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WORKSHOP ON FISH AGGREGATION DEVICES

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WORKSHOP ON FISH AGGREGATION DEVICES

An informal workshop was held in Honolulu on 23 October 1980 to discuss the problem of losses of fish aggregation devices (F.A.D.'s). The workshop was convened by the Director of the Honolulu Laboratory of the Southwest Fisheries Centre, Mr R.S. Shomura. Representatives of the following organisations took part: the Hawaii National Marine Fisheries Service, the Hawaii Department of Fish and Game, the Inter-American Tuna Commission and representatives of the fisheries departments of American Samoa, Guam, Northern Marianas and Palau.

The report[1] of the workshop covers the following items:

(1) Construction details of F.A.D.'s currently in use.
(2) The possible causes of mooring line failures.
(3) Modifications necessary to reduce further losses of F.A.D.'s.
(4) Catch results around F.A.D.'s in Hawaii and the build-up of fish populations around F.A.D.'s.

It was felt that the information in this report would be of considerable value to the many countries in the Region planning to deploy F.A.D.'s in the near future. For this reason, with the kind permission of Mr Shomura, relevant sections of the report covering items 1, 2 and 3 are reproduced below.

Gear Construction and Losses

The workshop report gives detailed information about the various designs of F.A.D. presently used by each of the organisations represented at the workshop. All consist of a buoy with a mooring line consisting of lengths of chain and polypropylene rope arranged in various configurations, but usually consisting of a length of chain at the top, followed by a length of polypropylene rope and with a second length of chain at the bottom attached to the anchor. A weight is usually attached at the middle of the rope section to prevent the rope from floating to the surface. Typical of the designs presently in use is that employed by the Hawaii Department of Fish and Game (Fig. 1).

Causes of Mooring Line Failures

A total of 33 F.A.D.'s deployed by the represented organisations had been lost by October 1980. Of these losses, 17 definite and 4 probable causes of mooring line failure could be identified (Table 1). 12 causes of failure could not be determined since the buoys were not recovered. Reasons for failure included errors in design and construction as well as incorrect placement.

Table 1: Causes of F.A.D. Mooring Line Failures

	Definite	Probable	Total	Cause
1. Shackle	2		2	Construction
2. Rope splice	1	1	2	Construction
3. Cable grip	1	2	3	Construction/Design
4. Nico-press sleeve	4		4	Design
5. Rope twist	1		1	Design
6. Rope cut by propeller	1		1	Design
7. Rope chafing	4	1	5	Setting error/Design
8. Buoy set too deep	1		1	Setting error
9. Run over by tug boat	2		2	Accidental/Design
	17	4	21	

1. Copies of the complete report, titled *Report on fish aggregating devices workshop*, can be obtained from the Director, National Marine Fisheries Service, Southwest Fisheries Centre, Honolulu Laboratory, P.O. Box 3830, Honolulu, Hawaii,96812.

