.65 (0.31)	0.42 (0.07)	1.68 (1.12)	0 -	0 -	0 -	0.15 (0.15)	0.61 (0.30)
SCA VETU	0 -	0 -	0.15 (0.06)	0.26 (0.06)	0.11 (0.07)	0 -	0 -	0 -	0 -	0.09 (0.09)
SCO CAVA	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
SCO MACU	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
SCO REGA	0.06 (0.06)	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.05 (0.03)	0 -
SER BALD	0 -	0.33 (0.24)	0 -	0.01 (0.01)	0.08 (0.06)	0 -	0.18 (0.18)	0 -	0.02 (0.02)	0 -
SER TIGR	1.83 (0.44)	0.67 (0.37)	0.47 (0.11)	0.28 (0.04)	0.19 (0.12)	0 -	0 -	0.03 (0.03)	0.10 (0.06)	1.34 (0.17)
SER TORT	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.03 (0.03)	0.02 (0.02)	0 -
SPA ATOM	0 -	0 -	0 -	0 -	0 -	0 -	0 -	0.06 (0.06)	0.12 (0.09)	0 -
SPA AURO*	1.78 (0.46)	0.67 (0.47)	1.12 (0.21)	1.60 (0.15)	0.61 (0.29)	0 -	0 -	0.03 (0.03)	0.05 (0.03)	1.36 (0.20)
SPA CHRY*	0.22 (0.17)	0 -	0.41 (0.41)	0.39 (0.39)	1.00 (0.24)	0.44 (0.18)	0.55 (0.37)	0.11 (0.07)	0.95 (0.76)	0.30 (0.10)
SPA RADI	0 -	1.56 (0.78)	0 -	0 -	0.68 (0.36)	2.00 (0.68)	0.46 (0.25)	0.11 (0.53)	4.00 (1.45)	0.02 (0.02)

Table 7.4. Mean abundance (± standard error) of selected species in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*" distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
SPA RUBR*	0.39 (0.29)	0 -	0.49 (0.19)	0.59 (0.10)	1.62 (0.45)	0.06 (0.06)	0.09 (0.09)	0 -	0 -	0.27 (0.15)
SPA VIRI*	0.50 (0.23)	0 -	1.44 (0.24)	1.64 (0.17)	1.22 (0.24)	0 -	0.18 (0.18)	0 -	0 -	0.34 (0.10)
SPH SPEN	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 -	0 -	0
SPH BARR*	0.06 (0.06)	0.22 (0.15)	0.27 (0.09)	0.43 (0.10)	0.41 (0.15)	0.25 (0.11)	0 -	0.03 (0.03)	0.10 (0.05)	0.04 (0.03)
STR TIMU	0 -	0 -	0 -	0 -	0.03 (0.03)	0 -	0 -	0 -	0 -	0 -
SYN INTE	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0 -	0 (0.03)	0 -	0 -
THA BIFA*	26.44 (5.30)	6.56 (1.38)	26.60 (4.50)	59.70 (5.20)	17.60 (2.50)	0.69 (0.51)	2.09 (1.01)	3.29 (1.06)	2.22 (0.96)	10.68 (1.24)
TRA FALC	0	0	0.15 (0.10)	0.02 (0.01)	0 -	0 -	0 -	0 -	0 -	0 -
TYL CROC	0 -	0 -	0 -	0.01 (0.01)	0 -	0 -	0.09 (0.09)	0 -	0 -	0 -
URO JAMA	0.11 (0.08)	0 -	0 -	0 -	0 -	0 -	0 -	0.06 (0.04)	0.05 (0.03)	0.54 (0.03)

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A.

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
CODE N	18	9	34	160	37	16	11	35	41	56
ABU SAXA*	0 0 - 19	33 7 - 70	85 68 - 95	78 71 - 84	62 45 - 78	36 15 - 66	0 0 - 29	0 0 - 10	2 0 - 13	2 0 - 10
ACA CHAP	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	14 4 - 29	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
ACA BAHI*	94 73 - 100	67 30 - 93	82 65 - 93	73 66 - 60	86 71 - 96	13 2 - 38	45 17 - 77	34 19 - 52	20 9 - 35	68 54 - 80
ACA CHIR*	11 1 - 35	0 0 - 34	15 5 - 31	16 11 - 23	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	30 19 - 44
ACA COER*	44 21 - 69	22 3 - 60	56 38 - 73	66 58 - 74	76 59 - 88	0 0 - 21	45 17 - 77	3 0 - 15	0 0 - 9	38 25 - 52
ALU SCHO	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	4 0 - 12
ALU SCRI	0 0 - 19	0 0 - 34	0 0 - 10	4 1 - 8	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
AMB PINO	6 0 - 27	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
ANI SURI	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
ANI VIRG	0 0 - 19	0 0 - 34	21 9 - 38	8 4- 14	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
APO PSEU	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
AUL MACU	0 0 - 19	0 0 - 34	12 3 - 27	11 7 - 17	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
BAL CAPR	0 0 - 19	0 0 - 34	3 0 - 15	1 0 - 4	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
BAL VETU	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	6 1 - 19	0 0 - 9	0 0 - 6
BOD RUFU*	22 6 - 48	0 0 - 34	65 46 - 80	56 48 - 64	27 14 - 44	0 0 - 21	0 0 - 29	0 0- 10	0 0 - 9	7 2 - 17
CAL BAJO*	0 0 - 19	0 0 - 34	21 9 - 36	11 7 - 17	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	4 0 - 12
CAL CALA	33 13 - 59	11 0 - 48	26 13 - 44	7 3 - 12	0 0 - 10	0 0 - 21	0 0 - 29	11 3 - 27	5 1 - 17	57 43 - 70

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
CAL PENA	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
CAN PULL	0 0 - 19	0 0 - 34	3 0 - 15	7 3 - 21	5 1 - 16	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
CAN 5UFF	0 0 - 19	0 0 - 34	3 0 - 15	3 1 - 7	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
CAN ROST	39 18 - 65	0 0 - 34	9 2 - 23	13 8 - 23	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	5 1 - 15
CAR BART*	11 1 - 35	33 8 - 70	3 0 - 15	4 1 - 8	0 0 - 10	13 2 - 38	0 0 - 29	0 0 - 10	2 0 - 13	2 0 - 10
CAR CRYS	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
CAR RUBE*	6 0 - 27	11 0 - 48	32 17 - 51	35 28 - 43	19 8 - 35	19 4 - 46	19 2 - 52	7 0 - 19	10 3 - 23	9 3 - 20
CHA FABE	0 0 - 19	0 0 - 34	3 0 - 15	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
CHA CAPI*	100 81 - 100	0 0 - 34	82 65 - 93	65 57 - 72	38 22 - 55	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	73 60 - 84
CHA OCEL*	28 10 - 54	0 0 - 34	50 32 - 68	26 20 - 34	11 3 - 25	0 0 - 21	0 0 - 29	6 1 - 19	0 0 - 9	36 23 - 50
CHA SEDE	28 10 - 54	0 0 - 34	3 0 - 15	2 0 - 5	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	0 0 - 9	5 0 - 15
CHA STRI	22 6 - 48	0 0 - 34	15 5 - 31	22 16 - 29	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	9 3 - 20
CHR CYAN*	89 65 - 99	0 0 - 34	41 25 - 59	45 37 - 53	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 0	9 3 - 20
CHR IN50	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
CHR MULT*	17 4 - 41	0 0 - 34	26 13 - 44	29 22 - 36	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
CHR SCOT	6 0 - 27	0 0 - 34	15 5 - 31	4 0 - 8	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
CLE PARR*	0 0 - 19	0 0 - 34	15 5 - 31	6 3 - 11	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
COR DICR*	22 6 - 48	11 0 - 46	6 1 - 20	12 7 - 16	16 6 - 32	0 0 - 21	0 0 - 29	3 0 - 15	0 0 - 9	21 12 - 34

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
COR GLAU*	61 36 - 83	33 8 - 70	44 27 - 62	28 21 - 36	22 10 - 38	6 0 - 30	9 0 - 41	17 7 - 34	7 2 - 20	48 35 - 62
COR PERS*	72 46 - 90	0 0 - 34	24 11 - 41	19 13 - 26	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	30 19 - 44
CRY ROSE	0 0 - 19	11 0 - 48	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	15 6 - 29	0 0 - 6
DEC MACA	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
DEC PUNC	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
DID HOLD	6 0 - 27	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
DID HYST	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
DIP FORM	0 0 - 19	11 0 - 48	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	11 3 - 27	10 3 - 23	0 0 - 6
ECH NAUC	6 0 - 27	0 0 - 34	0 0 - 10	2 0 - 5	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
EPI CRUE*	55 31 - 79	0 0 - 34	50 32 - 68	43 35 - 51	11 3 - 25	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	23 13 - 36
EPI GUTT	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
EPI MORI	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
EPI STRI	0 0 - 19	0 0 - 34	3 0 - 15	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
EQU ACUM	11 0 - 35	0 0 - 34	3 0 - 15	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
EQU PUNC	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
GER CINE	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	16 6 - 32	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
GIN CIRR	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
GNA THOM	11 1 - 35	33 7 - 70	6 1 - 20	13 8 - 20	16 6 - 32	0 0 - 21	0 0 - 29	3 0 - 15	0 0 - 9	9 0 - 20

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
GOB MACR	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 94	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
GOB OCEA	39 18 - 65	0 0 - 34	19 13 - 26	5 1 - 18	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	20 10 - 32
GYM MORI	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
HAE ALBU	0 0 - 19	11 0 - 46	0 0 - 10	1 0 - 4	8 1 - 22	0 0 - 21	0 0 - 29	6 1 - 19	2 0 - 13	0 0 - 6
HAE AURO*	6 0 - 27	36 7 - 70	74 56 - 87	48 40 - 56	16 6 - 32	19 4 - 46	27 6 - 61	37 21 - 55	15 6 - 29	0 0 - 6
HAE CARB	0 0 - 19	0 0 - 34	3 0 - 15	12 7 - 18	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HAE CHRY*	0 0 - 19	0 0 - 34	0 0 - 10	11 7 - 17	36 20 - 53	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HAE FLAV*	17 4 - 41	0 0 - 34	82 65 - 93	68 60 - 75	54 37 - 71	6 0 - 30	36 11 - 69	3 0 - 15	0 0 - 9	16 8 - 28
HAE MACR	0 0 - 19	0 0 - 34	26 13 - 44	19 13 - 26	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HAE FELA	0 0 - 19	22 3 - 60	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	5 0 - 17	0 0 - 6
HAE PARR	0 0 - 19	0 0 - 34	0 0 - 10	3 1 - 7	11 3 - 25	6 0 - 31	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6
HAE PLUM*	44 21 - 69	44 14 - 79	41 25 - 59	40 32 - 48	43 27 - 61	38 15 - 65	9 0 - 41	17 7 - 34	22 11 - 38	46 33 - 60
HAE SCIU*	0 0 - 19	0 0 - 34	56 38 - 73	35 28 - 43	46 30 - 63	6 0 - 30	0 0 - 29	0 0 - 10	0 0 - 9	29 17 - 42
HAL BIVI*	28 10 - 54	100 66 - 100	44 27 - 62	49 41 - 57	95 82 - 99	94 70 - 100	73 39 - 94	83 66 - 93	80 65 - 91	55 41 - 69
HAL GARN*	100 81 - 100	44 14 - 79	88 73 - 97	83 76 - 89	32 18 - 50	6 0 - 30	9 0 - 41	14 5 - 30	7 1 - 20	80 68 - 90
HAL MACU*	67 41 - 87	76 40 - 97	62 44 - 78	74 66 - 80	78 62 - 90	9 0 - 61	27 17 - 49	31 17 - 49	32 18 - 48	54 40 - 67
HAL POEY	0 0 - 19	44 14 - 79	0 0 - 10	1 0 - 4	14 4 - 29	38 16 - 65	18 2 - 52	14 5 - 30	37 23 - 53	4 0 - 12
HAL RADI*	0 0 - 19	78 40 - 97	21 9 - 38	34 27 - 42	65 47 - 80	25 7 - 52	28 6 - 61	31 17 - 49	12 4 - 26	23 13 - 36

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
HEM SIMU	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 -6
HEM NOVA	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	0 0 - 6
HEM SPLE	0 0 - 19	22 3 - 60	0 0 - 10	1 0 - 4	3 0 - 14	44 20 - 71	9 0 - 41	71 47 - 89	29 15 - 45	0 0 - 6
HOL BERM	11 1 - 35	0 0 - 34	0 0 - 10	4 1 - 8	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	14 6 - 26
HOL CILI	6 0 - 27	0 0 - 34	9 2 - 23	8 4 - 14	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	9 3 - 20
HOL TRIC*	67 41 - 87	35 7 - 70	6 1 - 20	17 11 - 24	11 3 - 25	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
HOL ASCE	0 0 - 19	0 0 - 34	0 0 - 10	4 1 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HOL RUFU	0 0 - 19	0 0 - 34	12 3 - 27	10 6 - 16	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HOL VEXI	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
HYP UNIC (all forms)	83 59 - 96	0 0 - 34	3 0 - 15	4 1 - 8	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	41 26 - 55
IOG CALL	0 0 - 19	22 31 - 60	3 0 - 15	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	26 13 - 43	49 33 - 65	2 0 - 10
INE VITT	0 0 - 19	0 0 - 34	0 0 - 10	2 0 - 5	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	7 2 - 20	2 0 - 10
KYP SECT	0 0 - 19	0 0 - 34	18 7 - 35	18 12 - 26	11 3 - 25	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
LAC MAXI	33 13 - 59	11 0 - 48	38 22 - 56	15 10 - 22	8 2 - 22	0 0 - 21	0 0 - 29	11 3 - 27	10 3 - 23	27 16 - 41
LAC BICA	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 -6
LAC QUAD	6 0 - 27	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
LAC TRIQ	0 0 - 19	0 0 - 34	0 0 - 10	3 1 - 7	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	0 0 - 9	0 0 - 6
LUT ANAL*	0 0 - 19	11 0 - 48	0 0 - 10	2 0 - 5	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	0 0 - 6

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
LUT APOD*	0 0 - 19	0 0 - 34	32 17 - 51	14 9 - 20	16 6 - 32	0 0 - 21	19 2 - 52	0 0 - 10	0 0 - 9	0 0 - 6
LUT GRIS*	0 0 - 19	0 0 - 34	12 3 - 26	15 10 - 22	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
LUT JOCU	0 0 - 19	0 0 - 34	3 0 - 15	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
LUT MAHO	0 0 - 19	0 0 - 34	0 0 - 10	2 0 - 5	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
LUT SYNA*	0 0 - 19	0 0 - 34	0 0 - 10	11 7 - 17	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
MAL PLUM	0 0 - 19	22 3 - 60	9 2 - 23	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
MAL GILL	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
MAL MACR	0 0 - 19	11 0 - 48	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
NAL TRIA	0 0 - 19	0 0 - 34	0 0 - 10	2 0 - S	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
MEG ATLA	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
MIC CARR	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	9 2 - 23	0 0 - 9	0 0 - 6
MIC CHRY*	0 0 - 19	0 0 - 34	74 56 - 87	81 74 - 87	59 42 - 75	0 0 - 21	27 6 - 61	0 0 - 10	0 0 - 9	0 0 - 6
MON TUCK	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	4 0 - 12
MUL MART*	0 0 - 19	0 0 - 34	41 25 - 59	24 17 - 31	0 6 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
MUR MILI	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0- 6
MYC BONA	6 0 - 27	0 0 - 34	6 1 - 20	3 1 - 7	0 0 - 10	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	0 0 - 6
OCY CHRY*	33 13 - 59	44 14 - 79	97 85 - 100	94 89 - 97	62 45 - 76	75 48 - 93	27 6 - 61	0 0 - 10	13 4 - 26	41 28 - 55

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
ODO DENT	0 0 - 19	0 0 - 34	21 9 - 38	16 12 - 26	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
OPH ATLA	0 0 - 19	11 0 - 48	0 0 - 10	9 5 - is	8 2 - 22	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	0 0 - 6
OPH AURI	0 0 - 19	33 7 - 70	0 0 - 10	2 0 - 5	8 2 - 22	0 0 - 21	0 0 - 29	11 3 - 27	7 2 - 20	2 0 - 10
PAR FURC	0 0 - 19	0 0 - 34	6 1 - 20	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 -6
PAR NIGR	0 0 - 19	11 0 - 48	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 -10	0 0 - 9	0 0 - 6
PAG PAGR	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
PEM 5CHO	0 0 - 19	0 0 - 34	21 9 - 38	4 1 - 8	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
POM ARCU*	50 26 - 74	0 0 - 34	56 38 - 73	26 20 - 34	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 12	41 28 - 55
POM PARU	33 13 - 59	0 0 - 34	3 0 - 15	11 7 - 17	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	20 10 - 32
POM DIEN	0 0 - 19	0 0 - 34	0 0 - 10	12 7 - 18	3 0 - 14	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	0 0 -6
POM FUSC*	11 1 - 35	0 0 - 34	57 38 - 73	36 29 - 44	35 20 - 53	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	0 0 - 6
POM LELIC	22 6 - 48	11 0 - 48	3 0 - 15	26 20 - 34	51 34 - 68	0 0 - 21	45 17 - 77	9 2 - 23	5 1 - 17	4 0 - 12
POM PART*	94 73 - 100	89 52 - 100	91 76 - 98	96 92 - 99	65 48 - 80	0 0 - 21	45 17 - 77	57 39 - 74	27 14 - 43	93 83 - 98
POM PLAN*	44 21 - 69	0 0 - 34	76 59 - 89	52 44 - 60	11 3 - 25	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	55 41 - 69
POM VAR!	33 13 - 59	33 7 - 70	0 0 - 10	13 8 - 20	27 14 - 44	0 0 - 21	9 0 - 41	6 1 - 19	5 1 - 17	29 17 - 42
PRI CRUE	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	3 0 - 14	0 0 - 21	0 0 - 29	3 0 - 15	5 0 - 17	0 0 - 6
PSE MACU*	17 4 - 41	22 3 - 60	59 41 - 75	4 1 - 8	22 10 - 38	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	23 13 - 36
SCA CRIS	0 0 - 19	11 0 - 48	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	9 2 - 23	5 1 - 17	2 0 - 10

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
SCA COEL	0 0 - 19	0 0 - 34	9 2 - 23	6 3 - 11	5 1 - 18	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
SCA COER	6 0 - 27	0 0 - 34	18 7 - 35	13 8 - 20	3 0 - 14	0 0 - 21	9 0 - 41	0 0 - 16	0 0 - 9	0 0 - 6
SCA CROI*	94 73 - 100	13 0 - 48	56 38 - 73	59 51 - 67	76 59 - 88	0 0 - 21	45 17 - 77	11 3 - 27	10 3 - 23	71 58 - 83
SCA GUAC	0 0 - 19	0 0 - 34	12 3 - 27	5 2 - 10	8 2 - 22	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
SCA TAEN	78 52 - 94	0 0 - 34	24 11 - 41	29 22 - 36	16 6 - 32	0 0 - 21	0 0 - 29	0 0 - 10	2 0 - 13	11 7 - 29
SCA VETU	0 0 - 19	0 0 - 34	18 7 - 35	15 10 - 22	0 2 - 22	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	2 0 - 10
SCO CAVA	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
SCA REGA	6 0 - 27	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	5 1 - 17	0 0 - 6
SER BALD	0 0 - 19	11 0 - 48	0 0 - 10	1 0 - 4	5 1 - 18	0 0 - 21	9 0 - 41	0 0 - 10	2 0 - 13	0 0 - 6
5ER TIGR	78 52 - 94	33 7 - 70	38 22 - 56	23 16 - 31	11 3 - 25	0 0 - 21	0 0 - 29	3 0 - 15	7 2 - 20	70 56 - 82
SER TORT	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	2 0 - 13	0 0 - 6
SPA ATOM	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	5 1 - 17	0 0 - 6
SPA AURO*	78 52 - 94	22 3 - 60	58 41 - 75	62 54 - 69	24 12 - 42	0 0 - 21	0 0 - 29	3 0 - 10	49 33 - 65	59 45 - 72
SPA CHRY*	11 1 - 35	0 0 - 34	26 13 - 44	20 14 - 27	43 27 - 61	31 11 - 59	27 6 - 69	9 2 - 23	10 3 - 23	18 9 - 30
SPA RADI	0 0 - 19	33 7 - 70	0 0 - 10	0 0 - 2	19 8 - 35	44 20 - 71	27 6 - 61	6 1 - 19	49 33 - 65	2 0 - 10
SPA RUBR*	13 1 - 35	0 0 - 34	19 7 - 35	28 21 - 36	43 27 - 61	6 0 - 30	9 0 - 41	0 0 - 10	0 0 - 9	7 2 - 17
SPA VIRI*	22 6 - 48	0 0 - 34	68 50 - 83	66 58 - 74	59 42 - 75	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	21 12 - 34
SPH SPEN	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6

Table 7.5. Percent frequency of occurrence (±95% confidence intervals) of selected speces in different habitats at Looe Key National Marine Sanctuary. Unidentified species are deleted. "*", distribution plotted in Appendix 7.A (cont.).

