Additional Information

Available habitat: (from 2000 FWRI reef Atlas: Benthic habitats of the Florida Keys, FMRI Tech report TR4 51 pages. FKNMS + Dry Tortugas National Park - provided by Dr. Walt Jaap):

Patch Reef: 3,370 hectares; 8,330 Acres
Outer Reef: 29,550 hectares; 73,010 Acres
Seagrass: 292,520 hectares; 722,840 Acres
Hard bottom: 82,370 hectares; 203,540 Acres
Bare Substrate: 14,820 hectares; 36,630 Acres
Unknown/uninterpreted: 74,170 hectares; 183,270 Acres

Octocoral density: means range from ~7 col/m^2 to ~25 col/m^2. However, these densities include *G. ventalina* which is a prohibited species and is a common gorgonian in the Keys and SE FL. (Vanessa Brinkhuis,FWRI).

Species harvested: (provided by Dr. Henry Feddern. Data for 2008)

Rank	# Sold	Species	Waters	Habitat	Bottom Type	Depth (ft)	Dist. from Shore
1	2409	*Diodogorgia nodulifera*	State	SE Florida	bedrock ridge	70-100	1 Mile
2	1855	*Muriceopsis flavida*	State	Upper Keys	bedrock & patch reef	10-15	1-2 Miles
3	1816	*Swiftia exserta*	State	SE Florida	bedrock ridge	60-90	1 Mile
4	1568	*Pseudopterogorgia elizabethii*	Federal	Upper Keys	forereef	50-80	3.5 Miles
5	1175	*Muricea sp.*	State	Upper Keys	smooth bedrock	10-15	0.5-1 Mile
6	1003	*Pseudopterogorgia sp.*	State	Upper Keys	smooth bedrock	3-15	Shore to 1 Mile
7	964	*Pseudopterogorgia sp.*	State	Upper Keys	patch reef	10-15	1-2 Miles
8	823	*Plexaurella sp.*	State	Upper Keys	smooth bedrock	10-15	0.5-1 Mile
9	739	*Pterogorgia anceps*	State	Upper Keys	smooth bedrock	3-10	Shore to 0.5 Mile
10	659	*Pterogorgia citrina*	State	Upper Keys	smooth bedrock	10-20	1-2 Miles

Top 3 species are not some of the more common species recorded in the field because they are deeper species. These deeper species are more colorful (reds and orange) than some shallow water species(Vanessa Brinkhuis,FWRI).

OCTOCORAL AS ESSENTIAL FISH HABITAT IN THE SOUTH ATLANTIC

Jennifer L. Wheaton
Florida Fish and Wildlife Conservation Commission, August 1999

DEFINITION AND CLASSIFICATION

Octocorals: For the purpose of the Habitat Plan (1998), includes species belonging to the Class Anthozoa, Subclass Octocorallia ("soft" corals, horny corals, sea fans, sea whips, sea pens, and others).

Class Anthozoa
- Subclass Octocorallia
  - Order Stolonifera
  - Order Telestacea
  - Order Alcyonacea (true soft corals)
  - Order Gorgonacea (horny corals, sea fans, whips, and precious red coral)
  - Order Pennatulacea (sea pens)

HABITAT IMPORTANCE

As a better understanding of habitat and fishery links has been developed, it has become extremely apparent that no habitat means "no fish". In reality, habitat becomes a limiting factor in species management. Integration of Florida state fisheries and habitat management has been occurring in conjunction with the Atlantic States Marine Fisheries Commission and Fishery Management Councils (Haddad, 1997).

Grouper "hiding" among sea fan and sea feathers (octocorals). Photo by Don DeMaria

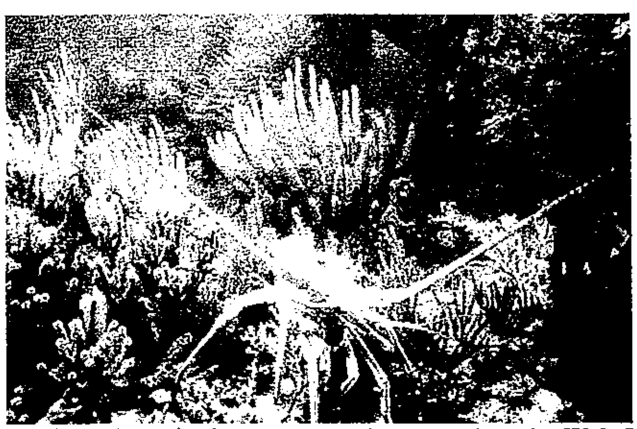
In an attempt to predict maximum sustainable yield of reef-fish as a function of stock biomass, Parker et al (1983) estimated reef-fish habitat for the South Atlantic and Gulf of Mexico continental shelf by submersible TV. In all areas surveyed, distribution of rock, coral and sponge was patchy and only a small amount of reef-fish habitat was available in US waters. Because of available knowledge, areas from Cape Canaveral to Key West were not included; however, they noted these areas contain prime reef-fish habitat and contribute significantly to the total amount (of available habitat). In an earlier study of reef fish, Risk (1972) found a strong positive correlation exists between fish species diversity and degree of substrate topographic complexity mirroring historical data of terrestrial ecologists in which bird species diversity was related to foliage height diversity.

