ICLARM-SPC/Small Boat/WP.3
1st October, 1975

ORIGINAL : ENGLISH

SOUTH PACIFIC COMMISSION

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

SMALL FISHING BOAT DESIGNS FOR USE IN THE SOUTH PACIFIC REGION: DISPLACEMENT AND MEDIUM SPEED FISHING BOATS

by

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of the United Nations
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SUMMARY

A brief outline of the fisheries background of the South Pacific island groups is followed by an analysis of the fishing methods practised and suitable vessel types for the various methods. The feasibility of using medium speed fishing boats for certain fishing methods is discussed as are the economic criteria and design requirements for such boats.

The past and present uses of medium and high speed boats in the South Pacific are examined. FAO designs of medium speed boats are illustrated and recommendations and design outlines provided for future vessels of this type.

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1. Introduction

1.1 Background

In most of the islands of the South Pacific, small-scale fishing activities are very largely those of a subsistence fishery, the greater part of which is based on the harvesting of the inner reef and lagoon areas. Many of these inner reefs and lagoons have reached or exceeded the limit of their harvest potential. This is particularly the case where population concentrations have occurred, a result of urbanization. Under-exploited lagoon resources are usually found in isolated islands where sufficient fish is harvested for the small local requirement but lack of a marketing and transportation infrastructure inhibits the catch of more fish than can be consumed by the local village population.

Potential for extending and increasing the local fishery away from the lagoons and inner reefs to the submerged banks, shelves and reef slopes around the perimeters of the islands out to the 100 fathom line appears good in most of the territories studied, while the offshore pelagic fishes of the tuna and tuna-like species, which are seasonally abundant near many of the islands, offer opportunities for increased local production as well as the possibility in certain cases for the establishment of an export industry.

No detailed information about standing stocks or potential sustained yields of shelves, banks and outer reef slopes exists in the region but potential production from these tropical coastal waters is not considered large enough to withstand the type of industrial fishery that occurs in temperate coastal regions. Relative to local needs, however, potential is expected to be adequate in a large percentage of island coastal areas, most of which are at present virtually untouched.

Apart from those cases where bait fish are available in commercial quantities, catches of demersal and near shore pelagic fishes are not expected to be high enough to warrant the setting up of an export market. Fishery effort will, therefore, be small-scale and designed to provide the local markets with adequate supplies of fishery products.

1.2 Fishing Methods and Suitable Vessel Types

Fishing methods expected to be used can be broken down into three main groups characterized by the water depths and feeding characteristics of the fish species caught. The first of these, shallow water fisheries in lagoon areas is practised in restricted depth using cast nets, traps, beach seines and hand lines for bottom feeding species.

Greater depth bottom feeding species on isolated banks and the outer reef slope can be caught using deep lining techniques either by hand or more efficiently using reels.

Surface schooling pelagic fish pose a more complex problem due to the clarity of the water with the consequent difficulty in using either purse seines or gillnets. The methods commonly used consist of pole and line fishing with live bait, pole and line using pearl shell lures and trolling with lures.

Commercial long lining for deeper swimming pelagic fish is a more sophisticated method using wide ranging off-shore vessels and is outside the frame of reference of this paper.

1.2.1 Shallow water fisheries in lagoon areas

These can best be carried out by simple low-cost flat or V-bottomed wooden boats. Suitable types are shown in FAO Fisheries Technical Paper No.117 (Rev.1), Fishing Boat Designs: 1 Flat Bottom Boats and FAO Fisheries Technical Paper No.134, Fishing Boat Designs: 2 V-Bottom Boats.

1.2.2 Deep lining on the reef slope

In island communities, where distances to be covered to the fishing grounds are small, this type of fishery can be most economically carried out by simple displacement boats. In the case of isolated village communities where the fishing effort is directed to supply of the community alone and no marketing outlet exists for excess fish caught, flat or V-bottom boats of the types described in the above mentioned publications could be built economically and powered by simple low hp outboard engines to keep the cost of fish production as low as possible. For the exploitation of isolated banks or reefs some distance from an urban centre of population a slightly larger vessel with insulated hold and carrying nested dories on deck could well provide a viable solution.

1.2.3 Surface schooling pelagic fisheries

Where the need exists for at least medium speed (10-15 knots) to range widely in the search of schools, the higher cost of a faster boat can be amortized by increased catch rates. However, where the fishery is seasonal, a very careful cost analysis should be made to ascertain the profitability of higher operating costs when compared with the yearly return.

Suitable boats could be found in the size range 24-35 feet equipped with inboard diesel engines. Inboard/outboard Z drive engines are not considered sufficiently robust to stand up to the requirements of such a fishery in a developing country.

Boats should be equipped with the capability of multiple trolling, pearl shell lure and possibly limited live bait capacity. The most economical solution is to provide a vessel which is designed to operate efficiently and comfortably in the medium speed range(10-15 knots) with enough hp to retain these speeds even when loaded. The semi-displacement hull of this type would be of moderate dead rise (up to 15°) with a relatively long, narrow, easily driven hull. Such a hull would be more comfortable, less inclined to hull damage due to pounding when driven at speed and should have considerably lower running costs than higher speed planing vessels. The 28 ft boat designed for Western Samoa and the proposed 35 foot extension of this type were designed with these operating characteristics in mind.

Where distances, fishing methods or economic and social factors dictate a wide ranging daily operation, the possibility of using light, medium speed boats should be considered. However, the catch rate and value of the catch landed must be sufficient to justify the higher operating costs, plus the fact that the greater hp and higher rpm engine needed for this type of boat is not only more expensive but requires considerably more care in use with particular attention to fuel quality and regular maintenance.

In many of the oceanic islands bait fish are not available in sufficient quantity to justify commercial exploitation of the surface schooling pelagic tuna resource by means of pole and line live bait fishing.

Due to extreme clarity of the oceanic waters of the area this has proved to be the only intensive fishing method for these species which could justify the provision of the larger, more sophisticated fishing vessel needed for catches on an industrial fishing scale. Project activities in this area should therefore be focussed on fish production using relatively small unsophisticated boats and equipment.

