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A PRELIMINARY FISHERY SURVEY OF THE VEMBANAD

BACKWATERS, KERALA

BY

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INTRODUCTION

Boardering the coastline of Kerala there are a large number of backwaters, which are connected with the sea by some permanent and some periodical openings and which in association with adjoining low-lying lands, paddy fields and the network of canals form an extensive source of year-round fish supplies. They are believed to be the nursery grounds of several species of prawns and fishes of commercial importance and hence afford a rich source of prawn and fish seed. But the recent development of reclamation projects in these areas pose a problem and it is imperative to assess their effects on fisheries. Further, according to Panikkar (1952) there has been a most marked 'depletion' of the fisheries in the backwaters, canals and low-lying areas in Travancore, owing probably to the intensive fishing that has been going on without replenishment having taken place. Earlier, John (1936) had referred to the indiscriminate fishing methods and lack of Government control, which tend to lead to decline in fish populations by destroying breeders and fry.

But, as yet there is no scientific information on the status of the fisheries in these waters. The hydrology and plankton of these waters have hardly received any attention, except for the work of George (1958). Likewise, their fish and fisheries have not been studied to any useful extent, even though some accounts have appeared regarding the bionomics of some fish (Bhaskaran, 1946), or the species available (Day, 1865; Pillay, 1929; John, 1936; Silas, 1949 etc). Only the prawn fisheries have been fairly extensively studied by a number of workers, notably Menon (1951, 1954, 1955, 1957 & 1958), Menon and Raman (1961), Panikkar & Menon (1955), Gopinath (1955), George (1959), Panikkar (1937) and Chopra (1943), while accounts of several fishing gear used in these waters have been given by Hornell (1937 & 1950), Gopinath (1953) and in a Government of India Publication (1951).

Therefore, a preliminary survey of the largest piece of Kerala backwaters, the Vembanad backwaters (including the Vembanad lake and the Cochin backwaters), was undertaken during March 1959 in order to obtain a general idea of its fisheries and to identify the problems requiring investigation.

TOPOGRAPHICAL FEATURES

The Vembanad backwaters extend from Cranganore in the north to Alleppey in the south, a distance of about 96.5 Km. (see map). The total area of this water mass as shown in the Survey of India map is roughly 300 Sq.Km. But an area of about 44 Sq.Km. at its south-eastern corner near Alleppey was found to have already been reclaimed at the time of survey, thereby reducing the total area to about 256 Sq.Km. The northern portion of the backwaters above Aroor is situated in the erstwhile Cochin State and is generally referred to as the Cochin backwaters, while the southern portion, termed normally as the Vembanad lake, lies in the erstwhile Travancore State. In view of the continuity of this water mass right up to Cranganore, the entire stretch is referred to as the Vembanad backwaters in this report. This, along with the Kayamkulam and Ashtamudi lakes; forms the more important of the Kerala brackishwater lakes.

The southern portion of the Vembanad backwaters is much broader, while the northern portion is narrower and sinuous. The lake runs parallel to the Arabian Sea, to which it is connected in the main at two places, at Cochin & Azhikode, both in the northern half. Branching off from the main stretch of backwaters are a number of subsidiary water masses and canals.

Except at Cochin, where dredging is carried out to facilitate the movement of ships, these backwaters are essentially shallow, with the depth in the fishing grounds varying from one metre near the shore off Vypin Island at its southern end to 7.75 metres off Aroor near the bridge, with a mean depth of about 3.5 metres. Below Munro Island at its southern part, the lake is quite shallow, the depth on an average being just two metres only. It is a little deeper between Thannirmukham and Vaikom (about 5 metres) and for some distance north of Cochin. The nature of the bottom is mostly muddy, with an admixture of fine sand granules in some places. Off Kumaragam, the bottom consists of mud with a thick deposit of sub-fossil lamellibranch shells, while off Aroor, Manapilli and Azhikode it is sandy. The depth and nature of the bottom in different parts of the backwaters are indicated on the map.

HYDROBIOLOGICAL FEATURES

(a) Salinity:

Since both connections to the sea are situated in the northern half of the backwaters, that section is much more saline than the southern half. At the time of survey (i.e., during March), the water above Chembu-Panavalli area up to Azhikode showed a salinity range varying from 23.31 to 33.55‰, with the maximum at Cochin, while the waters below Vaikom showed a gradual decline southwards from 18.44‰ at Vaikom down to 10.49‰ at the southernmost end of the lake off Alleppy. Panikkar (1937) has stated that these waters become almost fresh and are in a flooded condition from June to September during the South-West monsoon and that the water level falls considerably after the north-east monsoon during November, and by December the water is distinctly brackish. He further states that optimum conditions for the life of brackishwater animals are obtained in these waters from January to March. Local enquiries revealed that the waters south of Thannirmukham remain quite fresh during the period of southwest monsoon.

George (1958) has given an account of the hydrological conditions of the Cochin backwaters as observed at Narakkal bunder canal and has inferred that monsoon rain forms the most important factor influencing salinity variations. He found both salinity and surface temperatures high during the summer months and low during the monsoon months.

(b) Sources of pollution:

The discharge of effluents from the F.A.C.T. factory in Alwaye is believed to contaminate these backwaters. Even though there appears to be some agitation against this, the extent of this pollution does not seem to have been determined so far. A second likely source of pollution is the coconut husk retting, which is done on a large scale at certain places like Palangad, where the water appears darkish, with apparently high turbidity.

