

PARTICULAR NEEDS OF FISHING VESSELS  
FOR USE IN THE DEVELOPING WORLD

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## PARTICULAR NEEDS OF FISHING VESSELS FOR USE IN THE DEVELOPING WORLD

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### Abstract

The fisheries of developing nations sometimes require vessels whose characteristics are quite different from those used in the industrialized countries. The panel assembled here is composed of representatives from East Asia, Latin America, West Africa, Southeast Asia, and the Caribbean. Each of these regions encompasses a tremendous variety of fisheries and physical conditions. For example, to discuss the requirements for fishing vessels for Southeast Asia may be like discussing the needs of fishing vessels for North America. Constraints in space and time permit only general overviews, and detailed description of any one fishery is impossible here. In some cases the focus will be on a particular country within the region, and in other cases the discussion may center on considerations which are generally common to an entire region.

Also present in many of these areas are foreign flag, distant water fishing vessels, often with on-board freezing or processing capacity. The following discussion will not include such operations, but will focus on the fishing operations of the nations within each region.

Many developing nations have recently established 200 mile Exclusive Economic Zones, and they are anxious to increase their benefits from the fisheries resources of these zones. Where industrial fleets have increased, small scale fisheries have sometimes been neglected. Nevertheless, small scale fisheries are often extremely important local sources of protein, employment, and income. The particular problems and considerations involved in vessel operations in developing areas often have a greater impact on small craft than on large vessels. For the above reasons, this discussion will focus primarily on the small scale fishing sector. There is endless debate on the definition of small scale fishing, and any definition will find many exceptions. For discussion purposes here, the terms small scale fishery and artisanal fishery are used interchangeably, and defined as those fisheries involving vessels of less than 15 meters in length, generally operating within 20 miles off the coast.

The versatility offered by multi-purpose, combination fishing vessels is a great advantage in many developing areas, if the cost of conversion to a different fishery is not prohibitive. Many developing nations have high unemployment, and in these areas, innovations which tend to decrease crew size might do more harm than good.

Many developing countries have a shortage of foreign exchange with which to buy imports. Where this causes high fuel prices or shortages, fuel efficiency and alternative energy sources such as sail should be important considerations. In the fisheries of developing areas, inboard motors are sometimes far more economical to operate and maintain than outboards.

Motors, spare parts, and repair facilities are sometimes lacking, and new technology should be as easy as possible to maintain and repair. Provision for long-term supply of spare parts is a must. Vessel construction maximizing the use of local materials and labor can sometimes ease problems with foreign exchange.

In many areas, adequate harbor facilities are lacking, and small craft must be launched directly from the beach. In most areas, there is much room for improvement of fish handling and preservation on board.

The traditions and desires of local fishermen are extremely important considerations in the planning of new technology. Whenever unfamiliar equipment or methods are introduced, it is most important that they be accompanied by thorough training programs in their efficient operation and maintenance.

### Southeast Asia

Bambang Priyono, Resource Economist, Indonesia

This region covers an area much greater than that of the United States, with many island and coastal nations which harbor a tremendous range of maritime conditions and fisheries. Commercially valuable stocks include pelagic schooling species such as tuna, skipjack, sardines, and mackerel; as well as demersal fish species and crustaceans such as prawns, crabs, and lobsters.

The region's traditional fishing vessels are made of wood. Some are dugout canoe-style, but most are planked. Most small craft have one or two outriggers. This style of construction is common in vessels from six to eleven meters in length overall, and larger outrigger canoes are also seen in some areas. Most of these vessels are equipped with sails, and many also use outboard motors or inboards, a typical installation being a 5-20HP direct drive inboard gasoline engine. The most common fishing methods employed by these craft are handlines, pole and line, gillnets, bagnets, and various seines. Many use light to attract schooling fish at night. A very substantial part of the region's production comes from small craft in this category.

In the early 1960's bottom trawling was introduced to many countries of the area. It proved highly effective in many areas, and led to substantial increases in production. Many countries in the region now have a number of trawlers, longliners, and purse seiners of 50-200 Gross Tons.

Several countries are also involved in large scale offshore fishing operations, with vessels ranging up to 300 GT, either owned nationally or operated in joint ventures with countries such as Japan.

While some areas of the region are overfished, in many places there is room for expansion or improvement of the fleets. Many nations are very anxious to exploit the offshore waters of their recently

established 200 mile Exclusive Economic Zones. It is felt that vessels in the range of 30-60 GT might be most appropriate for this purpose. Fishing vessels are quite expensive in the area at this time. For example, in 1980, the price of a new wooden tuna pole and line vessel of 30GT in Indonesia was approximately US\$72,000, including motor and fishing gear. High quality wood for boatbuilding is very expensive, and in these tropical waters worms and borers contribute to short vessel life and high maintenance costs. Alternative building materials such as fiberglass, ferrocement, or steel would be superior in many ways. In addition, the following criteria should be considered in vessel design.

Many fisheries are aimed at fast-swimming pelagic species. For chasing these fish and manoeuvring with fishing gear, high speed and moderate speed vessels are most effective. Distances traveled to the fishing grounds are often greater than those seen in the fisheries of other regions. For example, some tuna boats of 20-30 GT make trips of one to four days, traveling to grounds 10 to 80 miles from their ports. Travel time to and from the grounds is often a high proportion of total vessel time, and faster boats facilitate landing fresher catch for higher prices.