2. Medium Speed Boat Design and its Application to Fishing Boats

2.1 Definition of Medium Speed

Naval architects and boatbuilders frequently use the terms displacement, semi-displacement and planing as a means of describing the three principal operating conditions of small craft. These conditions can be recognized in broad outline by:

(i) the speed at which the vessel operates
(ii) the measure of the different forces acting on the hull and
(iii) the wave patterns generated by forward motion

Speed is a relative quantity which is dependent on boat length. This dependence is due to the wave systems created as a boat moves through the water and speed of the boat at any moment is that of the transverse wave system formed by this motion. In quantitative terms this speed depends on the distance apart of the wave crests in the system and increases with increasing wave length. A long vessel produces a long wave system more easily than a shorter boat and her potential for absolute speed is, therefore, greater. A performance comparison between two vessels can be made by means of the speed length ratio obtained by dividing the speed in knots by the square root of the waterline length in feet. Two boats of different lengths at speeds giving the same length ratio have a number of operating characteristics in common, e.g., their wave patterns are similar, their power requirements in horsepower per ton are comparable, as are the proportions of buoyant and dynamic lift forces operating on the hull.

A second factor taken into consideration by naval architects when discussing boat operational characteristics, is the components of the various forces acting on the hull through a range of speed length ratios. These vary from the "at rest" condition when the entire load is supported by buoyant forces, to the high speed planing condition when dynamic lifting forces predominate.

Looking at these two factors together with the wave systems generated, it is possible to recognize in which of three categories a small boat is operating and establish appropriate design requirements.

Below speed length ratios of unity, frictional resistance makes up more than 50% of the resistance to forward motion with the remaining resistance due to the formation of the wave systems described above. Buoyant forces are predominant and dynamic lift forces negligible. These operating speeds are characteristic of large merchant and passenger ships and considered too slow for the majority of small craft.

Speed length ratios of 1-1.34 are the normal operating range for small craft of the displacement type and in this range resistance to forward motion increases rapidly with an increasingly high proportion due to wave making disturbance. Small boats designed to operate in this range are characterised by deep load carrying hull forms with curving buttock lines which as speed increases to the top of the range sink progressively deeper in the water. Hp requirements in this range are of the order of 3 to 5 hp per ton of displacement. At a speed length ratio of 1.34 the length between transverse wave crests is equal to the waterline length of the boat and increasing the speed up to a ratio of 1.5 with this type of hull results in a further sinkage and increasing trim by the stern with a very high proportion of wave making resistance caused by the deep waves produced by this hull form at the higher speeds. Beyond this speed, with this hull form, stern trim becomes excessive and the boat will finally become unmanageable. Hp increase becoming excessive with negligible or no increase in speed.

Transition into the second category, that variously known as semi-displacement or semi-planing, requires a fundamental change in hull design. With speed length ratios larger than 1.34 the distance between crests of the transverse wave system is longer than the boat and the after crest is located at an increasing distance aft of the transom.

In order to operate with the maximum efficiency in this condition, suitable designs must be comparatively light displacement with small draft and with flat aft buttock lines which will produce a shallow wave system and avoid the excessive aft trim and greatly increasing resistance of the deep wave making displacement hull.

In this range, with a suitable hull, increase in resistance becomes less until at a speed length ratio of about 2, it flattens to a relatively constant rate of increase comparable to that at speed length ratio of 1. Hp requirements will be from 20–40 hp per ton of displacement.

Dynamic lift forces begin to become significant and at speed length ratios between 2.2 and 2.5 the hull will have risen to its original static trim level and, as speed increases further, will begin to rise above this until at speed length ratios between 3 and 4 dynamic lift is predominate, the wave making proportion of the total resistance decreases and frictional resistance again becomes increasingly important.

We have then reached our third category of operations, the region of pure planing which is well known to anyone familiar with developments in the high speed pleasure craft field. Resistance to forward motion in this region are of the order of 110–150 kg (250–330 lb) per ton of displacement, requiring 50 and more hp per ton and except for certain special cases with a low weight, high value catch, horsepower requirements and operating expenses are such as to render uneconomic continuous operation by fishing boats in this range. Accordingly, for fishing operations in which speed is an advantage, boats will need to be designed for the middle of the three ranges discussed.

In order to avoid confusion with the use of conflicting terms, such as semi-displacement and semi-planing, it is proposed to adopt the term medium speed when applied to boats operating in the speed length ratio range greater than 1.5 and less than 3.

2.2 Feasibility of Medium Speed in Small-Scale Fisheries Operations

Speeds higher than that of the displacement range can be expensive both in the capital cost of the increased hp required and in the higher operating costs of the larger engine.

Successful fishing boat design requires the production of a safe and efficient working platform that can pay its way and leave a reasonable profit margin to the operator.

In order to justify the increased expenditure required for a medium speed boat, some or all of the following conditions should be fulfilled:

1) Weight and bulk of average daily catch required to cover total costs should be low in comparison to vessel displacement.

2) The catch can be increased by the use of a highly mobile vessel during fishing operations.

3) Travelling time to and from the fishing grounds is a large proportion of total vessel time.

4) The price obtained for landed catch is sensibly higher for fish landed in optimum condition due to reduction in travel time.

5) Sea conditions in the area will permit operation in the medium speed range for a high proportion of total possible vessel time.

6) Geographic, economic and/or social conditions dictate a one or two day operation.

2.3 Design Requirements for Medium Speed Fishing Boats

As indicated in Section 2.1, boats designed to operate at medium speed should be of light displacement with hull forms producing shallow wave systems with minimum water disturbance.

Where vessel cost must be at a minimum and load carrying ability can be much reduced as in the typical village fishery, narrow beam, light draught and a low displacement/length ratio can be used to obtain speed economically. For example, a 25 foot waterline length boat with a waterline beam of 5 feet fitted with a light weight 25 hp inboard engine, weighing around 220 kg (500 lb), has been quoted at a speed of 15 knots in light condition. It is, therefore, perfectly possible to obtain operating speeds of 11-12 knots with narrow beam, light draft vessels of this type, if loaded displacement can be kept to around 1 500 kg. At this displacement, average fish catch could probably not exceed 200 kg if speed in this range is to be maintained.

This is a viable solution in small-scale fisheries one step up from the subsistence fishery level where low load carrying ability is acceptable.

A requirement also exists for greater load carrying capacity and a greater return per crew unit effort in more urbanized communities. In this case design requirements for economical operation in the speed length ratio range 2.0-2.5 are as follows:

1) Basic hull dimensions

An easily driven hull shape is dependent on the correct choice of minimum displacement for the operating requirement. Displacement has the greatest single effect on speed as can be seen in the graph in Fig. 11 where displacement is plotted against brake horsepower for a fixed water-line and length/beam ratio for a consistent speed of 12 knots.

