

**Development of Circular Floating Cages for
Milkfish Broodstock at the SEAFDEC Aquaculture
Department**

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In fish breeding successful experimentation on artificial propagation greatly depend on the availability of fish in the appropriate stage of sexual maturation.

The present attempt to develop floating cages for holding milkfish broodstock at SEAFDEC was prompted by the need of the Department to have more fish for experimentation. With the initial success of the Department on artificial spawning and larval rearing (Technical Report No. 3), more experiments are required to standardize techniques and to establish broodstock for sexual maturation experiments.

Holding fish in floating cages has been popularized in Japan and is more geared towards growing fish for the market. A number of salmonid culture institutes in the US and Europe have reported employing cages for broodstock development. The paper briefly presents our experience in developing the cage culture system designed for holding milkfish for broodstock purposes.

Location

The floating cage system, comprising 2 units each of 6 m Ø, 9 m Ø and 10 m Ø cages, is located in the Igang Station of SEAFDEC Aquaculture Department. The site was chosen primarily for its natural protection. With all the buffers surrounding it, water current in the vicinity ranges from 25 to 44 cm/sec. There is constant exchange of water. Water depth is about 14 meters and the seabed is sandy with coral formations.

The southwest monsoons bringing heavy rains blow from June to November and the northeast winds blow for the rest of the year. The tide fluctuates over a range of 2 meters. Generally, the duration of rise or fall is 6 hours so there occurs 2 high tides everyday.

Design factors

1. Biological factors

Observations made in the Pandan Research Station of SEAFDEC indicate that the milkfish adult swims fast and in circles. To adapt to this behavior trait, the cages were made circular in shape. The land-based holding tanks of SEAFDEC are all circular in shape with diameters ranging from 2 m to 12 meters.

It has also been observed that the broodstock is a great leaper especially when agitated so that the cages were provided with net covering. The net is held in place by bamboo poles that are tied to the diagonal braces of the cage collar. Projecting towards the center of the cage at a vertical angle of approximately 45°, the poles are made to rise to a height of 2 meters from the water surface. The net, in effect, covers only the outer perimeter, a 12 meter-wide circular strip (Fig. 1). The central portion of the cage need not be provided with cover because the broodstock jumps out of the water at points near the walls of the cage.

2. Floats

Floats used are made of cylindrical styrofoam wrapped with canvas cloth. The float is 0.60 m in diameter and 1 m in length. Depending on the availability of materials, floating units may be made of empty barrels, fiberglass or ferrocement.

3. Netting

The synthetic nylon type, resin-treated, 210 d/57, 3" stretched mesh size is used for the netting material. The mesh prevents the head of the fish from slipping through and allows sufficient water exchange. Weld mesh is less subject to marine fouling (Milne, 1976). However, the galvanized iron is

bound to cause injuries on the newly-caught fish which has the tendency to bump itself against the cage walls. Galvanized welded wire mesh may be used to hold domesticated stock.

4. Framework

The collar is made of 3 rings of 2" Ø schedule 40 GI pipes which are welded together to form a right-triangular cross section. An improvised pipe-bender was fabricated to facilitate bending of the pipes to specifications (Fig. 2). Pipes are painted with epoxy for greater resistance to corrosion and visibility. Horizontal, vertical and diagonal braces are used throughout the collar length. The floats are tied in place to the collar. To keep the net in shape, side and belly ropes are used and the footrope is tied to a 1" Ø GI pipe ring that is kept in place at the bottom by concrete sinkers. (Fig. 3 & 4).

5. Layout and mooring

The cages are arranged in two rows of 3 units that are oriented to the direction of the current. The cages are held together with polyethylene rope

leaving a minimum 4 m distance in between units. Rigid woodplanks may be added to keep distance and which will likewise serve as walkways. The arrangement of cages is maintained by anchoring to the seabed with the use of steel anchors. For more permanent locations, heavy concrete blocks may be used as anchors. The chain link is also made of polyethylene rope (Fig. 5).

