ICLARM-SPC/Small Boat/WP.5
13 October, 1975

ORIGINAL : ENGLISH

SOUTH PACIFIC COMMISSION

ICLARM-SPC SMALL BOAT WORKSHOP
(Noumea, New Caledonia. 27 - 28 October 1975)

BOATS FOR VILLAGE FISHERY IN WESTERN SAMOA

by

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FAO Fisheries Adviser
Apia, Western Samoa

SUMMARY

The present fishery is very reliant on reef and lagoon resources as reflected in the number of fishing craft. Out of 1200 fishing craft only 170 are suitable for use in open sea. By end 1974 about 80 of these were fitted with outboard motors. The Fisheries Division is supporting this development through bulk import of standard outboard engines, spare parts and fishing gear. In addition two workshops are being operated by the Division for repair of engines.

The motorization of traditional craft is the first logical step since the investment is low. To meet the need for an expansion of the fishery beyond the reef two new boat types have been introduced, an 18 ft and a 28 ft boat, both powered with a 20 hp outboard engine. Local wood, pressure impregnated, has been selected for construction primarily because it is suitable for boat construction in the villages. The use of outboard engines is being supported while trials will be made with one 28 ft boat fitted with a 20 hp and one with a 10 hp Diesel engine. From the start of the boatbuilding programme eight months ago, 14 boats of 18 ft and 5 boats of 28 ft have been built by 6 carpenters.

The construction method is simple and village carpenters will be trained to build boats from prefabricated kits thereby greatly reducing the cost to the fisherman.

Over next 4 years it is planned to build 450 boats, mainly in the villages. This programme forms part of an integrated project for village fishery development, financed by Danish Aid through FAO.

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1. Traditional craft

A survey conducted in November-December 1974 showed the following number of fishing craft and engines in Western Samoa:

1130	small outrigger canoes	(paopao)
140	bonito canoes	(va'aalo)
10	Western type boats	(va'aafi)
27	catamarans	(alia)
83	outboard motors, 6-4 hp	

The "paopao" is unsuitable for use in open sea and only the larger "va'aaol" can be fitted with outboard motors. The "alia" is always used with an engine and also most of the "va'aafi". The number of fishing craft paddled or with engine used outside the reef is therefore in the region of 170 compared with 1130 paopaos which underlines the heavy reliance on lagoon fishery. The only resource capable of sustaining increased catches is however situated outside the reef - mainly skipjack tuna and bottom fish at 60-150 fathoms depth. Presently Western Samoa is yearly importing more than US$ 1 million in tinned fish and there is a need to expand local production of fresh fish to counteract this heavy drain on foreign exchange. The Government has in the Five Year Development Plan 1975-1979 put main emphasis on strengthening the economic foundation of villages. The Fisheries Division within the Department of Agriculture has prepared a Village Fisheries Development Project with an aid input of US$408.000 from Danish International Development Agency (DANIDA) channeled through FAO.

The boat development within this project falls into three phases:

- Support to viable fishing units using traditional craft and outboard engines.
- Introduction of new boats.
- Extension of boatbuilding to the villages.

2. Support to existing village fishery

The motorization of traditional craft started 6-7 years ago. Several setbacks occurred in the beginning, partly due to difficulties in keeping the engines running and partly through a too heavy reliance on village fisheries cooperatives. The fisherman often had to wait six months for spare parts and there was also a lack of trained mechanics. The Fisheries Division in 1973 established an outboard engine repair shop with the assistance of the Japanese Overseas Volunteers Organization (JOCV) and in end

1974 the Government placed a bulk order for 50 outboard engines of 20 hp including spare parts. This had the advantage of reducing the price from WS$400 to WS$350 per engine, at the same time facilitating the spare part supply through standardization. These 50 engines arrived in February 1975 and were sold out in two weeks - more than anything indicating a demand on part of the village fishermen for further motorisation.

Available records show that a typical village fishing unit consisting of a traditional craft with outboard motor, employs 2-3 men, makes 100 trips per year (2 per week) and has an average catch of 80-100 lb per trip. The yearly catch is in the region of 4 tons per unit, valued at WS$2500. The investment cost for a traditional fishing unit is in the region of WS$300 for the alia, WS$350 for the engine and WS$50 for fishing gear. The total investment is therefore around WS$700.