Coral ecosystems represent unique arrays of plants and animals in a balanced, highly productive system. The key to these systems, with their vast species diversity, trophic complexity, and productivity, is coral itself, since corals provide habitat and/or food for most other members of the ecosystem. The special nature of corals (stony corals and octocorals) as a fishery is further highlighted by their sedentary attached existence, which separates them from the subjects of many other fishery plans. Coral's most valuable contribution to the marine environment is as habitat for numerous associated organisms. For example, nine octocoral host specimens were found to harbor 135 species including 1,654 individuals in a study of invertebrate macrofauna associated with sponges and corals off Georgia (Wendt, vanDolah, and O'Rourke, 1985).

It is commonly known that stony corals are the main builders of the reef framework in tropical reefs and are also major occupiers of space in such habitats. However, in certain coral reef habitats, non-stony coral anthozoans, typically zoanthids and octocorals occupy comparable expanses of substratum and are functionally comparable to reef-building corals (Fautin, 1988). Coral reef environments also have vast expanses of solid substrata heavily populated by epibiotic micro- and algoflora (Sorokin, 1973). The physical and biological characteristics of a habitat are fundamental to determining which organisms live there. Octocorals are functionally as important as stony corals for habitat topographic complexity.

ESSENTIAL FISH HABITAT

Octocorals are a primary component of essential fish habitat and essential fish habitat areas of particular concern designated for other managed fishery species. Live bottom areas constitute essential habitat for warm-temperate and tropical species of snappers, groupers, and associated fishes (Habitat Plan, p. 83). Essential fish habitat for snapper-grouper species complex includes coral reefs, live/hard bottom, etc (Habitat Plan, p. 227). Essential fish habitat for spiny lobster includes...coral and live/hard bottom habitat (Habitat Plan, p. 244). For example, post-larvae of the Florida spiny lobster migrate from algal habitat to octocoral livebottom habitat which is critical to lobsters in the 20-40 mm size range (Hunt, pers. comm.). Destruction of juvenile habitat is the most permanent way to destroy a fishery resource (Moe, 1991).



Florida lobster in dense octocoral cover. Photo by Walt Jaap

DISTRIBUTION AND ABUNDANCE OF OCTOCORALS IN THE SOUTH ATLANTIC COUNCIL JURISDICTION

North Carolina to Cape Canaveral

Coral communities on the outer continental shelf proper are characterized by patches of low- relief hard bottoms also referred to as "live bottoms". NOAA's Office of Coastal Zone Management cited reports that three to 30 percent of the shelf region is covered by "live bottom" habitats. Perkins et al (1997) estimated the distribution and areal amount of hard bottom from the Florida/Georgia border to Jupiter Inlet. These hard bottom habitats are often dominated by octocorals. Bayer (1961) stated that the shelf octocoral fauna from the East Coast of Florida north of Cape Canaveral is indistinguishable from the fauna from Georgia and the Carolinas.

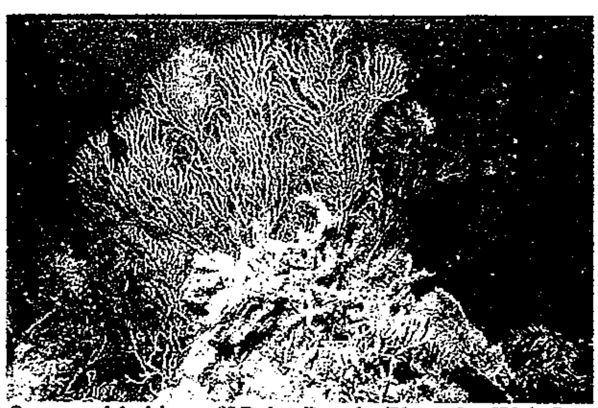
Octocoral habitat off Jacksonville. Photo by Paul Humann

Central Florida to South Florida (Cape Canaveral to Palm Beach)

Shelf-edge Oculina communities seem not to persist south of Jupiter, Florida; however, the stony coral is found on coquinoid rock ledges scattered over the shallow shelf south to St. Lucie Inlet and Stuart, Florida (27° 10'N) where it is associated with temperate octocorals.

Southeast Florida Coast (Palm Beach to Fowey Rocks)

South of 27° north latitude to near Miami, the continental shelf narrows to 3 to 5 km (1.6 to 2.7 m) and warm waters of the Florida current become the most dominant hydrographic feature. Accordingly, in the vicinity of Palm Beach, Florida, temperate coral communities are replaced by a diverse hard-bottom community, tropical in character, zoogeographically similar to that of the Florida Keys, but less well developed than the majority of the Florida reef tract. The hard-bottom community found in this region is dominated by gorgonian octocorals. The deeper zones of this community (20 to 30 m; 66 to 100 ft) are characterized by the presence of large fan shaped gorgonian octocorals (Iciligorgia schrammi) Goldberg (1970).



Octocoral habitat off Palm Beach. Photo by Walt Jaap

Goldberg's study reported 39 species of octocorals; however, his study included samples from depths outside the typical shallow water harvest working depths. Range in number of octocoral colonies/m^2 varied widely from 2 to 27 colonies/m2 for those studies summarized.