A close estimate of average daily catch will permit a good approximation of operating displacement. It is important in the design of a medium speed vessel not to over estimate the required carrying capacity.

As high a length to displacement ratio ($L/\sqrt{\nabla}^{1/3}$) as possible is chosen and this should range between 5 and 7 depending on the particular design requirement. As large a length/beam ratio as can be accommodated consistent with stability should be chosen. A minimum prismatic coefficient should be 0.65 with a value of around 0.7 as a satisfactory compromise between the need for adequate buoyancy forward to maintain good trim and sufficient fineness not to increase resistance unduly. A constant angle of deadrise in the after sections is desirable but this is conditional on correct placing of the LCB in relation to operating centre of gravity.

The chine beam should be appreciably narrower at the transom than at the midship section to aid water separation with chine and transom running dry in the medium speed range.

2) Powering

The boat should have sufficient hp to operate in the medium speed range when carrying the average daily catch. As a generalized approximation this will require between 20 and 40 BHP per ton of displacement. The variation depending on the length/displacement ratios chosen for a particular design requirement.

3) Stability and handling characteristics

Transverse stability should be sufficient to permit the loading of three times the expected average daily catch in safety. Determination of chine immersion aft and the length of chine immersed will be dependent on transverse stability. Directional stability should be sufficient to avoid any tendency to broach while travelling at speed in following seas. In order to retain good directional stability, deadrise aft should be around 15°, less will entail loss of directional stability while increase in deadrise much over this figure will result in a higher hp to maintain the medium speed requirement. The change in static trim due to change in variable weights should be kept to a minimum.

3. Medium Speed Fishing Boats in the South Pacific

3.1 The Introduction of Medium and High Speed Fishing Boats in the Region

Requirements for economic operation of medium speed fishing vessels have been given in Section 2.1. Sufficient of these requirements has been met in certain areas and certain fisheries in the region to justify the use of vessels using speeds greater than that of a normal displacement vessel.

A common use of medium and high speed boats has been in the crayfish (rock lobster) industries of Australia and New Zealand where a high value, low volume catch, in combination with the greater range of daily operations attainable, has made the higher speed boats economically viable. Small high speed boats are also used by divers in the abalone fishery in Australia for similar reasons.

Of more direct application to the South Pacific islands is the Tahitian pole and line/pearl shell lure fishery for bonito. At least five hundred people are engaged in this fishery and the reasons for the adoption of higher speed boats are of considerable interest in outlining areas where medium speed can be viable. Local custom demands fresh caught fish which have not been iced, which indicates a daily operation. As fishery activity has increased, boats venture further offshore thus requiring increased speed to return to market in time for the sale of catches. Fishermen locate schools of feeding bonito by flocks of seabirds diving on the school. As the schools may surface for only a few minutes at a time it is important that boats arrive "amongst the fish" in the shortest possible time after the school begins to feed. A boat capable of high mobility during the fishing operation can, therefore, be expected to increase its catch over that of a slower vessel. Where a number of boats are working the same area, the fastest boat reaches the school first, makes its total catch and returns to market in a shorter time thus fetching a higher price for fish caught. This has resulted in a competition for speed to the point where present boats, which are of 10-11 metres (33-36 ft) in length are using high speed diesel engines of around 300 hp giving cruising speeds of 17 knots and maximum speeds of 25 (speed length ratios of 3-4.4) which are in the pure planing range discussed in Section 2.1.

A typical example built in Tahiti and equipped with a 280 to 300 hp diesel engine costs approximately $30 000. The high speed and consequent high capital and operating costs of these boats are acceptable in the particular conditions of this fishery due to the high price received for fresh bonito landed in good condition. Prices in the height of the season (November to June) range from $1 to $2 per kilogram but may reach 3 times this level in the off-season (July to October).

While not recommending the use of such high power with the large operating costs this entails, several of the reasons for speed in this fishery are expected to increase catch or quality of fish landed and thus relevant to the use of the more economical medium speed boats proposed in this paper. For example, high mobility during the fishing operation, greater range for daily operations, fish returned to market in better condition due to shorter time from catching to landing.

The flat-bottom, high speed dory that was developed for fishing off the North West Coast of the United States has been tried in several countries in the South Pacific but does not appear to have provided a satisfactory solution to the need for boats with sufficient speed for the skipjack fishery. The original intention was to introduce a type of boat that could be operated from villages with beaches and shallow lagoons and consequently the boat was flat-bottomed and fitted with a Z-drive and high speed petrol engine of 130 hp. The advantages were in simplicity of hull construction and relatively low initial hull cost but against this must be put the higher operating costs and relative delicacy of the light weight, high rpm, petrol engines used, plus the small carrying capacity of the hull. Serious technical problems have occurred. The inboard gasoline engine and the Z-drive has shown itself too vulnerable for the job and the repair bills have been very high. There has been no construction problems with the plywood hulls, but the fishermen complain about the pounding and rough ride.

This experience has lead to various modifications in the last dories. A moderate V-bottom has been introduced to diminish the pounding. The Z-drive has been replaced by a Hamilton 2 stage Waterjet, Model 752 and the Volvo engine with a Ford Falcon 6-cylinder engine rated at 135 hp/5 000 rpm. The engine is normally run at 3 500 rpm.

It is doubtful whether the dory equipped with a high speed engine will be able to operate successfully from a village lacking essential service facilities. It will have some of the same drawbacks as the outboard engine - short service life, vulnerable electric parts and relatively high fuel consumption, without the advantages of easy removal from the boat for storage and transport to a central workshop for repair.

3.2 Medium Speed Boats Designed by FAO

These include the 28 ft open boat for outboard power shown in Fig. 1. The 30-foot flat-bottom, double chine, inboard-powered version of a sampan express hull in Fig. 2 and the 28-footer seen in Figs. 3, 4, 5 and 6 and the photographs of Figs. 7 and 8.

The 28-foot boat of Fig. 1 has been designed as an easily propelled, narrow beam, light displacement craft suitable for village fishery operations. The outboard-powered version of this boat, designed by Mr. Ø. Gulbrandsen, has been built in Western Samoa at a price of $1 250 and, with a 20 hp outboard, has achieved a speed of 12 knots in the light condition and 10 knots with 4 crew and 200 kg of catch. An inboard-powered version of this boat will be shown in a paper presented by Mr. A. Overaa.