6. Maintenance

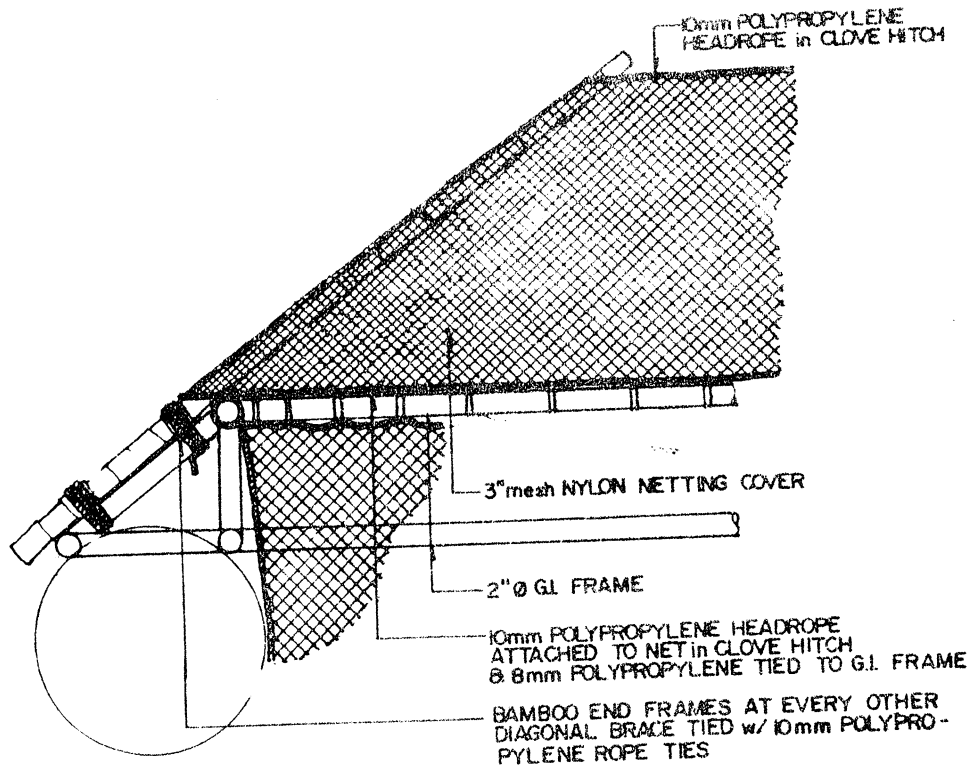
The nets are subjected to marine fouling. To facilitate changing of nets, each net is provided with a net patch at its side that may be closed and opened at will. Adjacent cages are connected with the use of a net channel that is fitted into the opened patches. As one net is being lifted by the use of the downhaul ropes, the stock will transfer to the other cage swimming through the net channel. After transfer, the patches are replaced and the net channel is removed (Fig. 6).

Costings

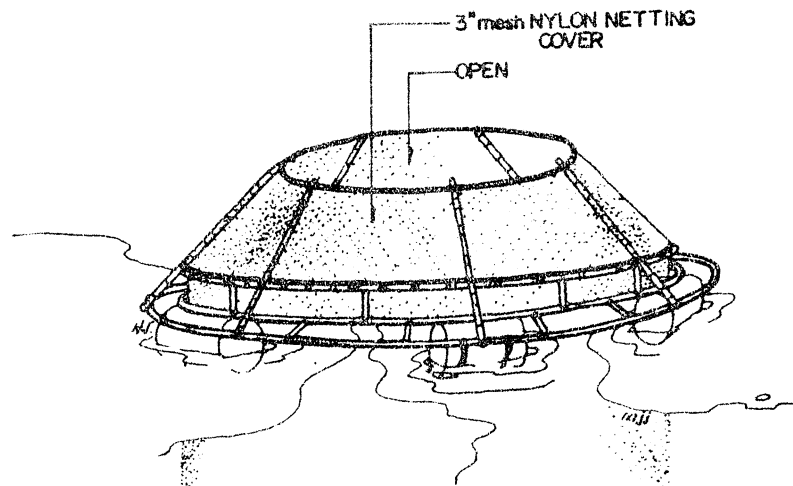
Item No.	Description of Item	Material Cost \$	Labor Cost \$	Others \$	Total Cost \$
1.	Construction of 2-units, 5.00 m diameter x 6.00 m depth circular floating cages				
1.1	Iron works to include painting	480.40	96.00		576.40
1.2	Netting works to include ropes and twine	720.30	144.00		864.30
1.3	Styrofoam floats and concrete anchor blocks	341.15	68.20		409.35
1.4	Towing & anchoring to site (from Bo. Buyuan to Igang Station)			57.00	57.00
	Cost of construction (2 units, 6.00 m Ø x 6.00 m depth)				\$1,907.05

2.	Construction of 2 units, 9.00 m diameter x 6.00 m depth circular floating cages			
2.1	Iron works to include painting	1,528.95	267.55	1,796.50
2.2	Netting works to include ropes and twine	969.75	169.70	1,139.45
2.3	Styrofoam floats and concrete anchor blocks	639.15	111.85	751.00
2.4	Towing and anchoring to site (from Bo. Buyuan to Igang Station)		62.00	62.00
	Cost of construction (2 units, 9.00 m \varnothing x 6.00 m depth)			\$3,748.95
3.	Construction of 2 units, 10.00 m diameter x 6.00 m depth circular floating cages			
3.1	Iron works to include painting	1,723.35	301.50	2,024.85
3.2	Netting works to include ropes and twine	1,095.75	194.80	1,290.55
3.3	Styrofoam floats and anchor blocks	752.25	136.65	888.90
3.4	Towing and anchoring to site (from Bo. Buyuan to Igang Station)		66.00	66.00
	Cost of construction (2 units, 10.00 m \varnothing x 6.00 m depth)			\$4,270.30

