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RESEARCH VESSEL *KALAVA* AND CO-OPERATIVE OCEANOGRAPHIC INVESTIGATIONS IN INDIAN WATERS

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INTRODUCTION

It is a recognised fact that a knowledge of the environmental conditions and the reactions of fishes to the dynamics of oceanographic pattern is essential in predicting availability of fish in any area. But it is not easy to achieve this and the progress towards such an end is dependent on the intensity of work done and extent of co-ordination effected between the study of the two disciplines, oceanography, and fishery biology. The management of marine fisheries is a very complex and intricate subject, since the marine environment is never static and is continuously subjected to various influences brought about by currents, tides, etc. many of which have their source far away from the place where their ultimate effect is reflected on the fisheries. To cite an example, it is such background knowledge that has enabled the Norwegian research vessel *G.O. SARS* to guide fishermen with a remarkable degree of precision to schools of herring resulting in considerable saving in time and effort.

The need for a research vessel in connection with marine fisheries investigations in India was recognised from the very inception of the Central Marine Fisheries Research Station, but various practical difficulties stood in the way of procurement of one. In the early stages the investigations were confined mainly to the coastal belt availing of the existing types of craft. Gradually the work was extended wherever possible to areas further out with the help of trawlers of the Deep Sea Fishing Station. In 1957 oceanographic investigations were initiated by the Central Marine Fisheries Research Station in co-operation with the Indo-Norwegian Project and *M.O. KRISTENSEN* one of the fishing vessels of the latter was made available for this purpose, with Cochin as the base of operations. Research cruises were started in September 1957 but due to the unsatisfactory condition of the vessel it was condemned and replaced by its sister vessel, *KALAVA* (Plate I). Since the end of 1957 the vessel has been making regular oceanographic cruises along the West Coast of India.

R.V. KALAVA

The general plan of the vessel is given in the diagrams (Plate III). It was originally built in Norway as a whaling boat and later converted as a trawler and was first known as *FRAM* and then as *SULA*. When the Indo-Norwegian Project acquired it in 1954 its name was changed to *COCHIN* and subsequently it was renamed *KALAVA* in 1957. Details of the vessel :—

Length overall	..	20.25 m.
Breadth moulded	..	5.20 m.
Draught, bow	..	1.40 m.
.. aft	..	2.60 m.
Main engine	2 cyl. 120 H.P. 'Hjelset' Semdiesel.	
Aux. engine	2 cyl. 8 H.P. 'Lister' diesel.	
Speed maximum	8 knots per hour.	
Bunkering capacity	: Diesel oil 7 tons.	
	: Freshwater 3.5 tons.	

The hull is plank built and covered over by copper sheath below the water line. The main deck is continuous. The crew's accommodation is at the fore part where there are 8 bunks for the purpose. Below the hatch is the fish hold and the stores for fishing gear. The refrigerating chamber with a capacity of 8,000 lbs. of fish is immediately behind the fish hold where all the provisions required for the cruises are kept.

In front of the main deck house and behind the hatch an improvised laboratory has been built with the entrance on the starboard side. The laboratory has a small work table with lockers and drawers below and racks for the chemicals and water bottles above. A writing board is fixed to the left entrance corner and two sleeping bunks are built on to the port side of the laboratory. Behind the galley are the entrances to the engine room which is comparatively spacious. The port side of the deck is enclosed and is used as the dining room. The hatch when closed could be used as a low platform for various purposes. The main mast is stepped on the fore deck and carries a derrick with a working load capacity of 2 metric tons.

The wheel house is provided with all the essential navigational equipment. It has a Robertson autopilot steering mechanism and a Simrad echosounder of white line recording type 513-2, 24 volts. In the chart-room behind are fitted a Philips radio direction finder, Simrad radio telephone, 70W, type 550-6, 24 volts having a range of about 200 miles and Simrad echosounder 'Barlodd' type 512-1, 24 volts. Behind the chart-room and on the Starboard side is a small cabin with 2 bunks, for the captain and the engineer. The boat deck is on the port side of the wheel house where a life-boat for 12 persons is kept. On the Starboard side of the wheel house is a small sundeck. The auxiliary engine is coupled to the freezer and main engine to the hydraulic winches and the requisite current for normal lighting purposes is also supplied when the main engine is running. The auxiliary engine is also used for operating the main search light and for general lighting requirements. There is provision for using sail on both masts.