The 30-foot flat-bottomed boat of Fig.2 has a hull based on a Texas dory Sampan Express 30, modified by FAO for inboard propulsion. The intention behind this design was to provide a hull of simple construction for local builders which, while achieving medium speed, would combine the relative simplicity and low cost of a dory-type hull with the improved operating capability of the medium speed inboard diesel. A prototype has been built by local builders in the West Indies and repeat orders are expected to cost $8000 - $9 000. Fitted with a marinized Ford diesel engine of 80 BHP at 2 650 rpm, the boat has achieved speeds of 13 knots on trials. The prototype is now being evaluated over a fishing period of 12 months.

The 28 ft design in Figs. 3, 4, 5 and 6 was designed for the small-scale pole and line/pearl shell lure skipjack fishery and was built in Fiji for use in Western Samoa. Fitted with a GM Bedford diesel giving 80 BHP (at 2 200 rpm), the boat achieved a maximum speed of 12.4 knots and is capable of extended operation in the 10 to 12 knot range. The hull is fitted with two small circulating water bait tanks, a water spray system run from an engine-driven pump and has a hold capacity of 2 000 lb in insulated hold compartments with individual hatches. A feature of the design is the individual hatch system which permits an open after deck with plenty of working space, while allowing easy access to fish storage, propeller shaft and stuffing box. With good after deck space the design is suitable for the fitting of mechanical reels for deep line fishing for skipjack in the off season. The boat is estimated to cost around $16 000 at present day prices.

For fishing from established harbours in urban communities, where boats are to work a wide ranging daily operation, a larger version than the 28 foot boat with a greater carrying capacity may prove advantageous.

General arrangements of a 10.67 m (35 foot) vessel are shown in Fig. 9 and a typical lines plan is sketched in Fig. 10.

Fitted with a medium speed diesel engine of 120-140 BHP and an insulated hold capacity of 1.5 tons, the boat would be expected to operate at a displacement of around 5 tons, giving an expected speed of 12-14 knots (SLR 2.1 - 2.5). Cost of complete boat is estimated at approximately $24 000, depending on engine installation.

3.3 Economic Returns for Different Boat Sizes and Types

Three vessel sizes are investigated. Firstly the simple outboard powered boat for village communities, illustrated in Fig.1. Secondly the 28 ft inboard powered, somewhat more sophisticated design of Fig.3, which could be considered suitable for more urban communities with some port facilities but not requiring large carrying capacity or long range. Finally, the 35 ft version of Fig.9 for operation from an established port, capable of ranging further afield and with an increased capacity making it suitable as a fishing unit operating from large urban communities where necessary operating and maintenance skills are more readily available.

Fuel costs, crew wages etc., are based on present costs in one island group converted to US dollars. Local costs should be substituted to obtain equivalent results in other island communities.

Market price for fresh fish in this particular urban market retails at around $0.66 per pound. It is assumed that price paid at the boat will be approximately half that of the retail price, i.e. $0.33 per pound. This will frequently be a conservative estimate as the fisherman himself or his family may well also handle retail sales in smaller island groups.

The analysis which follows includes all necessary annual and daily expenses to operate the vessel and an estimate is then made of the average daily catch required to cover the operating costs. A further estimate is then made allowing for a 20% return on investment (before taxation) and including an amount for crew incentive bonus which is estimated as a daily average of 30% of regular wages. For the case of the village community the outboard powered boat is assumed to operate on an average of 100 days per year, the fisherman being otherwise occupied during the remainder of the year on other village occupations or subsistence crop raising for his own family use. For the second and third case a total of 200 fishing days per year is assumed with time lost due to bad weather, vessel maintenance and repairs. The figure for maintenance is estimated at 10% of vessel cost and would cover wages paid to crew members engaged on maintenance tasks as well as slipping and repair costs.

The total catch figures arrived at can be used to make an estimate of profitability for various boat types and hence of choice of boat type for an area based on present catch rates of local boats or on data which can be obtained from experimental fishing.

1) 28 ft Outboard Powered Boat

Vessel Cost

Hull and equipment $1,500
20 hp outboard motor ....$ 600

Total $2,100

Operating Costs	Annually	Daily (assuming 100 fishing days/year)
Depreciation Hull 5 years Engine 2 years	300) 300) 600	6.00
Interest on capital at 10% on reducing balance	150	1.50
Petrol/oil mixture, average operation 6 hours/day = 10 g at $1.00/gal	1000	10.00
Crew wages 1 captain at $6.60 3 crew at $3.30	990	9.90
Food $1.00 per day per man	400	4.00
Maintenance and Repair, 5% of vessel cost, 20% of engine cost	195	1.95
Total	3.335.00	33.35

Average daily catch to cover costs = 101 pounds of saleable fish
Average daily catch to assure a 20% return on investment = 124 pounds

2) <u>28 ft Inboard Powered Decked Boat</u>

<u>Vessel Cost</u>

Hull and equipment	$11,000
Engine and installation	$ 5,000
Total	$16,000

Operating Costs	Annually	Daily (assuming 200 fishing days/year)
Depreciation Hull 10 years Engine and Equipment 5 years	1200) 800) 2000	10.00
Interest on capital at 10% on reducing balance	800	4.00
Insurance, 5% of vessel cost	800	4.00
Diesel fuel, 10 hours full power ($0.66/gal) operation/day	2640	13.20
Lubricating oil, 15% of fuel cost	400	2.00
Ice, 250 lb/day at $0.66/50 lb block	660	3.30
Crew wages Skipper at $7.50/day 3 crew at $3.33/day	3500	17.50
Food $1.0 per man/day	800	4.00
Maintenance and Repair, annually 10% of vessel cost (including crew wages on maintenance work)	1600	8.00
Total	13,200	66.00

Average daily catch to cover costs = 200 lb
Average daily catch for 20% return on investment = 264 lb