(c) Plankton and benthos:

The only published report on the plankton of these backwaters is by George (1958), who studied the seasonal fluctuations in abundance of the various plankters at Narakkal bunder canal and attempted to correlate these fluctuations with the fluctuations in salinity. He found a marked marine element in the plankton of these waters.

During the course of this survey, immense quantities of filamentous algae were noticed at the southern end of the lake off Alleppey and these were found to hamper the operation of big nets like Peruvala, by making the hauling process very difficult.

(d) Commercially important fishes and prawns:

A classified list of all the fishes, prawns and crabs collected during the survey is given in the Appendix. Among those of major commercial importance may be mentioned three species of prawns (Metapenaeus dobsoni, M.monoceros and Penaeus indicus) and five species of mullets (Mugil cephalus, M.cunnesius, M.parsia, M.troscheli and M.waigiensis) in the upper half of the backwaters above Arukutty, and Cock-up (Lates calcarifer), Milk fish (Chanos chanos) and Pearlsport (Etroplus suratensis) in the lower half. In addition to these, the Sciaenid Sciaena coiter, the Perch Lutianus argentimaculatus and the catfishes Tachysurus spp. are found in good numbers all along the backwaters. Among those of lesser commercial importance may be mentioned Carnax sansun, Tylosurus strongylurus, Hemiramphus cantori, Etroplus maculatus and Scatophagus argus in the lower stretches and Thrissocles spp., Anchoviella spp. and Eleutheronema tetradactylum in the upper stretches. The occasional occurrence of Hilsa (Hilsa ilisha) in shoals in these waters has already been reported by Pillay (1960).

Of the above, the Pearlsport is reported to be available in its maximum numbers during the rainy season, while maximum catches of the Cock-up are obtained from January to April. The catfish Tachysurus arius is reported to be fished from December to March, with the maximum catches obtained during February and March. The fishery for Beloniform fishes extends mainly from December to March, while the Milk fish is reported to be available in good numbers from November to June. The major prawns, being marine species, enter the backwaters as young ones along with tides in search of food, grow there and return to the sea for spawning. They are caught in their maximum numbers during the months September to February. The rare occurrence of Hilsa reportedly coincides with the high salinity period during March and April.

FISHING GROUNDS, LANDING PLACES, FISHING SEASONS
AND DISPOSAL OF CATCHES

Except at Cochin port area, where it is prohibited, fishing is done practically all over the backwaters. However, there are concentrations of dip nets and stake nets in certain regions adjoining important fishing villages. Free nets are

operated all through the lake, but mostly in the waters adjoining the respective fishing villages. Chinese dip nets and stake nets can be seen in large numbers along the banks and across the backwaters respectively from Thannirmukham in the south up to Cranganore in the north. Both these nets are completely absent below Thannirmukham, because of the lack in that region of strong tidal currents, which are necessary for the successful operation of these two nets.

There are also no regular landing places, the catch being mostly disposed off anywhere near the fishing ground. However, in some places where fishing is done in the waters adjoining the village, the fish is brought to the village regularly for disposal. Among the important fishing centres may be mentioned the following from north to south : Cranganore, Azhikode, Munambam, Pallipuram, North Parur, Manapilli, Edavankkad, Narakkal, Manjanakad, Malipuram, Vadutala, Ochanthuruthu, Thevara, Edakochi, Kumbalam, Arakutti, Aroor, Arukutti, Vuppuruthu, Chembu, Panavalli, Vaikom, Shertallai, Thannirmukham, Kumaragam and Alleppey.

There is no separate fishing season as such and fishing is done throughout the year; only the abundance of different species varies in different seasons and accordingly there may be variation in the frequency of operation of the concerned types of nets. As for example, Thelikanni vala is used more frequently in the rainy season when the Pearlsports are available in their maximum numbers, or a particular type of net may be used during a certain season of the year only, as in the case of Narimeenvala, which is operated for 'Narimeen' (Lates calcarifer) during the months February to April only. Further, the same net with altered mesh size is used during the rainy season for catching skates and rays.

In the majority of places, the catches are disposed off locally in fresh condition to individual consumers. Only when the catch consists of very small prawns, it may be sun-dried and sold later on. However, in some places like Cochin, Vaikom and Alleppey the catches are mostly sold to merchants. At Cochin, big and medium sized prawns are purchased by the freezing and canning companies for export to foreign countries. At Vaikom, the catches, specially the night catches, are purchased by merchants from Kottayam, to where they are taken by the first bus service in the morning. Similarly, marchants from Kottayam and Changanacherry frequent the Alleppey and Kumaragam fishing grounds.

FISHERIES AND FISHING OPERATIONS

(a) Dip net and Stake net fisheries:

The most striking feature of these backwaters is the extensive dip net and stake net fishing found all along the

stretch above Thannirmukham. These nets are essentially operated for prawns and mullets, which contribute to the most important commercial fisheries in the northern half of the backwaters.

