

Lessons Learned:

- Bolts are used to secure the corners of the frame (image below) instead of PVC corners since the PVC corners are susceptible to damage during storm events.
- If monofilament is not available, other types of lines can be used like parachute cord, Dyneema, or Spectra.
- Do not hang corals from the bottom of the PVC frame. This piece protects the corals from hitting the bottom during storms or if there is not enough flotation. If corals are hanging from this piece, they may be damaged or die from abrasion during such events.
- The length of the drop-line is a trade-off between the expected fouling and the potential for corals to interact or be entangled during storms; corals hanging from lines that are too long are likely to be damaged from storms or similar events.
- When hanging corals, the 18 ga coated copper single strand cable wire (image below) can be installed faster than monofilament, but it won't last as long and is not as strong. If you plan to grow corals for longer than one year, monofilament would be better.



For more information: Griffin et al., 2012.



This document is part of the Coral Restoration Consortium's Guide to Coral Reef Restoration: Methods to Optimize Efficiency and Scale.

Coral Nursery Structure Designs



Floating Underwater Coral Array (FUCA)

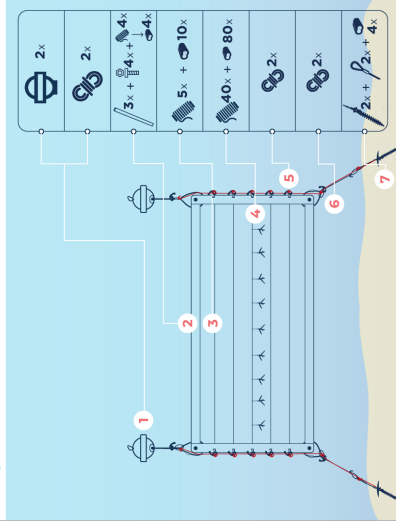


Description of the Nursery

Floating Underwater Coral Arrays (FUCA) have been used primarily for *Acropora cervicornis* in 6-15 m depth, though other genera like *Meandrina*, *Dendrogrina*, and *Porites* have also been grown on these structures - Case Study #12 in Chapter 1. This design was modified from the common line nursery and buoyant drop line nursery designs (Appendix 1) to include a rigid PVC frame to help reduce sagging as corals grow bigger and heavier, allowing corals to remain in the system longer. The frame may also reduce tangling of corals in storms and entanglement of marine life. The standard design of a FUCA can hold 40-100 corals.

The following are instructions for building a FUCA that holds **40 hanging corals**, with **secondary anchor lines**, floating approximately **1.5 m above the bottom** at a **rubby** nursery site with a **depth of 10 m**.

Diagram:



Supplies Needed:

1	2x	Buoys	- 19 cm round styrofoam buoys; see Chapter 1: Floats/buoys
1	2x	Buoy Line	- 60 cm segments of 9.5 mm black polypropylene
2	3x	PVC pipe	- 3m Schedule 80 1/2" (20 mm) PVC; 1 cut in half
2	4x	Bolts and Nuts	- 1/2" x 3" - 9.5 mm
2	4x	Loop monofilament	- 1000 lb test monofilament cut to 45 cm length
2	4x	Loop Crimps	- 3.9 mm aluminum crimping sleeves
3	5x	Horizontal lines	- 3.2 m segments of 600 lb test monofilament
3	10x	Horizontal line crimps	- 3.3 mm aluminum crimping sleeves
4	40x	Monofilament	- 100 lb test monofilament cut in 20 cm pieces
4	80x	Hanging crimps	- Size G (1.3 mm)
5	2x	Secondary anchor line	- 3.4 m segments of 9.5 mm black polypropylene
6	2x	Anchor line	- 12 m segments of 9.5 mm black polypropylene
7	2x	Anchor monofilament	- 12 m segments of 1000 lb. test monofilament
7	4x	Anchor crimps	- 3.9 mm aluminum crimping sleeves
7	2x	Anchor	- Penetrator screw; see Chapter 1: Anchor Types and Anchor Line Types

Details of Construction and Installation:

- Prepare the frame.** On each 1.5 m pipe, drill 6.4 mm holes starting from the top at 4, 10, 38, 66, 94, 122 cm, rotate the pipe 90 degrees and drill a 9.5 mm hole (for the bolt) 1.3 cm from the top and bottom of the pipe. On each 3 m pipe drill a 9.5 mm hole 1.3 cm from each end, rotate the pipe 90 degrees, and drill a 6.4 mm hole 5 cm from each end.
- Assemble the frame.** Insert bolts through the 9.5 mm holes on both the horizontal and vertical PVC pipes creating a rectangle. Tighten nut onto bolt. Thread the monofilament through the loops through the holes closest to the corner on both the horizontal and vertical pipes and create a loop by crimping the ends together.
- String the horizontal lines.** At one end of each line crimp a small loop using less than 75 cm of monofilament. Thread the other end through one of the sets of 6.4 mm holes on each vertical pipe. Pull the line taught and crimp in place.
- Prepare the anchor system.** Secure one end of the anchor monofilament to each of the anchors and create a loop on the opposite end using two 3.9 mm crimps.
- Install the anchors.** Using a sledgehammer, pound a penetrator anchor into the rubble at a distance just wider than the frame. Penetrator screw anchors can be removed with a wrench.
- Attach the FUCA.** Attach the anchor line to each monofilament loop on the anchor and to the loop at the corner of the base of the frame using bowline knots.
- Add buoyancy.** Thread a long line with buoys attached through the anchor loops of a weighted line, tie the line to the bottom of the frame. Pull the line taught. Put the buoys down to the bottom. Tie a buoy to each corner loop no more than 20 cm away from the frame and at least 3 m below the surface to reduce entanglement risk and avoid navigational hazards.
- Add secondary anchor lines.** Run the secondary anchor line from the anchor through the corner and horizontal line loops to the buoy.
- Add corals.** Hang coral fragments from the horizontal monofilament lines using monofilament drop-lines and crimps. Tightly wrap the lines around the horizontal lines.