Note: Exchange rate: \$1.00 – ₱7.375



SECTION



PERSPECTIVE

Fig.1. DET. OF NET CAGE COVER

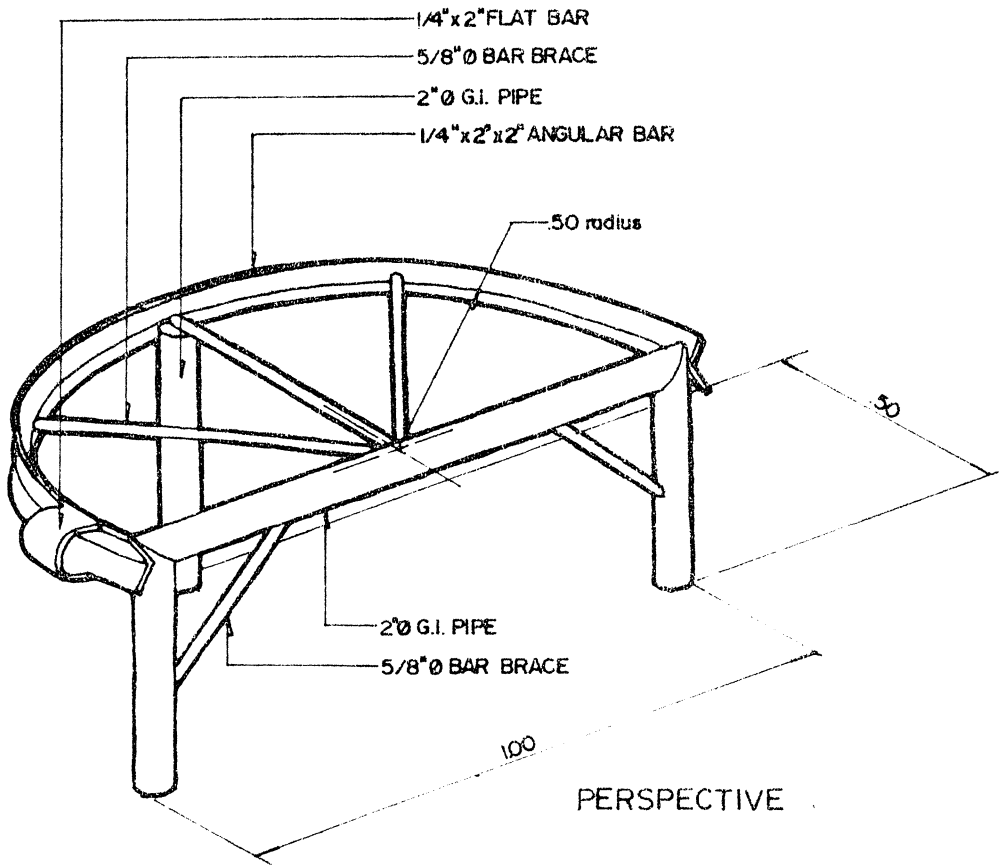
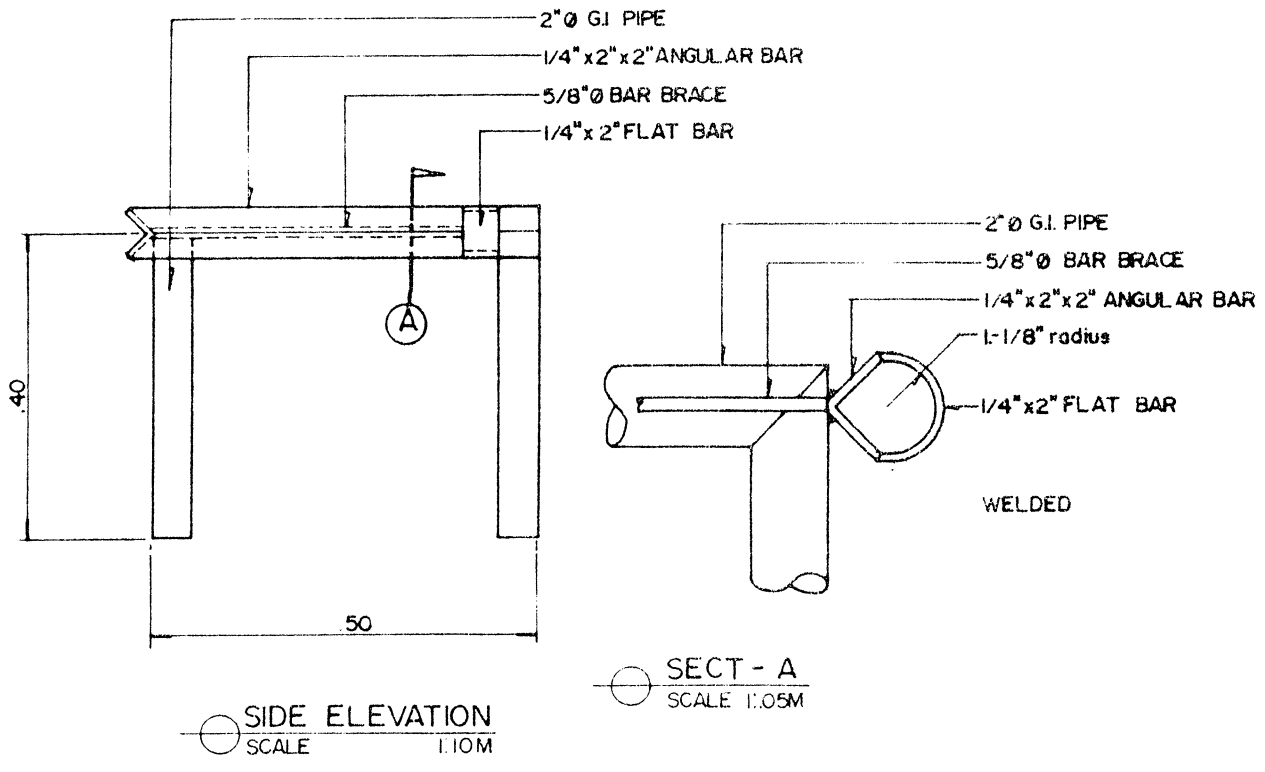
