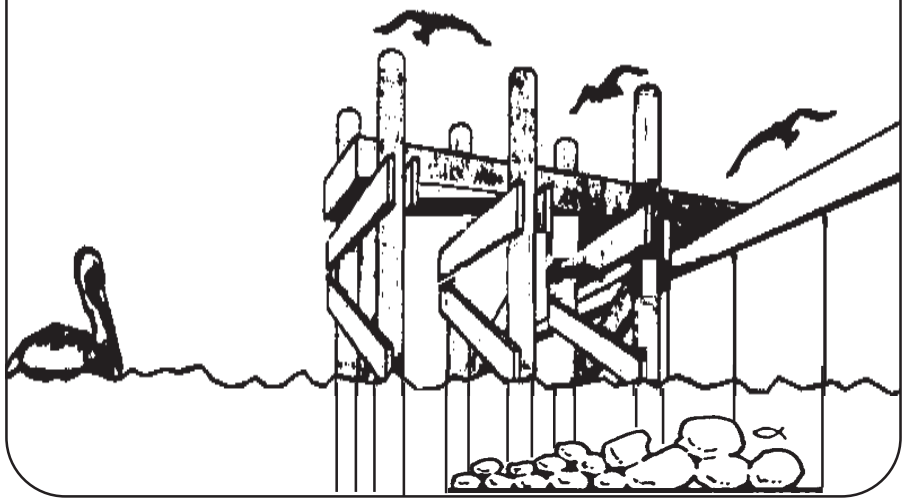
Environmental Resources Division
City of Cape Coral
P.O. Box 150027
Cape Coral, FL 33915-0027

City of Cape Coral

ARTIFICIAL HABITAT GUIDE



Revised 07/2001

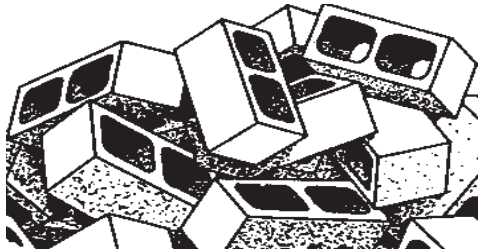
In October of 1990, the Environmental Resources Division began a project of constructing Artificial Nursery Habitats. These were intended to act as replacement substrate in areas where natural shoreline had been replaced with seawalls. The habitats provide a platform where larvae of barnacles, mussels, oysters, crabs, and other animals can grow. These filter-feeding organisms improve water quality by removing plankton which utilize nutrients. Juvenile fish are also attracted for food and shelter. The nurseries allow small fish to get through a critical stage in their life cycle, increasing their survival rate.

The project is currently focussed on completing the monitoring of installed habitats. Future research will involve colonization rates for fouling communities, measurements of fish attraction, and modifications to act as a saltwater plant nursery area.

This guide is a compilation of information on construction of habitats, sources of commercially available products, and some general findings of our research. This publication is designed to publicize the uses and advantages of artificial habitats in Cape Coral waters. It by no means represents an exhaustive report on artificial habitats.

In general, materials should be inexpensive, non-toxic, long-lasting, readily available, and easy to work with. Depending on the site, the habitat size can be adjusted to accommodate any area. The designs are limited only by your imagination and budget. The flotation should be roughly the same size as the habitat to ensure it will stay floating. Five gallons jugs are terrific floats, but detergent bottles, styrofoam floats, or something similar could be used. These must be firmly attached to the habitat and should have an additional rope attached “just in case.”

The E.R.D. has tried to keep construction costs and effort (both initial and maintenance) to a minimum. We have also attempted to utilize locally available materials when possible. The prices are based on material costs from when this project began. The listing of any trademarks, products, or individuals does not constitute an endorsement by the City of Cape Coral or the Environmental Resources Division. This material serves as a source of information and ideas for anyone interested. Any ideas, improvements or modifications will be gratefully accepted.



Introduction

The City of Cape Coral has over 400 miles of canals within its boundaries. This includes approximately 300 miles of freshwater and 100 miles of saltwater canals. During its development, the City of Cape Coral entered into a collaborative agreement with state regulatory agencies to develop a plan for maintaining and improving water quality. The explicit recommendation of this plan was for the city "to manage the waterway system in order to preserve both its functional and ecological characteristics".