(i) Dip net fishery:

The net employed is generally known as the Chinese dip net or Cheena vala or Kamba vala. It is a stationery balanced lever dip net, located singly or in groups both along the shore and near the shore in shallow waters. The structure and mode of operation of this net have been adequately described by Hornell (1937), Panikkar (1937) and others. It is operated at nights mainly for prawns and during the day mainly for mullets. During the night operations a petromax is tied just above the net to attract the prawns. The time of operation is usually at the turn of the tide from low to high, when the current is best felt. The greatest concentrations of this net are at and adjacent to, the two openings of the lake into the sea at Ernakulam and Azhikode. At Azhikode, these nets extend even into the sea for some distance (about a furlong) along the shore, south of the Periyar river mouth. Rows of them can also be seen on either side of a narrow stretch of backwaters (about six miles long), west of the main backwater mass, running southwards from the Periyar river mouth.

The night catches consist essentially of large and medium sized prawns, (mainly Metapenaeus dobsoni, M.monoceros and Penaeus indicus), with a sprinkling of several species of fish and at times even crabs and cuttle-fish. Among these may be mentioned the Sciaenids (Pama pama, Sciaena spp.), cat fishes (Tachysurus spp., Mystus spp., etc.), clupeoids (Thrissocles spp., Anchoviella spp., Megalops cyprinoides), Ambassis sp., Leiognathus spp., Eleutheronema tetradactylum, Neptunus pelagicus and Scylla serrata.

The day time catches consist mainly of mullets (Mugil parsia, M.waigiensis, M.troscheli, M.cunnesius and M.cephalus), the others present in lesser numbers being Eleutheronema tetradactylum, Scatophagus argus, Thrissocles spp., Anchoviella spp., Megalops cyprinoides, Sciaenids and cat fishes. The mullets dominate the catches specially in the Cochin part of the backwaters. It is gathered that the night prawn catches by this net are at their maximum from November to February and that the daily catch may go up to as much as 100 lbs per net.

(ii) Stake net fishery:

The stake net is a type of fixed conical bag net with a tapered cod-end, resembling the Been-jal of Bengal, about 20-25 ft. in length. It is locally known as the Kutti vala or Valu vala. A full description of its structure has already been given by Hornell (1937). Usually series of these nets are tied up to stakes planted across the backwaters, with one net between every two stakes.

This net is permitted to be operated only during the ebb tide, in order to prevent the destruction of young ones of prawns entering the backwaters. It is usually operated at a depth of about 3-5 metres and fishing goes on practically throughout the year. It is, however, mentioned by Menon (1955) that stake net fishing remains suspended when there are high floods during the monsoon months June-August, because of the likelihood of swift currents and floating debris damaging the nets. The daily catch varies from a few pounds to about 50-60 lbs in favourable seasons. The prawns form the bulk of the catches and it is gathered that they are obtained in their maximum quantities during September and October. The main species of prawns fished by this net are Metapenaeus dobsoni, Penaeus indicus and Metapenaeus monoceros. The fish caught in this net consist mainly of Clupeoids (Anchoviella spp., Thrissocles spp., Anodontostoma chacunda etc.) and gobeids. Occasionally eels, Squilla, Sepia and Octopus are also found in the catches.

(b) Other fisheries:

Besides the above two principal fishing gear, which belong to the fixed engine category, several others falling under the 'free engine' category are operated for different fishes and prawns. In addition to these, several people are engaged in extensive clam and shell fisheries. A brief account is given below of the various fishing operations and their catches.

(i) Cast net fishing:

Fishing with cast nets ('Veechu vala') goes on throughout these backwaters, but is specially concentrated in the upper stretches. All along from Narakkal to Edavanakkad, the stringed variety of cast nets was seen being operated in large numbers in shallow areas, which are reported to have flat bottom and hence more suitable for operation of small cast nets. Concentrations of this net were also observed from Manapilli to Cherai and at Parur, Pallipuram and Azhikode in the upper stretches and in the lower stretches at Arukutti, Kumaragam and Alleppey.

The catches in the upper stretches consist mainly of metapenaeid prawns, with also a few mullets, engraulids and sciaenids. In the lower stretches, where generally bigger-meshed cast nets are employed, Pearlsnouts constitute the bulk of the catches, the others being half-beaks, gobeids etc. The daily catch is said to vary from 10-80 lbs. and occasionally even up to two maunds, the average daily catch being about 15 lbs. It is gathered that the catches are the heaviest during the spring tides.

(ii) Canoe-trap fishing:

A kind of Canoe-trap, termed locally as the Changālapāyī-kkal or Changadam is in use in the middle and upper stretches of the Vembanad backwaters, operating in shallow regions during calm periods for catching prawns and grey mullets. This method of fishing is based on a knowledge of the habits of some prawns and mullets, which when frightened leap wildly out of the water.

Several workers like Hornell (1937 & 1950), Panikkar (1937) and Gopinath (1953) have given full descriptions of Changadam and its mode of operation. However, there are differences in these accounts regarding the dragging device, which as per the author's observations, consists of a chain attached to the bow of each boat, with the two chains joined together posteriorly. But according to Gopinath (loc.cit.), it consists of a single long chain, with its two ends attached to the two boats, while Hornell (1937 & 1950) and Job and Pantulu (1953) have described it as consisting of short pieces of chain, connected by lengths of rope. Further, according to Panikkar (1937) and Chopra (op.cit.), it is a net that is tied across between the two canoes and not any chain, and the prawns trying to swim through are trapped in this net. This may probably be a local variation at the place and time of observation. Again, it is stated by Panikkar (1937), Gopinath (1953) and Menon (1955) that only prawns and shrimps are caught by this method. But as per information gathered during the presnet survey, even though prawns constitute the main catch, mullets are also obtained occasionally. Hornell's (1937 & 1950) accounts confirm this observation.