LOCATION	STUDY	NO. SPECIES	MEAN #/m^2	RANGE#/m^2
FLA EAST COAST				
Dade County	Opresko 1973	29		7-27
Dade County	Blair & Flynn 1989			2-21
Palm Beach County	Goldberg 1970	39	25	

Florida Keys (Fowey Rocks to the Dry Tortugas)

Historical data illustrates that in diverse octocoral communities of the Florida Reef Tract, greater than 30 species are typically found in depths less than 80 ft. Localized densities can be as great as 73 colonies/m^2 with a mean number of colonies of about 22 to 32 colonies/m^2 in some octocoral dominated zones or habitats.

LOCATION	STUDY	NO. SPECIES	MEAN #/m^2	RANGE#/m^2
DRY TORTUGAS				
Bird Key Reef	Wheaton unpublished	25	11	2-22
Pulaski Shoal	Tilmant et al 1989	24	21	-
KEYS				
Eastern Sambo	Jaap & Wheaton I975	22	-	-
Western Sambo	Wheaton unpublished	30	7	5-13
Looe Key Reef	Wheaton & Jaap I988	23	8	0-30
Carysfort	Wheaton, unpublished	27	-	-
Biscayne Natl.Park	Wheaton unpublished	31	26-32	0-73

Biscayne National Park octocoral habitat. Photo by Walt Jaap

Data from Looe Key reef (Wheaton and Jaap 1988) is presented here as an illustration of the variety of octocoral habitat encountered in many Keys outer reefs. Survey work was conducted on the eastern (I), middle (II), and western (III) spur and groove tract, western forereef (IV) of Looe Key and on low-relief areas west of the spur and groove (V) and in the back reef (VI).

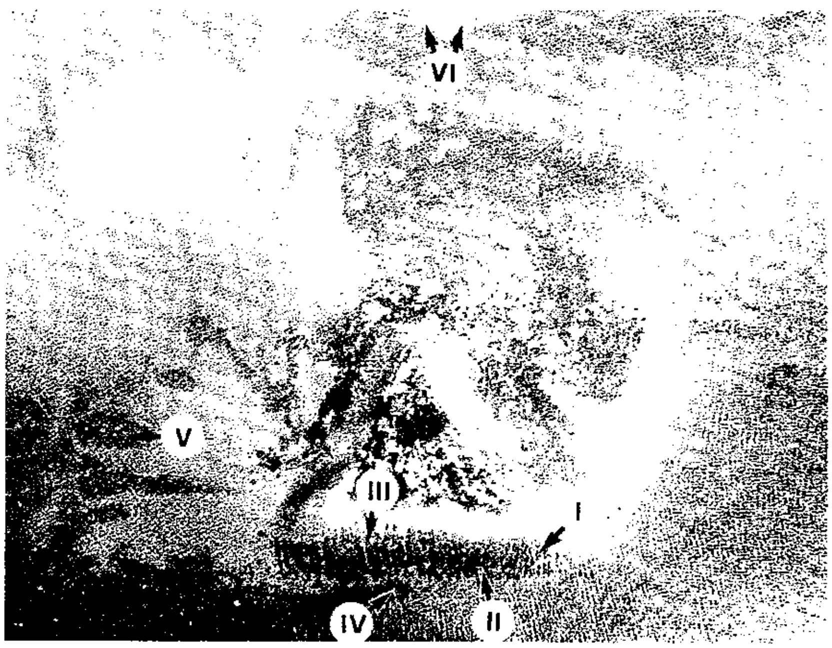


Figure 2 (above) and Table 13 (below) from Wheaton & Jaap, 1988

TABLE 13. DENSITY AND DIVERSITY OF STONY CORALS (MILLEPORINA AND SCLERACTINIA) AND OCTOCORALS LOOE KEY, AUGUST 1983.

