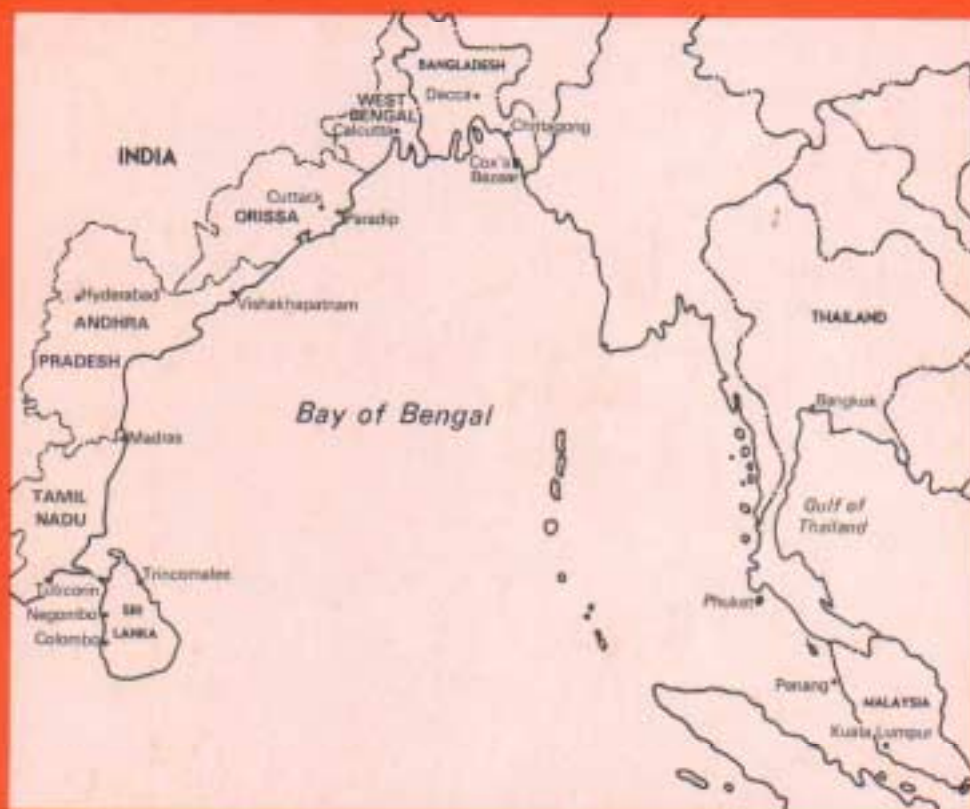


# Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal

Volume 1  
Proceedings

Chittagong, Bangladesh  
June 16-21, 1980



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**Development of Small-Scale Fisheries in the Bay of Bengal  
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## **PREFACE**

This document is the first part of a report of a consultation on stock assessment for small-scale fisheries in the Bay of Bengal held in Chittagong, Bangladesh, June 16-21, 1980. The consultation was hosted by the Government of Bangladesh. Fourteen fisheries scientists from the five member countries of the Bay of Bengal Programme- Bangladesh, India, Malaysia, Sri Lanka and Thailand — participated in the consultation, along with BOBP staff and observers.

The first part of the report (Volume 1) is a distilled compilation of available information on fish stocks in the Bay of Bengal region. It also reviews the methodologies adopted by member-countries for stock assessment, problems in collecting and interpreting data and measures required to manage fishery resources and to evolve suitable stock assessment programmes. It also lists the conclusions arrived at by the participants.

The second part of the report (Volume 2, BOBP/REP/10-2) contains the full texts of papers on the status of stock assessment submitted to the consultation by each member-country.

A background paper was prepared for the consultation, summarising published knowledge on the exploited and exploitable resources in the shelf area of the Bay of Bengal. This paper was revised after the consultation and is being issued separately as a working paper (BOBP/WP/8).

The two reports and the working paper may be useful for fisheries scientists who are concerned with stock assessment, for planners who are responsible for fisheries management and development and for officials concerned with small-scale fisheries development in general.

The report sets out the programme secretariat's understanding of the views expressed, the discussions that transpired and the conclusions reached at the consultation. It does not necessarily reflect the official views of the FAO or of the member-countries of the Bay of Bengal Programme.

The consultation was an activity of the Bay of Bengal Programme for the Development of Small-Scale Fisheries. This is a regional FAO Programme that seeks to develop and demonstrate appropriate technologies in several areas of small-scale fisheries -such as fishing craft, fishing gear, fish handling and utilization, coastal aquaculture. Its goals are to improve the conditions of small-scale fishermen and the supply of fish from the small-scale sector in five countries that border the Bay of Bengal. The Programme is funded by the Swedish International Development Authority and executed by the Food and Agriculture Organization of the United Nations.

## **SUMMARY**

The consultation reviewed the current knowledge on exploited coastal fishery resources in the Bay of Bengal region. It considered the possibilities for further development and the need for proper management of the stocks which are fully exploited. It also considered the organisational set-up for collecting and processing catch statistics, and identified the problems and the priority areas of action relating to stock assessment.

In countries bordering the western part of the Bay of Bengal, there is a clear scope for increasing production. These increases may, however, be achieved initially only in certain pockets. This situation contrasts with that on the eastern seaboard of the Bay of Bengal, where the fishery resources are heavily exploited.

The organisational set-up to collect the catch data required for stock assessment has to be strengthened considerably in some countries, whereas in others certain modifications or refinements are necessary in the methodology of data collection.

With some exceptions, stock assessment studies employing statistical models have not been generally attempted in the region, either because of low priority or because of lack of data and expertise. Estimates of potential yield have been largely based on various assumptions, the validity of which require to be carefully examined. Development of stock assessment models to suit tropical multispecies fisheries; comparative studies of estimates obtained by different methods of resource evaluation; compilation of published information on fishery biology and potential yield from both exploited and exploitable stocks for critical evaluation and interpretation -all these were steps considered necessary for estimating the abundance of coastal fishery resources.

Some other action priorities were identified for stock assessment and for better understanding of the coastal resources and their exploitation. These included identification and better utilization of underexploited stocks ; collection of statistics on fishing activities in estuaries and mangrove areas; the conduct of national seminars; establishment of a regional system for exchange of information; and the training of personnel in accordance with the requirements of various countries.

The consultation also suggested that the attention of administrators and of various sectors of the fishing industry should be drawn to the importance of stock assessment studies.

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## **1. INTRODUCTION**

The Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal was the outcome of a proposal originally endorsed in November 1978 at the Third Meeting of the Advisory Committee of the Bay of Bengal Programme. The proposal -for a workshop on stock assessment — was subsequently modified and a consultation was organised in accordance with views expressed at the Fourth Meeting of the Advisory Committee in November 1979.

