The Tanzania FAD Programme

DRAFT **FINAL REPORT**

February 2006

SAMAKI CONSULTANTS

for

DfID and project partners: Department of Fisheries and Marine Resources, Ministry of Natural Resources, Zanzibar; Fisheries Division of the Ministry of Natural Resources and Tourism, Dar es Salaam; WWF Tanzania Programme Office, CCAfrica

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1 EXECUTIVE SUMMARY

The goal of the project was to contribute to the Department for International Development (DfID) purpose of creating an improved understanding of marine and freshwater capture and enhancement fisheries and to develop and promote their contribution to the livelihoods of the poor. The purpose of the project was to test the mechanisms for implementing successful FAD programmes in East Africa and for communicating that success to relevant stakeholders. The project was partnered by the Department of Fisheries and Marine Resources, Ministry of Natural Resources, Zanzibar; the Fisheries Division of the Ministry of Natural Resources and Tourism, Dar es Salaam; WWF Tanzania Programme Office; and CCAfrica.

The project started in September 2003 and comprised the following main phases:

- Site survey;
- FAD purchase and importation of equipment (1);
- FAD construction and deployment (1);
- FAD purchase and importation of equipment (2);
- FAD construction and deployment (2);
- FAD monitoring;
- Offshore fisheries training.

Following delayed but successful importation of all the necessary equipment from South Korea, the third phase suffered a set-back due to the problems with the original FAD design. The effective delay of one year for a second deployment and project end of October 2005 meant that the bulk of the outputs and activities were restricted to a period of only seven months.

The design failure, requirements and preparations for a second deployment forced a number of adjustments to the project for its continuation. The second importation of equipment and a no-cost extension of the project was needed. As a result, investigations into socio-economic and marketing issues were largely irrelevant since these components rely on the successful use of the FAD and associated gears for a considerable time period, at least a few months, for comparison with existing gears and practices. All efforts were then focused on re-design, importation of equipment for three new FADs and re-deployment. Following deployment, monitoring of FAD performance was continued but hampered as wind and sea conditions deteriorated as the SE Monsoon season developed.

Within this much reduced effective project life, numerous outputs of the project were nonetheless produced. Bathymetric data between 300-700 m depth was gathered from three sites at two locations: northeast Unguja island, Zanzibar, and off the southeast of Mafia Island. Buoyancy systems were tested using different floats, FAD materials were imported and FADs constructed and deployment procedures were successfully followed using different logistical and shipping arrangements. Some fisheries data was gathered from Nungwi on Zanzibar and from demersal catches at Mafia, practical training on FAD fishing gears and there were a series of diverse communication outputs.

In terms of the project's contribution towards DfID's development goals, progress has been made on a number of fronts. Firstly, poor fishers on Mafia Island and Zanzibar have been shown and encouraged to venture further offshore, between 4-6 miles from the fringing coral reefs, to fish around six FADs, the latter representing new technology. At these two offshore locations fish were caught despite the adverse weather conditions during fishing training. Secondly, poor fishers have been instructed and have proven their ability in the use of new technology - vertical long-lining for fishing in deepwater and, more significantly, with circle hooks. Thirdly, fisheries officers from the participating institutions of Mbegani Fisheries Development Centre, the Zanzibar Government Fisheries Department, and staff at the Mafia Islands Marine Park have been actively involved in the main phases of the project and are now in a position to independently develop FAD Programmes. Two local vessels were used for FAD deployment (from MFDC and the private sector) thus further widening the promotion uptake options for local stakeholders.

Conclusions

Without conclusive results on FAD performance and increase fish yields, adoption cannot be expected. Nevertheless, the project has introduced a wide variety of stakeholders to the concept and potential of deep-sea FAD fisheries, previously tried (unsuccessfully) in Tanzania in 1984. These include poor people (fishers) but also institutions supplying services to the poor (national and district government; national

research institutions and NGOs), employers of the poor (fishing and processing companies) and policy-makers (national governments). The project has been able to demonstrate some of the technical requirements for fishing around FADs and this has encouraged at least two NGOs and a successful commercial company to further investigate the potential of investing in FADs beyond the life of R8331.

2 PREFACE

The recent development of FAD activity in Tanzania stems from a small study of the potential of FADs in Tanzania (MRAG, 1999) under the Sida-funded Marine Environmental, Awareness and Biodiversity (MEAB) Programme, based at Western Indian Ocean Marine Sciences Association (WIOMSA) on Zanzibar, with support from the Zanzibar-based Institute of Marine Sciences (IMS) of the University of Dar es Salaam (UDSM), the Department of Fisheries and Matemwe Bungalows. That preliminary study, off the Matemwe coast and Mnemba Island, in the northeast of Unguja Island, Zanzibar, suggested conditions were appropriate for that FADs and an initiative was provided by the managers of the Mnemba Island resort, Conservation Corporation Africa (or CC Africa). With the continued assistance of the IMS, that contribution three years later covered approximately the costs of deployment of a single FAD off the Matemwe coast. However, at the time, in order to conduct a full appraisal of the FAD technology and its impact on local fisheries and economies it was felt that a larger project should be developed, testing the technology in different areas and monitoring impacts over time. After a number of years, support was eventually secured from the UK DfID through the Fisheries Management Science Programme (FMSP). The FMSP initially contracted Samaki Consultants Ltd, Tanzania to conduct a preliminary study over a broader geographical area and examine a wider range of issues, leading to the assessment of assets associated with a FADs programme, (FMSP Project R8249 *Livelihood assets required for an East Arica FADs Programme*, Richmond *et al*., 2003). The latter was a short study but one that nevertheless generated significant further support for a FAD trial in Tanzania, notably from the fisheries department on Zanzibar (DFMR) and the mainland (FD), as well as NGOs and donors. This positive response encouraged the subsequent development of the current FAD trial, with principal funding from DfID under FMSP (Project R 8331 *Promoting livelihood benefits from FADs*). This report is one product R8331, primarily aimed for distribution to project partners. Under the FMSP requirements, a full Final Technical Report (FTR) and various other documents have been submitted to DfID and are under review. This report attempts to present the information in a conventional format, so as to be accessible to a wider readership.

3 INTRODUCTION

For Tanzania and large parts of Kenya, data on the status of the inshore fishery is scarce and there are many problems interpreting what historical and current data does exist, however there is a common belief that inshore marine resources are under stress and maximum sustainable yield being exceeded. There have been a number of investigations undertaken and reports produced on the status of Zanzibar's inshore fisheries over the last three decades (e.g. Tarbit, 1984; Iverson *et. al*., 1984; Jiddawi & Muhando, 1990; Jiddawi 1997). Most reports have concluded that the inshore resources are threatened by destructive fishing methods and over-fishing. Two decades ago, Tarbit (1984) concluded that 'the artisanal fishermen of Tanzania are approaching the upper limit of exploitation on their traditional fishing grounds'; Jiddawi (1997) observed that 'the fishery now shows signs of being over-exploited as the fishing pressure on the reef increases and destructive fishing techniques proliferate'; and Msuya (1997) presented results from interviews with fishers; these data indicated that 73% of fishers believed that there had been a decrease in catches of coral-reef species and 71% a decline in species diversity.

Figure 1 The coast of Tanzania, showing the FAD sites off southeast Mafia and northeast Unguja Islands (stars).

In terms of the socio-economic context and whilst baseline data is limited, it is estimated that almost 50% of the population of Tanzania are poor (URT, 2000a). In mainland Tanzania, poverty is most pronounced in Mtwara in terms of life expectancy, infant and under-five mortality and in the Coast and Tanga regions in terms of food security (cereal equivalent). In Zanzibar, where poverty (as well as political uncertainty) has also been an important problem, fish is the principal source of animal protein for the low-income families. Landings have remained steady over the last 10-years according to statistics but there has been an increase of 35% in numbers of fishing vessels and a several fold

increase in numbers of fishers, resulting in a decline in catch-rate (and therefore income) for individuals. About 25% of the population of Zanzibar is employed either directly or indirectly in fisheries. Similar figures are likely to reflect the situation on Mafia Island.

Poverty reduction and community empowerment are principle development aims for Tanzania (URT, 2000a), to be achieved through improved market efficiency, increased productivity and pro-poor policy support, with particular emphasis on promoting export-oriented expansion and diversification of the pro-poor sectors (RFIS, 2002). National agencies support the need to diversify activities, as demonstrated by the Tanzania Coastal Management Partnership (TCMP) that states 'there is a need to identify actions to increase the productivity of current economic activities in rural areas [and to] promote alternative, environmentally-sustainable livelihood opportunities' (TCMP, 2000). On Zanzibar, the focus on FADs is more specific, including: '1. Provide training and extension services in the use of different fishing techniques for offshore fishing grounds; 2. Establish fish aggregating devices (FADs) and artificial reefs'.

4 OFFSHORE FISHERIES IN TANZANIA

The offshore fisheries resources are of two distinct sorts: pelagic, comprising mainly tunas and billfish, and demersal, comprised mainly of snappers, breams, groupers, sharks and lobsters.

4.1 The pelagic tuna fishery

A review of the pelagic resource was presented in the precursor study FMSP R8249 (see Richmond *et al*., 2003) and a more recent analysis is presented here, mainly derived from the latest IOTC publications. For all tuna species the key regional scientific and management research in managed by the Indian Ocean Tuna Commission (IOTC), based in The Seychelles. The IOTC's Scientific Committee meet annually to undertake stock assessment activities and to develop management guidelines for the Commission. The following information is derived from the IOTC SC's eighth annual meeting report (IOTC, 2005).

4.1.1 Yellowfin Tuna

This species is cosmopolitan, distributed mainly in tropical and subtropical oceanic waters where it forms large schools. The sizes exploited in the Indian Ocean range from 30-170 cm fork length (see Figure 2). Smaller fish (juveniles) form mixed schools with skipjack and juvenile bigeye tuna and are mainly limited to surface tropical waters, while larger fish are found in surface and sub-surface waters.

Catches of yellowfin tuna in 2003 and 2004 were substantially higher than in previous years (458,800 mt compared to 343,000 mt), with the catch in the waters off East Africa being particularly high (see Figure 3). IOTC reports that there are two major possible explanations for the high catches; that there were large recruitments to the population in the late 1990's and early 2000's although during that period there were no evidence (in terms of large numbers of juvenile tunas being caught from the surface fisheries) to suggest this. A second possible explanation is either a concentration in the resource or a change in fishing efficiency. There were large concentrations of the crustacean *Natosquilla investigatoris* and the swimming crab *Portunus trituberculatus* upon which yellowfin feed, as well as some indication that the thermocline was shallower than usual which would have the effect of concentrating the yellowfin in the upper water column and therefore within reach of purse-fleets. The IOTC conclude that the increase was most likely due to both an increase in catchability and some increase in recruitment.

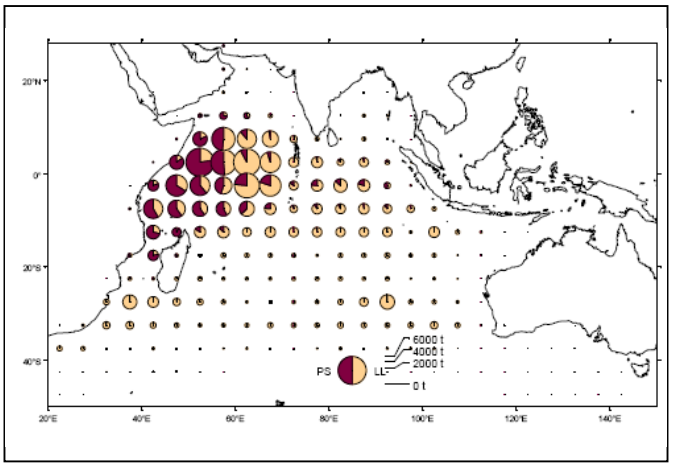

Figure 2 Mean distribution of Yellowfin tuna catches 1998-

The Scientific Committee reported that total catches in 2003/4 were substan-tially above MSY. If this is because of the increased recruitment then this will not adversely affect the conservation status of the species, although more high recruitment will be needed to sustain the level of catches seen in those two years. If the increase was due to increased catchability then there are negative consequences for the species. The IOTC recommended avoiding any further increase in fishing effort and catch above the levels in 2000 (IOTC, 2005).

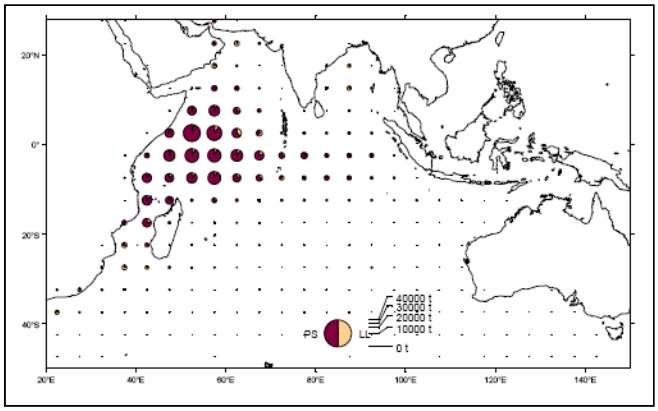

Figure 3 Mean distribution of yellowfin tuna catches 2003.

4.1.2 Bigeye Tuna

This tropical tuna species occurs in surface waters to about 300 m depth. Juveniles frequently school at the surface underneath floating objects in single-species groups or in aggregations with yellowfin and skipjack. Of the three large tropical tuna species, bigeye tuna lives the longest (more than ten years) making it the species most vulnerable, in relative terms, to over-exploitation. Bigeye start reproducing when about three years old, at a length of about 100 cm. The analyses of the IOTC Scientific Committee indicated that it is likely that current catches are still above MSY and it is possible that fishing effort has exceeded the effort that would produce MSY. There is also concern over the number of juvenile bigeye (<10 kg) being caught by purse-seine vessels. The Committee recommended that 'a reduction in catches of bigeye tuna from all gears, eventually to the level of MSY, be started as soon as possible and that fishing effort should be reduced or, at least, it should not increase further' (IOTC 2005).

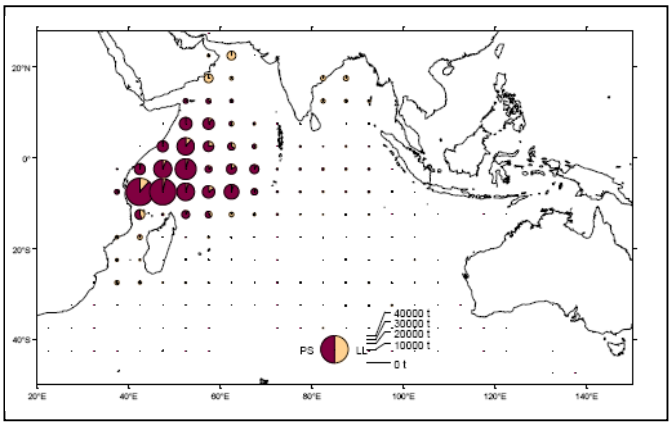

Figure 4 Mean distribution of Bigeye catches 2000-2003.

4.2 Tanzania industrial fishing effort

The high catches of 2003/04 (see Figure 4) led to substantial rise in interest amongst deep-water fishing fleets in gaining access to Tanzania's EEZ, coinciding also with a much improved national MCS capability largely supported by the EU. In 2004 there was a 144% increase in number of licences purchased. The current (2005) licensing profile is presented in the Table 1.

Licensing authority	Vessel type	No. vessels
Dar es Salaam	tuna longliner	57
Dar es Salaam	tuna purse seiner	85
Zanzibar	tuna longliner	43
Zanzibar	tuna purse seiner	7

Table 1 Licensing arrangements and details for Tanzania's EEZ fishery (source: SADC-EU MCS Programme).

Given the IOTC's general concerns about tuna catches there might be a case for "allocating" some of the tuna resource currently taken by foreign vessels in Tanzanian waters to a new, domestic artisanal fleet to supply a tuna export market. The development of such a domestic-fleet could be supported both by the World Bank's Marine and Coastal Environment Management Programme (MACEMP) and by the forthcoming South-west Indian Ocean Fisheries Programme (SWIOFP), which includes under Component Four (Assessment and Sustainable Utilisation of Pelagic Fish) research activities *and* investigations of gear optimization. This could arguably include the development of new domestic pelagic fisheries utilising as part of their options the FADs deployed under this programme.

4.3 National Fisheries Policies

Development policy themes support the development of FAD fisheries in general. More specifically there are a number of provisions in the mainland Fisheries Act (Anon., 2003) that provides additional policy and institutional support for a number of aspects of FADs fishery development. For example the Act states that:

'The Director shall, in cooperation with other appropriate agencies and divisions or departments of the Government, promote, encourage and support all initiatives leading to the development and sustainable use of the fish stock and aquatic resources through such measures as:

> *(f) encouraging the involvement of stakeholders in the planning, development and management of fishery resources;*
>
> *(j) pursuing continuation and introduction of fisheries integrated programme of effective management of coastal zone to meet the ecological and social economic needs of the presents and future generation'*

Source: Anon., 2003 Part III Development of the Fishing Industry (Section 9, Paragraph 1)

The Fisheries Act also provides support for any fisheries-related restrictions on the use of particular gears, marine-space, size or other characteristic of the target species. For example, the Act states that:

'The Minister shall by notice published in the Gazette impose conditions that are necessary for the proper management of fisheries which are:

> *(e) restricting the number, size and age of fishing vessels in any fishery;*
> *(f) prohibiting the use of certain types of fishing vessels and gears;*
>
> *(n) examining the performance of the existing fishing gear, methods and substituting for them those which are consistent with responsible fishing;*
>
> *(p) ensuring that…[the] needs and interests…of local fishing communities which are highly dependent of fisheries resources for their livelihood are given due regard.*

(Source: Anon., 2003 Part V Management & Control of the Fishing Industry (Section 17, Paragraph 1).