Site	No. of m² Plots	Total Species SC	Total Species OC	Density (Species/m²) Stony Coral Range	Stony Coral x̄	Stony Coral s	Octocoral Range	Octocoral x̄	Octocoral s	Total Colonies SC	Total Colonies OC	Density (Colonies/m²) Stony Coral Range	Stony Coral x̄	Stony Coral s	Octocoral Range	Octocoral x̄	Octocoral s	Diversity Stony Coral H'	Stony Coral J'	Octocoral H'	Octocoral J'
I	8	6	12	0-2	1.19	1.13	0-9	5.13	3.00	18	80	0-9	2.25	3.11	0-24	10.00	8.42	2.17	0.84	3.56	0.91
II₁	17	4	4	1-4	2.53	1.23	0-2	0.65	0.79	162	50	1-24	9.59	6.36	0-4	1.29	1.47	1.83	0.91	1.29	0.60
II₂	19	18	7	2-6	4.00	1.60	0-5	1.32	1.70	192	41	2-17	10.11	5.77	0-6	2.16	2.00	3.36	0.80	2.30	0.82
II₃	20	22	15	0-8	4.15	1.95	0-6	3.00	1.81	156	123	6-19	9.75	6.08	3-15	6.15	4.20	3.25	0.73	2.53	0.65
II_T	56	26	15	0-8	3.51	1.80	0-6	1.71	1.81	542	184	0-24	9.52	6.96	0-15	3.29	3.80	3.19	0.74	2.65	0.66
III₁	15	7	4	1-5	2.73	1.62	0-3	0.93	1.23	114	29	2-14	7.60	4.40	0-6	1.39	2.02	2.07	0.73	1.58	0.77
III₂	22	16	15	1-10	4.14	2.47	0-7	3.23	1.77	223	138	1-24	10.18	6.58	0-15	6.05	4.41	2.93	0.72	3.46	0.71
III₃	17	20	14	3-7	4.50	1.37	1-7	4.18	1.91	132	152	4-14	7.55	3.44	1-16	8.94	4.63	3.57	0.90	2.62	0.69
III_T	54	22	14	1-10	3.59	2.36	0-7	2.59	2.06	469	306	1-24	8.76	5.39	0-18	5.65	4.91	3.34	0.75	2.56	0.9[illegible]
IV	16	16	16	0-7	3.68	1.96	0-9	4.19	2.43	122	121	0-15	7.63	4.76	0-16	7.56	4.53	3.01	0.75	3.12	0.80
V	18	16	18	1-9	5.00	2.17	3-11	7.35	2.17	193	235	1-20	10.83	5.22	3-24	13.06	5.09	3.43	0.86	3.50	0.86
VI	19	21	22	3-8	5.74	1.24	5-13	9.47	2.46	219	391	5-17	11.53	4.11	10-30	20.58	4.79	3.44	0.78	3.52	0.83
TOTAL	171	33	23	0-10	3.69	1.47	0-13	3.91	3.30	1570	1226	0-24	8.7[illegible]	2.61	0-30	7.66	7.24	3.89	0.79	3.49	0.77

1 = *Millepora/Palythoa* zone, spur and groove formation.
2 = *Agaricia*/transition zone, spur and groove formation.
3 = *Montastraea*/octocoral zone, spur and groove formation.
T = Intrasite totals for combined zones, sites II and III, respectively.
SC = Stony coral
OC = Octocoral
x̄ = mean,
s = standard deviation.

Throughout the area of Looe Key surveyed, the number of octocoral colonies ranged from 0-30/m² with a mean of 7.7 colonies/m². Octocorals were the dominant cover at the low-relief hardbottom/patch reef areas (V, VI).

A summary of video data from EPA's Coral/hardbottom Monitoring Project (Wheaton et al 1998) for 40 reef sites in the Florida Keys National Marine Sanctuary shows that the majority of benthic "cover" for nearly all reefs (excepting hardbottoms) within the Sanctuary is represented by stony corals and octocorals. By benthic category, the substrate (with encrusting biota) category clearly dominated. Octocoral cover ranged from over 4% to more than 20% and surpassed stony coral cover in both patch reef and offshore deep reef categories.

Total Cover by Category	Hardbottom	Patch Reefs	Offshore Shallow Reef	Offshore Deep Reef
Stony Coral	4.83%	18.46%	11.83%	6.38%
Octocoral	4.12%	20.68%	8.87%	12.25%
Substrate	50.02%	50.04%	66.20%	65.64%

Coral (stony and octocoral) Cover for 40 EPA Coral/hardbottom Monitoring Sites, 1996

Site Name	Admiral	Alligator (Deep)	Alligator (Shallow)	Carysfort (Deep)	Carysfort (Shallow)	Cliff Green	Conch (Deep)	Conch (Shallow)
Total Cover								
Stony Coral	30.03%	1.93%	1.68%	13.51%	10.62%	20.11%	5.08%	4.89%
Octocoral	25.70%	17.08%	15.57%	8.18%	8.63%	23.11%	8.09%	7.57%
Substrate	40.46%	75.91%	56.12%	56.30%	69.40%	41.25%	75.79%	68.62%
% of Total	96.19%	94.92%	73.37%	77.99%	88.65%	84.47%	88.97%	81.08%

Site Name	Content Keys	Dove Key	Dustan Rocks	Eastern Sambo (Deep)	Eastern Sambo (Shallow)	El Radabob	Grecian Rocks	Jaap Reef
Total Cover								
Stony Coral	1.29%	0.12%	16.27%	8.82%	17.87%	0.03%	18.45%	31.82%
Octocoral	0.03%	1.63%	35.17%	8.96%	0.95%	0.89%	11.23%	1.66%
Substrate	60.42%	71.35%	36.20%	68.78%	62.69%	31.17%	61.95%	50.80%
% of Total	61.74%	73.10%	87.64%	86.56%	81.51%	32.09%	91.62%	84.28%

Site Name	Long Key	Looe Key (Deep)	Looe Key (Shallow)	Molasses (Deep)	Molasses (Shallow)	Molasses Keys	Moser Channel	Porter Patch
Total Cover								
Stony Coral	3.09%	11.08%	11.89%	4.07%	7.22%	0.06%	1.14%	2.87%
Octocoral	14.74%	12.24%	15.77%	19.47%	18.30%	2.50%	8.96%	12.81%
Substrate	63.25%	59.50%	52.40%	60.01%	63.35%	38.44%	11.07%	49.62%
% of Total	81.09%	82.82%	80.06%	83.55%	88.86%	41.00%	21.17%	65.29%