The purpose of the consultation was to review current knowledge of the exploited coastal fishery stocks of the Bay of Bengal region and the organisational set-up in the participating countries for collecting and processing data ; to provide a forum for the exchange of experiences among the participating countries; to consider various options for estimating the abundance of coastal fishery resources; and to indicate action priorities for the future.

The Bay of Bengal Programme was assisted in the preparation, conduct and reporting of the consultation by a consultant — Dr. B. T. Antony Raja, Deputy Commissioner, Fisheries Division Ministry of Agriculture, New Delhi. The consultant visited the participating countries in advance of the consultation, to hold discussions with fisheries scientists and to assist in the preparation of papers on the status of stock assessment in the respective countries.

The consultation was inaugurated on June 16 at Agrabad Hotel in Chittagong by the Deputy Prime Minister of Bangladesh, Mr. S. A. Bari, A.T., who is also the Minister-in-Charge of Fisheries and Livestock. Mr. Bari said that the consultation was timely: he hoped that it would result in practical suggestions for better management of fisheries resources. He assured the consultation of cooperation from Bangladesh and of careful consideration to its recommendations.

Mr. L. O. Engvall, Director of the Bay of Bengal Programme, described stock assessment as a tool for efficient resource management in fisheries. The consultation aimed at improving this tool. He noted that the classical approaches to stock assessment in marine fisheries had been designed and developed for non-tropical areas; it would be necessary to evolve practical methodologies for stock assessment relevant to the Bay of Bengal region. He added that the role of the Bay of Bengal Programme was catalytic and consultative, and the stock assessment consultation was organised in this spirit.

The consultation's working sessions began after the inaugural ceremony and extended till the forenoon of 21 June 1980. Appendix 1 (page 16) gives the list of participants; Appendix 2 (page 19) sets out the consultation's programme, and Appendix 3 (page 21) details the "annotations" or discussion points prepared for each session.

The consultation devoted one session to each of the following subjects :

- The status of exploited coastal fisheries in the region.
- Results from stock assessment studies carried out so far.
- The organisational set-up and the methodologies adopted by member-countries of the Programme for data collection and for stock assessment.
- The problems in the collection, processing and interpretation of data ; and measures required at the national, regional and international levels to evolve suitable stock assessment programmes.

— The practical application of measures to manage fishery resources.

On the penultimate day of the consultation, a field trip was organised for the participants. They visited the Chittagong fishery harbour, boatyards, and a fresh water fish farm. The final day was devoted to the “conclusions” of the consultation — a consensus of opinion among participants on action needed to improve stock assessment in the region.

The report that follows is divided into chapters, one for each session, and is presented in the form of subject summaries. Each summary is a distillation of views presented at the consultation, facts contained in the country status papers, and other published information. The final chapter contains the “conclusions”.

## 2. STATUS OF EXPLOITED COASTAL FISHERIES IN THE BAY OF BENGAL REGION

### Annual catch

The average annual catch during the past five years is of the order of 128,000 t, in Sri Lanka, 386,000 t\* in India, 91,000 t in Bangladesh, 246,000 t in Thailand and 308,000 t in Malaysia. Except in Thailand, as much as 95% to 100% of the catches are credited to the small-scale fisheries, consisting of the traditional non-mechanised and small mechanised sectors. Although no clear-cut distinction between the different sectors exists in Thailand, it would appear that about 10% of the catches come from the small mechanised and non-mechanised sectors, and about 60% from the commercial trawlers. Fishing activities in the coastal fishery are carried out over distances of 12 to 25 miles from the shore and up to depths ranging from about 20 metres in Bangladesh to the continental slope in Sri Lanka.

As regards year-to-year trends in the catches, they are reportedly on the increase in Sri Lanka due to increase in the effort of mechanised boats. In India, the landings have been fluctuating during the last five years between 12% and 13% of the average. The data from Bangladesh are not adequate to draw any conclusions, although the catches are assumed to be on the increase due to increased motorisation of traditional craft. In Thailand, there is a general decline in the yield from demersal and some pelagic resources, particularly the mackerel resources. In Malaysia, the latest figures (1977) represent the heaviest recorded catch in the country, but this may be an exceptional year-the average of nine earlier years points to a fluctuation within 15% of the average. One important feature noticed in recent years in Malaysia is the progressive decline in the "food" fish component of the trawler catches and an increase in the share of "trash" fish.

All the countries except Malaysia have conducted a marine fisheries census. The Bangladesh census is rather incomplete. In India, a crash survey was recently carried out to update the existing data.

The following table, which analyses the fish yield, has been compiled with the information obtained from the status papers presented for the consultation and with the aid of other published material.

Country	Annual yield ('000 t)	Coast-line (km)	Exploited area up to the depth indicated (km)	No. of active fishermen	Yield/ km (t)	Yield/ km <sup>2</sup> (t)	Yield/ fisherman t
Sri Lanka	128	1,200	24,372(0-200 m)	58,000	106.7	5.3	2.2
India	386	3,010	88,535(0-75 m)	151,770	128.2	4.4	2.5
Bangladesh	91	480	32,000(0-24 m)	156,000	189.6	2.8	0.6
Thailand	246	740	44,000(0-1 00 m)	11,177	332.4	5.6	22.0
Malaysia	308	900**	47,420(0-1 00 m)	48,690	342.2	6.5	6.3

\* Throughout this report, unless otherwise stated, the discussion on India refers to the east coast of India; on Malaysia to the west coast of peninsular Malaysia; and on Thailand to the west coast of Thailand. Also, tonnes is abbreviated as t throughout this report.

+\* approximate estimate



### Method of catch estimation

The methods of estimating the catches vary. For Bangladesh, the estimates are purely conjectural. A stratified random sampling method is followed in Sri Lanka, India and Malaysia. However, in Malaysia, this method is adopted only for trawler and purse-seine catches ; estimates of other catches are made through enquiry. For Thailand, the estimates are based on surveys of the log books maintained by pre-selected fishing vessels.

### Extent of data available

The extent of availability of catch data in respect of species, season, area, type of vessels, gear and unit of fishing effort also varies in the five countries. In Sri Lanka, data by gear and unit of effort are not available; species breakdown is also incomplete. In India, fairly detailed information on catches is collected, but the unit of fishing effort has yet to be standardised. In Bangladesh, no details of commercial catch are collected except those of the Bangladesh Fisheries Development Corporation and of mechanised boats at Cox's Bazar. In Thailand, detailed information is available in respect of surveys conducted by research trawlers but the same cannot be said about commercial landings. In Malaysia, craft-wise data on landings are limited only to trawlers ; otherwise, detailed information on catches is available.

In India, data on fishing activity in the backwaters have not been taken into account so far in the census or catch estimates. In other countries, wherever they are of some significance, the activities in the backwaters are taken note of.

