



**BAY OF BENGAL PROGRAMME
DEVELOPMENT OF SMALL-SCALE FISHERIES**



**INVESTMENT REDUCTION AND INCREASE IN
SERVICE LIFE OF KATTUMARAM LOGS**

BY R. BALAN

BOBP/WP/1

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Development of Small-Scale Fisheries

BOB P/WP/1
(GCP/RAS/040/SWE)

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SERVICE LIFE OF KATTUMARAM LOGS

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Funding Agency:

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Development Authc

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PREFACE

This working paper identifies and evaluates methods to increase the service life of Kattumarams, the traditional fishing craft used along the East Coast of India. The methods involve both chemical treatment and physical protection of the traditional type of kattumaram logs. The paper also examines ways to reduce the initial investment on kattumaram logs by examining alternative and less expensive species of suitable timber for the logs.

Some of the methods of chemical preservation and wood protection outlined in this paper may be of use to the boat buiking industry in general.

The paper is part of a project designed to improve the kattumaram, organized by the FAO programme "Development of Small-Scale Fisheries in the Bay of Bengal". This programme is funded by the Swedish International Development Authority (SIDA) and executed by the Food and Agriculture Organization of the United Nations.

The author of the paper is R Balan, Head of the Craft and Gear Division of the Central Institute of Fisheries Technology (CIFT), Cochin. He was deputed to the Bay of Bengal Programme during June-July 1979. His terms of reference are contained in Appendix I.

While compiling data for this paper, the author visited Port Blair, Andamans, various forest departments, research institutions, wood treatment plants and fishing centres in the Bay of Bengal region.

The author expresses his thanks to the Indian Council of Agricultural Research, New Delhi, and to the Director, Central Institute of Fisheries Technology (CIFT), Cochin, for their encouragement.

The views expressed in this paper are those of the author and do not represent the official views of the Government of India, the CIFT or the Food and Agriculture Organization of the United Nations.

SUMMARY

Kattumaram logs have a relatively short service life because of rot and subsequent water absorption. The logs are also subject to high wear and tear due to frequent beaching and alternate wetting and drying.

Melia Dubia and *Albizia Molluccana* are two log species from Sri Lanka most preferred for the making of kattumarams. Due to their non-availability and the depletion of sources of similar timber from Kerala forests, there has been a steep rise in the prices of logs. Hence the need for ways to lengthen the life and lower the cost of the traditional type of kattumaram logs.

Increase of Service Life: Both chemical and physical means in the form of Copper Chrome Arsenic compounds (ASCU), coal-tar creosote and reinforced plastic sheathing, have been identified to increase the service life of kattumaram logs. Specifications for treatment have been recommended.

Investment Reduction: Ten different species of timber abundantly available in the Andaman forests have been identified as substitutes for the traditional timber species. Two in particular – “Didu” and ‘White Dhup” – have been recommended for trials.

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INTRODUCTION

The economy and well-being of fishermen on the east coast of india is to a large extent dependent upon the efficient performance and service life of their traditional fishing craft– the kattumarams.

The kattumarams have many virtues.

- They are simple in design and easy to assemble and operate, requiring only a few simple accessories such as punting poles, oars, paddles, mast and sail.
- There are no maintenance problems.
- The capital investment is relatively meagre: the cost of buying timber logs, shaping them and fastening them together.
- In their present form, kattumarams are ideal beach landing craft, with excellent surf-riding capabilities. They are virtually unsinkable.

It is on account of these virtues that kattumarams have endured for centuries without any change. However, the cost of kattumaram logs is going up, and small fishermen find it increasingly difficult to afford them. Suitable timber for kattumarams is also harder to get.

This study tackles the two problems. It tries to increase the service life of kattumaram logs by both chemical and physical treatment. It also tries to reduce the investment on kattumarani logs by identifying new species of timber for the logs.

INCREASE IN SERVICE LIFE

Timber in its various forms is subjected to several types of deterioration following its removal from the forest. Timber easily deteriorates due to mechanical wear and tear and is most easily destroyed by fire. Cut logs and sawn timbers exposed to rain, sun and wind action become unstable and tend to deteriorate rapidly due to weathering. Being an organic matter, wood is subject to decay on account of fungus infection and insect damage against which proper protection and care is essential. Timber in sea water is severely affected by marine wood boring and fouling organisms.

