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SOUTH PACIFIC COMMISSION

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(Noumea, New Caledonia, 3-7 August 1992)

INSHORE FISH AGGREGATION DEVICES
Their deployment and use.

(Paper prepared by the Secretariat)

INTRODUCTION

1. Growing regional interest in the development of domestic tuna fisheries has inspired a parallel interest in fish aggregation device (FAD) programme development. The 22nd RTMF reflected this interest in its focus on FADs. At the direction of that meeting the DSFDP has increased its efforts to provide both practical FAD assistance and development work in offshore FAD technology and exploitation. In addition, as directed by the 22nd RTMF, the Project has widened the scope of its activities to include, among other things, an ongoing effort to develop effective technology and exploitation techniques for FADs set in shallow inshore waters, most often for the particular purpose of aggregating baitfish species.

2. Apart from appropriate gear, the single most important ingredient for successful mid-water tuna fishing techniques, such as vertical and horizontal longlining and mid-water handlining, is the availability of suitable bait. It is widely recognised among Pacific island fisherman that small pelagic species such as big-eye scad (*Selar crumenophthalmus*) and round scad (*Decapterus* spp.), which are widely known in the region by variations of the common Polynesian names of **atule** and **opelu** respectively, being a natural prey of tuna, make for superior bait.

3. These and some other small pelagic species also provide a seasonal source of food fish in some areas and fisherman have learned a good deal on a localised basis about the seasonal occurrence and behaviour of these fishes. Fishing methods range from the use of cast nets and beach seines to jigging with feathers and trapping. In at least one country, Tonga, small pelagic species are taken by purse-seine.

3. It is widely recognised too, that these fish are readily attracted to FADs, both those set offshore and those set in shallow, coastal waters. This response to nearshore FADs offers the opportunity to increase the efficiency and productivity of fisheries for small pelagic species, especially those undertaken to secure bait supply. In one area at least, in the East New Britain Province of Papua New Guinea, shallow-water FADs constructed of bush materials have long been used in association with traps to provide a steady source of food fish. Work by DSFDP masterfishermen in Tonga, Western Samoa and Tuvalu has indicated that the placement of FADs in shallow waters may increase the abundance of these species in areas where they are not commonly recorded as occurring and thus convenient fishing sites created. While bait can sometimes be taken at the same offshore FAD where tuna will be fished, it has been found that having a successful FAD moored inshore, particularly in protected waters, can greatly improve the ease and efficiency of securing good bait supply.

4. During development work with inshore FADs, DSFDP masterfishermen have made use of a variety of styles and types of rafts and moorings, mostly incorporating floating structures, but occasionally making use of pressure-resistant floats to maintain the system in a submerged state. Such submerged FADs have also been used with success in Hawaii (Figure 1). The common feature of these FADs has been their essential simplicity, and thus their relatively low cost, in comparison to those moored offshore. This feature of shallow-water FADs follows from the typically less harsh marine environment in which they are moored, and thus the less robust mooring hardware required to hold them on station. Successful shallow-water FADs are often, in fact, rigged from whatever mooring materials may be to hand.

5. This paper presents an account of a series of shallow-water FAD deployments presently being carried out by the DSFDP in the south of Espiritu Santo island at the request of the Vanuatu Fisheries Division as part of a national FAD programme development. The aim of the shallow-water FAD component of this work is to determine firstly the technical viability and aggregating effectiveness of a variety of FAD styles and mooring and raft materials and, subsequently, their value or otherwise to local fishing communities. It is expected that the results of this work will provide Vanuatu Fisheries Division with information on which to develop a rationale, national FAD deployment and exploitation plan and, thus to apply limited material and manpower resources to best effect.