The boat is equipped for fishing cum research purposes and has both trawl and hydrographic winches which could be operated independently. The hydrographic

winch carries 2,500 metres of steel rope, dia. 3 mm. for operating water bottles (Plate II, 1) bathythermograph, plankton nets (Plate II, 2), etc. The hydrographic line is operated through a Bergen Nautik automatic meter wheel for recording accurately the depths at which collections are made.

The research vessel has on board various kinds of scientific equipment such as reversing water bottles, protected and unprotected thermometers, bathythermograph, plankton nets, trawls, grabs, etc., which are normally used for oceanographic investigations. Standard water bottles serially numbered are stored in special boxes. The vessel could continuously cruise for 15 days.

All the expenses for running the vessel and repairs to it are met by the Indo-Norwegian Project. It is manned by a skipper, an engineer, both Norwegians and an Indian crew of 9. From September 1957 to April 1958 and from October 1958 to May 1959 a physical oceanographer and a marine biologist respectively from Norway who were working as Research Advisers to the Project were regularly taking part in the cruises along with the scientific personnel of the Central Marine Fisheries Research Station.

OCEANOGRAPHIC INVESTIGATIONS

The area under regular investigation hitherto has been the southern section of the west coast from Cape Comorin in the south to near Mangalore in the north. The voyages to Mandapam for dry-docking purposes were taken advantage of for making collections from the Gulf of Mannar. In addition to the above, three cruises to the Laccadive Archipelago were made on an oceanographic cum fishery resources survey of the area. It is needless to mention here that the Laccadive Sea with its special ecological conditions is likely to have considerable influence on the adjacent coastal waters of the mainland of India and any development of the latent fishery resources of the Laccadives could most effectively be carried out only with the ports of Kerala as the base. The stations covered so far are indicated in Plate IV.

It is only about a year and a half since the cruises have been under way and the biological collections are being studied and oceanographic data are being processed. Some points of special interest are mentioned below.

Oceanographical studies in the area between Cape Comorin and 65 miles south of Mangalore showed certain very interesting features (Ramasastry—MS, and Ramasastry and Myrland—MS). (1) It was found that the pattern of temperature distribution in most cases (except during the colder months) is bimodal or multimodal. (2) During the south-west monsoon upwelling takes place along this coast when the surface water is displaced by subsurface water. Almost a complete turning over takes place during the process of upwelling and is spread over the entire continental shelf. The amount of water drawn from the subsurface layers varies with the intensity of upwelling but in general the upper 100 m. of the subsurface water interacts in this process. The deeper water rises vertically to some extent but never up to the very surface. (3) In the south-eastern Arabian Sea three major water masses have been recognised in the upper 300 m. of the sea (a) The Arabian Sea surface water, (b) the Arabian Sea upper subsurface water, and (c) The Arabian Sea lower subsurface water. (4) The investigations have revealed the mixing of the Indian

Equatorial water, which is found between 200 and 2,000 m. with the Red Sea Water, a process very much similar to the mixing of the Mediterranean water with the Atlantic water. This mixing presumably results in the formation of the intermediate deep water masses in the Arabian Sea. (5) In the Laccadive Sea comparatively low salinity water is found during the dry months. This may indicate the presence of the subantarctic bottom drift. (6) Prominent eddy circulations have been noticed between Alleppey and Quilon and in the vicinity of Calicut. (7) The data collected on aspects such as divergence, convergence, upwelling, and circulation have given certain clues for a better understanding of the dynamics of the mud bank formation. (8) The circulation pattern and thermal structure show that the region off Calicut serves as a transition zone between the northern and southern water masses.

Velocity of sound in the Arabian Sea along the south-west coast of India during the post-monsoon season has been studied (Ramasastry and Ramamirtham—MS). A sound channel running westwards from Quilon to about 30 miles and then turning northwards is found between 10 m. and 50 m. depth. At greater depths this channel seems to have an eastward branch with other isopleths converging with it at 9° N.