It is seen that kattumaram logs have a relatively short service life as they are often infected with wood rotting fungi that soften the entire structure and thereby take in a lot of water. Very soon they are deprived of all their original strength properties and thereafter cannot function efficiently as floating rafts.

Kattumaram logs are also ravaged by their constant exposure to the scorching sun, the hot sea-sand and desiccating winds. Further, alternate wetting and drying causes surface splits, cracks and dimensional changes on the logs especially when they are smaller in size.

Though not all these maladies can be taken care of, it is possible to enhance the service life of the kattumaram logs. Chemical wood preservatives with toxic ingredients, when properly treated on logs, can give the logs adequate protection against decaying organisms and enhance their service life twofold or even threefold.

Chemical Protection

Material and Method:

ASCU: Even though a number of wood preservatives are known, a water-borne preservative like copper-chrome-arsenic compound (trade name ASCU) is cheap, easy to handle, clean, efficient and most widely used.

The ultimate efficiency of the chemical wood preservative is dependent very much on its strength or concentration, the rate at which it is loaded into the wood and its prolonged retention within the wood thus treated. The treatability of each log will also vary according to its quality and condition at the time of treatment. In the light of these facts, 'ASCU' wood preservative at 5% strength is recommended for treating the prototype kattumaram logs at three different dosages ranging from 0.3 to 2.5 lb/cu.ft. under pressure in a standard 'ASCU' treatment plant (listed in Appendix 2).

Pressure Treatment: Copper-chrome-arsenic composition conforming to Indian Standard Specification is: 401/1967 and is manufactured by M/s. ASCU Hickson Ltd., Calcutta under the trade name 'ASCU'.

Timber logs for 'ASCU' treatment shall be of good quality and bear the required moisture content, but not more than 30%.

All wood work like cutting, shaping, sizing and boring shall be completed (to make a readymade kattumaram) and treated individually or in lots.

Immediately after treatment, the logs shall not be exposed to rain or water for a period of three to five days, after which the logs can be assembled and put to operation in the conventional manner.

Immersion Treatment: The fully finished kattumaram log is submerged in the selected preservative solution for a sufficiently long period until the required absorption of the preservative is obtained.

'ASCU' process: A thorough treatment by dipping and soaking with 'ASCU' wood preservative will give fairly good results. In fact, kattumaram logs can be treated even at the beach site with the help of fishermen themselves when the present experiments prove to be a success.

A shallow tank made of G.I. sheets, or an old oil drum cut to shape and joined, or any other container, can hold the log and the preservative to a desired quantity and depth.

In this drum, the 'ASCU' wood preservative is well stirred in the recommended proportion of 1 kg. of 'ASCU' to 12 litres of fresh water. The solution is well stirred till it becomes clear. In this cold solution, finished logs are immersed and kept fully soaked for about 12 hours or till it gets a retention of about 2 litres per cubic foot. The log is then allowed to air dry and put to use.

Note: Compared to pressure treatment, immersion treatment will not result in deep penetration and greater absorption of the preservative.

In the absence of any readymade facilities for this method of treatment in and around Madras, it is recommended that this work be entrusted to a private firm.

Diffusion Process: The diffusion process is yet another method of treatment for timbers which are not easy to impregnate under pressure in dry conditions. In this process, a paste of the preservative is applied over all the timber surfaces. They are then closely stacked under cover.

A concentrated solution of 'ASCU' preservative (about 15%) is applied over the kattumaram log and it is wrapped all around with a cover of PVC or polythene sheet. The log has to be left for a few days during which time the preservative diffuses into the log and gives necessary protection.

Chemical Preservation:

Material and Method:

Creosote: Certain oil-borne preservatives like Creosote (a coal-tar distillate) are suitable for treatment of timber for exterior use.

It may be used alone or with a suitable admixture of fuel oil to the extent of 50% by weight that will give stability to Creosote against evaporation and leaching from the treated timber.