In early 1975 the Government established an "Agriculture Store" where fishing gear, engines and spare parts are sold with only 5% duty. This has been of major assistance to the village fishermen and has removed one of the major bottle-necks to development in the past: essential gear and equipment not available or available at a high cost.

3. Introduction of new boats

3.1 Boat types

The motorization of existing local craft was the first logical step in the development of the village fishery outside the reef. These craft although excellent for their original purpose, do not always perform very well with an outboard motor and new boat types would be required for a further expansion of the fishery. Due to the successful use of outboard-motors it was decided to introduce two new boat types suitable for the 20 hp standard outboard motor.

Type A: 18 ft open V-bottom boat of planing type, suitable for trolling for tuna and for use from places where the boat would have to be beached after each fishing trip. Speed with 20 hp engine and 3 men is 15 knots.
Price is WS$400.

Type B: 28 ft open V-bottom boat with narrow beam for efficient medium speed operation. Mainly intended for bottom fishing, but with sufficient speed to catch tuna on way to and from the fishing ground. Speed with 20 hp engine and 4 men is 11 knots.
Price WS$680.

These boat types were introduced initially - as development goes on it will be necessary to make modifications and try other boat types.

3.2 Choice of construction material

The 18 ft boat was considered for construction in different materials and page 7 gives a cost estimate of the boat in local wood, FRP and aluminium. There is not a significantly large difference in selling price between the various alternatives. However there is a considerable difference in the cost of imported materials, $60 for the wooden version and $275-285 for the FRP and aluminium respectively. For a country with problems of foreign exchange this could be significant if a major fleet expansion was envisaged. One can argue that the lighter weight of the FRP and the aluminium boat versus the wooden boat will give a saving in fuel. The weight difference is in the region of 120 kg for wood compared with aluminium

which results in an increase in top speed with a 20 hp engine from 15 knots to 17 knots. This can in return be translated into a fuel saving of around 100 gallons/year or WS$65 per year. Of this about 1/3 is government tax so the saving in foreign exchange would be around $40 per year per boat. Taken over five years this will compensate for the added cost of imported materials for the aluminium boat. To the fisherman the benefits in terms of lower maintenance and lower fuel costs will be substantial. There is therefore a case for choosing FRP or aluminium for a planing type of hull like the 18 ft boat. However there are some technical snags. With FRP construction according to Lloyd's Register of Shipping, the relative humidity in the moulding shop should not go above 70%, to avoid moisture accumulation by condensation on the glass materials. In areas like Western Samoa with relative humidity frequently above 90%, a dehumidifier will have to be fitted in the moulding shop. In shipping and storage of resin it is essential that the drums of resin are not subjected to direct sunshine for any length of time and this might be difficult to assure. Aluminium does not require such controlled environment, but it does require a relative high degree of skill. Two experienced New Zealand companies producing aluminium boats, considered that the cost of tooling up and the time of training of staff would make construction of 50 boats of 18 ft in Western Samoa impractical and expensive. The companies both felt it would be cheaper to ship ready-made boats from New Zealand. In spite of these warnings I feel that it is possible to overcome the problems of local construction in FRP or aluminium boats if a determined effort is made over a longer period.

In Western Samoa the choice was made to use wood in fishing boat construction because it is available and it can be utilized for building boats in the villages thereby considerably reducing the cost. This is dealt with in section 4.

3.3. Choice of engine

Boat construction in the villages is only feasible when using relatively simple boats, preferably powered with outboard engines. The proper installation of a diesel engine requires care and should only be done by an experienced marine mechanic. However this problem can be overcome at the village level by assistance through a mechanic employed by the Fisheries Division. The fact remains however that the inboard powered boat will be a lot more difficult to build. Is it worth it? What will the yearly costs be of operating a 28 ft boat with a 20 hp outboard engine compared to a 20 hp Diesel? (Although the diesel has a more efficient propeller it is also 250 kg heavier and every 100 kg added weight requires 2 hp more to maintain a speed around 10 knots).