The spirit of this Act may be applied to maintaining access to FADs and adjacent marine space for artisanal fishers in the case where larger commercial interests seek to establish monopoly access rights, such as may occur if commercial companies establish their own FAD fisheries. Similarly, if there are issues related to conservation of resources, the Act also provides support of small-scale rather than larger commercial interests. Similar policies exist for Zanzibar.

Current policies towards participation and recognition of the rights of local people to access fishing grounds are obviously grounded in good faith and partly reflect the growing democratization of Tanzania's politics. But artisanal fishers are typically not a strong political body, particularly in Tanzania and there are other usually more influential commercial interests competing for favourable terms of access to resources.

4.4 Deepwater demersal fishery

Few data exist on this fishery for Tanzania, but examples are presented here from three different sources. In the late 1950's, deepwater fishing trials were conducted off Lamu, at the North Kenya Banks, in water depths from 55-110 m (see Morgan, 1960). The findings after 1,170 line hours of fishing, and over 5,600 kg of fish, the best yields were of about 100 kg per-line-hour (number of hooks not given), but the average was about 5 kg per-line-hour. Species composition was 38% snappers, 28% groupers and 19% emperors, 10% sharks and 5% other species.

Tarbit (1984) describes the results of fishing trials and fishery investigations in Tanzanian coastal waters. With respect to waters off the Rufiji Delta there was recognition that the extensive 'rough' substrate area in the southern entrance to the Mafia Channel is important nursery grounds for species of the reef slope. Fishing trials conducted on the Mafia Shelf at fishing various depths using short setlines, produced catches of snappers, emperors, groupers and sharks, with the best rates at shallower depths of 45-60 m where 33.2 kg/100 hooks was recorded. Given the potential daily catch rates estimated during these surveys, Tarbit suggests that there was some potential for semi-industrial fishing in the northern and southern entrances to the Mafia Shelf where over 500 km^2 is available for exploitation and initial catches rates may approach 1,000 kg per day.

Demersal fisheries of the southern reef areas of Tanzania were investigated between 1987-1988 by another British Government ODA project. The study revealed good catch rates Songo Songo reefs (10-15 kg/100 hooks) with again snappers, emperors, and groupers comprising the bulk of the fish species. Catches however decreased rapidly to low levels and contrary to the recommendations of Tarbit (1984) the findings suggest that the development of a bottom-set long lines fishery should not be encouraged (Scullion, 1989). The relatively small fishing area in southern Tanzania suggests that the size of the fish resource is limited. It is argued that with catches dominated by slow-growing species with low natural mortality rates and low population turnover rates the likely-hood is that the resource would rapidly become depleted and thus the fishery not sustainable.

The conflicting evidence above does nevertheless warrant further investigation. It is now known for example that the fish species mentioned above are fast growers and some of them do re-populate quickly. Also it has been found that fishing trials using baited hooks are prone to decreasing catches when fished intensively, not because stocks are depleted but because fish are thought to become 'hook shy', although this has yet to be proven, and clearly much research remains to be done on biology, growth rates, distribution, migration and other facets of the deepwater fishery off Tanzania.

5 METHODOLOGY AND RESULTS

The development of the Tanzania FADs Programme comprised a number of components. This section presents all main components, from the development of the methodology to implementation and results. A photographic (and video) record was kept of all aspects of FAD construction, deployment, monitoring an fishing trials with a selection of the images presented in Annex 1. These photographic Reference Plates depict 43 images, all of which are referred to throughout the text that follows. Annex 2 presents a set of five Guidelines on the main aspects of the programme. The importation of FAD materials and customs clearance is summarised in the first set of Guidelines No. 1, and is not described here.

5.1 Bathymetric surveys

The recommendations from the SPC experience are that FADs are best sited away from shallow areas, by at least a few miles and with depths ideally over 400-500 m. Suitable sites around Tanzania were examined in the preliminary work (e.g. MRAG, 1999; Richmond *et al,* 2003) and eventually northern Unguja and southeast Mafia were selected as trial sites.

Local participation was necessary to determine site access by local fishing boats, and absence of conflict with other gears (see Plate 1 c,f). Visits were made to all sites with local vessels, before the final site was chosen and agreed.

The process of site selection included a examination of available charts for depths and distances from target fishing villages; knowledge of offshore shipping and fishing activities and access by local fishers. A detailed site survey was then undertaken of the deep-water bathymetry of the selected areas. For this activity the project chartered a 3.5 day survey with the catamaran *SV Amarula*, in February 2004 to cover both the northeast Unguja and Mafia sites. A deep-water sounder (model JRC NJA-1130) with a 3 KW transducer was mounted on the stern transom for the task. A 2 x 2 mile grid was navigated, at a constant speed of about 3 knots. Sounder readings were recorded with the GPS reading (see Plate 1 d). data were plotted as a 3-D chart of the seabed (see Figure 5).

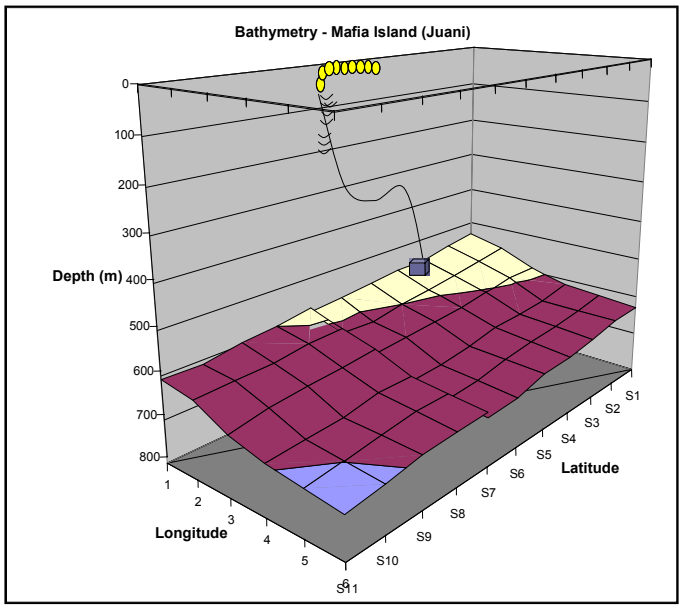

Figure 5 Bathymetry east of Juani Island, Mafia, showing position of FAD, on edge of the 500 m contour,

For the three Mafia Island sites, the surveys revealed a gently sloping seabed between

depths of 300-700 m in both areas (see Figs. 6 and 7). The absence of canyons and steep gullies is ideal for FADs, reducing the risk of slippage or loss from deployment over ground with un-expected depths greater than the length of the FAD, which would result in the float section never reaching the surface.

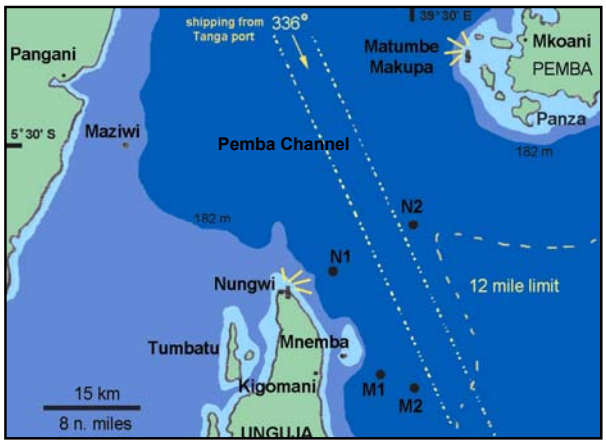

Figure 6 Northern Unguja Island and southern Pemba, Zanzibar with position of four FADs (N1, N2, M1, M2), the 12 mile limit of Territorial Sea.

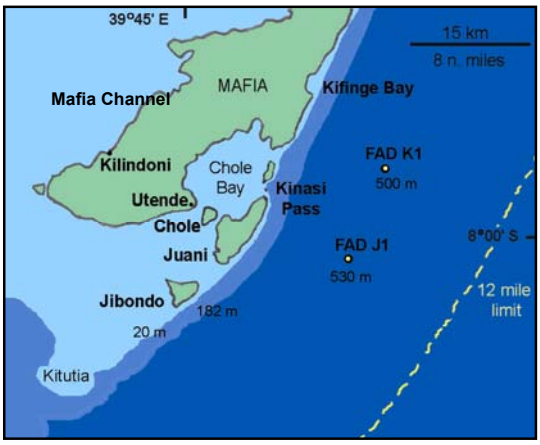

Figure 7 Southeastern Mafia archipelago, with position of two FADs, 12 mile limit of Territorial Sea and the southern reef of Kitutia.

5.2 FAD design and materials

The SPC Indian Ocean FAD buoy system was used in the Tanzania FAD Programme, as recommended in Volume II of the SPC FAD manual (see Gates *et al.* 1996). This design was used in many countries in the late 1990s and early 2000s and was well-accepted, though problems were later encountered with the wire cable breaking where it came out of the PVC coating.

The first FADs were deployed in April 2004 but unable to withstand the 4-5 knot seasonal ocean current along the coasts of Mafia and Unguja Islands and consequently, when submerged, the floats collapsed with a loss of surface buoyancy causing the FAD to sink. A similar problem in the Pacific Ocean, where this FAD design was extensively deployed, has led SPC to re-design their FADs (see Chapman *et al.,* 2005). Based on the present experience, the recommended design is rigged only with plastic pressure floats (as shown in Figure 8).

5.2.1 Floats system

The present design utilizes a single line of 25 pressure floats of 18 kg buoyancy each, separated by thick rubber spacers (made of car tyre), along the PVC-coated steel wire. The buoyancy and low drag of this type of buoy system places less strain on the mooring under the effect of strong surface currents. In extreme currents, the buoy system submerges without damage and resurfaces when currents ease.

Experience with FADs around the world during the last decade suggested that using a wire-rope (hot-dipped in U-PVC for protection against corrosion) was the best option for securing the floats of the surface unit against theft. The decision on whether to use wire-rope largely depends on the perceived risk of vandalism and/or theft.

5.2.2 Aggregator

To the lower 10 m of the 30 m steel wire section 20-40 PVC packaging strips were attached. These, also known as the ‘aggregator’ (or ”Xmas tree”) (plate 1b) serve to increase surface area for growth of marine fouling such as algae, barnacles, soft corals, etc. which in turn attract small fish for shelter and increases the profile of the FAD in the water column.

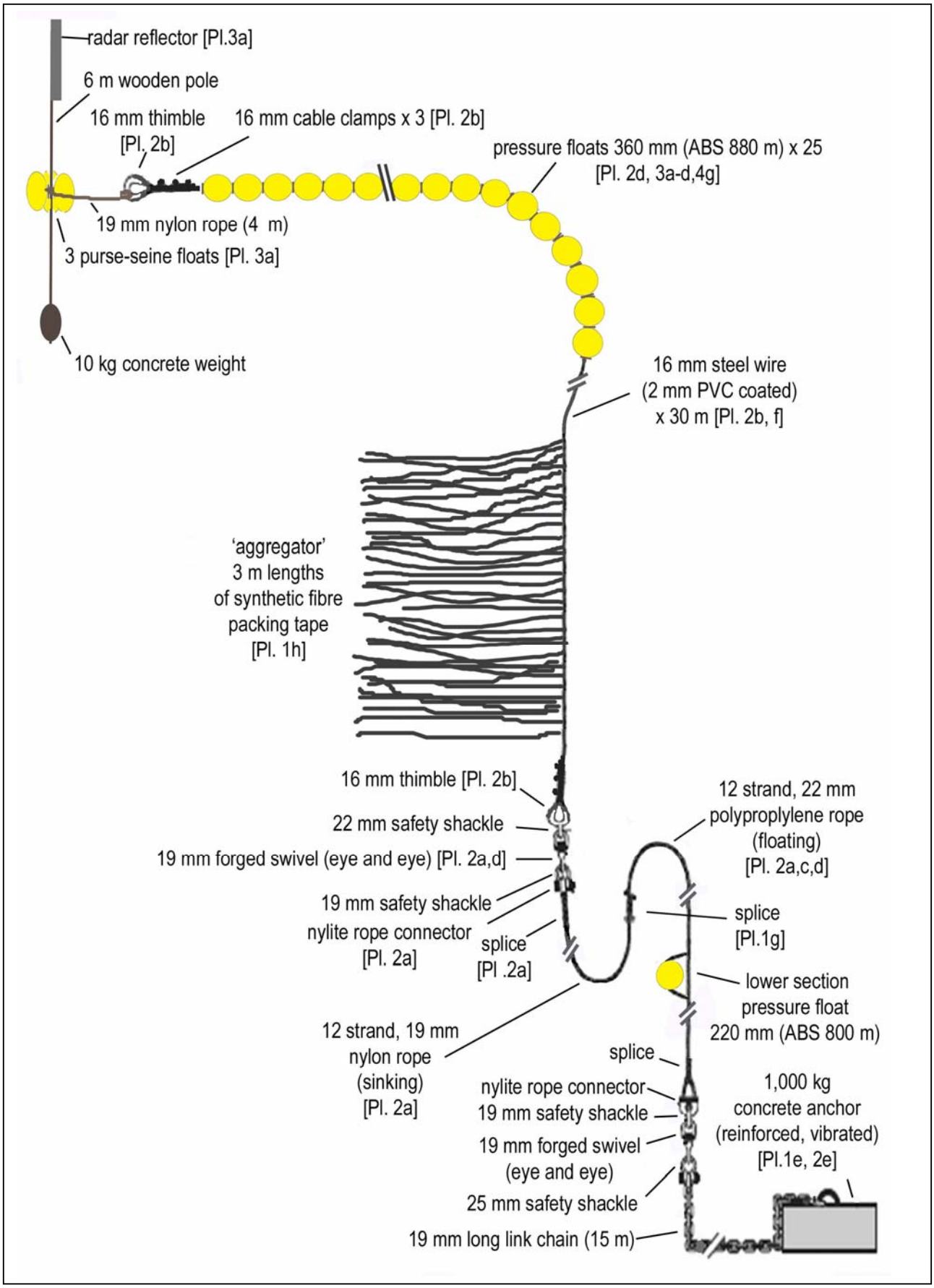

Figure 8 Design and components of FADs deployed in Tanzania in March 2005. Not to scale. Reference to photographs on plates in the Annex are include in square brackets e.g. [Pl. 2a].

5.2.3 Flagpole and reflector

A flagpole was attached to the end eye of each FAD using 16 mm nylon rope to a 6 m treated-wooden pole weighted at one end, floated in the middle by three purse-seine floats. The poles floated about 2 m high out of the water and visible at sea in a local vessel from about one mile. To the upper portion of the poles were secured a tube-model radar reflector. The reflector was recorded on the MT Solsky radar screen for 5 miles. Within two weeks all four flagpoles at Zanzibar FADs were missing, presumed stolen, while on Mafia some wearing was evident in the Juani FAD attachment rope.

5.2.4 Ropes

The Tanzania FADs have an upper section (30%) of negatively buoyant nylon rope (19 mm, 12-strand) and the lower portion (70%) buoyant polypropylene rope (20 mm, 12-strand). Splicing 12-strand ropes requires considerable skill. Lengths of rope depend on depth, with current arrengemtns shown in Table 2. The choice of 3-strand ropes or the more expensive multi-strand ropes has changed as a result of recent research in the Pacific Ocean and 3-strand rope is now seen as adequate for FAD moorings (SPC, 2005). Rope links comprise Samson *Nylite* rope connectors, safety shackles and forged swivels.

FAD Name	Length (m)	Nylon (m)	Polyprop. (m)	Depth (m)	Scope (L/D)
Nungwi 1	410	0	410	300	1.36
Nungwi 2	862	262	600	650	1.33
Matemwe 1	550	165	385	400	1.37
Matemwe 2	875	275	600	650	1.35
Kinasi	800	240	560	500	1.60
Juani	875	275	600	530	1.65

Table 2 Rope lengths and depths for the six Tanzania FADs deployed in March 2005.

5.2.5 Anchor and chain

The anchor should be constructed of concrete (using non-marine sand and aggregate) with steel-reinforcements (see Plate 1e) and must be vibrated to eliminate air bubbles that can implode at depth and weaken the concrete. A single anchor is much easier to handle than using engine blocks or other materials.

5.2.6 Circle hooks

Circle hooks were used exclusively for the trials and are recommended because they have the following features that are being promoted in some countries for their conservation and research values: (a) for released fish, mortality is lower than conventional straight-shank hooks, because circle hooks are rarely swallowed and thus gut-hooking is avoided. Instead, jaw-hooking is more common which also eases hook removal with reduced damage and handling time; (b) by-catch of turtles is significantly reduce; and, (c) fish are hooked even when lines are un-attended, as with vertical longlines used in the current fishing trials.