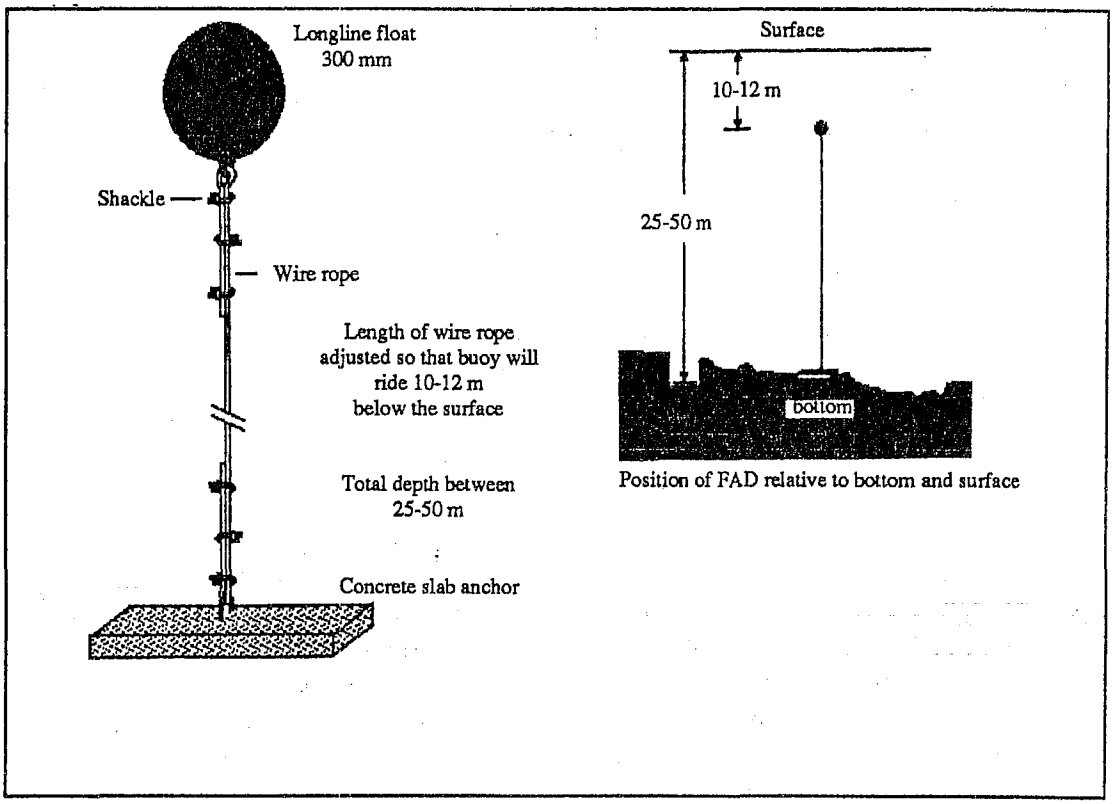


Figure 1: Shallow water FAD tested in Hawaii and Western Samoa

TECHNIQUES FOR CAPTURING FAD-ASSOCIATED BAITFISH

6. There are a variety of artisanal fishing techniques effective in the capture of small pelagic fishes associated with FADs. The most common of these are jigging and trapping.

Jigging

7. Jigging is a widely-known and effective method for capturing bait species that requires only very simple gear. A mainline of light monofilament nylon line is used, to which are attached a series of short leaders fitted with small jigs. With the aid of a small weight the line is lowered to a depth where baitfish are observed or expected to be and the jigs played. Island fishermen sometimes rig short rods to fish opelu brought near the surface with chum.

8. Jigs can be made by tying various skirting materials to No. 5-8 hooks; materials such as small feathers, cotton thread, plastic strips, tinsel and fish skin have been used successfully. Commercial Japanese rigs, commonly known as sabiki rigs, are also widely available at low cost.

9. During fishing trials on shallow-water FADs in Tonga, SPC masterfisherman Paul Mead averaged up to 70 fish per hour by jigging, and in 111 hours of fishing produced a total catch of 2,284 fish weighing over 300 kilograms. Many of these capture were made fishing around dawn and dusk.

10. A particularly effective way to jig for bait is by using a light and fishing at night - especially during dark moon phases. Plankton, which are a principal food of many baitfish species, are attracted to light. Atule and opelu which rise toward the surface at night to feed, may be drawn to prey that has concentrated around a light. With this technique, once bait have been attracted to the area of the light, gradual dimming of the light tends to draw the bait into a tight mass beneath the boat, where they can sometimes be held and fished for several hours. During the period of the DSFDP trials in Tonga a local purse-seine vessel, the *Albacore*, captured 3.5 tonnes of mostly opelu during three nights of setting in the area of a shallow-water FAD. Small boat operations using light (either 2 x 200 watt household bulbs powered by a portable generator, or a Coleman pressure lamp) showed that atule once gathered most often took jigs either at the edge of, or beneath, the loom of the light.