Oil-borne preservatives give a certain amount of protection to timber against splitting and cracking.

Creosote/Hot and Cold Process: The Creosote used for wood preservation under Indian conditions shall conform to Indian Standard Specification IS: 218-1 961 and the recommended fuel oil for dilution to IS: 1593-1960.

The hot and cold process of preservative treatment involves full immersion of the timber log in the Creosote + fuel oil mixture (50: 50) which is then heated to about 90°C and maintained at this temperature for a suitable period depending on the charge. It is then allowed to cool in the same mixture until the required absorption of preservative is obtained. The recommended rate of loading as per IS: 401 -1967 works out to 3 to 5 lb/c.ft.

“Creosant”/ Surface application: Alternatively, a concentrated and refined form of Creosote, such as Shalimar Creosant, can be applied over timber logs either by brushing or spraying periodically.

At least two coats should be applied after the first coat has dried or soaked into the wood. Surface application of hot Creosote on a hot day over timber surfaces is likely to give fairly good results. This treatment has to be repeated at regular intervals, say once in three months, to obtain the desired effect.

Caution: It may be noted that Creosote treatment will discolour the kattumaram log and also increase its weight considerably (3 to 5 lb/c.ft) after treatment. Further, the combustibility of wood is enhanced by this oil-borne preservative. This might enforce certain limitations on the use of Creosote for kattumaram treatment, as the logs are now stored in unprotected areas in the open beach.

Physical Protection

Fibre reinforced plastic (FRP) sheathing will provide a tough parchment-like covering on the wooden log and thereby protect it from damages and deterioration through external agencies. Biological infection by an external source as well as water absorption by the timber logs are thus successfully prevented. As long as the outer sheathing is intact, logs are expected to serve much longer.

Fibreglass or jute hessian in combination with activated polyester resin will be wound or wrapped around the fully finished kattumaram log. When the sheathing dries up tack-free and after a post-curing period of 10 to 15 days' storage, the logs can be assembled in the form of a kattumaram and be put to use in the conventional manner.

The drawback of FRP is that it is a costly and sophisticated technology, on account of the raw materials and the skilled labour involved. Further, timber logs sheathed with fibre reinforcement have to be protected against possible abrasion under day-to-day operations. Timber logs have to be dry before sheathing is attempted. In case of surface de-tamination at any one spot, water is likely to get into the wood, when further complete drying is difficult

The Fibre Reinforced Plastic Centre of the Indian Institute of Technology, Guindy, Madras was consulted in detail for a schedule of work which is presented below:

- Materials to be tried:*
- (1) Glass fibre (GRP)
 - (2) Jute fibre (JRP)
- Type of material:*
- (1) Chopped strand mat fibreglass
 - (2) Continuous filament fibreglass
 - (3) Jute hessian cloth/tape
 - (4) Jute continuous filament
- Type of resin:* Polyester resin with standard catalyst and accelerator and inert pigments if need be.
- Proposed combinations on individual logs:*
- (1) 450 g/m²CSM=2 layers
 - (2) Jute hessian tape/cloth=2 layers as per I.I.T. specification
 - (3) Fibreglass continuous filament winding as per I.I.T. specification.
 - (4) Jute hessian filament winding as per I.I.T. specification. Further alternative suggestions as a result of discussion also came up as below for consideration.
 - (5) Jute/glass fibre combination so as to reduce cost.
 - (6) Fibre sheathing on lightly treated timber logs.

In all, the project is in need of six kattumaram logs for two units which have to be shaped and finished and transported to the FRP Research Centre of I.I.T., Guindy, Madras, for sheathing with fibre reinforced plastics as per the worked out schedule. Only the following four FRP combinations will be taken up for the present experiments.

Details:

1. Two layers of 450 g/m² fibreglass chopper strand mat
2. Two layers of jute hessian tape/cloth
3. Fibreglass continuous filament winding
4. Jute hessian filament winding

	1	2	3
1st Unit	Jute filament winding	Glass fibre 450 g/m ² 2 layers	Jute filament winding
2nd Unit	Glass fibre filament winding	Jute hessian tape/cloth 2 layers	Glass fibre filament winding
	1	2	3

Note: The kattumaram logs have to be marked carefully after the sheathing work is over so that they may align properly at the time of the final assembly with the respective parent central logs. The side and the adjoining logs have to be handled like a pair of shoes.

