

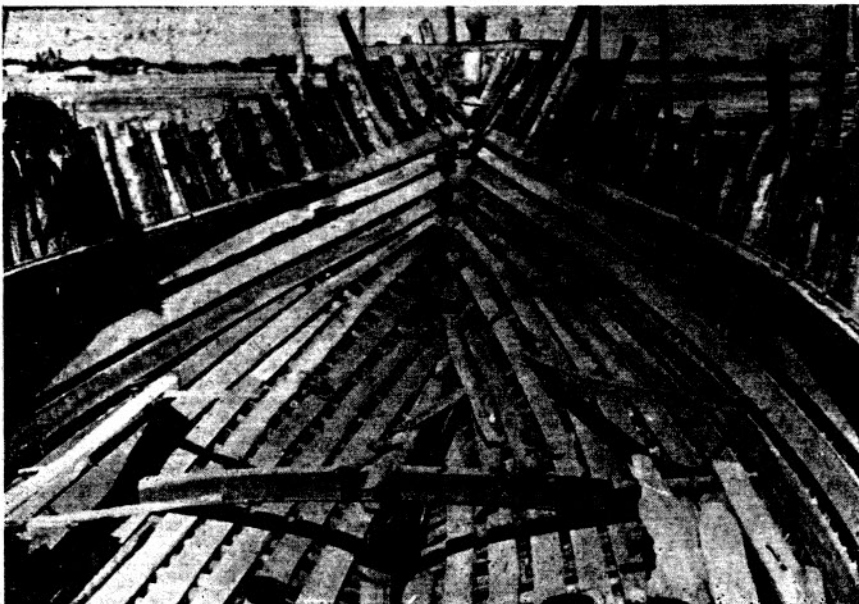
*Mechanised Wooden Fishing Boats above 50 feet. (Left) 'Gudjon' - Imported vessel with Oak wood for the hull; (Right) 'Travancore' - Indigenous Teak wood for the hull.*

In the previous contribution by the author ("Indian Sea-Foods", Vol. VII, No. 4, March, 1970), the important characteristics of 19 indigenous timber species suitable for

the construction of modern mechanised fishing boats were described. In the present paper a few important characteristics of wood as a boat building material are presented.

Wood consists of hollow fibres, the walls of which are composed of cellulose and lignin, the latter also acting as a cementing

*Khotia—a large sailing craft under construction at Veraval.*



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*Oiled wooden planks are being heated for subsequent bending as hull planks (C. I. F. T.)*

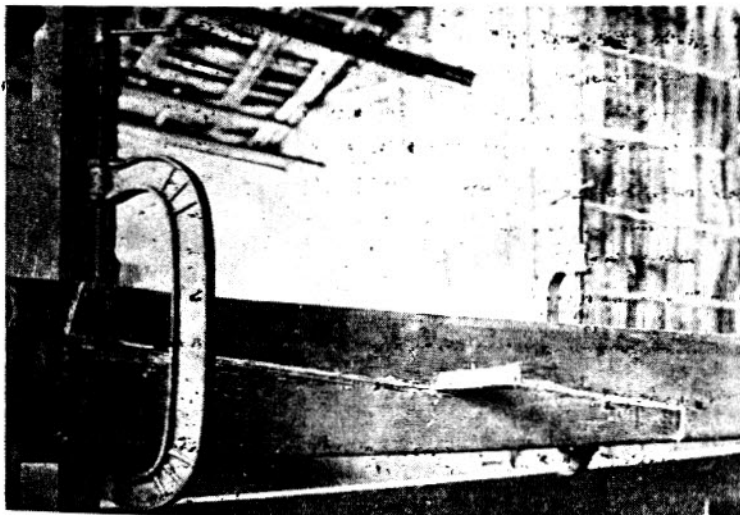
agent that binds them together. The direction, size, arrangement and appearance of these fibres in wood determines their strength. Unlike metals, which have generally uniform strength in all directions, wood does not have the same

strength across the fibres (grain) as parallel to the grain. Timber with a straight and close grain is stronger than the rest. Knots and other defects are objectionable on account of the distortion and discontinuity of the grain caused

by them. Such defects make machining difficult, cause irregular shrinkage and result in general weakening of the wood.