The upwelling along the south-west coast of India during the south-west monsoon appears to have considerable influence on the coastal fisheries there (Banse, 1959). The upwelling water has low oxygen content and as such this area is avoided by fish which move to either comparatively shallow water or to deeper zone. The high phosphate figures of the surface waters in this area during this time also appears to be mainly due to upwelling. The vertical distribution of dissolved oxygen during summer months in the deep waters of the Arabian Sea in the neighbourhood of the Laccadive Islands has been studied (Jayaraman *et al.*—MS) and it has been found that the surface layer upto a depth of 50 m. has a more or less uniform oxygen content from whence there is a rapid decrease with the lowest values at about 150 m. depth and again a rising trend from about 700 m. downwards.

Planktologically the area is extremely rich both in the number of species, and the abundance of organisms. Most of the forms present are holoplanktonic because a majority of the samples are collected far away from the coastal areas. However, larval forms, particularly of decapods are common. In this connection mention may be made of the several phyllosoma larvae obtained from the Laccadive-Minicoy region belonging to the species of *Panilurus* (Prasad and Tampi—unpublished). A few phyllosoma of *Scyllarus* spp. were also obtained. Pteropods and a variety of hydromedusae are common in many samples. Several species of Larvaceae and Thaliaceae are abundant and so also the Siphonophores. Chaetognaths form another important group. About 13 species of *Sagitta*, 2 species of *Eukrohnia*, 2 species of *Krohnia*, and *Pterosagitta* have been recorded (Prasad & Reddy—unpublished). Samples collected from the Minicoy area occasionally showed a fairly large number of the young ones of *Amphioxus*. In all the plankton samples copepods undoubtedly dominate and of these the Calanoids are predominant. However, in a few samples enormous numbers of the red Harpacticoid. *Metis jousseaumei* are found.

During some of the cruises extensive patches of *Trichodesmium* were encountered in the open sea.

Very valuable information has been collected about the fisheries around the various islands during the special cruises to the Laccadives. A study has been

made particularly of the tuna fishery of Minicoy (Jones, 1958a, Jones and Kumaran, 1959). A study of the bait fishes on which the fishery of the oceanic skipjack depends has been initiated with a view to determine their distribution and abundance. *Spratelloides delicatulus* has been noticed near certain islands and its utility as a potential bait fish for tuna fishing deserves investigations. A general collection of fishes has been made which includes several species not previously recorded from the area. Some of these like *Gemphylus serpens* are oceanic species while a few deep sea forms are also represented. The presence of swordfish, and sailfish, the larval stages of which have already been described (Jones, 1958a, and 1959) and a variety of other fishes indicates the scope for the development of a potential sport fish industry, with Cochin as the base, for the above highly prized fishes.

The collections of larval fishes from the Laccadive Sea are of special interest. Occurrence of larvae of fishes such as *Xiphias gladius*, *Istiophorus gladius*, *Katsuwonus pelamis*, *Neothunnus macropterus*, *Euthynnus affinis*, and *Auxis* show that this area forms an extensive breeding place for the above economically important fishes (Jones, MS). The eggs and larval stages of a number of Synentognathi have also been obtained and the material is being worked out.