Several nations of the region are oil producers, and although fuel is sometimes unavailable on outlying islands, fuel prices in many areas are lower than in the U.S.A. Sailing fishing boats have been used in this region for thousands of years, and their use is still common in many areas. Although the transitions between the monsoon seasons frequently bring strong winds which interrupt fishing, during most of the year steady, moderate trade winds provide favorable conditions for sailing. However, local fishermen are well aware of the advantages of motors, and many consider that the combination of sail and motor is most appropriate. Japanese motor manufacturers have very aggressive and effective practices for marketing, distribution, and service in the region, and most fishing vessels use Yanmar, Kubota, or Yamaha motors. These are also considered the most reliable and easiest to maintain and service.

Although a few fisheries of the region concentrate on low value species such as sardines, most fisheries produce moderate to high priced species, so most vessels do not need the capacity to hold very large quantities of low priced fish.

Some areas are characterized by strong currents and choppy seas. However, in most areas, seas are generally moderate, and permit operation in the medium speed range most of the time.

Most craft which make trips of more than one day's duration use ice on board to preserve the catch, so insulated holds or fish boxes are necessary. The pole and line fishery for tuna is widespread, and vessels for this fishery must have live bait wells.

The more developed areas have good harbor facilities with support services, although drydocking facilities are few, and generally very expensive. Outlying islands may be less well equipped, supporting only very small boats which fish strictly one day trips.

With regard to the above criteria, any new small craft must offer characteristics at least as favorable as the traditional banca fishing craft, or they are not likely to find acceptance by the fishermen.

In introducing prototypes, care must be taken to provide instruction in fishing methods which can take advantage of improved fishing capability of the prototype boats.

Due to the importance of small scale fisheries in the region, the FAO has done a great deal of work in the design of vessels appropriate for use in this sector, concentrating on the Philippines. A few of their sketches of traditional and alternative craft are included in the Appendix of this paper, as well as a design by the World Bank of a 30 GT tuna pole and line vessel. Since many other fisheries of the region are similar, this work may be considered a good base for working in many other nations.

### Southern Asia - Focus on Sri Lanka

Rajapaksa Don Warnadasa, Marine Engineering Assistant, Sri Lanka

Sri Lanka is a large island in the Indian Ocean off the southeast coast of India. Its large fishing sector exploits several pelagic species such as tuna, skipjack, mackerel, swordfish, and shark, as well as a variety of semi-pelagic and demersal species. Shrimp, lobsters, and crabs are also fished commercially.

Wind and sea conditions in the area are generally moderate, allowing a relatively high number of fishing days per year. Occasionally, during the monsoon seasons, winds blow up to 30 or 40 knots, causing several consecutive days of down time for fishermen.

The island has a few trawlers of about 100 GT, but the majority of the fishing activity is done with an estimated 25,000 fishing craft of less than 15 meters LOA. Almost half these small craft are wooden, non-motorized sailing outrigger canoes less than 12 meters in length. Another 5,000 similar boats are powered by outboard motors which run on kerosine (in 1983 kerosine and diesel sold for around US\$2 per gallon, while gasoline cost about US\$3 per gallon due to excise tax). In the 10 to 12 meter range there are also many fishing vessels with inboard diesel engines which fish offshore waters.

Dominant fishing methods are hook and line, trolling, gillnetting, beach seining, longlining, and shrimp trawling. Boats of less than 10 meters generally make 1-day trips, while the 10-12 meter vessels stay at sea for periods up to 1 week. On these trips ice is used for preserving the catch on board. The larger boats fish out to 80 miles offshore.

Most of the harbors in the country are overcrowded, and almost all the small craft are forced to land and offload catch directly on the beach, sometimes through moderate surf. Support facilities for hauling out vessels, maintenance and repair are also insufficient. Rising costs of materials, equipment, and operations have seriously hurt the fishing sector.

The Sri Lankan government is currently engaged in an ambitious campaign to improve its fishing fleet and increase production. Since the native woods which were used for boatbuilding are becoming very rare and expensive, alternative materials are being used, primarily fiberglass with some construction in steel as well. High fuel costs have prompted a great deal of experimentation with alternative energy sources, concentrating on sails for wind power as well as on solar power. Fuel efficiency is a top priority in boat design for the area.

The experience of recent fisheries development programs in Sri Lanka should provide valuable lessons for similar programs in other regions. The following guidelines for the introduction of new vessels and gear to the artisanal sector have been developed.

Combination vessels, which can switch to different methods and concentrate on different species according to the seasons and fishing grounds, would be most valuable.

Any new technology must be well suited to operation under local conditions, as outlined above. Vessel stability and safety for open water fishing is the top priority. Cost effectiveness is, of course a most important factor.

Since few vessels concentrate on very high volumes of low priced species, carrying capacity relative to vessel size need not be excessive. However, vessels over 10 meters need a capacity sufficient for trips of several days' duration.

Artisanal fishermen are most likely to accept new technology which is not too dissimilar from that which they are familiar with. New types of vessels, motors, and sailing rigs should be as simple and easy to use and maintain as possible. It is essential to introduce new technology carefully, with demonstrations and training programs in which the fishermen are taught proper operation and care of new equipment.

### The Caribbean Region

Norbert Simmons, Fisheries Technologist, Bermuda

The Caribbean region includes an area from 10 to 32 degrees North Latitude, stretching from the Grenadines to Bermuda. It contains dozens of self-governing, inter-trading islands. The quality of the different fishing grounds of the region are strongly affected by the two categories of islands:

- 1) Islands that rise immediately from the seabed with very deep water almost immediately offshore.
- 2) Islands surrounded by an extensive shallow (coral covered) reef with gradual drop-offs.