(iii) Drag net fishing:

Drag net fishing is again resorted to mainly for catching prawns, along with which a few miscellaneous fish like Anchoviella spp., Ambassis spp., Eetroplus spp., gobeids, half-beaks etc. are caught. The drag net commonly seen in these waters is known as the Vadi vala. It is a trough-shaped drag net resembling the Khadi-jalo of Orissa. It is generally seen in the middle and lower stretches from Arukutti down to Thannir-mukham in the main backwaters, as well as in the connected canals. The details of its structure have already been described by Hornell (1937). It is operated either singly or in groups of two throughout the year during both night and day at the time of low tide. The catch is mostly dried and sold later on.

(iv) Bag net fishing:

A kind of bag net called the Karimeen vala is seen in the lower stretches operating for about six months in a year from January to June catching Pearlsports. Mulletts and prawns are also caught in lesser numbers. It is a conical bag net

18 ft. long and 24 ft. across its mouth. It is made of cotton yarn, with the mesh size varying from $1\frac{1}{2}$ " near the mouth to $\frac{1}{2}$ " at the cod end. Fishing is done during both the tides. The net is fixed to the bottom by two stakes and is hauled up after about 30-45 minutes. There are floats on the upper half of the mouth and sinkers on the lower half. There is no opening at the cod end of the net.

(v) Trawl net fishing:

One kind of trawl net called Konchi vala operates in the middle stretches near Arukutti for catching big prawns and fish. It consists of a rectangular bag, 25 ft. long and 54 ft. across, made of 36 no. cotton yarn, with a mesh size varying from $1\frac{1}{2}$ "-2". During operation this bag is dragged along by two boats, the mouth being kept distended by floats on the upper half and sinkers on the lower.

(vi) Seine net fishing:

Several kinds of boat seines are operating all over these backwaters for catching a variety of fishes. Among these the Telikannivala and Pattikannivala are the most common. Both are provided with long scare lines of tender coconut leaves and are of similar structure, with only the mesh size of latter being smaller. The catch consists of a number of fishes, among which may be mentioned Caranx sanson, Therapon puta, Etroplus spp., mullets, clupeoids, sciaenids and prawns. The smallest meshed ($\frac{1}{2}$ ") Pattikannivala is without the scare lines and is used for catching prawns and hence termed chammeen vala. Part of the operation of this net consists of dragging it with two poles and this probably accounts for Hornell's (1937) inclusion of Telikannivala and Pattikannivala under drag nets. Maximum catches by Telikannivala are reportedly obtained during the rainy season.

In the middle and lower stretches can be seen an interesting method of fishing by Koori vala, wherein the sounds produced by moving shoals of fishes are made use of for locating their whereabouts and extent. This type of fishing has been fully described recently by Gopinath (1953), who terms it 'fishing by listening in'. According to him one of the two fishermen gets into the water and immerses his head in the water, while according to the author's observations, the fisherman sits inside the boat and by bending over immerses his head in the water. The net is generally used as a seine, but at times also as a gill net set across the path of shoals. The catch consists essentially of Tachysurus spp. and occasionally some Sciaenids. Surprisingly, Gopinath (loc.cit.) has not mentioned cat fishes among the catch of this net. Heavy catches are reportedly obtained during February-March and the rainy season.

A big 1" meshed boat seine called Peru vala is operated in the lower stretches throughout the year. The catch is miscellaneous, consisting of a number of fishes and a few prawns. This net is payed out in concentric circles and is hauled up in such a way that those of the fishes which are not gilled are encircled and brought up.

(vii) Gill net fishing:

A large number of gill nets are operated throughout the year, mostly in the lower stretches, Among them may be mentioned the Narimeen vala, Odu vala or Poomeen vala, Thiruda vala, Morashu vala and Chavala vala. The Narimeen vala for catching Lates calcarifer is a big net of 6" mesh size, operated generally during the months February to April at nights. The same net is used in the rainy season for catching skates and rays, by altering the mesh size to 12". The Odu vala is a similar net, but with smaller mesh (3") and is operated throughout the year. The catches consist essentially of Chanos chanos and Lates calcarifer, with also a good number of Mugil cephalus, Scatophagus argus, Lutianus argentimaculatus and Sciaena coiter. The Thiruda vala or Paithu vala is a stationery gill net for catching Mugil cephalus. Morashu vala is another kind of stationary surface gill net in the lower stretches for catching Hemiramphus and Tylosurus. It is mainly operated during the months January to March, when these fishes are reported to be available in their maximum numbers. Chavala vala is a drifting gill net operated at nights during the rainy season and the catch is similar to that of Odu vala.

(viii) Clam fishery:

Large numbers of live clams are available in these backwaters from a little to the south of Munro Island down to Alleppey and these are fished by a good number of lower stretch fishermen. The catch is generally taken to their respective villages, where the clams are boiled, the flesh taken out and sold to consumers, and the empty shells sold mainly to people preparing lime and to the Travancore Cement Factory. The shells are also reported to be used in house construction and maintenance works, while half-burnt shells and lime are extensively used to counteract acidity in paddy fields and lands.