Trapping

11. During several country assignments DSFDP masterfishermen have successfully used traps suspended from FADs to catch bait. Box traps 2 m x 1 m x 1 m were built with a wooden frame and covered with wire netting. A door was built into the upper surface for removal of catch, and cone entrances fashioned from the wire mesh were fitted at each end. Weights were wired to the wooden frame, inside and along the bottom, to sink the trap and keep it properly oriented. A rope bridle was rigged to the four corners of the trap's upper surface, and then the trap was suspended from the FAD about 4 m below the surface. Traps were never baited, nor were the entrances shaped so as to prevent fish from escaping.

12. Traps worked well when suspended from FADs known to hold bait. In Niue FAD-traps produced 30-60 pieces of atule/opelu daily, over a two-month period; the best haul was 140 pieces. An account of the use of traditional FADs and traps by the Tolai people of East New Britain suggests that traps there typically yield around 25 kg/trap of small pelagic species daily.

13. During the current work in Vanuatu a trap of split bamboo, modelled on the East New Britain type, was slung below FAD No.4. After producing no catch after being in the water for a month the trap was shifted to FAD No.1 where atule had been observed and jigged. After a week in th water there the a single haul of the trap produced a catch of 24 atule.

ESPIRITU SANTO FADS

FAD 1

COUNTRY: Vanuatu **DATE DEPLOYED:** Dec. 12, 1991

PLACE: North of Tubana Is. and Urelapa Is., South Santo

POSITION: 15° 36.23' S **SITE DEPTH:** 130 METRES
167° 00.96' E **DEGREE OF SLOPE:** 0°

SPECIFICATIONS

BUOY TYPE: Bamboo raft; constructed by lashing bamboo to timber cross-pieces to form a raft 3 metres by 1.5 metres.
Appendages comprise 5 weighted lines with coconut fronds attached slung beneath the raft.
The raft is tethered to two 800 mm floats, which are part of the permanent mooring. If the raft breaks up, the mooring is not lost.

MOORING TYPE: Catenary curve mooring system.

UPPER CHAIN: 3 m x 12 mm gal. chain

MAIN MOORING LINE: 160 m x 18 mm, 8-strand nylon

LOWER CHAIN: 5 m x 12 mm gal. chain

THIMBLE/CONNECTORS: Samson Nylite, 3/4"

SWIVELS: 16 mm forged eye-and-eye

SHACKLES: 12 mm screw pin, seized with s/s wire

ANCHOR:

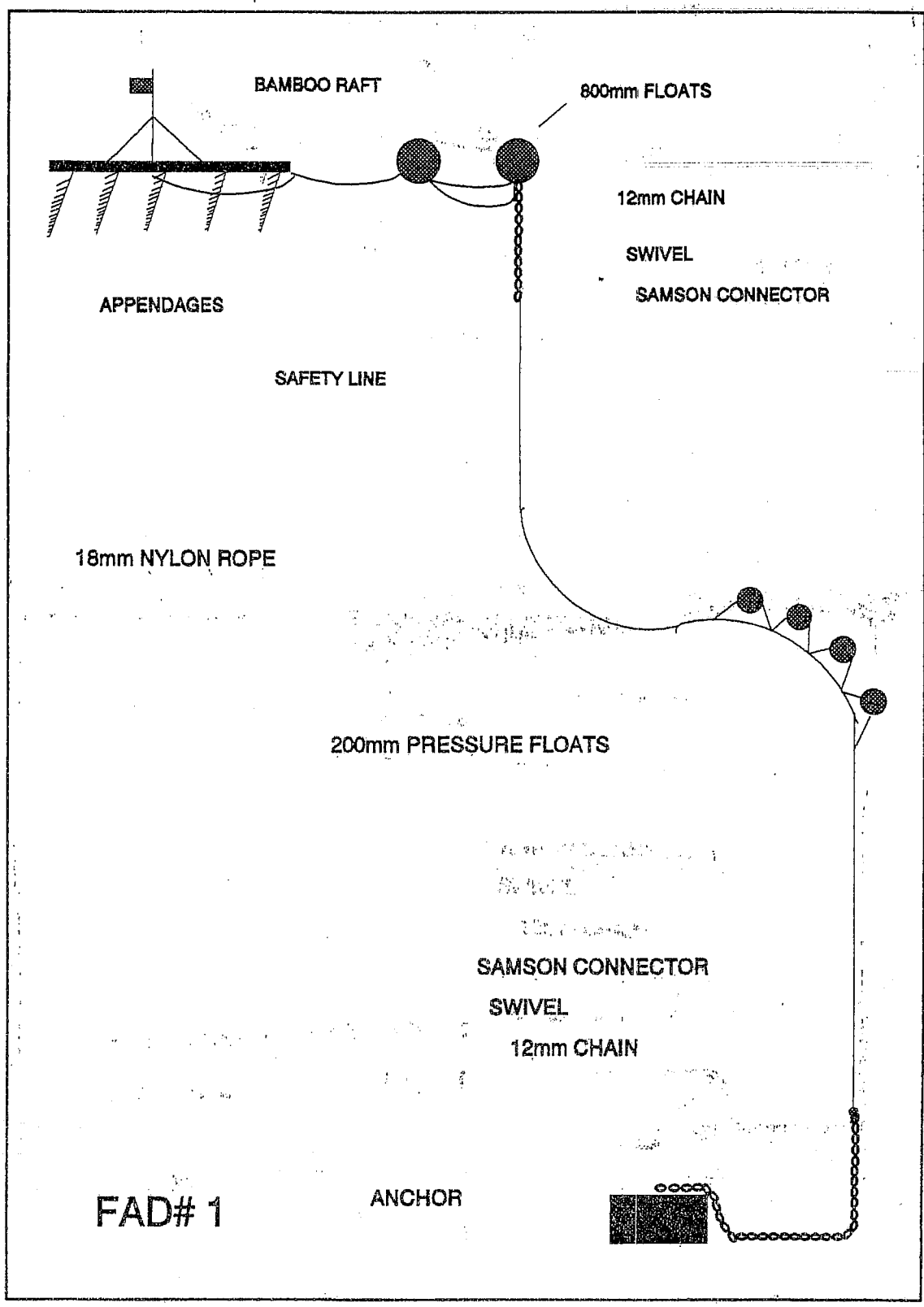
1/2 oil drum filled with concrete and one engine block, with an approximate weight of 400 kg. The anchor is connected to the main mooring with 4 m of 22 mm stud link chain.