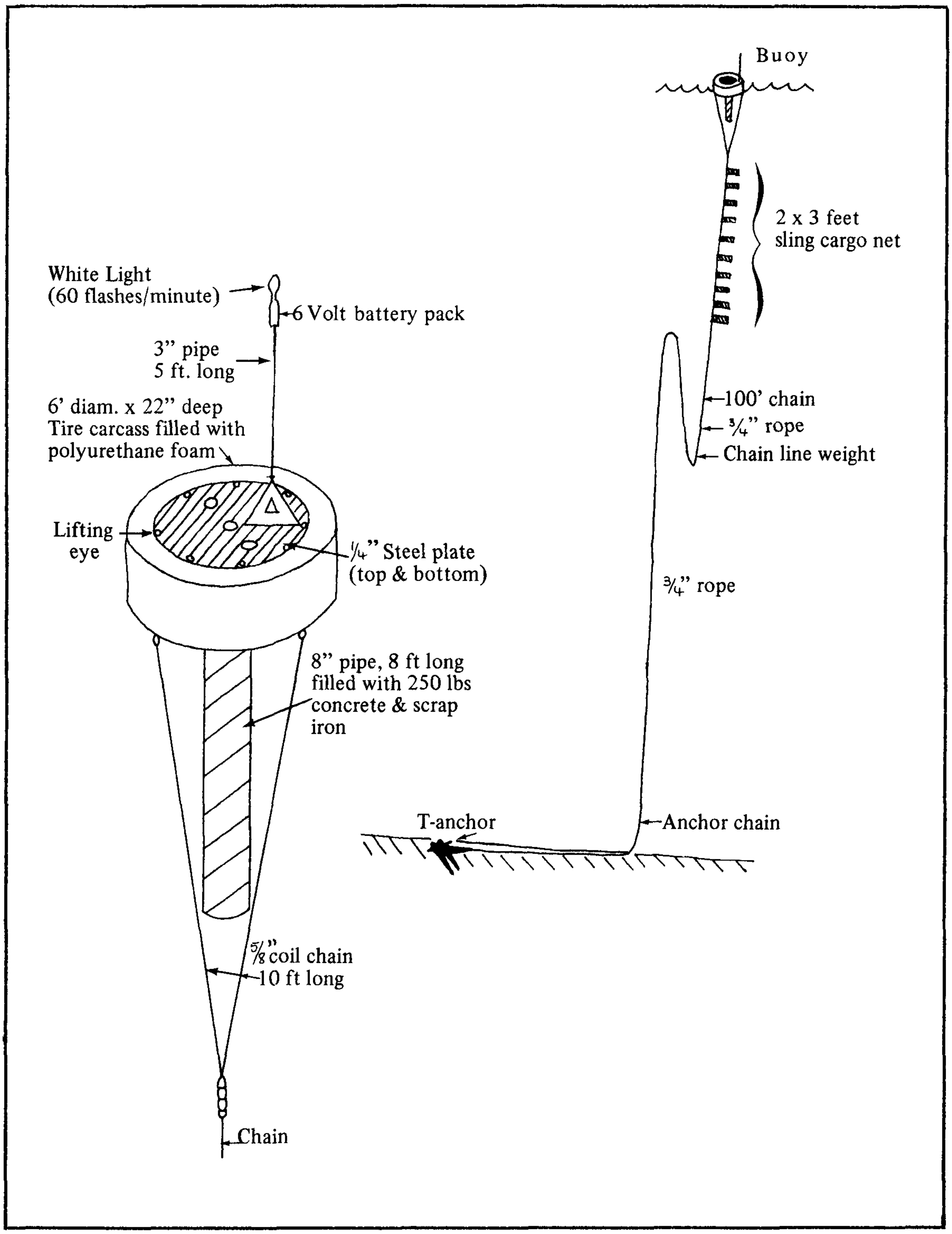

Figure 1: Hawaii Fish and Game FAD.

Comments on types of gear failure itemised in the table:

(1) ***shackle failure*** - usually occurred as a result of the pin working itself loose. This can be delayed to some extent by securing the pin with galvanised wire, but there is always the possibility that the wire used could be too small and corrode within a short time or that some of the shackles could be overlooked and not secured at all.

(2) ***poor splicing*** - particularly single, short splices, or loose splices are more likely to fail. This is especially so when using slippery synthetic ropes made of such materials as polypropylene and nylon.

(3) ***cable grip failure*** - this was probably due to insufficient or uneven tightening of the two bolts. The buoys, in this case, were not in position long enough for corrosion to set in, but the small bolts on the grip could corrode in due time.

(4) ***nico-press sleeve failure*** - this resulted from electrolysis caused by using copper sleeves on galvanised steel wire rope.

(5) ***rope twist*** - the absence of a swivel between the top chain section and the rope section resulted in a break in the rope adjacent to the splice. The twist was imparted either by buoy rotation or rotation of the rope or both.

(6) ***rope cut by boat's propeller*** - resulted from failure to attach sufficient weight to the rope. This allowed the excess line to float to the surface, where it was run over by a boat.

(7) ***rope chafing*** - was largely due to misplacement of the buoys. The buoys were placed too close to bottom ledges or anchored in depths much shallower than intended. In the latter case, chafing is believed to have occurred when the intermediate weight reached the bottom. Rope chafing may also occur when the currents are strong enough to drag the anchor. One buoy was dragged into water shallower than the intermediate weight and was eventually lost.

(8) ***setting too deep*** - this buoy was set in waters deeper than intended due to lack of proper instrumentation, i.e. depth recorder and navigational instruments.

(9) ***rope run over by tugboat*** - the rope section of the mooring lines of two buoys were severed by tugboat towlines. In one instance the tugboat approached too close to a buoy out of curiosity; in another incident, the tugboat, most likely, failed to notice the buoy.

Corrective Measures

Most of the failures listed above can be prevented if mooring lines are carefully designed and constructed. Failures stemming from the use of cable grips and copper sleeves and steel wire rope need not reoccur if these items are not used in construction. Incidences of rope being severed by propellers also need not occur if all are aware of the buoyancy of polypropylene rope and adjust it with an intermediate weight. Setting the buoys too shallow, resulting in rope chafing, and setting them too deep, resulting in complete submergence, need not occur if the buoys are set with the aid of proper navigational and depth sounding equipment.

Other failures involving shackles, rope splices and rope twists are more serious since they can occur in future moorings. These require extreme care in construction. Shackle failure can be reduced if the pins are secured and coated with epoxy or fibreglass resin. The epoxy and resin will inhibit corrosion and also freeze the pin and prevent it from working itself loose. An alternative would be to replace all shackles with oversized split chain links. These should also be coated with epoxy or resin.

Because of the numerous rope splices required to construct a deep mooring line, it is imperative that the splices are securely made. This is especially critical with synthetic rope since this type of rope is prone to slip. For added security, the rope ends should be double-spliced with each splice made at least 15 to 18 inches long and seized with twine at two or three places.

Line breaks due to twisting can be avoided by the addition of a sufficient number of swivels at critical places. These are at the ends of the top and bottom chain sections and at the lower end of the intermediate weight. Additional swivels may be added to the top of the intermediate weight and midway on the rope below the intermediate weight.