Site Name	Rattlesnake	Rock Key (Deep)	Rock Key (Shallow)	Sand Key (Deep)	Sand Key (Shallow)	Smith Shoal	Sombrero (Deep)	Sombrero (Shallow)
Total Cover								
Stony Coral	0.00%	6.10%	9.15%	5.37%	11.34%	17.83%	3.44%	1.64%
Octocoral	2.55%	13.53%	1.96%	7.62%	5.16%	1.49%	7.12%	8.65%
Substrate	82.82%	73.75%	83.92%	83.25%	82.70%	75.97%	80.55%	53.96%
% of Total	85.37%	93.38%	95.03%	96.24%	99.19%	95.30%	91.12%	64.25%

Site Name	Tennessee (Deep)	Tennessee (Shallow)	Turtle	W. Turtle Shoal	West Washer	Western Head	Western Sambo (Deep)	Western Sambo (Shallow)
Total Cover								
Stony Coral	9.22%	2.40%	9.99%	11.29%	29.29%	27.03%	8.22%	18.06%
Octocoral	14.34%	23.52%	35.01%	28.03%	18.23%	0.00%	7.49%	3.08%
Substrate	69.35%	65.02%	50.41%	50.13%	47.22%	63.97%	32.76%	71.71%
% of Total	92.91%	90.94%	95.41%	89.45%	94.74%	91.01%	48.48%	92.85%
Average Cover:								
Stony Coral	7.70%							
Octocoral	8.63%							
Substrate	35.21%							
Combined Total	51.54%							

Four sites had less than 1% octocoral cover, 2 sites had greater than 35% octocoral cover. Sanctuary-wide, the average octocoral cover was 8.6% which exceeded average stony coral cover (7.7%). Again, substrate dominated with an average cover of nearly 52%.

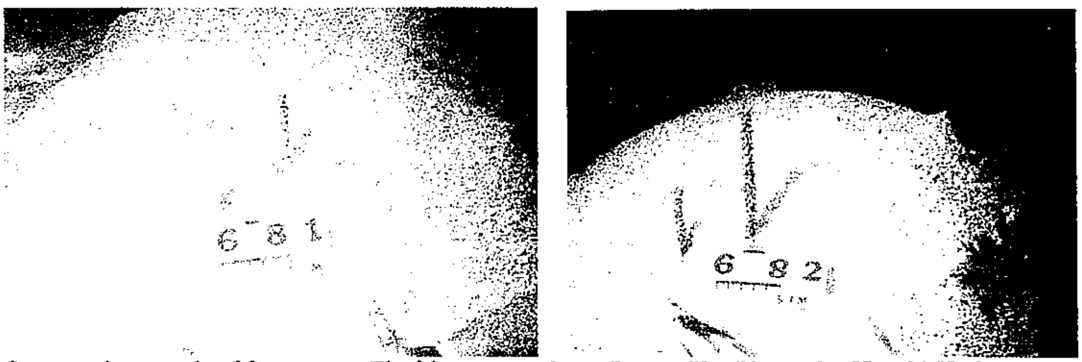
POPULATION DYNAMICS

Octocoral population dynamics follow a biological time scale rather than geological. However, octocorals are relatively long-lived colonial animals.

GROWTH AND AGE

Gorgonian octocorals common to the South Atlantic have annual growth rings in their axial skeleton. Studies on growth rates of these colonial animals are limited. Kinzie (1974) reported an average annual growth rate of 2 cm/year for an octocoral common to the Florida reef tract. Studies by Grigg (1970) on related octocorals (Muricea) in the Pacific, predicted that colonies 30cm high were about 20 years old; the largest colonies (45cm+) were estimated to be 50 years old. Opresko (1974) found that related octocorals (Plexaura) in the northern Florida reef tract ranged in height from 16 to 88 cm with estimated ages of 2.5 to over 22 years. Goldberg (1970) noted that many octocorals off Palm Beach were less than 20 cm in height but larger colonies to 40 cm were also present. Size and age determinations vary widely throughout the sub-class octocorallia because of many included species with differing morphologies.

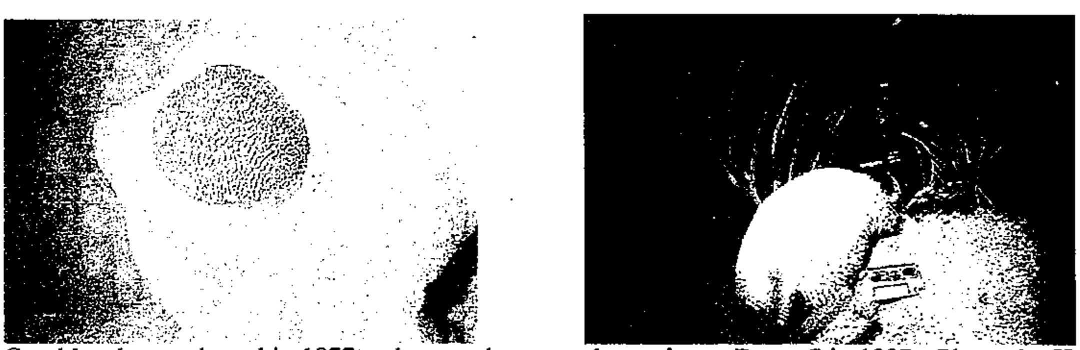
The following photographs were taken on concrete domes in an artifical patch reef in Biscayne National Park in 1977 (Hudson 1989). Two octocoral recruits were first photographed in 1981 (4 years after patch reef's creation) and again in 1982 after 1 year's growth. The scale bar is the same.