COMMENTS:

Four 200 mm pressure floats (rated to 300 m) were spliced into the nylon rope at 80 m from the bottom, their total buoyancy is 24.8 kg; sufficient to lift 3.5 m of chain and hardware off the bottom.

A safety line was shackled from the top chain to the 2nd mooring buoy so that if one of the buoys is damaged, the mooring will not be lost.

Position was found using a GPS Navigator. The WPS-72 datum was used.
The position should be moved 0.26' South and 0.43' West to agree with the chart, Plans on Espiritu Santo, when charting the position.


BAMBOO RAFT
800mm FLOATS
12mm CHAIN
SWIVEL
SAMSON CONNECTOR
APPENDAGES
SAFETY LINE
18mm NYLON ROPE
200mm PRESSURE FLOATS
SAMSON CONNECTOR
SWIVEL
12mm CHAIN
FAD# 1
ANCHOR

FAD 2

COUNTRY: Vanuatu **DATE DEPLOYED:** Jan. 20, 1992

PLACE: South of Tangoa Is., West of Elia Is. South Santo

POSITION: 15° 36.37' S **SITE DEPTH:** 150 METRES
166° 59.54' E **DEGREE OF SLOPE:** 15°

SPECIFICATIONS

BUOY TYPE: 250 litre mussel float, painted orange and white. Connected to mooring by 2 x 15 m lengths of combination wire/rope. Aggregate array made from mussel rope and plastic strapping attached to wire/rope.

MOORING TYPE: Catenary curve mooring system.

UPPER MOORING: Combination wire/rope

MAIN MOORING: 180 m x 18 mm, 8-strand nylon rope

LOWER CHAIN: 4 m x 12 mm gal. chain

THIMBLE/CONNECTORS: Samson Nylite, 5/8"

SWIVELS: 16 mm forged eye-and-eye

SHACKLES: 12 mm screw pin, welded closed

ANCHOR:

Engine blocks, with approximate weight of 500 kg.

COMMENTS:

Four 200 mm pressure floats (rated to 300 m) were spliced into the nylon rope at 90 m from the bottom; their total buoyancy is 24.8 kg which will lift 3.5 m of chain and hardware off the bottom.

A small flag buoy was attached to the mussel float with a tie=-off point for small craft.

Position was found, using a GPS Navigator. The WPS-72 datum was used.