The resources of the latter include pelagic as well as reef dwelling species, grouper, snapper, and lobsters. Waters surrounding the former type of island, with a sharper drop-off, generally have fewer reef-dwelling stocks, and fishermen there must concentrate more on deep-water or pelagic species. The major commercial stocks include the reef species mentioned earlier as well as tunas, kingfish, mackerel, shark, and wahoo.

Fisheries play a very prominent role in the regional economy, in most places ranking third or fourth in terms of GNP behind such activities as tourism, agriculture, home industry, and offshore company (tax exempt) business.

Fishing vessels range from the traditional long and narrow West Indian dugout canoe to large modern diesel work vessels and shrimp trawlers of a few areas. The four to six meter open craft usually use 1.5-25HP outboard motors, and operate with one or two man crews. Wood is the most common construction material, but in some areas fiberglass boats are increasing in number. Making one-day trips, these boats use hook and line, fish traps, trolling gear, beach seines, and in some areas, gillnets.

In the southern part of the region, the most common larger vessels, of 9-12 meters in length, are the traditional decked wooden fishing sloops, most of which have small inboard diesels. These may have a crew of up to five members, and fish over 100 traps in deeper water. Some also use deep water reels for snapper and grouper. In the northern islands, moving closer to the USA, it is more common to see fiberglass vessels of 9-14 meters in length, often with relatively large inboard diesels, equipped to fish traps or deep water snapper reels.

Hydraulic and electric line haulers and reels have contributed significantly to offshore vessel development. The larger vessels of this category make trips of up to one week's duration. Most of these preserve the catch with ice. However, during some seasons shortages of fresh water lead to unavailability of ice. For many years live wells have been used to keep reef fish and lobsters on board. As the reef dwelling stocks have become less abundant, many fishermen are concentrating more on the faster swimming pelagics, which do not survive in live wells; consequently, the use of ice is on the increase.

The use of sail is not uncommon in most fisheries of the region. It was very common 20 years ago, and is still used in inter-island freight delivery. The steady northeast trade winds provide very good conditions for sailing throughout the region. Fuel is very expensive in most areas (fuel in Bermuda cost US\$1.50 per gallon in 1982), and the re-introduction of sail to local fisheries could lead to substantial savings in operating costs. Many fishermen are becoming increasingly interested in this fuel-saving alternative.

The main cities of most islands provide limited landing facilities for commercial vessels, transport and fishing craft together. There is a need for more dock areas and facilities for commercial fishing vessels. In some areas, smaller fishing boats use beaches for landing and offloading catch.

Most fisheries concentrate on species of moderate to high individual value. While these vessels are not required to carry very large loads of low priced fish, the range and duration of fishing trips is generally increasing, and longer trips require increased hold capacity for the catch.

Although there is some evidence of overfishing in some inshore waters, there may be room for expansion of the fisheries for pelagic species, and there is definitely room for modernization of currently used vessels and equipment. The planning of new vessels must take into account the local conditions outlined above. One major design criterion would be a vessel's ability to participate in a variety of fisheries. A combination, multi-purpose vessel would be able to explore new fisheries, and take advantage of the region's diverse resources as well as stocks which migrate seasonally.

The 200 mile Exclusive Economic Zones of many Caribbean nations are presently fished by foreign nations under permits, with vessels generally of the 30 meter, 200GT classes. Most of these vessels are longlining tuna. This is a possible area for future fisheries expansion for many island nations.

#### Latin America - Focus on Venezuela

Alejandro Acosta, Fisheries Technologist, Venezuela

Venezuela has a coastline approximately 1700 miles long, on the north coast of South America. In some ways it is atypical of Latin American nations - for example, its oil production eases foreign exchange problems, and provides fuel for the fishing fleet at relatively low prices. However, the country provides a good illustration of the contrasts between large and small scale fishing operations working in the same area.

Species most commonly fished commercially include sardines, tuna, skipjack, snapper, grouper, shrimp, squid, and octopus. The continental shelf along this coast is relatively narrow, and it is intensively fished by over 200 Venezuelan shrimp trawlers of the double net type typical in the Southern USA and other areas. Since the resources and grounds of waters off the edge of the shelf are not well known by local fishermen, both small scale and industrial scale vessels compete for the resources of the narrow shelf. The country also runs a small fleet of offshore tuna vessels, pole and liners, longliners and purse seiners, which have the capability of freezing on board, and making longer trips to more distant grounds.

Steady northeasterly trade winds dominate the area, and provide conditions generally favorable for operation of a wide range of vessels.

The small scale fishery in Venezuela supplies much of the fresh fish and the domestically consumed protein. It also provides employment and income for a large percentage of the population in some areas of the country. However, it is generally considered a low priority, and many



obstacles hinder its development. The small scale fleet consists of around 6,000 vessels, ranging from 3 to 12 meters in length. Wood is the traditional building material, and the most popular. There are some small fiberglass fishing craft, including boats recently manufactured in the country under a joint venture with Yamaha of Japan. However, the fishermen have little experience operating, maintaining, and repairing fiberglass craft, and despite its advantages, they are sometimes reluctant to accept this new material. More energetic promotion of this fiberglass for fishing craft might overcome this problem.

Most of the small vessels use outboard engines running on gasoline, and Yamaha is the most common brand seen. Vessels over 8 meters in length often have inboard diesel motors. Fishing gear most commonly used by the artisanal fleet includes handlines, longlines, traps, beach seines, trolling, and gillnets. Most craft have neither electronics for navigation and fishfinding, nor mechanical equipment for hauling gear, and fishing operations require a great deal of manual labor. Most of these vessels make one-day trips, but some stay at sea for up to one week, using ice for preservation of the catch. Crews on small vessels generally have one to six members.