### Craft and gear

In Sri Lanka about 85% of the total fleet are indigenous craft of which about 85% again are non-mechanised, consisting mainly of dug-outs with outriggers and log rafts; the others are plank-built boats and dug-outs without outriggers. The remainder are mechanised 28'-32' wooden and FRP boats and 17'-18' FRP boats. Fishing is largely done by gill nets, trolling lines and shore seines. In India, about 95% of the boats are non-mechanised -mainly log-rafts, dug-out canoes and plank-built boats -operating mainly gill nets, drag nets, boat seines, bag nets and hooks and lines. The small percentage of mechanised boats are mainly trawlers. In Bangladesh, nearly 98% of the boats are in the small-scale sector and are traditional non-mechanized craft-dug-out or plank-built boats, operating mainly gill nets, set bag nets and stake nets. The small percentage of motorized boats operate mainly gill nets. In Thailand, most of the fishing fleet consists of mechanised boats of which about 68% belong to sizes less than 14 m. Fishing activities are carried out largely with trawl nets, gill nets, purse seines and push nets. In Malaysia, about 83% of the boats are mechanised, mostly with inboard engines. They employ mainly drift/gill nets, trawl nets and purse seines.

Thus, on the western side of the Bay of Bengal, not less than 90% of the total number of craft in the respective countries are non-mechanised -mostly log-rafts, dug-outs and plank-built boats-with gill net operation predominating. On the eastern side of the Bay of Bengal, most of the fishing craft are mechanised, operating trawl nets, gill nets and purse seines.

### Species composition

In Sri Lanka, scombroids (tunas, Spanish mackerel, Indian mackerel), clupeoids (sardines, anchovies, wolf-herring), carangids (especially horse mackerel), and hair-tails are the important pelagic fishes, while snappers, croakers, groupers, elasmobranchs and prawns are the important demersal resources. In India, the clupeoids (sardines, anchovies and *Hilsa*), hair-tails, carangids, and Spanish mackerel are significant from the pelagic group, while in the demersal group, elasmobranchs, catfishes, croakers, leiognathids, perches, pomfrets, prawns and crabs are the major items. In Bangladesh, the important pelagic fishes are *Hilsa*, Bombay duck, hair-tails, mackerel and scads; the important demersal fishes are elasmobranchs, catfishes, threadfins, croakers, pomfrets, eels, snappers, grunts and prawns. In Thailand, mackerels, scads, carangids, sardines, anchovies, king mackerel and little tunnies dominate the pelagic group and elasmobranchs, catfishes, threadfin breams, croakers, snappers and prawns are the important

fisheries in the demersal sector. In Malaysia, the principal pelagic stocks exploited are those of mackerels, anchovies, sardines, mullets and scads while the commercial food fishes from the demersal stocks include snappers, groupers, croakers, flat fishes, threadfin breams, cat fishes, lizard fishes and prawns.

Among the pelagic resources, the clupeoids, scombroids and carangids are the dominant groups in all the countries. In the clupeoid group, *Sardine/la* and *Stolephorus* are important in all countries except Bangladesh. *Hilsa* replaces these species in the upper east coast of India and Bangladesh. Among the scombroids, *Rastrelliger* is important in all countries. The tunas and tuna-like fishes are exploited to a large extent in Sri Lanka and to some extent in the contiguous area of the Tamil Nadu coast of India. To a somewhat similar extent, this would apply to the Spanish mackerel also, whose importance however extends further north to the Andhra Pradesh coast of India. Carangids are represented by many genera, the most important of which are *Decapterus*, *Magalaspis*, *Carangoides* and *Caranx*. The hair-tails and Bombay duck are more of sub-regional importance, the former in Sri Lanka, India and Bangladesh and the latter in the upper east coast of India and Bangladesh.

Among the demersal resources, the snappers and groupers, croakers, elasmobranchs and penaeid prawns are the important groups in all the countries. Catfishes form a sizeable percentage in all the countries except Sri Lanka. The importance of leiognathids and pomfrets is confined to sub-regional pockets-the lower east coast of India for the former and upper east coast of India - Bangladesh for the latter, are the principal areas. Similar are the threadfin breams in Thailand and Malaysia and threadfins in the upper east coast of India and Bangladesh.

There is thus a general similarity in the important exploited varieties both from the pelagic and demersal stocks. There is also a general similarity in the species concerned, more so in the geographically contiguous waters.

### 3. RESULTS FROM STOCK ASSESSMENT STUDIES IN THE REGION

In the main, the consultation reviewed the results from three stock assessment methods—trawl/acoustic surveys and simple logistic or exponential models. The potential yields as derived from published organic productivity data were either not considered or not dealt with in detail in the status papers of member-countries. However, in order to provide a total picture, the organic productivity estimates from various sources are also mentioned in this section.

In Sri Lanka, the provisional estimates from the results of the acoustic survey conducted by R. V. Dr. Fridtjof Nansen in 1978 indicated a potential yield of 250,000 t, comprising 170,000 t pelagic resources and 80,000 t demersal resources. The biological productivity data available in the literature appear to indicate a harvestable potential of 250-300,000 t. Considering the present state of exploitation, it would appear that the above estimated potential yield is a reasonable one to aim at for immediate development purposes. However, it was also pointed out that the commercial sizes of tunas and prawns have declined, and that any increase in fishing effort for these species must carefully consider this factor.

In India, the estimates obtained from trawl surveys appear to indicate a harvestable potential of 343,000 t from the demersal resources, as compared to the present average production of about 192,000 t. The catch and effort data pertaining to the period 1958-67, for individual groups of pelagic species or groups of species showed that the total maximum yield of these groups from the inshore waters of the east coast would be about 124,000 t. As compared to this estimate, the current average catch of these groups is 163,000 t. Except *Chirocentrus*, *Stolephorus* and carangids, the yield of all the species/groups has exceeded the respective estimated maximum yield. The acoustic surveys conducted by *Rastrelliger* during 1973-75, mainly in the shelf region off Cape Comorin and in the Gulf of Mannar (7°-9°N), indicated a high standing stock of fish biomass, mostly pelagic, during the June-October period. It ranged between 127,000 t and 970,000 t with an average of about 624,000 t. Of this, the *Stolephorus* stock was the mainstay, its abundance ranging from 55,000 to 804,000 t with an average of 509,000 t, forming 82% of the general average standing stock of the total fish biomass.

From the organic productivity data, various estimates of exploitable potential yield from the continental shelf have been made, which range from 0.6 to 1.0 million t. From what has been exploited so far, it would appear that for the small-scale fisheries sector, there is good scope for higher catch in the southern-most region, as well as in the northern coasts of Orissa and West Bengal. For the region in between, studies are required to identify the exploitable species for small-scale fisheries.