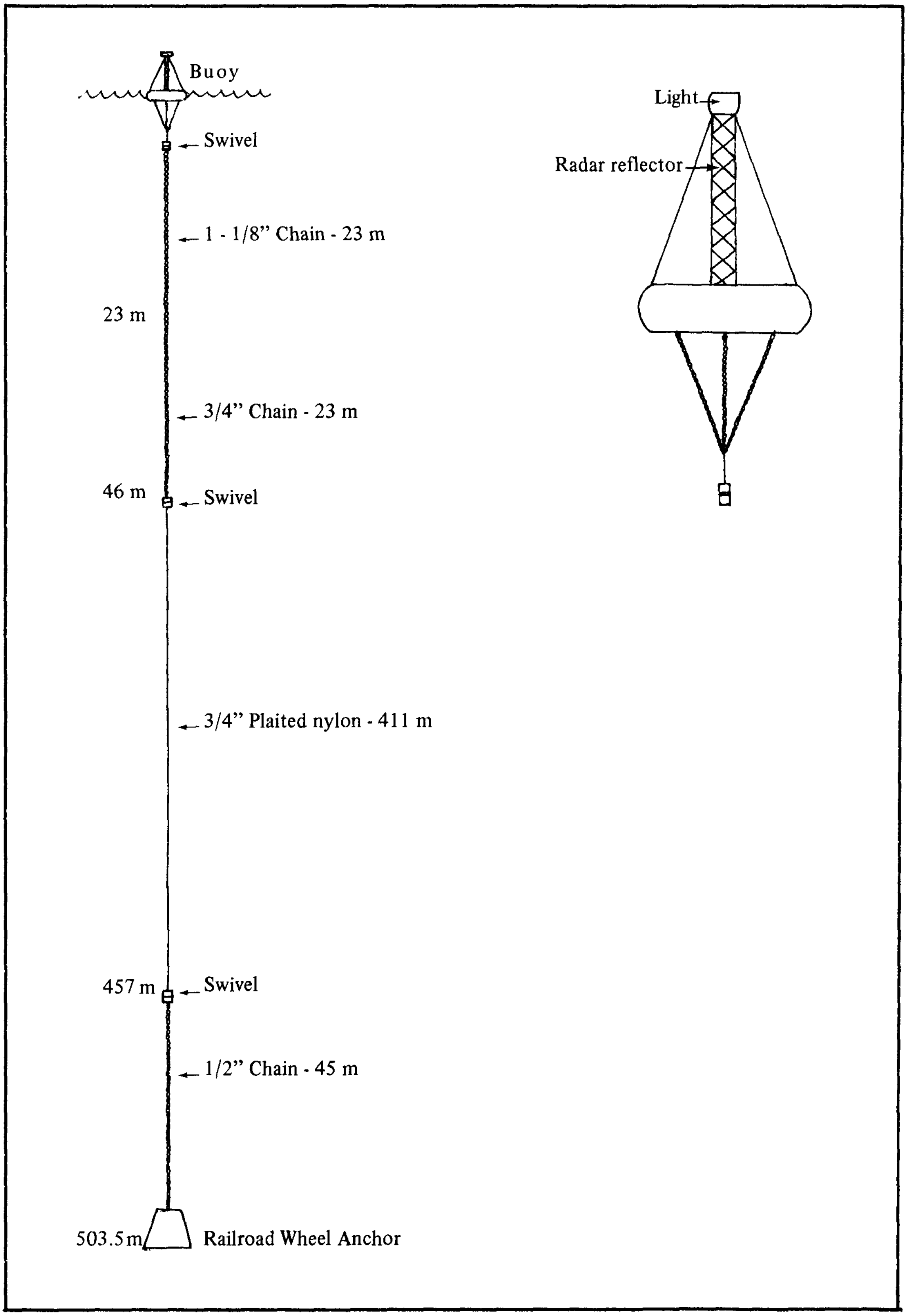

Figure 2: Suggested ideal mooring.

The swivels presently used, chain-link type, were suggested as being of inferior quality. Galvanised, barrel-type swivels with bearings were considered better since they were free to turn under heavy load.

One other problem that needed consideration was the avoidance of electrolysis which occurs when fittings made of different metals are placed next to each other. All fittings, thus, should be of uniform metal.

Suggested Ideal Mooring

Mr I. Blogg (ALA-PAC, Seattle) who has had wide experience with long-term deep water moorings, presented his ideas on ideal moorings. For moorings in excess of 500 m, he preferred a round buoy (Fig. 2) with a line scope of 1:1, with bearing race swivels at the buoy, and at the top and bottom of the rope section. Because strain on the mooring line was concentrated in the upper 100 ft, the first section to approximately 20 fathoms should be of chain. For shallower moorings, he suggested an all-chain tether consisting of a heavier chain section at the bottom attached to a dome-shaped anchor, the last to prevent the chain from winding around it. To overcome the weight problem, part of the mooring line could be of wire rope jacketed with a coating of epoxy. Epoxy fitted sockets and swivels were to be used at the ends of the wire rope. Such a mooring could withstand a current force of up to 4 knots.