While harbor facilities for the industrial fishing fleet are adequate, dock and offloading facilities for small craft are lacking, and many small craft land their boats and catch directly on the beach.

In Venezuela, fishery products have a high demand, and seafood prices are relatively high. It is felt that improved management and modernization of the fleet can lead to increased production in the long run. The mollusks such as squid and octopus are underexploited. More research is needed to estimate resources farther offshore, outside the range of the traditional fisheries. Vessels of 11 to 15 meters in length might be within the reach of some artisanal fishermen, and such craft could work on the resources near the edge of the continental shelf.

Since local stocks are very diverse and knowledge of potential new fisheries is incomplete, any new vessels must be designed for multi-purpose fishing. Conversion from one fishery to another should be as fast and simple as possible, allowing the fisherman to experiment with new stocks and grounds, as well as to enter seasonal fisheries.

In order to increase the efficiency of vessels in the 8 - 12 meter range, some electronic and navigational equipment, such as compasses and depth recorders would be very helpful. Mechanical or hydraulic equipment for hauling fishing gear would also be a significant improvement. However, since the coastal region depends heavily on fishing for employment, innovations which lead to reduced crew size would probably bring more problems than benefits. Planners should be careful not to displace fishermen from their current occupations.

Unfortunately, in contrast to cheap fuel, imported equipment and machinery is quite expensive, and sometimes unavailable. For successful operation in the long run, any new vessels or equipment must be accompanied by a commitment to provide spare parts and service in the country.

Sea and wind conditions would be favorable for sail-assisted fishing craft, but in Venezuela where fuel is inexpensive, they might not be able to compete with faster motorized craft.

Artisanal fishermen have very little exposure to vessels and gear not found in their area of operation. The introduction of new technology must be accompanied by education and training of fishermen. They should be made aware of the advantages and disadvantages of unfamiliar systems, and when new vessels are actually delivered, it is essential to provide thorough training in the operation, maintenance, and servicing of the new equipment.

### West African Region (Eastern Central Atlantic)

Theophilus Brainerd, Resource Economist, Sierra Leone

Along the coast under consideration, from Morocco to Zaire, fishing is an important activity for the production of food and income. The area contains large concentrations of pelagic stocks, such as sardines and anchovies, as well as moderate to sparse distributions of demersal species. Some countries have reasonably high stocks of shrimps and other shellfish. The fishing grounds in the northern part of the region are generally the richest.

For discussion purposes, the region can be said to contain four fishing sectors - a foreign flag distant water fleet, an African-owned industrial fleet in which some nations enjoy the right to fish in the waters of other African nations, local industrial scale fleets fishing in the waters of their flag states, and small scale, artisanal fleets. The distant water fleet is composed principally of foreign-owned freezer or processor fishing vessels, sometimes operating under agreements or joint ventures with local governments.

In the industrial sector of the African owned vessels, boats over 15 meters LOA include shrimp trawlers, purse seiners, side trawlers, longliners, and vessels which employ fish and lobster traps. The most common construction material is steel, but there are also wooden and fiberglass vessels. These vessels fish the grounds from 5 miles offshore to out past the edge of the continental shelf. Duration of voyages ranges from 3 days to one month, depending on the country and the fishery. Most of these boats use ice for preserving the catch, but some have freezing capability.

In this region there are approximately 40,000 artisanal fishing vessels, fishing one-day trips within 10 miles off the coast, using hook and line, cast nets, set nets, drift nets, surrounding gillnets, purse seines, and longlines. These craft fall into 3 main categories. The first category consists of vessels ranging in length from 5 to 6 meters with beams less than one meter. They are usually dugout from tree trunks, operated by one man with paddle as the means of propulsion. In recent years, the number of these vessels has declined considerably as fishermen move to the larger vessels.

The second category consists of vessels with lengths ranging from 6 to 9 meters, with beams greater than one meter. These vessels are usually operated with outboard engines in the 6HP to 15HP range. In some countries the use of sails is becoming popular due to high fuel costs and economic conditions. These vessels are built with wooden planks, and carry up to 10 fishermen.

In the third category, which has received a great deal of attention because of its suitability for use with larger fishing gear, vessels range in length from 9 to 15 meters with beams less than 5 meters. They are operated with outboard engines in the 25HP to 40HP range. Construction is of wooden planks, and the boats carry up to 15 fishermen. The fishing gear used by these boats consists of surrounding nets, purse seines, gillnets, and some longlines. Since winches and hauling machinery are not generally used in the area, a great deal of manual labor is needed to haul and set the relatively large nets.

In the past, storage facilities such as insulated ice boxes have been lacking on the vessels, and this limits the duration of fishing trips. Recently, insulated fish boxes are becoming popular in some countries, but their use is also dependent on the sporadic local availability of ice. Cabins or other crew shelter are lacking on virtually all small craft.

In small fishing craft, wood has been the traditional building material because of its availability, and also because local boatbuilders have experience only in wood construction. Fiberglass vessels have been introduced in some countries, but have not found much success.

In many areas, there is room for expansion of both the industrial and the artisanal fleets. New vessels could fish the same stocks currently exploited, as well as some underexploited species such as squid and sharks.

In planning effective vessels, certain deficiencies in the supporting coastal facilities must be kept in mind. Adequate harbor and port facilities are sometimes few and far between, and in many areas the small craft land and unload product directly on the beach. Problems in obtaining foreign exchange often cause difficulties in importing motors and spare parts, and it is best to find out in advance which manufacturers have effective local networks for parts and service. It is all too common to see fishermen unable to fish because their motors need repairs or parts which are simply not available in the country.