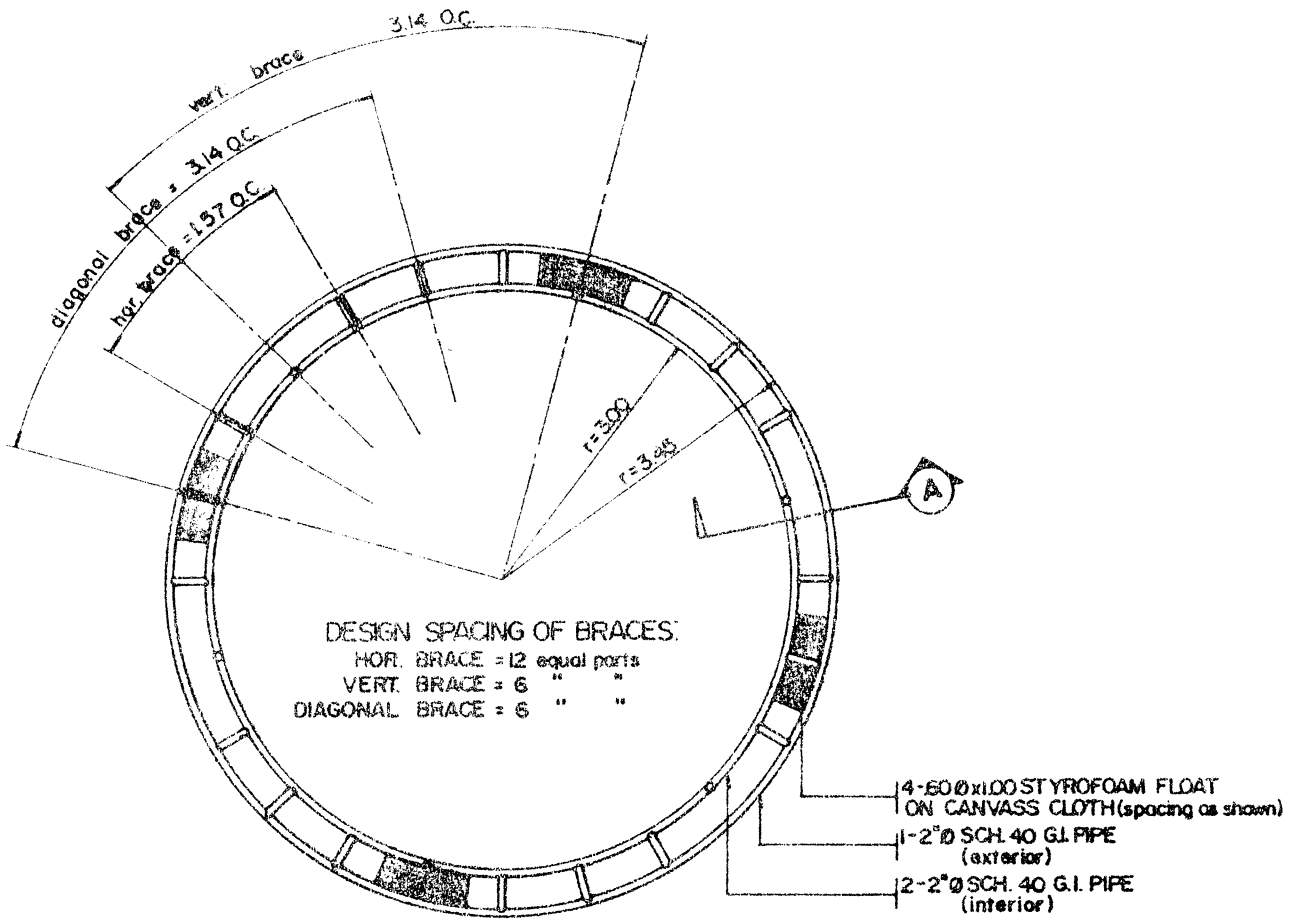
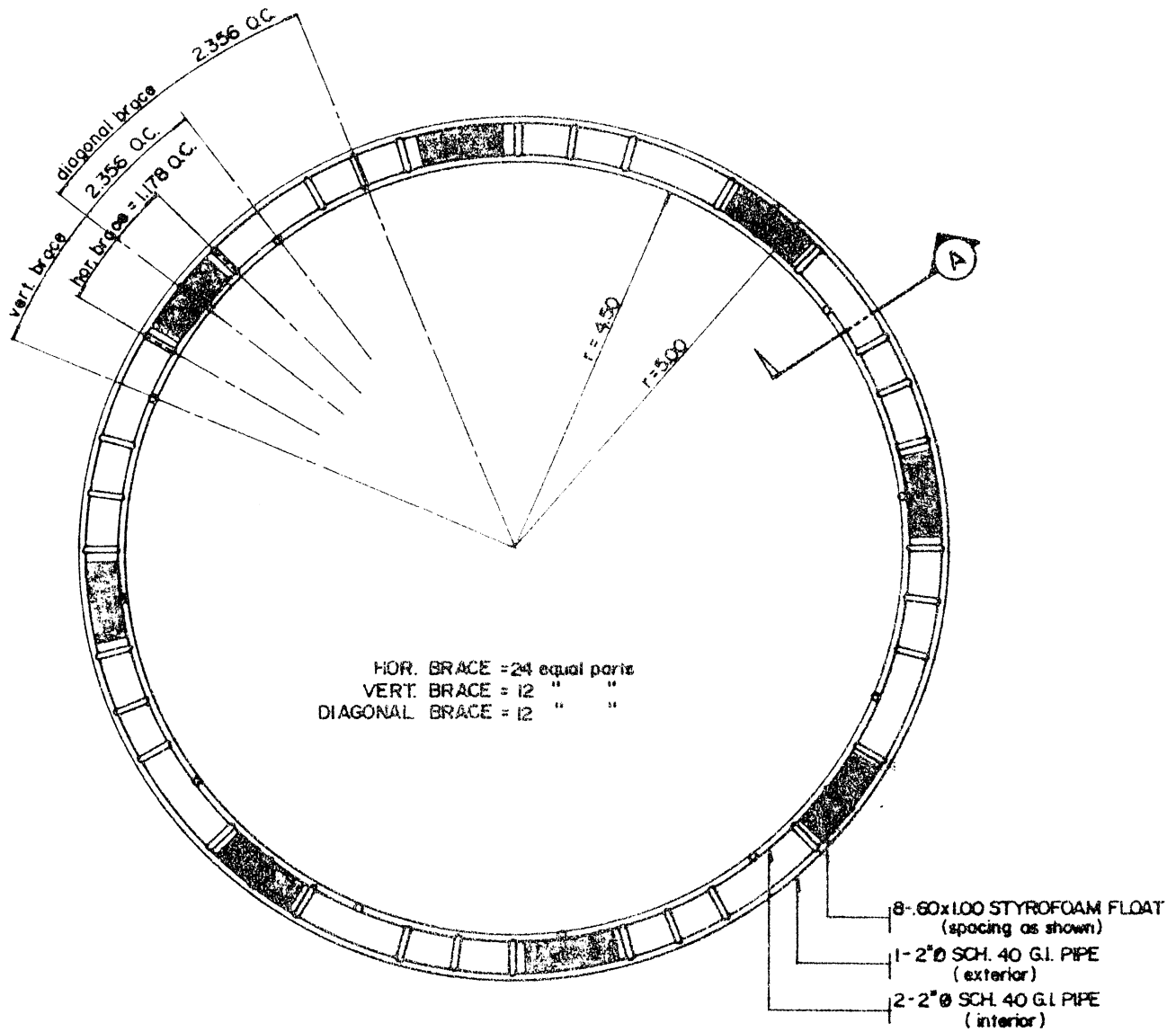