Wood is hygroscopic and it takes on or gives off moisture until the residual level balances with that of the surrounding medium, during which process it either swells or shrinks. However, the rate at which wood will absorb water when continuously exposed to it depends on very many factors like cell structures, extraneous deposits etc. Strength of wood is intimately related to the amount of moisture it contains. Wood in a very 'green' state or in an absolutely dry condition has poor strength properties. Timbers for boat building should be reasonably dry with a maximum moisture content of not more than 20%. Usually under Indian climatic conditions, a moisture content of 10 to 18% is permissible in all structural members of a boat except frames and hull planks where a little higher moisture content is necessary as

*(Left) Single piece timber logs for long keels have become scarce and hence scarphed joints are recommended. (Right) Different timber blocks are being tested for their natural resistance against marine boring and fouling organisms. (C.I.F.T)*

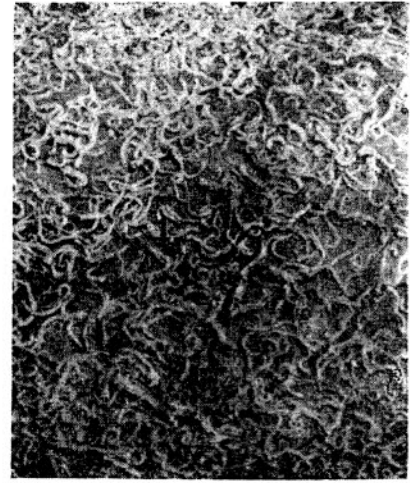




*Fouling by Barnacles*



*Fouling by Oysters*



*Fouling by Tube-worms*

bending of the members is involved.

Wood has certain inherent plastic properties. It will shrink and swell without rupture and has capacity for bending and shaping when heated and steamed. Water and heat increase the natural plasticity, water acting as a plasticizer. Some of the structural members like the frames and hull planking in a wooden boat can be satisfactorily bent to a desired extent provided stocks best suited for this purpose are carefully selected (Rosewood, Venteak, Mulberry and Aini are good examples). Most of the timber species mentioned in the list (*Part I-Table II* and *Part II-Table I*) are not able to retain their shape properly and be stable due to uneven shrinkage. Proper seasoning of such timbers is the only answer.

All woods can be grouped in two general classes; *hard-woods*, which come from trees with broad leaves (*Angiosperms*), and *soft-woods*, or conifers, which come

from trees with needle-like leaves (*Gymnosperms*). However, timber logs under both the groups normally will have a distinctly coloured inner heart-wood and outer lighter coloured sap-wood. The dark colouration of the heart-wood is due to the infiltration of gums, resins, oils and other materials which usually make them more resistant to decay. Devoid of all these extraneous materials, the sap-wood is more susceptible to decay than heart-wood, but at the same time it is much easier to treat the sap-wood with preservatives to overcome this drawback.

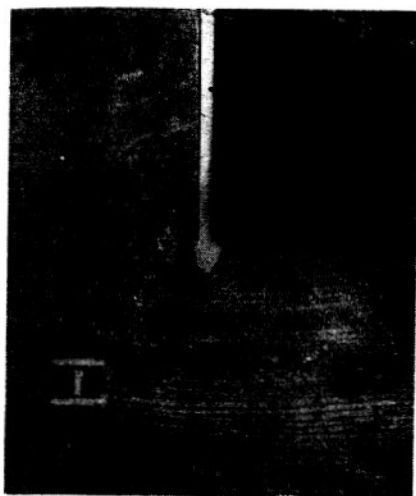
Specific gravity of timbers is an excellent index to their strength properties at a given percentage of moisture content. Weights of two different woods at the same moisture content are good indications of their relative strengths. (Specific gravity is the ratio of the weight of a given volume of a substance to the weight of an equal volume of water and thus weight of one cubic foot of *teak-wood* at 12% moisture content divided by

the weight of one cubic foot of water i.e.  $\frac{42 \text{ lb.}}{62.5 \text{ lb.}} = 0.672$  or 0.673 is the sp. gr. of teakwood at 12% m. c.)