In Bangladesh, the estimate of exploitable yield is mainly confined to the trawl survey, which provided a figure of 175,000 t of demersal fishes and 9,000 t of prawns. No firm figure for pelagic stock is available. The recent brief acoustic survey by R.V. Dr. Fridtjof Nansen beyond 10 m depth indicated a provisional figure of 60,000 t of pelagic species, besides 150,000 t of demersal stock. From the available provisional records on biological productivity in this and adjacent areas, a conservative figure of 354,000 t and an optimistic figure of 770,000 t of potential yield could be arrived at. Since the pelagic fishery stocks are assumed to be at least as large as the demersal resources, and since the present annual catches from both pelagic and demersal regimes are much lower than these figures, there is a distinct possibility of increasing the catches from the inshore region.

In Thailand, the estimates of MSY have been obtained largely from the logistic exponential model. The latest estimate indicates an optimum yield of 205,000 t for demersal resources and

61,000 t for pelagic resources, thus totalling 266,000 t. The earlier estimates of MSY for exploitable demersal resources ranged from 85,000 to 200,000 t. The estimated maximum sustainable yield for mackerel, sardines and anchovies are 20,000, 5,000 and 7,000 t respectively, and the actual yields have exceeded these estimates in different years during 1973-1976. The catches of these groups have since started to decline. There is evidence to suggest that the demersal stocks as well as the resources of mackerel have started declining due to overfishing. Available information on biological productivity indicates a tertiary production of about 370,000 t and 280,000 t for the shelf area up to 200 m and 100 m depths respectively, the latter being nearly 100% of the estimated MSY from the catch and effort data of the corresponding exploited area.

In Malaysia, the MSY estimates based on simple statistical models are 160,000 t of demersal resources and 88,000 t of pelagic resources. Estimates of some individual pelagic species have also been made based on these models, which may be seen in the country status paper. From the currently exploited situation, it appears that among the pelagic stocks, mackerel requires special management attention. The exploitation of demersal stocks has probably exceeded the optimum level ; in the process, it has considerably reduced the component of food fish but increased the trash fish component in commercial catches. Among other records on estimates of potential yield, mention may be made of the 1965 trawl survey; its conservative estimate of the standing stock of demersal fishes within 100 m depth was 372-542,000 t. Other assumptions indicate a potential yield of 119,000 t from demersal resources and 43,000 t from pelagic resources from the coastal waters up to 100 m depth. Both these estimates are rather low when compared with the MSY estimates indicated earlier. The computed tertiary production for the area up to 100 m depth amounts to nearly 300,000 t. As compared to this, the present fish production is about 378,000 t and the estimated MSY of pelagic, demersal and prawn resources is 301,000 t. Here again, as in the case of Thailand, it is interesting to note the absence of the conventionally assumed relationship between the tertiary production and the actual yield or potential yield. It is likely that the tertiary production has been underestimated or that the efficiencies of energy flow are higher than presumed, or both.

It would generally appear that in countries bordering the western Bay of Bengal, there is a clear scope for increasing fish production, although initially the increase may be confined to certain pockets. This situation contrasts sharply with that in the eastern sector of the Bay of Bengal, where the fishery resources are heavily exploited.

#### **4. ORGANISATIONAL SET-UP AND METHODOLOGIES ADOPTED FOR COLLECTION OF CATCH STATISTICS AND FOR STOCK ASSESSMENT STUDIES IN THE REGION**

In Sri Lanka, the statistical programming and planning division of the Ministry of Fisheries is responsible for the collection of catch statistics. The country is divided into 13 coastal divisions and estimates of catch and effort are separately recorded for inboard engine craft, outboard engine craft, beach seines and non-mechanised craft.

A stratified two-stage sampling design has been adopted for catch statistics with landing centres as primary sampling units and craft as secondary sampling units. At the first stage, landing centres are selected for each division ; at the second stage, the selection of craft, the PPS (probability proportional to size) concept is used. Ten craft are picked at random from selected landing centres and eye estimations are made of the catches on two days a week at each centre. The estimates for the country are made on the basis of these data.

The staff for collecting and processing detailed data as required from commercial landings is inadequate. Besides, some of the field staff have other duties as well. Due to lack of basic knowledge on the identification of species and inadequate training in the techniques of data collection, the reporting style lacks uniformity, and the statistical forms are not properly filled up. Supervision or inspection of field work for ensuring reliability and accuracy is also inadequate. Even the sampling methods require revision. In general, the organisational set-up for collection of catch statistics has to be strengthened and streamlined.

In India, catch statistics are collected by the Central Marine Fisheries Research Institute and also by some state fisheries departments. Discrepancies in catch figures, if any, are reconciled after mutual consultation. A methodology is being evolved to enable these organisations to combine their efforts and arrive at more precise estimates. The set-up in CMFRI is well organised, and all relevant particulars required for stock assessment studies are collected. A space-time stratified multi-stage probability sampling design is followed. Each maritime state is divided into zones, each of which may consist of 20-30 landing centres. The time stratum for a month consists of 12 days divided into two periods with a ten-day interval between the periods. Three landing centres are selected at random for observation during each time cluster. On the day of observation, the landings of selected units, picked in a systematic way, are recorded in minute detail. The details include the quantity of catch, species composition, type of fishing unit and effort. The total landings of all the units are estimated first; appropriate raising factors are then used to compute the monthly landings of the zones/states. CMFRI has a trained field staff, managed and supervised by senior technical/scientific personnel. The data centre at the headquarters processes all the data received from the field staff. The processed data are used for specific scientific studies and for periodic dissemination through the Marine Fisheries Information Service. Proposals to improve the system of data collection to ensure greater precision and to acquire more detailed data are already being given effect to.

Detailed analysis of catch and effort data relating to the east coast has been made only of prawn resources using Schaefer's logistic model. In view of difficulties in standardising fishing effort, stock assessment studies on other resources have yet to be completed. Sufficient expertise is available in India for conducting stock assessment studies; perhaps some external guidance may be required to help evolve suitable stock assessment models for multispecies systems.

In Bangladesh, there is no organised set-up for collection and processing of catch data. Sufficient manpower with academic background in biology/statistics is available in the country, but training, both for catch statistics methodologies and for stock assessment studies, is required.

In Thailand, the fisheries statistics section in the Department of Fisheries is responsible for collection of catch data. Fish landing surveys are conducted on pre-selected sampling units. These units are expected to maintain logs of all fishing data. The enumerator visits the sampling unit every Wednesday to collect the required catch statistics. The sampling survey covers 11 important gears. A simple method based on log book survey is used to compute the total landings. All the data are sent to the headquarters in Bangkok from where annual publications are issued.

Thailand has a sufficient number of biologists but those who are well-versed in stock assessment techniques are few. Both linear logistic and exponential logistic models have been employed for stock assessment. It has been found very difficult to assess the superiority of one model over the other; however, it is felt that the exponential model is more satisfactory. This model is applied for demersal stocks as a group as well as for specific pelagic species.