INVESTMENT COST	OUTBOARD	DIESEL
Cost of boat with accessories including engine installation	$ 700	$ 1200
Cost of 20 hp engine and accessories	$ 370	$ 1200
Total cost	$1070	$ 2400

YEARLY COSTS	Outboard	Diesel
Depreciation of boat over 5 years at 7% interest	170	290
Depreciation of engine (outboard -2 years, diesel 5 years)	200	290
Fuel costs, 600 hours/year, 3/4 speed (outboard -1, 8 gal/h at $0.65/gal, diesel 0, 9 gal/h at $0.40/ gal)	700	220
Maintenance and repair of boat	30	40
Maintenance and repair of engine	60	60
Repair and replacement of fishing gear	80	80
Wages, in cash or fish, 4 men	1200	1200
TOTAL YEARLY COSTS	WS$ 2440	WS$ 2190

The diesel powered boat has about WS$250 lower yearly costs or about 10% of the total. This has to be balanced against the considerably higher investment cost of the boat with a diesel engine and the inconvenience when breakdown occurs of not being able to remove the engine easily and bring it to an experienced mechanic. Breakdowns on diesel engines occur less frequently than on an outboard, but when they do occur they are usually of more serious nature, and repairs in a village might be difficult. In Western Samoa there is a bus leaving from almost every village each day, and an outboard engine can rapidly be brought to one of the two workshops belonging to the Fisheries Division. Although a diesel engine would be preferable when operating out of a protected port with service facilities, for village fishery there is not a clear-cut advantage of one over the other. The Fisheries Division intends to build a 28 ft boat with a 20 hp diesel engine and fish it parallel with the outboard powered boat to obtain some more indications. Until more conclusive evidence is available the use of outboard motors will be encouraged and attempts will be made to reduce the high tax on outboard motor fuel to the benefit of the fishermen. Trials will also be made with a 28 ft boat powered with a 10 hp Diesel engine. The speed would then go down from 10 knots to $7\frac{1}{2}$ knots but it is not known to what degree this will be a disadvantage for a boat mainly doing handlining for bottom fish. As the price of fuel goes up, it will make economic sense to use engines of lower horsepower, and for certain fisheries there will probably be a renaissance in the use of sail.

4. Boat construction in the villages

In industralized countries, the trend has been away from cottage industry towards large scale boat production at least for the size of boat we are now investigating. In Western Samoa and in most developing countries there is however often good economic reasons to resist this tendency. Specialization is a result of an economic system with most people fully employed. It pays to have somebody else specialized in the job doing it instead of doing it oneself. In a typical village economy there is not full employment. Money is scarce so if labour can be substituted for cash this is often welcome. Traditional boatbuilding does require some

specialized skills, but a large part of the work can be done by men with some basic knowledge of using tools. If a fisherman wants a new canoe he therefore normally engages a craftsman in the district who is known for making good canoes. This craftsman or "tufuga" as he is called in Western Samoa, selects the timber, organizes the transport and supervises the rough hollowing out of the log while he himself puts on the finishing touch. The fisherman himself participates in the building of his boat, and pays the "tufuga" in cash and/or traditional gifts. It is worth considering to what extent this system can be utilized even when non traditional boats are introduced. One can see that construction materials like FRP and aluminium are not well suited due to the requirement of the workshop conditions for FRP and additional tools and skill required for aluminium. Wood is a traditional material that the "tufuga" and the villagers are familiar with. The problem becomes one of choice among the many ways of building a wooden boat.