INVESTMENT REDUCTION: ALTERNATE TIMBER SPECIES FOR KATTUMARAMS

As long as the traditional kattumarams continue to function as floating rafts under marine conditions, they will attract only a few selected species of timber logs satisfying the required conditions.

The ideal timber would be a type that is light and buoyant, 'drinks' very little water, that is dimensionally stable and durable, easily available and reasonably priced.

No timber log yet known satisfies all these conditions, but timber species like *Mel/a dubia* or *Mella composita* (Tamil name: *Malai Vembu* or *Ceylon maram*) and *Albizzia* sp. (Tamil name: *Albisi* or *Sins*) are the primary timbers now being extensively used for kattumaram logs all along the east coast of India, more especially on the Tamil Nadu coast. Both *Mel/a dub/a* and *Albizzia mo/luccana* logs used to come from Sri Lanka and met nearly the entire demand of the South. This supply ceased totally many years ago and the entire burden of supply has since been on the Kerala forests. Even there, resources for these rare species have diminished considerably. A limited quantity meant to provide shade that is grown in the coffee and tea plantations of Kerala, is extracted and brought to the east coast towns by private agencies, and sold to fishermen at fancy prices. This practice may not continue for long. Further, these are only the loops and tops of those trees and very rarely the main trunk. Moreover, these light timbers and other allied varieties occur in scattered form only in the rain-fed evergreen forests of India. There are no man-made forests; and extraction of timber from natural forests is difficult, time consuming and costly.

Many other light timber species are presently diverted to the plywood veneer and match industries. The dry forests of both Tamil Nadu and Andhra Pradesh, it is reported, do not have kattumaram-quality timbers in the required quantity.

The time has now come to locate various new sources and alternate species of timber for well planned tests and trials. Apart from the Kerala forests, the north-eastern frontier states of India and the Andamans are the alternate sources for forest timbers.

As a result of detailed discussions with many of the forest officials and forest research institutes and a short and rapid survey of the Andaman timber resources, a fairly good number of light timber species have been located as probable substitutes for *Mel/a dub/a* and *A/b/zzfa* sp. These new timbers have to be evaluated from the standpoint of their utility as kattumaram logs and their acceptability by the coastal fishermen.

Andaman Timbers: There are over 300 indigenous tree species in the Andaman Islands but only a few well-known species are exploited at present. It has been estimated that the Andaman group of islands can yield about 150,000 tons of timber annually, although only one third of that is extracted at present. It is likely that more and more timber will be made available for all types of timber industries.

The Andaman Forest Department at Chatham Islands, Port Blair, is very well organised, with highly qualified technical experts to look after the forest management and planning; timber logging and transport; saw milling, wood seasoning and preservation plants.

In fact, the situation is so ideal in the island that suitable logs should be selected there itself, properly seasoned, shaped and finished into kattumarams and then chemically treated in their 36' long x 4' dia. pressure tank (ASCU Plant) before shipping them to Madras (for Tamil Nadu) and Visakhapatnam (for Andhra Pradesh). This scheme requires further exploration along with some more species of new timbers.

At present, the logs have to be bought at the island and transported to the mainland (Madras) by ship; later shaped and finished as a kattumaram, and treated thereafter as per the recommended schedule before actual use. This is likely to involve too many handling centres, and consume too much time and money.

The following list of timber species from Andaman forests is presented below as alternatives to the conventional timbers for kattumaram logs.