In Malaysia, the responsibility for collecting catch statistics rests with the statistical unit of the Department of Fisheries, which, however, suffers from paucity of personnel. The catch statistics of trawl and purse-seine fisheries, forming a little more than 70% of the total catch, are collected by a two-stage stratified random sampling method. In this case, the space-stratification is based on three centres in each state for each type of gear, selected at random by the PPS method. Time stratification is for five consecutive days a month at each centre. Each day, a complete count of all operating units is taken and the catches of a sample of 3-5 units of each gear are recorded by direct observation. By employing suitable raising factors, the total catches are estimated for each month/state.

For the other minor fisheries, which make up less than 30% of the total catch and which are mostly traditional in nature, catch estimates are made by a simple sampling method through enquiry. However, catches are not classified by vessel type in either of the two catch methods mentioned above -trawlers providing the only exception. The catch data are published quarterly and annually by the Department of Fisheries. For research purposes, data are also collected by the Fisheries Research Institute.

Demersal stock abundance in Malaysia has been estimated by the swept area method; these stocks are monitored by trawl surveys conducted by the Fisheries Research Institute. However, there is no such sustained programme at present for pelagic stocks. Stock assessment studies are based on linear and exponential logistic models, of which, provisionally, the former has been found to be more satisfactory in respect of the *Stolephorus* fishery.

Taking the Bay of Bengal region as a whole, it is felt that there are certain areas where deeper and more zealous analysis of available data could yield more information than has been so far extracted. There is also a need to look beyond the conventional methods and evolve new methods of stock assessment, especially for multi-species systems. In this connection, attention was drawn at the consultation to the studies conducted in freshwater bodies where the catch per unit area has been related to readily measurable environmental conditions. It was considered worthwhile to attempt a similar approach for the marine ecosystem, at least in the naturally protected waters, estuaries and short stretches of coastline. There is also a need for comparative studies on different methods of resource evaluation. There are at least two areas, namely, Gulf of Mannar and Wadge Bank, where much information is available from trawl/acoustic surveys, on catch and effort data and on organic productivity. Studies to compare the results of these methods would provide an insight into the comparability of the different estimates. If they are found reasonably comparable, certain conversion factors could be adopted so that quicker estimates of stocks can be obtained for areas where sufficient catch and effort details are lacking at present.

The need for studies on species interaction in the multispecies system was discussed. It was felt that such studies could be undertaken on a priority basis in those areas where fishing intensity has exceeded the optimum limit.

## **5. PROBLEMS/CONSTRAINTS ENCOUNTERED AND SOLUTIONS REQUIRED AT NATIONAL/ REGIONAL/INTERNATIONAL LEVELS**

In Sri Lanka, the method of collection of catch statistics and the sampling survey are not adequate to meet the requirements. Since the survey staff is not controlled administratively by the Programming and Planning division, effective modifications cannot be implemented. Studies on stock assessment are hard to come by because expertise is not available, funds are scarce and data collectors are too few. National effort has therefore to be mobilised for organising a strong fisheries statistical set-up with adequate staff and funds. The research wing has also to be strengthened considerably and studies of stock-oriented problems undertaken immediately. Necessary in-service training in all aspects of fishery science is an immediate requirement, as also the participation of scientists in international forums. Assistance/advice from regional/international agencies may be required for catering to the above needs. It is also considered desirable to conduct joint Sri Lanka-India studies for tuna and tuna-like fishes.

In India, the delay in processing data for stock assessment studies of the east coast (except prawn fisheries) is due not only to the low priority assigned to this task, but also to difficulties in standardising the unit of fishing effort-difficulties arising from the multiplicity of gears and the varying efficiencies of these gears in a multispecies ecosystem. To quicken data processing a national workshop is considered desirable, the conduct of which may require some assistance from an international agency. Cooperative studies with Sri Lanka for tunas and tuna-like fishes are also considered desirable. A few acoustic surveys to obtain some knowledge of standing stocks of the east coast, some aerial surveys in the Orissa-West Bengal area to assess the effort deployed in that region, and a few coastal surveys for squids/cuttlefishes and tuna and tuna-like fishes to help development/diversification of small-scale fisheries, are some of the steps considered important for early action.

In Bangladesh, the major problem is the absence of an organisation with overall responsibility for collection and processing of catch data. Inaccessibility of the landing centres, inadequate transport facilities, reluctance of fishermen to provide information, shortage of trained personnel, paucity of funds and lack of direction have been mainly responsible for the inadequacy of required information on catches. However, the need for reliable data has been appreciated at all levels and a project for rectifying these difficulties has been undertaken in cooperation with FAO/UNDP.

Academically qualified persons are available in the country, but they need intensive training in fishery science within the country and participation in training programmes conducted at regional/international levels.

More detailed studies and analyses should be made of the existing resources survey reports, for which some external assistance would be necessary. The marine fisheries set-up will have to be strengthened and research efforts initiated.

In Thailand, there are some doubts about the reliability and adequacy of data. The statistics relating to the non-mechanised and small-mechanised sectors are far from complete. Improvement in the sampling methods of traditional small-scale fisheries is considered necessary. Training in data collection and stock assessment techniques is found essential. For the latter, both in-service training and participation in regional/international programmes/workshops are required.

For Malaysia, some guidance from international agencies is required to improve the sampling system for data collection. Biological studies on important commercial species common to Thailand and Malaysia may be shared to avoid duplication of effort.

In the general discussion on this topic many participants felt that there was a need for a comprehensive compilation of all published data in the region on the biology of exploited fishes and the potential yield from resources, followed by expert evaluation and interpretation of the data. There is also a need for frequent consultation between the scientists of the region ; for cooperative studies of mutual interest on important species crossing national boundaries; for exchange of information and publications between countries of the region; and for a regional system for regular exchange of information.

The consultation recognised the need for an inter-regional centre for training in stock assessment in tropical waters, but suggested that to meet immediate needs, any existing national set-ups may be strengthened with international assistance.

The consultation also appreciated the urgent need to identify and tap under-exploited stocks in the area, such as the *Stolephorus* stock of the Gulf of Mannar, with the proviso that any development measures for such stocks should as far as possible benefit and not adversely affect small-scale fisheries of the area.



## **6. PRACTICAL APPLICATION OF MEASURES FOR PROPER DEVELOPMENT/MANAGEMENT OF COASTAL FISHERY RESOURCES**

In Sri Lanka, mechanised boats have been kept out of certain areas where artisanal fishermen have been traditionally operating. In certain lagoons and bays, regulations permit only the use of traditional gears, e.g. cast nets and rod and line. There are also regulations relating to lobster fishing.

The Fisheries Ordinance bans the use of explosives in fishing. No licences are issued for foreign fishing vessels to operate in national waters. If any serious conflicts develop among the different fishing sectors, there is provision for legal action. An important indirect measure of conservation adopted recently is the ban on the export of lobsters.

There are indications of a reduction in the size of some commercially important fish species. If this is confirmed, conservation will be vitally necessary. "Closed season" or "closed areas" could be declared, mesh regulations could be imposed, but the snag lies in implementation. Although legal provision exists for enforcement, the required staff and facilities may not be available, and regulatory measures may also create socio-economic and political problems.