3) 35 ft Inboard Powered Boat

Vessel Cost

Hull and equipment $15,000
Engine and installation .... $ 9,000
$24,000

Operating Costs	Annually	Daily (200 days)
Depreciation Hull 10 years Engine 5 years	1500) 1800) 3300	16.50
Interest on capital at 10% on reducing balance	1200	[illegible].00
Insurance, 5% of vessel cost	1200	6.00
Diesel fuel, 10 hours/day average = 60 gal ($0.66/gal)	7920	39.60
Lubricating oil, 10% of fuel	792	3.96
Ice, 400 lb/day	1056	5.28
Crew wages Skipper at $8.00/day 3 crew $4.00/day	4000	20.00
Food, $1.00 per man/day	800	4.00
Maintenance and repair, 10% of vessel cost (including crew wages on maintenance)	2400	12.00
	22,663	113.34

Average daily catch to cover costs = 344 lb
Average daily catch for 20% return on investment = 435 lb

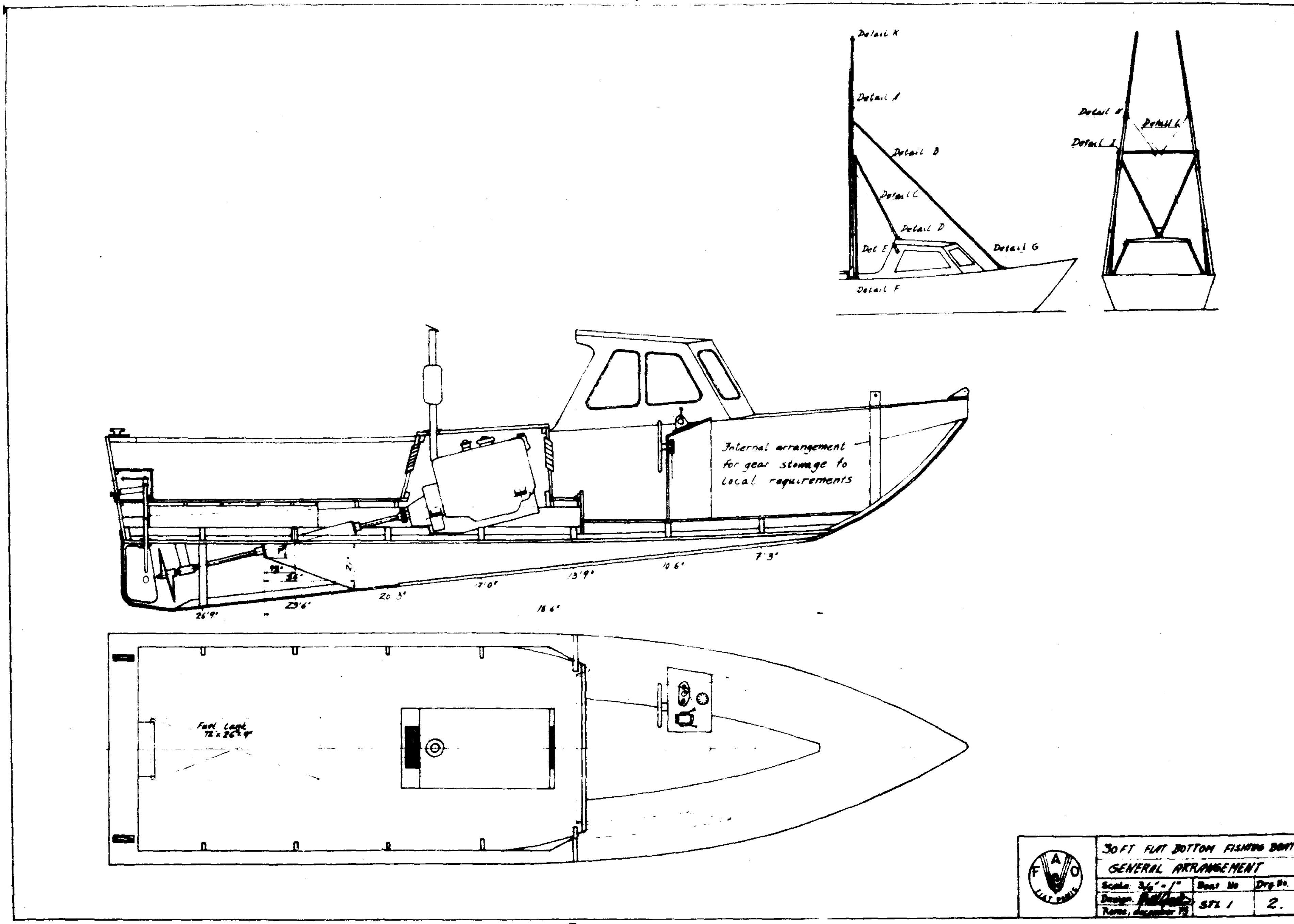
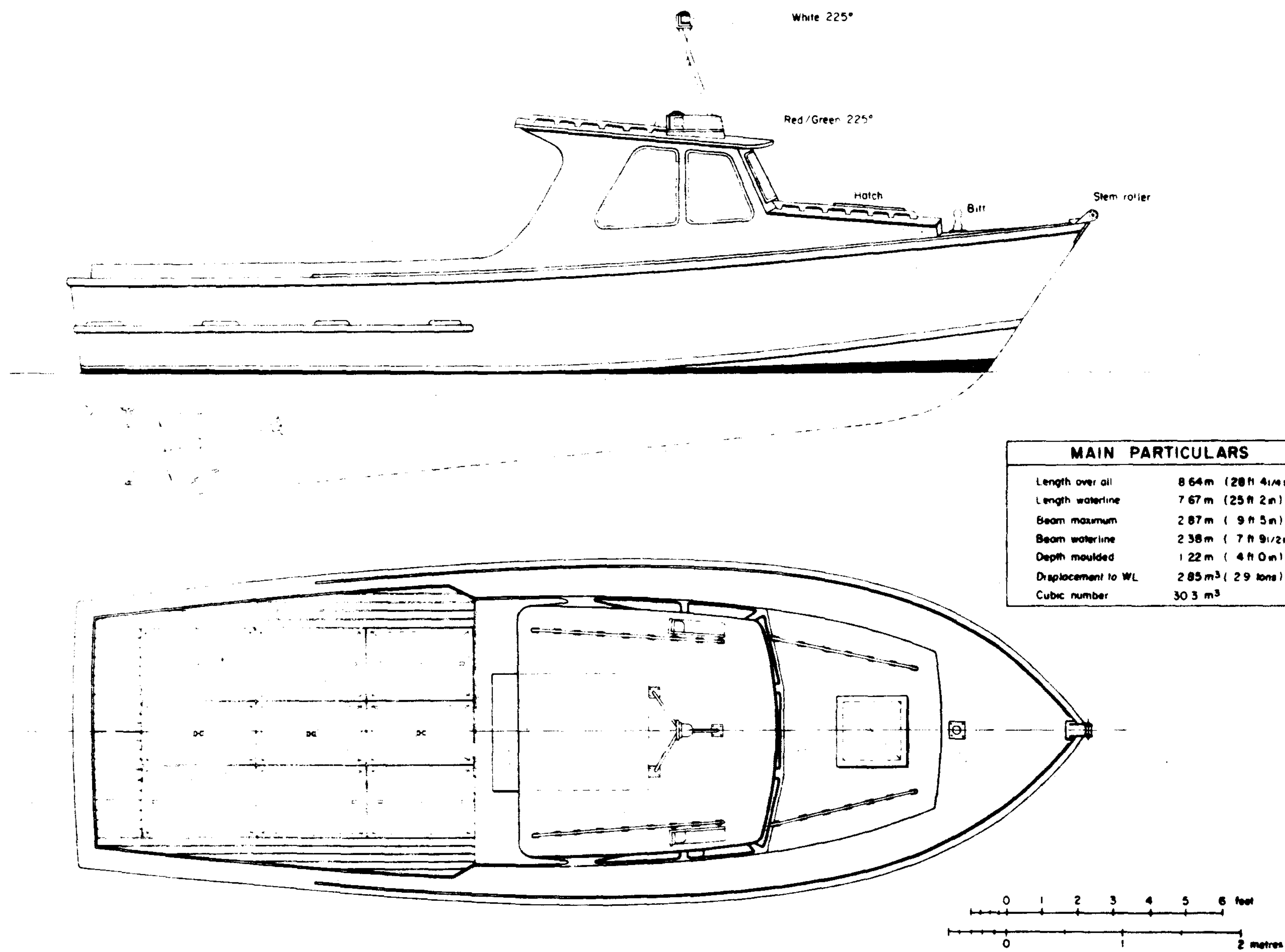