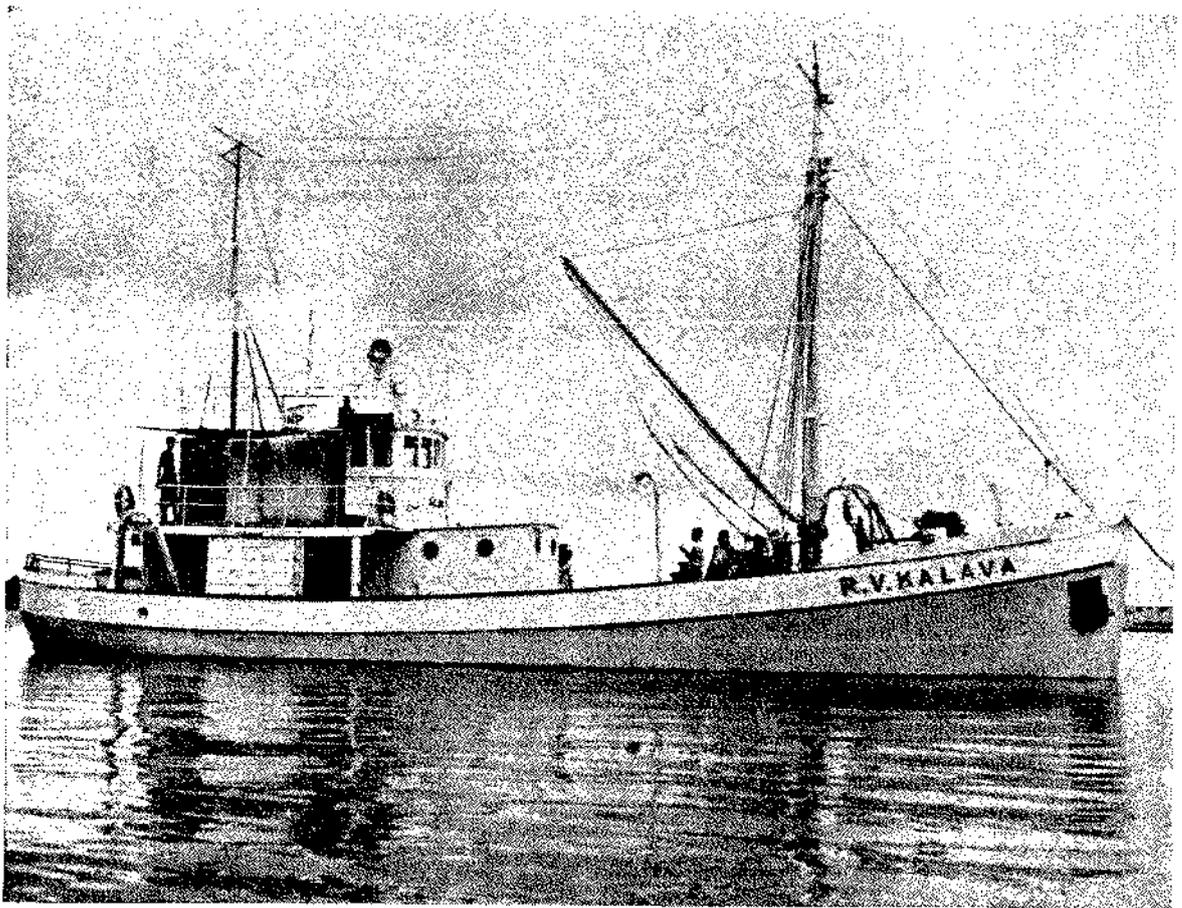
Indian Ocean continues to remain the largest unknown water mass and an international assault on it is contemplated in 1961 under the auspices of the UNESCO. It is hoped that R.V. KALAVA despite its limitations will be able to contribute its share in this co-operative effort. With increased mechanisation of fishing craft and consequent greater range in fishing operations, the marine resources of India are being exploited more and more. Considerable expansion is envisaged under the third five-year plan requiring a large number of trained personnel for research and development. In this connection R.V. KALAVA is also serving the dual purpose of a training cum research vessel for the technical personnel recruited in connection with marine fisheries research in this country.

The work of R.V. KALAVA is a demonstration of international co-operation on a miniature scale. The investigations initiated by the Central Marine Fisheries Research Station in co-operation with the Indo-Norwegian Project have helped to open a new chapter in the annals of oceanographic research in general and fisheries research in particular in Indian waters.

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FIG. 1. Operation of reversing water bottle.