Demersal resources in Sri Lanka need to be better exploited. Experimental fishing/demonstrations and extension work are necessary.

In India, laws to protect small-scale fisheries exist in some of the coastal states. There are also some general executive orders which stipulate that the first 5 km from the shore should be reserved for the traditional non-mechanised fisheries sector; beyond this limit, the small mechanised craft can operate; the larger-sized commercial fleet is permitted to operate only beyond 10 km from the shore. A model Marine Fisheries Bill has been circulated among the coastal states of India for their consideration.

An expert committee has been formed to examine the issue of prawn conservation. Although details are not available, it is believed that the prawn resources of the northeast coast of India need conservation measures. Past experience indicates that enforcement of mesh size regulations is almost impossible and that any curbs on estuarine fishing to protect the nursery grounds of prawns are likely to adversely affect the livelihood of small fishermen who would have to be suitably rehabilitated. The only way to implement any legislative measure is to strengthen the coast guard or similar organisations. Indirect methods of conservation could include banning the export of certain sizes of prawns, removal of subsidies and incentives, etc.

Regarding development of under-exploited resources for small-scale fisheries, the *Stolephorus* stock of the Gulf of Mannar requires priority attention. It should be ensured, however, that any development measures taken do not impair the existing fisheries in the area.

In Bangladesh, no legislative measures exist at present to protect small-scale fisheries. There are also no data available regarding stocks that require conservation. The first 12 miles from the shore, however, have been reserved for national vessels, and extension of this area up to 30 miles is contemplated. In this connection, it was suggested that it would be preferable to prescribe different limits of depths and distances for different regions to ensure adequate exploitation of resources. It was also felt that fishing boats should be registered.

The extensive clearing of mangrove forests for prawn culture was considered injurious to the prawn nursery grounds, besides causing ecological damage. It was suggested that embankments should not extend right along the coast and that provision should be made to allow free

migratory passage to the young prawns. The excessive capture of juvenile prawns in the estuaries and its drastic implications on marine fisheries was discussed, but in view of inadequate data, no conclusions could be drawn. The problems of the estuarine prawn fishery is also applicable to *Hi/sa*.

The demarcation of certain areas as sanctuaries, declaration of closed seasons, and regulation of mesh sizes were suggested. Regulation of the mesh size of *Behundijaland* similar small-meshed nets was also suggested. It was however recognised that the enforcement of such measures would be difficult. One way to solve the problem of enforcement may be to provide alternative employment and income opportunities to people affected by such measures.

To assess the impact of the increased fishing pressure on the coastal fisheries in general, and on the prawn fishery in particular, special studies are considered desirable at some selected centres such as Cox's Bazar and Dubla Island.

In Thailand, the operation of trawlers and mechanised push nets within 3 km from the shore is prohibited. This regulation is meant to protect the resources rather than to help the traditional small fisherman operating non-mechanised craft. Certain areas such as Phang Nga Bay have been reserved exclusively for small-scale fishermen. There are no other conservation measures on the Indian Ocean side of Thailand. In the Gulf of Thailand, however, closed areas and closed seasons for mackerel have been specified and during the spawning season there are regulations governing the mesh size of gill nets. There is a need to regulate and conserve demersal stock and mackerel resources on the west coast of Thailand, where reduction of effort (number of boats) is considered necessary.

At present, conservation laws are being violated due to inadequacy of enforcement staff.

In Malaysia, the main existing legislation to protect marine small-scale fisheries is the Fisheries Act of 1963. Boats and fishing gear are licensed under the rules and regulations made under the Merchant Shipping Ordinance and the Fisheries Act. The bulk of the legislative measures are directed at trawl fisheries. Within three miles from the shore no mechanised fishing is permitted; mechanised boats larger than 25 tonnes and propelled by engines of more than 60 hp should operate only beyond seven miles from the shore, and those larger than 100 tonnes and with engines of more than 200 hp should operate only beyond 12 miles from the shore.

The Department of Fisheries, the Marine Police and the Navy are authorised to enforce fisheries laws. The problems of enforcement, as elsewhere in the region, arise mainly from the inadequate size of enforcement staff. Although attempts have been made to educate fishermen, it has been found difficult to convince them of the need for conservation.

The consultation noted that complex and comprehensive studies are necessary to decide on mesh size regulations for conservation ; determination of the best mesh size on a sound scientific basis and adequate rapport with the industry are essential if mesh size regulation is to be successful. In some places the regulations exist only on paper; they are not implemented because of stiff opposition from the fishermen. Those countries who are confident that mesh-size regulations can be implemented but have not made exhaustive studies for determining the right mesh size may utilise the studies relating to comparable or identical species in other areas.

There is an undisputed need for strengthening the extension set-up in the region. The problem encountered is that the fishermen seem apathetic and disinterested. To break this barrier, and to gain the confidence of the fishermen, the dissemination of information has to be undertaken by technical/scientific personnel especially trained in extension techniques.

Measures are also considered necessary to project the importance of stock assessment studies to non-technical sectors. One way of doing so is to organise national seminars for administrators as well as various sectors of the fishing industry.

## **7. CONCLUSIONS**

At the final session of the consultation, an attempt was made to sum up the conclusions on which a consensus had emerged during the third and fourth sessions. These conclusions are set out below :

1. There is a need for comprehensive compilation of all published fisheries data in the region — on fishery biology and potential yield from both exploited and exploitable resources. Such a compilation should be followed by a critical evaluation and interpretation of the data by a team of experts. These reports may be made available to the respective countries on request from governments. The existing reports in Bangladesh and Sri Lanka, not subjected to any serious in-depth studies, may be analysed by experts and the reports submitted to the governments concerned for their information and necessary action.
2. Several estimations have been made based on the biological productivity of the waters. It is desirable to evaluate/re-evaluate this information critically against the present exploited situation, the species composition of the catches, the trophic levels the species belong to, and the changes if any in the composition of current catches as compared to earlier years. The estimations should be also evaluated in the light of information from other methods of stock assessment such as trawl/acoustic surveys and statistical models, to ascertain the extent to which these estimates can be considered mutually comparable for assisting initial developmental planning.
3. Studies similar to those conducted in freshwater bodies correlating the yield per unit area with environmental variables could be organised for marine ecosystems, initially in naturally protected waters, estuaries and short stretches of coastline.
4. Studies to understand the interaction between different species in the tropical multispecies systems are urgently required. These may perhaps be undertaken on a priority basis in those areas where exploitation has gone beyond the optimum level.
5. Identification and better utilisation of underexploited stocks — such as the anchovies of the Gulf of Mannar—are urgently needed. However, it has to be ensured that any developmental measures for such stocks benefit and do not adversely affect existing small-scale fisheries of the area.
6. Since pre-regulation studies on mesh-size for conserving any species are complex and comprehensive, available studies on identical or comparable species may be utilised to meet any immediate needs.
7. Wherever statistics are not being collected on fishing activities in estuaries and mangrove areas there is a need to initiate the collection of such statistics to obtain a total understanding of the marine fishery resources.
8. National seminars should be organised wherever necessary, to apprise administrators and various sectors of the fishing industry of the importance of stock assessment studies.
9. There is need for frequent regional consultation between the scientists of the region, co-operative studies of mutual interest on species crossing the national boundaries, and exchange of information and publications between the countries of the region. In this context, it is desirable to establish a regional system for regular exchange of publications and other information related to stock assessment of marine fisheries resources.
10. With regard to personnel training, the nature of requirements varies for different countries. In some cases like Bangladesh and Sri Lanka, the priority requirements concern basic fishery