One year's growth of 2 common Florida octocorals on Dome #2. Photos by Harold Hudson

RECRUITMENT

Recruitment is closely tied to substrate conditioning. Settlement on artificial substrate varies. It may occur in limited numbers only after several years of immersion as illustrated in the previous photographs.
Or recruits may cluster around natural substrate (transplanted coral head) as in the photographs below.

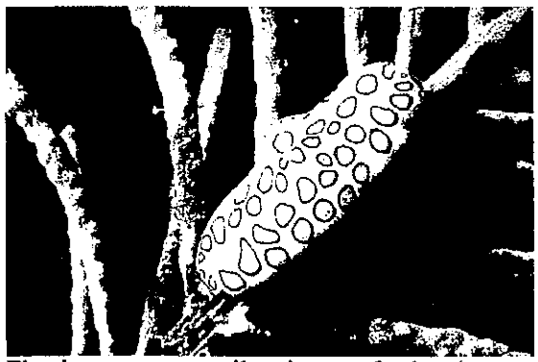

Coral head transplanted in 1977 and natural octocoral recruits on Dome 7 in 1987. Photos by Harold Hudson.

REGENERATION

Numerous studies have documented the regenerative capability of octocorals. Kinzie's (1974) work showed that a common sea rod (Plexaura) octocoral sealed over ends exposed by cutting in less than 1 week.

NATURAL MORTALITY

Natural predation on octocorals is minimal. Aside from ovulid gastropods (snails) and a few fish species, octocorals are not palatable to most other animals.



Flamingo tongue snail eating sea feather (octocoral).

Their primary source of natural mortality is considered to be toppling due to bioerosion of the substrate and their morphological resistance to water motion (Kinzie, 1974). Some are overgrown by fire coral and others are smothered by algal overgrowth. Recently mortality of sea fans was attributed to fungal infection.

HARVEST CONSIDERATIONS

SIZE LIMITS

At present, management of octocoral harvest in the South Atlantic consists of allowable catch of whole colonies for commercial sale with a marine life endorsement and saltwater products license. The Sanctuary defers octocoral harvest other than prohibited Gorgonia to the State permitting system . In 1977, Grigg outlined a fishery management plan for precious corals based on the closely related black coral fishery. He stated that the age at first capture (size limit) must incorporate an adequate reproductive cushion before yield can be sustainable. That age for the black coral fishery is 20 years (height of 1.2m). In the marine life fishery, octocoral harvest is not reported by species. A single size limit would not be appropriate for the subclass because of differences in morphology throughout the subclass. Fully-grown adult colonies of some species may be less than 10 cm in some species but nearly 90 cm in other species.

PARTIAL COLONY COLLECTION/PRUNING

In a study of the possible ecological effects of commercial harvest of a plexaurid gorgonian, Kinzie (1974) outlined the implications of harvesting whole colonies, waiting for sexual reproduction, settling and growth to replace the colonies harvested. This work has direct application to the South Atlantic Marine Life Fishery because the majority of octocorals harvested are closely related animals.

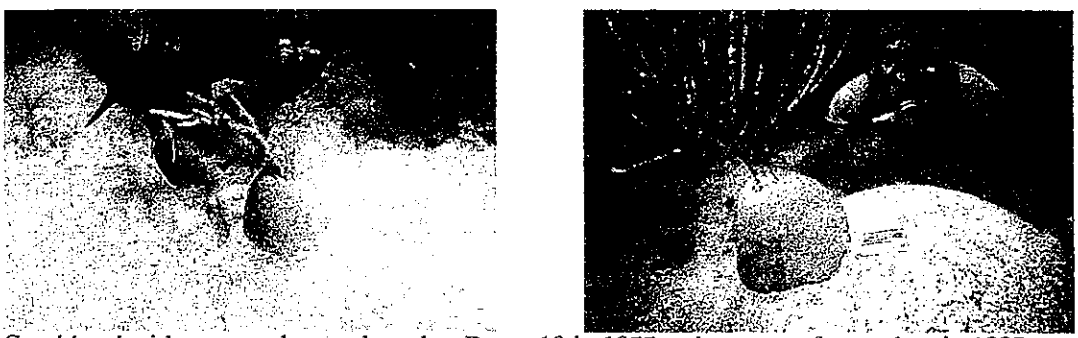
1. Removal of an octocoral colony reduces the reproductive potential of that population by an amount equal to the contribution of each colony taken.
2. Reproduction is at best annual.
3. Mortality of newly settled polyps is high (1 in 60,000 survive, Theodor 1967)
4. Growth rate is slow.

Based on the above factors and his experimental research, Kinzie concluded that pruning was a more efficient and conservation minded method of harvest. Advantages of pruning are summarized here.

