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OPTIMIZATION OF FAD DEPLOYMENT AND MANAGEMENT FOR COMMERCIAL EXPLOITATION

(Paper prepared by the Secretariat)

1. Introduction

Fish aggregation devices (FADs) are used in several countries and territories of the South Pacific Commission to augment natural fish production. Fisheries of all scales, ranging from subsistence to commercial, are associated with FADs. Commercial tuna fisheries in some areas have been targeted on FADs and have been quite successful. In particular, intermediate scale local purse seine fisheries have been very successful fishing in association with FADS. There are, however, a number of uncertainties associated with the use of FADs.

Previous work on FADs sponsored by the SPC has assisted in improving mechanical design both to increase their life expectancy and to decrease their cost (Boy and Smith, 1984). Present work on FADs at the SPC is directed toward deployment of FADs for use by artisanal fishermen and analysis of acoustic population estimates and catch data from commercial operations. To date, there have been relatively few scientifically designed experiments conducted to address the questions of where and how far apart to deploy FADs or how frequently they may be harvested.

Current approaches to FAD deployment and management for commercial operations are empirical. Commercial fishermen take a conservative approach to these questions. They are not likely to take a scientific experimental approach to the questions of FAD density and exploitation by requiring long steaming times between FADs, by allowing very long time intervals between fishing, or by leaving schools of fish associated with a FAD unfished. This pragmatic approach has been reasonably successful for individual cases, but continued success depends on stable conditions both in availability of fish and in the price of tuna in the market place. At present, the optimum FAD density and fishing interval are developed for a particular vessel operating in a particular area. Very little information is gained which would allow results to be applied in different situations.

The goals of the proposed research are to systematically investigate: (a) the rate at which tuna aggregations accumulate at FADs; (b) the effect of distance between FADs on the accumulation rate; (c) the rate at which tuna accumulations at FADs may be harvested; and (d) to use this information to develop methods for determining the optimum density for FAD deployment and frequency at which they should be fished.

2. Proposed Work

The work will be divided into three phases over a period of two years. It is presumed that the work will take place in a country which has an established commitment to the use of FADs in the development of their local commercial tuna fishery. Results of the analysis of existing data on FAD productivity will be used to produce a general experimental design to meet the overall goals of the study. Detailed plans will be developed and all work will be conducted in close co-operation with local fisheries officers and fishermen to ensure that the study also meets the specific local goals.

Phase 1 The existing inventory of FADs will be augmented with an additional 15 units. These additional FADs will be deployed in several arrays of varying density depending on local conditions. The accumulation of fish stocks at the new FADs will be monitored using acoustic methods to determine the initial rate of recruitment to the FADs. Full scale fishing operations will be deferred until such time as it is considered that the fish populations at the new FADs have become relatively stable. Monitoring of the FADs will be carried out by local experimental officers using existing equipment or by charter of an appropriately equipped vessel. Duration: approximately three months.

Phase 2 After it is judged that tuna schools have been fully recruited to the new FADs, commercial fishing will begin. The sequence and frequency at which new FADs are harvested will be carefully controlled. At the same time, acoustic monitoring of FAD stocks will continue. This phase of the study will require close co-operation between the experimental officer and the local fishing fleet. Duration: approximately 15 months.

Phase 3 Information generated in phases 1 and 2 will be used to develop a general description of the population dynamics of tuna schools in association with FADs. This description will be used to further develop a method for optimizing FAD deployment and harvest. The optimization method will depend extensively on operational details of the fishery operation in question. For instance, such details as vessel ownership, FAD ownership, tuna prices, and operation costs (i.e. steaming time) will be included. Much of the activity during this phase would involve participation by the SPC Tuna Programme staff in Noumea. Duration: approximately six months.

3. Potential Benefits

The success of a field study such as this depends a great deal on such imponderables as the weather and the general fishing conditions. Fisheries data always contains a large component of variability which effects the accuracy of conclusions based on such data. In expressing the conclusions based on this study, careful attention will be paid to the uncertainties of the predictions and the risks associated with such uncertainties. If conditions permit successful conduct of the experiment the potential benefits would include:

(a) Countries contemplating development of FAD-based commercial fisheries may be assisted in determining potential benefits and costs prior to deployment.

(b) Countries committed to deployment of FADs may be assisted in determining the pattern of deployment best suited to their national requirements.

(c) Countries with FADs in place may be assisted in determiniing the rate of exploitation of FADs which produces the maximum economic return.

(d) The country in which the project operates will inherit a set of FADs with well understood performance. Local fisheries staff will develop expertise in all aspects of FAD management.

4. Preliminary Budget

It is not possible at this time to accurately project costs for this programme. Actual costs will depend on local conditions and on the availability of Tuna Programme staff and travel expenses. The following projections should be considered approximate and indicative of the type and level of activity forseen. Costs are shown in United States dollars.

		Year 1	Year 2
(a)	FAD deployment and maintenence (at $3 000)	45 000	10 000
(b)	Vessel Charter (at $500/day)	30 000	15 000
(c)	Salaries		
	Professional (SPC P3)	28 000	30 000
	Technical	8 000	4 000
(d)	Expendable supplies	3 000	1 000
(e)	Capital equipment	15 000	
	TOTAL	129 000	60 000
(f)	Contingency	(45 000)	

The initial capital cost of the FADs is a major item in the budget for the first year. Routine replacement of lost FADs and maintenence comprise costs shown under this item for the second year. At the termination of the project, the FADs and the responsibility for their maintence will revert to the local authorities. The charter costs will depend to a great extent on the costs and availability of a suitable vessel for monitoring the populations of fish associated with FADs. Salaries similarly depend on local conditions. The figure above includes one full-time professional employed at the equivalent of an SPC grade P3 and one full-time plus one half-time local fisherman/research assistant. It is possible that the professional position could be supplied from Tuna Programme staff. Capital equipment provides for the necessary acoustic survey and navigational equipment, if such equipment is not available on the chartered vessel. The contingency item is included to accomodate exceptional loss of FADs due to unforseen circumstances (ie. very severe weather) during the projected two-year life of the study.

5. Additional Activities

During phases 1 and 2 opportunities may exist to interact with related research programmes. The SPC is planning a major programme of tuna tagging for the western Pacific. One of the goals of this tagging programme is to determine the exchange of fish between several fisheries. Tagging fish associated with FADs would greatly enhance the information obtained from monitoring the aggregation process in Phase 1. It is also possible to track the movements of individual tunas using special sonic tags. If a suitable vessel is available, such tracking could be undertaken to further augment the data on accumulation rates. The proposed work can therefore be viewed as an aspect of general SPC studies on fisheries interaction.

6. References

BOY, J.L. and B.R. SMITH (1984). Design improvements to fish aggregation device (FAD) mooring systems in general use in Pacific Island countries. Handbook No. 24, 77 pp. South Pacific Commission, Noumea, New Caledonia.