5.3 FAD construction and deployment

Construction and deployment skills was transferred in April 2004, and March 2005, to MFDC and Zanzibar fisheries staff as well as the crews of the MV Mafunzo and the MT Solsky who participated in the FAD project (see Plate 2). In total, nine FADs were constructed with local counterparts, under the supervision of the Masterfisherman from Canada. Once all materials were in place, construction of the six FADs requires 2-3 days and some experience in splicing 12-ply ropes (see Plate 1g). Anchors require two week for construction. A second FADs construction exercise was supervised by the Masterfisherman, in December 2005.

The first deployment from MFDC with six FADs aboard the MV Mafunzo was in April, 2004 (see Plate 2c). Following discovery of the design problem and loss FADs, the vessel returned to port and the remaining three FADs were unloaded and stored. Following completed preparations for a second deployment, in January 2005, the MV Mafunzo was taken to dry dock. With uncertainty about the date of repair completion, a private sector marine logistics company was approached, and the second deployed was

successfully completed on March 22-25, 2005, again departing from the MFDC jetty, but this time with the MT Solsky tugboat (see Plate 2d,e). Deployed with local partners, four FADs were set off Zanzibar (see Plate 2f) and two off Mafia (see Plate 3a). The deployment experience is summarized in Guideline No. 4 (Annex 2).

The FAD sites are shown in Figs 6 and 7, with geographical data shown in Table 3. The position of the FADs was communicated to the Tanzania Port Authority (TPA) and the necessary "Notice to Mariners" issued (see Annex 3).

FAD Name	ID	Lat. new	Long. New	Depth (m)
Nungwi 1	N1	5^0 41.011'	39^0 23.791'	300
Nungwi 2	N2	5^0 37.079'	39^0 30.055'	650
Matemwe 1	M1	5^0 50.716'	39^0 27.570'	400
Matemwe 2	M2	5^0 52.135'	39^0 30.794'	650
Kinasi	K1	7^0 56.330'	39^0 55.078'	500
Juani	J1	8^0 02.300'	39^0 52.570'	530

Table 3 Names, positions and water depths of Tanzania FADs deployed in March, 2005.

5.4 FAD access, weather and monitoring

5.4.1 Weather and FAD access

Regular monitoring of the weather, especially wind speed and direction, was initiated soon after deployment. Contact with the Tanzania National Meteorological Agency was established in March 2005 with provision of requested forecasts for both Mafia and Zanzibar. Eventually the web-based facilities (e.g. www.weather.com) allowed for closer monitoring of wind speed and direction (see Annex 4).

Access through April and May 2005 was acceptable using local vessels and conditions were favourable for fishing, although this was before the FADs had "matured". By June, increasing southerly winds prevented access on many days and on two attempts at monitoring FADs at Matemwe (Zanzibar) worstening sea condition forced trips to be abandoned. Un-favorable conditions continued through the entire SE Monsoon period, until late October. Winds were predominantly southerly, between 10-12 knots, reaching 17 knots, in July and August. The large swells associated with these easterly winds considerably interfered with access especially in Mafia. By end of October the wind was mainly easterly, 8-15 knots, and finally in mid-November the wind has shifted set to northeast. The plot of wind speed shown in Figure 9 shows that southern Tanzania experiences stronger winds and that the months of June through August witnessed the strongest winds, as was noted during the last seven months.

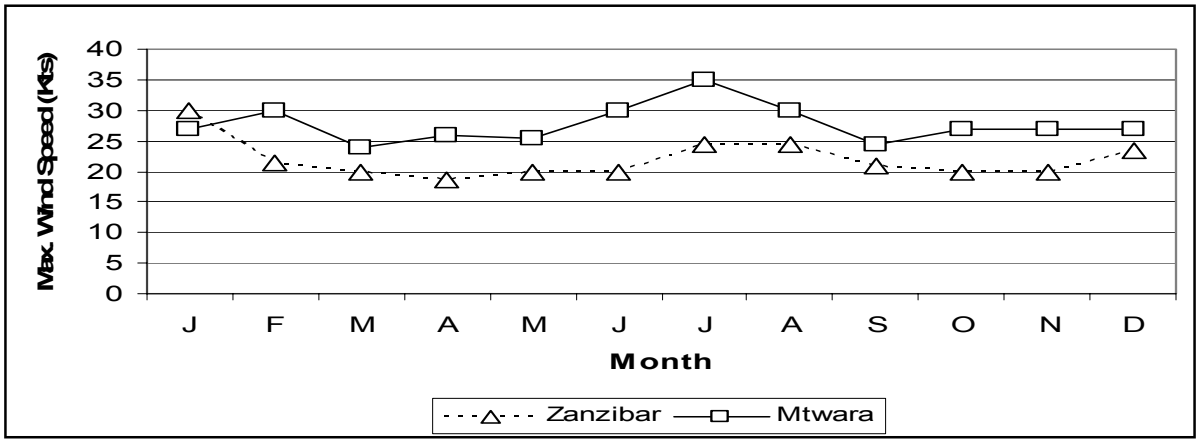

Figure 9 Maximum monthly wind speeds (1972-96); modified from Dubi (2001).

The time from Nungwi beach to the nearest FAD, N1 (see Figure 6) is about one hour (in calm conditions). From Matemwe village, there is an increase in the distance to the FAD depending on the need to first travel up the lagoon and exit the northern pass, or on high tide simply cross the reef. From Utende village in Mafia, about half an hour is required to reach the Kinasi Pass at the eastern side of the Chole bay (see Figure 7). From the Pass, time taken to reach either of the two FADs is just over one hour, in calm conditions. Crossing through the Pass can be restricted during ebbing tide due to high standing waves at the entrance, dangerous for the wooden dhows.

5.4.2 FAD Monitoring

With the previous experience of FAD submersion, special efforts were made to monitor the six FADs at every opportunity, especially in the initial months before the SE Monsoon set. In addition to boosting the involvement of the various project partners, contact was also made with a private game fishing operator. Within two weeks of the deployment date, all six FADs had been inspected. By end of the project five of the six FADs were visited between July and October, 2005, with fishers and using local vessels (see FAD Inspection Report and FAD Status Sheets, Annex 5). Between deployment in March to end of project in October, 28 visits were made to inspect the FADs. Details reported included the number of buoys at the surface, an indicator of current velocity, GPS data on position of float section and other observations.

The first inspections revealed two main concerns. Firstly, three of the four Zanzibar FADs had, within ten days, lost their flagpoles. Theft is suspected and not surprising since the UV-proof purse-seine floats are a very versatile product that can be cut and adapted to numerous uses. The second, potentially more important discovery from initial monitoring was evidence of slippage of the three cable clamps in the final section (see Plates 2b, 3b). Following discussion with various marine experts, the consensus was that the slippage was expected and could only continue to the point where the final meter of steel cable is twisted and crimped so tightly it could never shift.

5.4.3 Surveillance

During FAD monitoring, illegal industrial fishing activity was observed on two occasions: in March, about two weeks after deployment, a long-liner was seen inside the Marine Park (see Plate 3 e,f), and in May, two purse-seiners were from the air off Mafia in almost the exact position of the Juani FAD. Both incidences reported, with photos, to the MCS (SADC) project operating from Mbegani.

5.5 FAD and offshore fishing trials

5.5.1 Fishing gears for FADs and offshore use

The basic components of gear for use around FADs are presented in Table 4 and described fully in Guideline No. 5, based on the vertical longline, with the following options:

- Hand line - For use in 30-70 m depth; large hooks (size 12-14).
- Drop line - Use in 60-300 m depths; 25 hooks; size
- Trolling line - Usually 3-4 can be rigged per vessel.

The choice of gears benefited from inputs from Seychellois, British and Canadian master-fishermen, local fishers and from the SPC Manual (Preston et al., 1998). Comparative pricing of fishing gears was also obtained from different sources, namely Seychelles, UK, Tanzania and South Africa. For all items, cost data was recorded for importation, construction and deployment.

An additional item to the list presented in Table 4 is an echo-sounder or fish finder, recommended, especially for determining the depth of the tuna around the FAD (not proven in the present study) and if new grounds are being sought (e.g. Mafia for demersal fishery).

The development of the FAO or Samoan reel started in early in December 2004, with the visit of the Masterfisherman during FAD construction. Eight reels and two mountings were constructed and the reel was tested at sea for a few hauls, on a single day in June, 2005 (see Plate 4d,e,f). The reel and mountings performed well (though no fish were caught). When the fishing trials began in July, 2005, the decision was made not to use the reels so as to reduce the equipment to be carried each day from shore to vessel, but also to reduce the amount of new technology introduced during the trials. It was agreed that when too many fish were being lost from failure to manually haul, then the applicability of the Samoan reel would be re-examined. Images of the trials are included in Plates 4c.

Item	Quantities	Price (US$)
Braid line (4 mm, nylon, woven)	3 x 400 m roll	195
Circle hooks (size 13/0)	100	25
Nylon monofilament (no. 180)	100 m roll	12
Swivels (No. 5)	50	70
Tuna S.S. snaps	30	6
Buoys (10 litre buoyancy)	10	65
Trolling lures	10	80
Cold box (for bait)	1	40
Steel gaff	2	30
	Total	**523**

Table 4 Standard fishing gears and equipment ideal for FAD fishing, sufficient for one local vessel such as those used in the present trials.

5.5.2 Training of local fishers

Training in the use of fishing gears specific for FADs was conducted on two occasions, in July from a base in Nungwi, and later in October at all three sites of Nungwi, Matemwe and Mafia. All the hand-lining gear was sourced from the Seychelles. Training was led by the fishing gear technologist from SFA, Antoine Polite, who visited Tanzania for a total of 50 days, during which 33 days were spent at sea. On all days at sea, two motor-sailing mashua were chartered, carrying between 10-12 fishers in total. A diary of the fishing trials, location data and list of participants is presented in Annex 6.

The first training took place between July 2-21 and was restricted to Nungwi because of all the three sites, Nungwi allowed the best possible chances of access, all other FADs being further offshore or more exposed (especially on Mafia). Fishers from Matemwe and Mafia were involved in the first Nungwi trials. Some days were spent on the Nungwi 1 FAD, but much of the trial took place to the more sheltered west side of Nungwi, towards the mainland (see Fishing Trials Location data in Annex 10.7, see Plate 5a-d).

The second set of fishing trials took place between October 4 and November 5, starting in Nungwi for five days, then Matemwe for five days and then shifting to Mafia. This phase involved 53 fishers, with a significant increase in the number of fishers from Mafia (see Annex 10.7). On Zanzibar, the field-based training in FAD fishing gear rigging and use also included representatives DFMR, while on Mafia the MIMP-WWF staff were involved.

The focus of training was on deepwater/FAD fishing skills, as recommended in the SPC Manual (see Preston *et al*., 1998). Gears were primarily hand-lines using circle hooks, but fish bleeding, boat, anchor design and bait were also addressed. Mindful that the magnitude of this output was reduced due to the delayed deployment and only short period of training, at the end of the project, the training was successful. While on Mafia, despite the weather conditions preventing access to the FADs sites, following successful exploration of alternative sites, the MIMP and WWF requested that Mr. Polite continue for a further five days to continue with the training. On Mafia success was mainly due to the application of the FAD gears in another environment, the demersal fishery of 70-100 m.

There were days during both visits of the gear technologist that fishing near the FADs was not possible due to sea conditions. Alternatives were examined and the consensus was to continue fishing with the same gears, but as drop-lines for bottom fishing in deep water, thus fishers would still benefit from the experience of using the deep-water lines and circle hooks - the main components of the gears for use around FADs (see Plate 4 e,g,h).

Safety - During all activities at sea, emphasis was always placed on safety and this is not something that local fishers normally address. In order to maximize safety and minimise risk, lifejackets, buoyancy aids, first aid kit and mobile phones were carried on all trips that were made by two vessels, equipped with sail and motor. There was one occasion when engine failure meant the sail was needed and on another occasion, 4 miles south of Kitutia at Mafia, man-overboard was successfully recovered unharmed, assisted by use of a buoyancy aid cast at the drifting fisher. The exercise strengthened the belief in the use of life jackets.

5.5.3 Catches of tuna for July and October by gillnet fleet

For nine consecutive days in July, all offshore gill-net fishing boats at Nungwi were sampled, with length measurements taken of all tuna landed at Nungwi in the mornings. For 94 boat trips, 25 returned with yellowfin, confirming the low availability at the time of the trials. For a few days in September and October, length data were also collected. Over 680 fish were measured, including about 200 yellowfin tuna and 350 kawakawa (see Tables 5 and 6 and Plate 4 a,b).

The abundance of tuna during the July and October visits was confirmed for the general area, though none were caught at the FAD sites themselves. In October, small tuna were seen in surface feeding schools close to the reefs south of Mnemba Island off Matemwe and outside the Kinasi Pass of Mafia). More yellowfin were landed in October but for many days sea conditions reduced fishing effort. From the tuna data shown in Tables 5 and 6, there is some indication that yellowfin and kawakawa landed at Nungwi are slightly larger in October compared to July, with fish reaching about 90 cm and 65 cm respectively.

Date	n	Mean length (cm)	SDev.
06/07/05	110	59.77	3.60
10/07/05	25	62.88	4.15
11/07/05	21	61.00	4.38
12/07/05	17	65.59	3.91
13/07/05	40	62.40	6.41
14/07/05	18	60.22	6.76
15/07/05	36	65.00	4.59
16/07/05	44	64.50	7.64
29/09/05	13	66.46	6.63
01/10/05	9	67.33	3.77
07/10/05	27	65.07	7.43

Table 5 Mean total length for Yellowfin tuna (*Thunnus albacares*) *at* Nungwi, July-October 2005. n = number of fish sampled.

Date	n	Mean length (cm)	SDev.
06/07/05	30	72.83	9.60
10/07/05	17	67.12	7.78
11/07/05	27	68.04	14.44
13/07/05	5	97.00	19.20
15/07/05	18	85.56	15.42
16/07/05	26	70.38	8.76
29/09/05	33	89.03	12.08
30/09/05	30	91.10	10.62
01/10/05	19	86.37	7.92
07/10/05	18	91.67	12.31

Table 6 Mean total length for Kawakawa (*Euthynnus affinis*) at Nungwi, July-October 2005. n = number of fish sampled.

Fishing trials catch data

In July, rough-weather days were spent fishing in the shallower, but more sheltered west of Nungwi (see Fishing Trials Summary, Annex 6). In Mafia in October, access through the Kinasi Pass was not always possible, with high oceanic swell and 15 knot easterly wind. After a few attempts, it was agreed that the gears should be tested in alternatives sites, notably the more sheltered areas to the south of the main Island, beyond Kitutia reef.

At all three sites, FAD gears were rigged for bottom-fishing at 70-120 m. Each drop-line was rigged with ten hook set free for a minimum of 20 minutes before hauling. Three lines were operated as such, usually for two or three hours, generally starting at about 10 am through 1 pm, after which the boats began the return journey to Utende. Travel time to the southern Kitutia grounds from Utende was about two hours. Fisheries data collections were made for all fish caught during the trails. The practicalities of obtaining good quality, ideally squid (but also Indian mackerel or sardine), was a regular challenge, but at all locations mechanisms were developed or adapted to provide bait, with only two fishing days lost for failure to secure bait.

The results were most notable at Mafia, were after 15 days of trial fishing (almost exclusively demersal), about 1,000 kg of fish was landed from three lines (each with 10 hooks), representing 135 kg per-line-hours. Detailed catch data was recorded for five days, during which 465 kg of fish was landed, with an average of 93 kg per day, equivalent to about 100 kg per-line-hour. However, for the total 15 days fishing at Mafia, with 135 line hours, the average yield equates to 7.5 kg per-line-hour, demonstrating a high variability in catch rates.

Table 7 lists the 24 species of main commercial importance caught during trials held in October, 2005. About 60 % of the weight being two species of red snapper, *Lutjanus sebae* and *L. sanguineus* (see Plate 6). The mean total length and weights for these two species of high-values snapper from Mafia, from July to October 2005 were: *L. sebae* 4.22 kg (1.26 SD, n = 53), 64.74 cm (7.09 s.d, n = 53); *L. sanguineus* 3.96 kg (1.00 SD, n = 20), 63.65 cm (6.57 s.d, n = 20). The data shows that almost all fish caught fish are

mature and exceed the length at first maturity (ca. 50 cm) and the minimum size limit set by Australian authorities (56 cm for *L. sebae*) for this species (see Anderson & Ngatunga, 2005).