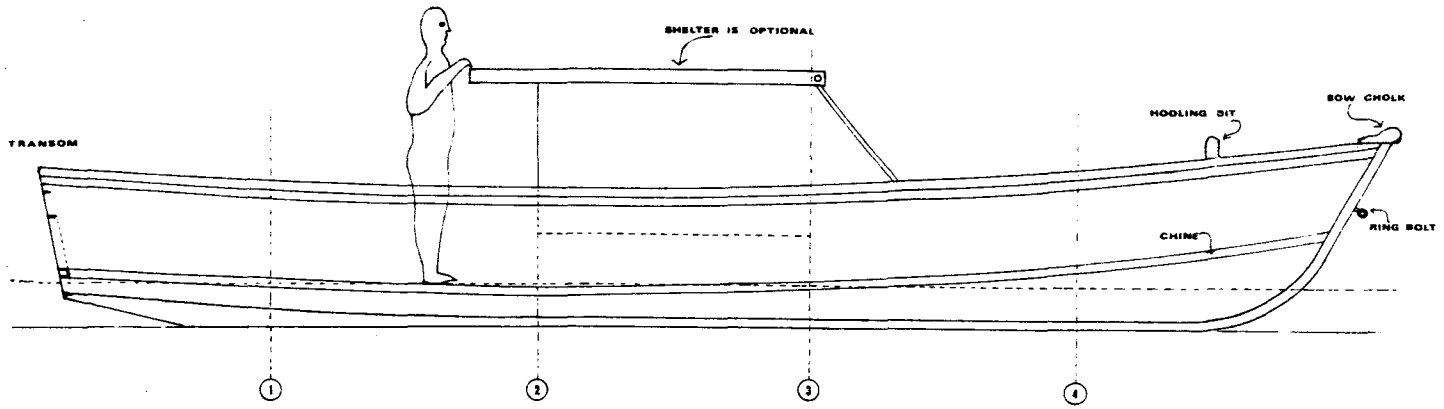
Firstly the construction must be simple so that required additional training is reduced. The simplest material with which to build a wood boat is plywood, but it must be marine grade and it should be pressure impregnated against rot and toredo. Such plywood is available from Papua New Guinea and USA. In Western Samoa the choice was made to use a locally available timber called "Malili" (Terminalia rechii) which is both relatively stable and takes pressure impregnation well. To reduce weights it was decided to use seam batten construction on both the 18 ft and the 28 ft boat. The design of the boats follow the general principles in the FAO booklet: Fishing Boat Design: V-Bottom Boats, FAO Fisheries Technical Paper No. 134. Starting in February 1975 and for the following 8 months, 14 boats of 18 ft and 5 boats of 28 ft have been built by 6 carpenters without any previous boatbuilding experience. The carpenters are all leper patients that are now cured and released from the hospital, but would otherwise have difficulties in obtaining a job. Supervision was mainly necessary for the first 3 boats, now only sporadic checks are necessary. This experience indicates that the boats and the construction method utilized is well suited for village boat building.

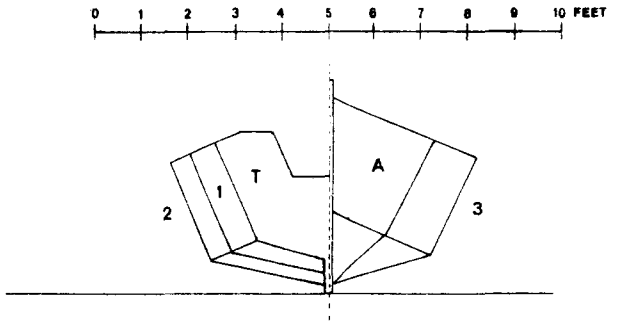
The extension of the boat construction programme to the villages will start in November 1975 with the training of selected village carpenters/canoe builders. In a pilot project area with 10 villages, 2-3 carpenters will be selected for a one-month training at the boatyard in Apia, to familiarize themselves with boat types and also to participate in the construction. The key word is "on-the-job training." Next step will be to initiate construction of boats in a central place in the pilot area. To cut down complications, the materials will be supplied in kits prepared in the Apia boatyard. The kit will consist of a complete frame set, with stem and transom and all planks planed to correct dimensions and with necessary glue, nails, paint etc. The boats are built bottom up on a jig. The fisherman and members of his family will assist the boatbuilder in the construction. It should then be possible to reduce the cost of the 18 ft boat from WS$400 as supplied from a central boatyard to WS$230. The cost of 28 ft boat will be reduced from WS$700 to around WS$400. Apart from the financial advantage to the fisherman, it also ensures a better local maintenance and repair service after the boat is put into operation and it will probably lead to a self sustained development in village boatbuilding. After completion of the first series of boats in one district the same approach will be made in other districts. The boat building programme forms part of an integrated fishery development project involving construction of boats, training of fishermen, repair of engines and marketing of the catch. The input by the Fisheries Division consists of selection of the boatbuilders, organization of the training course at the boatyard in Apia and supervision during the initial stage of the boat construction in the villages.