Many coastal canal problems arise from initial design flaws. Cape Coral has a box-cut canal system which is subject to poor water flow and subsequent filling in with soil. Canal system problems are complicated by an increase in nutrients from fertilizers, storm water discharge and septic tank leaching as the population increases. It is in our best interests to encourage the growth of organisms which filter out pollutants from our water (plants, tunicates, barnacles, oysters, etc.). Because they also foster the growth of other wildlife, they tend to keep the aquatic system more ecologically balanced and stable as well.

In Cape Coral, property development on saltwater requires installation of a seawall (vertical bulkhead). For new construction, at least 50% of the seawall must be lined with rip-rap (12-24"diameter rocks). The rip-rap adds stability to the seawall, reducing erosion and preventing seawall collapse. Rip-rap also results in increased vertical mixing of water, increasing the amount of dissolved oxygen in the water. An additional benefit of lining half of the seawall with rock is to provide in this same area countless hiding places and attachment points for marine organisms.

Prior to the rip-rap requirement, the saltwater canals consisted of miles of vertical concrete walls with a flat, sand bottom. Most of the existing vegetation was removed for seawall construction and conditions remaining discourage its return. A seawall is poorer

ecologically than a naturally-vegetated bank. Where a seawall is required, rip-rap and/or artificial habitats can restore many of the benefits of a natural shoreline. This shoreline enhancement provides hiding places, a variety of depths, and an increase in available space to attract marine animals into our canals. Because the canal, lake and river shorelines are the principal landscape features in Cape Coral and in danger of being seriously degraded, they must be protected and enhanced.

What features make a waterfront appealing to one person may annoy another. There are strong differences in aesthetic taste. One homeowner is delighted with the clean, unbroken view provided by seawalls and cares little if the canal is sterile. Another is appalled by a seawalled, biologically impoverished system and longs to have fish, vegetation and wildlife to see. Artificial habitats can bridge the gap by encouraging healthy ecological communities and yet, remain out of sight from the casual observer.

COST INFORMATION

Type	Cost	Construction (hours)	Repair (cost/time)
EC-30	$30	2-3 hrs.	$30/20 hrs.
MC-40	$40	4-6 hrs.	$10-20/2-3 hrs.
Calinski	$250	n/a	$10/ 8 hrs.
EZ-25	$25	1-2	n/a
Plastic Mesh	$5/tube	1-2	n/a

RESEARCH FINDINGS

At the time this project was initiated the current market for pre-fabricated (ready made) habitats seemed limited and overpriced. Some habitat designs were not ideal for certain seawall installations. The E.R.D. felt a habitat could be built cheaper and designed to complement seawalls. Our chief objective was to design a model that would be inexpensive and easy to work with. It needed to provide a large amount of surface area for settling organisms, yet be small enough to be placed under existing platforms and docks.

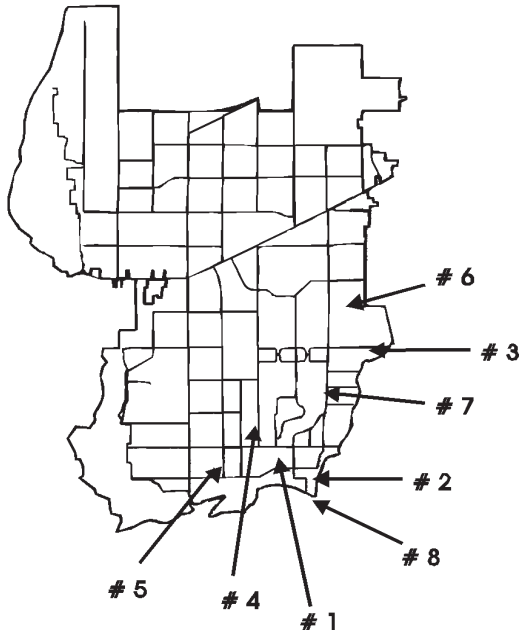
The E.R.D. installed 13 habitats in the southern half of Cape Coral at 8 sites (shown on map). These have been monitored on a quarterly basis since installation. Routine water quality measurements (oxygen, salinity, pH, etc.) have been collected. The habitats were also studied in terms of what actually lived there. For 1.5 years, data was collected by observing which animals were found on the habitats. During the last year, quarterly counts have been done to quantify the amount of organisms on habitats. This was done by installing a sheet of PVC plastic, which was removed after 3 months. The plate was scraped, the different species separated and weights recorded. This method allows for comparisons of different areas or different habitat types. The method essentially measures the organisms clinging to the plate, while underestimating those that move (shrimp, fish and larger crabs).