Fig.2 30 foot flat-bottomed double chine fishing boat for the West Indies



MAIN PARTICULARS	
Length over all	8 64 m (28 ft 4 1/4 in)
Length waterline	7 67 m (25 ft 2 in)
Beam maximum	2 87 m (9 ft 5 in)
Beam waterline	2 38 m (7 ft 9 1/2 in)
Depth moulded	1 22 m (4 ft 0 in)
Displacement to WL	2 85 m^3 (2 9 tons)
Cubic number	30 3 m^3

FAO FIAT PANIS

28 ft Medium speed fishing boat

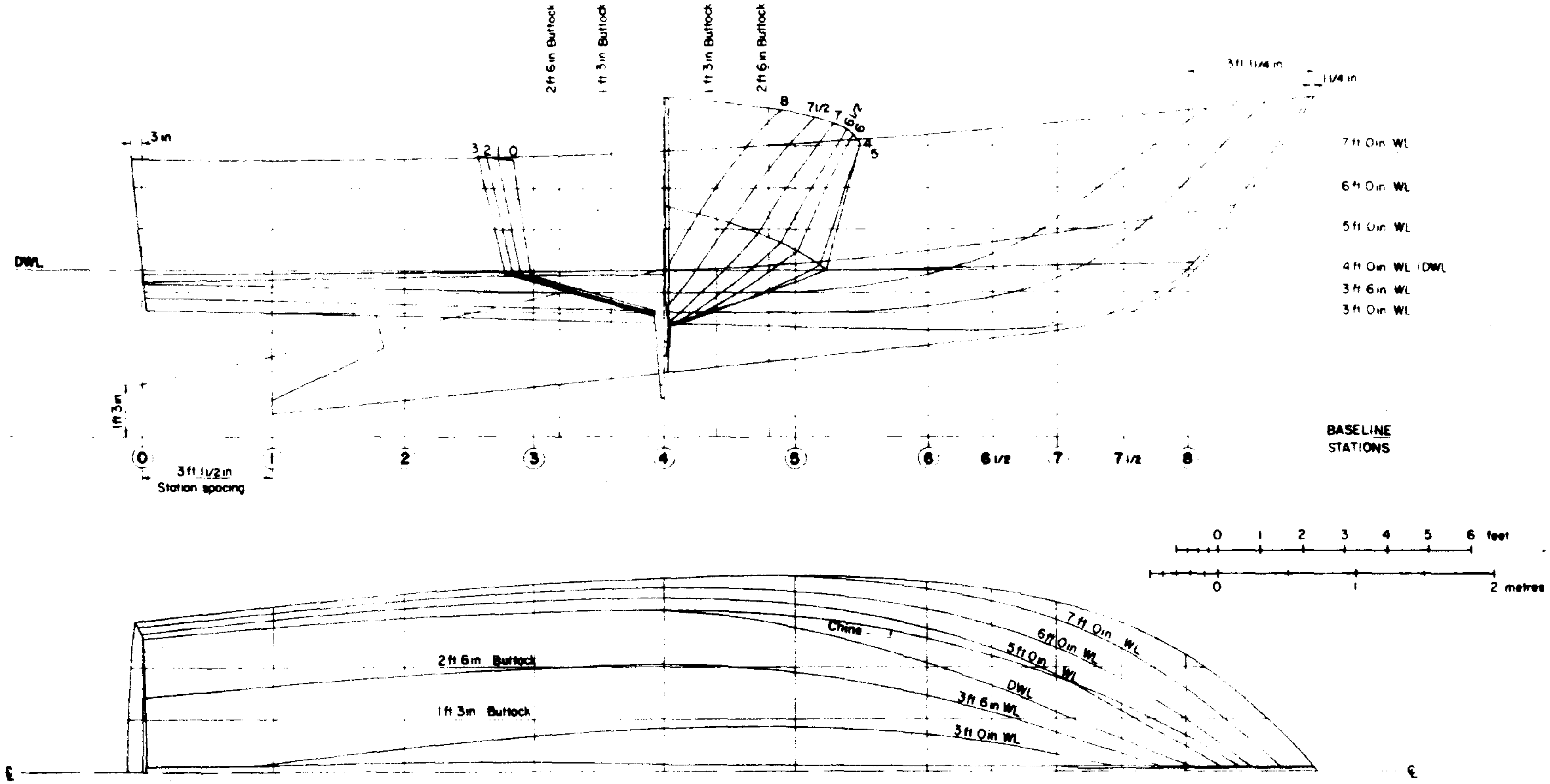
PROFILE AND DECK PLAN

Design JF
Suva, December 1971

WS - 1 | 1

Fig.3 General Arrangement of 28 foot boat for pole and line/pearl shell lure

DO NOT SCALE FROM THIS DRAWING



Measurements in feet inches and eighths

	STATION	0	1	2	3	4	5	6	6 1/2	7	7 1/2	8
HALF BREADTHS	SHEER	3-7-2	3-11-3	4-3-1	4-6-0	4-7-5	4-8-4	4-6-7	4-5-6	4-1-0	3-7-2	2-10-0
	7 ft-0 in WL	-	-	-	-	-	4-8-2	4-4-5	4-1-3	3-8-0	2-11-4	2-0-0
	6 ft-0 in WL	3-6-6	3-9-5	4-1-5	4-3-1	4-4-4	4-3-6	3-10-1	3-6-1	2-11-4	2-2-4	1-2-4
	5 ft-0 in WL	3-4-2	3-7-5	3-10-1	4-0-3	4-1-4	3-11-6	3-5-0	2-11-5	2-4-0	1-5-4	0-7-0
	CHINE	3-3-7	3-5-1	3-7-9	3-9-4	3-10-2	3-8-4	3-2-2	2-9-4	2-3-2	1-7-3	0-9-2
	4 ft-6 in WL (DWL)	3-3-6	3-6-2	3-8-2	3-10-0	3-10-6	3-5-4	2-7-2	2-0-6	1-5-2	0-9-0	
	3 ft-6 in WL	1-10-5	2-0-5	2-3-2	2-5-5	2-8-4	2-4-4	1-9-7	1-5-0	0-11-0	0-4-4	-
	3 ft-0 in WL	0-4-2	0-2-6	0-6-6	0-10-1	1-0-4	1-1-1	0-10-6	0-8-0	0-4-5	-	-
	RABBET LINE	0-1-2	0-1-7	0-2-4	0-2-4	0-2-0	0-1-7	0-1-6	0-1-4	0-1-4	0-1-4	0-1-4
HEIGHT ABOVE BASE	SHEER	6-8-3	6-8-3	6-8-6	6-9-4	6-11-1	7-1-2	7-4-0	7-5-3	7-7-0	7-8-6	7-10-4
	CHINE	3-10-6	3-10-7	3-11-0	3-11-0	4-0-0	4-2-2	4-6-0	4-8-2	4-10-6	5-1-5	5-4-4
	2 ft-6 in BUTTOCK	3-7-2	3-7-4	3-6-7	3-6-0	3-5-6	3-6-3	3-11-2	4-5-0	6-3-0	6-5-0	7-6-4
	1 ft-3 in BUTTOCK	3-4-2	3-3-3	3-2-2	3-1-4	3-0-4	3-0-2	3-1-5	3-4-4	3-10-0	4-8-4	6-1-2
	RABBET LINE	3-0-3	2-11-4	2-10-6	2-9-6	2-8-4	2-7-5	2-6-5	2-6-5	2-7-6	3-0-1	3-10-2
	KEEL BOTTOM	-	0-7-0	0-9-0		-		-	2-4-2	2-6-0	2-10-2	3-8-2

MAIN PARTICULARS

Length over all	8.64 m	(28 ft 4 1/4 in)
Length waterline	7.67 m	(25 ft 2 in)
Beam maximum	2.87 m	(9 ft 5 in)
Beam waterline	2.38 m	(7 ft 9 1/2 in)
Depth moulded	1.22 m	(4 ft 0 in)
Displacement to WL	2.85 m^3	(2.9 tons)
Cubic number	30.3 m^3	