Species Name	FAO English name*	Family	Location
Caranx melampygus	Blue-spotted trevally	Carangidae	Mafia Island
Caranx ignobilis	Giant trevally	Carangidae	Mafia Island
Seriola lalandi	Yellowtail amberjack	Carangidae	Mafia Island
Elegatis bipinnulata	Rainbow runner	Carangidae	Kipwani, Unguja Is.
Epinephelus chlorostigma	Brown-spotted grouper	Serrandidae	Mafia Island
E. tukula	Potato grouper	Serrandidae	Mafia Island
Cephalopholis sonnerati	Tomato hid	Serrandidae	Mafia Island
Plectropomus maculatus	Spotted coral-trout	Serrandidae	Mafia Island
Pristopomoides filamentosus	Blue-spotted jobfish	Lutjanidae	Mafia Island
Macolor niger	Black and white snapper	Lutjanidae	Mnemba, Zanzibar
Lutjanus sebae	Red snapper	Lutjanidae	Mafia Island
Lutjanus sanguineus	Red snapper	Lutjanidae	Mafia Island
Lutjanus bohar	Two-spot red snapper	Lutjanidae	Mnemba, Zanzibar
Aprion virescens	Green jobfish	Lutjanidae	Mafia Island
Aphareus ritulans	Small tooth jobfish	Lutjanidae	Mnemba, Zanzibar
Lethrinus elongatus	Long-face emperor	Lethrinidae	Mafia Island
Lethrinus conchyliatus	Red-axil emperor	Lethrinidae	Mafia Island
Montaxis grandoculis	Humpnose big-ete bream	Lethrinidae	Mafia Island
Scomberomorus commersoni	Narrow-barred mackerel	Scombridae	Mafia Island/Nungwi
Thunnus albacares	Yellowfin tuna	Scombridae	Mafia Island
Euthynnus affinis	Kawakawa	Scombridae	Mafia Island
Sphyraena barracuda	Giant barracuda	Sphyraenidae	Nungwi 1 FAD
Carcharhinus melanopterus	Black-tip reef shark	Carcharinidae	North Mnemba Island
Trionodon obesus	White-tip reef shark	Carcharinidae	Mafia Island

Table 7 Important fish species caught during fishing trials in October, 2005. * From Bianchi (1985).

After the 50 days of sea trials in the three sites, under various sea conditions, and using the standard offshore local vessels (8-11 m wooden 'mashua'), some important comments on vessel use are needed. Firstly, the vessels are well-built, and apparently do not sink even when flooded (due to buoyancy of the timber in seawater). Secondly, the capability to carry both sail and engine is a benefit that normally allows for at least one passage (to or from the fishing grounds) to be made under sail, thus saving fuel. The sail also serves as a reserve means of propulsion should there be engine problems - a feature relied upon on one occasion. However, there are some negative aspects attributed to the 'mashua' vessels that relate to the weight, manoeuvrability, speed and fuel consumption. Based on the recent experience, it is suggested that fishers consider the much lighter, faster and more manouverable fibre-glass open boat powered by a 40 Hp outboard (see Plate 6g) of an image of hand-line fishers in Papua New Guinea and their equipment).

5.6 Costs and profits in the FAD/Offshore fishery

5.6.1 Present costs

Costs associated with the trials and monitoring trips to sea were recorded yet with only relatively few fishing days (15 on Mafia and 21 on Zanzibar), and mostly during the SE Monsoon season, a true analysis of the financial assets associated with the project is not possible. However, some comment can be about relative costs, but worthy as a start in calculating what is needed by way of catch to encourage adoption by fishers.

The longline gear required to equip a three-man fishing vessel was presented earlier and equates to about US$ 500 of initial capital investment. Daily expenses included fuel and bait and on each fishing trip about US$ 35 of petrol was spent for the 1-2 hours each way voyage to reach the fishing grounds, using a 15 or 25 HP outboard engine on the wooden dhows. A lighter boat (e.g. fibreglass) would significantly reduce fuel

costs and travel time. Suitable wind also occasionally served to considerably reduce fuel consumption. Bait and ice was relatively expensive, averaging about US$ 9 per day, depending on the lunar period and whether fresh or stored (frozen). Thus daily operating costs were about US$ 44.

Catches on Zanzibar amounted to less than 100 kg with most days yielding no catch, while on Mafia, the active demersal fishing that was conducted for 15 days yielded a total catch of about 1,000 kg. The daily average catch was about 90 kg, for only 2.5 hours fishing. At the Utende beach landing site the catches were sold to a range of buyers, including the representative from the Tanpesca fish processing plant at Kilindoni on the other side of the island, which paid the highest, at 800 Tsh per kg (about 75 US cents). Based on the latter price, the gross financial returns from a day's demersal fishing was US$ 72. Once the daily (maximum) operating cost (US$ 44, see above) is deducted, the net daily profit is US$ 28. With three fishers required to operate the vessel and gears, the return to the individual fisher, following a 50% deduction for vessel and engine owner, is US$ 14 divided by three fishers. It is anticipated that if fishers were operating without independently, the daily operating costs could be reduced, perhaps to half the figure above, thus increasing the return to individual fishers to over US$ 10 per day.

5.6.2 Returns from existing local fisheries

Recently analysed data (MIMP *pers. comm*.) from the 2003 records shows that handlines yield about 15 kg of (mainly reef) fish. Only the use of the beach seines yielded higher rates per fisher, with approximately 20 kg on average. While recognising that Mafia data is of variable sample size (occasionally insufficient for strong conclusions to be drawn) and subject to seasonal variation, it allows for a very basic comparison of gears and yields.

Of the four gear types reported for Mafia, the most comparable is that of handline fishers because they are catching fish species that would sell for equivalent prices to those fish caught from FAD or deepwater demersal fisheries. The other gears, notably 'nyavu kupweleza' (purse seine-net) and 'mtando' or circling net) catch mainly small species (e.g. sardine) or small shoaling benthic species. Yields from the 'jarife' or shark net, mainly used inshore, yielded slightly less than handlines. For the latter, fishers' average financial return was 13,943 Tsh per trip (or day). Using the US dollar exchange rate of the time (about 1,000 Tsh to 1 US$), this equates to US$ 13 per day.

Data from 11 months of monitoring two gill-net fishing boats at northern Zanzibar in 1994-95 showed that the average catch of seven fish (about 40 kg) per night generated an average income of about US$ 17 per month per fisher for 15 days of fishing. At that time, this yield was attracting fishers away from reef fisheries and into the offshore pelagic fishery (see Richmond & Mganwa, 1995), a trend that continues to this day.

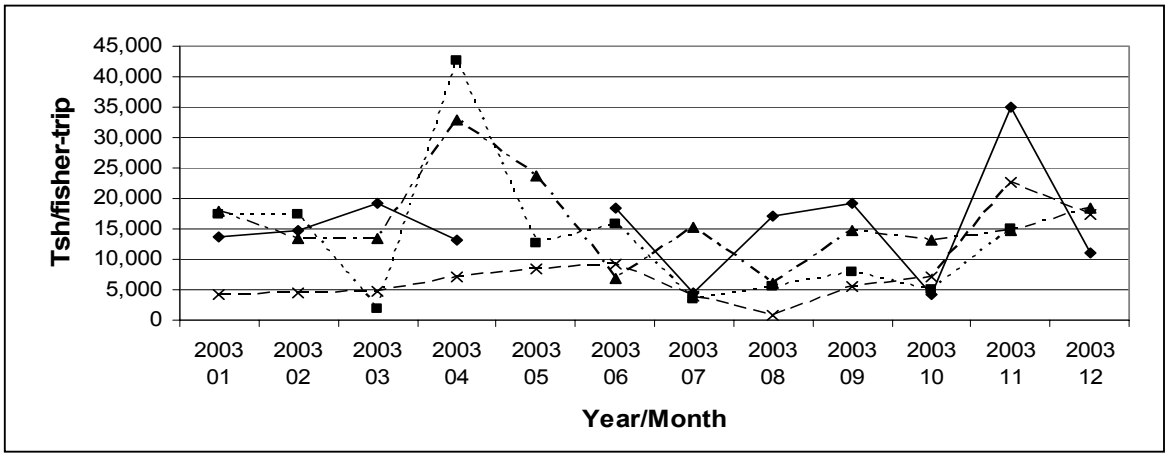

Figure 11 Mafia catch rates (Tsh per fisher per trip).

Despite the limited details above for comparison, it may be possible to conclude that for the FAD or offshore fishery to be adopted, fishers need to secure yields above 50 kg of quality fish that are sold for the highest prices (e.g. tuna, red snapper, grouper).

6 DISCUSSION

6.1 Private Sector Involvement

The presence of viable commercial activities is a critical aspect of the development of a FAD fishery. As has happened elsewhere in the world, FADs are expected to attract not just the artisanal fishers but larger operations as well. A competitive and diverse fishing and marketing industry that can offer different solutions to the exploitation of FADs is now developing, particular off Mafia Island. Middle-men will also be involved by supplying vessels and equipment to FAD fishers and purchasing their catch, as they do in all other fisheries in the country (Anon, 2001; Jiddawi & Yayeh, 2003).

A higher level of commercialization is now quietly developing as a fishing company in the country (name withheld as the information is commercial-in-confidence) has started to investigate the opportunities for establishing its own FAD fishery, including the purchase and deployment of additional FADs and the introduction of improved vessel technology. A second company has recently purchased three long-liners for tuna fishing in the EEZ. It remains to be seen exactly how these developments unfold and the extent to which the crew is employed from within the local pool of manpower or sourced from within the company's existing staff (i.e. from outside the locality). Some hotels and resorts operating around Mafia Island and Zanzibar are also starting to take advantage of the new dive and fishing opportunities that FADs offer and although they are perhaps unlikely to deploy FADs themselves, they are an important economic asset to the economy and dive operators may be able to influence future government involvement in FAD fisheries in Tanzania and Zanzibar. It may also be that groups of hotels could work together to contribute towards the costs of FAD deployments, something that has been seen for example in the Mamanuca Group of islands in Fiji, in the South Pacific Ocean (Poni, *pers comm*.). On Zanzibar, two other beach hotel have expressed interest in participating and possibly supporting continued monitoring.

The present activities on Zanzibar were largely managed through the DFMR, Zanzibar, but the project did develop a relationship with a hotel enterprise, CCAfrica/Mnemba Island Resort that provided funds for the purchase of two FAD units. CCAfrica saw FADs as a means to contribute towards local community development and to balance some of their impact on local communities, in this case the closure of the island and some of its surrounding marine resources. Adjacent villages had historically used the Island as a fishers' camp and the reef for fishing and the closure represented an important loss of access to marine space and marine resources for these villages. The main act of this annexation had taken place prior to CCAfrica's involvement with Mnemba Island, when the government of the day (1989) was perhaps less sensitive to the needs of local communities, but nevertheless the closure has persisted. CCAfrica very has had little involvement in the project but since the March 2005 deployment has assisted with FAD monitoring and is supportive of the project.

6.2 Export Policy for Marine Finfish

There are no restrictions on the export of marine finfish from Zanzibar, although the current market is dominated by marine invertebrates rather than finfish. On the mainland however, export of marine finfish was proscribed until 2004, although there is some debate as to whether this ban covered tuna and tuna-like species or only demersal finfish species. But a new directive has recently been issued by the Fisheries Division to offer, for a period of one year in the first instance, four export licenses (see Anderson & Ngatunga, 2005). One of the key features of the Fisheries Division policy in relation to the development of the export fishery and alleviating poverty is that the commercial processing industry will not be allowed to develop their own fishing capacity but will have to buy directly from *independent* artisanal fishers.

Recognising the limitations of the current fishing fleet in terms of vessel and gear technology, the Fisheries Division proposes that the industry invests in local fisheries by providing new fishing technology to allow fishers to access fishing grounds/resources previously out of their range of operation, as well as to improve post-harvest treatment (Section 5, Anon, 2003). Abila (2003) noted that a relatively limited number of companies own or control the other enterprises relating to fish supply acquisition, transportation, product distribution and export marketing on Lake Victoria. Just how independent artisanal FAD fishers would remain is open to question, but the experience from Lake Victoria is not necessarily very encouraging. Bokea & Ikiara (2000) indicated that the dominance of the processing (export) trade by few large commercial interests led to fishers being controlled by their credit relationships with large buyers, and because individual fishers contribute only a small amount to the total daily landings, they are 'price-takers'. There are sound economic reasons for vertical (and

horizontal) integration, because such companies will inevitably profit from economies of scale that can provide for efficient acquisition, in the required quantities, to satisfy the demands of the export market. Well-established companies will also be in a better position to cover the transaction costs of establishing a new market (Anderson & Ngatunga, 2005). Whether this pro-artisanal strategy will affect the development of a FAD-based fishery by commercial companies in mainland Tanzania remains to be seen

7 CONCLUSIONS AND RECOMMENDATIONS

The FADs presently deployed in Tanzania have proven that the design works and can withstand the temporary emersion when currents exceed 2-3 knots, through their success at attracting tuna as catches to the local artisanal fishing fleet has yet to be proven, their continued trial is strongly recommended.

In addition to serving to increase fish from offshore resources, FADs can act as a motivation or reference point (for fishers and managers) to begin to maintain a presence in the 12 miles of Territorial Seas off Mafia and Zanzibar. Twice in 2005 illegal fishing by foreign, industrial fishing vessels (a longliner and a purse seiner) were observed within the 12 miles off southeast Mafia and frequently local residents report seeing vessels and hearing them during the night. If nothing else, monthly FAD monitoring visits should be made to strengthen the monitoring, control and surveillance of these inshore waters, perhaps in conjunction with the MCS project operating from Mbegani. The conclusion from the South Pacific Commission (SPC) is that "vertical long-lining around FADs can be a productive and potentially lucrative activity". As such the SPC is actively promoting FAD-based vertical longlining to draw greater benefits from their tuna resources, improve quality of food available to the population, and to divert fishing effort away from lagoon stocks that are often overfished. We believe this situation, and potential, is equally applicable to much of East Africa and especially to Mafia Island.

1. Arrange and conduct a 'wind-up' meeting with fishers in Zanzibar and project partners and discuss future options.

2. Seek funds to combine the recent October 2005 video footage of fishing trials with the previous footage (of FAD construction and deployment, as used by HandsOn for the Earth Watch series), to produce a final product of the whole trial. The final product should be 25-20 min. duration and be a valuable training tool, possibly translated into Swahili.

3. Provide information and details of the project to private companies and EPOPA.

4. Seek support to continue monitoring the fishery and conduct a third phase of trials in the next few months to fully test whether the FADs attract tuna that can be caught with the gears used. By conducting more fishing trials during the coming five months of the NE Monsoons this will provide much more data that presently collected, to determine whether or not the FADs function as a fishery enhancement tool.

5. If continued monitoring can be coordinated for the coming six months, over a full NE Monsoon fishing season, then it might be possible to prepare some of the policy briefs originally proposed. In particular, significant information and data would be generated on access, gear performance and tariffs, marketing and export issues, and cooperatives.

6. Design a FAD monitoring and maintenance schedule, and circulate to project partners.

7. Explore the deepwater demersal fishery of southeast Mafia in a controlled manner, involving local fishers, and considering the use of five fibreglass vessels as shown in Plate 6 g.

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9 LIST OF ACRONYMS

CCAfrica	Conservation Corporation Africa (Mnemba Island)
CMAs	Collaborative Management Areas
DFiD	Department for International Development
DFMR	Department of Fisheries and Marine Resources (Zanzibar)
DRC	Democratic Republic of Congo
DWFN	Distant Water Fishing Nations
EEZ	Exclusive Economic Zone
EPOPA	Export of Organic Products from Africa
EU	European Union
FAD	Fish Aggregation Devices
FFEM	Fonds Français pour l'Environnement Mondial
FMSP	Fisheries Management for Science Purposes
GEF	Global Envir0onment Facility
HACCP	Hazard Analysis Critical Control Point
IMS	Institute of Marine Sciences
IOTC	Indian Ocean Tuna Commission
IUCN	The World Conservation Union
MACEMP	Marine and Coastal Environment Management Project
MALNR	Ministry of Agriculture, Livestock and Natural Resources (Zanzibar)
MANREC	Ministry of Agriculture, Natural Resources, Environment and Cooperatives
MBREMP	Mnazi Bay Ruvuma Estuary Marine Park
MCS	Monitoring, Control and Surveillance
MEAD	Marine Education, Awareness and Biodiversity Programme
MFDC	Mbegani Fisheries Development Centre
MIMP	Mafia Island Marine Park
MNRT	Ministry Natural Resources and Tourism
MPA	Marine Protected Area
MPRU	Marine Parks and Reserves Unit
MRAG	Marine Resources Assessment Group
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organisation
NSGRP	National Strategy for Growth and Reduction in Poverty
SADC	Southern Africa Development Community
SPC	South Pacific Community
TAFIRI	Tanzania Fisheries Research Institute
TCMP	Tanzania Coastal Management Partnership
TCZCDP	Tanga Coastal Zone Community Development Programme
URT	United Republic of Tanzania
UDSM	University of Dar es Salaam
WWF	World Wide Fund for Nature

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ANNEXES

Annex 1 - Reference plates

Annex 2 - Tanzania FAD Programme Guidelines

Annex 3 - “Notice to Mariners”

Annex 4 - Sample weather sheet

Annex 5 - FAD Monitoring

Annex 6 - Fishing Trials Summary

Annex 7 - Promotional materials

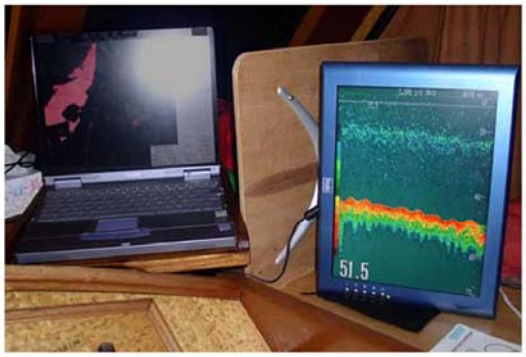
Annex 1 - Reference plates

Plate 1

a) Gill-net fishing in Pemba Channel.

b) Examining gill-nets at Nungwi.

c) Local particpation on bathymetry surveys.



d) Deep-water sounder and chart screen.

e) Making reinforced concrete anchors.

f) Preliminary survey of FAD sites at Mafia.

g) Splicing nylon and polypropylene ropes.

h) PVC-coated steel wire and 'aggregator' tape.