RAFT

APPENDAGE ARRAY

(ON COMBINATION WIRE/ROPE)

SWIVEL

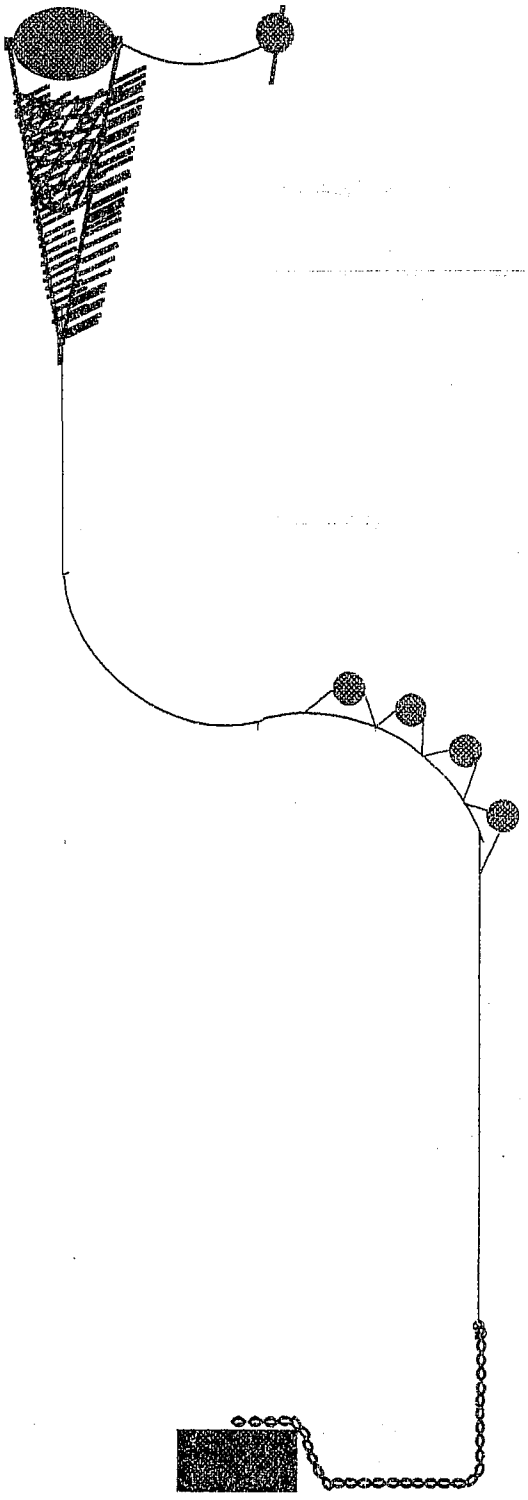
NYLON ROPE

PRESSURE FLOATS

SWIVEL

12MM CHAIN

ANCHOR



FAD #2

FAD 3

COUNTRY: Vanuatu **DATE DEPLOYED:** Jan. 24, 1992

PLACE: Channel between Tangoa and Mainland. So. Santo

POSITION: 15° 35.32' S **SITE DEPTH:** 23 METRES
166° 58.62' E **DEGREE OF SLOPE:** 0°

SPECIFICATIONS

BUOY TYPE: 300 mm x 5 m PVC pipe, closed at both ends. Painted yellow. Connection fiberglassed to bottom end for attachment of mooring. Aggregator made from plastic strapping.

MOORING TYPE: Taut Mooring

MAIN MOORING: Combination wire/rope

LOWER CHAIN: 2 m x 12 mm gal. chain

THIMBLE/CONNECTORS: Samson Nylite, 5/8"

SWIVELS: 16 mm forged eye-and-eye

SHACKLES: 12 mm screw pin, welded closed

ANCHOR:

Engine blocks with approximate weight of 350 kg.