Fuel is generally quite expensive in the region; for example, in 1983, in Sierra Leone, gasoline and diesel cost approximately US\$2.00 per gallon. Any new vessels should be as fuel efficient as possible. The northeast trade winds and southwest monsoons are prevalent, often providing conditions favorable for sailing, and the use of sails as auxiliary power is increasing. Vessels which concentrate on pelagic species should be capable of relatively high speeds.

Since many large and small vessels fish low priced, high volume species, carrying capacity for any vessel should be as large as possible relative to the cost of the boat. In these tropical temperatures, there

is much room for improvement in on-board equipment for fish handling and preservation.

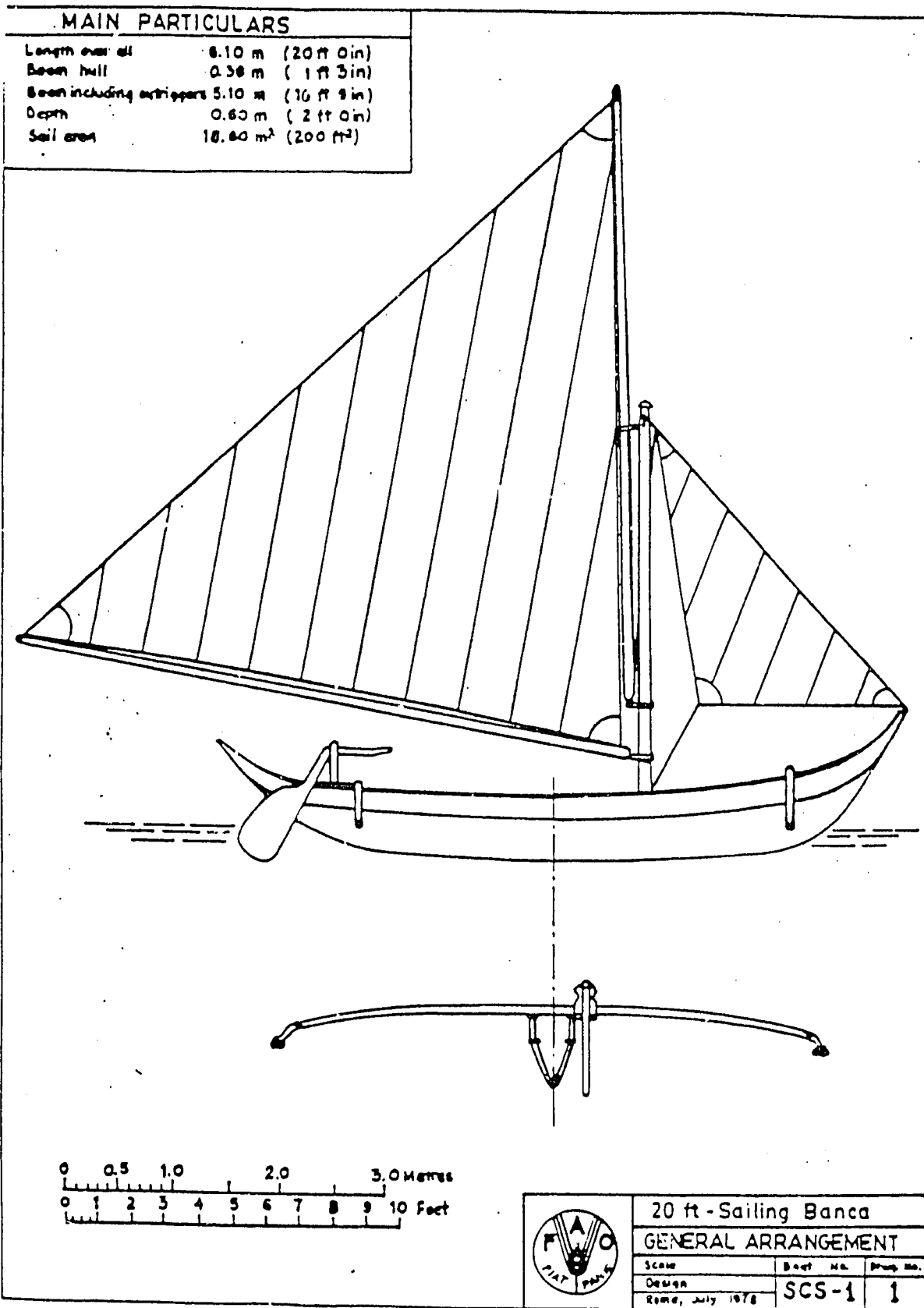
The versatility offered by multi-purpose vessels could be a very valuable quality for new fishing craft here, especially small craft. However, even with a multi-purpose vessel, conversion from one fishery to another is sometimes very expensive, especially with larger vessels. A careful feasibility study should precede any added construction expense involved in making a vessel suited for various fisheries.

Labor is relatively cheap in the region, and unemployment is sometimes a problem. Consequently, crew numbers tend to be quite high relative to vessel size. While modernization of equipment could bring some benefits, changes which would reduce crew size might cause serious social and economic problems.

Worms and borers are a serious problem for wooden vessels in the area, and fiberglass, steel, or WEST (wood-epoxy saturation technique with an outer coat of fiberglass), would offer significant advantages in increased durability and low maintenance. However, the infrastructure and expertise for service and repair of these materials is presently incomplete, and support facilities must accompany such new developments.