(ix) Shell fishery:

In addition to clam fishery, a large number of people are engaged in collecting the sub-fossil deposits of lamelli-branch shells found in the backwaters from Thannirmukham down to Alleppey. These people mostly belong to the Ezhava community and are from Kumaragam and its neighbouring villages. The shells, belonging mainly to the genera Meretrix and Vellorita, are given to the cooperative societies at Kumaragam, Mohamma,

Vechchur, Kuttamangalam etc., which sell them to people preparing lime or to the cement factory, These shells are also utilised in house construction works and for counteracting acidity in paddy fields. In addition to the above people, the public sector cement factory at Kottayam is also collecting the shells for the manufacture of cement. It is reported that annually about 50 lakh tons of shells are collected from the Kerala backwaters, with the season lasting from August to May, the peak period being January to March (Director of Fisheries, Kerala, 1961).

(c) Paddy field prawn fishery:

In addition to the rich backwater fisheries for them, the prawns are also cultured extensively in about 8,000-10,000 acres of paddy fields bordering the Vembanad backwaters (Gopinath, 1955). The annual production from these fields has been estimated as ranging from 3,000-5,400 tons, of which prawns form about 80%, with an average yield of 360-680 Kgm. per acre (Director of Fisheries, Kerala, op.cit.). This fishery has been fully described by Menon (1954) and Gopinath (1955). The highest yield is reportedly obtained in the Parur and Cochin - Kanayannur taluks in the northern sector.

ESTIMATION OF PRODUCTION

So far, there has been no serious attempt at estimating the production from these and other backwaters. The only figures available are those for the estuarine fish farms in the State. However, Shri M.Krishna Menon (personal communication) estimates that about 10,000 tons of prawns are annually caught from the Travancore-Cochin backwaters and connected canals.

ADMINISTRATION OF FISHERIES

Day in his "Fishes of Malabar" (1865) has observed that at that time there was no tax upon fishermen or on their implements of trade either in the "British territory or in the native State of Cochin", while previously the fishermen had to pay for their fishing rights either in kind or by way of taxes or both. At present the fishing rights in the Vembanad backwaters are controlled by a system of leasing the licensing. The main stretch of the backwaters, as also the major subsidiary masses are not leased out, but the fishing gear operating in them are licensed. The only type of, rather indirect, leasing in these waters is in connection with the fixed engines, wherein the places allotted for their operation are fixed and

cannot be changed. But here also a certain licence fee is charged for each operating net. It is gathered that even if the Government wants to take over such locations, due compensation will have to be paid to the licensee and that the right of erecting stake nets in any particular area is hereditary. This type of permanent assignments for fixed engine operations is common to the whole of Travancore-Cochin section of the State, while in the Malabar-Kasargode section, where large numbers of stake nets are operated at the mouths of rivers, they are renewed from year to year. Likewise, as in the Vembanad backwaters, in the rest of the Travancore-Cochin area also, the Government issues licences to individual fisherman for operating free fishing implements; but in the Malabar-Kasargode area the fishing rights in public waters are leased out (Govt. of Kerala, 1959).

The licence fee levied varies with the type of gear and the area of its operation. The licence fee for stake and dip nets is higher in areas where there is greater tidal influence. Similar licensing is resorted to with regard to the prawn-culturing paddy fields, where also the magnitude to the licence fee depends on the nature of the field and the tidal conditions in the adjoining backwaters. Gopinath (1955) has given a detailed account of the classification of these fields and the licence fee levied by the Government.

Certain canals and minor subsidiary backwater masses are annually leased out by public auction. The lessees might themselves fish in these waters, in which case no separate licence fee is payable to the Government for the gear operated. At times, the lessees sub-lease these waters to others, from whom some fee is obtained for the gear operated.

MAJOR INVESTIGATIONAL PROBLEMS

For a proper utilisation of these important backwaters with regard to the management and conservation of their fisheries, it is necessary to undertake some major investigations on a systematic basis.

(1) In the first place, there must be suitable machinery for the collection of fishery statistics, for estimating total production, catch-per-unit of effort etc., data on which will be necessary before formulating any development measures.

(2) The suspected depletion of the fisheries of these backwaters requires immediate detailed investigation. Panikkar (1952) had reported that many areas which previously used to yield appreciable numbers of Etroplus had ceased to be so.

Enquiries made during the survey revealed that there has been a progressive reduction in the maximum size of Etrophus in the lake, which is almost a sure sign of depletion. Further to taking suitable measures to improve the Etrophus fishery, it may be worthwhile considering implementation of Panikkar's (loc.cit.) suggestion of introducing omnivorous feeders, which can tolerate wide variations in salinity and can reproduce more rapidly than Etrophus.

(3) The probable effects of reclamation projects on the fisheries should be ascertained. There are possibilities of the breeding, nursery and feeding grounds of some commercially important species of fishing and prawns getting destroyed by extensive reclamation. This will directly affect the prawn and fish seed source, as well as the paddy field prawn culture, in addition to reducing the production potential of the lake itself.

