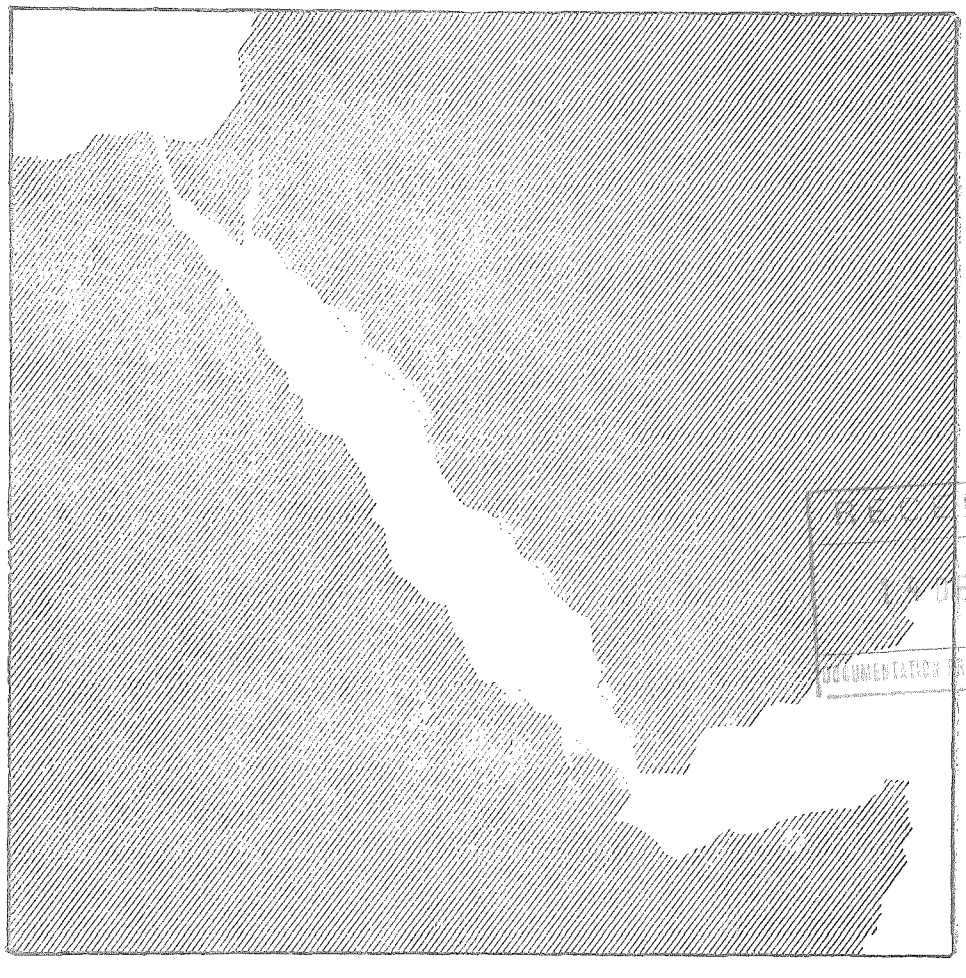
RAB 81/002/INT/20

DEVELOPMENT OF FISHERIES IN AREAS OF THE RED SEA AND GULF OF ADEN

FINAL REPORT



UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

RAB/81/002/INT/20

PROJECT FOR DEVELOPMENT OF FISHERIES IN AREAS OF THE RED SEA AND GULF OF ADEN

RAB/81/002

FINAL REPORT

by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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C O N T E N T S

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1. INTRODUCTION

1.1 The Report

This report covers the period from January 1981 when I joined the Project, at that time Project number was RAB/77/008, to my departure in April 1984, Project number was RAB/81/002. Previous to joining the Project, I had visited the Project site in Port Sudan from 10 to 15 May 1980 and written a report giving the situation and suggesting action to be taken. The background situation described here is based on that report and some alterations made through being able to verify particular points more thoroughly during the three years of my employment in the area. The work was centred at two places at different times: Mohammed Qol and Suakin. The timetable was dictated by the nature of the work. The nature of the work was not affected by the change in the Project's overall phases.

1.2 Objectives

In association with the Marine Fisheries Division, Port Sudan:

(1) to develop a new inshore fishing boat;

(2) to build a fish carrier boat to serve the area around Mohammed Qol to the north of Port Sudan, and

(3) to train counterpart staff and local boatbuilders.

1.3 Boatbuilding Situation, Red Sea Coast, Sudan, mid-1980

Almost all fishing was by handline from 8-9 metre motor-launches and 4-5 metre dugout canoes. Most boats were rigged with Lateen sails. The British ODA had sponsored the construction of many launches and had provided Lister diesel engines. Cost of boat was low and the builder highly paid, indicating high productivity. Little or no machinery was used in their construction. Most boats were round bilged. Constrcution was weak, all parts were lightly made. Planking joints had little strength. Framing, through scarcity of suitable timber, was weak. Corrosion resistant fastenings were not then available in Port Sudan. Paints were made by the boatbuilder and were normally based on vegetable oil and 'Sandros', an imported tree resin. This would seem a good product for preserving timber and waterproofing joints. Its claimed resistance to teredo worm has not been clearly proved. A good life for a boat was considered five years. Some boats treated with care lasted longer. Major repairs were often in the first two years (replacement of planks and keels). Boats were designed by eye and moulds. Sometimes simple drawings were made. Boats of any shape could be built but they were weak and short lived. Indigenous timber was used for the framing. Large crooks from which several frames could be cut were not available and much of the framing came from croppings of branches. Neem and acacia are popular. Keels were made from imported teak, keruing (lipterocarpus), home grown sunnut or pine, resistance to teredo worm being of prime importance. Planking and all fore and aft stringers were made from imported softwoods, imported in bulk and bought from merchants. The greatest obstacle to strengthening round bilge construction was the

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provision of suitable framing material. There was little technical understanding of matching engines to boats by horse power and some of matching propellers or how best to locate them. Marine equipment, unless made locally, i.e. masts, iron boat nails, forged rudder fittings, ... etc. were not available. This was either provided by donor agencies through the Marine Fisheries Division (MFD) or bought privately in Saudi Arabia.

Only the Lateen rig was used on fishing boats. This rig is quite efficient on all course of sailing but limits a boat's manouvering ability to windward and takes up much space when stowed in the boat.

Small boats: round bilge and small boats down to 3.5 m were built, all to the same style of construction as the launches. Dugout canoes had been imported about 20-30 years ago for inshore coastal fishing these ranging from 4 to 5.5 metre long, carrying one to two men. Conditions ranged from very good to total decay. Low degree of seaworthiness limited their range of fishing but their cost effectiveness was high.

One local engineer had produced a general purpose steel launch of about 10 metre which gave service. No other experiments had been made with materials other than wood.

2. PHASES OF WORK

The work had two phases:

(a) Work done in Mohammed Qol, and
(b) Work done in Suakin

2.1 Work done in Mohammed Qol

2.1.1 Background

The town: Mohammed Qol is 160 kilometres north of Port Sudan. It had been a major town before the construction of Port Sudan having a sheltered beach and anchorage. Its population had dwindled to under 300. The nearest wells were 3 kilometre from the town and water was brought from there by camel. There is no vegetation for food, fuel or building materials. The only industry is fishing and initially there were three motor fishing launches and four canoes. No craftsman lived there to do effective repairs. All materials had to be bought from Port Sudan.

2.1.2 Aim

The overall aim to revitalize the town's fishing activities was to be through assistance to the boatbuilding sector, providing a workshop, equipment and training inhabitants to repair existing and to build simple boats suited to local conditions.