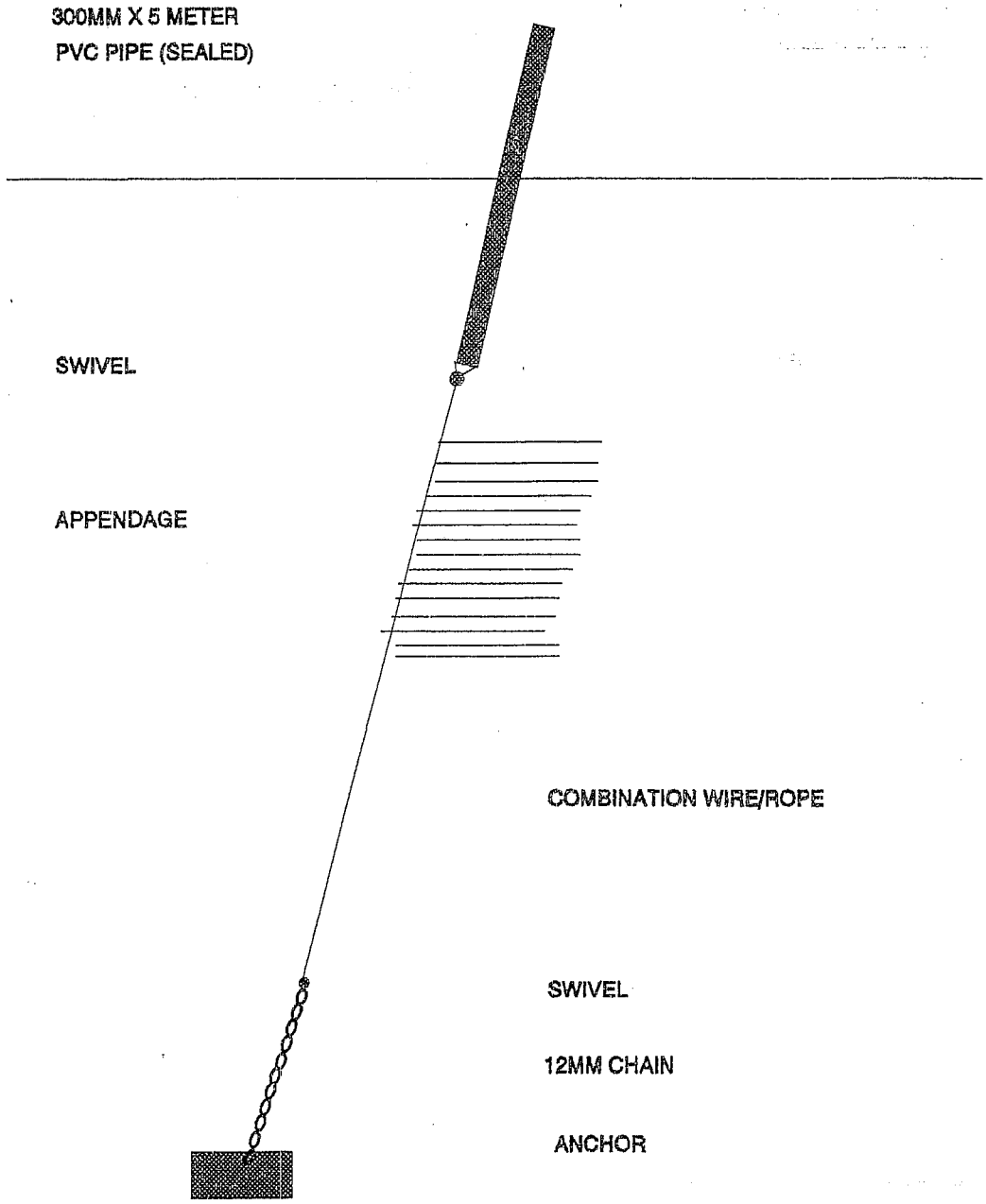
COMMENTS:

Deployed on the west side of the channel separating Tangoa from mainland Santo.

At mid-tide the buoy is 2.5 metres above water level.

This type of buoy should present no problems to navigation.

FAD# 3


300MM X 5 METER
PVC PIPE (SEALED)
SWIVEL
APPENDAGE
COMBINATION WIRE/ROPE
SWIVEL
12MM CHAIN
ANCHOR

FAD 4

COUNTRY: Vanuatu **DATE DEPLOYED:** May 24, 1992

PLACE: Channel between Tangoa and Mainland. So. Santo

POSITION: 15° 31.93' S **SITE DEPTH:** 12 METRES
167° 08.78' E **DEGREE OF SLOPE:** 2°

SPECIFICATIONS

BUOY TYPE: Bamboo raft, held together in a bundle by 3 tires. The length of the bamboo is 3 metres.

MOORING TYPE: Catenary curve mooring system.