Fig. 2. DET. OF PIPE BENDER



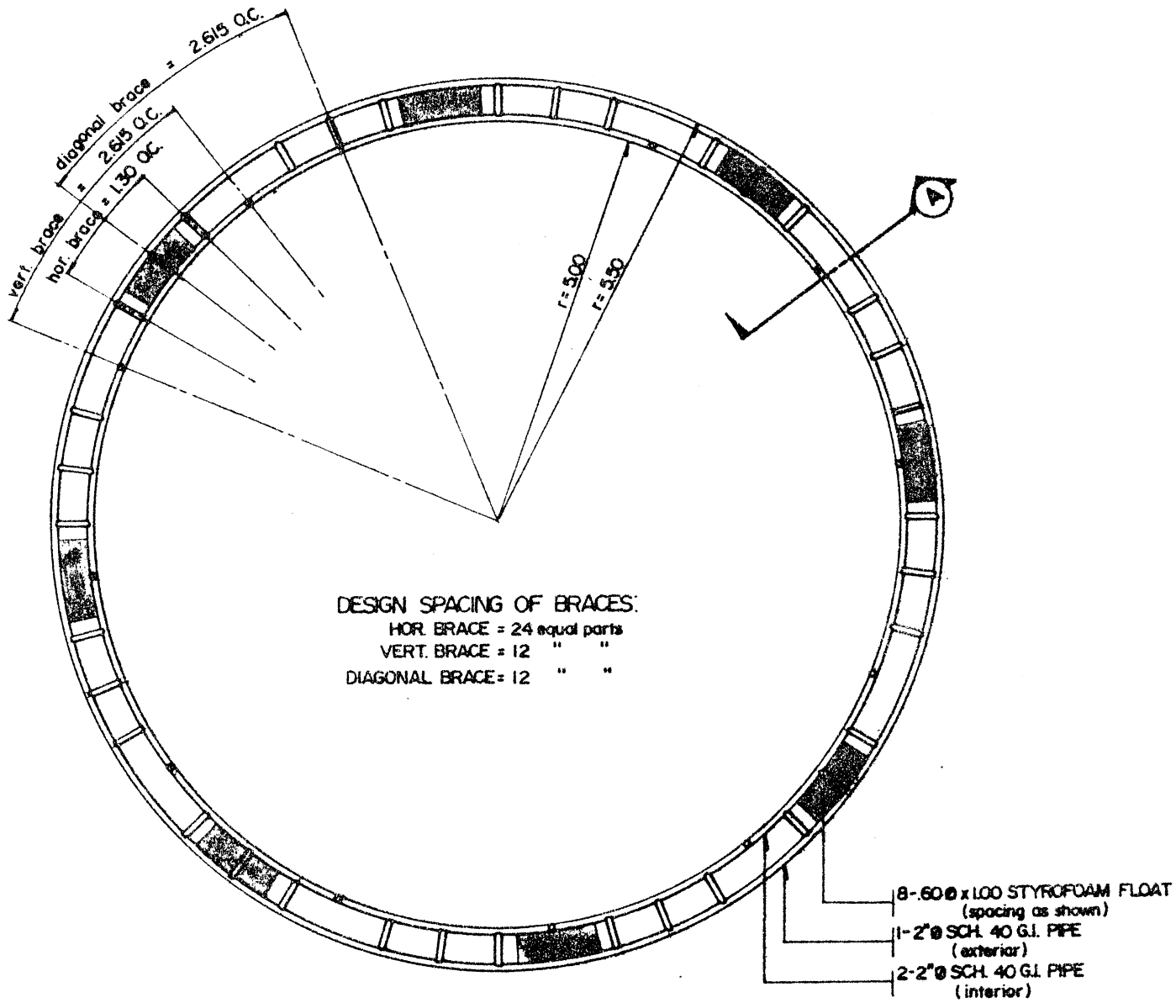
PLAN OF G.I. FRAME SHOWING LOCATION OF FLOATS
SCALE 1:80 M