2.1.3 Activities

(a) Boats and equipment produced: Four boats were built. For simplicity of construction with the limited skills available all were flat bottomed. This form is also well suited to fishing in shallow lagoons (for merits of different forms, see Appendix 1).

Boat 1: six metre canoe capable of carrying 45 kilograms capacity ice box. Suitable for operation by 1-3 men and propulsion by paddle, oar, sail of outboard motor up to 6 HP, (drawings nos. 1-a and 1-b refers).

Boat 2: five metre boat capable of carrying 45 kilograms ice box, suitable for operation by 1-4 men and propulsion by oar, sail or outboard motor from 5 to 20 HP. The greater beam made this boat suited to carrying and handling nets, (drawing no. 3 refers).

Boat 3: five metre, 1-2 man, canoe suitable for propulsion by paddle or sail and outboard motor up to 5 HP, (drawing no. 2 refers).

Boat 4: Verandah net boat. A shallow, light weight boat for setting verandah nets in shallow lagoons. Propulsion by paddle, oar or outboard motor up to 5 HP, (drawing no. 4 refers).

Both canoes were fitted with Lateen sails (boats 1 and 3). With this rig the mast is stepped near the centre of the boat. This makes the fitting of an ice box impossible and for the 6 metre canoe a standing Lug sail, for which the mast could be stepped at the forward frame, was also made. This proved satisfactory and it is the only rig suited to the 5 metre boat since it leaves the centre free for an ice box and handling gear. Following advantages of the standing lug sail rig were demonstrated:

- ability to tack and gybe only using one rope for control;
- ease of raising and lowering;
- small amount of space required in the boat when lowered.

For the five metre boat and six metre canoe, a Bermudian type mainsail of smaller area than the standing lug sail was made enabling each to be sailed safely in strong winds. Sails were made with different types of available cloth and the denim proved the best.

Lee boards were made to enable the boats to sail to windward. This ability was demonstrated. Drop blade rudders were made to enable the boat to operate in shallow waters and amongst coral without being damaged.

Oars and paddles were in short supply. The timber available was poor grade and oars made of it to normal dimensions frequently broke. A system of making strong oars from the same timber laminating with glue or nailing and binding with twine was devised and oars made.

Pumps: A simple plunger flap valve water pump was made from local materials. This, although mechanically less efficient than the imported pumps, the exposed diaphragm of which perished, was likely to prove more durable and could always be repaired in the field.

(b) Repairs:

Even newly constructed motor launches needed repair, particularly to rudders, the fittings of which were weak and in the stern post to keel and horn timber area. After these in frequency came leaking butt joints of the planks and damage by teredo worm. New rudder and strong rudder fittings were made, butt straps fitted, new planks and in one case a complete new keel fitted.

Repairs were also done to dugout canoes when we obtained good waterproof glue.

Gravine pieces were let in and glued in position, and laminated frames, laminated in situ added to boats with serious splits. Repair work always got priority over new construction to keep the boats operating.

(c) Training:

Two local men were trained in the use of tools and in all work which was done. The type of work, as regarded new construction, was limited to their skills. Our main aim was to teach rather than to build. Two counterpart staff, Mr. Adam Idris and Mr. Ali Mosbah were trained in all aspects to the point where they could themselves instruct. Two manuals were produced. One pictorial with Arabic captions for craftsmen with little or no literacy on flat bottom boat construction, and a manual for instructors, in Arabic, explaining fully the methods and understanding technology.

2.1.4 Results

The period of direct involvement in boatbuilding started in February 1981 and ended in June 1982. The results went as far as the activities listed above. There were some complaints about all aspects of the work by the villagers, particularly as regard to the types of boat and that they were flat bottomed. Flat bottom boats are built locally at Halaib under similar conditions as those found in Mohammed Qol. What we built were considerably better and although we started a V-bottom boat there, this was clearly beyond the level of skill available. The two trainees did not volunteer of their own accord for training. One was a boy brought by his father who despaired of him learning at school. The other was the village handyman and he was told to attend by a senior villager. There was little interest from the village to support them and after we left they showed no much inclination to support local boatbuilding and repair.

2.1.5 Recommendations

That the boatbuilding activities did not become fully self supporting after eighteen months was one of the hazards of rural development and should not condemn the system for suitablity elsewhere or in Mohammed Qol at another time, possibly soon. Small rural communities have a small labour pool in which each individual affects the whole more than in an urban area where an individual is quickly replaced and where in any training scheme an initial high turnover of

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trainees and some loss is anticipated in the first few months. Where there is a local aptitude for the work, particularly where there are men with interests or skills, restricted by lack of amenities the system can work well. As the fishing community of Mohammed Qol increases and more young men come to the area, so the likelihood of a village boatbuilding operation working successfully increases. Good facilities now exist and it is within the ability of the trained counterpart staff to operate. The system could be put into immediate effect at other rural centres.

From Halaib, near the Egyptian border, there were requests for us to go and set up a small workshop and train local people. Individual handymen sent requests with the towns' Leaders. They already built crude boats from driftwood. Similarly from Agig on the Eritrean border there was a similar request, where a young man trained at a technical training centre in Port Sudan was willing to learn. In either of these places, a small workshop equipped with basic tools could be set up and six months training given. The tools would be best donated after training to the town, in the care of a reliable craftsman, since collecting payments from such distantly placed locations could cost more than the tools. Boatbuilding would not be a self-supporting industry by the available skills and equipment would enable each place to maintain and enlarge its own fleet. More advanced boat types could be built on site from parts made in Port Sudan or Suakin. More than six months training would not initially be economic in terms of the returns possible. The counterpart staff trained in Mohammed Qol are cappable of running such a scheme, given enough support in equipment and materials.

2.2 Work done in Suakin

2.2.1 Background

Suakin is the centre of the Sudanese Red Sea boatbuilding industry. The Project had been asked to provide a fish transport boat to carry ice and fish between Mohammed Qol and Port Sudan. The skilled labour required could be found in Suakin. It had been agreed that the Project would provide a suitable design, engine with propeller, tube and shaft and any expertise required. The boat would be a technical advance on the traditional boats. The construction of the boat was to be given priority over any other work. Other work done in Suakin was the construction of a light V-bottom inshore fishing boat, prototype for a type to be built from batch produced sets of parts. The testing of this boat and the construction of sets of parts for six boats developed from the prototype. The Project's Launch, built in Alexandria was to be sheathed in G R P to protect it from decay.

2.2.2 Activities

(a) Products:

1. Building a V-bottom transport boat:

To build a strong boat from local materials a V-bottom hull was chosen. This enabled frame with continuous strength from the floor on the keel to the deck beams to be made out of straight grained planks of strong Sudanese hard-

wood, such as mahogany. Mahogany is a moderately durable timber which must not be used in direct contact with seawater where it can be attacked by toredo worm, but for framing it is very suitable, being strong, easy to work and resilient. The design chosen was MLW-4, a basic and proven trawler hull. With the assistance of an FAO Naval Architect, the designed hull was lengthened to increase the carrying capacity and the structure modified to suit local building conditions.