	HABITAT									
SPECIES CODE	DEEP LIVE BOTTOM	DEEP SAND	BUTTRESS ZONE	FORE-REEF ZONE	LAGOON RUBBLE	LAGOON GRASS	LAGOON SAND	SHALLOW SAND	GRASS FLATS	SHALLOW LIVE BOTTOM
SPH BARR*	6 0 - 27	22 3 - 60	24 11 - 41	24 17 - 31	22 10 - 36	25 7 - 52	0 0 - 29	3 0 - 15	10 3 - 23	4 0 - 12
STR TIMU	0 0 - 19	0 0 - 34	0 0 - 10	0 0 - 2	3 0 - 14	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 -6
SYN INTE	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	0 0 - 29	3 0 - 15	0 0 - 9	0 0 - 6
THA BIFA*	100 82 - 100	100 66 - 100	97 85 - 100	98 95 - 100	89 75 - 97	19 4 - 46	36 11 - 69	34 19 - 52	27 14 - 43	88 76 - 95
TRA FALC	0 0 - 19	0 0 - 34	9 2 - 23	2 0 - 5	0 0 - 10	0 0 - 21	0 0 - 29	0 0 - 10	0 0 - 9	0 0 - 6
TYL CROC	0 0 - 19	0 0 - 34	0 0 - 10	1 0 - 4	0 0 - 10	0 0 - 21	9 0 - 41	0 0 - 10	0 0 - 9	11 0 - 6
URO JAMA	11 1 - 35	0 0 - 34	0 0 - 10	0 0 - 2	0 0 - 10	0 0 - 21	0 0 - 29	6 1 - 19	5 1 - 17	5 1 - 15

Table 7.6. Trophic structure of fishes at Looe Key National Marine Sanctuary. Species, listed alphabetically by family and genus, are grouped according to times of major feeding activity (diurnal, nocturnal, crepuscular, and generally active). Abundance values are based on all random point samples in all habitats irrespective of effort in different habitats. Trophic level codes: H, herbivore; P, planktivore; 8, browser; Mi, microinvertivore; Ma, macroinvertivore; F, piscivore. Principal feeding zones: 5, surface; M, midwater, B, bottom. 'off' indicates feeding is usually away from the reef proper. Dashes indicate species observed in rapid visual samples but not in point samples. "*" indicates species observed after 5 min in random point samples.

TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
DIURNALLY FEEDING FISHES						
ACANTHURIDAE (surgeonfishes)						
Acanthurus bahianus	Ocean surgeon	265	1231	H	B	
Acanthurus chirurgus	Doctorfish	53	97	H	B	
Acanthurus coeruleus	Blue tang	189	561	H	B	
AULOSTOMIDAE (trumpetfishes)						
Aulostomus maculatus	Trumpetfish	23	27	F	B	
BALISTIDAE (leatherjackets)						
Aluterus schoepfi	Orange filefish	4	6	H	B	
Aluterus scriptus	Scrawled filefish	7	7	B,H	B	
Balistes capriscus	Gray triggerfish	3	4	Ma	B	
Balistes vetula	Queen triggerfish	2	2	Ma	B	
Cantherhines macrocerus	Whitespotted filefish	-	-	H	B	
Cantherhines pullus	Orangespotted filefish	15	17	H,B	B	
Canthidermis sufflamen	Ocean triggerfish	6	7	P,Ma	B	
Monacanthus tuckeri	Slender filefish	3	4	Mi	B	
BELONIDAE (needlefishes)						
Strongylura notata	Redfin needlefish	*	*	F	S	
Strongylura timucu	Timucu	1	1	F	S	
Tylosurus crocodilus	Houndfish	3	3	F	S	
BLENNIIDAE (combtooth blennies)						
Hypleurochilus spp.	Unidentified blenny	1	5	H	B	
Ophioblennius atlanticus	Redlip blenny	19	38	H	B	
Scartella cristata	Molly miller	12	20	H	B	

Table 7.6. Trophic structure of fishes at Looe Key National Marine Sanctuary. Species, listed alphabetically by family and genus, are grouped according to times of major feeding activity (diurnal, nocturnal, crepuscular, and generally active). Abundance values are based on all random point samples in all habitats irrespective of effort in different habitats. Trophic level codes: H, herbivore; P, planktivore; 8, browser; Mi, microinvertivore; Ma, macroinvertivore; F, piscivore. Principal feeding zones: 5, surface; M, midwater, B, bottom. 'off' indicates feeding is usually away from the reef proper. Dashes indicate species observed in rapid visual samples but not in point samples. "*" indicates species observed after 5 min in random point samples (cont.).

TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
CALLIONYMIDAE (dragonets)						
Callionymus bairdi	Lancec dragonet	-	-	Mi	B	
CHAFTODONTIDAE (butterflyfishes)						
Chaetodon capistratus	Foureye butterflyfish	206	555	B	B	
Chaetodon ocellatus	Spotfin butterflyfish	90	162	B	B	
Chaetodon sedentarius	Reef butterflyfish	12	18	Mi	B	
Chaetodon striatus	Banded butterflyfish	53	92	B	B	
CIRRHITIDAE (hawkfishes)						
Amblycirrhitus pinos	Redspotted hawkfish	2	2	Mi	B	
CLINIDAE (clinids)						
Acanthemblemaria chaplini	Papillose blenny	1	5	P	B	
Acanthemblemaria spp.	unidentified blenny	-	-	P	B	
Malacoctenus gilli	Dusky blenny	2	6	P,Mi	B	
Malacoctenus macropus	Rosy blenny	1	1	P,Mi	B	
Malacoctenus triangulatus	Saddled blenny	5	5	P,Mi	B	
Malacoctenus versicolor	Barfin blenny	-	-	P,Mi	B	
Paraclinus nigripinnis	Blackfin blenny	1	1	P,Mi	B	
DIODONTIDAE (porcupinefishes)						
Diodon holocanthus	Balloonfish	1	1	Ma	B	
Diodon hystrix	Porcupinefish	1	1	Ma	B	
EPHIPPIDAE (spadefishes)						
Chaetodipterus faber	Atlantic spadefish	1	1	Ma	B	off

Table 7.6. Trophic structure of fishes at Looe Key National Marine Sanctuary. Species, listed alphabetically by family and genus, are grouped according to times of major feeding activity (diurnal, nocturnal, crepuscular, and generally active). Abundance values are based on all random point samples in all habitats irrespective of effort in different habitats. Trophic level codes: H, herbivore; P, planktivore; 8, browser; Mi, microinvertivore; Ma, macroinvertivore; F, piscivore. Principal feeding zones: 5, surface; M, midwater, B, bottom. 'off' indicates feeding is usually away from the reef proper. Dashes indicate species observed in rapid visual samples but not in point samples. "*" indicates species observed after 5 min in random point samples (cont.).

TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
G0BIIDAE (gobies)						
Coryphopterus dicrus	Colon goby	45	111	H	B	
Coryphopterus glaucofraenum	Bridled goby	119	623	H	B	
Coryphopterus personatus	Masked goby	69	3611	P	B	
Coryphopterus sp.	unidentified goby	*	*	H	B	
Gnatholepis thompsoni	Goldspot goby	39	106	H	B	
Gobiosoma macrodon	Tiger goby	1	3	Mi	B	
Gobiosoma oceanops	Neon goby	60	132	Mi	B	
Ioglossus calliurus	Blue goby	15	75	P	B	
Microgobius carri	Seminole goby	3	5	P	B	
GRAMMIDAE (basslets)						
Liopropoma rubre	Peppermint bass	-	-	Ma	B	
HAEMULIDAE (grunts)						
Haemulon album	Margate	9	49	Ma	B	
KYPH0SIDAE (sea chubs)						
Kyphosus sectatrix	Bermuda chub	39	407	H	M,S	

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
LABRIDAE (wrasses)						
Bodianus pulchellus	Spotfin hogfish	-	-	Mi	B	
Bodianus rufus	Spanish hogfish	129	218	Ma,Mi	B	
Clepticus parrai	Creole wrasse	14	274	P	M	
Halichoeres bivittatus	Slippery dick	258	3590	Mi,Ma	B	
Halichoeres garnoti	Yellowhead wrasse	251	1110	Mi,Ma	B	
Halichoeres maculipinna	Clown wrasse	246	1512	Mi,Ma	B	
Halichoeres pictus	Rainbow wrasse	-	-	P	M	
Halichoeres poeyi	Blackear wrasse	40	119	Mi,Ma	B	off
Halichoeres radiatus	Puddingwife	123	252	Mi,Ma	B	
Hemiemblemaria simulus	Wrasse blenny	1	1	Mi,P	B	
Hemipteronotus novacula	Pearly razorfish	2	2	Mi,Ma	B	off
Hemipteronotus splendens	Green razorfish	49	267	Mi,Ma	B	off
Lachnolaimus maximus	Hogfish	70	98	Ma	B	
Thalassoma bifasciatum	Bluehead wrasse	328	12484	P,Mi	B,M	
MALACANTHIDAE (tilefishes)						
Malacanthus plumieri	5and tilefish	7	10	Mi,Ma	B	
MULLIDAE (goatfishes)						
Pseudupeneus maculatus	Spotted goatfish	36	78	Mi	B	
OPISTOGNATHIDAE (jawfishes)						
Opistognathus aurifrons	Yellowhead jawfish	17	43	P	B	
Opistognathus maxillosus	Mottled jawfish	-	-	Mi	B	
OSTRACIIDAE (boxfishes)						
Lactophrys bicaudalis	Spotted trunkfish	2	2	B	B	
Lactophrys polygonia	Honeycomb cowfish	-	-	B	B	
Lactophrys quadricornis	Scrawled cowfish	-	-	B	B	
Lactophrys triqueter	Smooth trunkfish	5	5	B	B	

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
POMACANTHIDAE (angelfishes)						
Holacanthus bermudensis	Blue angelfish	17	18	B	B	
Holacanthus ciliaris	Queen angelfish	23	23	B	B	
Holacanthus tricolor	Rock beauty	58	77	B	B	
Pomacanthus arcuatus	Gray angelfish	96	121	B	B	
Pomacanthus paru	French angelfish	35	45	B	B	
POMACENTRIDAE (damselfishes)						
Abudefduf saxatilis	Sergeant major	185	6799	P	M,S	
Chromis cyaneus	Blue chromis	107	324	P	M	
Chromis insolata	Sunshinefish	1	1	P	M	
Chromis multilineata	Brown chromis	59	892	P	M	
Chromis scotti	Purple reeffish	12	47	P	M	
Microspathodon chrysurus	Yellowtail damselfish	180	974	H	B	
Pomacentrus diencaeus	Longfin damselfish	21	109	H	B	
Pomacentrus fuscus	Dusky damselfish	82	692	H	B	
Pomacentrus leucostictus	Beaugregory	46	132	H	B	
Pomacentrus partitus	Bicolor damselfish	322	10021	P,H	B	
Pomacentrus planifrons	Three spot damselfish	152	1257	H	B	
Pomacentrus variabilis	Cocoa damselfish	61	166	H	B	
SCARIDAE (parrotfishes)						
Cryptotomus roseus	Bluelip parrotfish	8	22	H	B	
Scarus coelestinus	Midnight parrotfish	14	51	H	B	
Scarus coeruleus	Blue parrotfish	30	61	H	B	
Scarus croicensis	Striped parrotfish	212	1645	H	B	
Scarus quacamaia	Rainbow parrotfish	15	20	H	B	
Scarus taeniopterus	Princess parrotfish	84	215	H	B	
Scarus vetula	Queen parrotfish	34	57	H	B	
Sparisoma atomarium	Greenblotch parrotfish	3	7	H	B	
Sparisoma aurofrenatum	Redband parrotfish	180	441	H	B	
Sparisoma chrysopterum	Redtail parrotfish	84	190	H	B	
Sparisoma radians	Bucktooth parrotfish	43	246	H	B	
Sparisoma rubripinne	Yellowtail parrotfish	76	200	H	B	
Sparisoma viride	Stoplight parrotfish	167	386	H	B	

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
SERRANIDAE (groupers)						
Diplectrum formosum	Sand perch	13	59	Ma,Mi	B	off
Hypoplectrus gemma[Δ]	Blue hamlet	16	16	Mi	B	
Hypoplectrus nigricans[Δ]	Black hamlet	1	1	Mi	B	
Hypoplectrus unicolor	Butter hamlet	31	38	Mi	B	
Hypoplectrus puella[Δ]	Barred hamlet	3	3	Mi	B	
Serranus baldwini	Lanternfish	8	11	Mi	B	
Serranus tabacarius	Tobaccofish	*	*	Mi	B	off
Serranus tigrinus	Harlequin bass	113	185	Mi	B	
Serranus tortugarum	Chalk bass	2	2	Mi	B	off
Paranthias furcifer	Creole-fish	-	-	P,F	M	off
SPARIDAE (porgies)						
Calamus sp.	Unidentified porgy	1	1	Ma	B	
Calamus bajonado	Jolthead porgy	27	35	Ma	B	
Calamus calamus	Saucereye porgy	65	94	Ma	B	
Calamus penna	Sheepshead porgy	2	3	Ma	B	
Pagrus pagrus	Red Porgy	1	1	Ma	B	
TETRADONTIDAE (puffers)						
Canthigaster rostrata	Sharpnose puffer	42	53	B,H	B	
Sphoeroides spengleri	Bandtail puffer	1	1	Mi,B	B	
Other (unclassified)						
Fry	Unidentified species	1	15	P	M	

[Δ] Now considered color forms of *H. unicolor* (American Fisheries Society, 1980).

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
NOCTURNALLY FEEDING FISHES						
APOGONIDAE (cardinalfishes)						
Apogon binotatus	Barred cardinalfish	-	-	P	M	
Apogon maculatus	Flamefish	-	-	P	M	
Apogon pseudomaculatus	Twospot cardinalfish	1	2	P	M	
Apogon quadrisquamatus	Sawcheek caradinalfish	-	-	P	M	
ATHERINIDAE (silversides)						
Atherinomorus stipes	Hardhead silverside	-	-	P	M	off
CLUPEIDAE (herrings)						
Jenkinsia lamprotaenia	Dwarf herring	-	-	P	M	off
Jenkinsia spp.	Unidentified *Jenkinsia*	-	-	P	M	off
ENGRAULIDAE (anchovies)						
Anchoa lyolepis	Dusky anchovy	-	-	P	M	off
GERREIDAE (mojarras)						
Gerres cinereus	Yellowfin mojarra	6	681	Ma,Mi	B	off

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
HAEMULIDAE (grunts)						
Anisotremus surinamenis	Black margate	1	1	Ma	B	off
Anisotremus virginicus	Porkfish	20	28	Ma	B	off
Haemulon aurolineatum	Tomtate	138	10842	Ma	B	off
Haemulon carbonarium	Caesar grunt	23	355	Ma	B	off
Haemulon chrysargyreum	Smallmouth grunt	21	877	Ma	B	off
Haemulon flavolineatum	French grunt	175	714	Ma	B	off
Haemulon macrostomum	Spanish grunt	40	90	Ma	B	off
Haemulon melanurum	Cottonwick	8	22	Ma	B	off
Haemulon parrai	Sailor's choice	11	62	Ma	B	off
Haemulon plumieri	White grunt	163	1122	Ma	B	off
Haemulon sciurus	Bluestriped grunt	111	542	Ma	B	off
HOLOCENTRIDAE (squirrelfishes)						
Holocentrus ascensionis	Squirrelfish	6	7	Ma,Mi	B	
Holocentrus coruscus	Reef squirrelfish	-	-	Ma,Mi	B	
Holocentrus rufus	Longspine squirrelfish	20	32	Ma,Mi	B	
Holocentrus vexillarius	Dusky squirrelfish	1	1	Ma,Mi	B	
Myripristis jacobus	Blackbar soldierfish	-	-	P	M	off
INERMIIDAE (bonnetmouths)						
Inermia vittata	Boga	6	352	P	M	off
LUTJANIDAE (snappers)						
Lutjanus analis	Mutton snapper	6	6	Ma,F	B	off
Lutjanus apodus	Schoolmaster snapper	42	208	F,Ma	B	off
Lutjanus griseus	Gray snapper	29	157	F,Ma	B	off
Lutjanus jocu	Dog snapper	1	1	F,Ma	B	off
Lutjanus mahogoni	Mahogany snapper	3	9	F,Ma	B	off
Lutjanus synagris	Lane snapper	17	254	Ma,F	B	off
Ocyurus chrysurus	Yellowtail snapper	259	1602	Ma,F	B	off

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
MULLIDAE (goatfishes)						
Mulloidichthys martinicus	Yellow goatfish	53	346	Mi	B	off
MURAENIDAE (morays)						
Enchelycore nigricans	Viper moray	*	*	F	B	
Gymnothorax funebris	Green moray	2	2	Ma,F	B	
Gymnothorax moringa	Spotted moray	-	-	F	B	
Muraena miliaris	Goldentail moray	2	2	Ma	B	
ORECTOLOBIDAE (carpet sharks)						
Ginglymostoma cirratum	Nurse shark	1	1	F,Ma	8	
PEMPHERIDAE (sweepers)						
Pempheris schomburgki	Glassy sweeper	15	493	P	M	
PRIACANTHIDAE (bigeyes)						
Priacanthus cruentatus	Glasseye snapper	6	6	Ma,P	M	
SCIAENIDAE (drums)						
Equetus acuminatus	High-hat	7	7	Ma	B	
Equetus lanceolatus	Jacknife-fish	-	-	Ma	B	
Equetus punctatus	Spotted drum	1	1	Ma	B	
Odontoscion dentex	Reef croaker	37	87	Ma	B	

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CREPUSCULARLY (Twlight) FEEDING FISHES						
CARANGIDAE (jacks)						
Alectis ciliaris	African pompano	-	-	Ma	B	off
Caranx bartholomaei	Yellow jack	18	48	F	M	
Caranx crysos	Blue runner	1	28	F	M	off
Caranx ruber	Bar jack	93	661	F	M	
Seriola dumerili	Greater amberjack	*	*	F	M	off
Trachinotus falcatus	Permit	6	8	Ma	B	off
GRAMMISTIDAE (soapfishes)						
Rypticus saponaceus	Greater soapfish	-	-	Ma,F	B	
SCORPAENIDAE (scorpionfishes)						
Scorpaena plumieri	Scorpion fish	-	-	F	B	
SERRANIDAE (sea basses)						
Epinephelus adscensionis	Rock hind	-	-	Ma,F	B	
Epinephelus cruentatus	Graysby	114	133	Ma,F	B	
Epinephelus fulvus	Coney	-	-	Ma,F	B	
Epinephelus guttatus	Red hind	-	-	Ma,F	B	
Epinephelus itajara	Jewfish	-	-	Ma,F	B	
Epinephelus morio	Red grouper	1	1	Ma,F	B	
Epinephelus striatus	Nassau grouper	2	2	Ma,F	B	
Mycteroperca bonaci	Black grouper	9	9	F	B	
SPHYRAENIDAE (barracudas)						
Sphyraena barracuda	Barracuda	69	107	F	M	
SYNODONTIDAE (lizardfishes)						
Synodus intermedius	Sand diver	2	2	F	B	

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TAXON	COMMON NAME	FREQUENCY (N = 417)	TOTAL ABUNDANCE	TROPHIC LEVEL (H,P,B, Mi,Ma,F)	FEEDING ZONE (S,M,B)	FEEDS OFF REEF
	DAY AND NIGHT FEEDING FISHES					
CARANGIDAE (jacks)						
Decapterus macarellus	Mackerel scad	1	70	P	M	off
Decapterus punctatus	Round scad	1	150	P	M	off
DASYATIDAE (stingrays)						
Dasyatis americana	Southern stingray	-	-	Ma	B	off
Urolophus jamaicensis	Yellow stingray	9	9	Ma	B	off
ECHENEIDAE (remoras)						
Echeneis naucrates	Sharksucker	6	6	F	M	off
ELOPIDAE (tarpons)						
Meqalops atlanticus	Tarpon	2	2	F	S,M	off
MYLIOBATIDAE (Eagle rays)						
Aetobatus narinari	Spotted eagle ray			Ma	B	off
SCOMBRIDAE (mackerels)						
Scomberomorus cavalla	King mackerel	1	1	F	M	off
Scomberomorus maculatus	Spanish mackerel.	1	1	F	M	off
Scomberomorus regalis	Cero	3	3	F	M	off

Table 7.7. Summary of trophic activity analysis of fishes censused in Looe Key National Marine Sanctuary. Data summarized from Table 7.6. Classification was based an primary behavior of adults.