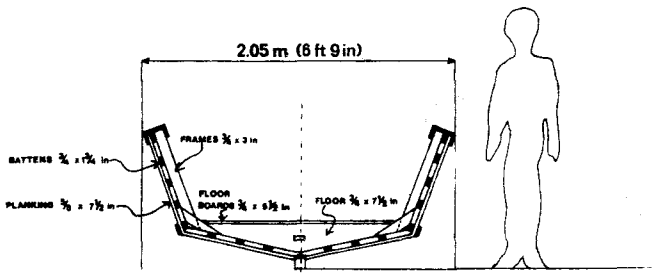
The Development Bank will be responsible for the recovery of the loans on the boats, engines and fishing gear and create a revolving fund for future financing. Besides care in selecting the fishermen, a down payment will be required that is sufficiently high to ward off the ones that are not keen enough; at the same time not so high that the poorer families cannot afford it. The fact that the cost can be reduced by 40% due to use of own labour should put the two boat types within the reach of a larger section of the fishing community. The Five Year Development Plan calls for an increase in number of motorized fishing units from 80 by the end of 1974 to 450 by the end of 1979 and a large part of these are intended to be built in the villages using centrally fabricated kits.

COST ESTIMATE OF 18 FT OUTBOARD POWERED BOAT (IN WS$)

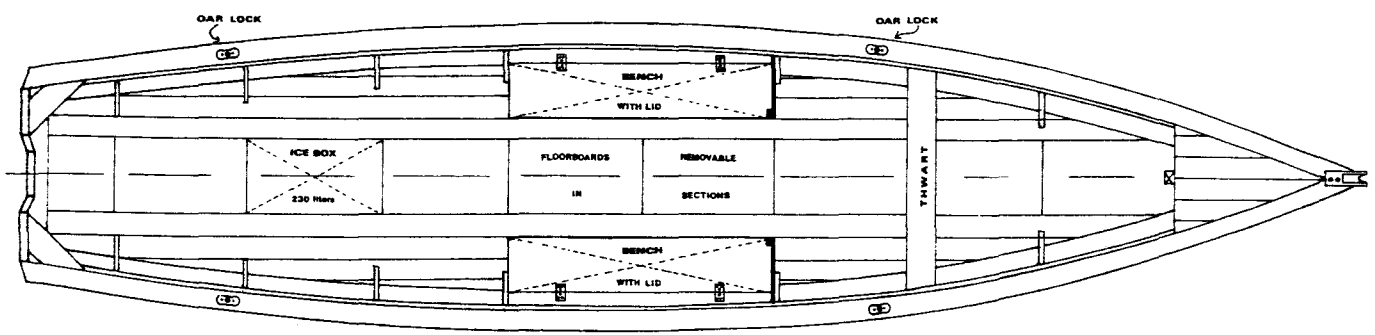
	LOCAL WOOD	FRP	ALUMINIUM
Basic cost	$0.18/super ft = $77/m^3 planed to commercial dimensions and pressure impregnated.	Mat, Roving $1.30/kg Resin. $1.00/kg Assuming. 35% glass content Cost per kg laminate: 1.30 x 0.35 = 0.46 1.00 x 0.65 = 0.65 $1.11/kg	$1.50/kg
Net quantity of materials	400 dm^3	200 kg	140 kg
Wastage	500 dm^3 (125%)	30 " (15%)	30 kg (20%)
Total materials	900 dm^3 (0.9 dm^3)	230 kg	170 kg
Cost materials	$77 x 0.90 = $70	$1.11 x 230 = $255	$1.50 x 170 = $255
Fastenings and paint	$60	$ 20	$ 30
Total materials	$ 130	$275	$285
Labour	36 man days at $5.00 = $ 180	8 man days at $5.00 $ 40	15 man days at $5.00 = $ 75
Overhead	$ 50	Assume 50 boats) $100	$ 70
Profit	$ 40	$ 40	$ 40
Total selling price	$ 400	$455	$ 470
Cost of imported materials	$ 60	$275	$ 285







SECTION AT STATION 2
Seam Batten Construction



MAIN PARTICULARS	
Length overall	8.70 m – 28 ft 6 in
Beam overall	2.05 m – 6 ft 9 in
Depth moulded	0.80 m – 2 ft 8 in
Weight empty approx.	500 kg – 1100 lb
Propulsion Outboard Engine	15-25 hp long shaft

	8.70 m OUTBOARD POWERED BOAT		
	General Arrangement		
	Scale	Boat No.	Drw.No.
	Design: O. Gulbrandsen	WES 3	1
	Apia, July 1973		