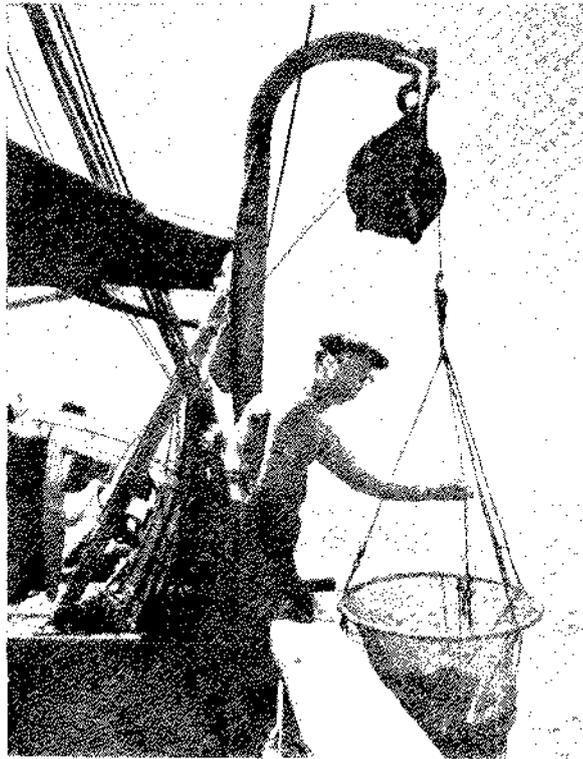
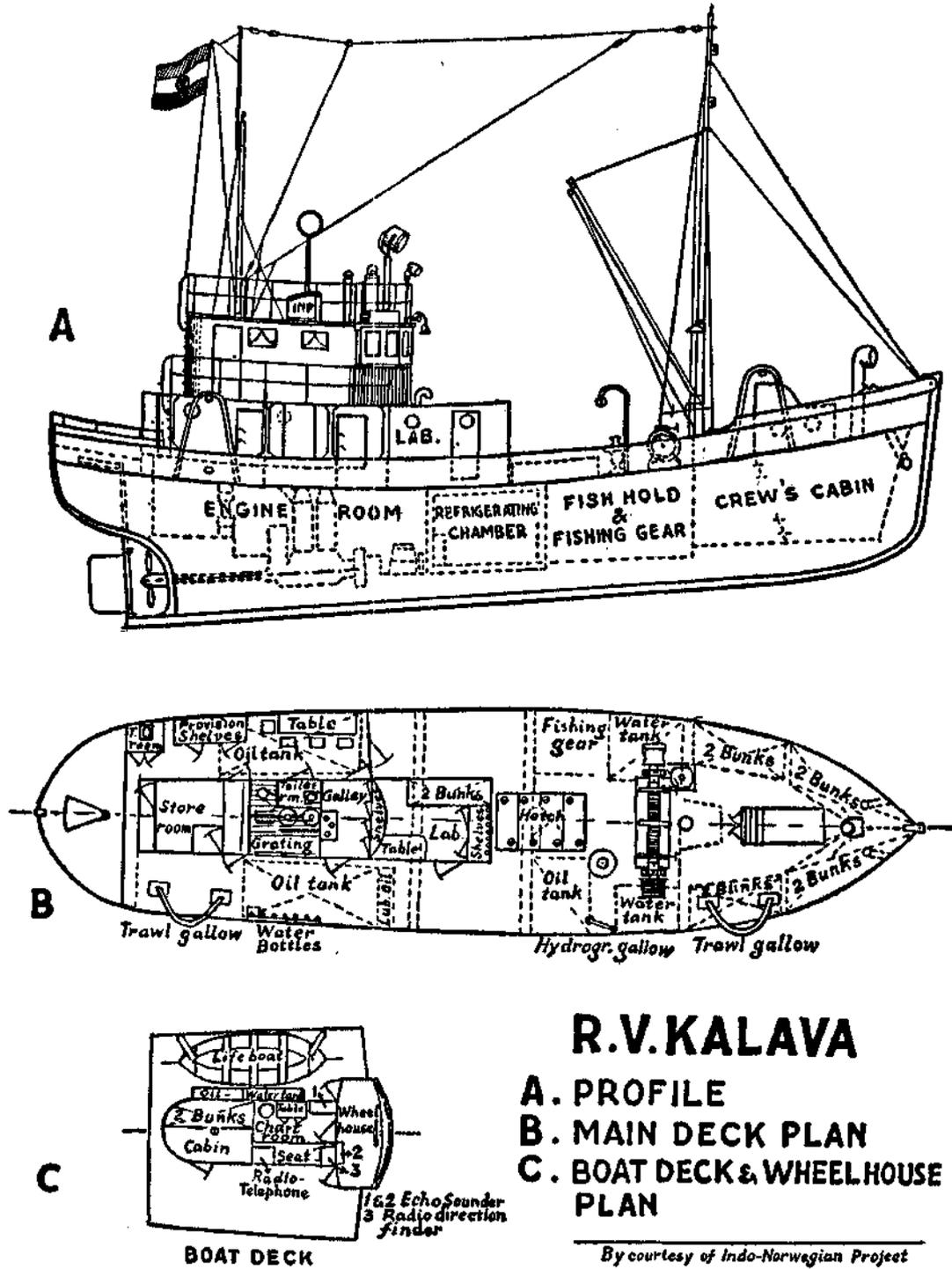


FIG. 2. Plankton haul.



R.V. KALAVA

- A. PROFILE
- B. MAIN DECK PLAN
- C. BOAT DECK & WHEELHOUSE PLAN

By courtesy of Indo-Norwegian Project