The artificial habitats installed at the Yacht Club Pier have required more modification and repair than any other site. This "torture test" area has enabled us to locate design weaknesses. This site has the highest wave energy and has required a tremendous amount of maintenance to keep floats attached to the habitats.

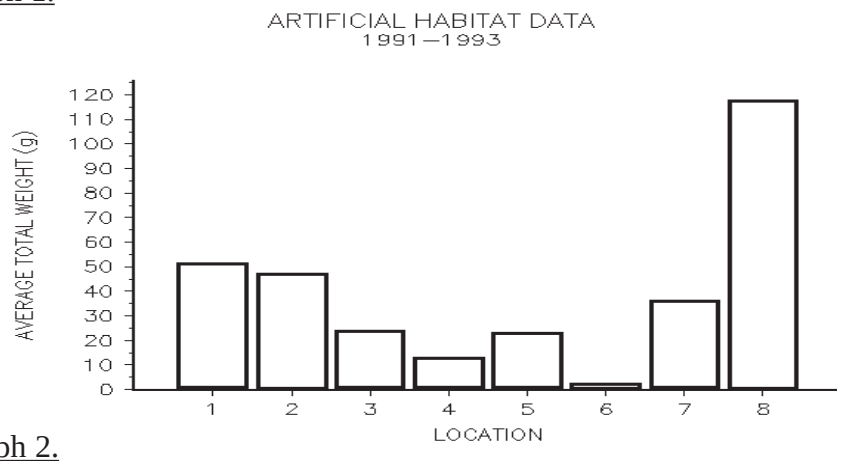
The floating habitats (Calinski, EC-30, and MC-40) had nearly identical amounts of growth on them. This suggests the habitats act similarly in promoting the growth of marine organisms. Location of the units has a dramatic effect on total weight found on a habitat and what type of organisms could be expected in greatest numbers (graph #1).

Habitats closest to the Caloosahatchee River had the greatest average total weight. This is due to increased tidal flushing, which brings larvae in, keeps dissolved oxygen high and maintains a fairly constant salinity. These areas had the highest numbers of crustaceans (crabs, barnacles, shrimp, etc.), bivalves (mussels and clams) and worms (graphs 2, 3 and 4).

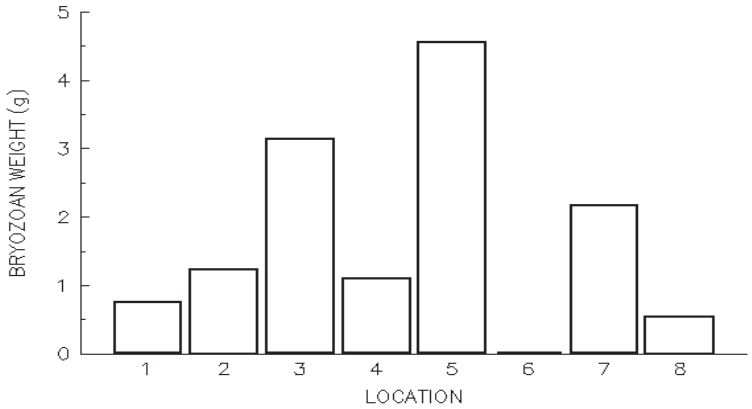
The areas furthest from the river had lower salinities and little tidal flow. Algae and bryozoans were found in greatest numbers at these sites (graphs 5 and 6).