PRIMARY TROPHIC CLASSIFICATION:	HERBIVORE	PLANKTI-VORE	CARNIVOROUS BROWSER	MICRO-INVERTI-VORE	MACRO INVERTI-VORE	PISCIVORE	TOTAL
NUMBER OF SPECIES							
DIURNAL SPECIES	33	18	14	31	16	4	116 (62%)
NOCTURNAL SPECIES	0	11	0	1	25	8	45 (24%)
CREPUSCULAR SPECIES	0	0	0	0	8	10	18 (9%)
GENERALLY ACTIVE SPECIES	0	2	0	0	3	5	10 (5%)
TOTAL	33 (17%)	31 (16%)	14 (8%)	32 (17%)	52 (27%)	27 (14%)	189 (100%)
NUMBER OF INDIVIDUALS							
DIURNAL SPECIES	10,095	34,603	1,160	7,362	577	31	53,828 (73%)
NOCTURNAL SPECIES	0	847	0	346	17,341	378	18,912 (26%)
CREPU5CULAR SPECIES	0	0	0	0	141	858	999 (1%)
GENERALLY ACTIVE SPECIES	0	220	0	0	9	13	242 (0%)
TOTAL	10,095 (14%)	35,670 (48%)	1,160 (2%)	7,706 (10%)	18,068 (24%)	1,280 (2%)	73,981 (100%)

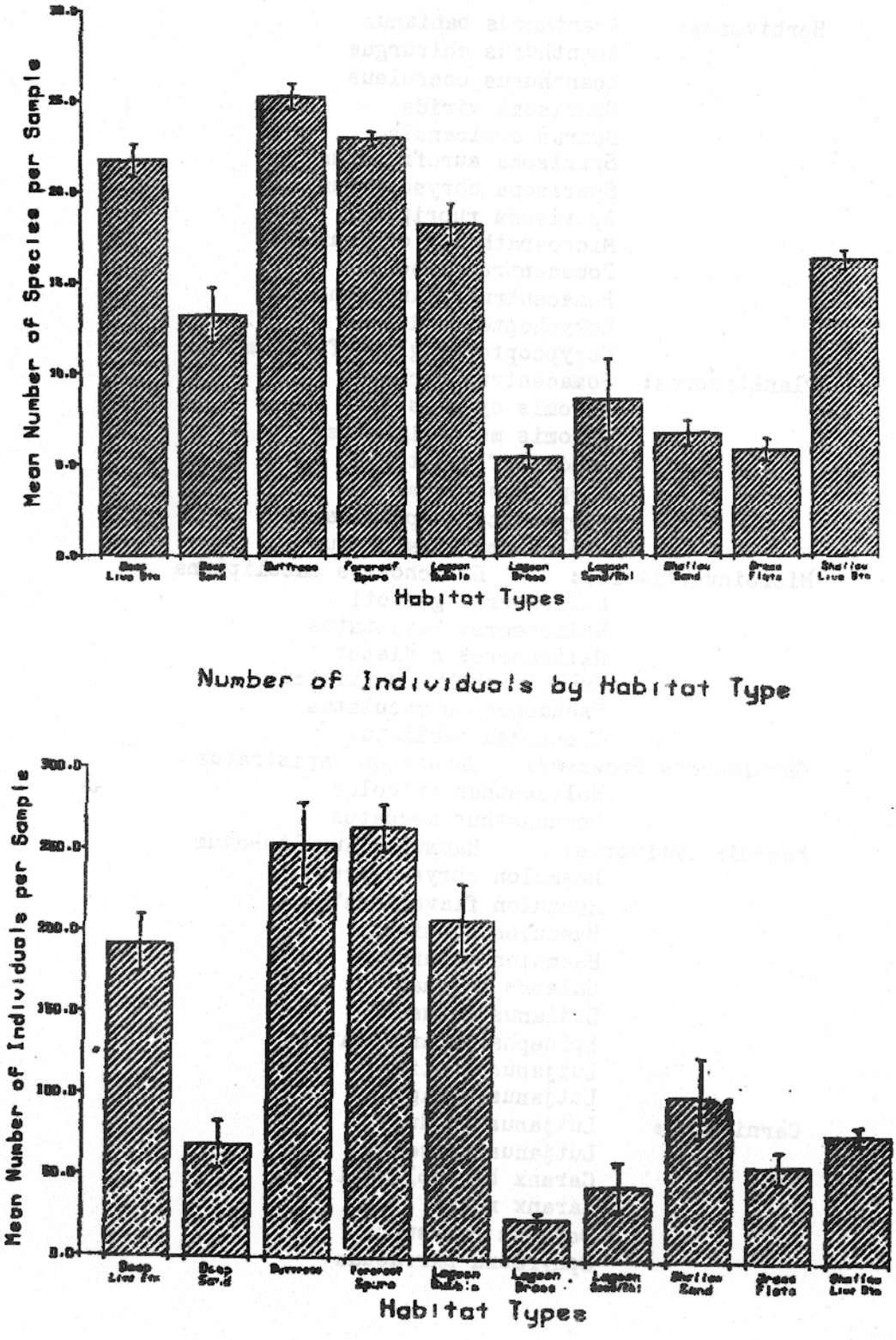
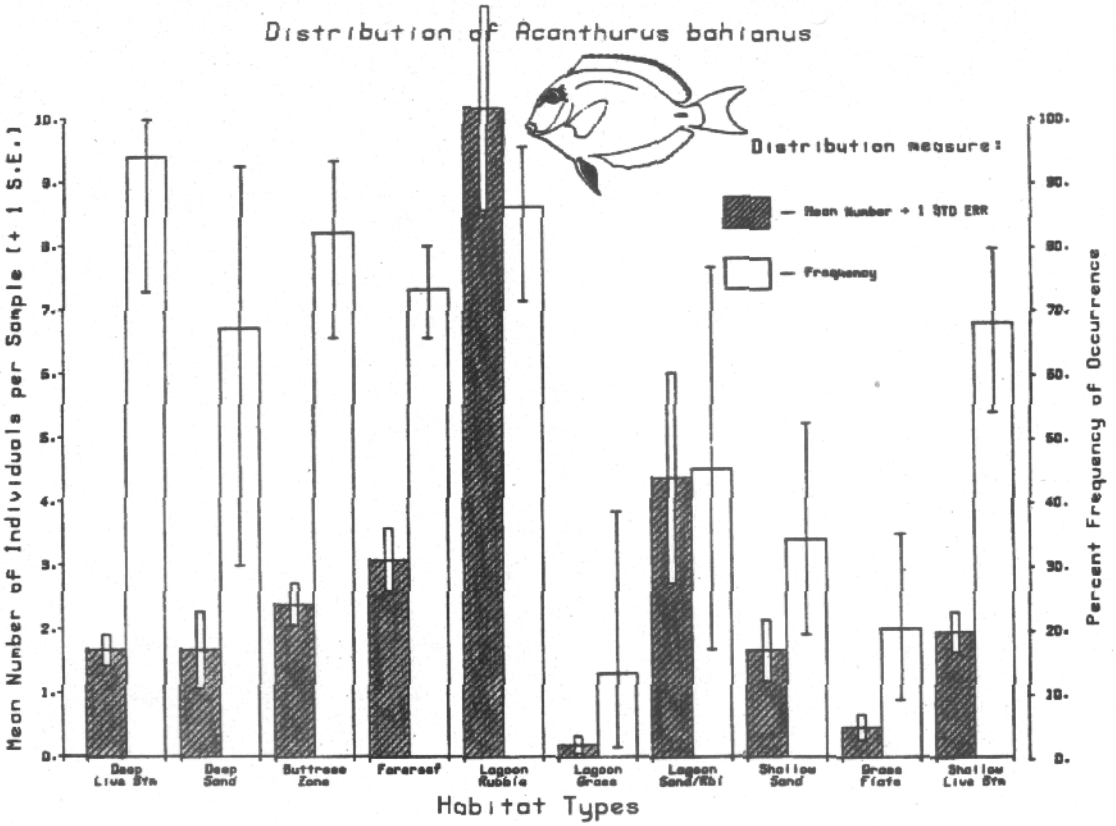
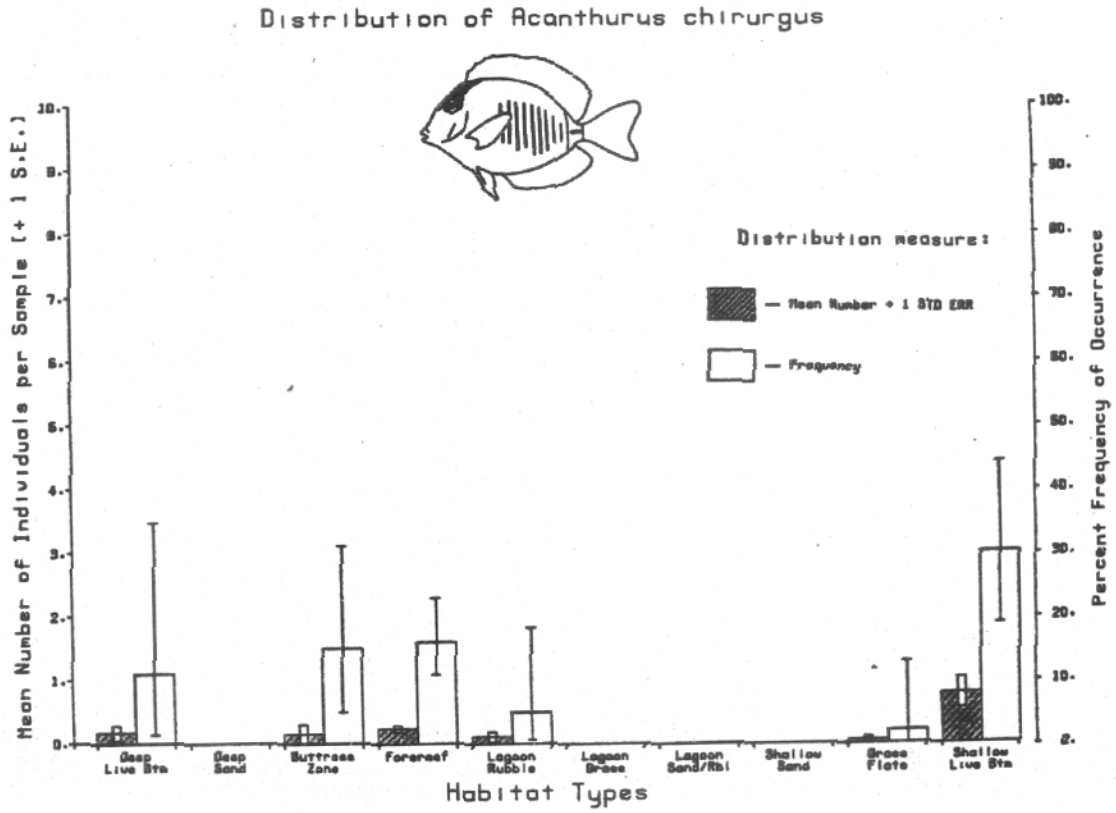
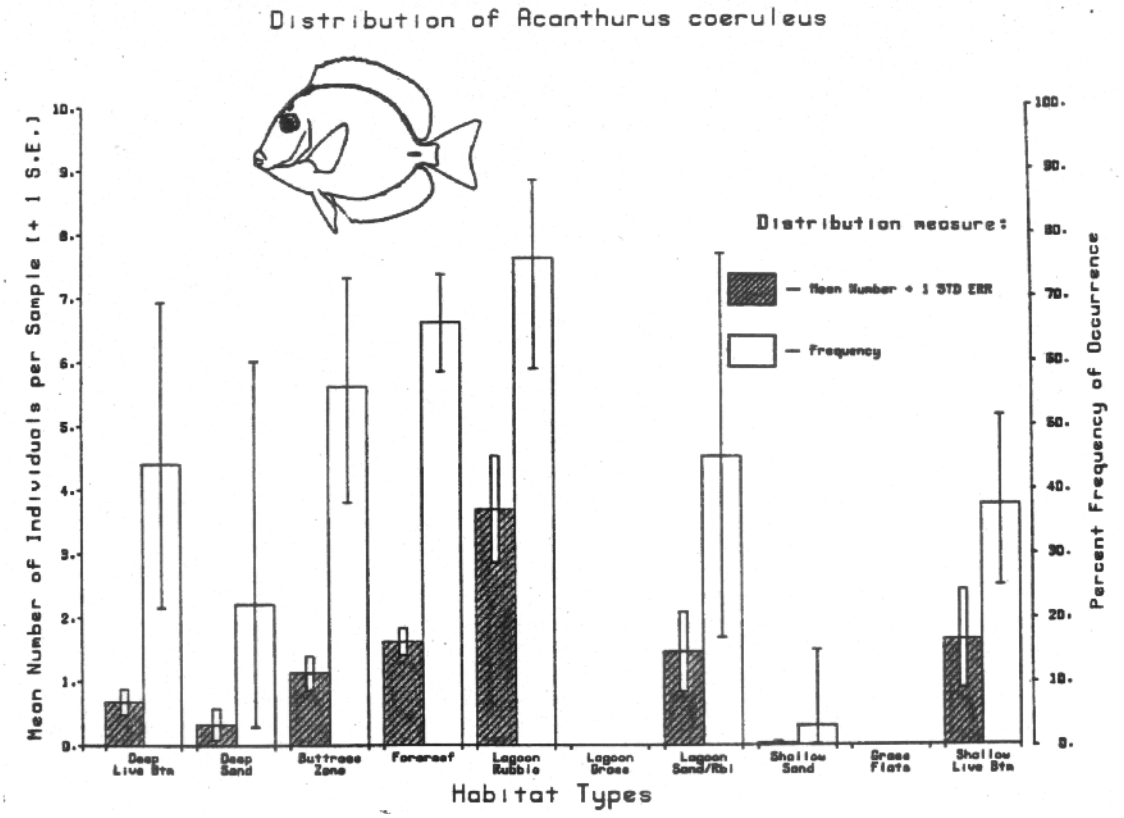


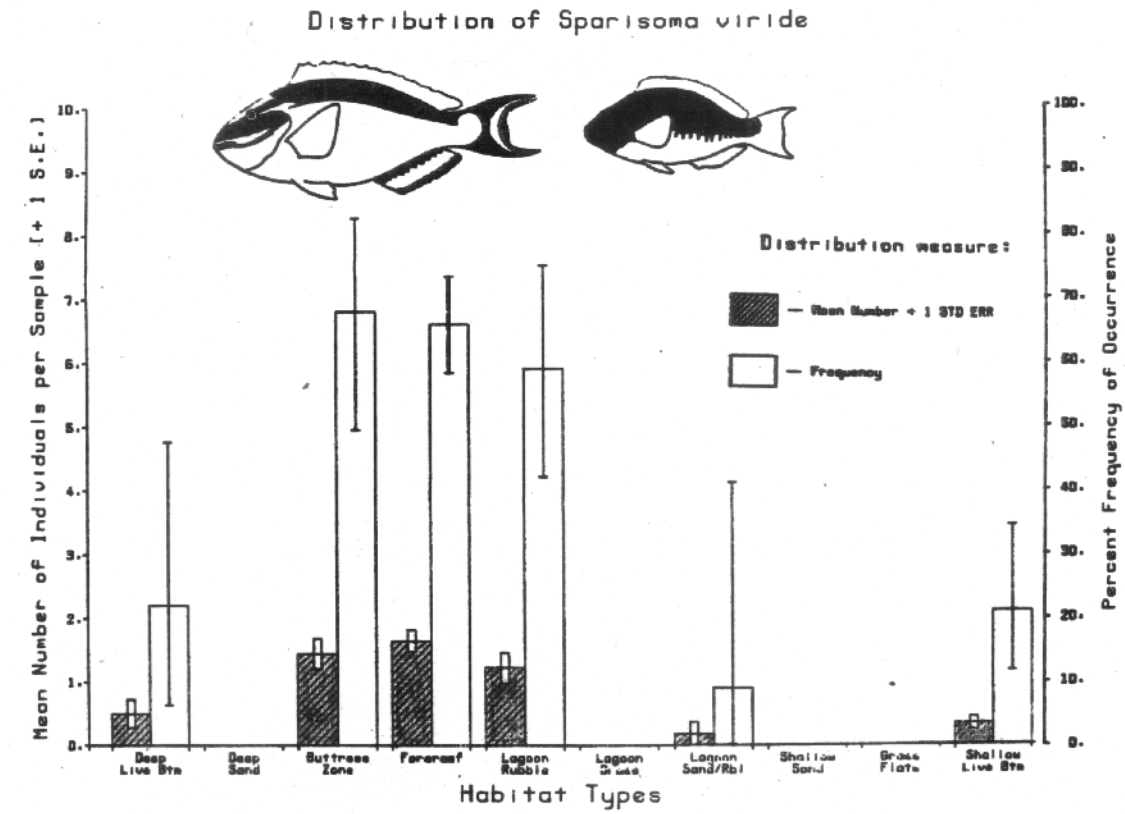
Figure 7.1. Mean number of species and individuals per point sample by habitat. Vertical lines show ±1 standard error of the mean.

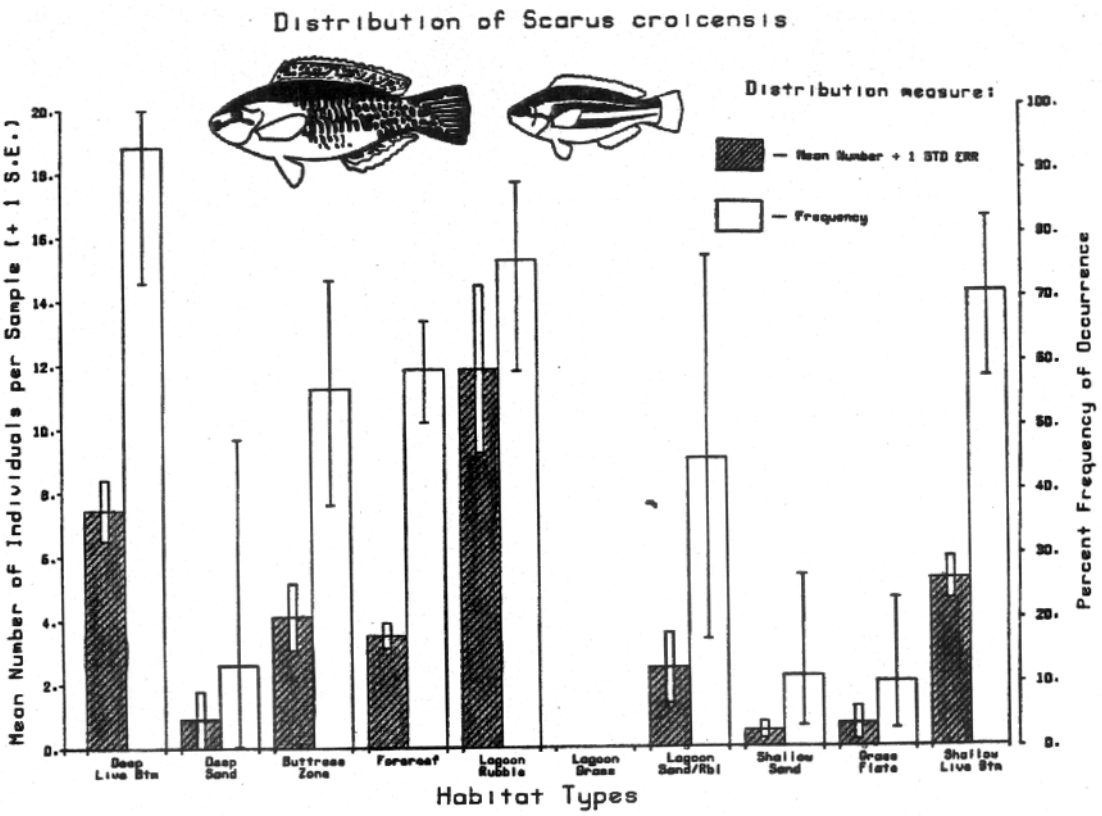
Appendix 7.A. Abundance, distribution, and frequency of occurrence of selected species at Looe Key National Marine Sanctuary. Vertical bars show 95% confidence limits and vertical lines show ± one standard error of the mean. Data are presented in Tables 7.4 and 7.5.

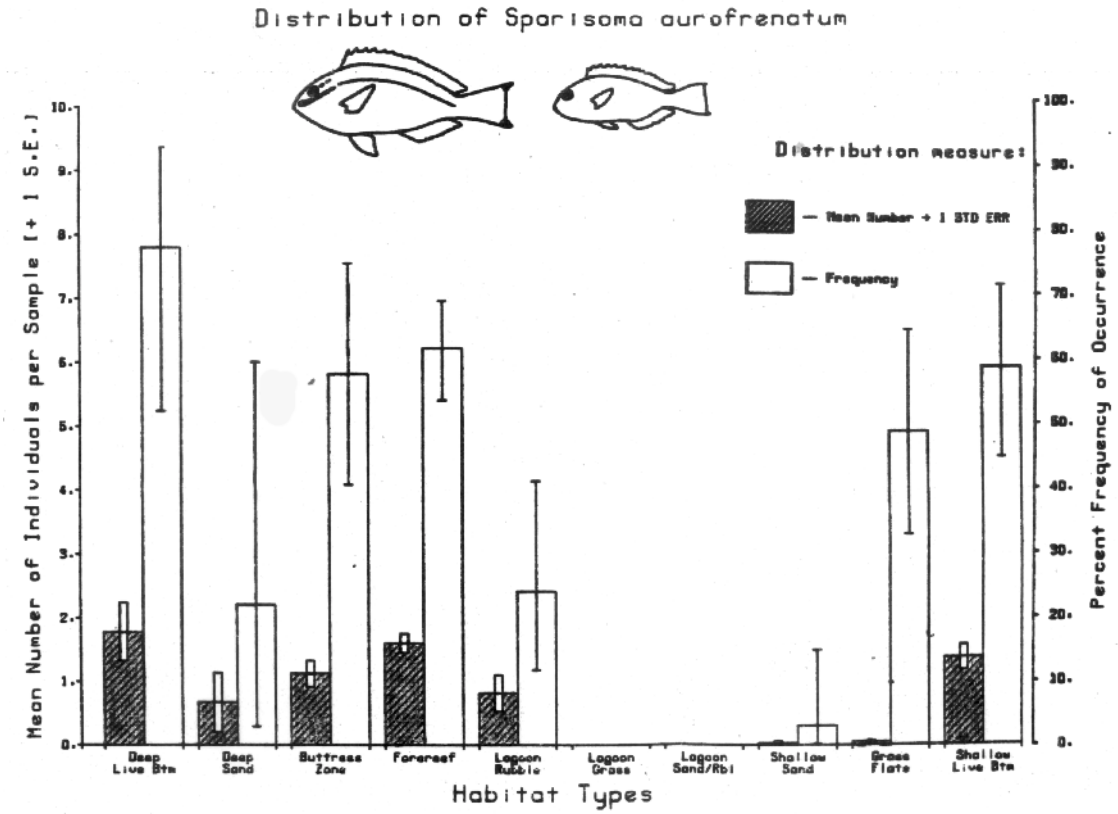

Distribution of Acanthurus bahianus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

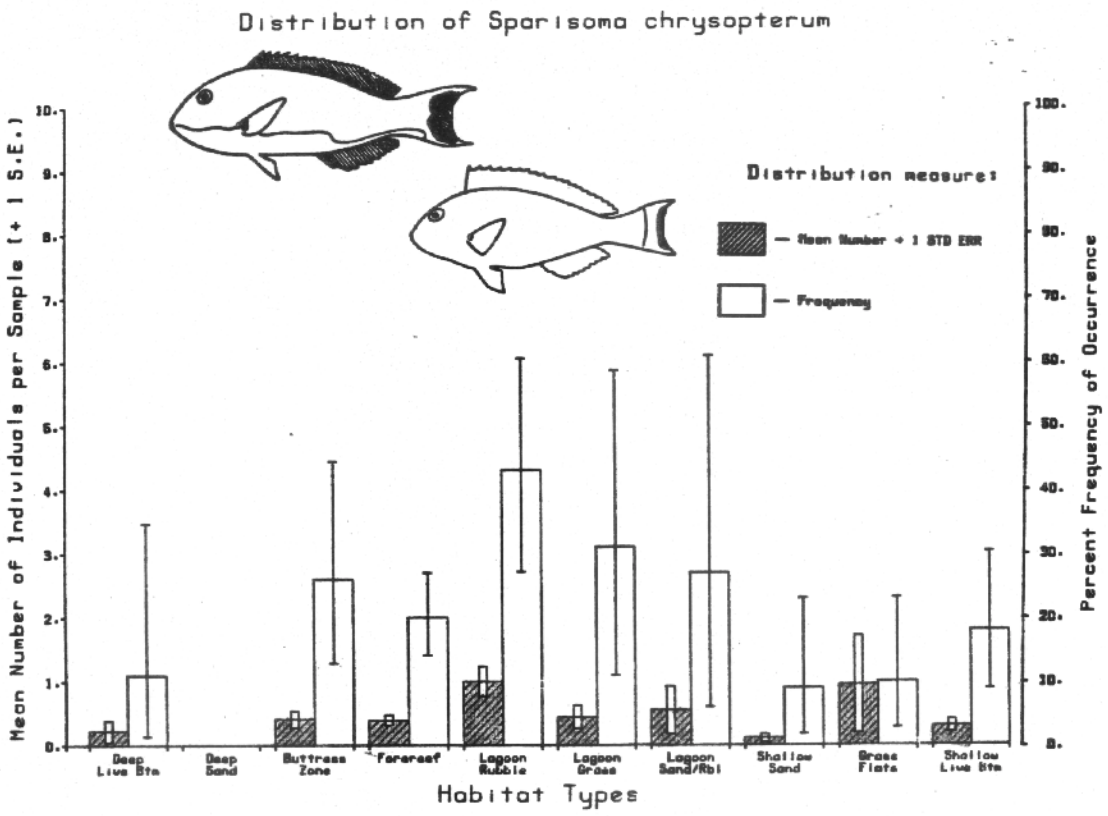

Distribution of Acanthurus chirurgus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