Sl. No.	Scientific Name	Weight lb/c.ft	Trade name	Andaman local name
1	Tetrameles nudiflora	22	Mama	Thitpok
2	Endorpermum malaccense	24	–	Bakota
3	Bombax insigne	23	Semul	Didu
4	Canarium euphyllum	26	–	White dhup
5	Albizia stipulata	27	Siris	Bonmeza
6	Planchonella longipetiolata	27	–	Lambapatti
7	Parisha insignis	23	–	Red dhup
B	Pterocymbium tinctorium	22	–	Papita
9	Ailanthus triphysa	28	–	Andaman Maharukh
10	Artocarpus chaplasha	32	Chaplash	Taungpeinne

ANDAMAN TIMBER SPECIES REQUIRED TO BE TRIED FOR PROTOTYPE STUDIES:

(Any two of the following on their early availability)

1. *Didu (Bombaxinsigne):*

The tree grows to a height of 24 to 36 metres, up to 5 metres in girth, with a clear bole of 12 to 18 metres. It is commonly found in moist deciduous forests.

The wood is creamy white when fresh, turns pale yellowish brown on ageing. Soft to very soft, light, straight-grained and coarse-textured.

About 2,500 cubic metres are available annually. Requires quick seasoning. The timber is easy to saw and work. Can be chemically treated for longer life. This species is somewhat similar to *Bombax ma/abaricum* of the Kerala forests.



A set of assembled kattumaram logs that have seen many years of rough use.



A new assembled unit of kattumaram (five logs) waiting to be launched.



Logs are being carefully shaped and finished for a new kattumaram.

2. *Pap/ta (Pterocymbium tinctorium)*;

The tree grows to a height of 30 to 40 metres, and a girth of 2 to 3 metres, with a 24 to-30-meter straight cylindrical bole. Very common in deciduous forests.

The wood is creamy white to oat-meal coloured. Soft and very light, straight-grained and coarse-textured.

About 11,500 cubic metres are available annually. Easy to season and work with. Can be chemically treated.

3. *White Dhup (Canarium euphy/lum)*:

The tree grows to a height of 24 to 30 metres and a girth of 2.4 to 4.2 metres with a clear bole of 18 metres. Frequently found in deciduous forests.

The wood is white to greyish-white, often with a pinkish cast, and sometimes discoloured. Lustrous, soft, light, straight-to-somewhat-interlocked graining and coarse-textured.

About 7,500 cubic metres are available annually. Prone to infection and has to be dried and chemically treated.

Note: Since the project is interested only in two alternative species for the present, more species' names are listed only for future experimentation. Samples of the new timber species have been deposited with the project headquarters at Madras for reference.

4. *Mainland alternate timbers:*

From experience, it is seen that apart from *Mella* and *Albizzia*, certain other secondary species of timbers like *Erythrina*, *Eriodendron*, *Gyrocarpus*, *Gmelina*, *Odina*, *Sterculia* etc. are also in use, though not extensively, for small kattumarams and floats.

Timber species like *Tetrameles nudiflora*, *Ailanthus excelsa* or *Malabarica*, *Anthocaphalus cadamba* and *Bombax malabaricum* of the Kerala forests (west coast of India) appear to have some acceptable properties close to the requirements, but unfortunately they are not easily available in the desired quantity for large-scale use. It is only for this reason that newer areas and newer species (Andamans) are being considered for the present tentative experiments.

RECOMMENDATIONS

The project will purchase three chinnamaram units (kattumarams) at Madras, either of *Melia* or *Albizzia* timber species, and treat them as follows:

1. Chemical Treatment:

Unit one: One side log to be pressure-treated with 'ASCU' wood preservative as per the recommended schedule at M/s Tamil Nadu Small Industries, Guindy, Madras. The log should be less than 20' in length and 3' in diameter.
One side log to be immersion-treated (same size as above) with 'ASCU' wood preservative solution as per recommended schedule.
The central log (being larger in size) may be left untreated and kept as a control.

2. Physical Treatment

The entire work on the fibre reinforced plastic sheathing on the selected kattumaram logs will be undertaken at the F.R.P. Research Centre of the I.I.T., Guindy, Madras as per their own process, under their own expertise and guidelines.

Unit two: The central log will have two layers of 450 g/m² of chopped strand mat fibreglass reinforced plastic sheathing with appropriate finish.
The two side logs for the above will have jute hessian fibre-reinforced plastic filament winding with appropriate finish.