Fig. 3a. I-UNIT 6.00m dia. x 6.00 depth FLOATING CAGE



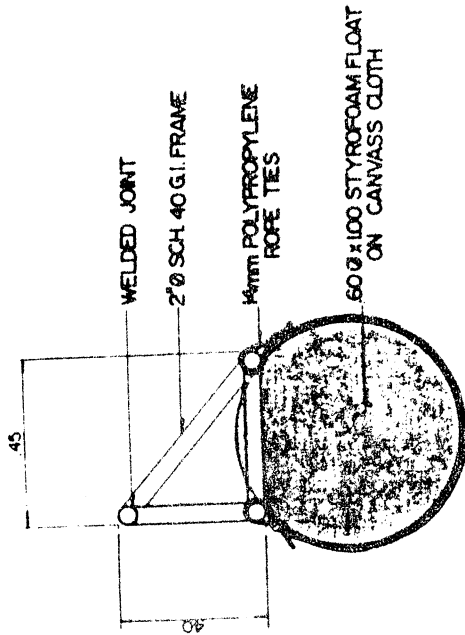
○ PLAN OF G.I. FRAME SHOWING LOCATION OF FLOATS
 SCALE 1/80M

Fig. 3b. 1-UNIT 9.00m. dia. x 6.00m. depth FLOATING CAGE

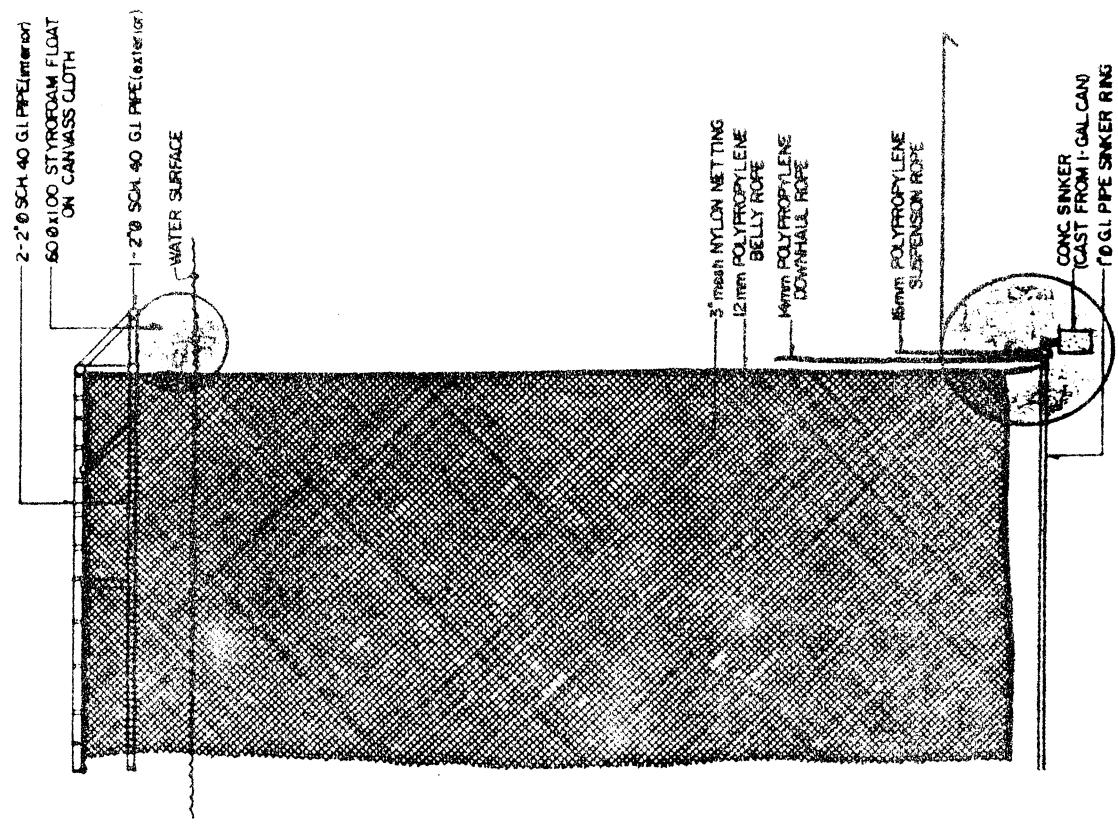
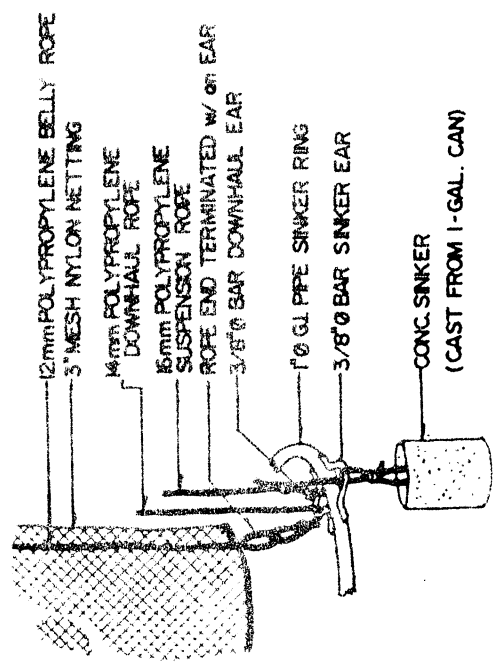