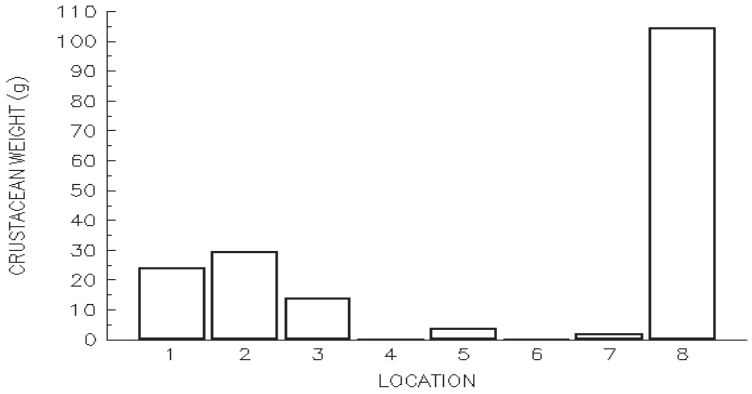
Graph 1.



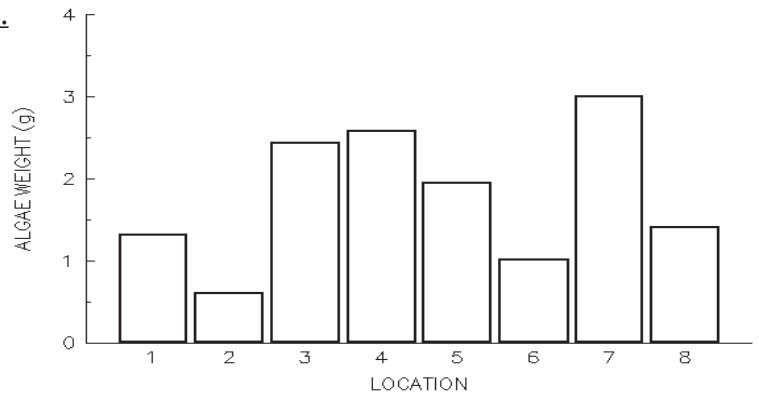
Graph 2.



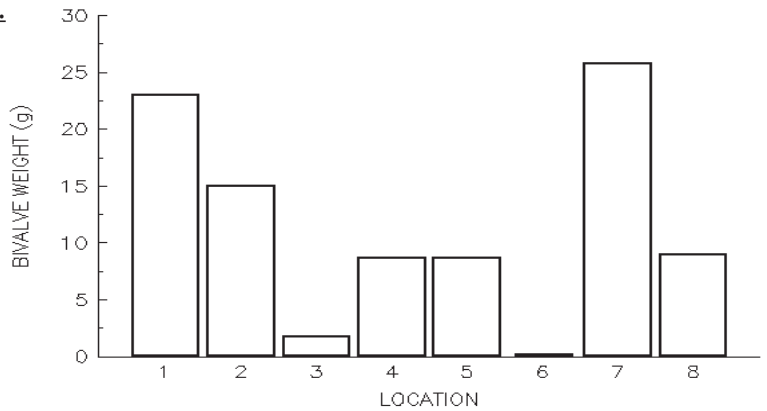
Graph 3.



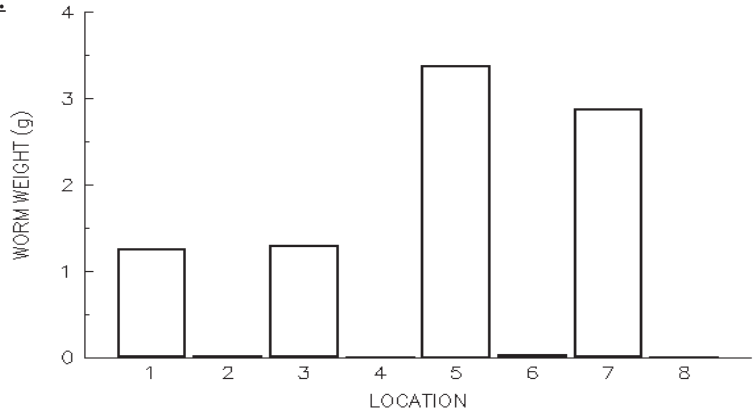
Graph 4.



Graph 5.