Plate 1

Plate 2

a) Swivel, nyalite rope connector and splice.

b) Cable clamps and thimbles on 16mm wire.

c) MV Mafunzo loaded and travelling to sites.

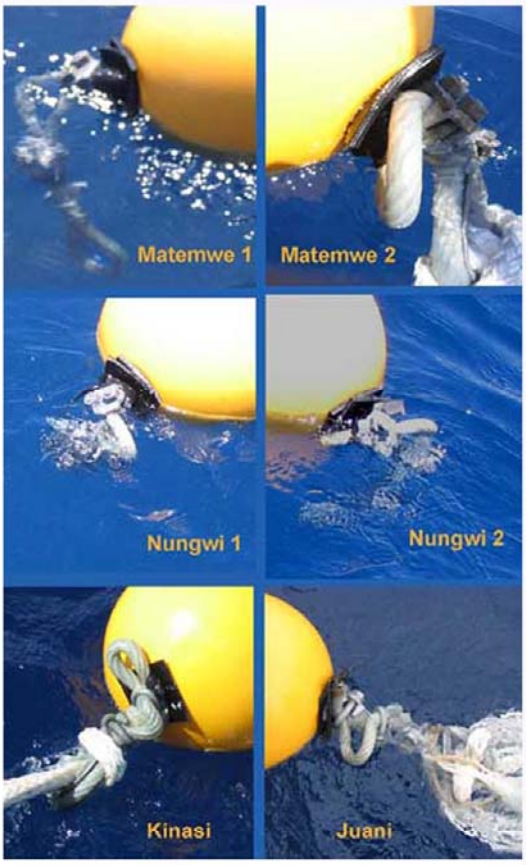
d) FAD deployment from MT Solksy.

e) FAD anchor release from MT Solsky.

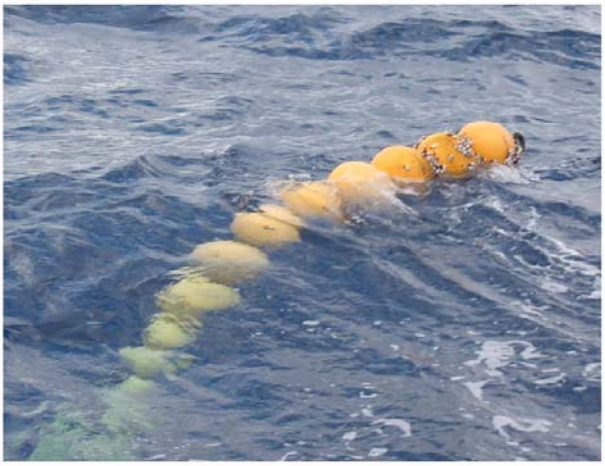
f) FAD Nungwi 1 in March 2005.

Plate 3

a) Kinasi FAD, Mafia, March 2005.



b) End thimbles and clamps after 2 weeks.



c) Kinasi FAD, Mafia, October 2005.

d) End thimble on FAD M2, in October 2005.

e) Purse seiner fishing off Mafia, May 2005.

f) Long-liner fishing in MIMP, March 2005.

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a) At sea off Nungwi, July 2005.

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g) Barracuda caught at FAD N1, October 2005.

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a) 7 kg yellowfin tuna, Mafia, October 2005.

b) Supply of good bait required special plans.

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d) 3 hour catch from bottom fishing at Mafia.

e) Deep-water hand-line with red snapper.

f) Selection of deepwater species from Mafia.

g) Deep-water hand-liners, Papua New Guinea.

Annex 2 - Tanzania FAD Programme Guidelines

No. 1 - Equipment Import and Logistics

No. 2 - Site Surveys

No. 3 - FAD Design

No. 4 - FAD Deployment

No. 5 - FAD Fishing Gears

Tanzania FADs Programme

Guideline No. 1 - Equipment Import and Logistics

The purpose of this guideline is to summarize the key issues related to the logistics of ordering, purchasing and importing FADs equipment into Tanzania, East Africa. Although ideally materials would be sourced from within the country, in practice obtaining the often high-specification FAD equipment is not possible in East Africa, thus FAD programmes require extensive lead-in periods for equipment to be sourced, ordered and then imported - ideally a minimum of three months is advised. Port charges and clearing agent fees must be included into FAD Programme budgets.

1. To start the import process an **Import Declaration Form (IDF)** must be purchased from importer's company bank, although agents can complete the IDF. Cost of an IDF varies by country but in Tanzania it is currently 1.2% of the Free on Board (FOB) value (regardless of the FOB value). To purchase and complete the IDF some detailed information from the supplier is required, therefore a preliminary order and **Proforma Invoice** is needed from supplier. Information required are:

- Specification and description of quantity/quality of equipment;
- FOB value;
- Freight Value (if applicable);
- Customs harmonised commodity code; currency of payment;
- Mode of transportation;
- Goods country of origin;
- A proforma invoice (the number should be the same as the Final Invoice).

2. On completion of the IDF it mist be submitted back to the bank, along with any proforma invoices. It is recommended that the IDF is submitted **at least 10 working days** prior to the goods arrival into Tanzania to avoid delays.

3. COTECNA/TISCAN (a registered subsidiary of COTECNA in Tanzania) collects IDFs from banks on a daily basis.

4. COTECNA/TISCAN issues/transmits Inspection Orders to COTECNA offices in charge of respective countries of export.

5. Upon receipt of an Inspection Order from COTECNA/TISCAN, the COTECNA office in charge of the country of export sends exporters a **Request for Information (RFI)**. The exporters must complete and return the RFI as soon as possible.

6. Exporters must provide the **final documentation** (final invoice, shipping documents and the packing list) to the COTECNA office in charge of the country of export **for each shipment** to Tanzania.

7. COTECNA carries out price analysis to determine dutiable value of the goods in accordance with the Agreement on Customs Valuation (ACV), as well as Customs Tariff Classification. Information is electronically transmitted to COTECNA/ TISCAN in Tanzania.

8. In turn, COTECNA/TISCAN issues a **Provisional Classification and Valuation Report (PCVR);** this provides an opportunity to Appeal the PCVR if needed. Importers must sign and return the PCVR to COTECNA/TISCAN along with an **Application for a Single Bill of Entry (SBE)**.

9. COTECNA/TISCAN then drafts and issues a **Final Classification and Valuation Report (FCVR)** and a SBE to importers, which are both mandatory documents for Customs clearance in Tanzania. For IDFs below USD5,000 (FOB), COTECNA/TISCAN performs valuation/classification services locally and issues a **Declared Valuation and Classification Report (DCVR)** to importers.

10. All shipments are subject to the COTECNA/TISCAN **Computerised Risk Management System (CRMS)** which automatically computes a level of physical intervention/inspection to be performed by Customs.

Note: Importers must make pre-payment of all Duties and Taxes as per COTECNA/TISCAN's assessment indicated on the SBE. Pre-payment to be made at designated bank and importers can only collect original FCVR and SBE after pre-payment.

Key Experience: It is cheaper and easier to import directly from a supplier in the country of origin of the equipment rather than through an agent based in another (third) country. A FAD constitutes a type of fishing gear, which is duty-free in Tanzania. Shipments must be specified as 'House to House' to facilitate import process. Payments to suppliers are best made by Telegraphic Transfer (TT). The supplier/exporter having to declare separately the value of the equipment, the freight costs and the insurance costs and send provide a Proforma either by courier or a scanned graphic image which can be printed out.

Shipments carried by large container vessels from Asia/Europe are often transhipped to smaller vessels at Jeddah or Salala before transportation to East Africa. This can cause a delay in the arrival of equipment. If there are many vessels in port will be delays in release of equipment and payment of additional port charges are likely. Important to ensure agent has someone available to make *frequent and regular* follow-ups to expedite clearance of equipment. Customs officials may only work Monday to Friday and it may take another 14 days *after* the vessel has arrived in-country for equipment to actually be released from Customs.

Useful Websites: Dictionary of Common Trade Terms: www.exportbureau.com/dictionary.html
COTECNA (Worldwide): www.cotecna.com

Costs: Shipment cost from most parts of the world to Tanzania for a 20 foot container is approximately US$ 2,000. Clearance costs for importation into Tanzania, assuming zero import tax and using local agent, should be under US$ 2,700 per full container consignment, depending on storage fees and other Tanzania-based port and handling charges.

Tanzania FADs Programme

Guideline No. 2 - Site Surveys

The purpose of this guideline is to summarize the key issues related to selecting the correct site for placing the FADs, since generally it is very difficult and costly to change the position of a FAD once it has been deployed. The South Pacific Commission (SPC) Manual Vol. 1: Planning FAD Programmes (Anderson & Gates, 1996) is the basis for much of the guideline.

1. Pre-selection surveys

This should include discussion and site visits with the local fishers who are to benefit from the FADs, with special focus on influence of wind and currents, especially in East Africa where the few offshore fishers tend to rely on sail power. The discussions should also cover the presence of tuna, and possible customary fishing grounds or other traditional uses of the proposed sites. Information on offshore shipping and industrial fishing activities is also gathered at this stage.

Close scrutiny of relevant charts is necessary before selecting the approximate areas. Relevant UK Hydrographic charts for Tanzania include: No. 3310 Dar es Salaam to Wasin Island; No. 1032 North Mafia to Kilwa Point; No. 3308 Cabo Delgado to Fanjove Island.

2. Physical factors

a) Sea floor - The ideal situation is a flat seabed, without pinnacles where the FAD mooring rope might abrade, and lacking crevasses or canyons into which the anchor could drag under strong currents, hence submerging the FAD.

b) Depth and distance from shore - The South Pacific experience suggests that FADs function best when placed at least two miles from the nearest reef. In East Africa that will probably mean the water depth will be between 300-700 m.

c) Currents - In East Africa, currently are likely to often exceed 2 knots, thus the FADs float system will certainly submerge, at least during the SE Monsoon season when the southern East Africa Coastal Current is strongest (3-4 knots). It is unlikely that there will be many locations that do not experience such currents, thus FADs need to be designed and maintained for periodic submergence.

d) FAD spacing - There is no firm rule on spacing of FADs, though it is believed from SPC programmes that in general FADs should be set over 10 miles apart, but that where conditions (e.g. restrictions in depth and distance) require FADs to be closer together, benefits may arise from greater access by fishers and thus a reduction in possible conflict.

3. Infrastructure, experience and markets

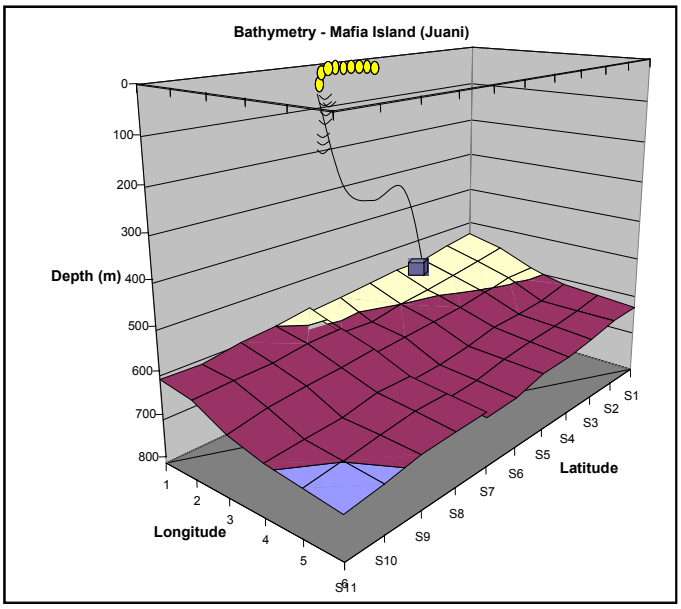
The beneficiaries must have the means to reach the FADs, thus suitable boats, and experience in use of appropriate fishing gears to catch fish at the FADs. The product, mostly tuna, must have a ready market locally. Ideally, ice should be available to improve quality of the product.

Once the approximate area for the FADs has been identified the following detailed steps are needed:

A. Site visit with local fishers - This should be done using local boats and serves also to test whether their perceptions of distance and time are correct and the proposed area really is suitable in terms of distance from shore and local access.

B. Detailed deepwater echo sounder survey - A deep-water sounder (model JRC NJA-1130) with a 3 KW transducer was mounted specially for the present survey and is strongly recommended. Mounting of the sounder depends on the hull design of the survey vessel. A pre-drawn grid (of 2 x 2 miles) is navigated (at 4 knots), with sounder readings synchronized with the GPS, producing the 3-D charts output of the seabed (see next page). The surveys allow the precise drop site to be selected. **Cost:** A one-week charter of suitably equipped vessel may cost US$ 3,000 - 6,000 depending on distances.

C. Agreement, support and authorization from National Authorities - FAD programmes need to be fully supported by relevant national institutions (e.g. departments of Fisheries, harbour authorities, etc.).

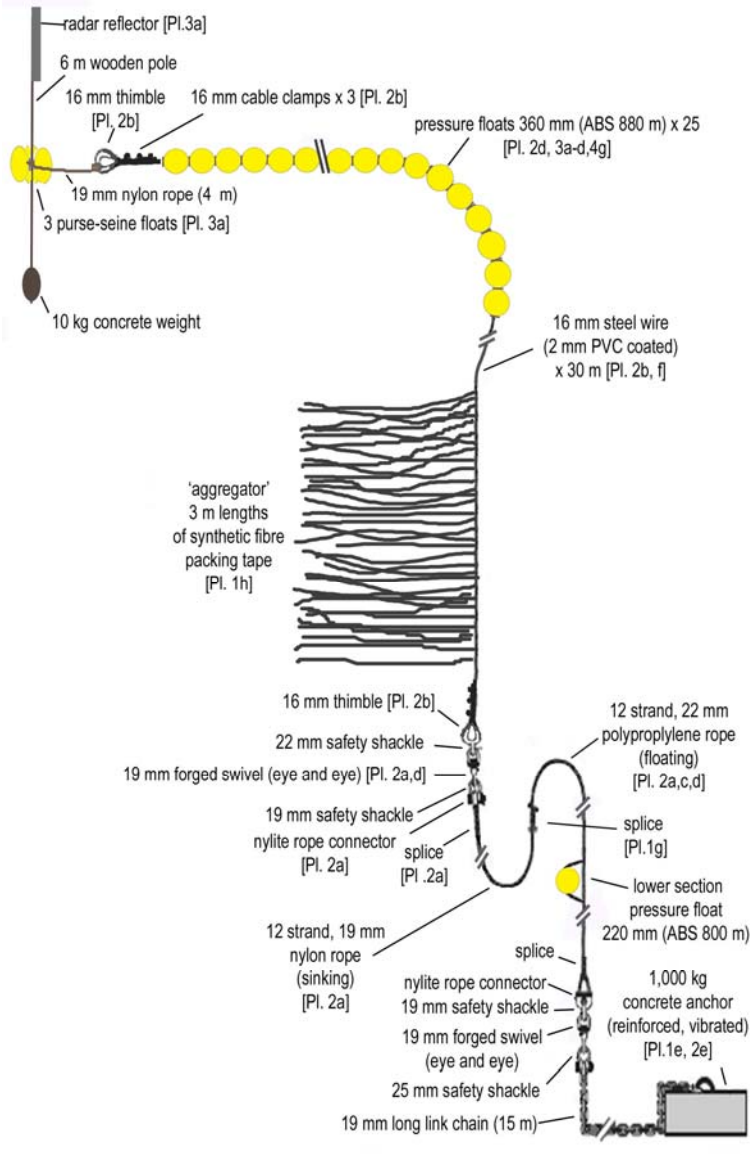


Three dimensional plots of six sites (2x2 mile grids) surveyed off the coast of northern Unguja Island (Mnemba and Nungwi) and southeastern Mafia using the methods described above.

Tanzania FADs Programme
Guideline No. 3 - FAD Design

The purpose of this guideline is to summarize the key aspects related to FAD design, construction and maintenance, based on the experiences gained from the deployment of nine FADs in Tanzania. The final design used in Tanzania is illustrated below (not to scale). Although ideally materials should be sourced from within the country, in practice obtaining the high-specification materials necessary is not always the cheapest option and may not even be possible in the East Africa region. With the exception of flagpole, aggregator materials and anchors, all material were imported.

FLOAT SYSTEM - 25 plastic **pressure floats** of 20 kg buoyancy, with 40 mm centre hole rated to 800 m depth, separated by rubber spacers, along 30 m PVC-coated **steel wire** (18 mm, PCV coated (2mm)). The wire is necessary in areas where theft might be a problem, such as in East Africa.



AGGREGATOR - To the lower portion of the wire section 20-40 **PVC packaging strips** or other material (e.g. synthetic sacking, nets ropes) are attached, forming an 'aggregator' that increases surface area for growth of marine life (e.g. algae, barnacles, soft corals, etc.) which in attract small fish for shelter and increases presence of FAD in the water column. It may be worth fixing additional 'aggregators' to the float section.