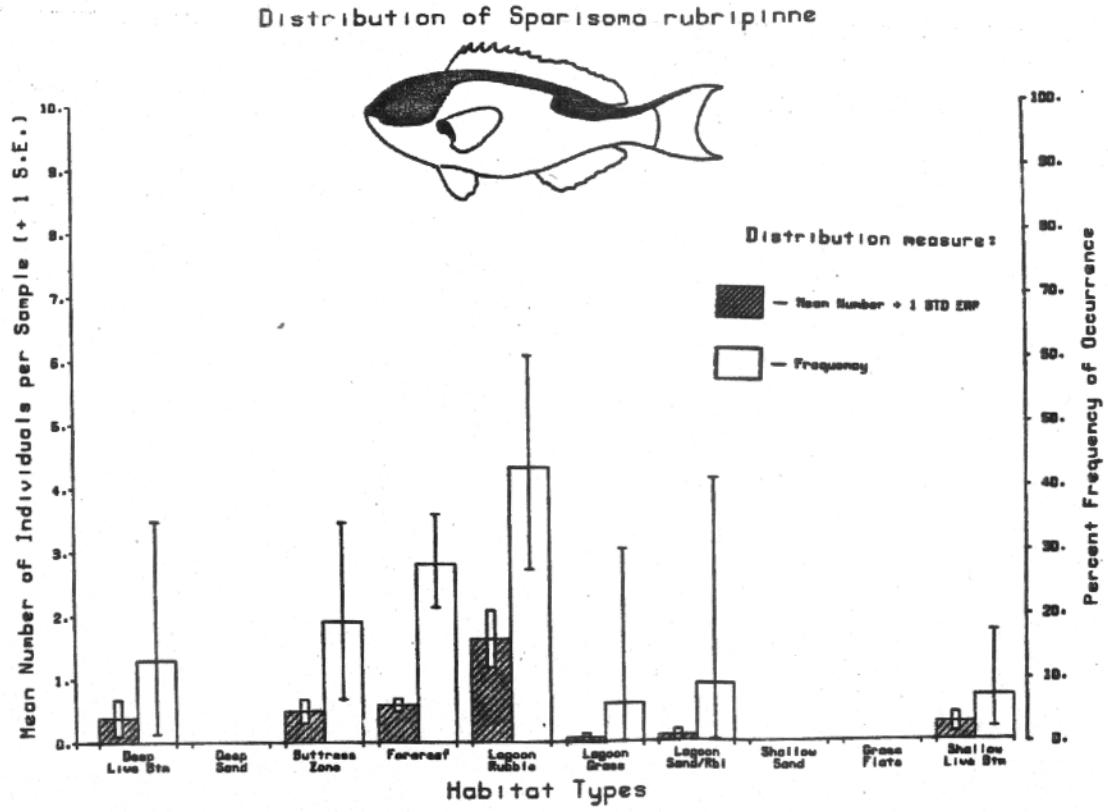

Distribution of Acanthurus coeruleus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Fororeef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

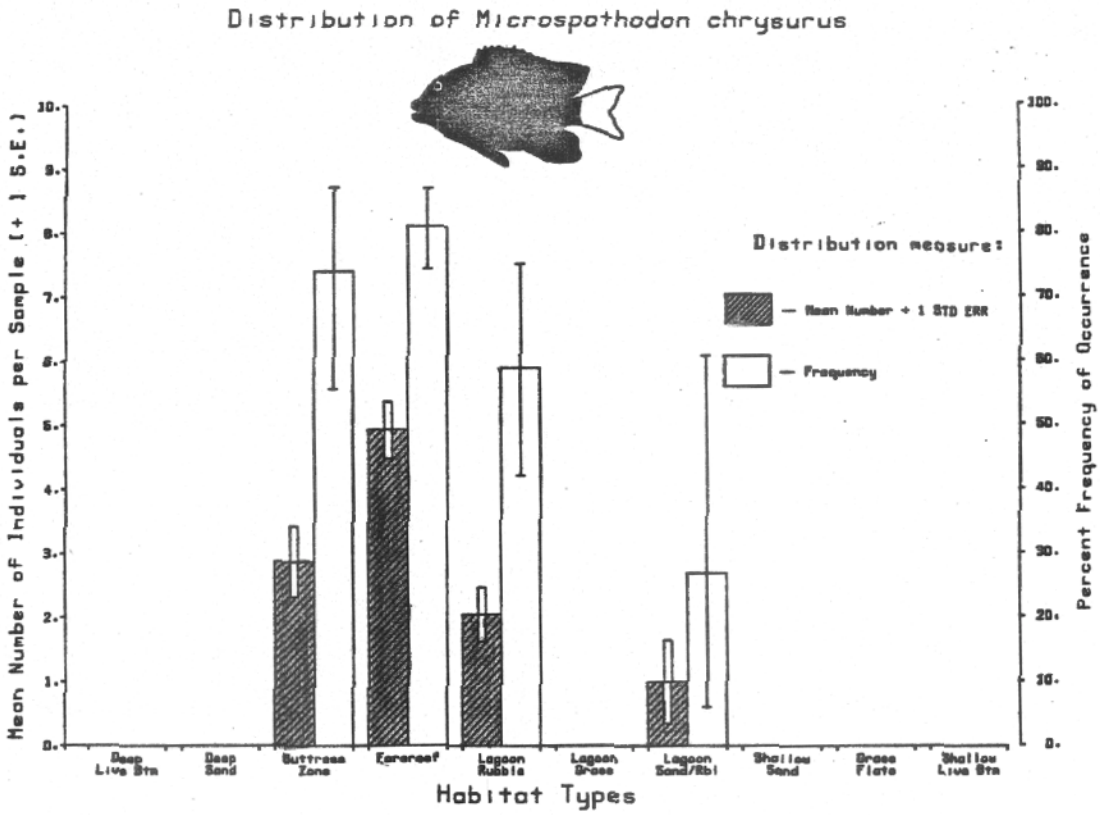

Distribution of Sparisoma viride
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Fororeef
Lagoon Rubble
Lagoon Sand/Rbl
Shallow Live Btm
Habitat Types

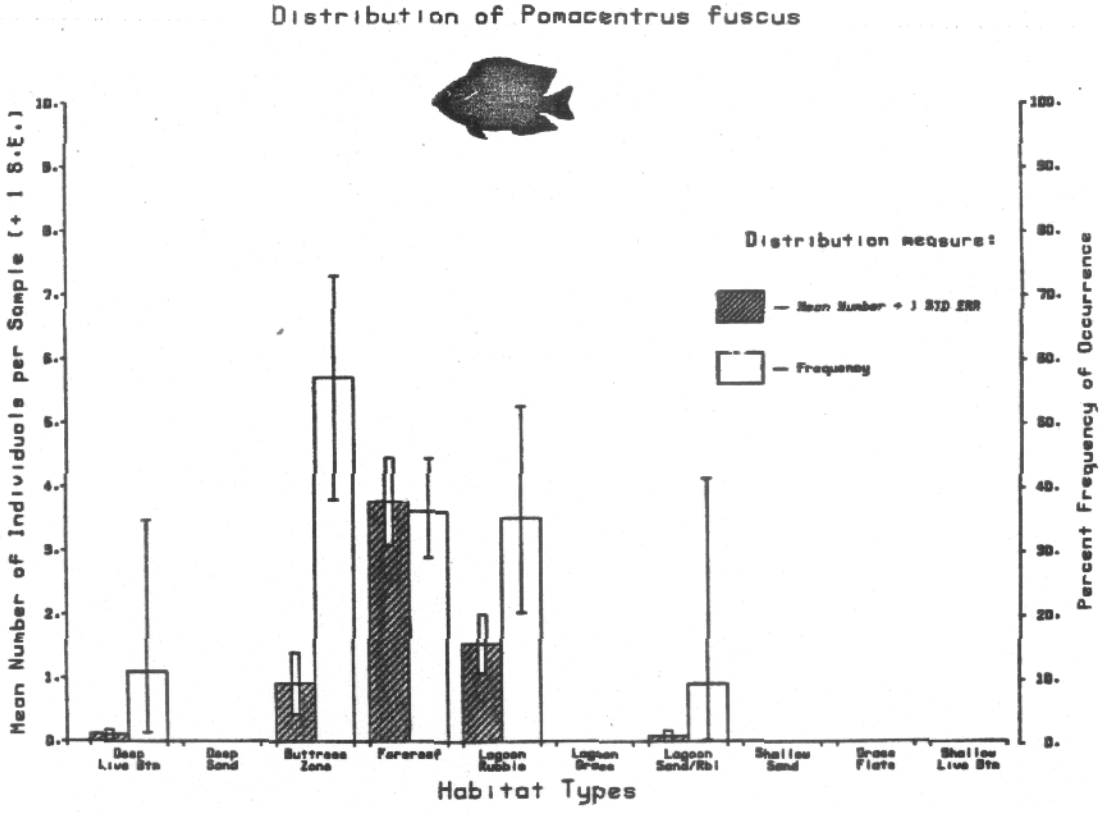

Distribution of Scarus croicensis
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

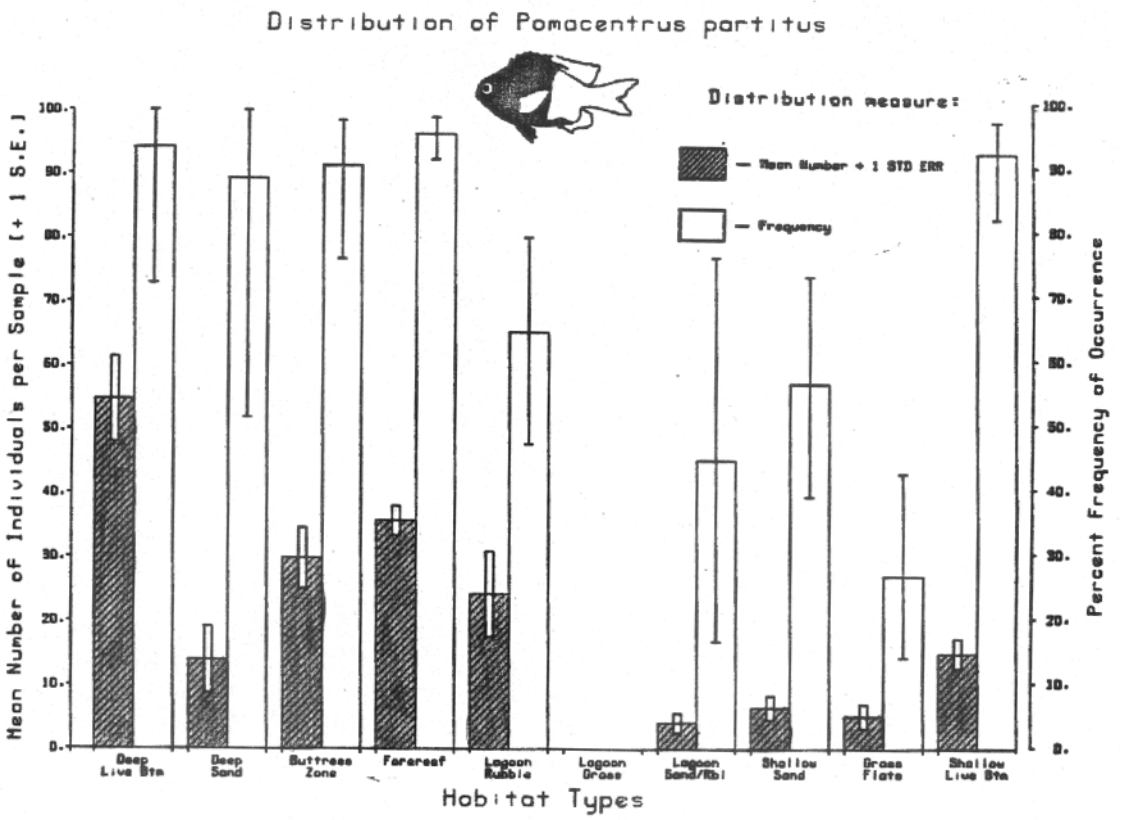

Distribution of Sparisoma aurofrenatum
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

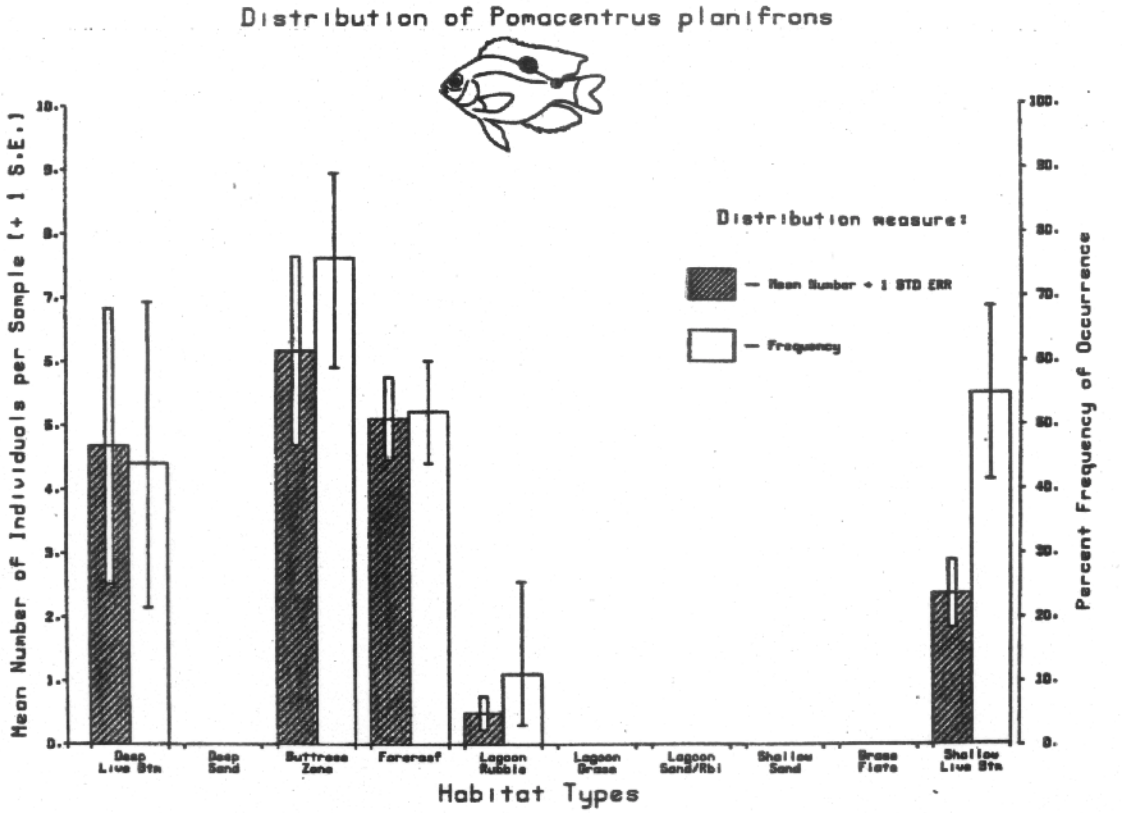

Distribution of Sparisoma chrysopterum
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

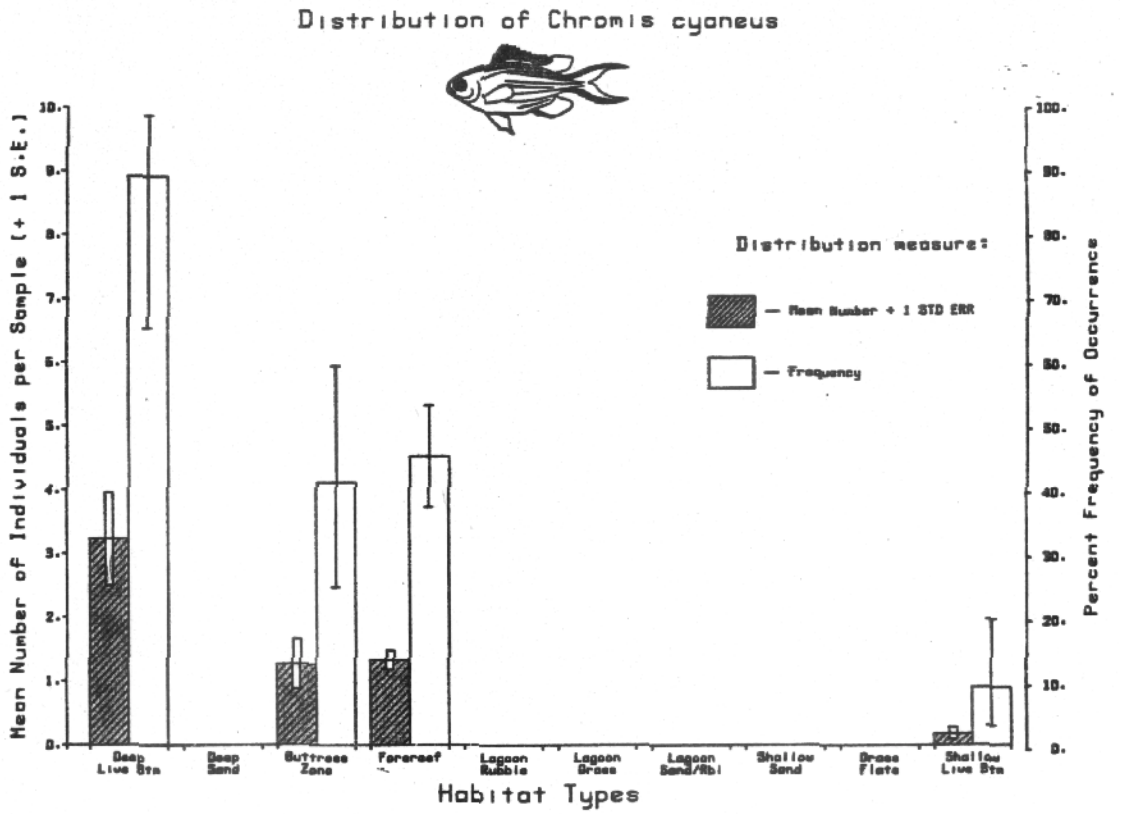

Distribution of Sparisoma rubripinne
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

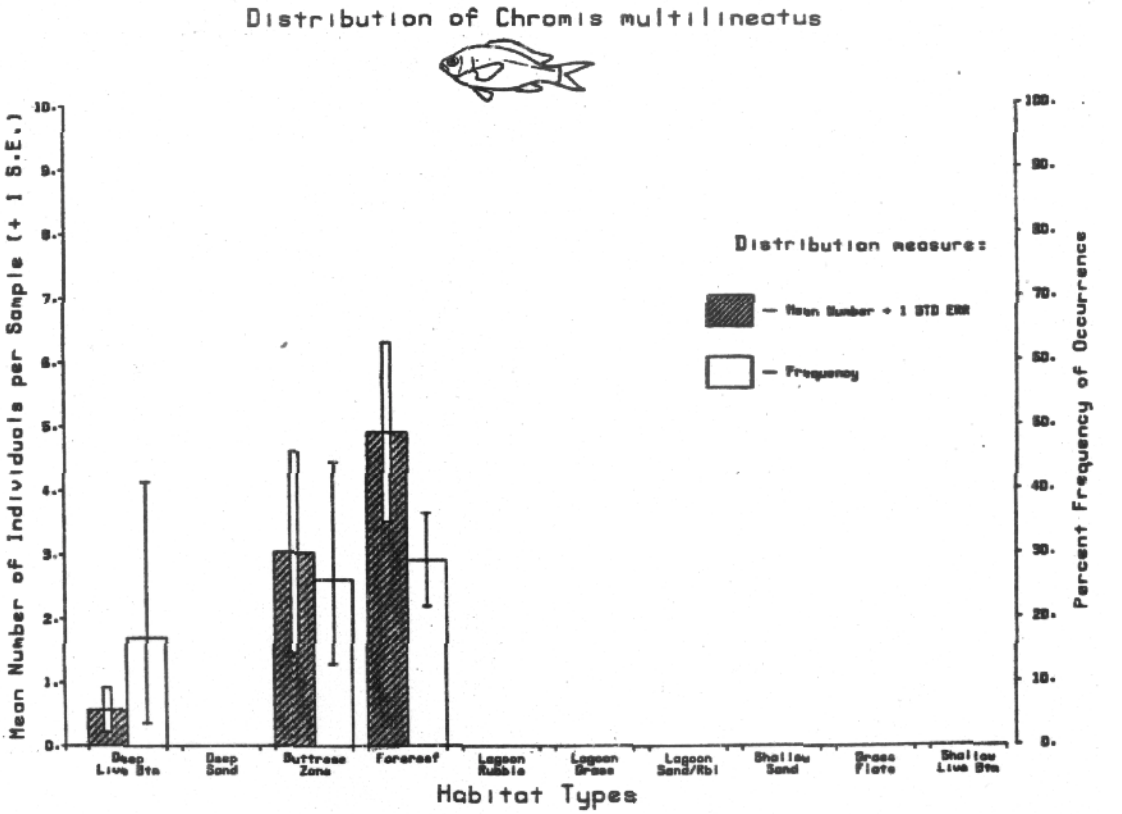

Distribution of Microspathodon chrysurus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