Fastenings of galvanized and plain steel, copper, bronze and brass were not available in Sudan so we standardized on steel. The fastest corrosion occur, in the Red Sea through electrolytic action caused by mixing dissimilar metals. Normal rusting through oxidation occurs mainly around the waterline. The slowest corrosion, where there are no other metals nearby, is in saturated timber below the waterline, the next slowest is the dry timber above. Wherever possible galvanized fastenings were used. The suitable ones were not available. Solid steel were used, treated so that its surface was corrosion resistant, given two coats of aluminium paint and finally coated with a mix of aluminium paint and being driven in asphalt. The latter acted as a lubricant as well as an effective barrier to corrosion. The stern tube being yellow metal was electrically insulated from the surrounding structure by first priming with a polyurethane metal primer, then coated with GRP and bedded in tar. Zinc anodes were placed near the propeller and bronze skin fittings for the enigne. Painting with epoxy tar had noticeably reduced the rate of deterioration of fastenings and had protected the planking from toredo worm when applied to the FAO launch. Four coats of epoxy tar were applied from the keel to well above the waterline.

Work commenced in August with setting up a workshop in Suakin, making benches, some specialized tools and lofting the plans. The money for the building materials was not made available immediately, hence, the prototype V-bottom was built and tested whilst waiting for timber for the transport boat. Timber started to arrive and work started in February. A full team of four private sector boatbuilders and three government sector boatbuilders were employed by the end of April. A basic team of 7 was maintained with occasional additions (one boatbuilder joined for three months asking to be trained, he charged nothing for this work, and men for particular jobs, making ladders, caulking, painting, ... etc.). After the first sea trial the private sector was reduced to two. There was insufficient work for more. Because much of the work was new to the team, the maximum employable was limited by the number that could be supervised by me and Mr. Adam, my counterpart, who was also learning. Preparing parts to previse dimensions in a workshop so that they would fit when assembled on the boat was a new method to them. Whilst this allowed the optimum use of facilities and builders, much time was lost when individuals allowed their standard of accuracy to drop below that required. This revealed the training aspects of the work and the maintenance of correct standards improved towards completion of the hull. A second boat built by the same basic team should save 25 percent in time from this alone. The boat was launched and proved satisfactory on sea trials.

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2. V-bottom boats:

These are simple boats to build. Suited to locally available materials. All the parts can be prefabricated in a workshop. A prototype was built and tested in winds of up to force 5 in the open sea. It was sent to Halaib for use by the school there for fishing inside the reef. The different sea conditions around Halaib, a reef out to sea and shorter steeper waves inshore, necessitated an 8 percent increase in beam and 16 percent increase in free board over the prototype. The design was modified and templates of parts made to ensure accuracy and speed in marking out, and 6 sets of parts made. This boat is suited to batch production with limited facilities. Also sets of parts can be made by skilled craftsmen, with the machinery available, and can be assembled at remote locations by less skilled but basically trained builders equipped with simple tools.

3. Work done to Project launch:

The boat built in Alexandria was suffering severe electrolytic decay to its steel fastenings and electrolytic decay of the timber had necessitated some replacement of planking. The inboard and outboard shaft bearings needed replacing as did the shaft. The boat was hauled out in Suakin. The paint stripped off and a GRP sheath applied to the hull. The adhesion of the sheath to the hull was assured by using a polyurethane bonding agent. Mechanical bonding was assured by nailing the sheath to the hull, the nails going through the planking into the frames were driven through four laminates while they were still 'green' and the last two laminates applied on top. The old shaft, stern tube and bearings were removed in February 1983 and new ones ordered. These had not arrived by April 1984. Their installation will be done by Mr. M. Kerkeni, the Marine Engineer based in Suez. The boat was repainted and the wheelhouse revarnished.

(b) Training:

Training beyond that required for the work in hand was not given because of lack of time. The work gave four local boatbuilders and three government sector boatbuilders training in building boats to a higher standard. The Senior Counterpart gained experience in organizing a workshop to optimise on manpower and equipment available.

All counterpart officers and three local craftsmen gained experience in applying GP. One man applied to join the transport boat team to work without pay for three months just for the training. Mr. Kasim, Director of Education for the Red Sea Province, requested that we give school boys workshop experience. We arranged with three local schools for 2-3 boys to attend daily for two hours. This eventually failed since the boys came as and when they pleased and it became impossible to integrate them. One boy, Hashim, returned for a further period of training after leaving school, working for a basic labouring wage. He had been the most reliable of the school boys and was working on fitting out the transport boat when I left.

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Considerable interest was shown in our work in Suakin by people who live with boats and appreciate their qualities. Some of what we did was copied by those not directly involved. More machinery is being used and stronger rudders and proper rudder fittings are the most obvious improvements to boats since our arrival.

2.2.3 Results

The construction of the transport boat provided the Marine Fihseries Division with a reliable means of supporting the northern fisheries initially around Mohammed Qol and, when ice becomes available in Mohammed Qol, Halaib. This could lead to the local market for fish being satisfied and Sudanese fish could then become an important export. The technology introduced is relevant to the boatbuilding situation. The demand for many boats capable of carrying goods across the Red Sea with only a short economic working life is decreasing. The demand for boats strong enough to work through a wide range of weather conditions and with a long working life and good resale value is quickly becoming important. With the introduction of Egyptian fishing methods small trawlers will be required. The methods used in building these could be the same as those used for the transport boat and the orders would enable the Suakin boatbuilding industry to modernize and continue competing with its neighbours for orders. If the Mohammed Qol ice plant enables the catch from the northern area to increase a second transport boat would be needed. The boat proved the viability of building a boat as good as any built in the Red Sea area and many imported boats, in Suakin.

Initiating the production of the 6 metre V-bottom inshore boats introduced batch production of parts and assembled boats. For a stock design, this should lower the labour cost which in Suakin is high for the area. It enables the most skilled to accurately make the parts, leaving the less skilled for assembly while still ensuring a sound product.

The use of light machinery, all of which can be bought in Port Sudan or Khartoum, for boatbuilding demonstrated how labour costs could be saved and the cost of equipment and running it covered profitably. Most boatyards were under equipped and the amount invested in equipment far lower than that for optimum profitability. The extent to which any manufacturer can economically mechanize varies with many factors and from one place to another within the same country: what would benefit the boatbuilders' profitability in Suakin could cripple the boatbuilders in an isolated village. For the Suakin boatbuilder to continue building boats of value to fishermen they need to mechanize as one or two are doing.

Sheathing the Project launch with GRP has provided a nucleus of boatbuilders with basic understanding of handling glass fibre and polyester resins.

The atmosphere in Suakin was different to that in Mohammed Qol. The local people were more interested in being themselves productive and many showed a positive interest in the transport boat. For some days after the launching, members of the team were stopped in the street and congratulated by local inhabitants. They have the interest to enlarge the scope of their technology.

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2.2.4 Recommendations

The three counterpart staff should gain further experience working on boats of more advanced types. This would enable them to evaluate their own boatbuilding industry, the relevance of their recent experience and to broaden the scope of their craftsmanship. Mr. Salah Ali El Beshir and Mr. Ali Mosbah would benefit from 3-6 weeks in Attaka near Suez. Mr. Adam Idris Shehatta would benefit from a fellowship of a year's course in boatbuilding technology in a country where boatbuilding is a well developed industry, such as the United Kingdom. He is intelligent, a good craftsman with a quick grasp of technical matters. With such experience he would need no assistance to lead a team to build a repeat order of the transport boat or to build a different boat to a set of plans. He could also be of great permanent assistance to local boatbuilders and boatowners assisting the development of the local industry. Should more boats of the same type be required before he can attend a fellowhsip he will require for a repeat order of the transport boat, a consultant for three weeks. For a boat of similar construction but different measurements he will need a consultant for Lofting, 6-8 weeks.