FLAGPOLE AND REFLECTOR - A 6 m flagpole (treated wood) is attached to the FAD using 16 mm nylon rope. The pole is weighted at one end and floated centrally by three purse-seine floats. To the upper portion of the poles were secured a tube-model radar reflector. The reflector was recorded on deployment ship's Radar from 5 miles. **Note**: all flagpoles were stolen from the Zanzibar FADs within a week, mainly because of the desirability of the purse-seine floats. It can be argued that there is limited value in having a flagpole, especially since the float system totally submerges periodically. During the main fishing season, temporary (sacrificial) flagpoles may be useful to assist for fishers locate the FADs, though after a few visits, fishers were able to relocate the FAD with ease.

ROPES AND CONNECTIONS - The upper section (30%) uses sinking nylon rope (19 mm, 12-strand) and the lower portion (70%) utilizes buoyant polypropylene rope (20 mm, 12-strand). Splicing 12-strand require considerable skill. Lengths of rope depend on depth, with current experiences using scope of 1.3-1.6 x water depth. Choice of 3-strand ropes or the more expensive multi-strand ropes has changed as a result of recent research in the Pacific and 3-strand rope is now seen as adequate for FAD moorings. Rope links comprise Samson *Nylite* **rope connectors** (size 3, 22 mm), **safety shackles** (with SS cotter pin, sizes 20, 22 and 25 mm) and **forged swivel** (eye and eye), 22 mm.

ANCHOR AND CHAIN - Comprises long-link chain (19 mm) and a concrete anchor of 1,000 kg (using non-marine sands and aggregate, steel-reinforced and vibrated).

FAD MAINTENANCE - Every six months FADs should be inspected. This requires a small boat and calm weather, during which the entire upper section (upper 30 m of wire, including floats, cable clamps, thimbles, swivels and nylon splice) should be inspected by commercial divers; parts should be cleaned and replaced as necessary.

COMPONENTS AND COSTS FOR CONSTRUCTION OF A SINGLE FAD

Figure	Description and material	No. /length (m)	Unit cost (US$)	Total cost (US$)
-	Flagpole Reflector Purse-seine floats	1 1 3	10.0 50.0 54.0	10.0 50.0 54.0
-	Thimble (galvanized) 16 mm	2	4.5	9.0
-	Cable clamps 16 mm	6	2.8	16.8
	Hard plastic pressure floats	25 + 1[+]	61.8	1,606.8
	Steel wire 16 mm PVC coated (2 mm)	30 m	130.0	130 .0
	Safety shackle (hdg-lcs*, with SS cotter pin)	19 mm x 2 22 mm x 1 25 mm x 1	5.2 6.9 10.5	10.4 13.8 10.5
	Forged swivel 19 mm (eye + eye)	2	5.2	10.4
	Samson *Nylite* rope connector	2	48.0	96.0
	Nylon (sinking) rope (19 mm, 12 strand)	150 m	365.9	365.9
	Polypropylene (bouyant) rope (22 mm, 12 strand)	600 m	700.0	700.0
	Long-link chain (19 mm)	15 m	320.0	320.0
	Concrete anchor	1	1	350
			Subtotal	**3,753.6**
Shipment cost - components for six FADs can be included in a 20ft container (@ US$ 2,000 shipment) thus 1/6th part thereof:				330.0
IDF form process fee (1.2%)				45.0
Clearance costs for importation into Tanzania, using local agent (@ US$ 2,700 per full container consignment) thus 1/6th part thereof:				450.0
Total cost of components, shipment and clearance of a deepwater FAD in Tanzania				**4,578.6**

* Hot-dip galvanised, low-carbon steel. [+] single float used in lower section to raise lower connection.

The above summary table of equipment (above) is reproduced courtesy of the Secretariat of the Pacific Community (Chapman *et al.,* 2005). Greater detail is available in the main document.

Suppliers - For ropes it is advised that either *Marlow Ropes UK Ltd* (www.marlowropes.com) or *Hyo Jin International Corporation* of South Korea (hyojinint@netsgo.com; www.hjint.co.kr) is contacted as they are known to be reliable and the South Korean company already has experience of supplying ropes to Tanzania. *Hyo Jin International* can also provide the majority of the remaining equipment, the centre-hole hard plastic pressure floats, shackles and swivels. It is recommended that some spare items are included in the order.

Nylite rope connectors are recommended to provide protection against abrasion and the eye-splices working free. They are produced by *Samson Rope Technologies* (SRT) based in the USA and can be ordered over the internet (www.samsonrope.com; custserv@samsonrope.com) and are delivered by airmail. *SRT* sell the rope connector (spool and shield) together with their own shackle but these shackle components are expensive and are designed for a smaller shackle-pin than a FAD requires so it is recommended that hot-dip galvanised shackles are purchased separately, for example from *Hyo Jin International*. The nylite spool will have to be drilled out to fit the new bolt-pin but using a drill press this is a simple operation.

Tanzania FADs Programme

Guideline No. 4 - FAD Deployment

The purpose of this guideline is to summarize the key issues related to the deployment of FADs in East Africa, particularly Tanzania. Recommendations from the South Pacific FADs are well documented in SPC manuals, especially Volume 3 (Gates *et al.*, 1998) and are included in this guideline, combined with experiences from the Tanzania deployment of nine FADs between April 2004 and March 2005. The three main aspects of deployment that are addressed here.

Suitable vessel

Almost the single most important equipment needed is a vessel that can safely load, transport and deploy the FADs at the required sites. There exist some methods of adapting small fishing boats for deployment, but in practice, when the entire components for a single FAD can exceed 2,000 kg and occupy considerable space, the vessel needs to have adequate open deck space for assembly and controlled deployment. The Tanzania experience found that two such vessels were locally suitable and both were successfully chartered. These were:

- MT Solsky tugboat from Alpha Logistics Tanzania Ltd. (see plates a, c, d).
- MV Mafunzo training stern trawler from Mbegani Training Centre (see plate b).


a


b

Fishing trawlers may also be suitable, of which about 30 are present in the country, although timing may be critical to avoid seasons when vessels will be engaged. Other arrangements might use a barge with crane and small tugboat, depending on distances. It is important that vessels have Seaworthiness and Survey Certificates.

Deployment procedure

Once the vessel is located at the correct drop site, the FAD is ready to be deployed. The most recommended, and by far the safest method of deploying a FAD is to follow the 'anchor-last' procedure. For this, the float section is first lowered over the side of the deployment vessel (see plate c) followed by all the ropes and chain and finally the anchor is cut away or lowered into the water (plate d). This is easiest done if the vessel holds it's position in the current/wind while the float section and rope drifts astern, or by navigating in a circle. The method avoids the danger of rope snagging or knotting on deck or around the feet of deployment personnel!


c


d

Deployment costs

Chartering a suitable deployment vessel is likely to be a significant cost for a FAD programme, equal to or more than the cost of a single FAD, thus it is essential that all equipment be carefully assembled and tested beforehand. Fuel costs are likely to be a major component of the charter depending on distance. The deployment events undertaken during the Tanzania FAD Programme cost between US$ 6,500-10,000 from Mbegani to all sites at Zanzibar and Mafia. If VAT exemption is possible, savings on charter and fuel can be considerable.

Tanzania FADs Programme

Guideline No. 5 - FAD Fishing Gears



The purpose of this guideline is to summarize the key issues related to fishing gears for effective use around deepwater FADs such as the six FADs present in Tanzania. The choice of gears benefited from inputs from the Seychellois, British and Canadian master-fishermen that have participated in the Tanzania FAD trial, as well as local fishers and from the comprehensive SPC Manual (Preston *et al*., 1998), from which the illustrations below are based.

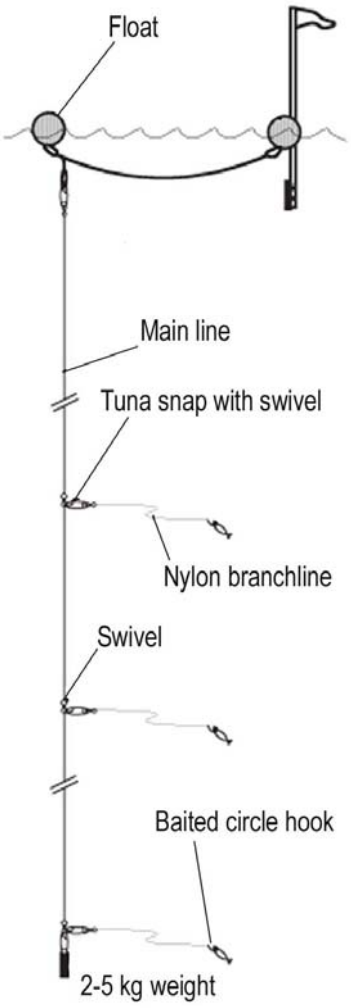
Vertical longlines

The basic arrangements of fishing gear recommended for use around FADs is based on the vertical longline for which several options and modification are possible. The two main arrangements are the hand line and drop line, but the lines can also be used for surface trolling.

- Hand line - use in 30-70 m depth, either when tied off on the FAD or drifting (see figure below).
- Drop line - for use in 60-300 m depths, free-floating.
- Trolling line - usually 3-4 rigged per vessel.

The components for equipping one vessel with longlines (for use as hand line or free floating drop lines) are listed in the table below. Prices refer to purchases from the Seychelles, with assistance of local fisheries department, though suppliers exist in the UK and South Africa. Except for tuna snaps, most of the gear can be purchased in Tanzania, though most importers have little demand for circle hooks.

Circle hook



Items for equipping a single (4-man) fishing vessel for FAD fishing	**Quantities**	**Price** (US$)
Float - ideally hard pressure long-line float, 10 litre (or several purse seine floats), with marker buoy and flagpole preferably.	1-3 per line, 10 total	70
Mainline - braid line (4 mm, nylon, woven, 200 kg test) or polypropylene equivalent.	3 x 400 m roll	200
Tuna snaps - with swivel for attaching to branchlines.	10 per line, 30 pcs. total	75
Circle hooks - Mustad, size 13/0, or Japan tuna hook size 3.6 mm. 5-10 per line.	100 incl. spares	25
Branchlines - nylon monofilament (no. 180; 50 kg test less than mainline) 3-5 m length	100 m roll	12
Swivels (No. 5)	50	70
Subtotal (longling gears only)		452
+ Cold box (for bait)	1	40
+ Steel gaff	2	30
+ Trolling lures	10	80
Total (longling gears + additional items) US$		**602**

Fish finder

In additional to the list above an echo-sounder or fish finder is a useful equipment. For the October fishing trials, a Garmin 250, with greyscale 8x8 cm display and 4000 Watt (peak to peak) transducer, was mounted on the local vessel prior to each fishing or FAD inspection trip. At a cost of about US$ 450, the sounder worked very well and is recommended, especially for determining the depth of the tuna around the FAD (not proven in the present study) and if new grounds are being sought (e.g. Mafia for bottom fishing).

Safety

For all fishing trials (and FAD inspections) using local vessels during the Tanzania FAD Programme, safety was an important consideration and can be increased by adopting the following measures:

- use of TWO vessels when fishing offshore
- vessels equipped with outboard engine and sail
- mandatory presence of life-jackets aboard all vessels
- use of mobile phones or radios
- first aid kit

Care of catch

The use of ice greatly increases the condition and value of fish, especially ‘hot’ fish such as tuna. Bleeding of tuna also improves the quality of the meat, by reducing the amount of blood that rests in the meat when the fish dies.

Annex 3 - "Notice to Mariners"

Tanzania Ports Authority

Office of the Director General
One Bandari Road Kurasini P.O. Box 9184 Dar es Salaam
Telephone: (255-22) 2110371/9 Fax (255-22) 2113432
E-mail dets@tanzaniaports.com

Our Ref: EN/3/6/11 Friday, May 27, 2005

Dr. M. D. Richmond
Managing Director
Samaki Consultants Limited
P. O. Box 77143
DAR ES SALAAM

Dear Sir,

RE: NOTICE TO MARINERS NO. 1 / 05

DEPLOYMENT OF FISH AGGREGATION DEVICES (FADs) OFF THE COAST OF TANZANIA

Please be informed that the information regarding the above subject has been promulgated in Admiralty Notices to Mariners, Weekly Edition 20 dated 19th May 2005.

Please see details on Notice No. 2343(T)/05 in the attached copy of Admiralty Notice to Mariners.

Yours faithfully,
For TANZANIA PORTS AUTHORITY

Eng. F. A. Maro
For DIRECTOR GENERAL

2303-2447/05

* Charts:
1032
2929
3310

27/5/2005

ADMIRALTY CHARTS AND PUBLICATIONS

ADMIRALTY NOTICES TO MARINERS

Weekly Edition 20

19 May 2005

CONTENTS

Mariners are requested to inform the UK Hydrographic Office, Admiralty Way, Taunton, Somerset TA1 2DN immediately of the discovery of new dangers, or changes or defects in aids to navigation and of shortcomings in Admiralty charts or publications. Copies of form H 102, which is a convenient form on which to send in a report, may be obtained gratis from any Admiralty Distributor or the reproduction at the end of Section VI of the Weekly Edition of Notices to Mariners may be used. A copy of the form, which may be used as a pro forma, is also printed in the Mariner's Handbook (NP 100).

In addition to postal methods, the following additional communication facilities are available:

Notices to Mariners Website	Web: www.ukho.gov.uk
Searchable Notices to Mariners	Web: www.nmwebsearch.com
Urgent navigational information:	Fax: +44(0)1823 322352 Telex: 46464 Phone: +44(0)1823 723315 e-mail: rnwuser@ukhornw.u-net.com
Other navigational information:	e-mail: hdcfiles@ukho.gov.uk
General enquiries:	e-mail: helpdesk@ukho.gov.uk
General Website	Web: www.ukho.gov.uk
Other matters:	Fax: +44(0)1823 284077 Telex: 46274

For UKHO use only 205420

2343(T)/05 TANZANIA - Territorial Waters - Fish havens.

Source: Tanzanian Harbours Authority

1. Fish aggregating devices have been established in the following positions:

5° 40′·35S., 39° 24′·00E.	5° 37′·20S., 39° 30′·50E.
5° 51′·00S., 39° 27′·70E.	5° 52′·50S., 39° 30′·70E.
7° 56′·80S., 39° 55′·00E.	8° 01′·80S., 39° 52′·50E.

Charts affected - 1032 - 2929 (INT 7680) - 3310 (INT 7690)

2336(P)/05 QATAR - Approaches to Doha (Ad Dawḥah) - Dredging areas. Buoyage.

Source: MENAS, NDIA Notice 1/05 and Qatar Customs & Ports General Authority

1. Dredging operations have commenced in the vicinity of the Doha (Ad Dawḥah) Port Approach Channel and to the south of the channel for the construction of the new Doha International Airport.
2. Dredging operations are in progress in areas bounded by the following positions:
   Area B:

   25° 15′·65N., 51° 41′·71E.
   25° 16′·73N., 51° 41′·71E.
   25° 16′·73N., 51° 42′·31E.
   25° 15′·64N., 51° 42′·30E.
   Area C:

   25° 15′·11N., 51° 39′·91E.
   25° 15′·11N., 51° 41′·10E.
   25° 13′·48N., 51° 41′·10E.
   25° 13′·49N., 51° 39′·91E.
   Area D:

   25° 18′·49N., 51° 39′·34E.
   25° 18′·49N., 51° 40′·53E.
   25° 17′·27N., 51° 40′·52E.
   25° 17′·28N., 51° 39′·33E.
3. A southern access channel, defined as Area A, has been established for the dredgers. It is marked by light-buoys and is bounded by the following positions:

25° 16′·04N., 51° 37′·94E.	Red buoy, *Fl.R No 1*
25° 15′·76N., 51° 38′·68E.	Yellow buoy, *Fl.Y No 2*
25° 15′·34N., 51° 39′·92E.	Red buoy, *Fl.R No 3*
25° 14′·92N., 51° 39′·75E.	Red buoy, *Fl.R No 4*
25° 14′·92N., 51° 38′·68E.	Yellow buoy, *Fl.Y No 5*
25° 14′·92N., 51° 37′·93E.	Red buoy, *Fl.R No 6*

This channel has been declared a maritime exclusion zone and all shipping should keep clear of the area.

4. Mariners are requested to proceed with caution when navigating in the vicinity of these areas. For further information mariners should consult the local authorities.
5. Charts 3782 and 3787 will be updated when more information becomes available.
6. Former Notice 991(P)/05 is cancelled.

Charts affected - 3782 - 3787 (INT 7245)

DRAFT

NOTICE TO MARINERS

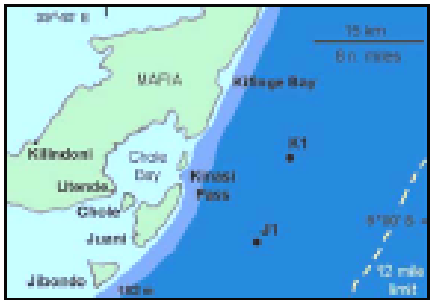
FISH AGGREGATION DEVICES (FADs) OFF TANZANIA

April 11, 2005

Between 23-24 March 2005, six Fish Aggregating Devices (FADs) were set in deep water along the coast of Tanzania in the following locations:

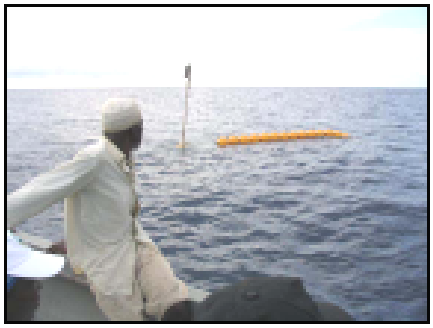
- The Pemba Channel approx 4 and 12 nautical miles respectively North East of Ras Nungwe, Unguja Island;
- Off Matemwe on the East Coast of Unguja Island, approx. 4 and 7 nautical miles respectively South East of Mnemba Island;
- Off the East Coast of Mafia Island approx 8 nautical miles East and 7 nautical miles South East of Kinasi Pass.