biology and the fundamentals of stock assessment techniques. In Thailand and Malaysia training in the techniques of data collection and stock assessment is found essential — in the form of in-service training, participation in regional and international meetings and participation in workshops with particular reference to tropical fishes.

11. While recognising the need for an inter-regional centre for training in stock assessment in tropical waters, it was felt that in order to cater to immediate requirements, it is desirable to strengthen any available national set-ups by providing supplementary equipment and by arranging adhoc training courses with assistance from international sources. In this connection, one possibility may be to strengthen the Central Marine Fisheries Research Institute in India which is already conducting training courses at the national level.

12. In Sri Lanka, the existing sampling survey needs to be reviewed and re-framed so as to obtain more reliable and detailed information on coastal stocks. The statistical section needs to be considerably strengthened and administered exclusively by a single division of the Ministry of Fisheries.

13. In India, there is an immediate need to expedite present efforts on the processing of catch data relating to the coastal fisheries of the east coast for a quick appraisal of the stock situation. A national workshop may be conducted with this in view, in which some expertise from international agencies may collaborate. Detailed studies of all data relating to the Gulf of Mannar area may be taken up to compare the estimates of potential yield obtained from different sources for the purpose of finding out whether some simpler and quicker methods of stock assessment for general application can be evolved. A few acoustic surveys may be arranged for the east coast of India to obtain some knowledge of the standing stock of the pelagic resources. In view of difficulties in assessing the fishing effort in the Orissa-West Bengal area, a few aerial surveys may be required to assess the effort deployed in the region. In order to help further development of small-scale fisheries on the east coast of India, coastal surveys for squids, cuttlefishes, coastal tunas and tuna-like fishes may be conducted.

14. It was noted that steps are already being taken in Bangladesh to improve the machinery for data collection and to strengthen the organisational set-up for the purpose. It is necessary that these measures are implemented without delay. In the meantime, detailed studies may be initiated at some selected centres, particularly with a view to assess the impact of fishing pressure by various commercial undertakings in Bangladesh waters, on the coastal fisheries in general and the prawn fishery in particular.

15. It was suggested that the Bay of Bengal Programme should, as far as possible, initiate and implement activities identified and proposed by the consultation. It was noted, however, that stock assessment is a small component of the Bay of Bengal Programme; major work will have to be taken up by the Bay of Bengal Committee and its specialised supporting programmes for fisheries development and resource monitoring, for which external funding is being sought from UNDP and other agencies. Since the establishment of the Bay of Bengal Committee has been already endorsed by member governments, it is desirable that the nucleus of a secretariat should be established without delay.

## Appendix 1

### CONSULTATION ON STOCK ASSESSMENT FOR SMALL-SCALE FISHERIES IN THE BAY OF BENGAL

#### List of Participants

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## Appendix 2

### CONSULTATION ON STOCK ASSESSMENT FOR SMALL-SCALE FISHERIES IN THE BAY OF BENGAL

		Programme	
<b>Monday, 16 June</b>			
11.00 - 13.00	Inauguration	Tilwat-e-Quran	
		Welcome address by Mr. Abdul Huq, Director of Fisheries, Bangladesh	
		Address by Mr. L. O. Engvall, Director, Bay of Bengal Programme	
		Address by Mr. S. A. Bari A. T., Deputy Prime Minister and Minister-in-Charge of Fisheries and Livestock, Government of Bangladesh	
		Address by Dr. M. B. Rahman, Chairman, Bangladesh Fisheries Development Corporation	
		Vote of thanks by Mr. A. H. A. Jalil, Assistant Director of Fisheries, Bangladesh	
14.00 - 17.00	Introduction		
	Session I	Status of the exploited coastal fishery resources of Bangladesh, India, Malaysia, Sri Lanka and Thailand.	Discussion Leader : Mr. A. H. A. Jalil Rapporteur : Mr. Edwin James Savariraj
<b>Tuesday, 17 June</b>			
08.30 - 12.30	Session II	Results from stock assessment studies in the region.	Discussion Leader : Mr. Udom Bhatia Rapporteur : Mr. Somsak Chullasorn
14.00 - 17.00	Session II	Continued	
<b>Wednesday, 18 June</b>			
08.30 - 12.30	Session III	Organisational set-up and methodologies adopted for collection of data and for stock assessment.	Discussion Leader : Mr. K. P. Hapuarachchi  Rapporteur : Mr. Mohiuddin Ahmed
14.00 - 17.00	Session IV	Problems/constraints in the collection, processing and interpretation of data; and solutions re- quired at national, regional and interna- tional levels for evolving suitable stock assessment programmes.	Discussion Leader: Mr. Lui Yean Pong  Rapporteur : Dr. K. C. George



*Thursday, 19 June*

**08.30 - 12.30**

**Session IV**

**Continued**

**14.00 - 17.00**

**Session V**

**Practical application of  
measures for manage-  
ment of coastal fishery  
resources.**

**Discussion Leader:  
Dr. M. J. George  
Rapporteur :  
Mr. S. R. Madhu**

*Friday, 20 June*

**Field Trip .**

*Saturday, 27 June*

**08.20 - 12.00**

**Session VI**

**Summing up**

## Appendix 3

### CONSULTATION ON STOCK ASSESSMENT FOR SMALL-SCALE FISHERIES IN THE BAY OF BENGAL

Annotations to the Programme

#### *Session I Status of the exploited coastal fishery resources:*

What are the important resources ? What is the quantum exploited ? How are they exploited ?  
What is the contribution of small-scale fisheries (traditional non-mechanised and small mechanised sectors) to the total catch?

What is the depth/distance from shore of the currently exploited fishing grounds?

What is the area up to 50 m depth and up to the continental shelf?

What are the salient features on the census of fishing craft, gear and active fishermen?

What is the amount of catch per active fisherman? per km of coastline? per sq.km of the exploited area ?

What is the extent of availability of catch data in respect of species, seasons, areas, types of vessels and gear and unit of fishing effort?

Have the backwaters been covered for the purposes of census and catch estimations ?

