# ON THE IMPORTANCE OF SHIP—BOTTOM FOULING BY MARINE ORGANISMS — A TECHNO—ECONOMIC SURVEY *

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World attention has to-day been drawn on the need for constant research on the preservation of materials in the marine environment. This includes all phases of design, development, applied engineering and economics which may influence the construction and operation of ships and underwater installations.

The Indian fishing fleet comprising of innumerable indigenous sailing crafts and a large number of introduced mechanised boats have all assumed a greater responsibility to-day than ever before in the harvesting of the natural food resources of the seas around India. Of the 69 million tons of fish the world produces to-day (1970), India's annual contribution is about 1.7 million tons. Besides feeding her own millions, India has also exported to world markets 38,271 tons of marine products valued at Rs. 581.7 million during 1972. The entire economy and the well being of the Indian fishing industry to-day lies, to a great extent, in the efficient, operation and management of her fishing fleet.

Apart from the high initial investment on the development and the expansion of the fishing fleet, an enormous amount of money is being spent annually on their proper maintenance for a prolonged trouble free and uninterferes with the smooth sailing of fishing vessels in Indian waters, is the intensive settlement of the marine fouling organisms on the boat hulls and their successful prevention. While marine corrosion is restricted to metallic surfaces and marine woodborer distruction to timber structures, settlement of marine fouling organisms is common to all surfaces in sea -water may that be wood, steel, aluminium, fibreglass reinforced plastics (FRP or GRP) or even ferro-cement.

The innumerable marine sedentry organisms comprising of both plants and animals that settle on ship's bottom constitute the fouling complex and they seem to cause considerable amount of havoc to fishing boat afloat. The frictional resistance of the hulls, the loss of efficiency of all under water propelling devices and the frequent malfunctioning of all underwater electronic installations as a result of the accumulated fouling complex on them are too well known. Each and every boat has to be taken on the dry-dock periodically to get rid of all the unwanted fouling and again refloat them. This means a constant source of recurring expenditure,

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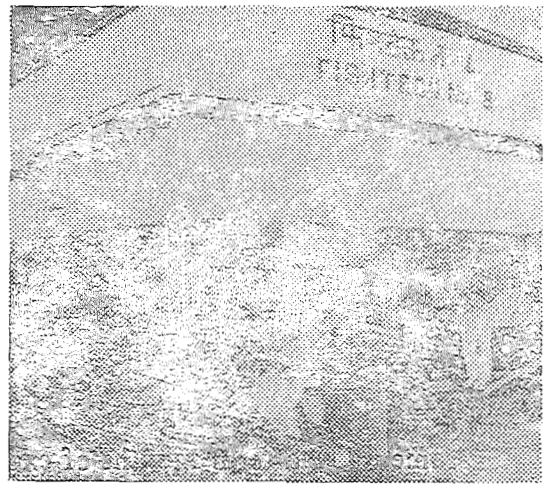
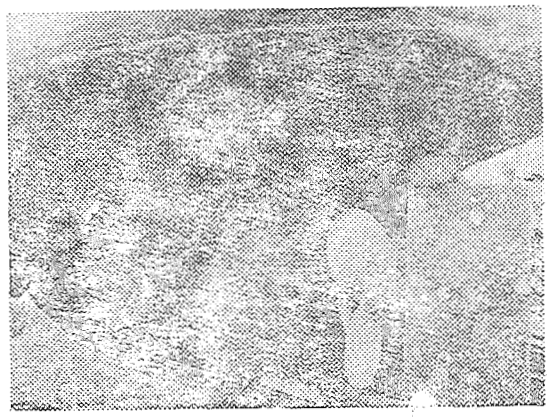
and less of fishing time, but however, fouling has to be prevented at any cost because of the alarming consequences.

Though nearly 2000 species of plants and animals all over the world have been reported to constitute to the marine fouling complex, practically only a restricted few of them become a menace to all crafts, boats and ships by their permanent settlement and massive growth on hulls underwater. The marine fouling complex along the 5000 km length of coastal waters of India appears to be a true representative of the typical Indo-West pacific -Tropical flora and fauna. The most common forms that are frequently met with during the dry-dock inspections of the hulls are reported. The Cirripede barnacles, Lamellibranch bivalves, Annelidan tube-worms, Coelenterate hydroids, the encrusting colonial bryozoans, the water-line green-algae besides the ever present primary film of slime are the problematic forms of foulants. The project study, extending over a period of years, included extensive survey and collection of the major fouling forms from different surfaces from natural resources as well as from raft exposures and laboratory studies. (Figs. 1-6)

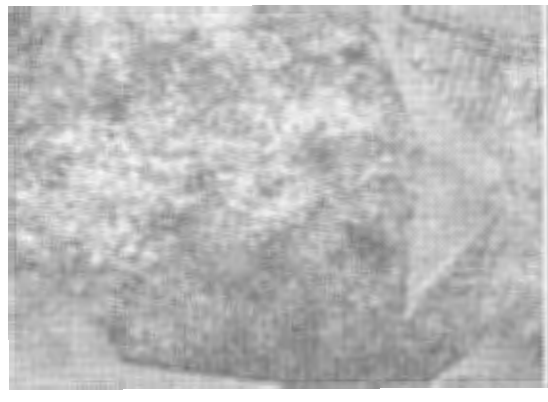
A course of biological studies and investigations on the coastal foulants have revealed their quicker growth, early maturity, greater fecundity and intensive settlement within a short time and greater resistance to adverse conditions under typical tropical Indian conditions. A supporting investigation on the hydrographical studies of the aquatic environment brought to light the greater influence of water salinity and lesser influence of water temperature on the fouling complex encountered.