PLAN OF G.I. FRAME SHOWING LOCATION OF FLOATS
 SCALE 1:80M

Fig.3c. 1-UNIT 10.00m dia. x 6.00m depth FLOATING CAGE



DET. OF FLOAT TO FRAME
INSTALLATION
SCALE 1:150 M



DET. SECT. THRU A
SCALE 1:40 M

Figure 4.

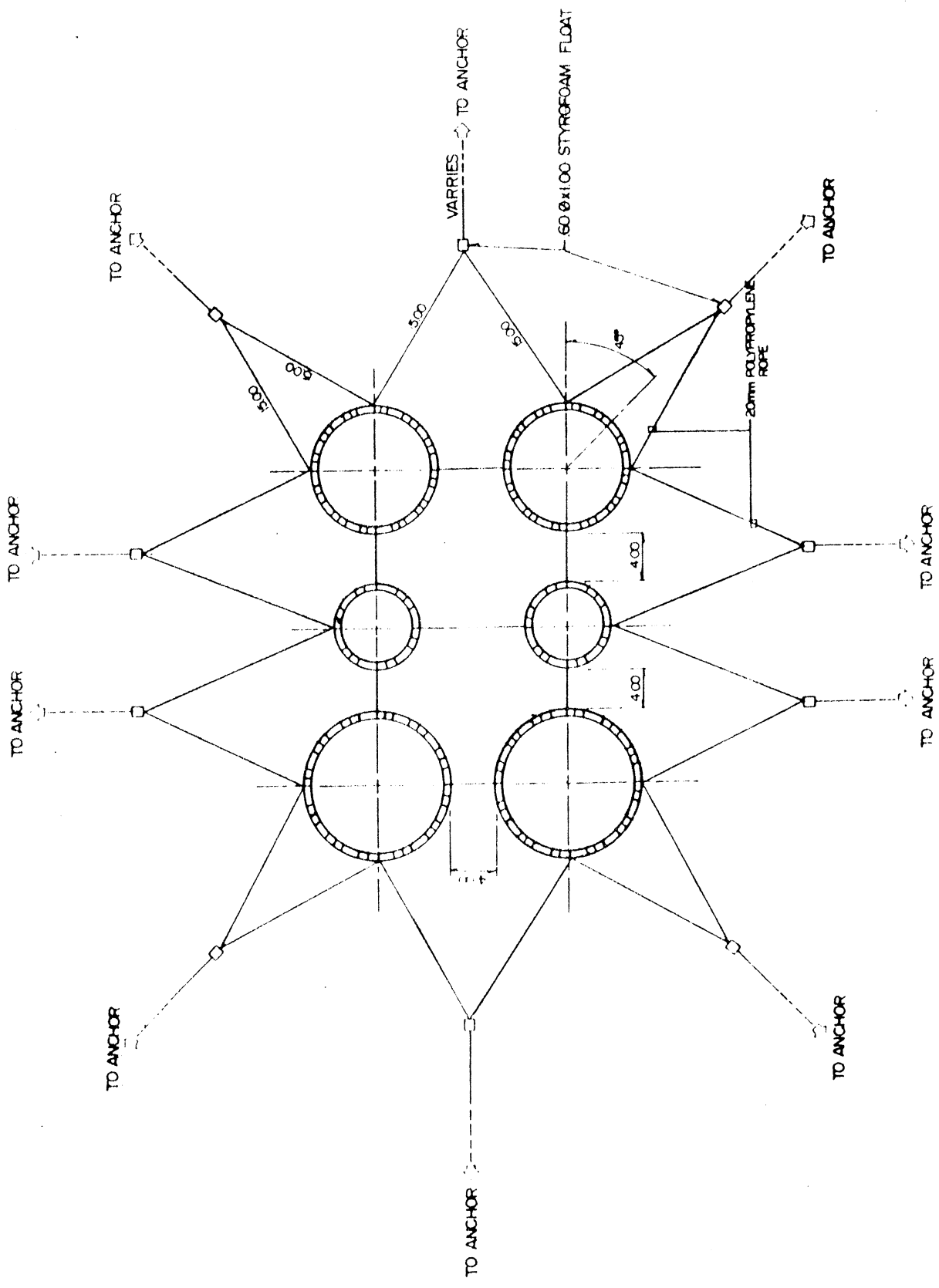


Fig. 5. LAYOUT OF 6-units FLOATING CAGES
2 - 600 m dia
2 - 900 m. "
2 - 1000 m

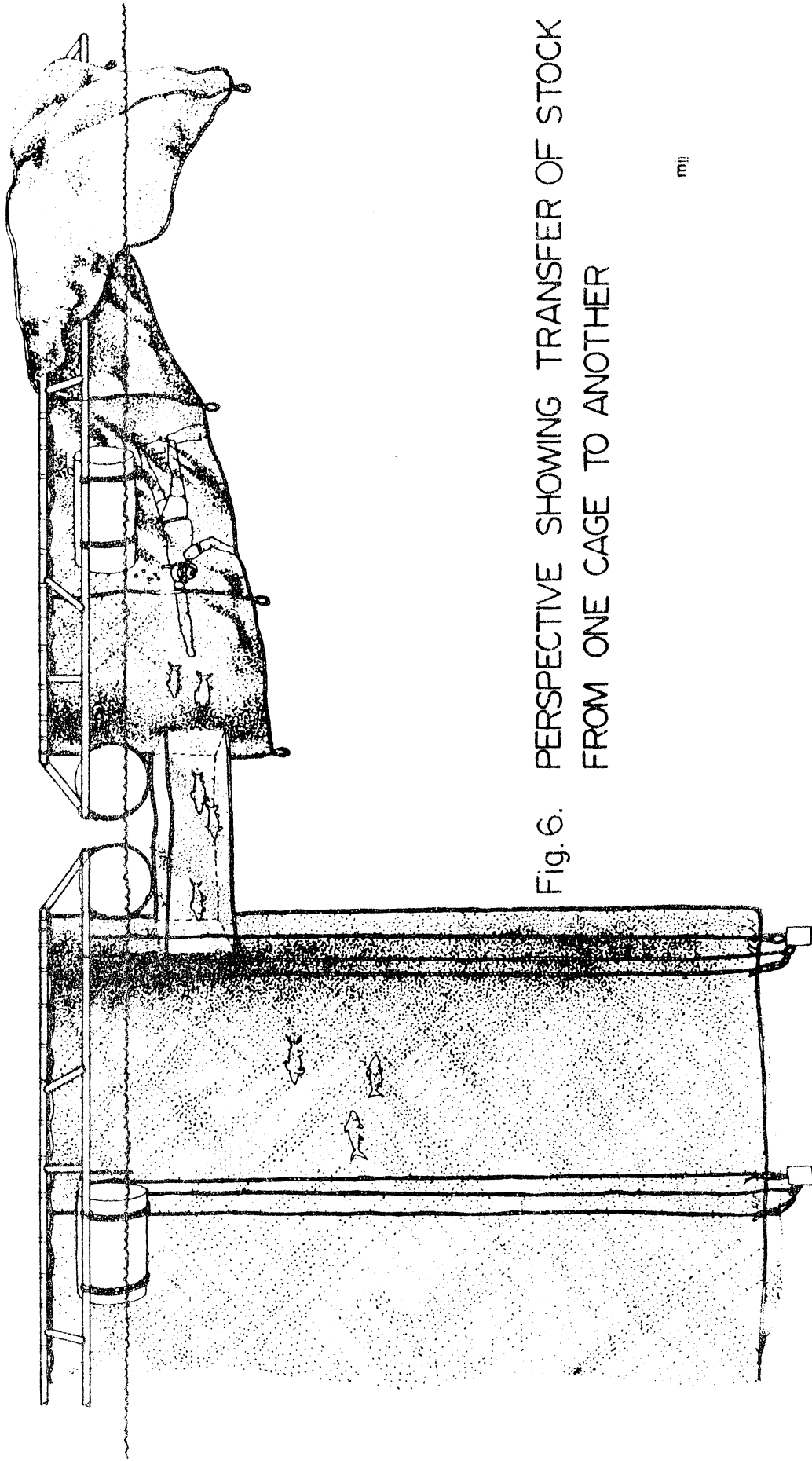


Fig. 6. PERSPECTIVE SHOWING TRANSFER OF STOCK FROM ONE CAGE TO ANOTHER

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