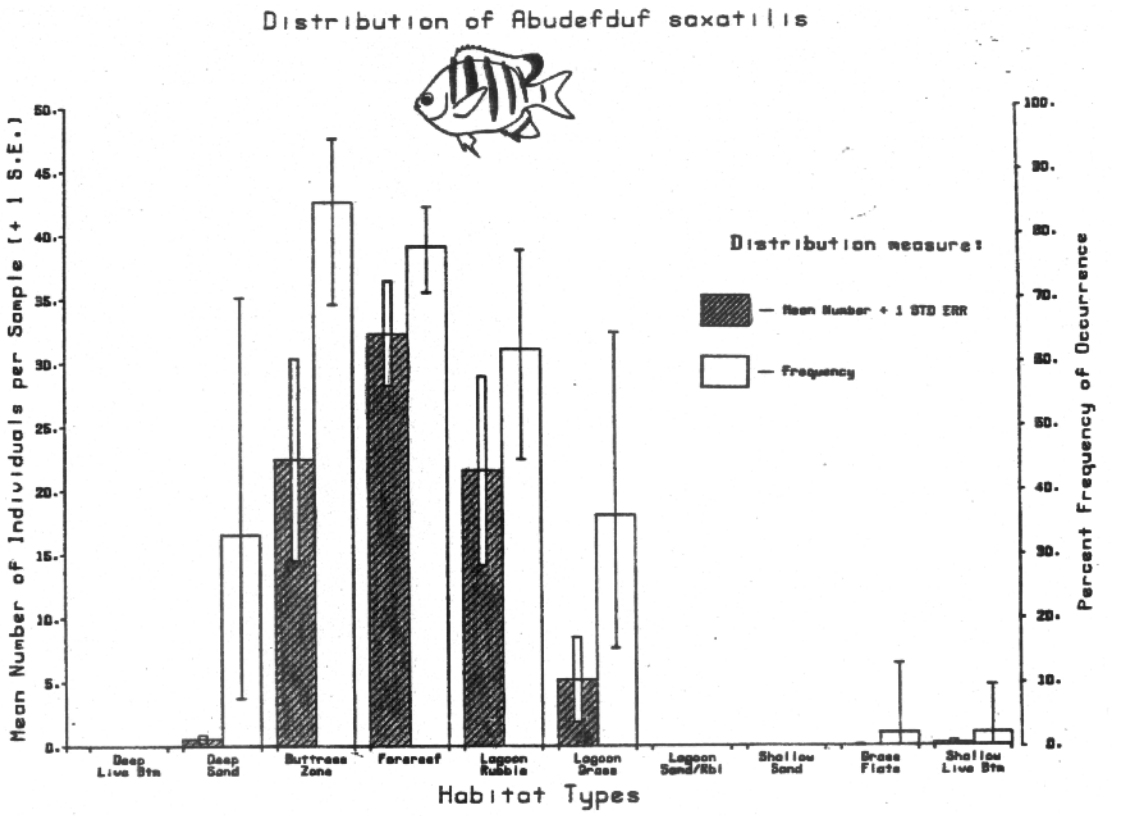

Distribution of Pomacentrus fuscus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

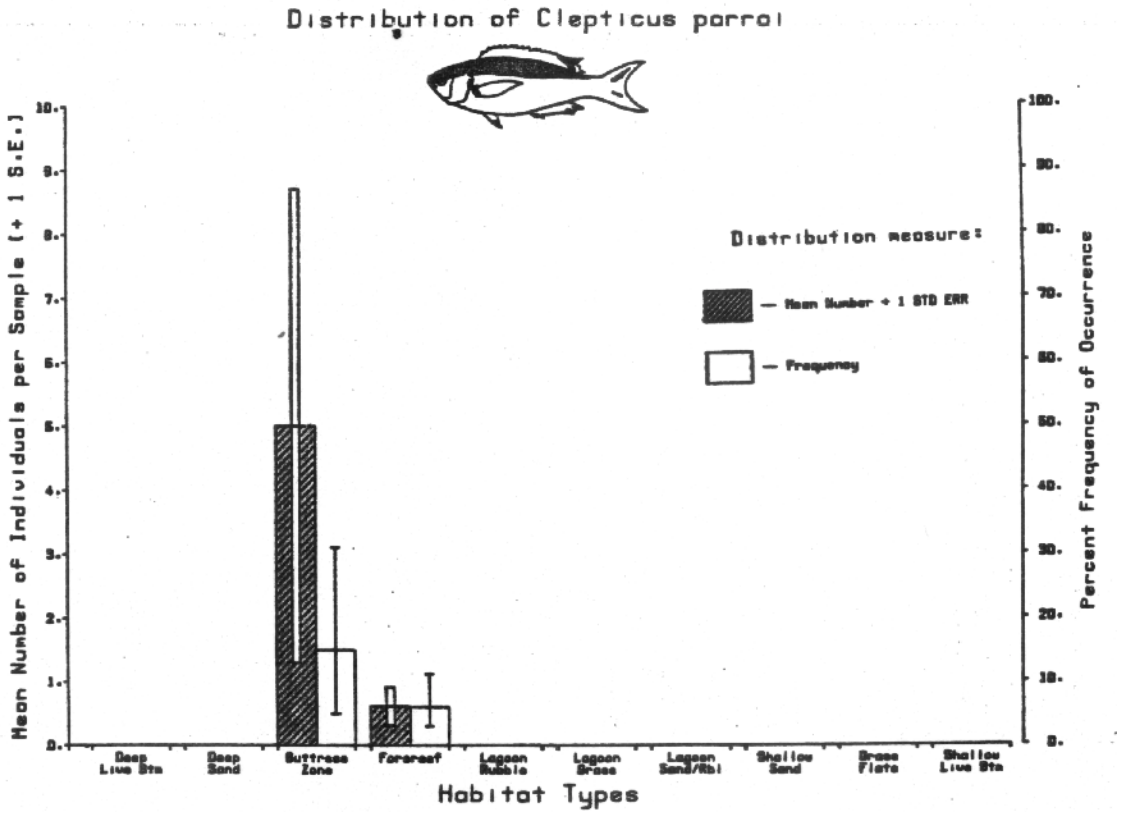

Distribution of Pomacentrus partitus
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

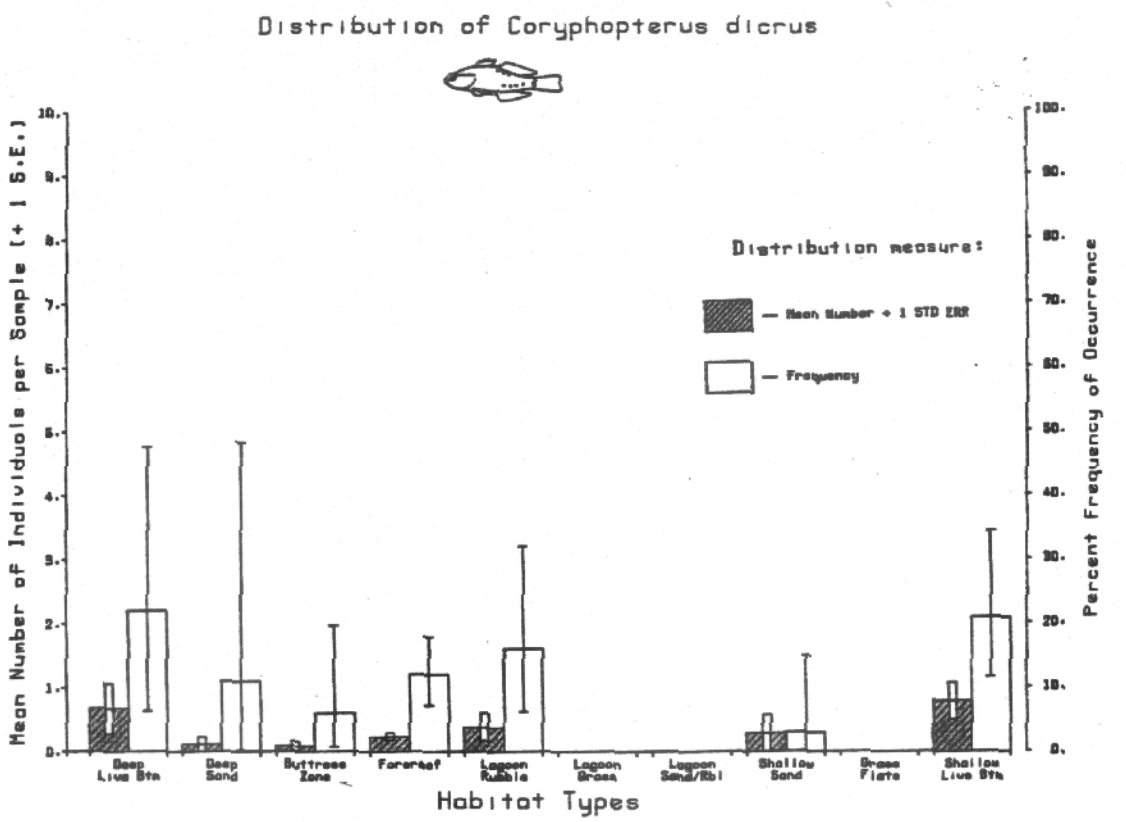

Distribution of Pomacentrus planifrons
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

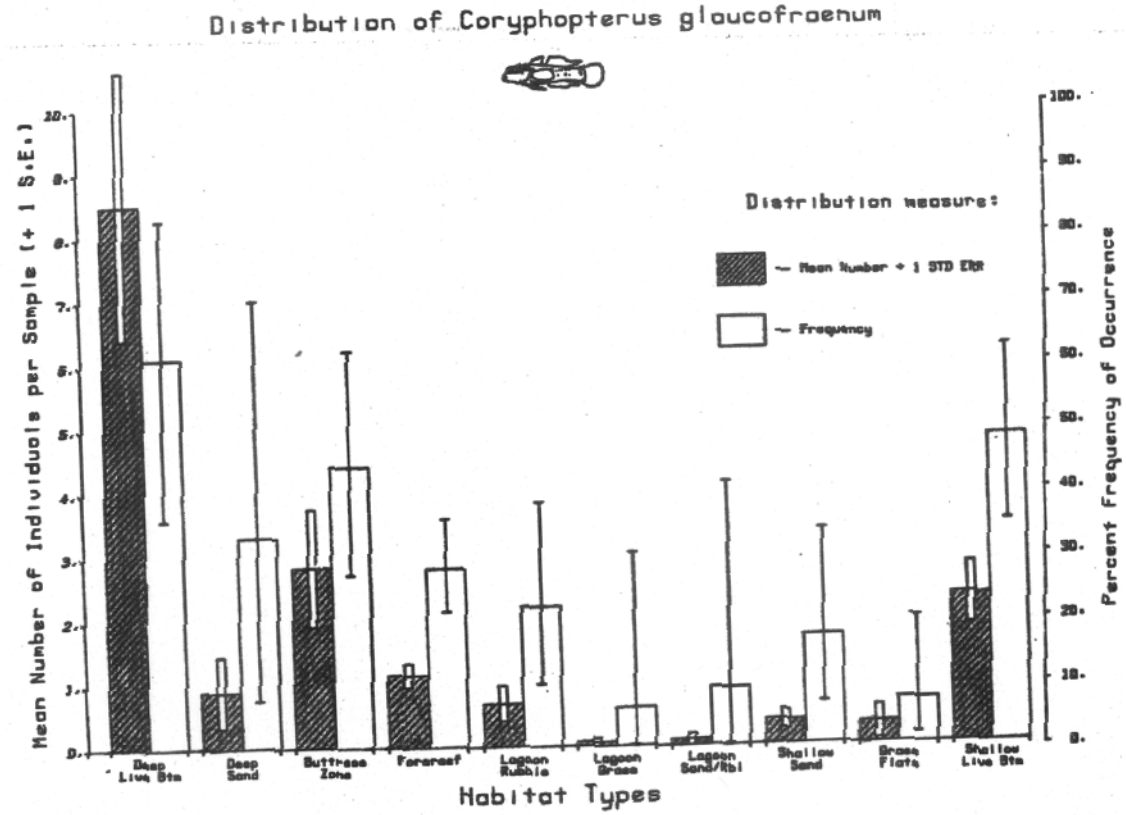

Distribution of Chromis cyaneus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

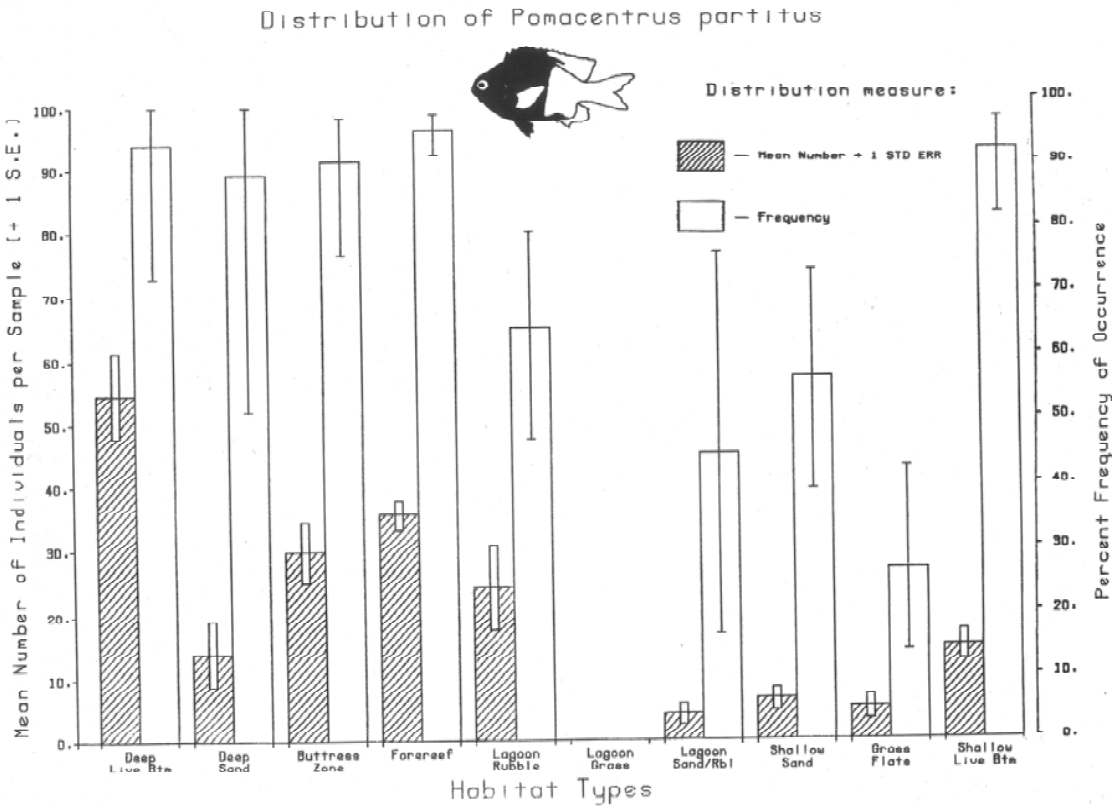

Distribution of Chromis multilineatus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

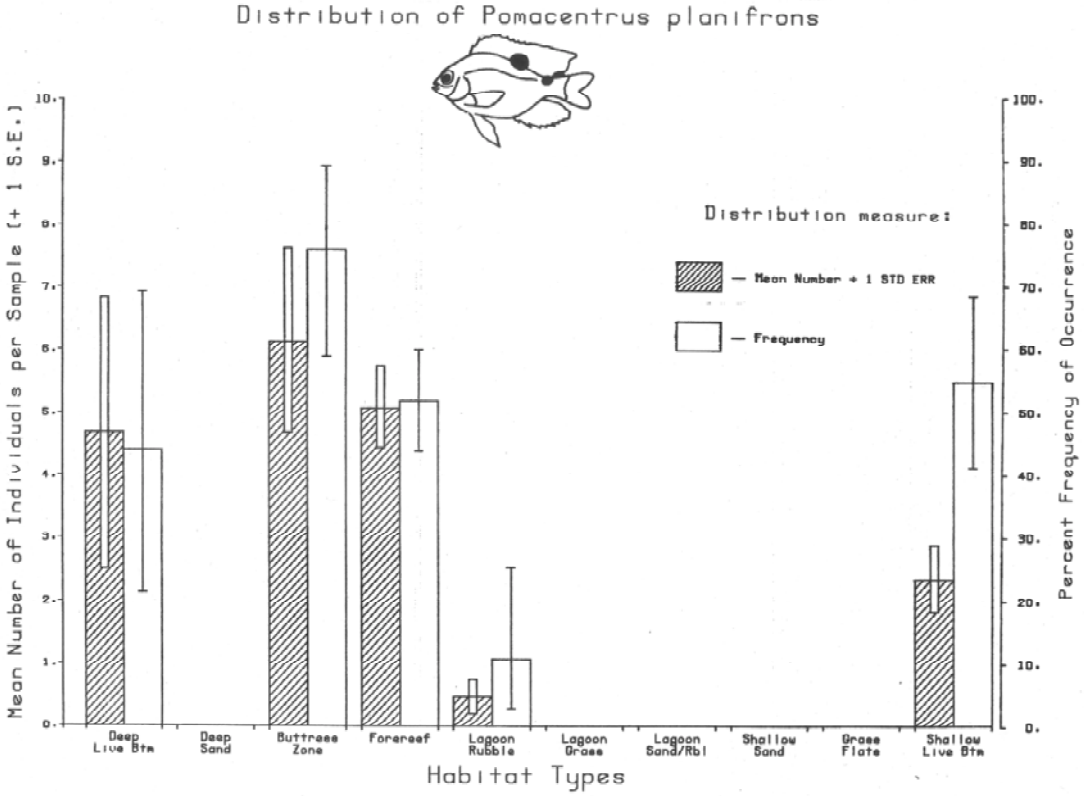

Distribution of Abudefduf saxatilis
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

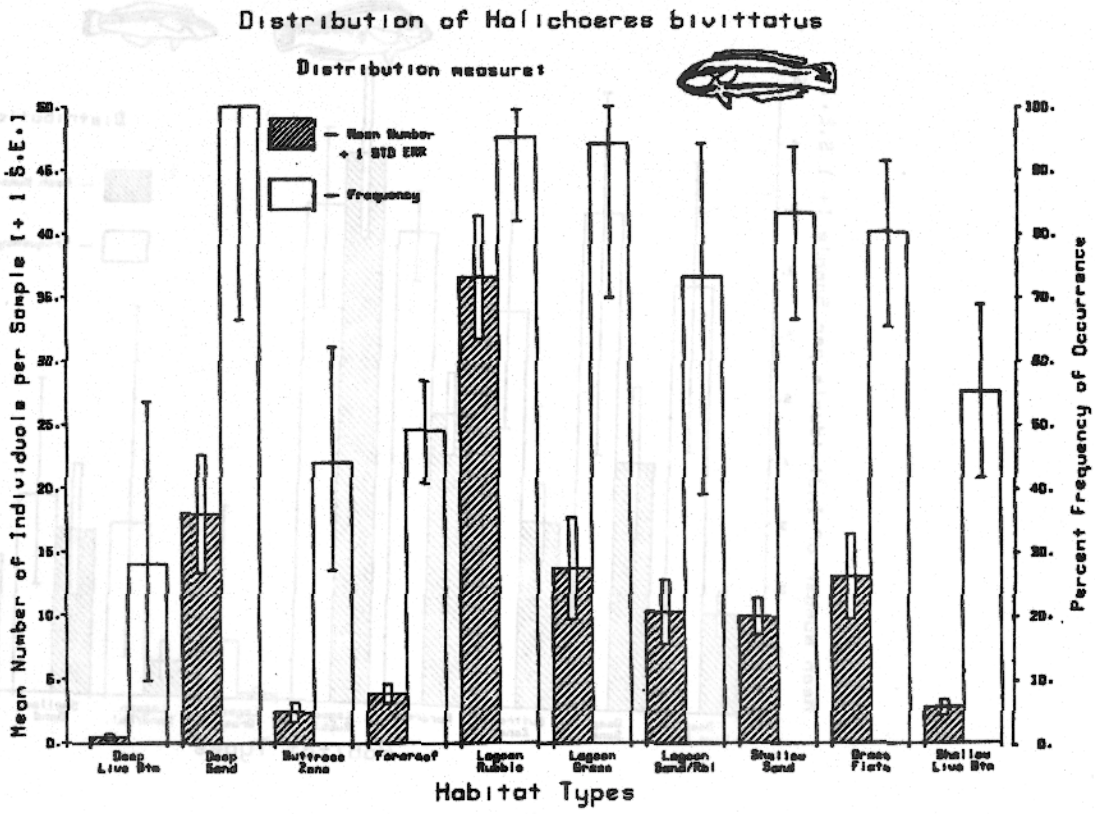

Distribution of Clepticus parrai
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