Unit three: The central log will have two layers of jute hessian mat or tape reinforced plastic sheathing with appropriate finish.

The side logs for the above will have fibreglass filament reinforced plastic winding with appropriate finish.

3. Alternate Species for two Kattumarams (Irukkumarams):

The two new alternate species of Andaman timbers, 'Didu' (*Bombax insigne*) (5 logs) and 'White dhup' (*Canarium euphyllum*) (5 logs) will have to be ordered (as per the recommended size specifications and numbers, either in round logs or squares) with the Andaman Forest Department (Port Blair) through the Assistant Conservator of Forests, Andaman Timber Depot, Madras-9.

Two units of irukumarams (5 logs each) and accessories with these new timbers, when made ready at Madras, will be chemically treated with 'ASCU' wood preservative as recommended.

It may be carefully noted that the 'ASCU' treatment plants in Madras can only take timber logs that are less than 20 feet in length and 3 feet in diameter. Hence bigger/longer logs may be kept as untreated controls and only smaller logs/squares may be picked for treatment.

The remaining alternate species of Andaman timbers may also be tried along with a few other mainland timbers before a final list is prepared and recommended. The project could perhaps consider the idea of procuring at least one log in each of the new species of timbers from the mainland as well as from the Andamans for the present.

As it is, only the light hard wood is being used for kattumaram logs, and there is not enough useful data on light hard wood. (Factors like specific weight, durability, treatability, capacity to withstand alternate wetting and drying and water absorption have to be studied with reference to the type and condition of the wood that goes into a kattumaram.)

The project may continue to develop a closer association with the Forest Research Institute, Dehra Dun, the Central Institute of Fisheries Technology, Cochin, and the regional forest and fisheries institutions.

APPENDIX 1

Terms of Reference

IMPROVEMENT OF KATTUMARAMS: REDUCTION OF INVESTMENT AND INCREASE OF SERVICE LIFE

Under the direction of the Project Manager, and in close co-operation with staff of related Central and State Government services and institutions, the specialist will prepare a detailed programme of chemical and physical protection of kattumaram logs, and will identify alternative timbers, if any, suitable for kattumaram construction.

He will in particular:

- identify suitable methods for chemical protection of logs and prepare relevant schedules of work with institutions/firms suitably equipped to undertake this work;
- specify in detail the physical protection measures to be experimented with (such as FRP sheathing) and prepare relevant schedules of work in close- co-operation with the FRP Research Centre, I.I.T., Madras;
- make recommendations in regard to using alternative wood species for kattumaram construction, keeping in mind the essential characteristics of timbers required for this purpose – e.g. high degree of buoyancy, high resistance to mechanical wear, low water absorption, low cost. Forestry institutions will be closely associated with the task of identifying alternative wood species.

Timing: One month during May/June, 1979.

Organization: The specialist will work at project headquarters in Madras and utilize the services available through contacts with I.I.T., Madras, the Tamil Nadu Government Forestry Department, the University of Madras, the Central Government Forest Utilization Service. The specialist may have to travel to Dehra Dun, and to timber depots of the Tamil Nadu Forestry Department. The specialist will prepare a detailed report on his activities, including specific and detailed schedules of work concerning protective measures to adopt and recommendations on alternative wood species to be used.

APPENDIX 2

Chemical Treatment Plants (Madras area)

1. TANSI —Tamil Nadu Small Industries Corporation Ltd.

Location: Industrial Estate, Guindy, Madras-32

Capacity: Cold operating/pressure cylinder 20 ft. length x 3 ft. dia.
Can complete treating 200 c.ft. of wood in a 8-hour day.

Rate: Can accommodate three kattumaram logs per charge in lengths less than 18 feet.
Logs should be brought to the plant and taken back after treatment at customer's cost.
Rate for the specified treatment: Rs. 8 to 10/c.ft. (approx.).

2. Tamil Nadu Housing Board (Plant could not be inspected)

Location: Ashok Nagar, Madras-93

Capacity: Cold operating/pressure cylinder 20 ft. length x 3 ft. dia.
Can complete treating 200 c.ft of wood in a 8-hour day.