(4) It is imperative to investigate the extent of pollution of these backwaters, resulting from the discharge of effluents from the F.A.C.T. factory, Alwaye and from coconut husk retting in different areas and their effect on fish populations.

(5) It would be interesting to study the effects of stake net fishing on the commercially fisheries of the lake, as well as of the sea. The net being small-meshed, appreciable quantities of commercially unimportant smaller size-groups are caught and this may adversely affect some of the commercial fisheries.

(6) Suitable means must be worked out either to discourage the growth or for the removal of the huge quantities of filamentous algae found near Alleppey, to facilitate easy operation of certain big nets like Peru vala, unless these algae form the food of any commercially important fishes. In addition to physically hampering the operation of Peru vala, these algae, by clogging the meshes of the nets, bring about the destruction of considerable numbers of fry which are unable to escape. In this connection, it may be mentioned that Cervenka et al. (1959) had tried compounds of copper, silver and sodium pentachlorophenolate to prevent excessive increase of phytoplankton in Sedlice reservoir.

(7) Finally, the study of population dynamics and biology of the commercially important species of prawns and fishes would be of immense help in the management of the backwater fisheries.

S U M M A R Y

A rapid survey of the Vembanad Backwaters in Kerala was carried out in March 1959 in order to obtain a general idea of its fisheries resources and to identify the problems requiring investigation.

These backwaters are connected to the sea in two places, both in the northern half, which therefore shows more pronounced salinity and tidal conditions. The mean depth is about 3.5 metres and the bottom is mostly muddy. There is apparently some pollution of the waters by the effluents of the F.A.C.T. Factory, Alwaye and by the coconut husk retting in some places.

Prawns and mullets dominate the northern half of the backwaters, while the Cock-up, Milk fish and Pearlsport predominate in the southern half. Fishing is done practically all over the backwaters throughout the year. There are no regular landing places and the catches are mostly disposed off in fresh condition. Big sized prawns are exported to foreign countries by the freezing and canning companies.

Dip nets and stake nets are extensively operated mainly for prawns and the former for mullets also, while a variety of other nets are used for catching these and other fishes. Live clams and sub-fossil lamellibranch shells are fished extensively in the southern half. Prawns are cultured on a large scale in the paddy fields adjoining these backwaters.

The fishing rights are controlled by a system of leasing and licensing. For a proper management of the fisheries resources, it is necessary to undertake some detailed investigations like the collection of catch statistics, population dynamics and biology of commercially important species and the probable effects of reclamation projects and water pollution on the fisheries.

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A P P E N D I X

Classified list of fishes, prawns and crabs of the
Vembanad Backwaters, recorded during the survey.

(Malayalam names, wherever known, are
indicated within inverted commas)

F I S H E S *

- Class ELASMOBRANCHI. Subclass SELACHII
Order LAMNIFORMES Suborder SCYLIORHINOIDEI
Family SCYLIORHINIDAE
1. Chiloscyllium indicum (Gunther)
- Class TELEOSTOMI Subclass SCTINOPTERYGII
Order CLUPEIFORMES
Suborder CLUPEOIDEI
Family MEGALOPIDAE
2. Megalops cyprinoides (Broussonet)
Family CLUPEIDAE
3. Kowala coval (Cuvier)
4. Hilsa ilisha (Hamilton) - "Vālava"
5. Anodontostoma chacunda (Hamilton)- "Thodi"
6. Nematalosa nasus (Bloch)
7. Dussunieria hasselti Bleeker - "Kokolichala"
Family ENGRAULIDAE
8. Thrissocles purava (Hamilton) - "Challa"
9. Thrissocles malabaricus (Bloch) - " -do- "
10. Thrissocles mystax (Schneider) - " -do- "
11. Anchoviella indica (van Hasselt) - "Koluva"

* The Classification followed upto the families is that of
L.S. Berg ["Classification of fishes, both recent and
fossil" Trav. Inst. Zool. Acad. Sci. URSS, 5(2), 1940]

Suborder CHIROCENTROIDEI

Family CHIROCENTRIDAE

12. Chirocentrus dorab (Forsk.)

Suborder CHANOIDEI

Family CHANIDAE

13. Chanos chanos (Forsk.) - "Poomeen"

Order CYPRINIFORMES

Suborder CYPRINOIDEI

Family CYPRINIDAE

14. Barbus ticto (Hamilton)

Suborder SILUROIDEI

Family ARIIDAE (Tachysuridae)