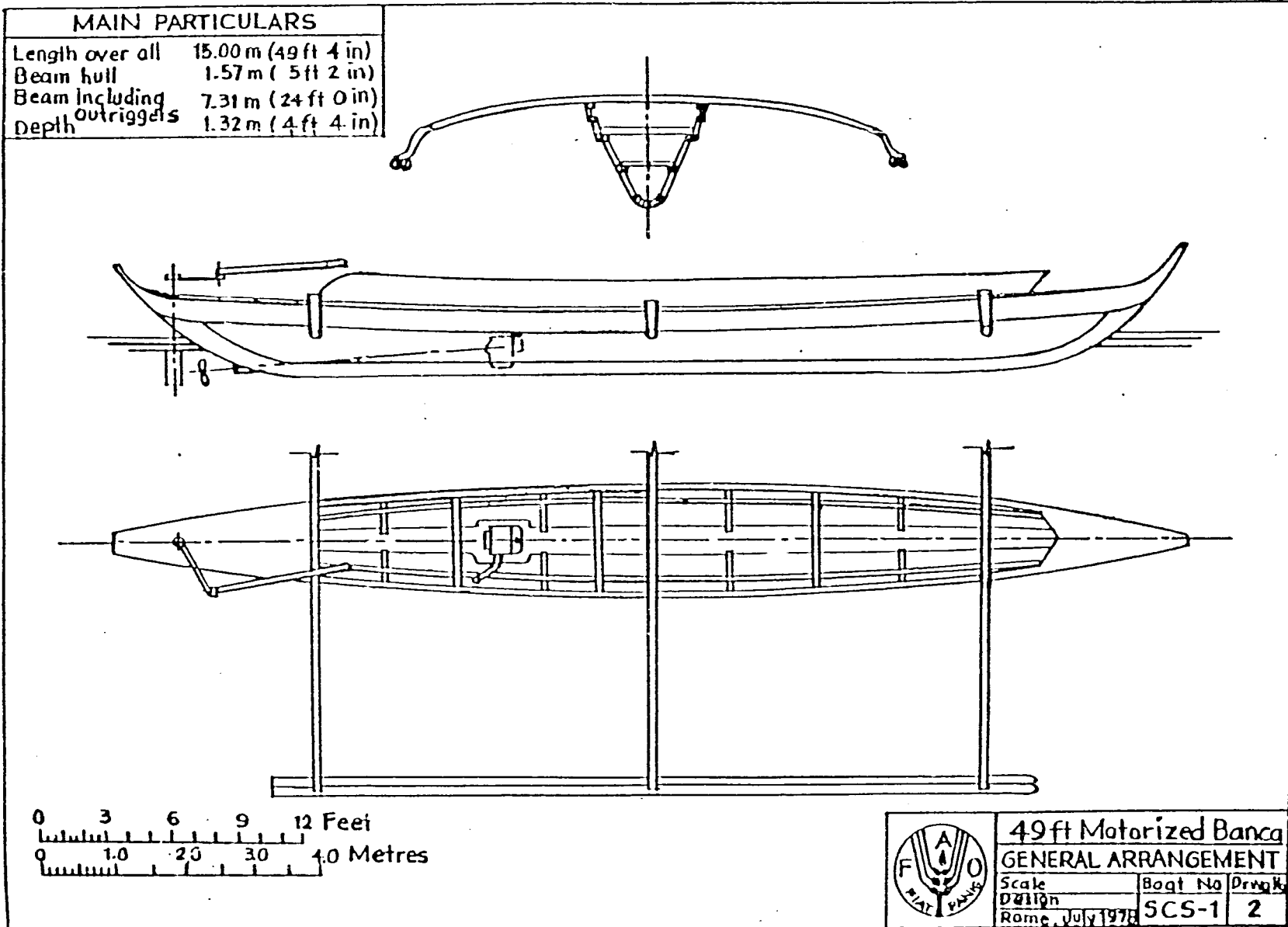
Artisanal fishermen may be reluctant to try technologies which differ significantly from traditional methods. Planning of new vessels and gear should include input directly from the fishermen. Actual introduction of new technology must be done carefully and tactfully, and thorough training programs to familiarize fishermen with new equipment are a must.