Shipping is advised to maintain a safe distance of about half a nautical mile from the FAD positions given below, in consideration of the likely change in position of the surface floats as influenced by the prevailing currents and tidal streams.



Tanzania FAD details

FAD Name	ID	Lat.	Long.	Depth m
Nungwi 1	N1	5 ° 40.350'	39 ° 24.000'	300
Nungwi 2	N2	5 ° 37.200'	39 ° 30.500'	650
Hatemwe 1	M2	5 ° 51.000'	39 ° 27.700'	400
Hatemwe 2	M2	5 ° 52.500	39 ° 30.700'	650
Kinasi	K1	7 ° 56.800'	39 ° 55.000'	500
Juani	J1	8 ° 01.800'	39 ° 52.500'	530



Surface objects comprise a line of maximum 25 yellow plastic floats on a 16 mm steel wire of 30 m length. The wire descends to nylon and polypropylene rope anchored to the seabed with one tonne concrete anchors. A 2 m pole with radar reflector may be present at the end of the float section. During the southeast monsoon (April-September), all or part of the float section may be submerged, re-surfacing during the northeast monsoon (October-March).

The six FADs are part of a local offshore fisheries development trial being coordinated by Samaki Consultants Ltd, Dar es Salaam, together with the Zanzibar Dept. Fisheries and the Mafia Island Marine Park.

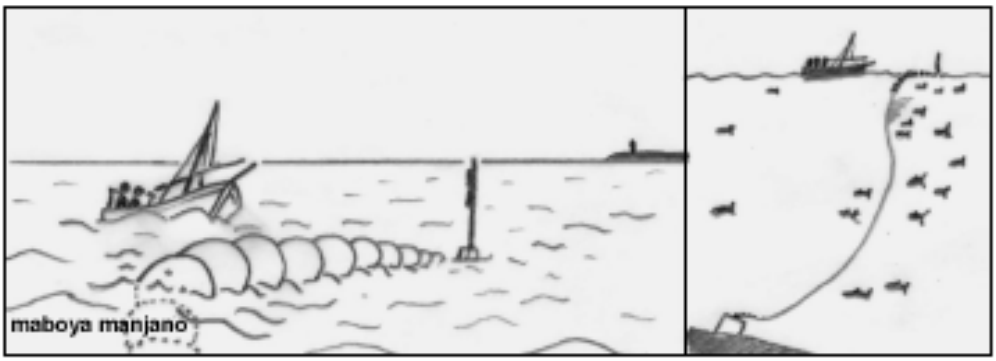
Dr. M. D. Richmond
Managing Director
Samaki Consultants Ltd. Dar es Salaam, Tanzania

TANGAZO KWA BAHARIA NA WAVUVI WOTE TANZANIA

Tarehe 24 na 25 Machi, 2005, Tanzania imeanzisha mradi wa uvuvi wenye lengo la kuboresha mapato ya wavuvi wa samaki wa bahari kuu; kama vile Jodari, Panji, Nduaro, n.k. Haya ni majaribio ya kwanza kwa Tanzania

Mradi huu ni mpango wa msaada kutoka Serikali ya Uingereza ikishirikiana na Kampuni ya CCA (Mnemba Hotel) na WWF (UK) kwenda kwa Idara ya Uvuvi ya Serikali ya Mapinduzi Zanzibar na Mradi wa Hifadhi ya Bahari Mafia. Mradi huu umeanzishwa chini ya uratibu wa kampuni ya Samaki Consultants Tanzania.

MTEGO WA KUVUTIA SAMAKI ILI KUBORESHA MAPATO YA WAVUVI WA ZANZIBAR NA MAFIA



Mtego ni kamba nzito yenye urefu wa mita zaidi ya 500 na inashikilia maboya 25 na bendera ndogo, vyote vikishikizwa na nanga nzito ya zege yenye uzito wa tani moja.

Mtego huu utaanza kufanya kazi baada ya miezi miwili. Kipindi ambacho samaki watakuwa wameshazoea kwenye eneo hilo. Kuanzia mwezi Mei wavuvi wa Zanzibar na Mafia wataanza kupata mafunzo ya uvuvi kwenye maeneo ya mitego hii.

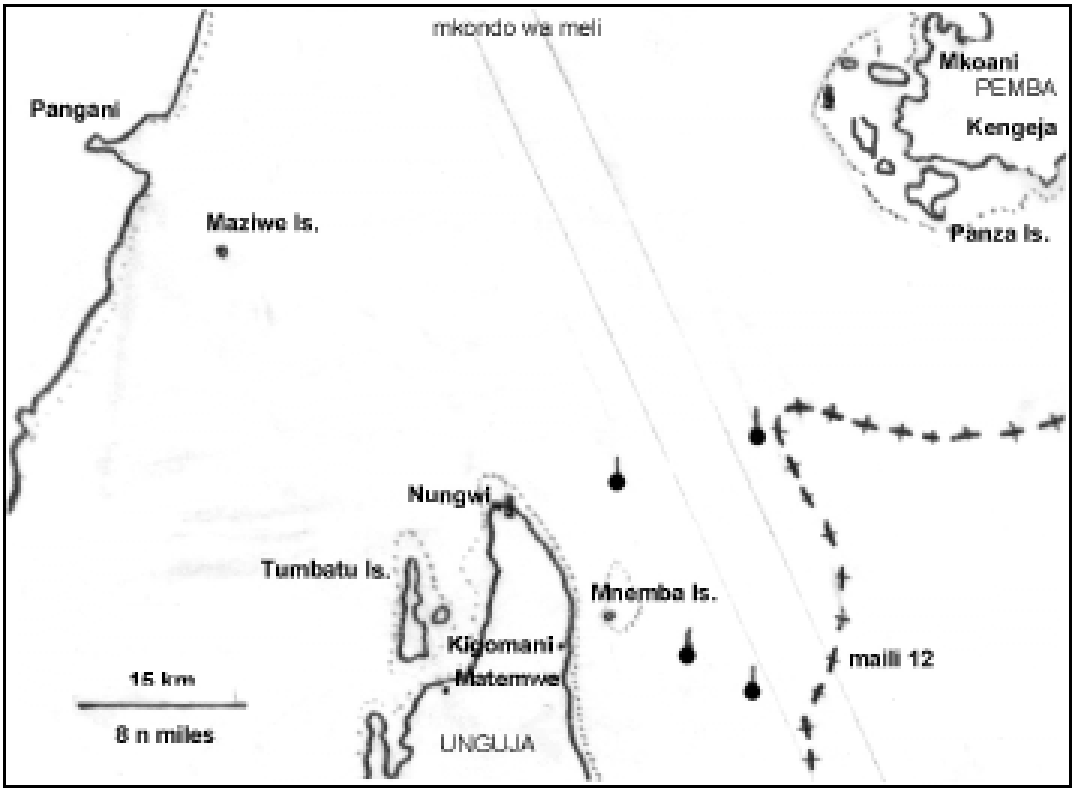
Kuharibu mitego hii ni sawa na kuharibu maisha ya wavuvi wadogo wadogo wa Tanzania wasio na uwezo wa kuvua nje ya mipaka ya bahari ya Tanzania.

Mitego hii imetengenezwa kwa maboya maalum ambayo yanaweza kuzama chini ya bahari kwenye mkondo mkali wakati wa pepo za kusi na yanarudi juu kuelea baada ya pepo hizo.

Kwasababu haya ni majaribio ni muhimu sana kwa manahodha kutuma habari za kuwepo au kutokuwepo kwake au kuharibika kwake mara baada ya vipindi vya pepo kali.

Mradi wa majaribio ya mitego ya kuvutia samaki Tanzania

MAENEO YALIYOWEKWA MITEGO

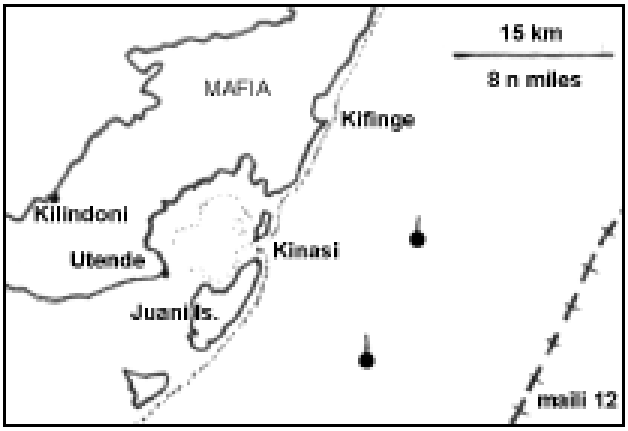


Yafuatayo yazingatiwe

► Manahodha wote mnaombwa kufahamu mahali ilipo mitego hiyo ili kuepuka kugonga na kuharibu maboya (mitego hiyo) au vyombo vyenu.

► Ni marufuku kuiba kamba au maboya hayo

► Ni marufuku kuharibu mitego hiyo



► Kwa kuwa mitego hii iko ndani ya eneo la maili 12 za mwambao wa bahari wa Tanzania wavuvi wote wanaagizwa kuwa ikiwa wataona meli za uvuvi za nchi za nje zinavua katika maeneo hayo ni muhimu kutoa taarifa haraka kwa Mradi wa Hifadhi ya Bahari Mafia, kikosi cha doria cha Idara ya Uvuvi Mbegani (MCS) na Idara ya Uvuvi Zanzibar. Au piga simu Namba 0745 507248 Mbegani; 0747 460172 Idara ya Uvuvi Zanzibar; 0745 345400, 0745 671004 Au Radio call Hifadhi ya Bahari Mafia VHF Chanel 9.

Mradi wa majaribio ya mitego ya kuvutia samaki Tanzania

Annex 4 - Sample weather sheet

The website: www.weather.com provides hourly weather forecasts.

Hour-by-Hour Forecast for
Dar es Salaam, United Republic Of Tanzania

Fri, October 21						
Time	**Condition**	**Feels Like**	**Chance Precip**	**Dew Point**	**Humid.**	**Wind**
4am	Clear **72°F**	**72°F**	**10%**	70°F	93%	From NNW 1 mph
5am	Clear **74°F**	**74°F**	**10%**	71°F	90%	From N 2 mph
6am	Sunny **75°F**	**75°F**	**20%**	71°F	87%	From NNE 2 mph
7am	Sunny **78°F**	**82°F**	**20%**	72°F	82%	From NE 3 mph
8am	Sunny **80°F**	**85°F**	**20%**	72°F	76%	From ENE 4 mph
9am	Sunny **82°F**	**87°F**	**20%**	72°F	72%	From ENE 5 mph
10am	Sunny **84°F**	**90°F**	**20%**	72°F	67%	From E 6 mph
11am	Sunny **86°F**	**92°F**	**20%**	71°F	61%	From ENE 8 mph
12pm	Sunny **87°F**	**92°F**	**20%**	70°F	57%	From ENE 10 mph
1pm	Mostly Sunny **88°F**	**94°F**	**20%**	70°F	55%	From ENE 11 mph
2pm	Mostly Sunny **88°F**	**93°F**	**20%**	69°F	53%	From ENE 13 mph
3pm	Mostly Sunny **88°F**	**93°F**	**20%**	69°F	53%	From ENE 15 mph
4pm	Mostly Sunny **87°F**	**92°F**	**20%**	69°F	55%	From ENE 13 mph
5pm	Mostly Sunny **85°F**	**90°F**	**20%**	70°F	61%	From ENE 11 mph
6pm	Mostly Sunny **83°F**	**88°F**	**20%**	71°F	67%	From E 10 mph

Annex 5 - FAD Monitoring

FADs Inspection Report (April, 2005)

FAD ID	Depth (m)	FAD age (days)	Observations
N 1	300	9	22 floats up; 3 below (same on day 4). Reflector missing. Current NW (NE on day 4). Some slippage of end line through clamps with initial signs of bulging of return length, but plenty of length left.
N 2	650	9	17 floats up; 8 below. Reflector missing. Current W. Some slippage of end line (as for Nungwi 1), but with plenty of original clamped section remaining.
M1	400	9	22 floats up; 3 below. Reflector missing. Current N. Very small amount of slippage of end line through clamps, but plenty left.
M2	650	9	17 floats up; 5 below. Current N. Reflector ok. Severe slippage of end section, with all clamps very closely packed, but the original length of excess beyond the first clamp remains (folded over on itself).
Kinasi	500	3	12 floats up; 13 below. Current N. Reflector ok. Moderate slippage through end section clamps, with two clear bulges of the return length. Final surplus end doubled over and jammed against the first float.
Juani	530	3	13 floats up; 12 below. Current N. Reflector ok. Moderate slippage through end section clamps, with both bulges on the return length.

FADs Status Sheet (March-July, 2005)

Date	Time	FAD ID	Remarks
23/03/05	10:45	Nungwi 1	Deployment: Water depth 300m, and length of FAD is 410m. 25 floats on surface.
23/03/05	13:54	Nungwi 2	Deployment: Water depth 400m, and length of FAD is 550m. 25 floats on surface
23/03/05	16:15	Matemwe 1	Deployment: Water depth 400m, and Length of FAD 800m. 25 floats on surface
23/03/05	17:00	Matemwe 2	Deployment: Water depth 663m, and length of FAD is 862m. 25 floats on surface
24/03/05	15:30	Kinasi	Deployment: Water depth 540m, and length of FAD is 875m.
24/03/05	17:00	Juani	Deployment: Water depth 530m, and length of FAD is 875m.
27/03/05		Juani	Inspection: Final eye and clamp section has slipped (pics), but all 3 clamps are tight. Flagpole rope is wearing at eye. Position estimated to have shifted 600 m N.
27/03/05		Kinasi	Inspection: As above; flagpole tender ok. Illegal long liner “Maestro No. 21”. No port of registration. Vessel light seen outside Kinasi pass 2100 hrs, 27/03/05.
01/04/05	10:39	Matemwe 1	Inspection: 22 floats on surface
01/04/05	11:10	Matemwe 2	Inspection: 22 floats on surface, Marker pole intact
01/04/05	12:05	Nungwi 2	Inspection: 17 floats on surface
01/04/05	12:39	Nungwi 1	Inspection: 22 floats on surface
06/06/05	06:42- 08:30	Nungwi 1	Current: 07:31 at FAD - 05 40.846, 39 23.736 at 07:37; barnacles collected; Peter S snorkeled & fly-fished. New moon Jun 7. 13-14 floats on surface
04/07/05	05:11-10:22	Nungwi 1	Fishing Trial Phase 1: Failed to reach FAD due to sea condition.
17/07/05	06:08-12:43	Nungwi 1	Fishing Trial Phase 1: 14 floats on surface, barnacles attached on the surface of floats.
18/07/05	06:01-11:54	Nungwi 1	Fishing Trial Phase 1: 19 floats on surface, barnacles attached on the surface of floats.
20/07/05	05:15-13:04	Nungwi 1	Fishing Trial Phase 1: 19 floats on surface, barnacles attached on the surface of floats.

FADs Status Sheet (October, 2005)

Date	Time	FAD ID	Remarks
06/10/05	07:15-11:45	Nungwi 1	Fishing Trial Phase 2: 15 floats on surface, barnacles attached on the surface of floats.
06/10/05	06:40-12:30	Nungwi 2	Fishing Trial Phase 2: 1 float at surface, barnacles attached on the surface of floats.
07/10/05	07:05-02:05	Nungwi 1	Fishing Trial Phase 2: 7 floats on surface, barnacles attached on the surface of floats. Dolphin fish and tuna seen swimming around FAD.
08/10/05	06:15-12:45	Nungwi 1	Fishing Trial Phase 2: 1 float on surface, barnacles attached on the surface of floats. Lot of small fishes
09/10/05	06:15-13:10	Nungwi 1	Fishing Trial Phase 2, All floats were submerged. Strong current
10/10/05	07:10-12:15	Matemwe 1	Fishing Trial Phase 2: 7 floats on surface, barnacles attached on the surface of floats. Groups of small fishes
11/10/05	07:15-04:15	Matemwe 1	Fishing Trial Phase 2: 15 floats on surface, barnacles attached on the surface of floats. Groups of small fishes around FAD
12/10/05	08:05-01:30	Matemwe 1	Fishing Trial Phase 2: 15 floats on surface, barnacles attached on the surface of floats. Groups of small fishes around FAD
13/10/05	09:15-13-05	Matemwe 1	Fishing Trial Phase 2: 15 floats on surface; Groups of small fishes around FAD
13/10/05	09:15-13-05	Matemwe 2	Fishing Trial Phase 2: 7 floats on surface, barnacles attached on the surface of floats. Very strong current. No Marker pole
17/10/05	12:30	Kinasi	Fishing Trial Phase 2: 2 floats on surface, barnacles attached on the surface of floats.