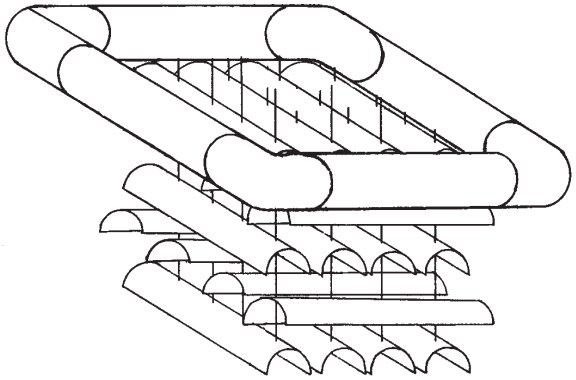


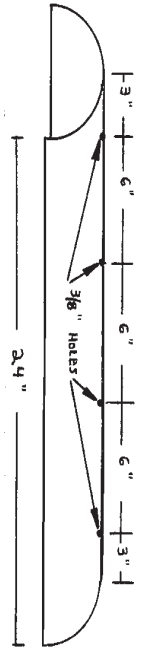
Graph 6.



TYPES OF ARTIFICIAL HABITATS

EC-30: The El-Cheapo (costs $30). This was our first attempt at building a habitat. The price was right, construction was simple, and it was easy to install (just tie a couple ropes to something). It does fairly well in areas receiving little or no wave energy. It also collapses during low tides, so the pipe halves are never out of the water. In areas with regular wave action, it must be modified to limit movement of the pipe halves (barnacles and oysters effectively cut the ropes after it has been colonized). Additional flotation should be added.





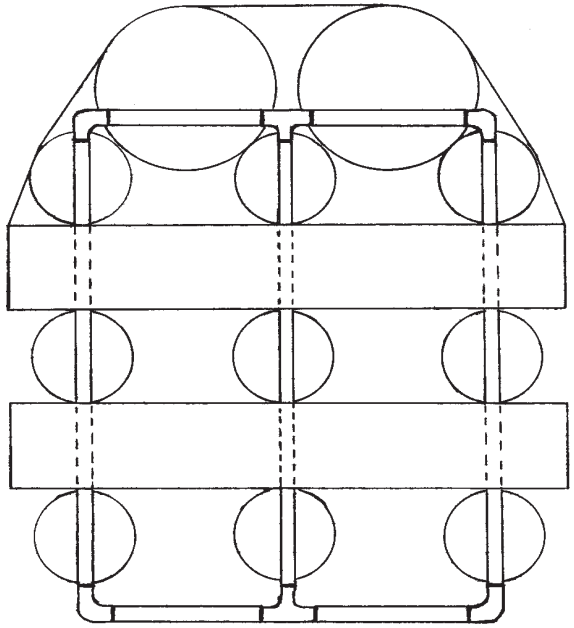
Materials:
4pcs. 4" PVC sewer pipe elbows
28 feet 4 " sewer pipe
100 feet 3/8" nylon rope

Construction:

4" PVC 4 pcs. 24" long (float pipes)
10 pcs. 24" long, cut in half lengthwise
(3/8" holes drilled as shown)

Rope 12 pcs. 60" long (runs through the outside holes of the half pipes and ties to the PVC float)
4 pcs. 48" long (to attach additional flotation)

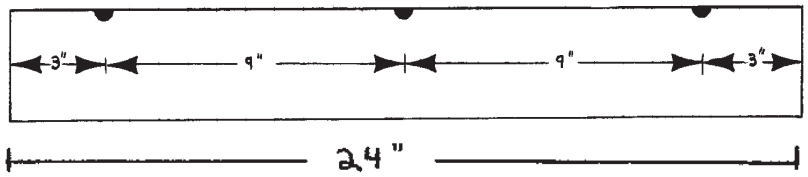
MC-40: This was a modification of the EC-30, the Moderate-Cheapo MC-40: This was a modification of the EC-30, the Moderate-Cheapo ($40). Construction is fairly difficult, requiring fairly precise measuring. This model can handle higher energy areas and is nearly indestructible. Two 5 gallon plastic jugs used for flotation proved inadequate after 1 1/2 -2 years. PVC slide-mounts (one pipe slides inside another) work very well and require little or no maintenance. Construction was of PVC pipe with pipe sections stacked upon one another. Plastic mesh was used in between layers of pipe and also to attach the floats.



