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FAD PROGRAMME
(EVAAM ORSTOM IFREMER)

ANALYSES OF RESULTS OF THE FISH AGGREGATION DEVICE (FAD) PROGRAMME IN FRENCH POLYNESIA, JUNE 1981 TO JUNE 1990

by

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INTRODUCTION

The first Fish Aggregation Devices, deployed in 1981, encountered a few technical problems. Over the years, as we added to our knowledge of the behaviour of FADs in the water and of the factors causing their loss, improvements were made to materials used in order to increase their average life-span.

However, although the technique now seems good when operating in normal conditions, other factors are appearing in addition to the technical difficulties and creating further problems to be overcome in attaining the goal that has been set for this aspect of the programme: that is, to make FADs that have a life-span of about two years in order to keep to the minimum the operations that have to be made and to reduce costs which to date are relatively high.

This study describes first of all the situation of the FADs deployed since the beginning of the programme, which allows us to give a partial explanation of the causes of breaking, this being the main subject of the second part of the document.

I. PLACEMENT OF FADs

I.1. Criteria for selection

Before laying Fish Aggregation Devices, a preliminary selection is made in terms of the dynamics of the fishery (number of fishermen, production, proximity of ports for unloading, storage facilities, etc.). In the second stage, the fishermen of the area concerned are consulted in order to choose an area for the mooring bearing in mind the places where most fish are found and the boats and gear they have. The third stage, which is purely technical, is to select the site having regard to the bathymetry and the hydroclimatic conditions.

I.2 Distribution by island group

On the basis of the abovementioned criteria the following mooring programme has been carried out:

Table 1: FADs moored since 1981: distribution by island group

ISLAND GROUP	NUMBER OF FADs	AVERAGE DEPTH	AVERAGE DISTANCE FROM COAST
Austral	13	861	2
Windward	69	1831	6,8
Leeward	20	1461	4
Marquisas	17	623	2
Tuamotu	11	1296	2,9

Of the 130 FADs moored between June 1981 and 5 July 1990, 69 have been deployed around the Windward islands where both ocean and coastal fishing are most developed. The programme was not extended to the other island groups until more recently: in particular the Tuamotus were until the present time more specifically interested in developing lagoon resources.

I.3 Depth and distance from the coast

The average depth and the average distance for all the FADs taken together are 1,460m and about 5 nautical miles respectively. However these figures have changed over the years and now vary according to the island group.

Table 2: Average depth and distance from the coast for each year of mooring

YEAR OF MOORING	AVERAGE DEPTH	DISTANCE FROM THE COAST	DISTANCE FROM COAST (SOCIETY)*
< 1984	1003	2,5	2,7
1984	1285	4,2	4,4
1985/86	1573	7,2	9
1987/88	1321	4,8	6,3
1989	1627	5	6
1990	1995	5,2	5,8

*Society Islands: Windward islands and Leeward islands

The growing use of the FADs by small boats (canoes or 'poti marara' 3 to 6 meters long), whereas they were initially intended for use by skipjack boats, has obliged us gradually to increase the distance of the FADs from the coast; especially in the Windward islands (Tables 1 and 2) where some have been moored more than 15 nautical miles from the coast. However in the last 3 years the average distance has been set at 6 miles because the request by 'poti marara' fishermen outnumber those received from skipjack boats. At the same time the figure for the average depth appear to be higher but this is not in direct relation to the distance from the coast since FADs moored far from the coast may be anchored on sea mounts.

The distribution by island group (Table 1) shows great differences between the depths and the distance from the coast which are explained partially by the fishing activity and partially by the profile of the sea bottom. In the case of the Austral, Marquisas and Tuamotu islands, ocean fishing is very slight or only just beginning, and accordingly the means (boats and gear are not substantial); the sea bottom has a relatively gentle slope near the coast of the Austral and Marquisas islands and steeper around the Tuamotu atolls; the FADs are therefore laid near the coast. But in the case of the Society Islands (Windward and Leeward islands), where ocean fishing is carried on much more FADs are anchored further from the coast in order to avoid excessive activity around them by fishermen of all categories, both commercial and non-commercial.

II. FAD losses

Analysis of the relevant data has been divided into six periods of time, thus:

- before 1984, the period when different types of raft were being tried out
- 1984
- 1985/1986: two years taken together because the number of FADs moored in 1986 was very small (3)
- 1987/1988: taken together for the same reason as above (4 FADs in 1988)
- 1989
- and 1990.

The figures for the last three years are not definitive as the FADs deployed in this period are still in place.

II.1 Average life-span

The average life-span of a FAD is about 300 days: this is the average for the total number of FADs laid since the beginning of the programme and the figure has risen from 215 days before 1984, to 471 days in 1984, 448 days in 1985-86, 375 days in 1987-88 and 252 days in 1989 (figure 1), the last two figures being provisional. A large number of FADs (33,3%) were lost within the first 3 months of being moored in the period before 1984, but this figure fell to about 12% in 1989. At the same time the number of FADs with a life-span exceeding 2 years rose from 0% before 1984 to 24% in 1988 (Table 3).