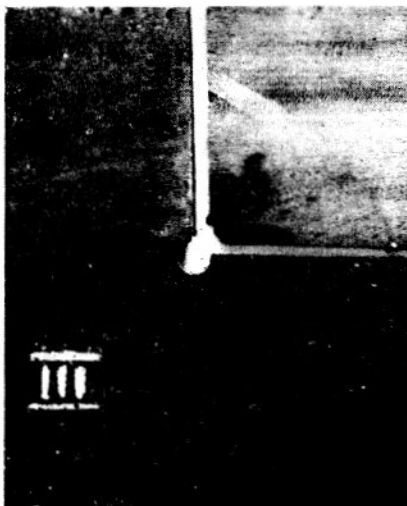
Various types of metal fastenings are in use in wooden boat construction including nails, spikes, screws and bolts besides metal sheathing. The pH value (*Hydrogen ion concentration*) of wood is of high importance in wood research and application. Timbers with low pH-value might cause metal corrosion due to the acidity and humidity in wood. The nail holding power of timber varies widely according to the species of timber and its condition as well as the type of fastening under use.

Timber in its various form is subject to several types of deterioration following its removal from the forest. Knots, cross-grain, checks, splits, shakes, compression and pitch pockets are the most common defects and blemishes encountered while converting timber logs into lumber. These defects

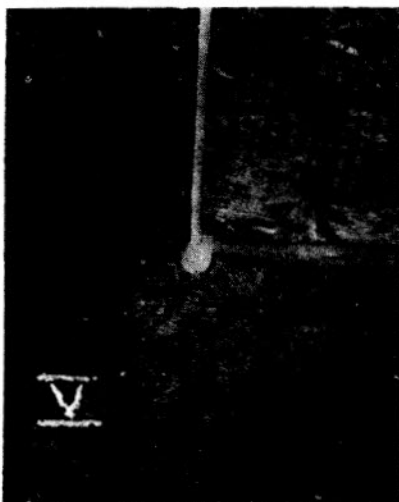
Figs. 1, 2, 3 & 4. Showing the degree of natural resistance offered by four different species of boat-building timbers against marine wood boring organisms (C. I. F. T.)



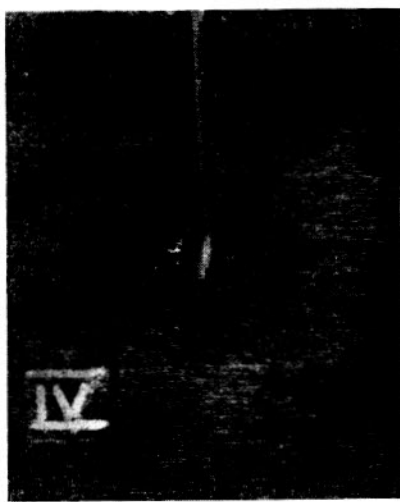
1. Teak Wood



2 Aini Wood



3. Mango Wood



4. Marudu Wood

Note: Top right sliced to show the internal timber damage.

are likely to reduce the strength properties of timber structures. 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 would become unstable and tend to rapid deterioration due to weathering. Being an organic matter, wood is subject to decay due to fungus infection and insect damage against

which proper protection and care is essential. Timber in sea-water is very much affected by marine wood borers and marine fouling organisms.

Boat building timbers should be adequately seasoned as seasoning improves their suitability for use. Timber that would decay under normal working conditions should be used only after prior treatment with proper wood preservatives. Proper selection, seasoning, careful storage, pre-treatment and maintenance during service of the various wooden structures assures a long trouble-free service to fishing boats. Details on these will follow in the subsequent issues of this Journal.

It would be interesting to note that the demand for suitable wood for industrial uses has considerably increased that there will be a gap of more than 100 percent between the demand and supply position during 1975. As India's forests occupy only 1.8 per cent of the total world forest area and 15 per cent of that of Asia, it is considered that our total wood production per unit area is below average. Therefore, it is felt, that besides intensification of production and planting up of large areas with suitable species of timber yielding trees, improved utilisation of low grade species should be taken up as substitutes for the scarce conventional timbers like Teak, Aini and the like. In addition to the list of timbers described under Part I, Table II, details on twelve more timbers are presented under Part II, Table I.