1. Existing colonies regenerate.
2. Losses due to larval and early juvenile mortality are eliminated.
3. Number of potential parent colonies is not reduced (number of parent polyps are however).
4. Ecology of area less disturbed by pruning rather than whole colony removal.
5. Size reduction might reduce toppling of large colonies by reducing their resistance to water movement

<u>TRANSPLANTATION IN SITU OR IN CLOSED SYSTEMS (AQUARIA)</u>

In the controversy surrounding elimination of live rock wild harvest, an exemption was made for a holdfast for octocorals because whole colonies would not stay upright and would die. Numerous adhesives have been found to transplant/cement octocorals and other benthic organisms to various substrates (artificial substrate, natural culture product, and in situ substrate in ship grounding sites, etc.). Octocorals can be transplanted as whole colonies and thrive in habitats similar to those in which they originated.



Coral head with octocoral transplanted to Dome 19 in 1977 and success of transplant in 1987. Photos by Harold Hudson.

Numerous octocorals and other reef benthos were transplanted into a ship-grounding site at Pulaski Shoal, Dry Tortugas (Jaap et al, 1991). Larger octocoral colony transplantation failed in the first winter with severe storm action. Most remaining transplants have survived to present (9 years).

Transplant grid for grounding site and close up of center grid showing transplanted octocorals.

The advantages of octocoral pruning and transplantation apply to the South Atlantic Fishery for octocorals. Aesthetically appropriate terminal segments of whole colonies could be pruned leaving the parent colony intact. The pruned segments can then be cemented to the preferred substrate. Newly attached "colonies" of octocorals could then be incorporated into existing in situ live rock aquaculture sites or transferred to facilities for final distribution for the marine aquarium trade. At least 3 recent scientific collecting permits issued for the Florida Keys National Marine Sanctuary were examining clonal propagation, long-term husbandry and propagation, and restoration with clippings of octocorals.

COMMERCIAL VALUE

Within waters shallower than 200 m (660 ft.), corals have been identified as having potential commercial value, defined herein as a monetary value for use in research, industry (jewelry, marine aquaria), or unusual art value. Although nearly all corals could conceivably be, and have been marketed as curios, only species with major potential for exploitation are acknowledged as commercially important.

In 1981, the Gulf of Mexico Fishery Management Council voiced concerns regarding octocoral collection for the curio trade and possible exploitation for pharmacological research. Initially, total prohibition of octocoral collection from State waters was recommended based on their importance as habitat and their role in the reef ecosystem balance. No hard data substantiating overexploitation was available. Permitting was not instituted because most collectors asserted they were unable to identify their catch.

During inquiries and later ban on live rock, an octocoral permit was instituted for harvest in federal waters and a saltwater products license with a marine life endorsement was required in State waters. Octocorals are still being harvested in Florida with a saltwater products license for display in marine aquaria. Moe (1989) states that a variety of colorful gorgonians, sea fans, sea whips, and sea fingers and occasionally sea pens are available for marine aquaria. However, they require relatively strong currents and planktonic food to do well in marine systems.

Various octocorals in a marine reef tank.

The following tabulation of octocoral (gorgonian) collection combines harvest from both offshore (federal) and inshore (State) for South Atlantic waters.

GORGONIAN COLONIES BY COLLECTION AREA 1991-1998								
PALM BEACH/BROWARD 741		DADE 744		MARATHON, MONROE 748		KEY WEST, MONROE 1		
Year	Total Colonies	Year	Total Colonies	Year	Total Colonies	Year	Total Colonies	Grand Total
1991	7754	1991	11600	1991	8527	1991	155	28036
1992	6549	1992	5371	1992	16802	1992	133	28855
1993	6842	1993	7574	1993	11308	1993	348	26072
1994	8778	1994	10727	1994	11344	1994	301	31150
1995	12692	1995	5551	1995	20987	1995	529	39759
1996	19091	1996	2696	1996	11577	1996	453	33817
1997	13878	1997	6977	1997	16889	1997	2866	40610
1998	13067	1998	4817	1998	15515	1998	2200	35599
TOTAL	88651	TOTAL	55313	TOTAL	112949	TOTAL	6985	

As reported in the Marine Fisheries Trip Ticket system in South Atlantic waters, total octocoral harvest increased 22% from 28,036 in 1991 to 35,559 in 1998. Harvest from Indian River, St. Lucie and Martin Counties were by one dealer and are confidential. An additional 53,150 colonies were collected from an unspecified area. By area of collection, increases of 41% (Palm Beach/Broward), 45% (Marathon), and 93% (Key West) were reported over the 8 years. Dade harvest was erratic.

Numerous octocoral species are also collected for marine natural products (pharmacology research). Antimicrobial activity of octocorals was first reported by Burkholder and Burkholder in 1958. Burkholder (1973) reported new information in a paper on ecology of marine antibiotics and coral reefs. Since prostaglandins were discovered in a gorgonian in 1969 (Weinheimer and Spraggins, 1969) the research on chemistry of octocorals has grown exponentially. Some octocorals (primarily the sea feather/sea plume) are collected for the dry curio trade and others (mostly precious red corals Corallium) are collected for jewelry (primarily Hawaiian fishery).

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LIVE ROCK LANDINGS

The following table summarizes total pounds of live rock landed between 1991 and 1998 in the South Atlantic Council's jurisdiction from Florida Marine Fisheries Trip Ticket data.