Rate: Can accommodate three or four kattumaram logs per charge in lengths less than 18 feet. Logs should be brought to the plant and taken back after treatment at customer's cost. Rate for the specified treatment: Rs. 8 to 10/c.ft. (approx.).

3. M/s. Timber Preservers and Contractors

Location: No. 13, West CIT Colony, Madras-35.

Capacity: Mobile 'ASCU' treatment plant 10 feet long x 3 feet dia.
Short chinnamaram logs, less than 10 ft. in length, can be treated at project's choice of location as per recommended specifications provided 500 c.ft. work contract is given. Alternatively logs have to be transported to plant site.

Rate: At 0.3 lb/c.ft. 'ASCU' retention Rs. 5.50 to Rs. 6/c. ft. (approx.).

4. Madras Port Trust

Location: Madras Harbour.

Capacity: 20 ft. length x 3 ft. dia.

Rate: Standard rate of Rs. 12.00/c.ft. plus 170% extra.

5. ASCU Hickson Limited

Location: 7A, Elgin Road, Calcutta-700 020.

6. "Creosant"/surface application

Location: M/s. Shalimar Tar Products Limited, 6 Lyons Range, Calcutta-700 001.

APPENDIX 3

Andaman Timber for Trial

Quantity of logs required: (for 2 sets of Kattumarams of 5 logs each)

a. Central main log	2
b. Side logs	4
c. Adjoining side logs	4
Extra tons	2
	12 to be used for 2 units and accessories

Size specification of each log/square.'

Square a. 30 cmx40 cmx6 mx2 Nos.	= 1.44m ³
Square b. 35 cmx35 cmx5 mx5 Nos.	= 3.06 m ³
Square c. 30 cmx30 cmx5 mx5 Nos.	= 2.25 m ³
Total	<u>6.75 m³ or</u> 7 m ³ approximately.

Round logs are also acceptable provided length and total quantity are within the prescribed specifications,

ESTIMATE AS PER PRICE SCHEDULE 'A' (Andaman Forest Depot, Port Blair)

1. Squares of 30 cm and up x 30 cm up at Rs. 320/m ³ x 7	= Rs. 2,240.00
2. Lengths from 3 m to 6 m=10% extra	= Rs. 224.00
3. Handling and loading at Andaman depot at Rs. 25/m ³ x 7	= Rs. 175.00
4. Freight by ship to Madras at Rs. 150/m ³ x 7	= Rs. 1,050.00
5. Handling and unloading at Madras at Rs. 25/m ³ x 7	= Rs. 175.00
6. Provision for (1) square ends to be strapped against splitting (2) suitable end coating against cracking (3) prophylactic coating (ASCU or Tar) to withstand any delay in transport	= Rs. 136.00
Total	<u>= Rs. 4,000.00</u>

(Rupees four thousand)

Source of supply:

1. Chief Conservator of Forests
Andaman Forest Department
Chantham Island/Port Blair
Andaman - 744 101.

To be negotiated through:

2. Assistant Conservator of Forests
Madras Andaman Timber Depot
Marshalling Yard/Fort St. George
Madras - 600 009.

- Note:
1. Logs/squares on receipt at Madras to be checked/dressed/shaped as desired with the services of an expert carpenter who has specialised in kattumaram making and in consultation with the ultimate operator.
 2. Chemical treatment may be given without delay as per recommendations.
 3. Treated logs to be assembled and put to operation after making necessary markings and observations.
 4. Behaviour of logs to be carefully observed and recorded throughout for further guidance and action.

**LIST OF PUBLICATIONS
OF THE BAY OF BENGAL PROGRAMME (BOBP)**

Development of Small-Scale Fisheries (GCP/RAS/040/SWE)

Reports (BOBP/REP/....)

1. Report of the First Meeting of the Advisory Committee, Colombo, Sri Lanka, 28-29 October 1976.
(Published as Appendix 1 of IOFC/DEV/78/44.1, FAO, Rome, 1978)
2. Report of the Second Meeting of the Advisory Committee, Madras, India, 29-30 June 1977.
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