15. Tachysurus macronotacanthus Bleeker

16. Tachysurus falcarius (Richardson)

17. Tachysurus subrostratus (Cuv. & Val.)

18. Tachysurus arius (Hamilton) - "Vellakoori" (?)

19. Tachysurus coelatus (Cuv. & Val.)

Family BAGRIDAE

20. Mystus (Mystus) gulio (Hamilton)

21. Mystus (Mystus) armatus (Day)

Order ANGUILLIFORMES

Suborder ANGUILLOIDEI

Family MURAENESOCIDAE

22. Muraenesox cinereus (Forsk.)

Family OPHICHTHYIDAE

23. Ophichthys microcephalus Day

Order BELONIFORMES

Suborder SCOMBEROSOCODEI

Family BELONIDAE

24. Tylosurus strongylurus (van Hasselt) - "Kola"

Suborder EXOCOETOIDEI

Family HEMIRAMPHIDAE

25. Hemiramphus limbatus Cuv. & Val. - "Morashu"

26. Hemiramphus cantori Bleeker - "Morashu"

Order CYPRINODONTIFORMES

Suborder CYPRINODONTOIDEI

Family CYPRINODONTIDAE

27. Haplochilus lineatus (Cuv. & Val.) *of Puchooti.*

Order MUGILIFORMES

Suborder MUGILOIDEI

Family MUGILIDAE

28. Mugil cephalus Linnaeus - "Thiruda"

29. Mugil cunnesius Cuv. & Val. - "Kanambadu"

30. Mugil troscheli Bleeker

31. Mugil parsia Ham. Buch.

32. Mugil waigiensis Quoy & Gaimard

33. Mugil poicilus Day

34. Mugil belanak Bleeker

35. Mugil amarulus Cuv. & Val. (?)

36. Mugil seheli (Forsk.)

Order POLYNEMIFORMES

Family POLYNEMIDAE

37. Eleutheronema tetradactylum (Shaw) "Vaazhmeen"

38. Polynemus paradiseus Linnaeus

Order PERCIFORMES

Suborder PERCOIDEI

Family Centropomidae

39. Ambassis gymnocephalus (Lacepede)

40. Ambassis urotaenia Bleeker - "Nandan"

41. Lates calcarifer (Bloch) - "Narimeen"

Family SERRANIDAE

42. Serranus waandersi (Day).

43. Serranus diacanthus Cuv. & Val.

44. Serranus salmoides (Lacepede)

Family THERAPONIDAE

45. Therapon puta Cuv. & Val. "Kora"

(Kallan)

Family SILLAGINIDAE

46. Sillago sihama (Forsk.)

Family CARANGIDAE

47. Caranx sansun (Forsk.) - "Vatta"

48. Chorinemus toloo Cuv. & Val.

49. Chorinemus moadetta Cuv. & Val. - "Pannāchi"

50. Trachinotus ovatus (Linnaeus)

OR

- Trachinotus blochi (Lacepede)

Family LUTIANIDAE

51. Lutianus argentinaculatus (Forsk.) - "Chemballi"

52. Lutianus johnii (Bloch)

Family LOBOTIDAE

53. Lobotes surinamensis (Bloch)

Family LEIOGNATHIDAE

54. Leiognathus equulus (Forsk.) - "Kavari"

55. Leiognathus brevirostris (Val.)

56. Leiognathus lineolatus (Val.)

57. Leiognathus fasciatus (Lacepede)

58. Secutor ruconius (Hamilton)

OR

- Equula ruconius (Hamilton)

Mullan.

59. Secutor insidiator (Bloch)

OR

- Equula insidiatrix (Bloch)

60. Gerres filamentosus Cuv. & Val. - "Prānjil"

61. Gerres lucidus Cuv. & Val.

62. Gerres oblongus Cuv. & Val.

Family POMADASYIDAE

63. Pristipoma hasta (Bloch)

64. Pristipoma operculare Playfair

65. Pristipoma guoraka (Russell)

Family SCIAENIDAE

66. Sciaena albida (Day)

67. Sciaena glaucus Day

68. Sciaena axillaris (Cuv. & Val.)
69. Sciaena coiter (Hamilton)
70. Sciaena carutta (Bloch) (?)
71. Pama pama (Hamilton)
72. Sciaenoides biauritus (Cantor)
- Family LETHRINIDAE
73. Lethrinus reticulatus Cuv. & Val.
- Family SPARIDAE
74. Chrysophrys berda (Forsk.)
- Family DREPANIDAE
75. Drepane punctata (Linnaeus) - "Pundthu"
- Family SCATOPHAGIDAE
76. Scatophagus argus (Bloch) - "Nachcha Nachara.
Karimeen"
- Family CI CHLIDAE
77. Etroplus suratensis (Bloch) - "Karimeen"
78. Etroplus maculatus (Bloch) - "Pallathi"
- Suborder SIGANOIDEI
- Family SIGANIDAE (TEUTHIDAE)
79. Teuthis margaritifera Gunther
80. Teuthis sutor Gunther
- Suborder GOBIOIDEI
- Family GOBIIDAE
81. Trypauchen vagina Bloch & Schneider
82. Gobioides caeculus (Bloch & Schneider)
83. Glossogobius giuris (Hamilton) - "Poctan"
- Suborder COTTOIDEI
- Family PLATYCEPHALIDAE
84. Platycephalus insidiator (Forsk.)
- Order PLEURONECTIFORMES
- Suborder PLEURONECTOIDEI
- Family SOLEIDAE
85. Synaptura orientalis (Bloch & Schneider)
- Family CYNOGLOSSIDAE
86. Cynoglossus bengalensis (Bleeker)

87. Cynoglossus puncticeps (Richards)

88. Cynoglossus lingua Hamilton

Order TETRODONTIFORMES

Suborder BALISTOIDEI

Family TRIACANTHIDAE

89. Triacanthus brevirostris Temminck & Schlegel
- "Chapperi"

Suborder TETRODONTOIDEI

Family TETRODONTIDAE

90. Tetrodon patoca Hamilton

Order BATRACHOIDIFORMES

Family BATRACHOIDIDAE (BATRACHIDAE)