MAIN MOORING: 17 m Combination wire/rope

LOWER CHAIN: 2 m x 12 mm gal. chain

THIMBLE/CONNECTORS: Galvanised thimbles

SWIVELS: 16 mm forged eye-and-eye

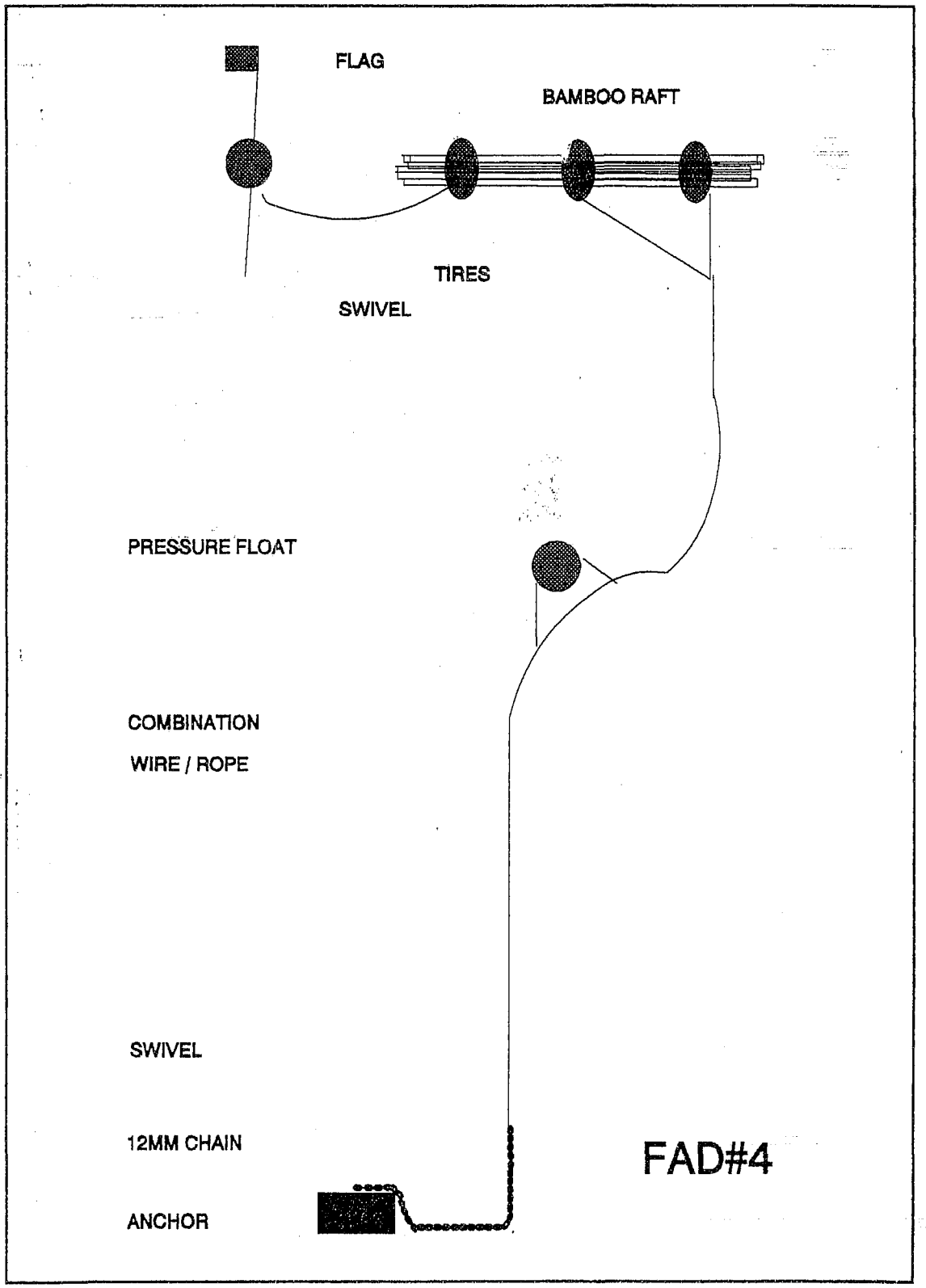
SHACKLES: 12 mm screw pin, welded closed

ANCHOR:

Engine blocks, with approximate weight of 300 kg.

COMMENTS:

FAD was placed close to Fisheries Centre so that fish trap to be attached could be easily monitored.


FLAG
BAMBOO RAFT
TIRES
SWIVEL
PRESSURE FLOAT
COMBINATION
WIRE / ROPE
SWIVEL
12MM CHAIN
ANCHOR
FAD#4