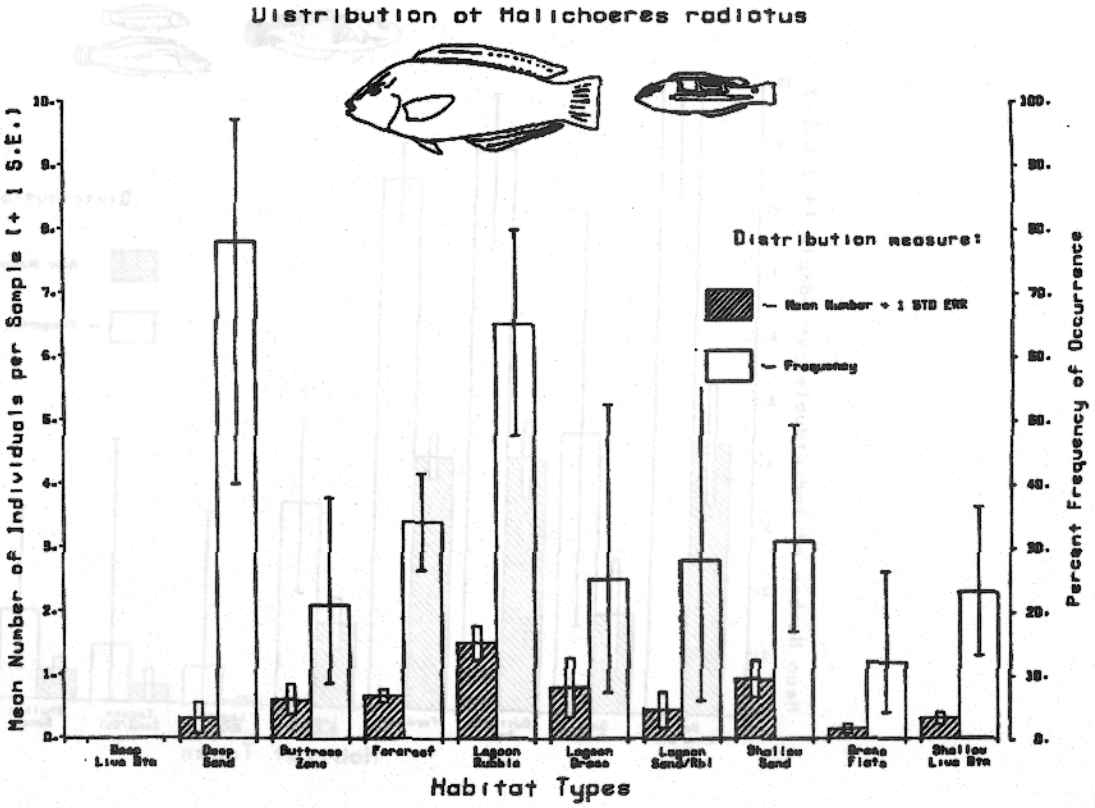

Distribution of Coryphopterus dicrus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

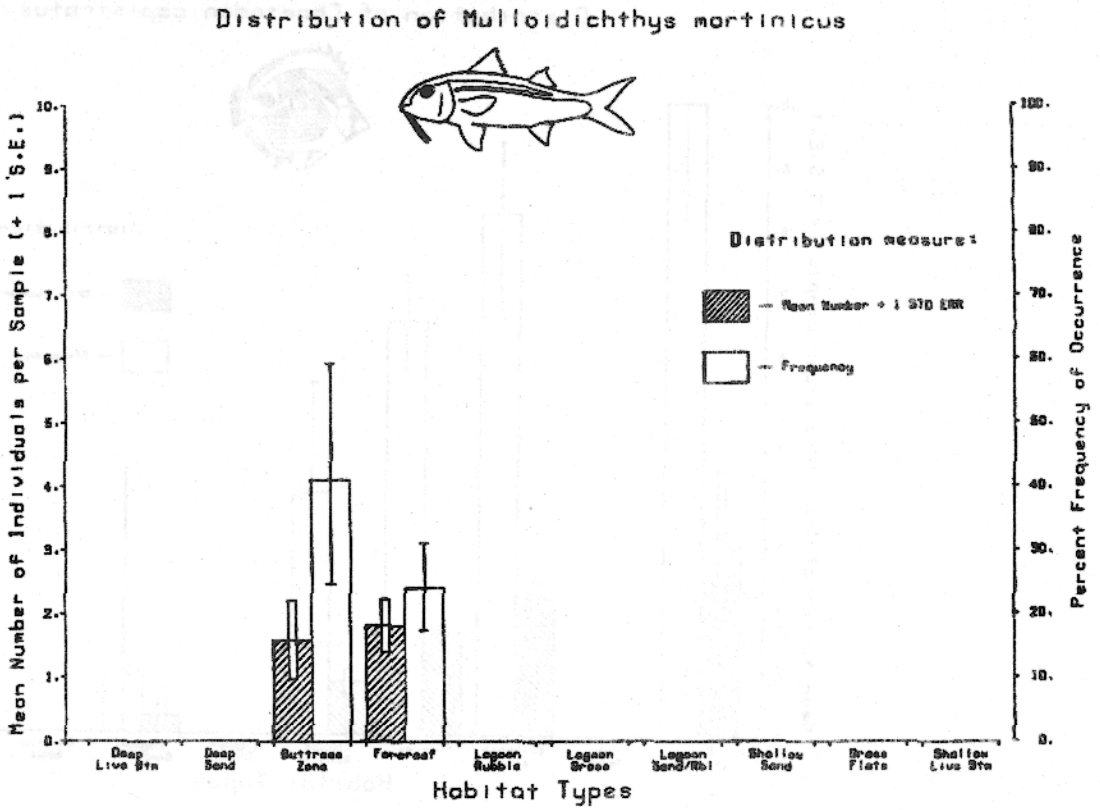

Distribution of Coryphopterus glaucofraenum
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

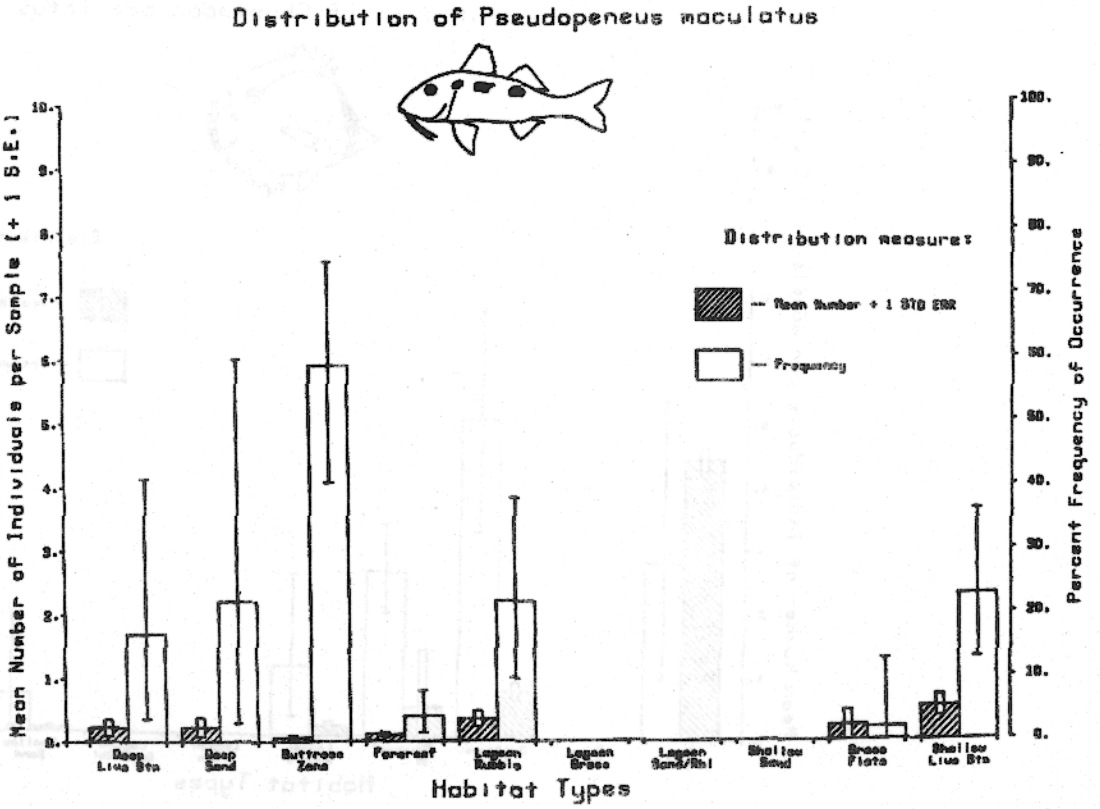

Distribution of Pomacentrus partitus
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

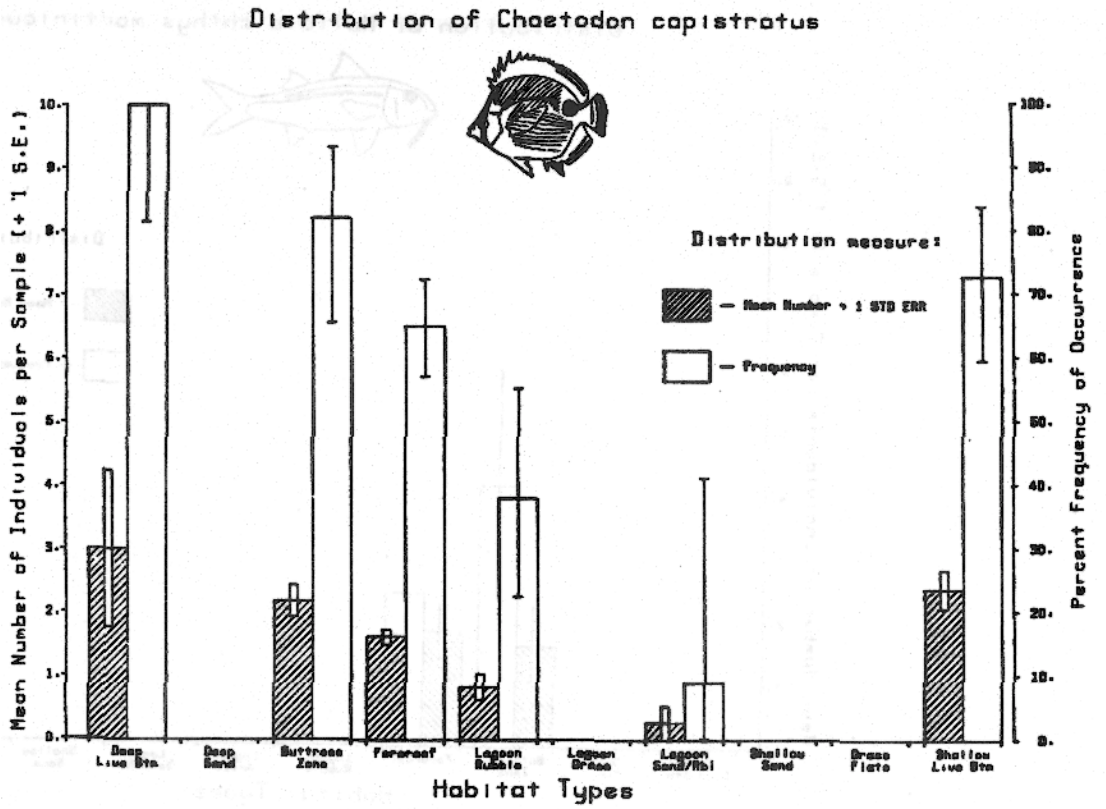

Distribution of Pomacentrus planifrons
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

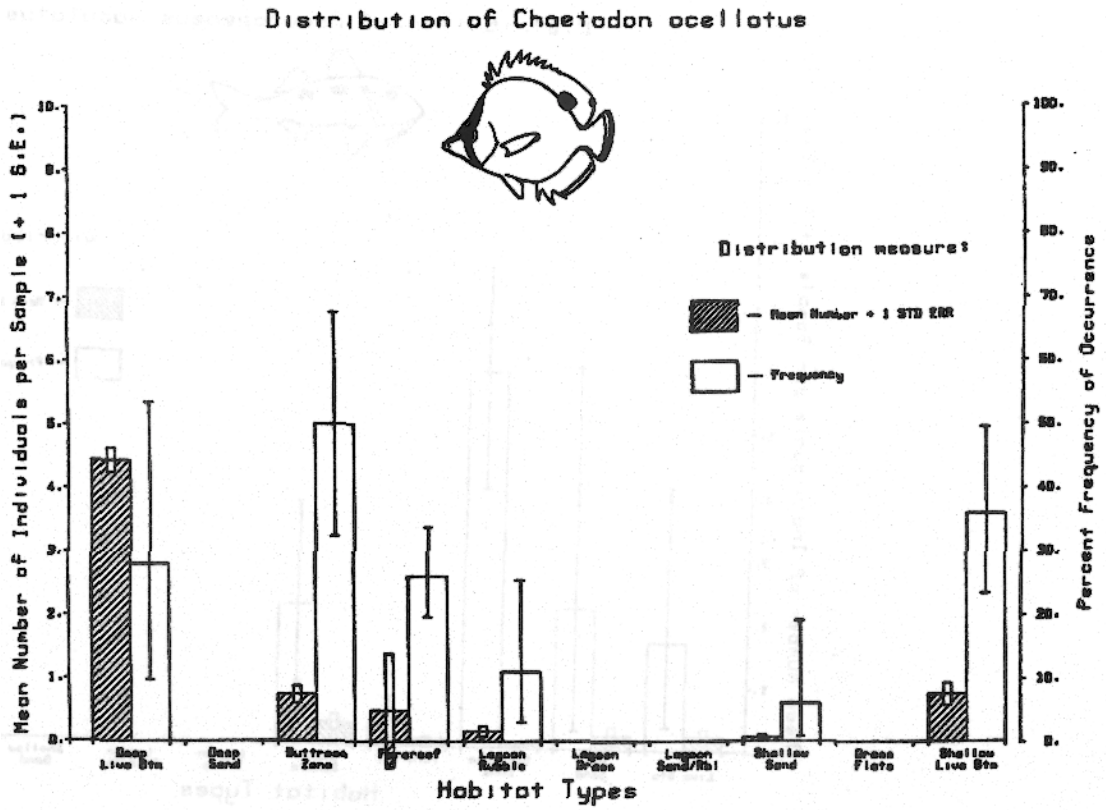

Distribution of Halichoeres bivittatus
Distribution measure:
Mean Number + 1 STD ERR
Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

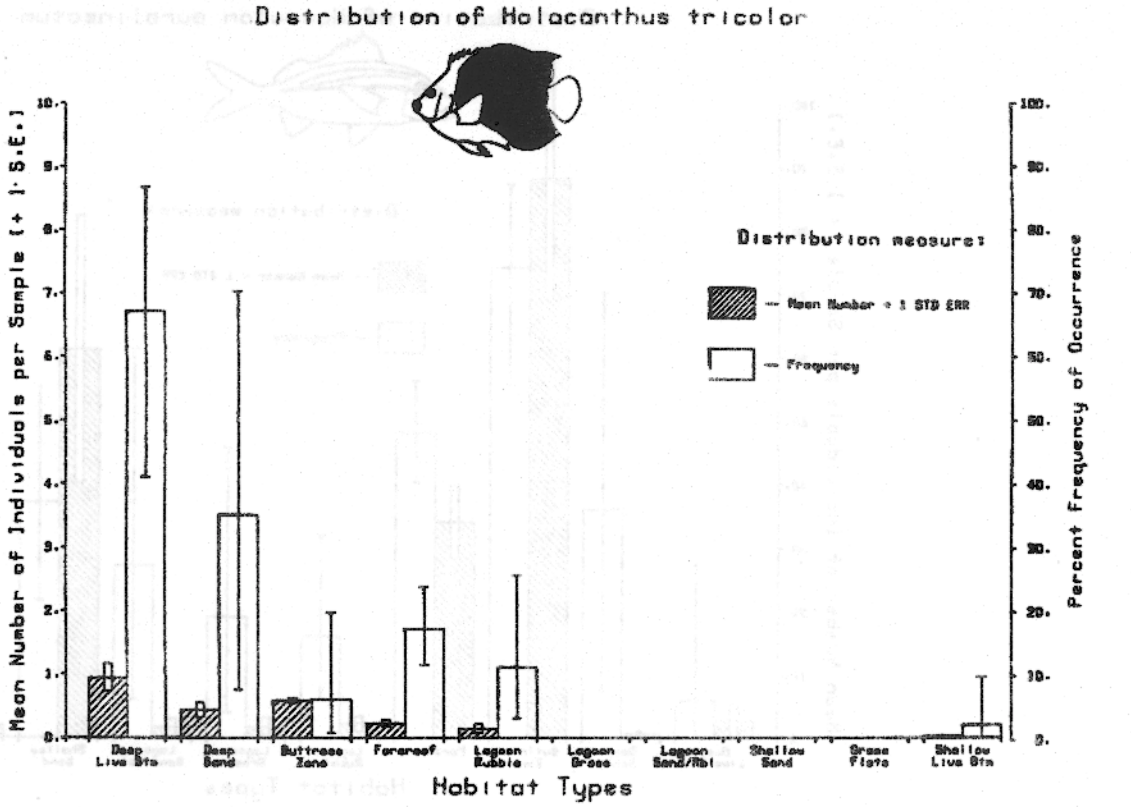

Distribution of Halichoeres radiatus
Distribution measure:
Mean Number + 1 STD ERR
Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

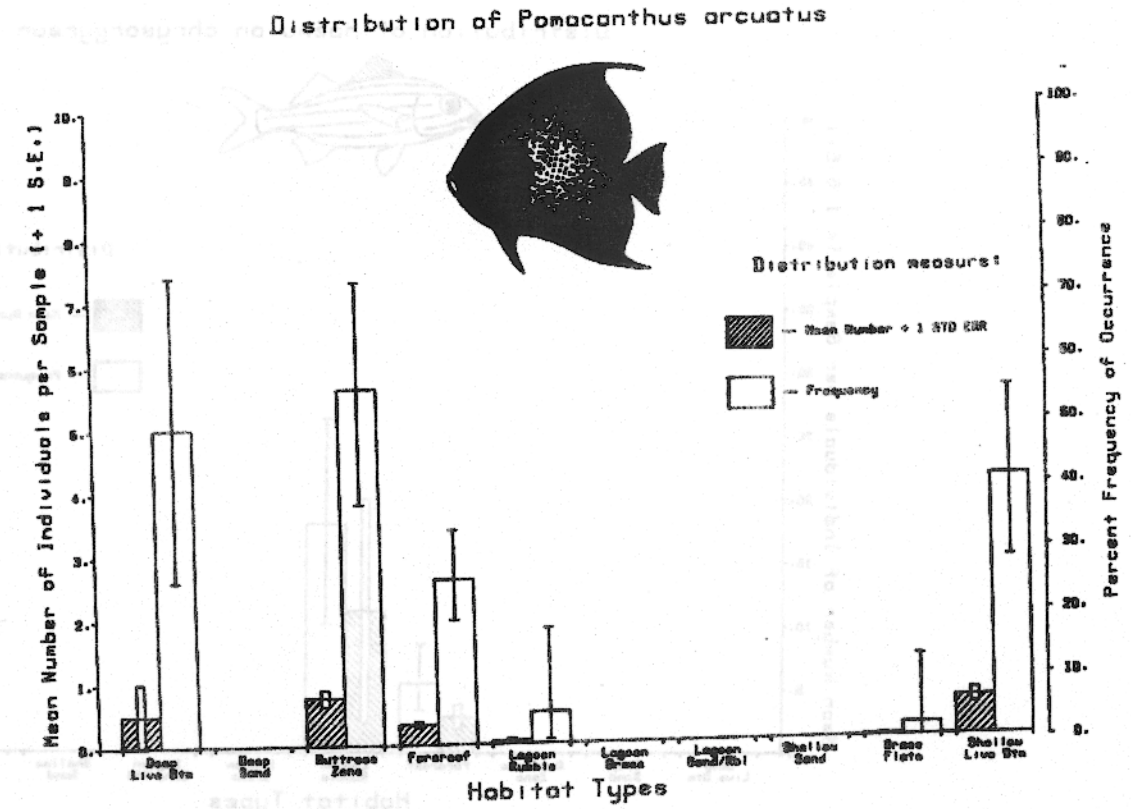

Distribution of Mulloidichthys martinicus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

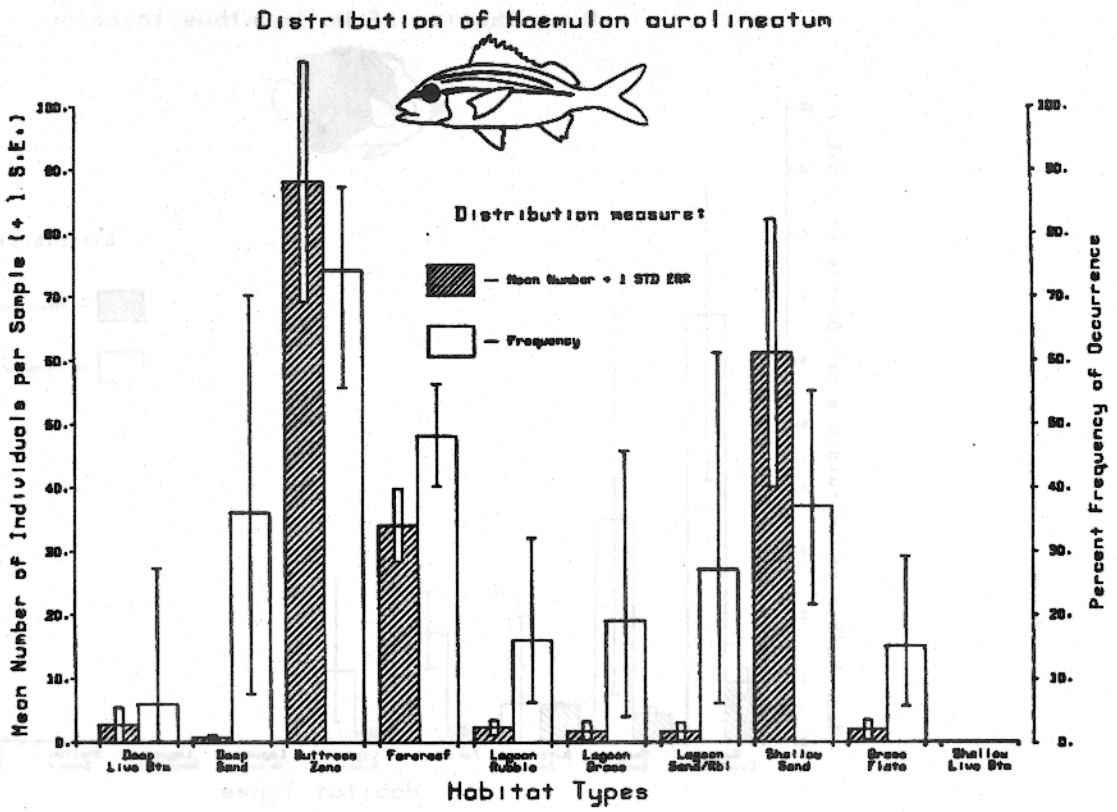

Distribution of Pseudopeneus maculatus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