Materials:
20 1/2" PVC elbows
28 1/2" PVC tees
20 feet 4" PVC sewer pipe
45 feet 1/2" PVC pipe

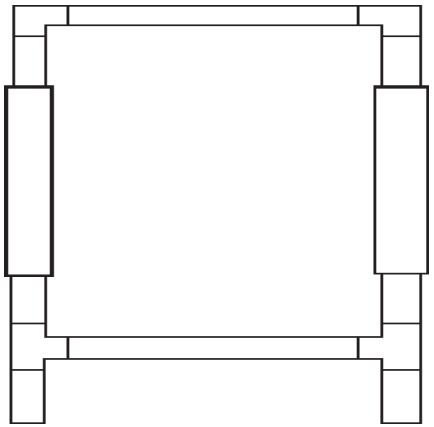
Construction

4" PVC 15 pcs. 24" long
(drill 3/4" holes as shown below)
1/2" PVC 12 pcs. 8" long
9 pcs. 24" long
9 pcs. 1 3/4" long

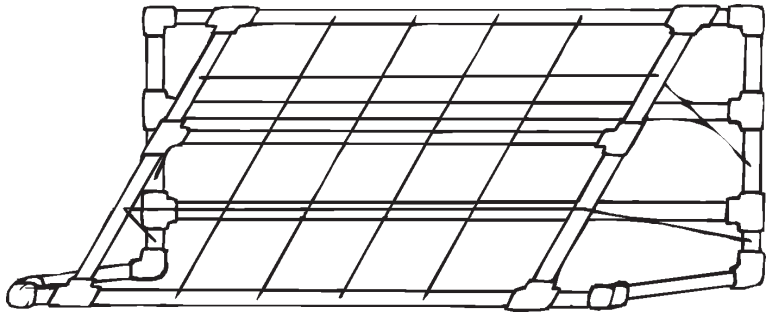


Slide Mount (optional)

2 1 1/2" elbows
2 1 1/2" tees
2" PVC 2 pcs. 24" long
1 1/2" PVC 2 pcs. 24" long
2 pcs. 48" long
(depends on tides & dock height)



EZ-25: This design was first installed as this guide was being assembled. Its chief strengths are low cost, ease of assembly, and no maintenance. While studies have not yet been done, this model is intended to act primarily as a fish attractant. It has a large amount of open space, with a minimum of space for organisms to attach to.



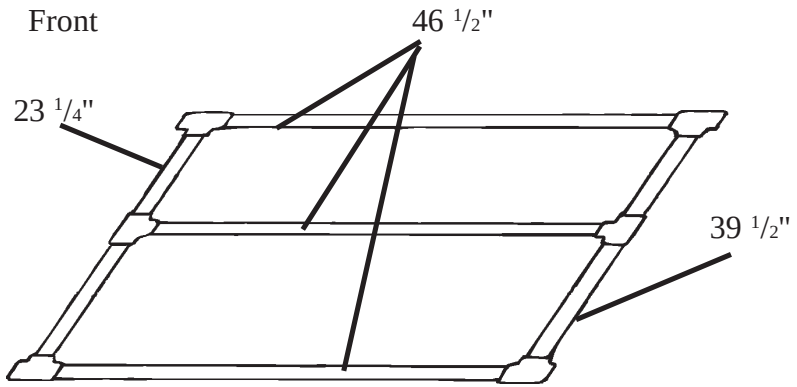
Materials:

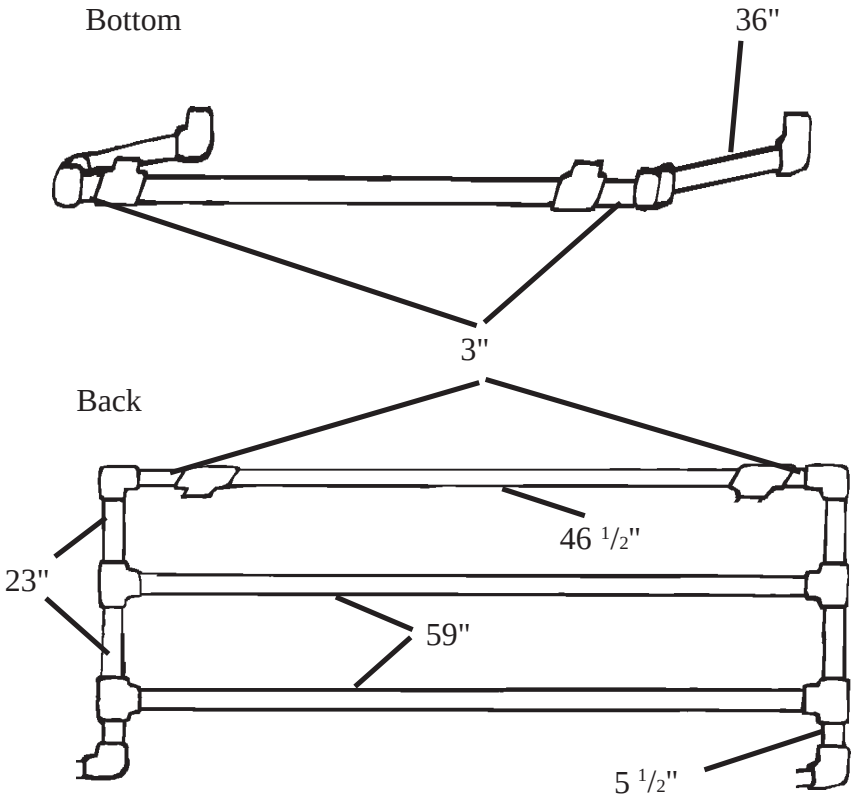
100 feet of 3/8" rope
10 1 1/2" Sch 40 PVC tees
6 1 1/2" Sch 40 PVC elbows
45 feet of Sch 40 1 1/2" PVC pipe, cut as follows:

Construction:

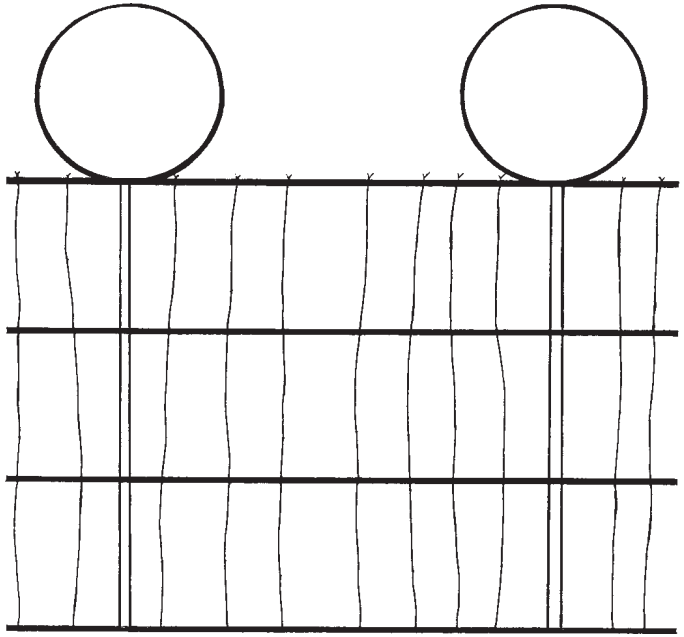
4 pcs. 23" long
3 pcs. 46 1/2" long
4 pcs. 3" long
2 pcs. 36"long
2 pcs. 39 1/2" long
2 pcs. 5 1/2" long
2 pcs. 23 1/4" long
2 pcs. 59" long

Rope is criss-crossed through holes drilled at approximately 10" intervals along pieces.