Have the catches of foreign fishing vessels licensed to operate in national waters been taken into account ?

Is there uninhibited flow of information from these foreign vessels and from large industrial fishing vessels?

Is there any indication of progressive decline in the yield of any fisheries? Is it related to or independent of fishing effort ?

Have the catches been fluctuating ? If so, can any explanations be offered?

Have the catches been increasing ? If so, what are the reasons? Are they related to greater fishing effort from existing fishing methods, improvement of these methods, or introduction of new methods, etc.

What are the salient biological characteristics of the important species (age/size, composition, growth parameters, feeding habits, maturity and spawning)?

#### *Session II. Results from stock assessment studies in the region:*

What is the available information on total exploitable biomass/important species/pelagic resources/demersal resources/prawn resources from :

- (1) catch and effort and biological data from commercial landings
- (2) resources survey
- (3) studies on organic productivity
- (4) other sources

Which estimate could be considered reasonable?

How do these estimates compare with the present state of exploitation?

Can an attempt be made to draw parallels from other tropical areas for the relation between the estimated potential yield and the exploited quantum? What lessons can be drawn ?

**Session III. Organisational set-up and methodologies adopted for collection of data for stock assessment:**

What are the agencies responsible? What is their organisational set-up and their strength for collection, processing and interpretation of the data?

What is the system of collection of data ?

How are the data processed and disseminated?

How is the Index of abundance determined?

What is the expertise available for stock assessment?

What are the methods adopted?

What is the experience on the methods employed? Are they satisfactory?

If not what are the alternatives? Is there need or scope for revising the methods and re-evaluating the data ?

**Session IV. Problems encountered in data collection/processing/dissemination and measures required at national, regional and international levels for evolving suitable stock assessment programmes.**

What are the problems/constraints/difficulties in the collection/processing/dissemination of data and for evaluation of stocks ?

What are the measures required?

**National:**

Is the present organisational set-up adequate for collection of fishery and biological data ?

Is the methodology adopted for collection of catch statistics considered sound or would it require further improvement? If so, on what lines?

What would be the desirable organisational set-up for implementing an improved system of data collection ?

Which method of stock assessment is considered necessary for priority attention? What action is required for implementing it?

What type of training is required for meeting the requirements of data collection and stock assessment ?

Is it considered necessary to organise a workshop within the country for the purpose?

**Regional / International:**

What are the areas where regional/international assistance would be required ? Is there need for developing a more suitable model for tropical fish stocks, especially for the multi-species system ? If so, is regional-level assistance considered necessary for a comprehensive compilation of all data pertaining to the fisheries in the region including all basic data on growth and mortality, feeding habits, fecundity and spawning habits of important fishes and potential yield from both exploited and exploitable resources?

If so, should an expert team of fishery biologists/ecologists/statisticians be assigned the task of interpreting the compiled data so as to suggest the best practical approaches to be adopted for assessing the stocks?

Would it be necessary to have the report of the team discussed among selected international experts in order to obtain recommendations for development/management of the fisheries in the Bay of Bengal region ?

What type of training, discussed earlier, should be taken up under regional/international assistance ?

is there need for establishment of a Regional Training Centre for stock assessment techniques or is conduct of the required courses on an *ad hoc* basis sufficient? Or would it be more helpful to obtain the services of international stock assessment experts to the respective countries for short periods which could be repeated according to the needs ?

Are there areas where cooperative studies have to be conducted between neighbouring countries on species which move across the national boundaries ? What sort of studies can be suggested ? On what species?

What measures are considered necessary to have better contact and communication between scientists of the region? How to develop more international contacts?

*Session V. Practical application of measures for proper development/management of coastal fishery resources.*

What are the present legislative or executive measures to protect small-scale fisheries?

Are there any stocks in the region which require conservation measures? Were any measures considered necessary for conservation of these resources? Were these measures implemented and, if so, with what results?

What are the difficulties experienced or envisaged for implementing conservation measures?

What types of measures are considered necessary for legislative/executive action?

Besides legislative/executive orders, which are the indirect ways feasible for implementation to discourage increase in exploitation ?

Can the extension organisation be strengthened to carry conviction to the industry ?

## **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.  
(Published as Appendix 2 of IOFC/DEV/78/44.1, FAO, Rome, 1978)
3. Report of the Third Meeting of the Advisory Committee, Chittagong, Bangladesh 7-10 November 1978. Colombo, Sri Lanka, 1978.  
Reissued Madras, India, September 1980.
4. Role of Women in Small-Scale Fisheries of the Bay of Bengal. (In preparation)
5. Report of the Workshop on Social Feasibility in Small-Scale Fisheries Development Madras, India, 3-8 September 1979. Madras, India, April 1980.
6. Report of the Workshop on Extension Service Requirements in Small-Scale Fisheries, Colombo, Sri Lanka, 8-12 October 1979. Madras, India, June 1980.
7. Report of the Fourth Meeting of the Advisory Committee, Phuket, Thailand, 27-30 November 1979. Madras, India, February 1980.
8. Pre-feasibility Study of a Floating Fish Receiving and Distribution Unit for Dubla Char, Bangladesh. Madras, India, April 1980.
9. Report of the Training Course for Fish Marketing Personnel of Tamil Nadu, Madras, India, 3-14 December, 1979. Madras, India, September 1980.
- 10.1 Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal. Chittagong, Bangladesh, 16-21 June, 1980.  
Volume 1 : Proceedings, Madras, India, September 1980.
- 10.2 Report of the Consultation on Stock Assessment for Small-Scale Fisheries in the Bay of Bengal. Chittagong, Bangladesh, 16-21 June, 1980.  
Volume 2 : Papers. Madras, India, October 1980.

#### **Working Papers (BOBP/WP/ . . .)**

1. Investment Reduction and Increase in Service Life of Kattumaram Logs.  
Balan, R. Madras, India, February 1980.
2. Inventory of Kattumarams and Their Fishing Gear in Andhra Pradesh and Tamil Nadu, India. (In preparation)
3. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Sri Lanka.  
Madras, India, June 1980.
4. Inboard Motorisation of Small F.R.P. Boats in Sri Lanka. (In preparation)
5. Improvement of Large-Mesh Driftnets for Small-Scale Fisheries in Bangladesh.  
Madras, India, September 1980.

6. Fishing Trials with Bottom-Set Longlines in Sri Lanka ( In preparation)
7. Technical Trials of Beachcraft prototypes in India ( In preparation)
8. Current Knowledge of Fisheries Resources in the Shelf Area of the Bay of Bengal. Madras, India, September 1980.
9. Boatbuilding Materials for Small-Scale Fisheries in India. (In preparation )
- 10 Fishing Trials with High-Opening Bottom Trawls in Tamilnadu, India (In preparation)

*Miscellaneous Papers* (BOBP/MIS/. . .)

1. Fisheries Cooperatives in Kerala : A Critique (In preparation)