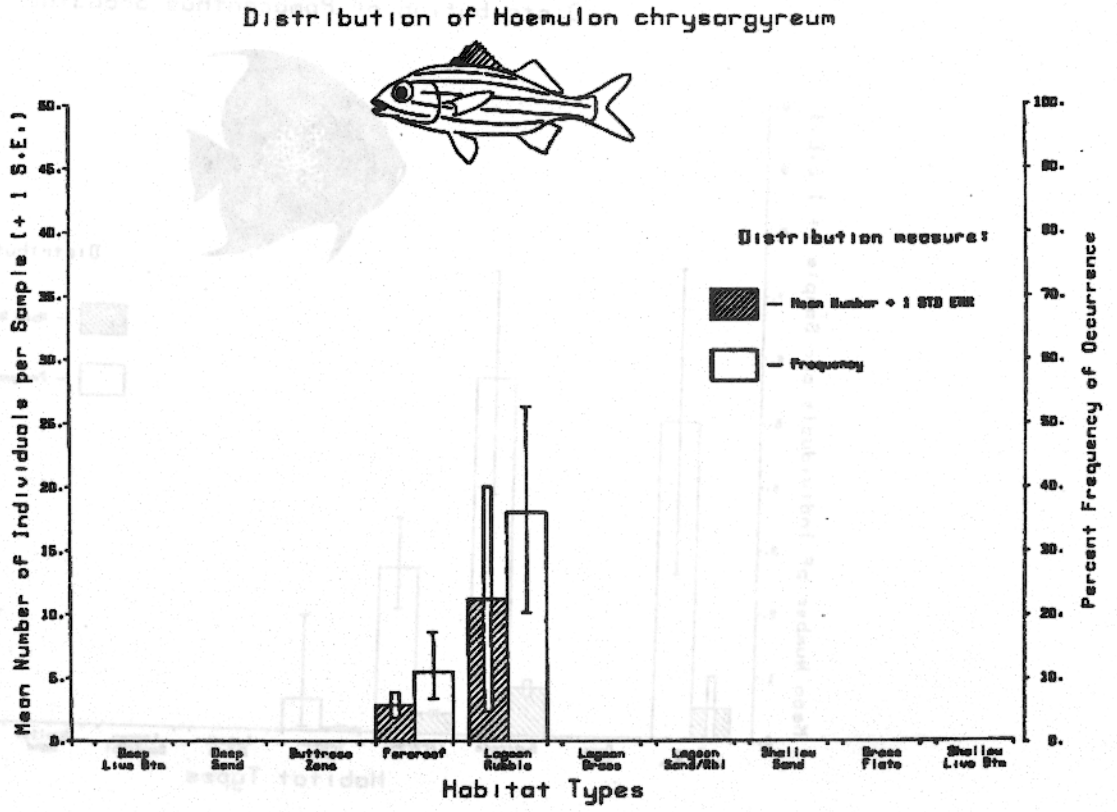

Distribution of Chaetodon capistratus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

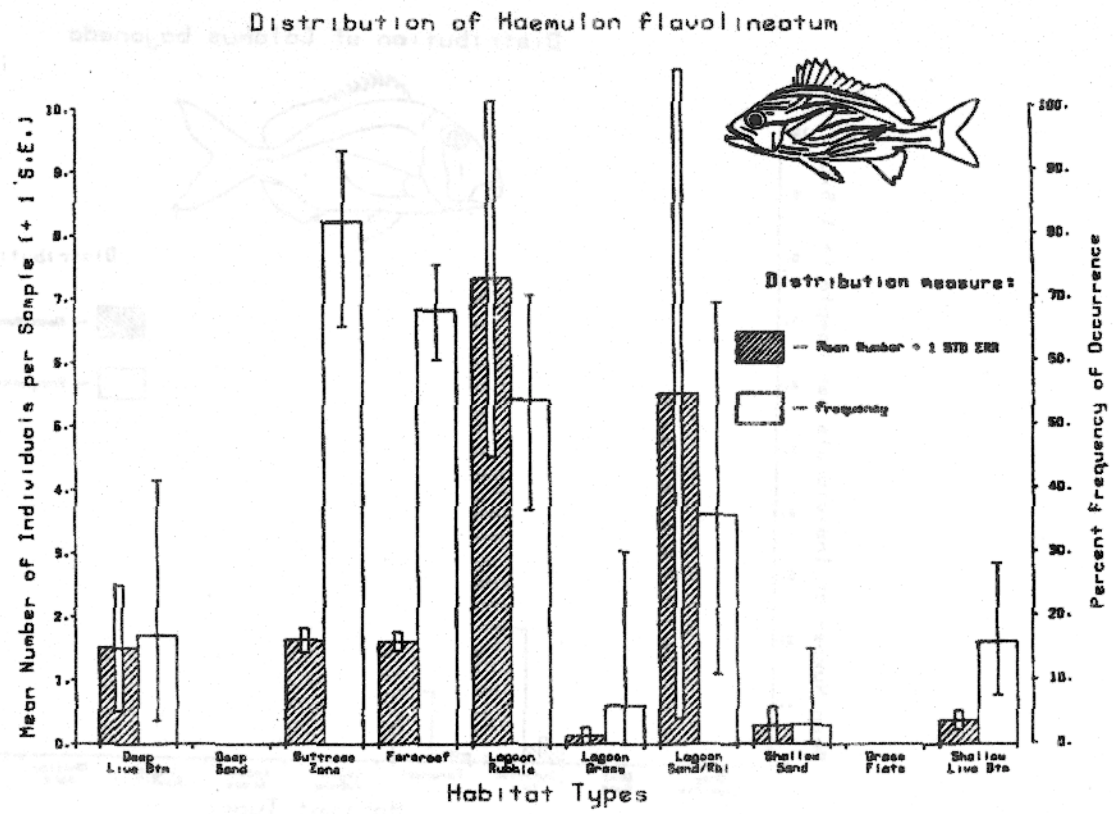

Distribution of Chaetodon ocellatus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

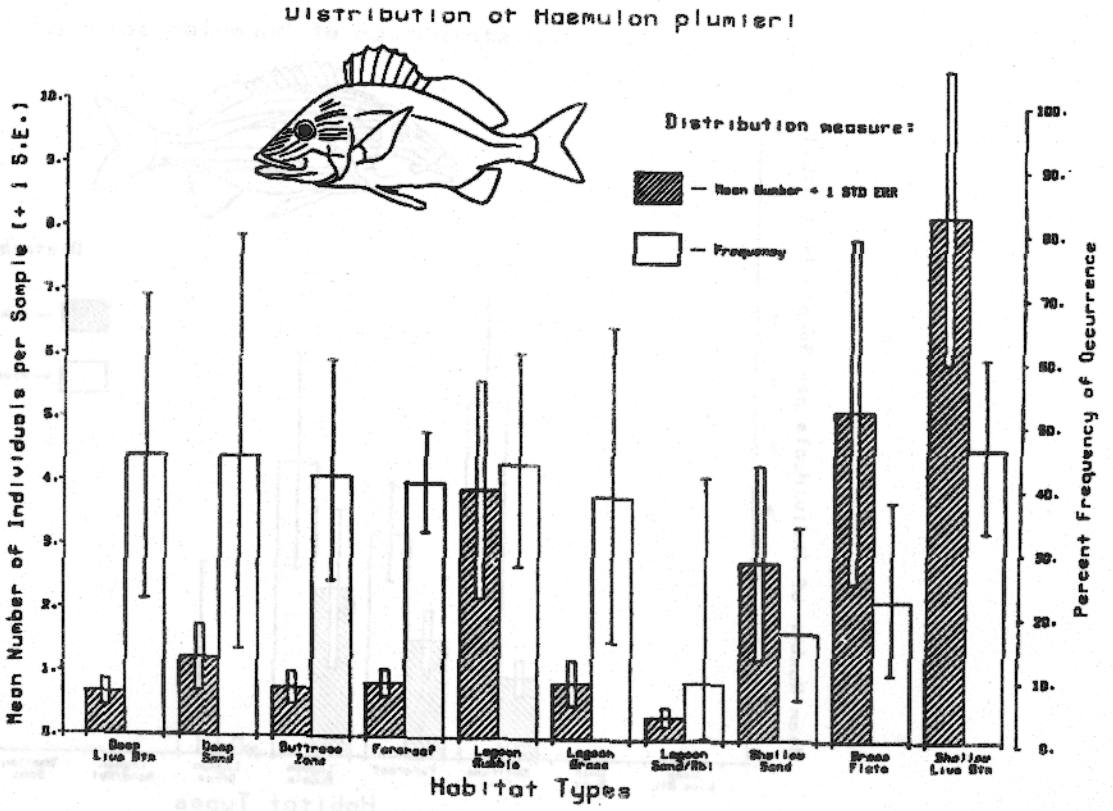

Distribution of Holacanthus tricolor
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

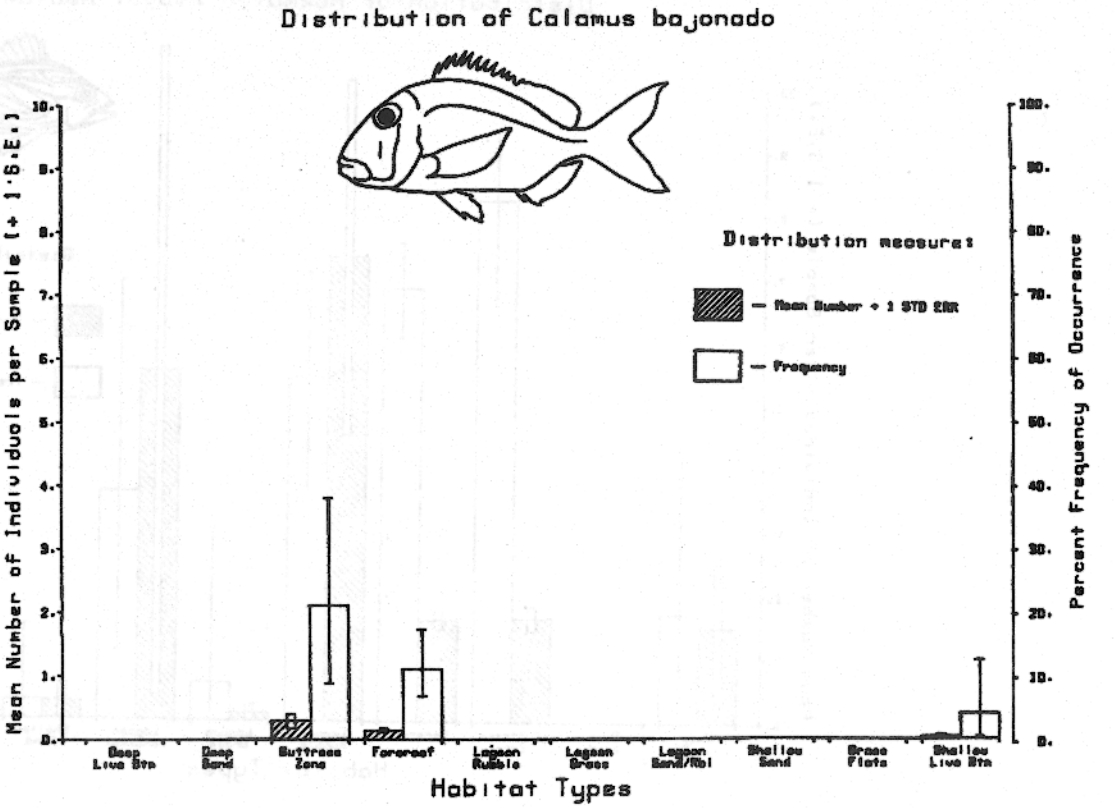

Distribution of Pomacanthus arcuatus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

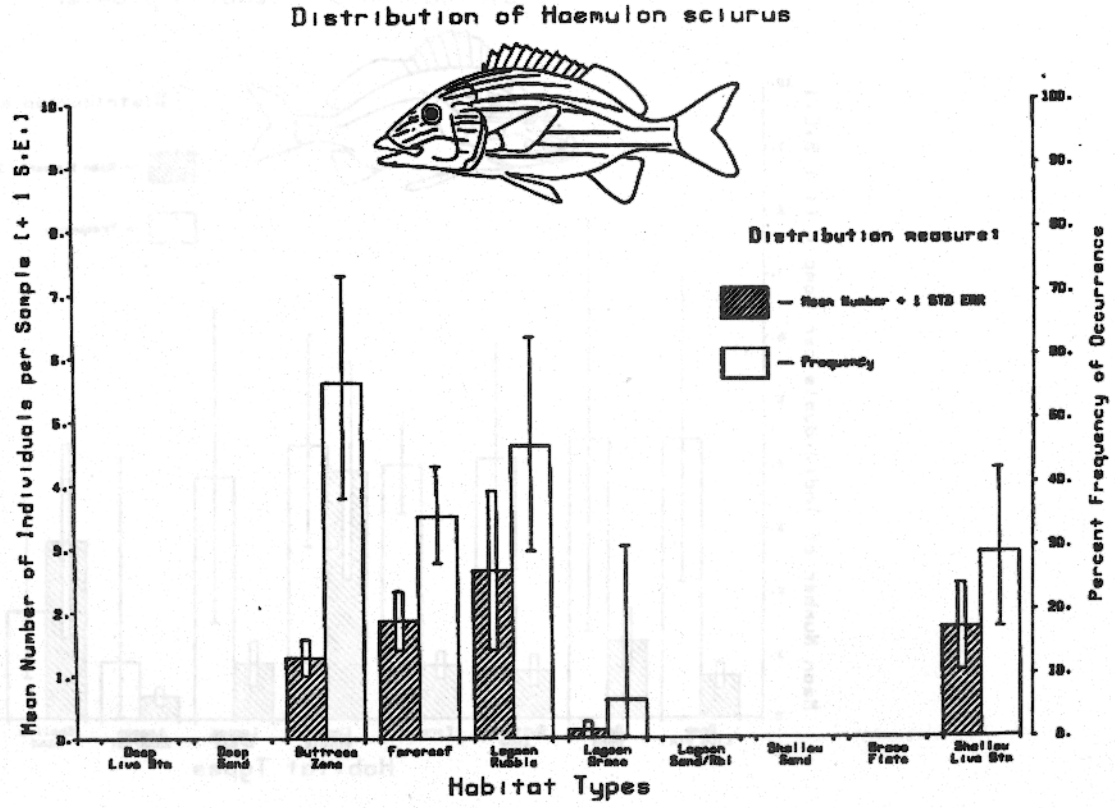

Distribution of Haemulon aurolineatum
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Fererecf
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

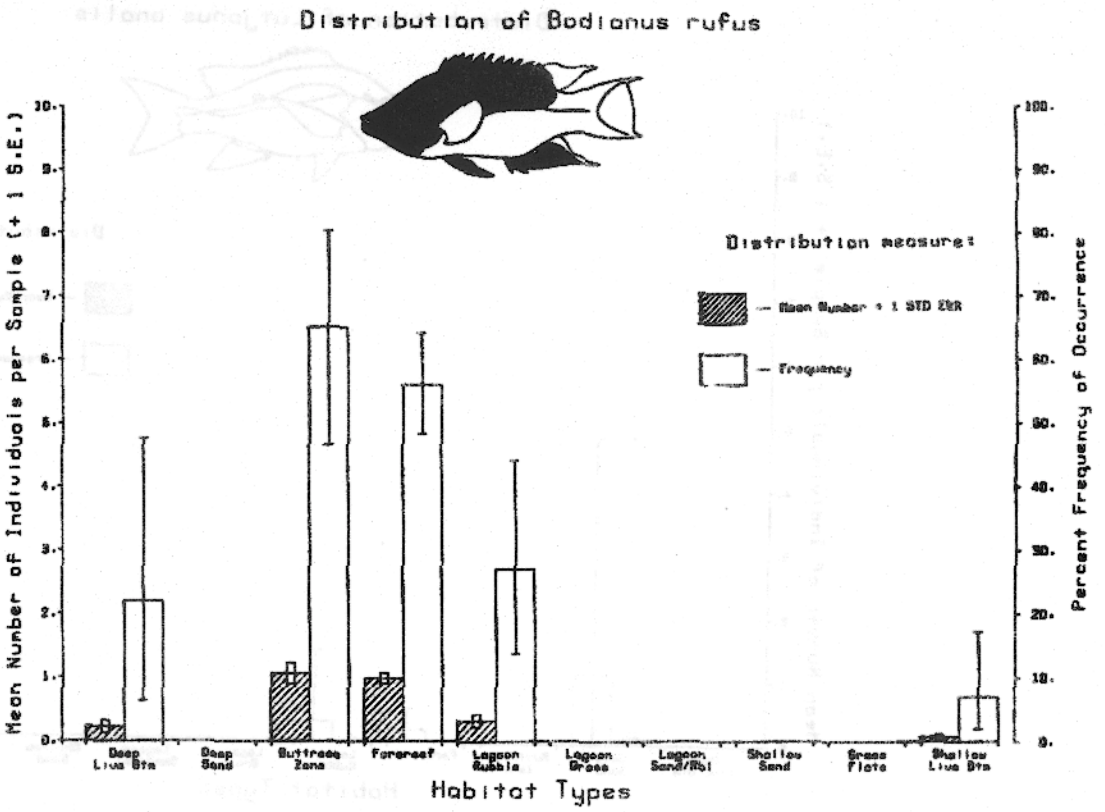

Distribution of Haemulon chrysargyreum
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (± 1 S.E.)
Percent Frequency of Occurrence
Deep Live Btm
Deep Sand
Buttress Zone
Fererecf
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

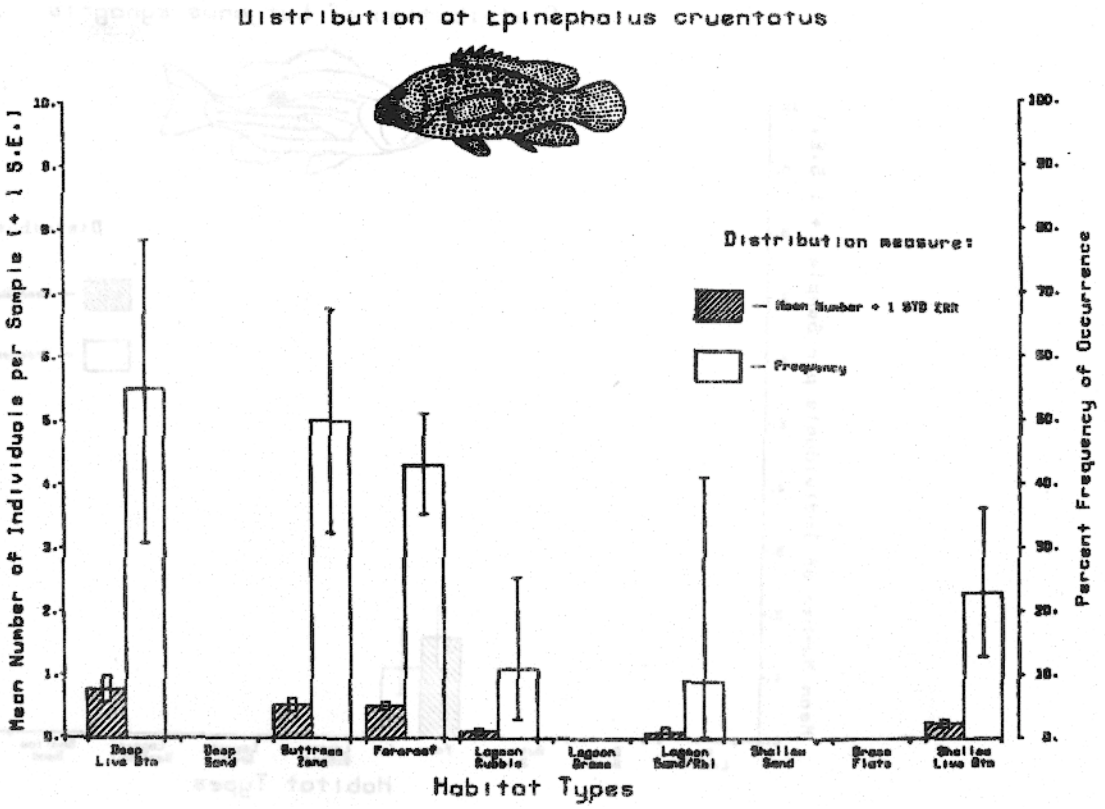

Distribution of Haemulon flavolineatum
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

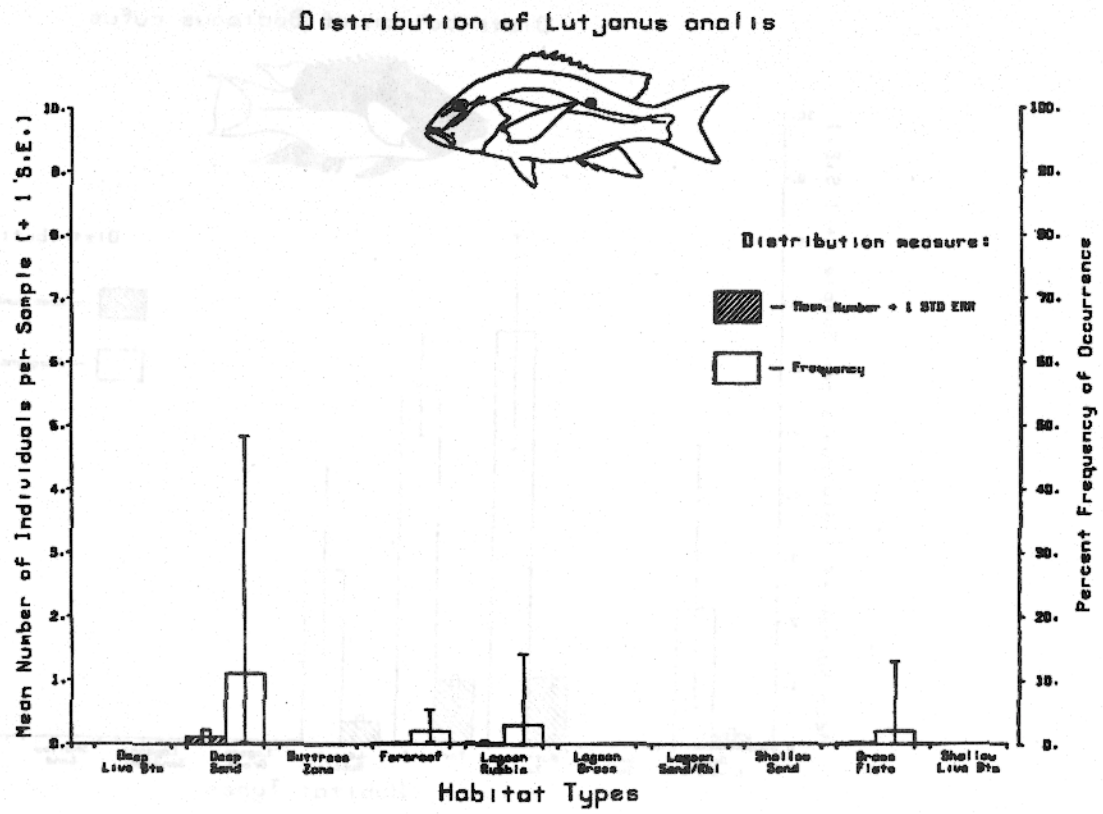

Distribution of Haemulon plumieri
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number ± 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