Other materials than wood should be tried. Port Sudan has a growing number of people capable of working steel. A steel boat's overall life expectancy may not be more than the best locally built wooden ones. But a mediocre steel boat will outlast and may be cheaper to repair and maintain than a boat of mediocre local wooden construction. In terms of fishing time it could be more productive. The initial cost of a V-bottom fishing boat designed on conical sections will be close to that of a wooden boat. Because of steel handling gear presently available a trial boat should not be too big. The sponsoring of a steel boat could directly benefit the fishermen and it would encourage an engineering firm to orientate some of its interest around the marine field, to the further benefit of fishermen and the boatbuilding industry.

If the Rainbow Paint Factory, Khartoum, can produce a suitable laminating resin, a limited batch from one mould of smaller fibreglass boats could be sponsored to assess their commercial viability. There is a need for simple technical papers in Arabic. In Suakin and Port Sudan there are many literate craftsmen who will read whatever they can get about their craft. The FAO technical publications were on interest to the few who read English. Their production in Arabic would be of immediate and lasting value. Simple technical boats produced in stripcartoon form have a high value in the field. A project to translate and produce relevant technical books would speed development. The speed at which technically advanced countries develop their technology is greatly assisted through the easy availability of technical papers. Such a project could use a trained counterpart officer for translating the specialized technical language which is seldom translated intelligably by qualified translators. This would prove much cheaper, even paying salary increments and other benefits, and more beneficial than paying for translation by professionals.

3. SUMMARY

3.1 Boatbuilding Situation on the Sudanese Red Sea Coast, March 1984

The industry has changed little in four years. A greater percentage of motor launches are now transom sterned with easy lines and flattening of the

stern sections, as has been found beneficial the world over in medium powered motor launches. Some interest has been taken in our methods and rudder fittings and their fastenings are noticeably improved, even in one case in excess of the strength of our fittings. There have been marked increases in some of the monthly catch rates, particularly for launches. The need now for sound fishing boats is becoming evident. There is also an interest in Suakin in sailing boats which can sail out of Suakin to windward. This was not considered possible until I frequently demonstrated it in a sailing dinghy. Boats rigged with a tackable rig and centreboards would find a market there.

3.2 Results

(a) Mohammed Qol:

- four fishing boats built,
- paddels and oars developed and batch produced. Pumps, designed and made,
- sailing rigs for small boats developed and demonstrated,
- launches repaired,
- two local men trained in the above work,
- two counterpart boatbuilders trained to reach the above work,
- instruction manuals produced in Arabic.

(b) Suakin:

- V-bottom, 6 metre inshore fishing boats built and tested,
- parts for six improved 6 metre boats produced,
- 13.5 metre fish carrier boat built, launched and tried,
- training in the above given to four local craftsmen and three government employed craftsmen,
- project launch had stern removed and was sheathed in GRP,
- training in basic GRP work given to three local craftsmen and three counterpart craftsmen.

3.3 Summary and Recommendations

(1) Two counterpart boatbuilders could have a study tour to Attaka, Egypt, to study Egyptian boatbuilding,

(2) The senior counterpart boatbuilder could be awarded a year's fellowship to attend a boatbuilding course in the United Kingdom,

(3) One steel launch and a batch of small inshore GRP fishing boats could be built to assess their commercial potential,

(4) More technical papers should be produced in Arabic, and

(5) Simple boat building and repair workshops should be set up by counterpart staff in rural fishing countries to promote their self sufficiency and expansion.