SOUTH/EAST COAST
LIVE ROCK LANDINGS 1991-1998

YEAR	WILD HARVEST	AQUACULTURE
1991	392,421	0
1992	535,786	0
1993	634,658	0
1994	502,272	0
1995	519,567	0
1996	146	5,664
1997	0	45,803
1998	0	14,412

Aquaculture rock deposited 11/16/93, photo 5/25/94, Gulf of Mexico.

Aquaculture rock with red encrusting biota. Off Key West 9/10/98

As of November 1998, 10 Federal Aquaculture sites were in production in the South Atlantic with 31,150 pounds rock deposited.

FEDERAL 1998 AQUACULTURED LIVE ROCK SITE STATISTICS				'11/16/98
	Gulf of Mexico		**South Atlantic**	
	Federal	**State**	**Federal**	**State**
# Sites	29	3	10	4
Total Acreage	73*	14.7	10	6.35
Lbs Rock Deposited	227,125	N/A	31,150	N/A
Rock Origin	Bahamian	Bahamian	Miami Oolite;	Red Lava;
	Coral Rock;	Coral Rock;	Miami Lime-	Tufa &
	Utah Riverbed	Miami Lime-	stone/Bryozoa	Molluscan
	Rock;Bonifay	stone/Bryozoa	Facies;	Limestone;
	Lime Rock;	Facies.	NE FL-VA	Miami/Key
	Miami Lime- Stone		Coquina;	Largo Lime- stone
	Bryozoa facies		Concrete	
*Includes nine 6.5-acre sites permitted by Corps of Engineers prior to March 1995 and				
"grandfathered" into the NMFS permit system.				
**Partial reports through August.				
Sources:	Lorie Elder, NMFS, Southeast Region, Regulations and Permits Branch			
	Wanda Prentis, FUDEP, Marine Resource Regulation and Development			
	Martha Norris, Florida Marine Research Institute, FL/DEP			

Only four aquaculture lease holders have deposited product in State waters in the South Atlantic.

DIVISION OF MARINE RESOURCES		
BUREAU OF MARINE RESOURCE REGULATION AND DEVELOPMENT		
July 30, 1999		
Florida Live Rock Aquaculture Lease Activities		
Name/Address	Lease Information	Lease Activities
Richard Londeree	Lease No, 52-AQ-049 (5 acres)	Deposited Bahamian Petrified
Tampa Bay Saltwater	5 Miles Offshore of Tarpon Springs	Coral rock (I Million lbs, 11/93
1720 Eldred Drive	In the Gulf of Mexico	2nd qtr. 1998 - 5,365 lbs. harvested
Tampa, FL 33603	In Pinellas County	4th qtr. 1998 - 4,600 lbs. harvested
		Prior harvests total 11,429 lbs.
Thomas A. Frakes	Lease No. 52-AQ-054 (I acre)	Deposited 500 cubic yds. rubble
Anclote Aquaculture	5 Miles Offshore of Tarpon Springs	Babarnian rock - 03/94
7344 Demshar Drive	In the Gulf of Mexico	2,000 lbs, harvested 12/94
Mentor, Ohio 44060	In Pinellas County	
Thomas A. Frakes	Lease No. 52-AQ-216 (4.7 acres)	Miami Limestone & Bryzoan
Anclote Aquaculture	Approximately 2 Miles West of Three	Facies rock from South Fla.
7344 Demshar Drive	Rooker Bar, In the Gulf of Mexico	4th qtr. 1998 - 1,350 lbs. harvested
Mentor, Ohio 44060	In Pinellas County	
Nanette Young	Lease No. 44-AQ-215(2.5 acres)	Tufa Rock & Red Lava rock
c/o Forrest Young	Between Long Point Key and Crawl	1st qtr. 1997 11,500 lbs, deposited
Dynasty Marine	Keys	2nd qtr. 1997 17,500 lbs. deposited
Associates	In Florida Bay	
113 Coco Plum Drive	In Monroe County	
Marathon, FL 33050		
Michael F. MeMaster	Lease No. 44-AQ-326 (2 acres)	Redlines Quarry Calcerous rock
Northeast Brine Shrimp,	Northeast (shoreward of Davis	Deposited 12,000 lbs. 7/97
Inc.	Reef)	
125 Auburn Street	In the Atlantic Ocean	
Allentown, PA 18103	In Monroe County	
Kenneth Nedimyer	Lease No. 44-AQ-326 (1.7 acres)	Fossilized Miami (non-indigenous)
Sea Life, Inc.	East-Southeast of Indian Key	rock
Post Office Box 712	Bridge & due East of Channel	
Taviernier, FL	Five Bridge to Long Key	
	In the Atlantic Ocean	
	In Monroe County	
Donald J. DeMaria and	Lease No. 44-AQ-310 (0.15 acre)	Key Largo Limestone & Miami
Scott S. Hutchinson	9 Miles West-Southwest of Key	Limestone rock
c/o Mrs. Karen Kennedy	West, near Boca Grande Bar	As of 1/7/98 40,000 lbs. of rock
DeMaria	In the Atlantic Ocean	deposited
Post Office Box 420975	In Monroe County	
Sumerland Key, FL 33042		