91. Batrachus grunniens (Linnaeus) - "Thavalemeen"

P R A W N S

Family PALAEMONIDAE

92. Palaemon carcinus Fabricius

Family PENAEIDAE

93. Penaeus indicus (M. - Edw.)

94. Penaeus carinatus Dana - "Kadal Konje"

95. Metapenaeus dobsoni Miers

96. Metapenaeus monoceros Fabricius

97. Metapenaeus affinis (M. - Edw.)

98. Parapenaeopsis stylifera (M. - Edw.)

Family SERGESTIDAE

99. Acetes erythraeus Nobili (?)

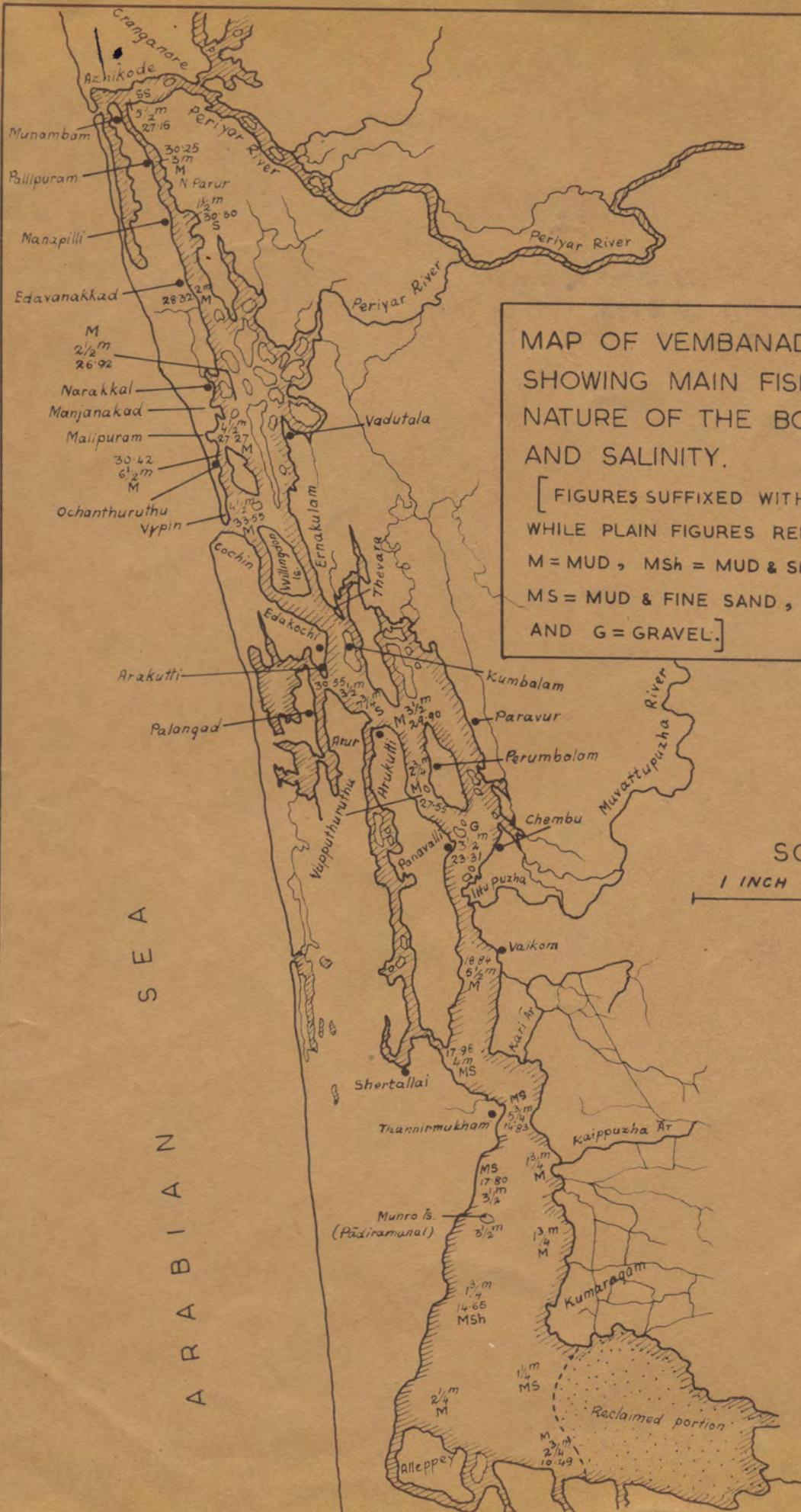
C R A B S

Family PORTUNIDAE

100. Scylla serrata (Forsk.)
101. Neptunus (Neptunus) sanguinolentus (Herbst)
102. Neptunus (Neptunus) pelagicus (Linnaeus)

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MAP OF VEMBANAD BACKWATERS SHOWING MAIN FISHING CENTRES, NATURE OF THE BOTTOM, DEPTH AND SALINITY.

[FIGURES SUFFIXED WITH 'm' INDICATE DEPTH WHILE PLAIN FIGURES REFER TO SALINITY. M = MUD, MSh = MUD & SHELLS, S = SAND, MS = MUD & FINE SAND, SS = SAND & SHELLS AND G = GRAVEL.]

SCALE

1 INCH = 5.5 MILES (9 KM.) (Appx.)



ARABIAN SEA