Table I — SHOWING DATA ON DIFFERENT TIMBER SPECIES

(Continued)

Sl. No.	Scientific name	Trade name	VERNACULAR NAMES									English Common name
			Hindi	Gujarati	Marathi	Canarese	Malayalam	Tamil	Telugu	Oriya	Bengali	
1	2	3	4									5
*	<i>Tectona grandis</i>	Teak	Sagwan	Sag	Sag	Theki-namara	Theku	Theku	Teku	Shegun	Shegun	Teak or Indian Oak
20	<i>Acrocarpus fraxinifolius</i>	Mundani	—	—	—	Belanji	Mala-veppu	Malam-konnai	—	—	—	—
21	<i>Callophyllum inophyllum</i>	Poon	Sultana Chempa	—	Surangi	Sath-onne, Surahanne	Punna	Kattu Punnai	Pouna	Poonang	—	Poon
22	<i>Cedrus deodara</i>	Deodar	Diar, Kelo, Kelon	—	—	—	—	—	—	—	—	Himalayan cedar
23	<i>Cullenia excelsa</i>	Karani	—	—	—	—	Mulluchakka	Vedipila	—	—	—	—
24	<i>Dysoxylum malabaricum</i>	Whiteceder	—	—	—	Bilidevdari	Velligil	Velligil	—	—	—	White cedar
25	<i>Grewia tiliaefolia</i>	Dhaman	Phalsa	Dhamana	Damani	Thadasalu	Chadachi	Thadachi	Peddajana	—	—	—
26	<i>Hardwickia binata</i>	Anjan	—	—	—	Karacha	Acha	Acha, calam	Yepi	Dhaman	—	—
27	<i>Hardwickia pinnata</i>	Piney	—	—	—	Yennamara	Chukana, Payni, Shurali	Kolavu	—	—	—	—
28	<i>Hopea parviflora</i>	Hopea	—	—	Kalhoni	Kiralobogi	—	—	—	—	—	—
29	<i>Hopea glabra</i>	Hopea	—	—	—	Bogimara	Irumbogam	Vellai-gongu	—	—	—	—
30	<i>Sterospermum xylocarpum</i>	Vedankonnai	—	—	—	—	Vedankorana	Onthi	—	—	—	—
31	<i>Terminalia belerica</i>	Bahera	—	—	—	Thare	Thani	Thani	—	—	—	—

\* Teak is taken as a standard timber for comparison (100 points on average)

MECHANICAL PROPERTIES															Resistance to marine wood borers. Time for 50% internal damage	Price at c. ft. in log form
Wt. of 1 cft. in lb. @ 12% moisture	Wt.	Strength as a beam	Stiffness as a beam	Suitability as a post	Shock-resistibility	Retention of shape	Shear	Hardness	Seasoning	Durability	Treatability	Resistance to marine fouling				
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
42	100	100	100	100	115	100	115	100	Seasons well with care	Very durable	Not possible	Free fouling	8 months	Rs. 27/-		
43	100	100	105	100	110	80	135	105	Seasons well with care	Fairly durable	Heartwood partially treatable	Free fouling	4 months	—		
41	95	85	90	85	90	65	105	95	- do -	Moderately durable	Very difficult	- do -	3 months	—		
34	80	80	80	85	60	85	90	70	- do -	Very durable	Heartwood partially treatable	- do -	4 months	Rs. 13/-		
39	90	95	105	100	105	70	70	85	- do -	Non-durable	Heartwood treatable	- do -	3 months	—		
45	110	85	95	90	120	60	115	95	- do -	Very durable	Difficult to treat	- do -	5 months	—		
49	115	110	120	125	145	60	140	155	- do -	Moderately durable	- do -	- do -	4 months	—		
53	125	75	60	70	125	90	145	180	Difficult to season	- do -	- do -	- do -	4 months Martesia	—		
39	90	80	90	85	90	65	100	85	Seasons well with care	Very durable	- do -	- do -	4 months	—		
59	135	120	120	120	130	65	135	200	Difficult	Extremely durable	- do -	- do -	5 months Martesia	—		
65	160	125	130	130	155	60	180	225	- do -	Very durable	- do -	- do -	5 months Martesia	—		
43	110	80	80	85	75	85	120	115	Seasons well with care	Durable	—	- do -	4 months	—		
43	115	100	115	105	110	65	120	115	- do -	Fairly durable	Fairly treatable	- do -	3 months	Rs. 8/-		