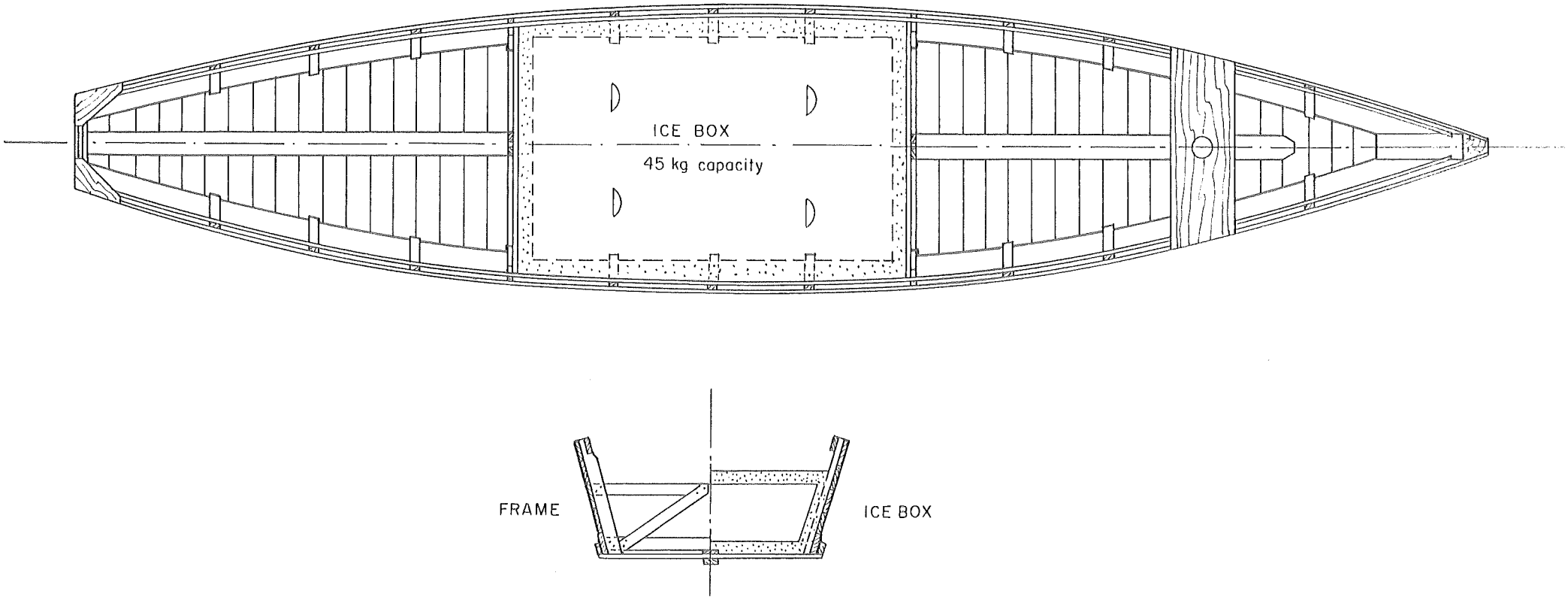


Fig. 1 Layout of 6.0 m canoe

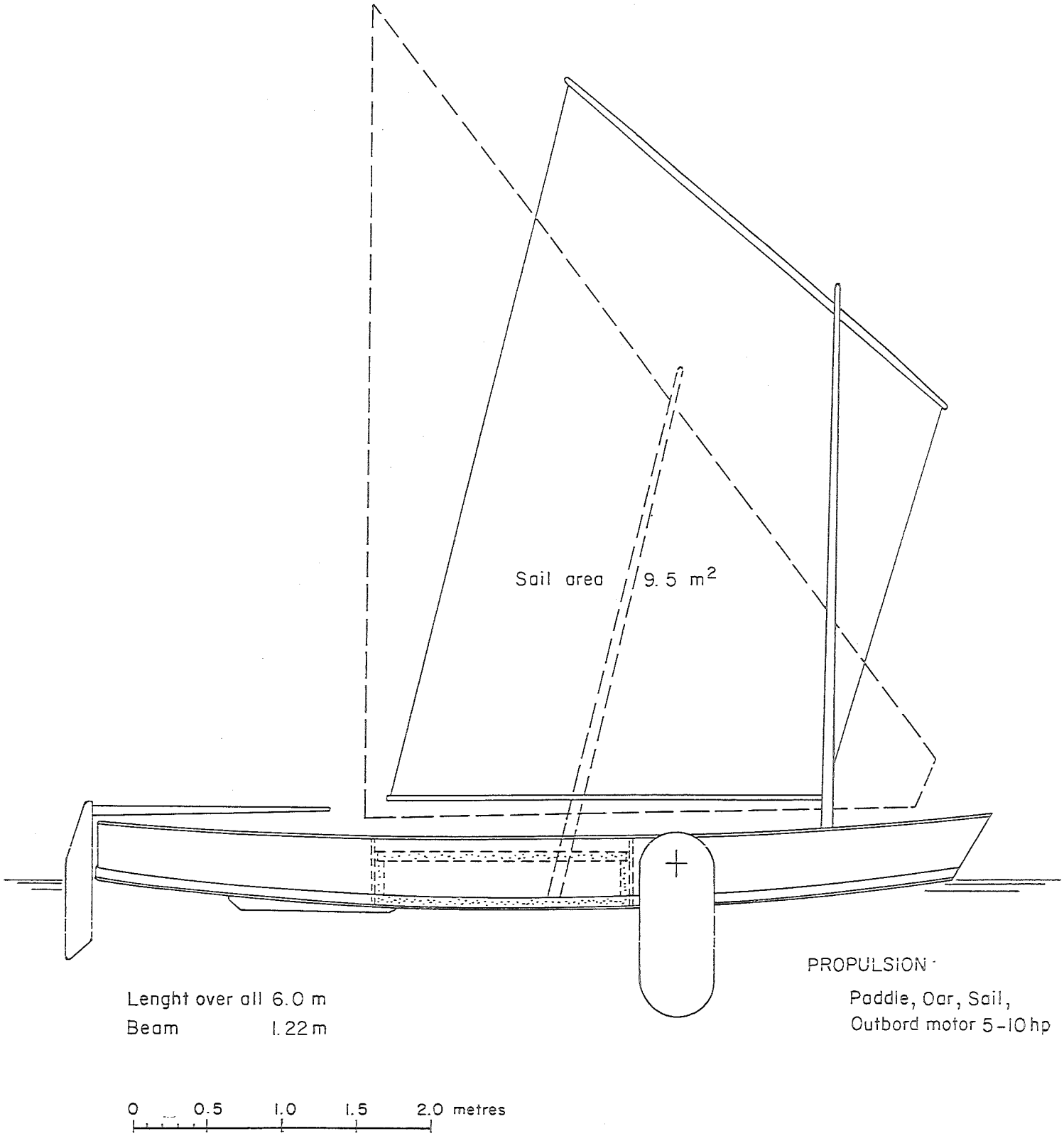


Fig. 2 Sailing rig alternatives for 6.0 m canoe

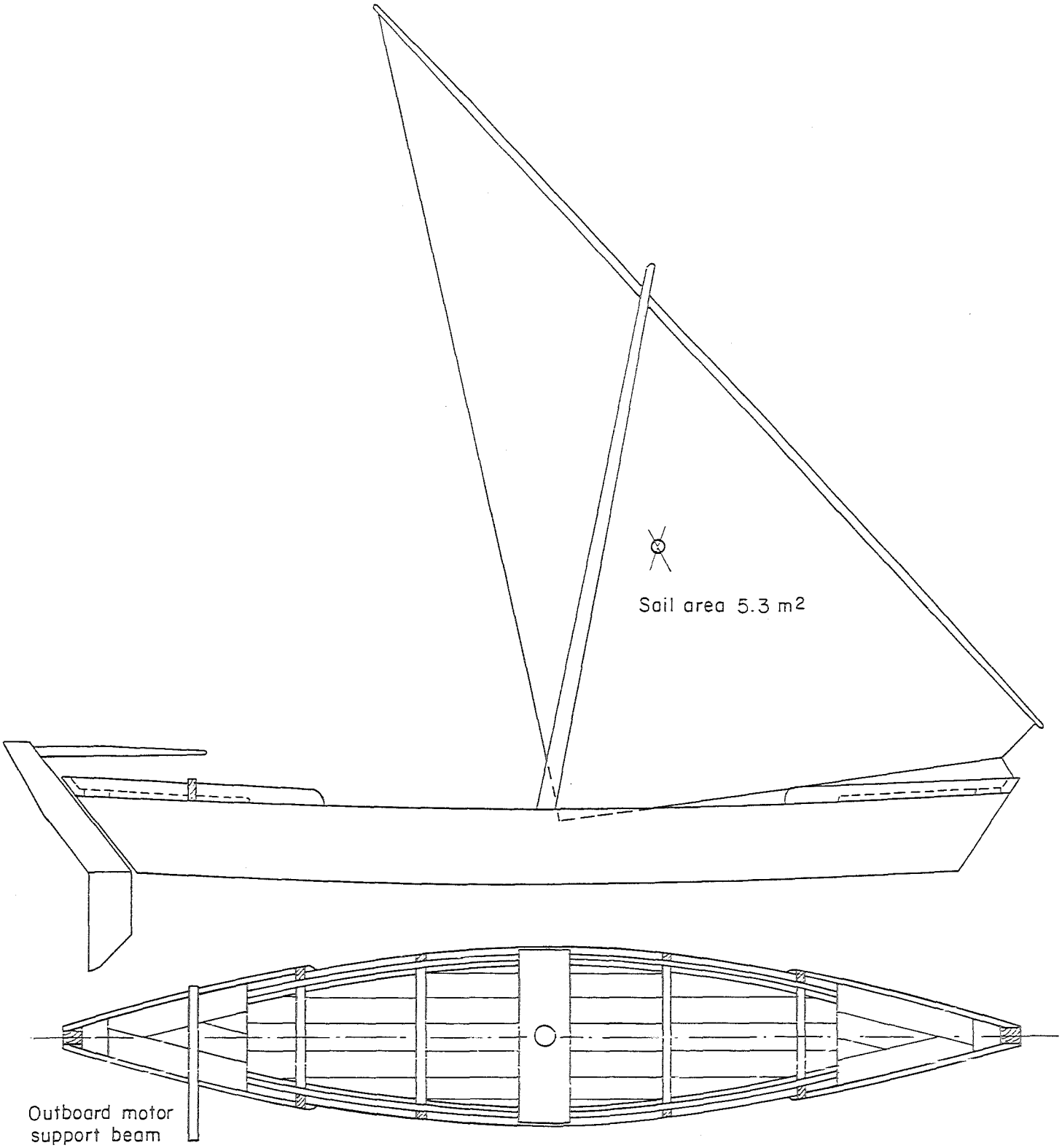


Fig. 3 Layout of 4.8 m canoe for 1-2 men