FAO FIAT PARIS

28 ft Medium speed fishing boat

LINES

Design JF
Suva, December 1971

WS - 1 | 2

Fig.4 Lines plan of the design shown in Fig.3

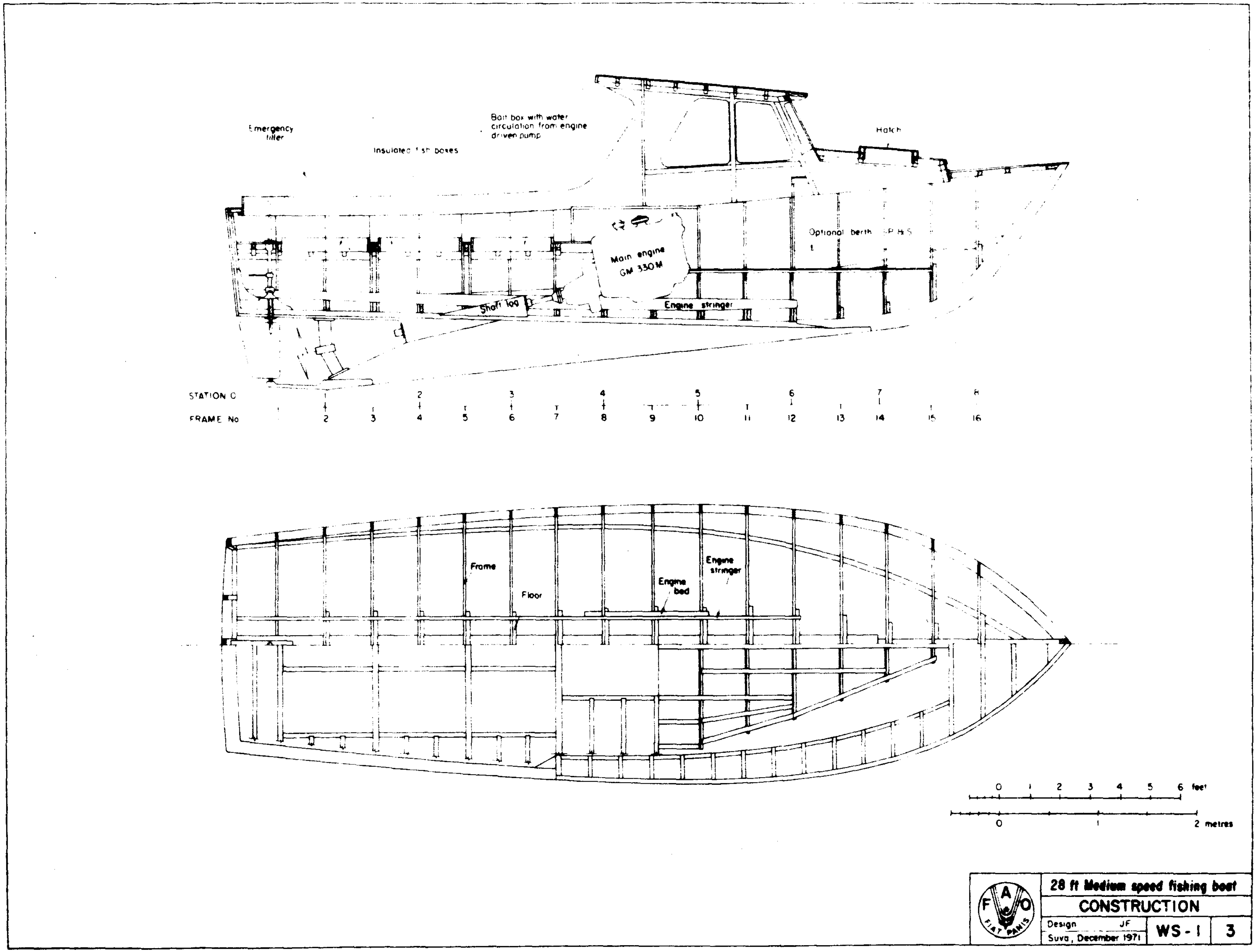


Fig.5 Construction drawing of Fig.3,

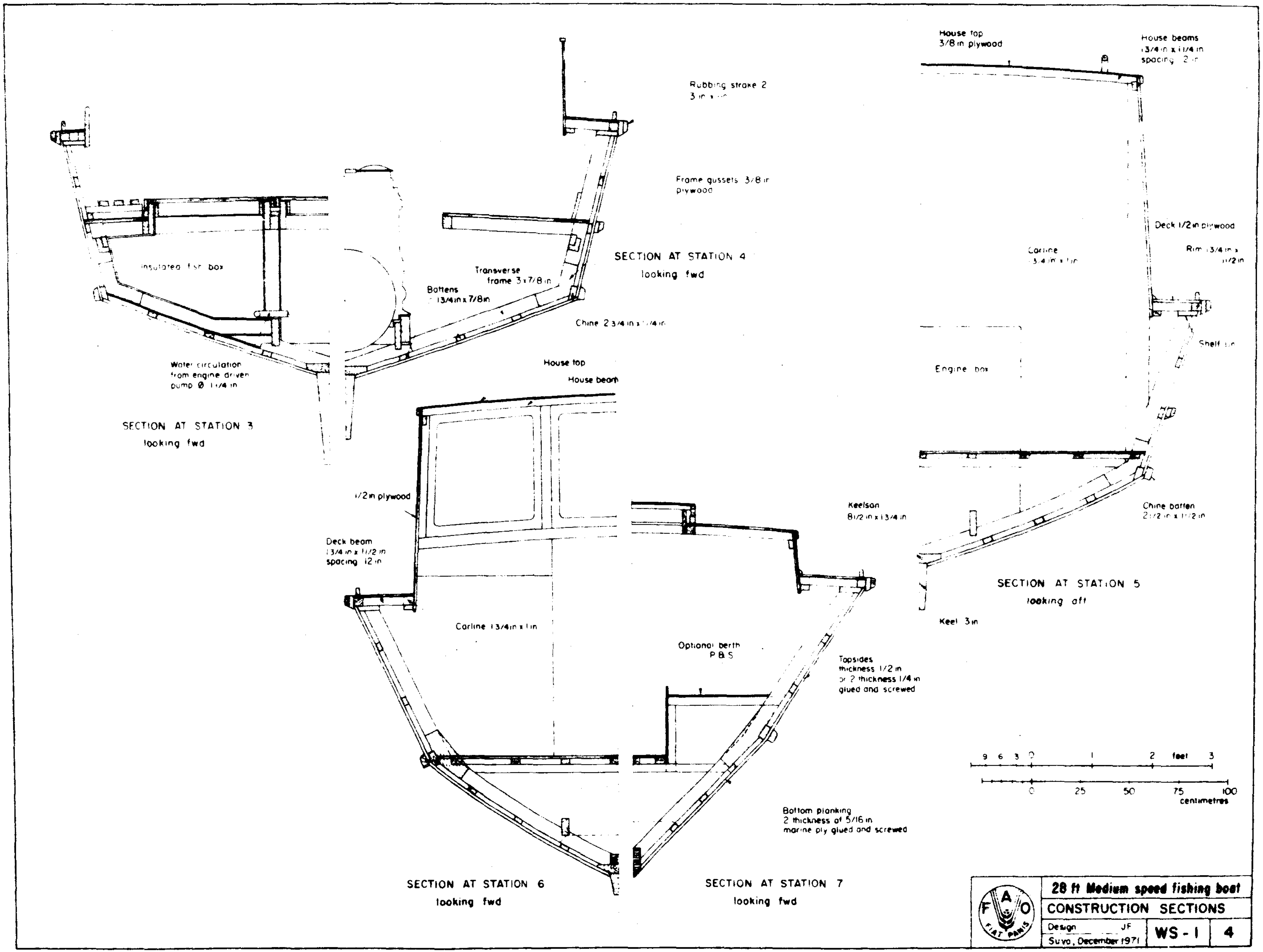


Fig.6 Construction sections of Fig.3

4. Conclusions

Economically driven hulls, designed to operate in the medium speed range are expected to be viable in comparison with lower powered boats, especially in the skipjack fishery, due to increased catches resulting from higher mobility in the catching operation and greater operational range in a day fishery. Prices received for better quality landings can also be expected to be higher.

Choice of correct vessel size and type is important.

For a village fishery, where daily catches can be smaller, due to a lower acceptable return per crew effort, the outboard boat of Fig.1, or its inboard-powered equivalent, will provide a satisfactory return.

For larger, urbanized communities and operation from deep water harbours, vessels in the 28 to 35 foot range of Figs. 3 and 9 can be chosen. Decision on optimum size of boat is dependent on expected average daily catch and operational range required. FAO interest in medium speed fishing boats is expected to result in a volume in the FAO Design Series illustrating vessels of this type with publication provisionally set for 1976.

Further details of designs illustrated in this paper can be obtained from the Fish Production and Marketing Service, Department of Fisheries, FAO, Via delle Terme di Caracalla, 0010 Rome, Italy.