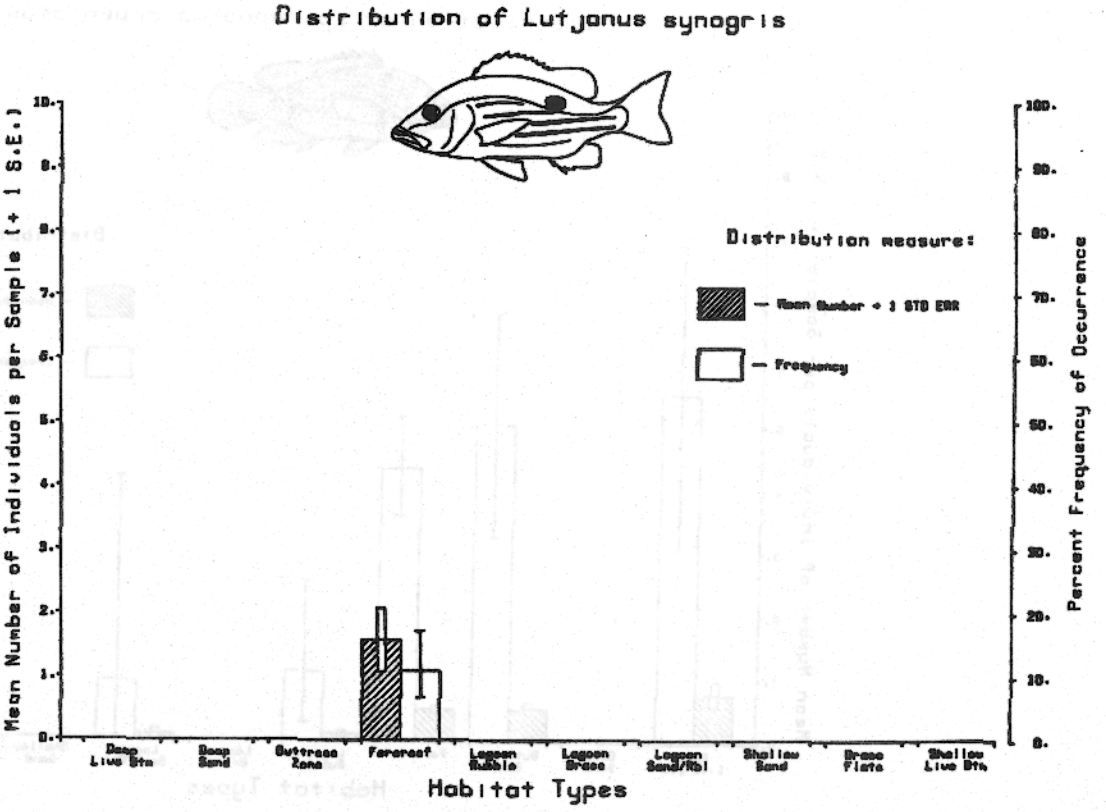

Distribution of Calamus bajonado
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

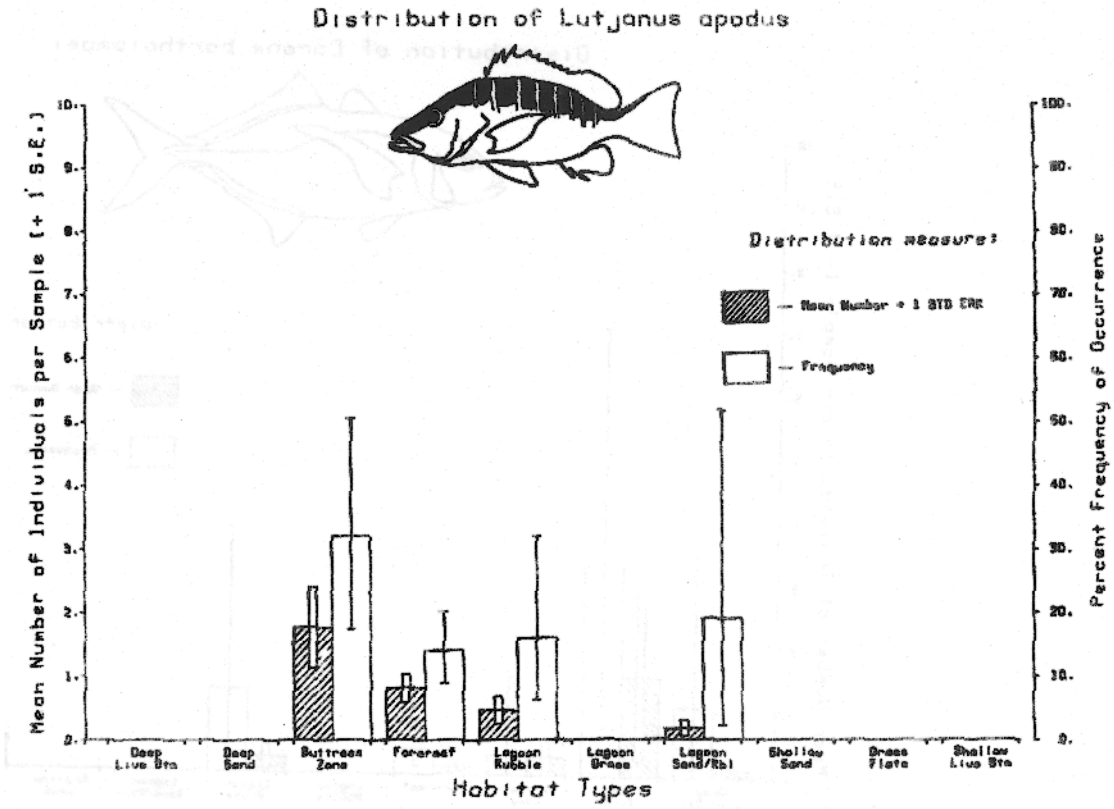

Distribution of Haemulon sciurus
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

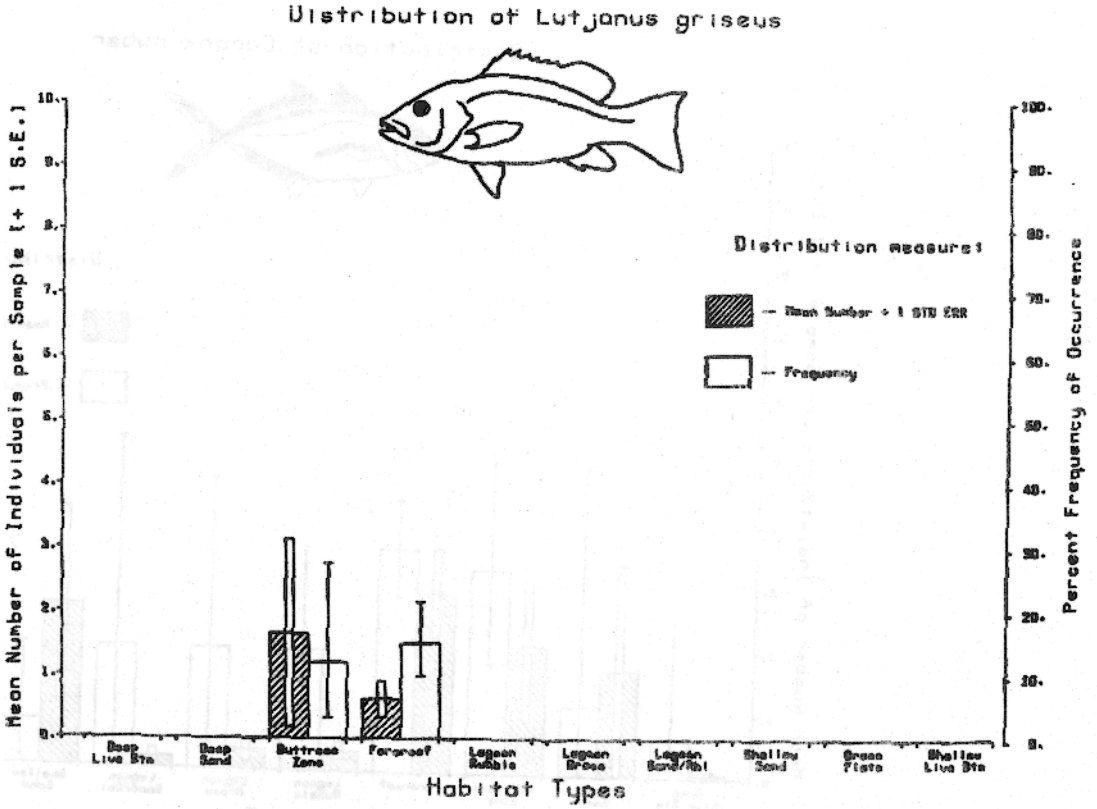

Distribution of Bodianus rufus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

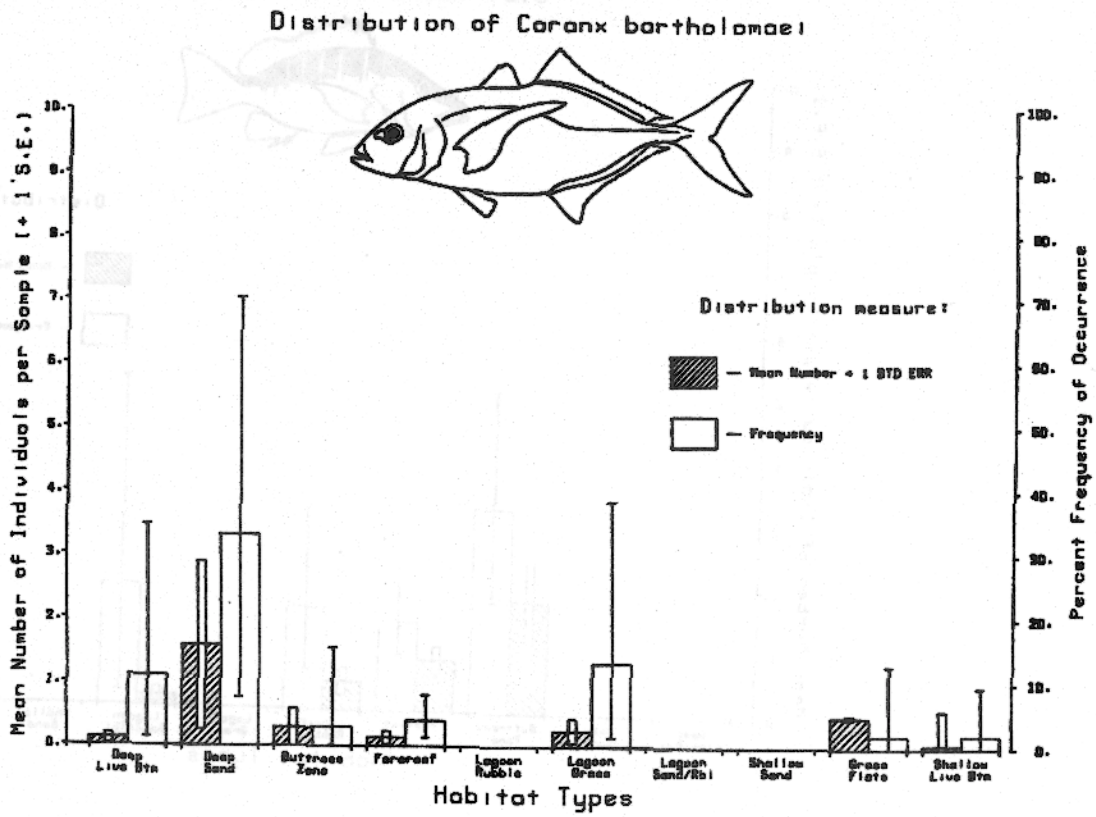

Distribution of Epinephalus cruentatus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types

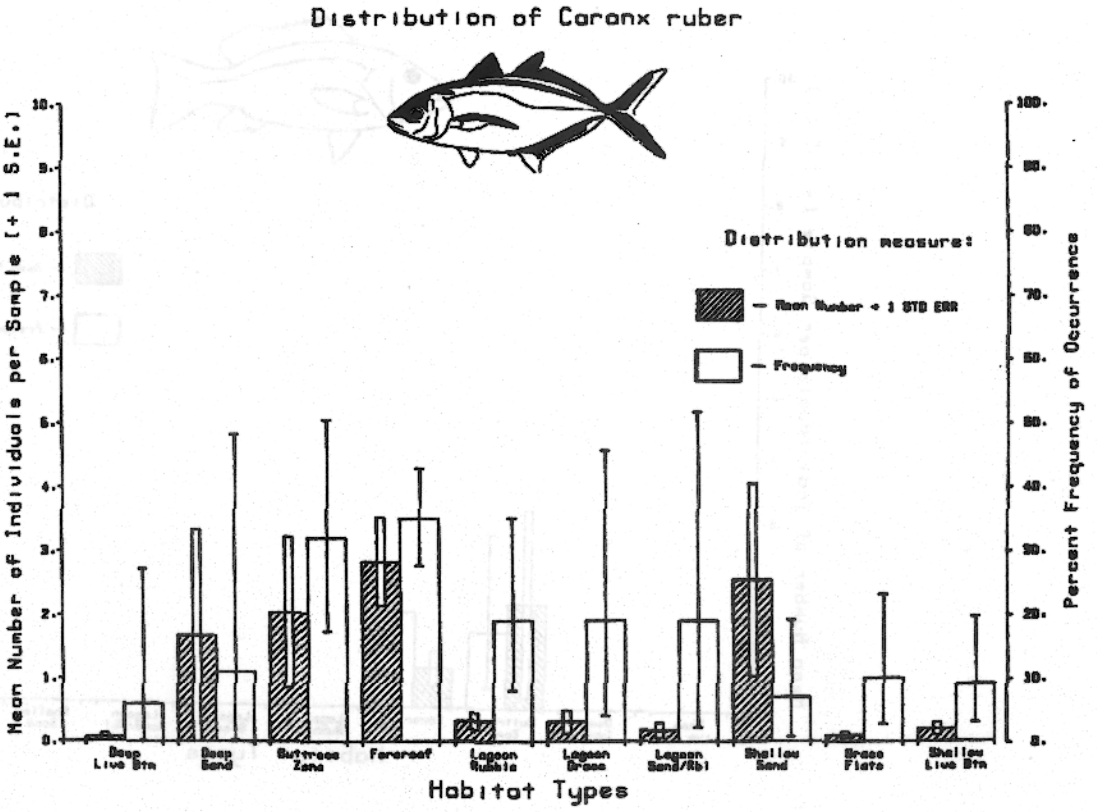

Distribution of Lutjanus analis
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

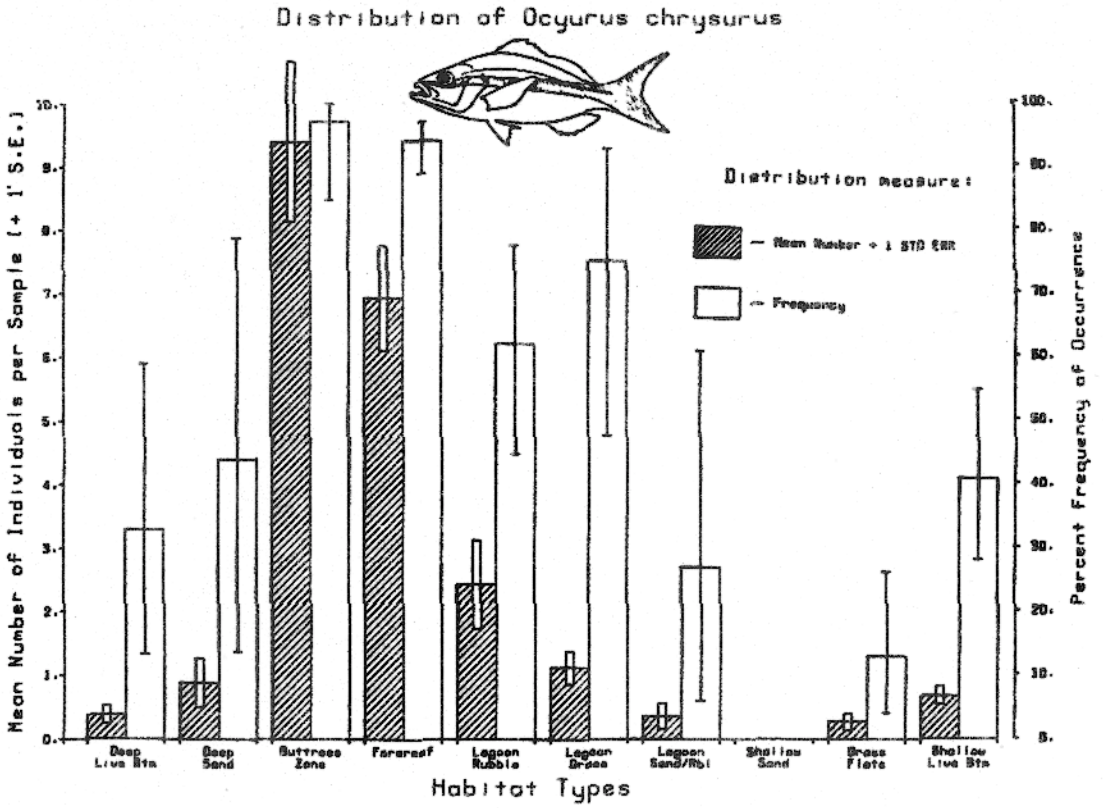

Distribution of Lutjanus synagris
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types

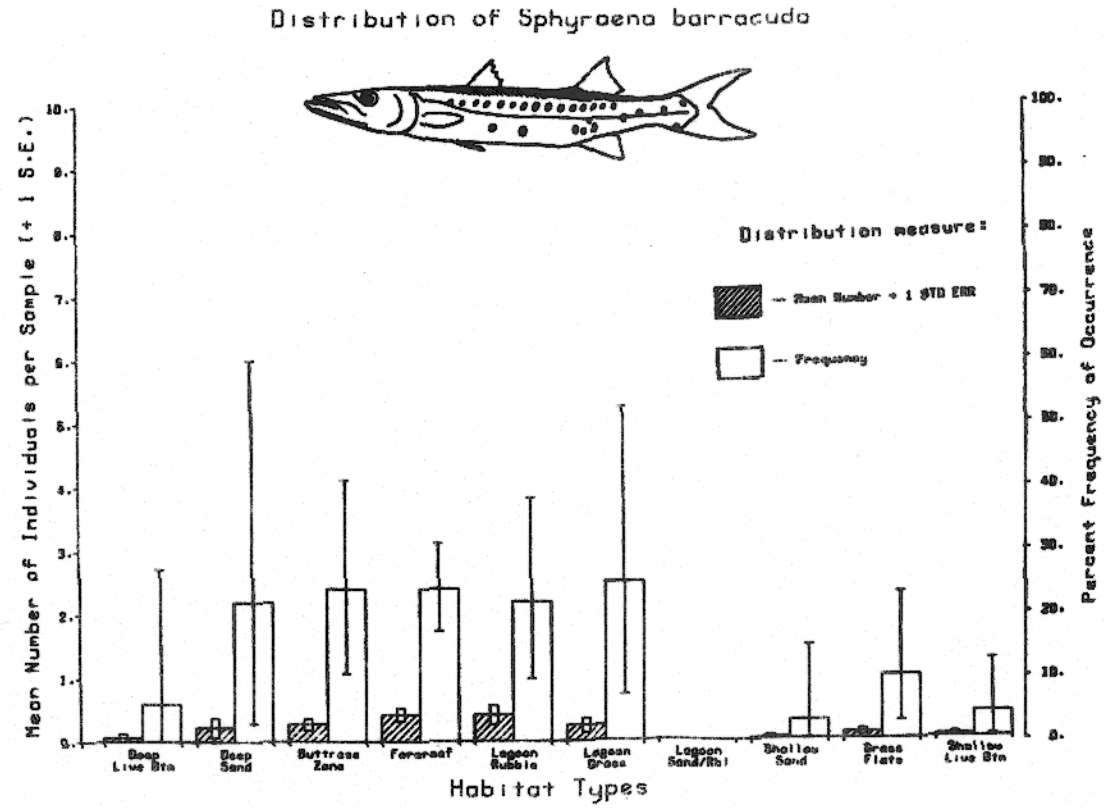

Distribution of Lutjanus apodus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
Mean Number + 1 STD ERR
Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types


Distribution of Lutjanus griseus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
Mean Number + 1 STD ERR
Frequency
Deep Live Stn
Deep Sand
Buttress Zone
Forereef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Stn
Habitat Types


Distribution of Caranx bartholomaei
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Fororeef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types


Distribution of Caranx ruber
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Fororeef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types


Distribution of Ocyurus chrysurus
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Fore reef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types


Distribution of Sphyraena barracuda
Mean Number of Individuals per Sample (+ 1 S.E.)
Percent Frequency of Occurrence
Distribution measure:
— Mean Number + 1 STD ERR
— Frequency
Deep Live Btm
Deep Sand
Buttress Zone
Fore reef
Lagoon Rubble
Lagoon Grass
Lagoon Sand/Rbl
Shallow Sand
Grass Flats
Shallow Live Btm
Habitat Types