APPENDIX



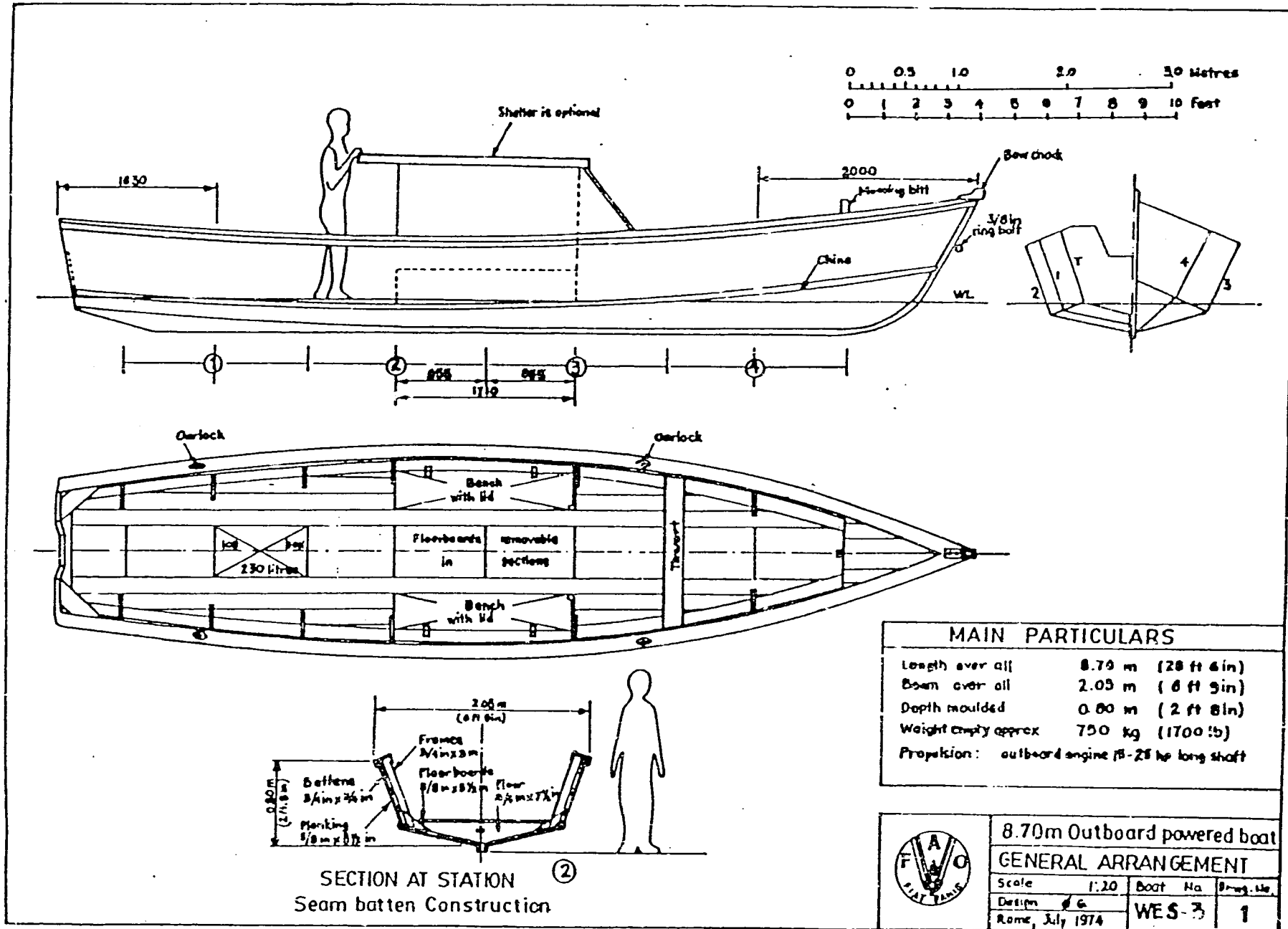
TRADITIONAL PHILIPPINE FISHING VESSEL

APPENDIX



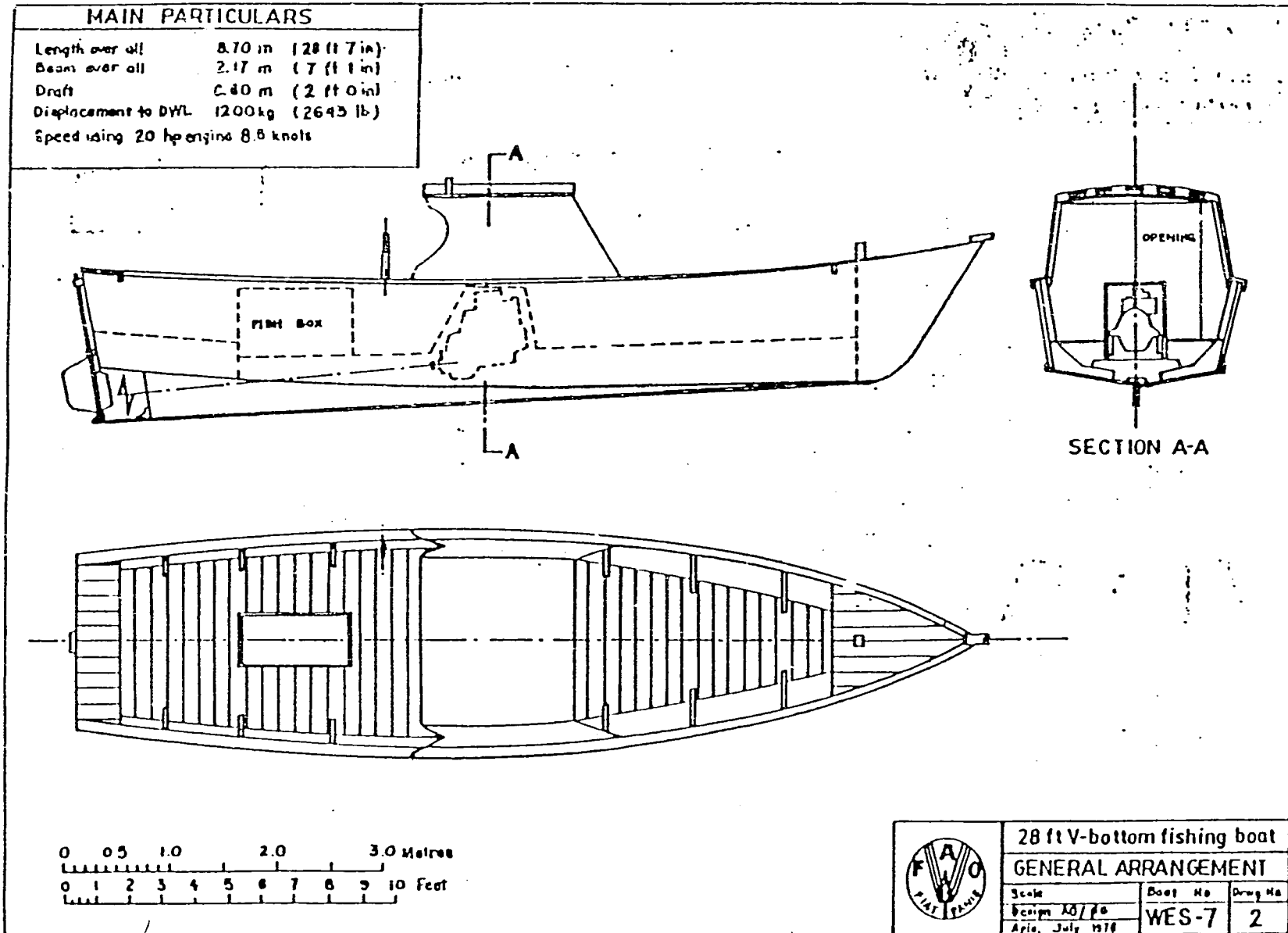
TRADITIONAL PHILIPPINE FISHING VESSEL

APPENDIX



RECENT VESSEL DESIGN FOR THE PHILIPPINES

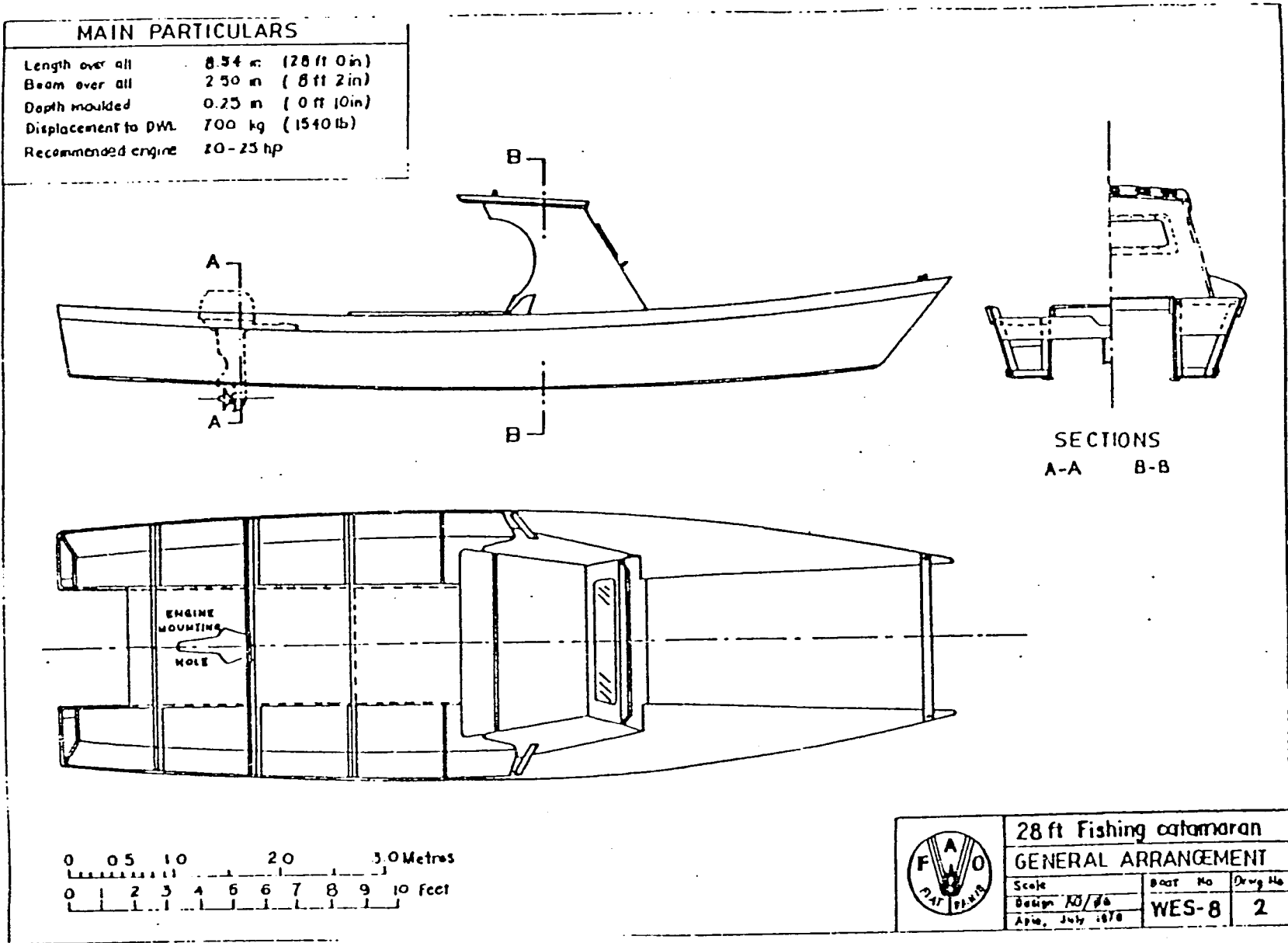
APPENDIX



RECENT VESSEL DESIGN FOR THE PHILIPPINES



APPENDIX



RECENT VESSEL DESIGN FOR THE PHILIPPINES

INDONESIA  
 FISHERIES CREDIT PROJECT  
 EXAMPLE OF ACCEPTABLE DESIGN FOR 30 G.T.  
 WOODEN SKIPJACK LIVE BAIT POLE AND LINE FISHING VESSEL

PRINCIPAL PARTICULARS	
LENGTH	17.50 M
BREADTH	3.90 M
DEPTH	1.80 M
GROSS TONNAGE (ABT)	30.0 Tons
MAIN ENGINE	150 H.P.
SERVICE SPEED	8.5 Knots
FISH HOLD CAPACITY	28.79 M <sup>3</sup>
FUEL OIL TANK	2.81 M <sup>3</sup>
FRESH WATER TANK	1.44 M <sup>3</sup>
COMPLEMENT	30 Persons

SCALE 1/70