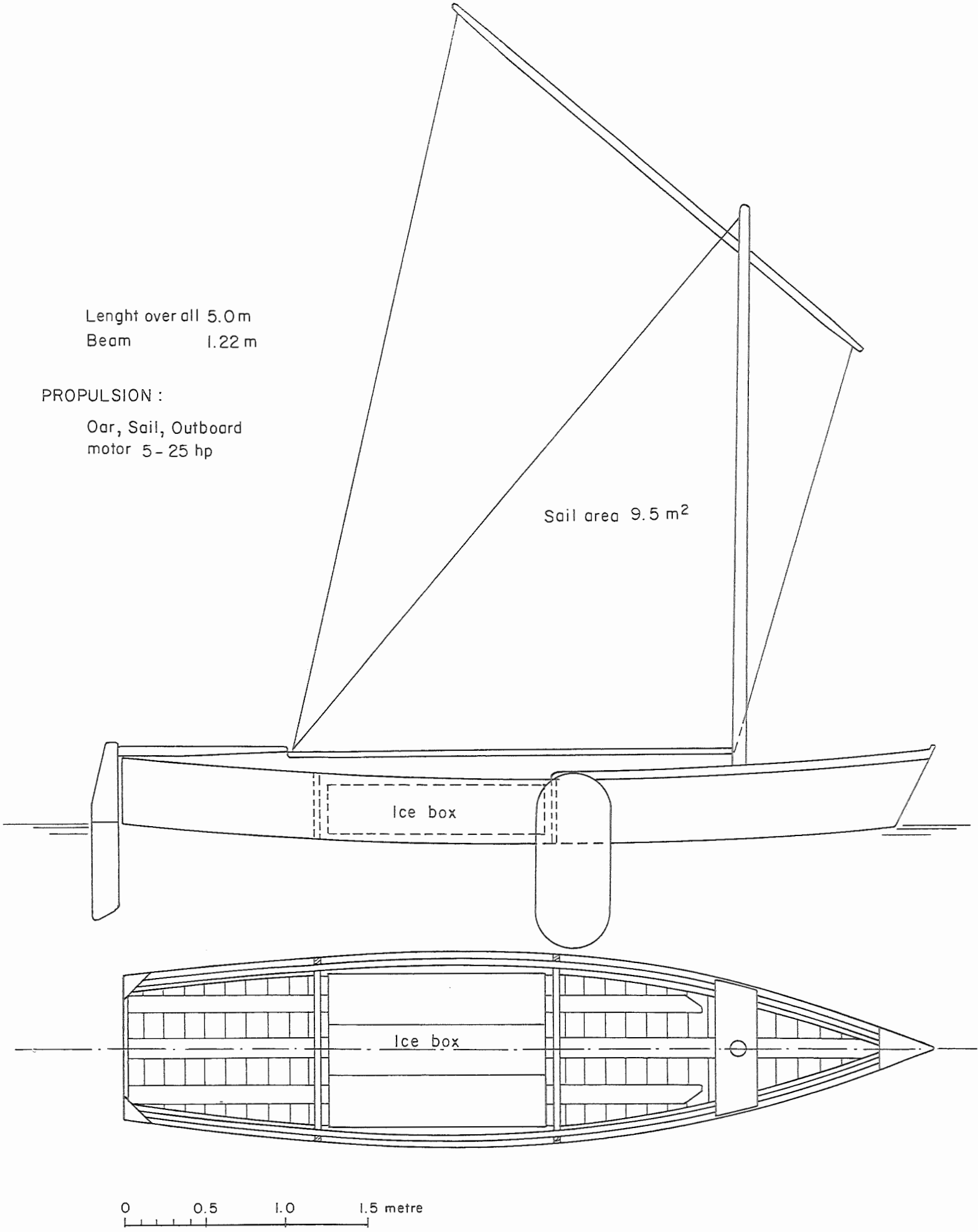
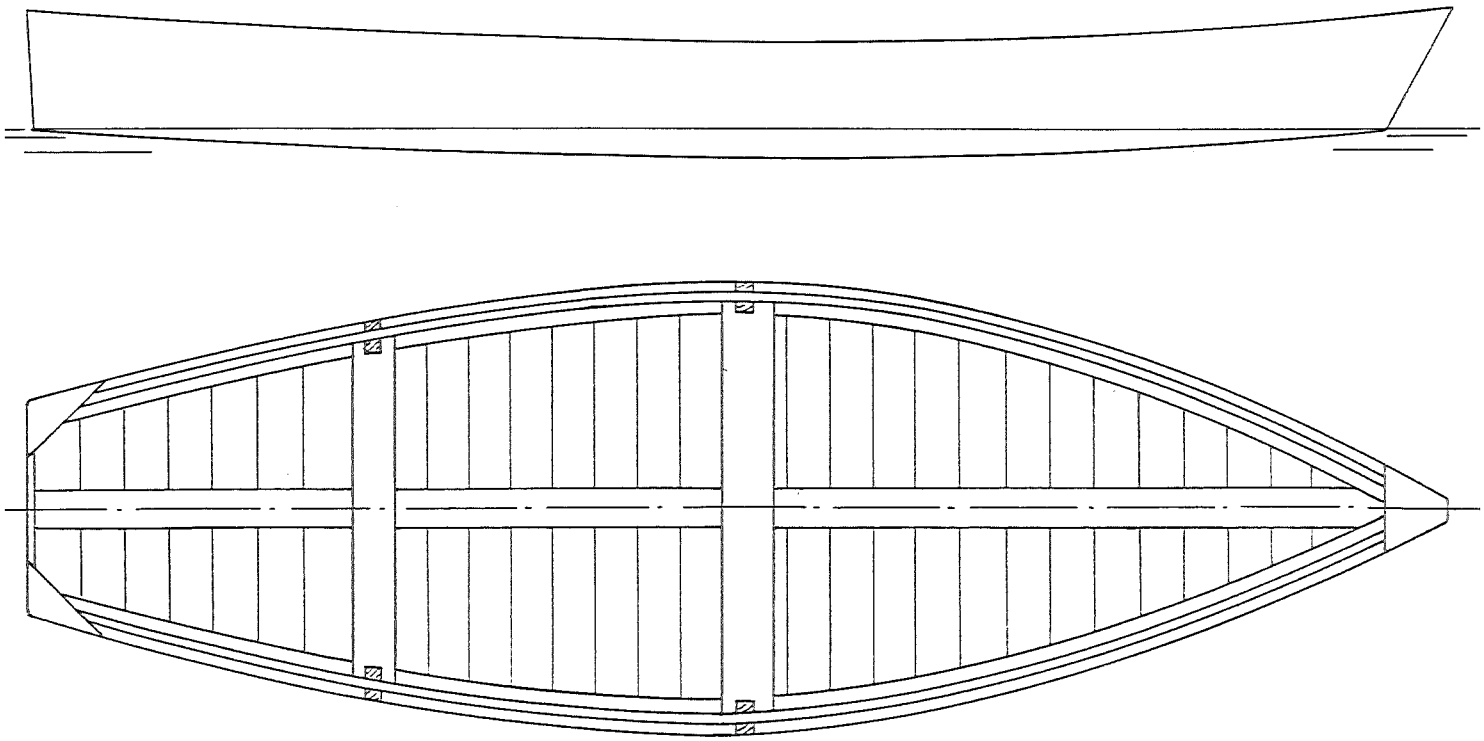
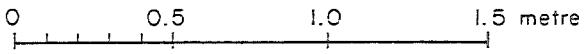


Fig. 4 Layout of 5.0m boat for 1-4 men

Lenght over all 4.5 m

Beam 1.45 m





PROPULSION:

Oar, Paddle or Outboard motor up to 5 hp

Fig. 5 Layout of 4.5m verandah net boat

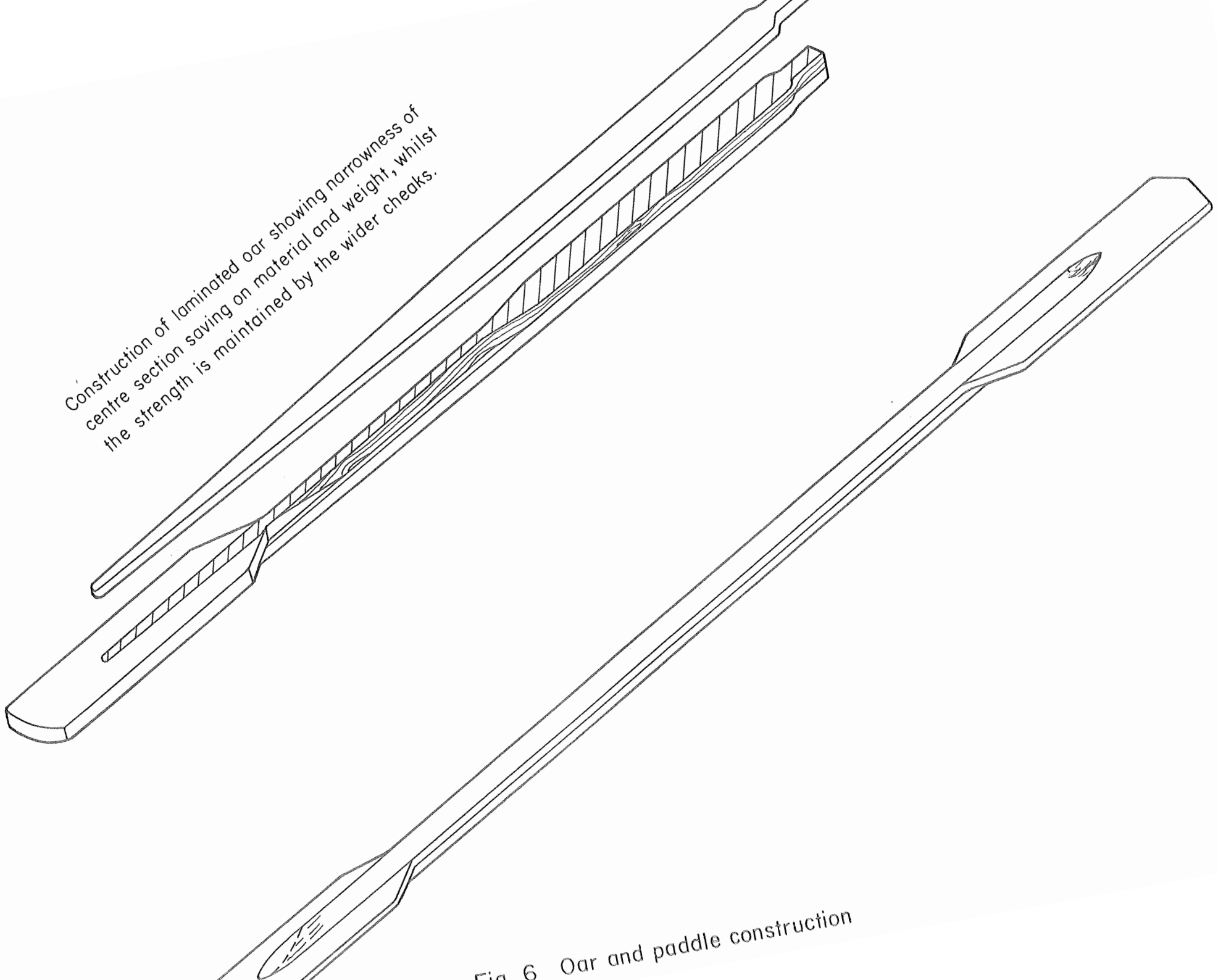


Fig. 6 Oar and paddle construction

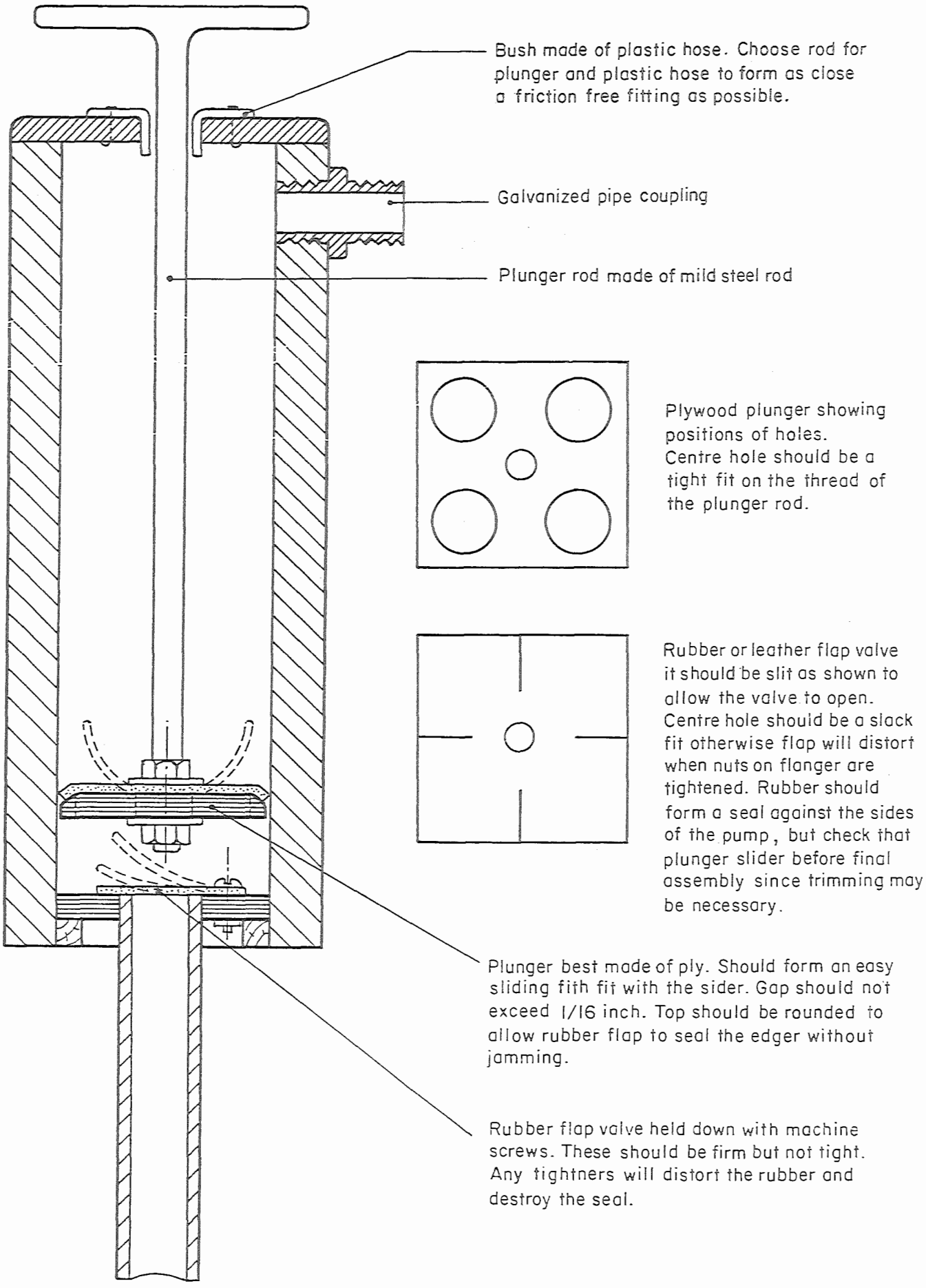