Table 3: Breakdown of life-span of FADs per year of mooring

LIFE-SPAN	1981-82-83	1984	1985-86	1987-88	1989
0-3 months	33.3%	38.5%	23.8%	20.0%	12.2%
3-6 months	20.0%	15.4%	9.5%	8.0%	14.6%
6-9 months	13.3%	7.7%	9.5%	28.0%	24.4%
9-12 months	13.3%	0.0%	9.5%	12.0%	26.8%
1-1,5 years	13.3%	7.7%	9.5%	4.0%	22.0%
1,5-2 years	6.7%	7.7%	23.8%	4.0%	0.0%
2-3 years	0.0%	0.0%	9.5%	24.0%	0.0%
3-4 years	0.0%	7.7%	4.8%	0.0%	0.0%
> 4 years	0.0%	15.4%	0.0%	0.0%	0.0%

II.2 Causes of breaking

By 'breaking' we mean loss of a FAD, which in more than 90% of cases is the result of the mooring line's breaking.

II.2.1 Factors beyond our control

The causes of breaking of FADs are listed in figure 2 together with the respective percentages calculated with reference to all FADs lost since the beginning of the programme.

It will be noted that there are 2 factors that are totally beyond control: these are the effect of bad weather, cyclones or tropical depressions, and attacks by carnivorous fish which probably result from fishing lines becoming entangled with a catch on part of the roped. These 2 factors are responsible for 9.4% of losses and are very occasional.

II.2.2 Factors that are subject to control

This heading refers to all causes of loss which could be minimised or even eliminated by technical measures or regulations.

I.2.2.1 Unsuitable deployment

This factor is responsible for 6.25% (Figure 2) of losses and is the result of the anchor's falling into a fault or its slipping because of being laid on too steep a slope. These losses, although occasional, were more frequently encountered at the beginning of the FAD programme and have for the last 3 years been almost totally eliminated by a series of measures that are carried out before the anchor is laid.

II.2.2.2. Technical problems

Technical problems are caused by a weakness at one point or another of the mooring line (a shackle becoming unfastened or worn, rope becoming unbraided etc.) or of the raft itself (instability, failure at a joint etc.). This category includes of those FADs that have been voluntarily withdrawn, usually because a technical failure has been found. They account for nearly 11.5% of losses (Figure 2). Since 1987 these problems have occurred only occasionally (Figure 1).

Of the various types of FAD, 3 have been used more than the others. They are:

- a metal buoy, diameter 2.5 m, with 3-stranded rope, used until 1983
- a metal buoy, diameter 1.5 m, with 3-stranded rope, used from 1984 to the end of 1985
- a metal buoy, diameter 1.5 m, with 8-stranded rope, used since the end of 1985.

The average life-span of the above types of raft has been respectively 252 days, 497 days and 307 days. (The last figure may be different because FADs of this type are still in use.)

Data at present available is not sufficient to allow us to state whether the depth has an influence on the reliability of the materials used; these figures are much influenced by a human factor that is described below. However it appears logical that the greater the depth, the longer the life-span of the FAD, since the physical stresses will be lessened by the greater mass of water and the greater length of mooring line.

II.2.2.3 The human factor

This factor is responsible for 37.5% of losses (Figure 2) noted for the total number of FADs and it rose from under 20% in the period until 1986 to 50% in the last 2 years: nearly 60% in 1989 and already 45.5% in 1990 (Figure 1). These losses result from vandalism and more particularly from entanglement of fishing lines or hooks catching on the upper part of the rope. These dilapidations explains to a great extent the foregoing observations, i.e.:

- longer life-span of FADs of 1.5 m diameter with 3-strand rope on account of their being little visited in 1984/1985 by fishermen who were at that time more inclined to fish for dolphinfish (*Coryphaena hippurus*) away from the FADs;

- a reduction of the average life-span noted since 1987 in proportion to the increase of man-caused damage, which reflects the increased number of visits to the FADs.

This cause is probably the one responsible for a large number of FAD losses for which no explanation has been found.

The figures do not indicate any direct link between distance from the coast and causes of breaking that are due to the human factor for two reasons:

- first as the FADs are deployed mainly in areas accessible to all categories of fishermen the numbers of visits, which are as yet not known, may prove to be identical, regardless of the distance from the coast (this applies to all, or at least to a large number of the FADs in the Society Islands, for which we have the most information);

- secondly, it has been noted from observation that the number of visits to each FAD varies in accordance with their productivity, which also varies throughout the year. However, during the last 2 years we have noted many cases of breaking after a period of more intense frequentation of the FAD.