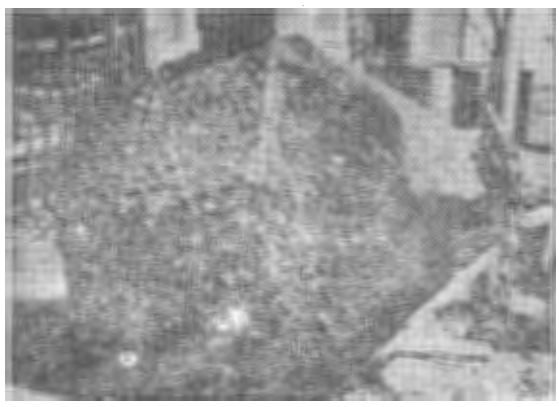
1. A close-up view of the perfectly clean ship-bottom at the time of launching



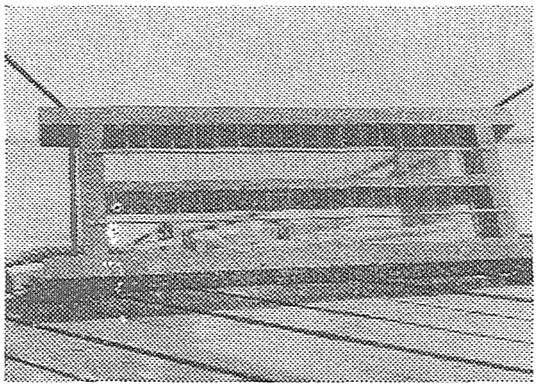
2. A close-up view of the same ship-bottom showing the heavy fouling during the annual docking.



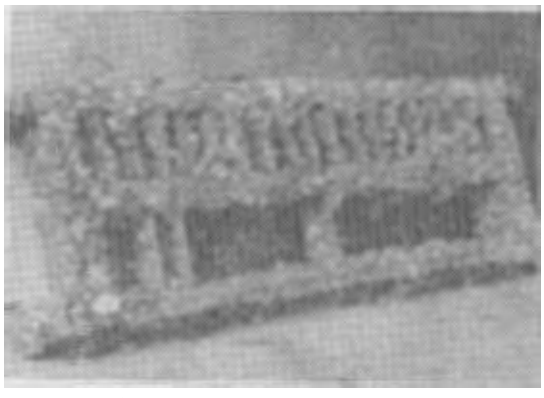
3. A newly fabricated floating buoy before exposure to sea-water.



4. The same buoy after 8 months of exposure to sea-water with accumulated fouling forms.



5. An experimental immersion rack for the collection of the marine fouling forms (before exposure to sea-water).



6. The same rack after 8 months of exposure to sea-water with heavy fouling.

As far as fishing boats are concerned; the intensity of settlement was confined to few restricted zones like below the keel, at the turn of the bilge, rudder surfaces and waterline areas. Displacement hulls with deep draughts had comparatively more fouling. An overall quantitative study has revealed an accumulation of 1 to 1.5 kg per square foot (dry weight) of hull surface during a period of 7 to 8 months of active service of fishing boats (Fig 6). Fouling was heavy when boats were inactive and lying at anchor inside harbours, river mouths and estuaries. Intensive fouling by shell forms not only has caused surface damages to wooden structures but also acce lerated corrosion on steel hulls. Copper and copper based alloys were free from fouling under normal conditions of immersion but were fouled as usual under galvanic inactivation. External installation of cathodic protection sometimes interferred with the efficient performance of antifouling coatings.

Periodical coating of antifouling paint on the hulls while the boats are on the docks, is the only method of preventive measure, the Indian fishing fleet is adopting at present. Studies on the biological evaluation of commercial antifouling paints have indicated much scope for their improvement as regards design, formulation, toxic loading and actual performance. The Institute (C. I. F. T) brought to light the efficiency of *copper-aceto -arsenite* as a toxic pigment in the antifouling composition in place of *cuprous oxide*. For the first time in India, a laboratory formulation of antifouling paint incorporating organo metalic tin (Tri-butyl -tin-oxide) was formulated and put to test successfully. The newer construction materials like aluminium alloy, FRP or GRP and Ferro-cement and their surfaces will in no way be free from fouling in Indian

waters. Such new surfaces require not only an efficient antifouling paint but also an elaborate surface preparation, priming and anticorrosive under coats as is for wood or steel.

Indian fishing fleet is fast expanding in size as well as in numbers. In the absence of adequate dry docking facilities at present, the only way is to enhance the life of antifouling paints with better formulations. It is roughly estimated that the Indian mechanised fishing fleet alone may require approximately 3,00,000 litres of antifouliug paint valued at Rs. 45,00,000 annually to keep their hulls free from fouling and to have a smooth sailing. This estimate, however, does not include docking charges, labour and expenditure on other ancillary items. Marine fouling is not just a growth of plants and animals but "pins and needles" to boat owners.

To-day studies and investigations on the phenomena of marine fouling are being carried out by a number of organisations and various agencies apart from Colleges and Universities all over the world. Studies of this type can no longer be considered as of mere academic interest but have immense industrial applicability. The subject of marine fouling and the various methods of their prevention have become a technology by themselves. The Central Institute of fisheries Technology at Cochin is at present actively engaged in similar studies and has infact been suggesting improved remedial measures from time to time.