Fig. 7 Bilge pump construction

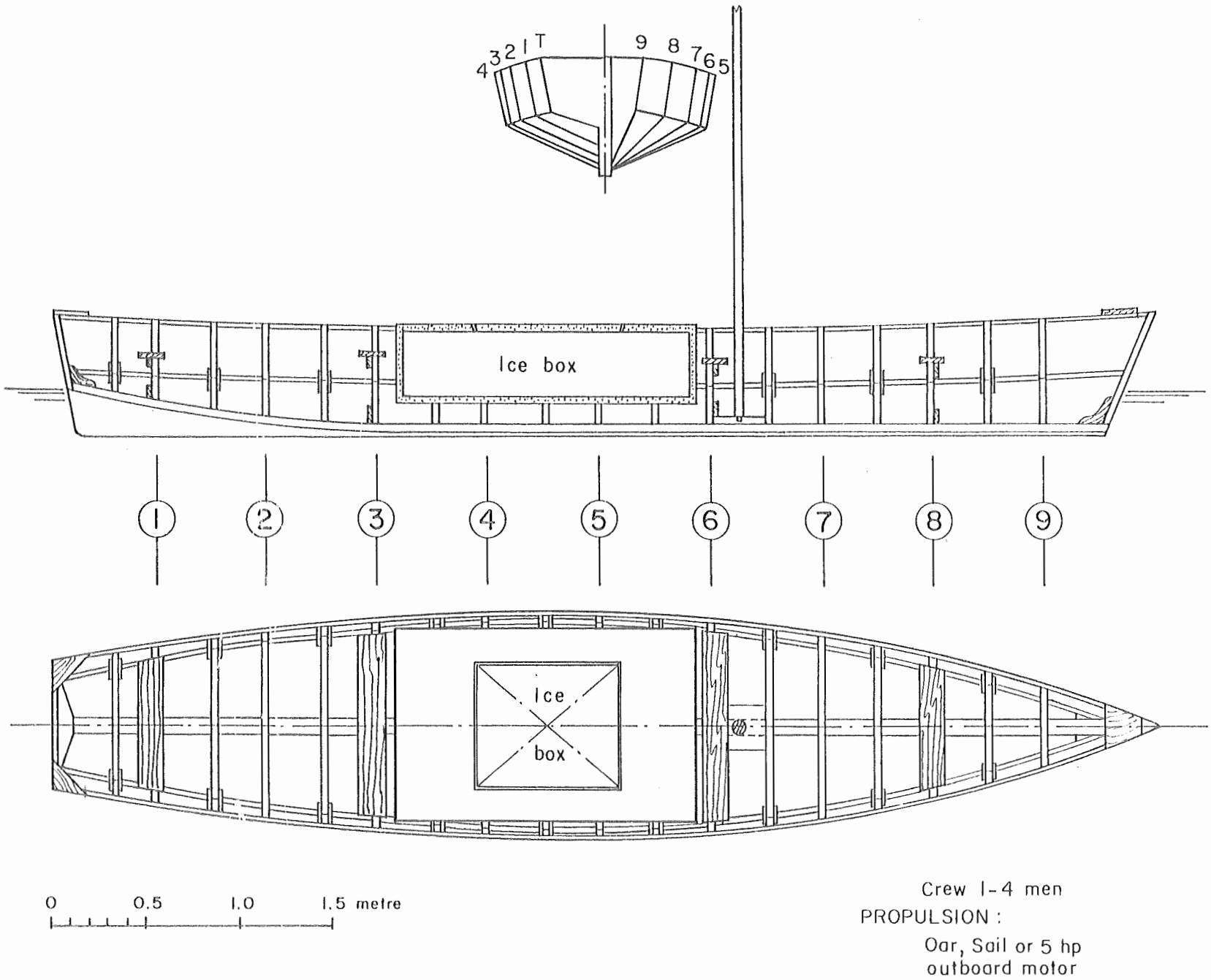


Fig. 8 Layout of 6.0m V-bottom Houri

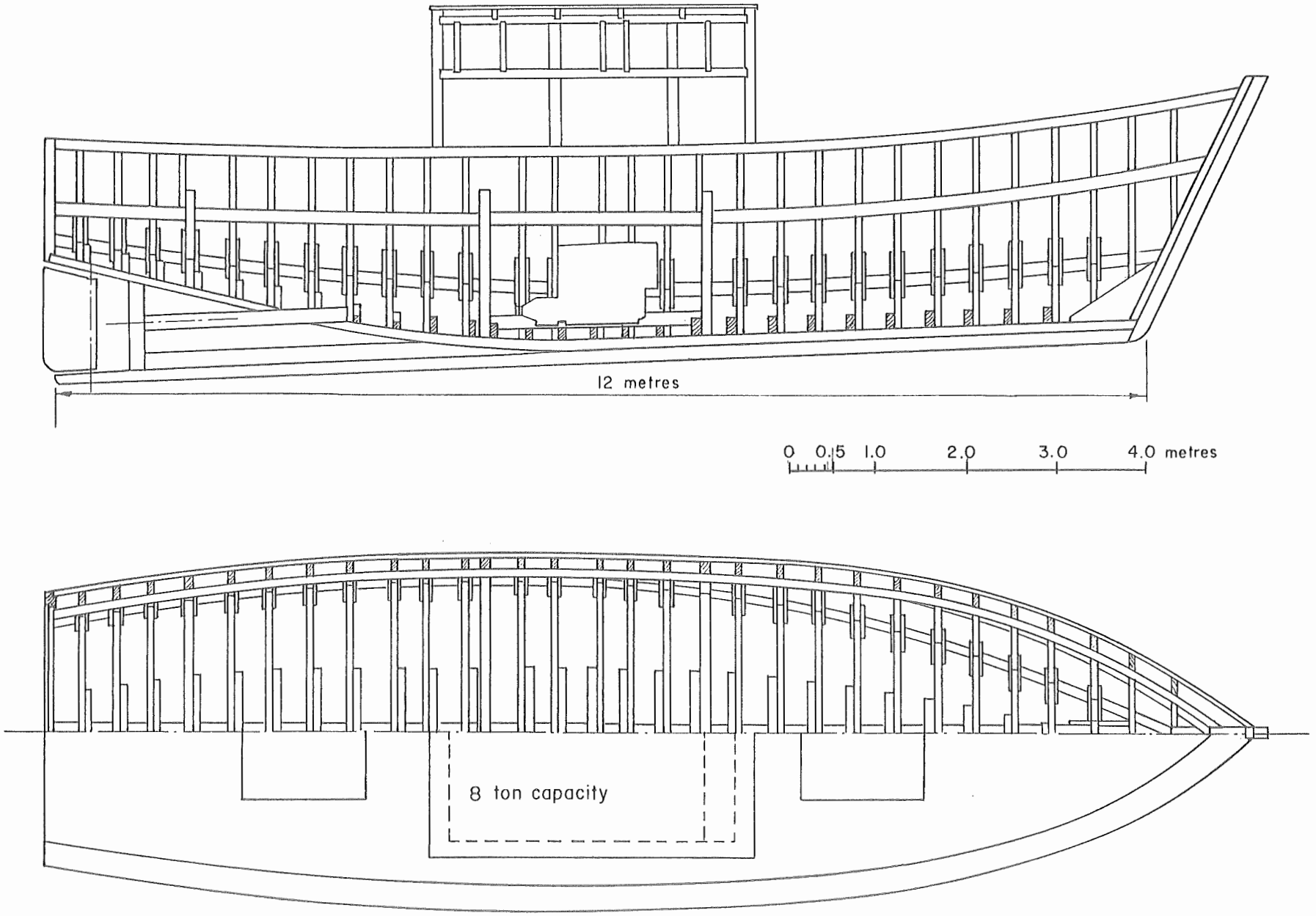


Fig. 9 Layout of 13.5 m transport boat