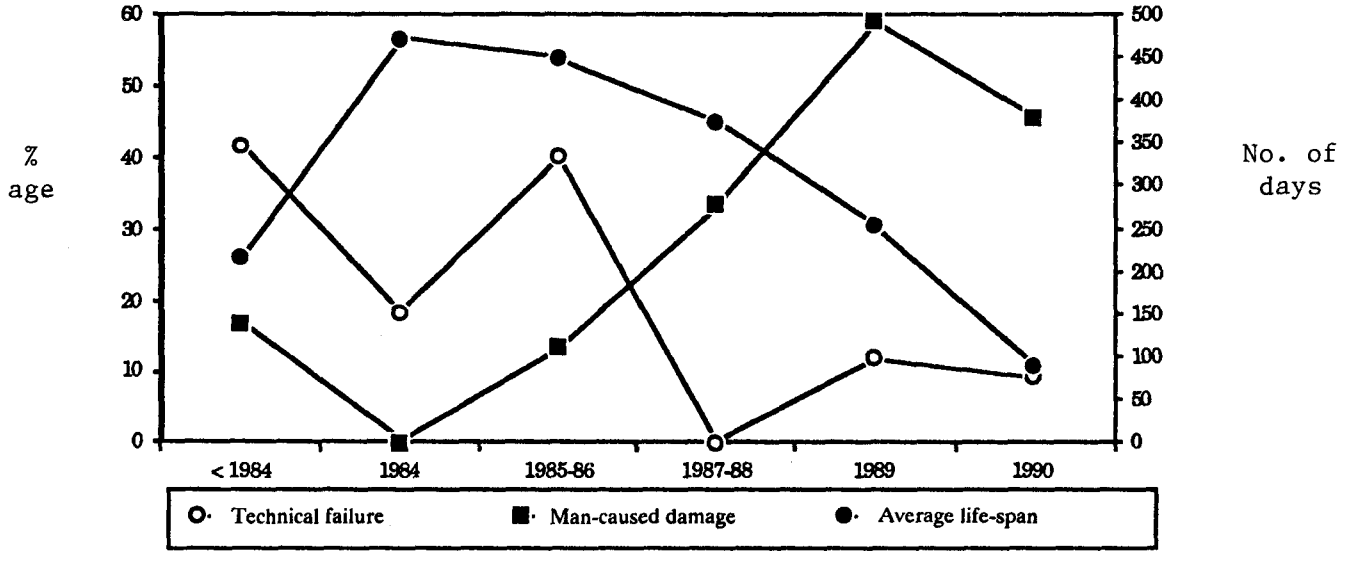

Figure 1: Influence on the average life-span of FADs of the 2 main factors that can be controlled (*figures for life-span in the years 1987-1990 are not definitive)

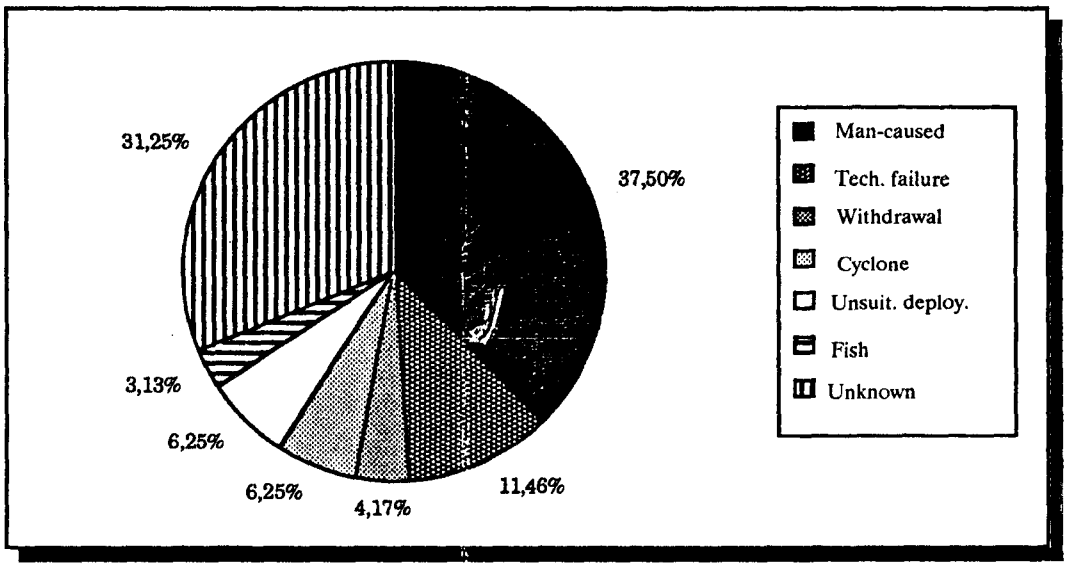

Figure 2: Causes of breaking of FADs

CONCLUSION

In conclusion it can be said that the materials employed at the present time, in conditions of normal use and normal weather, allow FADs a life-span greater than 1 year and even amounting to nearly 2 years. But the growing influence of the human factor resulting from increasing visits to the FADs by commercial or non commercial fishermen tends to reduce their average life-span. Hence the decision, in order to reduce cost and maximise yield, to direct the mooring programme towards 3 main objectives:

- protection of the mooring line against man caused damage: a polythene covering is being tried;
- a search for less costly materials that would be easier to manipulate: trials are under-way on a FAD made of plastic;
- reusable FADs: drifting FADs, which would result in all mooring problems being eliminated and large areas being covered; but the deployment of such devices involves many problems.

Lastly, there is a definite need to educate FAD users to make them aware of the importance of maintaining as long as possible these aids to fishermen, which are of benefit to the whole category of commercial fishermen.