Fishing Trials Diary (July 2005**)**

Date	Location	Water depth (m)	Effort (hr)	Notes and catch summary
Jul 5	Kipwani	25-60	2	Vertical longline was used for fishing, lead anchor at bottom, mackerel and squids were used as baits; ocean was very rough; Nungwi fishers. Rainbow runner, Grouper, Lutjanidae 3 Kg (est.).
Jul 7	Leven Bank	60-70	2	Vertical longline was used for fishing; mackerel and squids were baits; Ocean very rough, we didn't even put our line in the sea; - Nungwi fishers. No catch.
Jul 10	South of Mnemba Island Kibumbwili	60-100	3	Bait was eaten but no fish caught, hence lot of small fish, vertical longline; Area was close to coral reef, which surround Mnemba Island; Matemwe fishers. No catch.
Jul 11	Close to Kipumbwi.	70-100	4	Sea was calm at the beginning but later it became rough; We used horizontal longline, squids and Mackerel used as bait; Matemwe fishers 2 catfish, 1 Shark.
Jul 12	Beyond Tumbatu Is., towards Kipumbwi	70-100	4	Strong wind and rough sea; We used horizontal longline; squid and mackerel used as bait; Matemwe fishers No catch
Jul 14	Close to mnemba Island	60-70	3	Bait were eaten but no fish caught; 2 sharks escaped by cutting monofilament line; Horizontal longline; Matemwe fishers 1 Caranx, 3 Shark, 1 Barracuda 25 Kg (est.)
Jul 15	Close to mnemba Island	60-70	5	7 Sharks escaped by cutting monofilament line, horizontal longline was used; Matemwe fishers. Catch: 1 Red snapper, 3 Sharks 30 Kg (est.).
Jul 17	Nungwi 1 FAD	300	3	No sign of fish; Vertical longline, Mackerel and squids were used as bait; Mafia fishers; 14 buoys on the surface. No catch.
Jul 18	Nungwi 1 FAD	300	1	Ocean calm, no strong winds-Vertical longline, no sign of fish; Mafia fishers; 19 buoys on the surface No catch.
Jul 20	Nungwi 1 FAD	300	2	Vertical longline; We used Ras Nungwi fiber boat and our local fishers boat; Mafia fishers; 19 buoys on the surface. No catch.

Fishing Trials Diary (October 2005)

Date	Location	Water depth (m)	Effort (hr)	Notes and catch summary
Oct 6	Nungwi 1 FAD	300	O	15 buoys at surface, groups of Dolphin fish seen.
Oct 6	Nungwi 2 FAD	650	0	1 buoy at surface.
Oct 7	Nungwi 1 FAD	300	1	7 buoys at the surface, groups of small fish seen. No catch.
Oct 8	Nungwi 1 FAD	300	1	1 buoy at the surface groups of small fish seen; 20 kg (est.)
Oct 8	Close to Mnemba Is.	80-100	2	No catch.
Oct 9	Nungwi 1 FAD	300	0	All buoy submerged.
Oct 10	Matemwe 1 FAD	400	3	7 buoys at surface, with groups of small fish. No catch.
Oct 11	Matemwe 1 FAD	400	1	15 buoys, with groups of small fish. Fishing time limited by need to return early on the tide. No catch.
Oct 12	Matemwe 1 FAD	400	1	15 buoys at the surface, with groups of small fish. No catch.
Oct 13	Matemwe 1 FAD	400	0	15 buoys at surface, with groups of small fish.
Oct 13	Matemwe 2 FAD	650	0	13 buoys at surface, with groups of small fish.
Oct 17	Kinasi FAD	500	3	2 buoys at the surface; 2 Tuna caught inshore. 20 kg.
Oct 18	Tutia	70-100	2	Snappers, blue fin trevally, longface emperor. 120 kg (est.).
Oct 19	Tutia	70-100	2	Snapper, grouper, green job fish. 30 kg (est.).
Oct 20	Tutia	70-100	2	Snapper, blue eyed large eye brown, Spotted coral-trout, Variegated emperor, green job fish. 40 kg.
Oct 21	Tutia	70-100	2	Snapper, emperor, red snapper, blue-lined large-eye bream, Longface emperor, shark, blue fin trevally. 101 kg.
Oct 22	Tutia	70-100	2	Humped snapper, Blue-lined large eye bream, Brown spotted grouper, Green job fish. 80 Kg.
Oct 24	Tutia	70-100	2	Snapper, Blue eyed large eye bream, Longface emperor, Two spot red snapper. 80 Kg.
Oct 25	Tutia	70-100	2	Snapper, humphead snapper, blue lined large eye bream, longface emperor, and malabar emperor. 40 kg.
Oct 26	Tutia	70-100	2	Snapper, blue-lined large eye bream, emperors, carangidae. 140 KG.
Oct 27	Tutia	70-100	2	Snapper, grouper, blue-lined large eye bream. 25 kg.
Oct 28	Kinasi	70-140	2	Shark, Lutjanidae, blue-lined large eye bream, emperor. 20 kg.
Oct 29	Tutia	70-100	2	Red snapper, grouper, Lethrinidae. 169 kg.
Oct 31	East Juani Island	70-120	3	High swells; wind gaining strength in afternoon, becoming strong; emperor, Carangidae, grouper, snapper, sharks. 85 kg.
Nov 1	East Jibondo Is	70-120	2.5	Sea with high swell up to 5m; grouper, snapper, greenjob fish. 207 kg.
Nov 2	North East Tutia	70-120	4	Green job fish, snapper, emperor, grouper. 59 kg.
Nov 3	South Tutia	70-120	1.5	Returned early for Eid preparations. Cathces: grouper and snappers 42 kg.

Location data for Phase 1 fishing trials at Nungwi, Zanzibar (July)

Date	Location	S GPS Positions	E
05/07/05	Kipwani	05 41 065	039 15 523
07/07/05	Leven bank	05 42 347	039 19 860
10/07/05	Kibumbwili (South Mnemba Island)	05 50 411	039 24 351
11/07/05	Close to Kipumbwi	05 48 944	039 05 788
12/07/05	West Tumbatu Island	05 45 470	039 11 505
14/07/05	North Mnemba Island	05 47 877	039 24 268
15/07/05	North Mnemba Island	05 46 294	039 23 466
17/07/05	Nungwi 1 FAD	05 40 978	039 23 777
18/07/05	Nungwi 1 FAD	05 41 046	039 23 739
20/07/05	Nungwi 1 FAD	05 41 038	039 23 761

Location data for Phase 2 fishing trials at Nungwi, and Matemwe, Zanzibar (October)

Date	Location	S GPS Positions	E
06/10/05	Nungwi 1 FAD	05 41.046	39 23.739
06/10/05	Nungwi 2 FAD	05 37.079	39 30.055
07/10/05	Nungwi 1 FAD	05 41.038	39 23.761
08/10/05	Nungwi 1 FAD	05 41.056	39 23.727
08/10/05	North Mnemba Island	05 47.807	39 24.198
09/10/05	Nungwi 1 FAD	05 41.011	39 23.791
10/10/05	Matemwe 1 FAD	05 50.716	39 27.570
11/10/05	Matemwe 1 FAD	05 50.716	39 27.569
12/10/05	Matemwe 1 FAD	05 50.732	39 27.612
13/10/05	Matemwe 1 FAD	05 50.757	39 27.549
13/10/05	Matemwe 2 FAD	15 52 135	39 30.794

Location data for Phase 2 fishing trials at Mafia (October, November)

Date	Location	S GPS Positions	E
31/10/05	East Juani Island	08 00.209	39 48.566
31/10/05	East Juani Island	08 00.209	39.48.558
31/10/05	East Juani Island	08 00.097	39 48.646
31/10/05	East Juani Island	08 00.070	39 48.628
01/11/05	East Jibondo Island	08 04.559	39 44.836
01/11/05	East Jibondo Island	08 04 395	39 44.935
01/11/05	East Jibondo Island	08 04 448	39 44 868
02/11/05	North East Tutia	08 07 080	39 42.258
02/11/05	North East Tutia	08 07 036	39 42.205
02/11/05	North East Tutia	08 06 697	39 42.259
02/11/05	North East Tutia	08 06.652	39 42.512
02/11/05	North East Tutia	08 06.450	39 42.722
03/11/05	South Tutia	08 06.947	39 42.205
03/11/05	South Tutia	08 08.003	39 41.441
03/11/05	South Tutia	08 07.967	39 41.556
03/11/05	South Tutia	08 07.973	39 41.378
03/11/05	South Tutia	08 07.888	39 41.616

List of participants of FAD deployment and monitoring

Name	Occupation	Participation	Location
Makame Hamza	Nungwi captain	FAD deployment	Nungwi, ZNZ
Makame Juma	Nungwi fisher	FAD deployment	Nungwi, ZNZ
Abdulrahim Juma	Nungwi fisher	FAD deployment	Nungwi, ZNZ
Ally Makame	Nungwi fisher	FAD deployment	Nungwi, ZNZ
Seif Hamza	Nungwi Beach Recorder	FAD deployment	Nungwi, ZNZ
Ally Kundi	Matemwe fisher	FAD deployment	Matemwe ZNZ
Makame Kundi	Matemwe fisher	FAD deployment	Matemwe ZNZ
Uchungu Makame	Matemwe fisher	FAD deployment	Matemwe ZNZ
Koko Mwiga	Matemwe fisher	FAD deployment	Matemwe ZNZ
Tawakal Rajab	Mafia fisher (Chole)	FAD deployment	Juani FAD, Mafia
Miwad Juma	Mafia fisher (Chole)	FAD deployment	Juani FAD, Mafia
Hasan nahoda	Mafia fisher (Chole)	FAD deployment	Juani FAD, Mafia
Miwadi hamad	Mafia fisher (Juani)	FAD deployment	Juani FAD, Mafia
Ahmad Miwadi	Mafia fisher (Juani)	FAD deployment	Juani FAD, Mafia
Mwinjuma adam	Mafia fisher (Juani)	FAD deployment	Juani FAD, Mafia
Salum Said	Mafia fisher (Utende)	FAD deployment	Juani FAD, Mafia
Masoud Kipanga	WWF Mafia Marine Park	FAD deployment	Juani FAD, Mafia
Mohamed Shamte	Park Ranger	FAD deployment	Juani FAD, Mafia
Ramadhani Nyumba	Park Boatman	FAD deployment	Juani FAD, Mafia
Salum Jafari	Mafia fisher (Juani)	FAD monitoring	Both FADs, Mafia
Hamis Chum Juma	ZNZ fisher (Kizimkazi)	FAD monitoring	Both FADs, Mafia
Sheha Selemani	Mafia fisher (Juani)	FAD monitoring	Both FADs, Mafia
Juma Miwadi	Mafia fisher (Chole)	FAD monitoring	Both FADs, Mafia
Said Mshangama	Mafia fisher (Chole)	FAD monitoring	Both FADs, Mafia
Catherine Msima	Park Ranger	FAD monitoring	Both FADs, Mafia
Abdallah Yahya	Park Boatman	FAD monitoring	Both FADs, Mafia
Masoud Kipanga	WWF Mafia Marine Park	FAD monitoring	Both FADs, Mafia
Mohamed Shamte	Park Ranger	FAD monitoring	Both FADs, Mafia
Ramadhani Nyumba	Park Boatman	FAD monitoring	Both FADs, Mafia

List of participants of Phase 1 fishing trials (July, 2005)

Name	Occupation	Location
Kibabe Makame	Nungwi fisher	Nungwi, ZNZ
Mdura Juma	Nungwi fisher	Nungwi, ZNZ
Uchoro	Nungwi fisher	Nungwi, ZNZ
Iddi kombo	Nungwi fisher	Nungwi, ZNZ
Makame Kibera	Nungwi fisher	Nungwi, ZNZ
Ibrahim Mohamed	Nungwi fisher	Nungwi, ZNZ
Seif Hamza	Nungwi Fish recorder	Nungwi, ZNZ
Nahoda Salamala	Mafia fisher	Nungwi, ZNZ
Said Mshangama	Mafia fisher	Nungwi, ZNZ
Sheha Selemani	Mafia fisher	Nungwi, ZNZ
Juma Miwadi	Mafia fisher	Nungwi, ZNZ
Mohamed Shamte	Mafia Ranger (MIMP)	Nungwi, ZNZ
Kipanga Masoud	WWF Mafia Marine Park	Nungwi, ZNZ
Makame Juma	Matemwe fisher	Nungwi, ZNZ
Makame Kundi	Matemwe fisher	Nungwi, ZNZ
Koko Makame	Matemwe fisher	Nungwi, ZNZ
Haji Mosi Mbaya	Matemwe fisher	Nungwi, ZNZ

List of participants of Phase 2 fishing trials (October, 2005)

Name	Occupation	Location
Khamis Mjaka	Nungwi fisher	Nungwi, ZNZ
Kibabe Makame	Nungwi fisher	Nungwi, ZNZ
Sheha Jafari	Nungwi fisher	Nungwi, ZNZ
Kingongo Kikoti	Nungwi fisher	Nungwi, ZNZ
Juma Makame	Nungwi fisher	Nungwi, ZNZ
Haji Hatib	Nungwi fisher	Nungwi, ZNZ
Selemani Mohamed	Nungwi fisher	Nungwi, ZNZ
Makame Kundi	Matemwe fisher	Matemwe ZNZ
Koko Mwiga	Matemwe fisher	Matemwe ZNZ
Uchungu Makame	Matemwe fisher	Matemwe ZNZ
Ali Kundi	Matemwe fisher	Matemwe ZNZ
Hamisi Mosi	Matemwe fisher	Matemwe ZNZ
Haji Mosi Mbaya	Matemwe fisher	Matemwe ZNZ
Haji Vuai	Matemwe fisher	Matemwe ZNZ
Zuli Juma	Matemwe fisher	Matemwe ZNZ
Hamadi Dondo	Matemwe fisher	Matemwe ZNZ
Nahoda Salamala	Mafia fisher	Mafia
Salum Said	Mafia fisher	Mafia
Juma Miwadi	Mafia fisher	Mafia
Saidi Mshangama	Mafia fisher	Mafia
Sheha Selemani	Mafia fisher	Mafia
Said Nahoda	Mafia fisher	Mafia
Musa Ahmad	Mafia fisher	Mafia
Ahmad Hamis	Mafia fisher	Mafia
Sheha Miwadi	Mafia fisher	Mafia
Mkanga Ahmad	Mafia fisher	Mafia
Ahmad Hamis Nyundo	Mafia fisher	Mafia
Miwadi Hamad	Mafia fisher	Mafia
Hasan Nahoda	Mafia fisher	Mafia
Ahmad Miwadi	Mafia fisher	Mafia
Ahmad Sheha	Mafia fisher	Mafia
Khatib Mikidadi	Mafia fisher	Mafia
Khatib Yakini	Mafia fisher	Mafia
Miwadi Juma	Mafia fisher	Mafia
Makungu Ahmad	Mafia fisher	Mafia
Ahmad Mkanga	Mafia fisher	Mafia
Omari Abdallah	Mafia fisher	Mafia
Ahmad Hasan	Mafia fisher	Mafia
Makame Makungu	Mafia fisher	Mafia
Mohamed Soud	Mafia fisher	Mafia
Omari Jaffari	Mafia fisher	Mafia
Hasan Swalihu	Mafia fisher	Mafia
Imam Makungu	Mafia fisher	Mafia
Kasim Omari	Mafia fisher	Mafia
Bakari Hamis	Mafia fisher	Mafia
Mohamed Amanzi	Mafia fisher	Mafia
Salamala Juma	Mafia fisher	Mafia
Makungu Mgeni	Mafia fisher	Mafia
Tawakal Rajab	Mafia fisher	Mafia
Hatib Mikidadi	Mafia fisher	Mafia
Hija Said	Mafia fisher	Mafia
Salamala Selemani	Mafia fisher	Mafia
Omari Ahmad	Mafia fisher	Mafia

Annex 7 - Promotional materials

A number of promotional and publicity materials were prepared during the FA Programme, and some of these have been communicated through the media described below.

MEDIA	Year	Audience
PRINTED MATERIAL		
2-page theme sheet "I4 Fish Aggregating Device" in *Managing Marine Protected Areas: A Toolkit for the Western Indian Ocean*. IUCN- EARO.	2004	MPA staff; global
SADC Fisheries Observer Handbook (in press)	2005	Tanzania fisheries staff; national
TELEVISION		
BBC World Earth Report - 3:44 min. video of construction and deployment, entitled "Not Just a FAD" Real2Reel for HandsOn.	2005	Satellite TV users, global
INTERNET		
http://www.wildwatch.com/magazine/eyesonwild.asp Promoted by the private sector partner, CC Africa.	2005	Internet users; global
UK Hydrographic Office	2005	Internet users; global
http://www.handsontv.info/ Promoted in Programme 1 (of 10) - 'Africa Works'. "Not Just a FAD - Tanzania".	2005	Internet users; global
DAILY NEWSPAPER		
Zanzibar Leo newspaper, January 25, 2005 (front page).	2005	General public; national
Zanzibar Leo newspaper, April 24, 2005 (front page).	2005	General public; national
Zanzibar Leo newspaper, May 24, 2005.	2005	General public; national
NEWSLETTER/OTHER		
FAD Tanzania Programme 2-page newsletters (Apr, Jun, Nov)	2005	Project partners; regional
FAD Programme 2-page Swahili flyer (May) (see Annex 3).	2005	Project partners; regional
Tanzania Port Authority Letter (enclosing Swahili flyer and UKHO)	2005	Shipping agents; national and regional