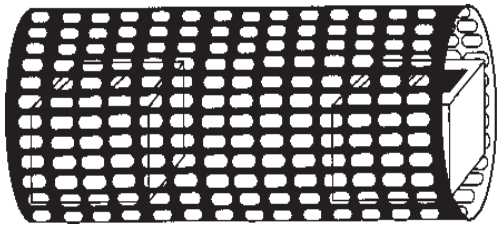


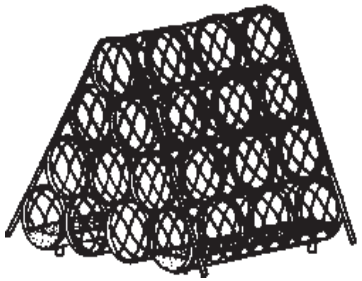


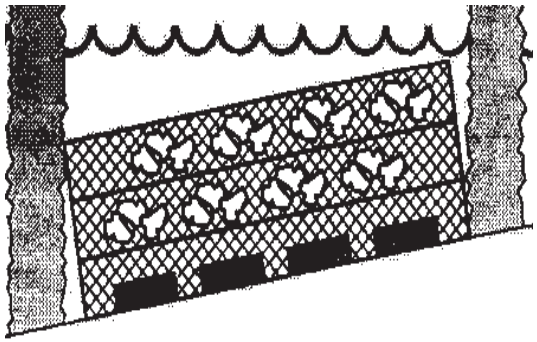
Calinski: This was the first commercially available product in our area. The E.R.D. purchased 4 of these in 1990. The design does have its merits, but should be modified for shallow or smaller areas. This design extends beyond a seawall platform and one was crushed by an anchored sailboat. Maintenance has been fairly extensive, especially replacing the styrofoam floats. The stainless steel rods were replaced after heavy corrosion and disassembly occurred. The floats are susceptible to wave energy impact, doing better in calmer waters.



Plastic mesh: This can be purchased in rolls, but specify that it is sun (UV light) resistant. It has many possibilities as to placement, whether alone or as part of a PVC structure. It can be rolled up in tubes (held together with cable ties) and weighted with rocks to keep it in place.







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Philips, S. H. 1990. A Guide to the Construction of Freshwater Artificial Reefs. The Sport Fishing Institute, Washington, D.C.

Prince, E. D., O.E. Maughan, and P. Brouha. 1977. How to Build a Freshwater Artificial Reef. Sea Grant at Virginia Tech., Extension Division, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Seaman, W., L. M. Sprague. 1991. Artificial Habitats for Marine and Freshwater Fisheries. Academic Press, San Diego, CA.

ARTIFICIAL HABITAT INFORMATION

Aquatic Eco-Systems, Inc.
2056 Apopka Blvd.
Apopka, FL 32703
(407) 886-3939
Source of plastic mesh.

Artificial Reef Company of America
Attn.: Eldon Blancher
Research and Development
1717 Old Shell Road
Mobile, AL 36604
(205) 479-0394
Source of pre-fabricated habitats.

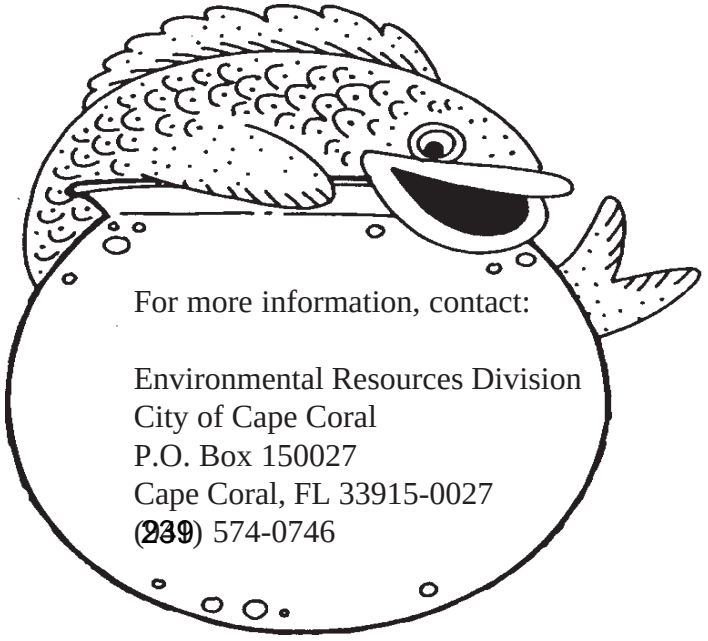
Marine Habitat Foundation, Inc.
Attn.: Mike Calinski
P.O. Box 1225
Captiva, FL 33924
(813) 472-8534
Source of pre-fabricated habitats.

Mote Marine Laboratory
Attn.: Randy Wells
Sarasota, FL
Source of habitat information.

Oyster Reef Designs, Inc.
Attn.: Gus Muench
P.O. Box 1821
Ruskin, FL
(813) 645-3888
Source of pre-fabricated habitats.

Reef Research Team
Attn.: Carol DeMort
Coastal Fisheries Laboratories
P.O. Box 43370
Jacksonville, FL 32203
(904) 398-7887
Source of habitat information.

Sport Fishing Institute
Artificial Reef Development Center
1010 Massachusetts Avenue, N.W.
Suite 300, Washington, D.C. 20001
(202) 898-0770
Source of habitat information.



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