

# Bay of Bengal Programme

**Marine Fishery Resources Management**

FISHERY STATISTICS  
IN THE BAY OF BENGAL

BOBP/WP/59



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FISHERY STATISTICS  
IN THE BAY OF BENGAL

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This report describes current fisheries statistics collection systems in six countries of the Bay of Bengal region — Maldives, Sri Lanka, Bangladesh, Thailand (west coast), Malaysia (west Peninsular) and Indonesia (Sumatra, north of the equator). Suggestions for improving existing systems are made for each country. It is hoped that the report will be useful to national fisheries statistics organizations, planners and policy makers.

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This document is a working paper and has not been cleared by the governments concerned or by the FAO.

## CONTENTS

	<i>Page</i>
1. Introduction	1
2. Current fisheries statistics systems in the Bay of Bengal region	1
2.1 Maldives	1
2.2 Sri Lanka	4
2.3 Bangladesh	6
2.4 Thailand (west coast)	10
2.5 Malaysia (West Peninsular)	13
2.6 Indonesia (Sumatra, north of the Equator)	15
3. References cited	19
 <i>Figures:</i>	
1. Map of study area in the Bay of Bengal region	23
2. Marine fishery statistical districts in Maldives	24
3. Marine fishery statistical districts in Sri Lanka	25
4. Marine fishery statistical districts in Bangladesh	26
5. Marine fishery statistical districts in Thailand (west)	27
6. Marine fishery statistical districts in Peninsular Malaysia	28
7. Marine fishery statistical districts in Indonesia (North Sumatra)	29
8. Major components of the standard system for fishing statistics (Indonesia)	30
 <i>Annexures</i>	
1. Frame survey form (Sri Lanka)	31
2. Record form for daily landings in the selected centre (Sri Lanka)	34
3. Data collection form for catch assessment survey in marine artisanal fisheries (Bangladesh)	35
4. Report form for deep sea fishing trawler (Bangladesh)	36
5. Survey form (L-II): Estimation of number of trips and total catch (Indonesia)	37
6. Survey form (L-III): Estimation of number of trips and total catch (Indonesia)	38
 <i>Publications of the Bay of Bengal Programme</i>	 <b>39</b>

## 1. INTRODUCTION

The planning of policies for rational fishery development, resources assessment and management depend crucially upon the basic information that fisheries statistics provide. The importance of accurate fisheries statistics cannot, therefore, be over-emphasized. The quality of fisheries statistics in the countries bordering the Bay of Bengal\* ranges from fairly reliable to very uncertain.

Uncertainties, both natural and those caused by human intervention, bedevil fisheries data in the region. Accurate stock assessment, leading to better development and management of fisheries, depends on eliminating these uncertainties. However, fisheries planners cannot postpone their decision-making till accurate statistics become available. There is, therefore, a need to develop methods of searching and eliminating uncertain data.

This report describes existing statistical systems in the Bay of Bengal region and discusses their shortcomings and problems. Suggestions for improvement are also outlined.

## 2. CURRENT FISHERIES STATISTICS SYSTEMS

### IN THE BAY OF BENGAL REGION

#### 2.1 Maldives

The Republic of Maldives is an archipelago of some 1,190 small coral islands forming a long narrow chain strung over an area of nearly 90,000 sq km. The nearest landmass (the southern tip of India) lies about 480 km north-east. The Republic is divided into 19 administrative districts. An administrative map is given in Figure 2. The population (181,453 according to the 1985 census) is scattered over 202 islands. The sea makes up almost 99% of Maldives' territory and fisheries are a major activity contributing 16.8% of the country's gross domestic product and employing 44% of the active population. Close to 50% of the annual fish production is consumed locally, with the daily per caput fish consumption being estimated at 205 g in 1983 (World Bank, 1983). The dominant fishing method is pole and line fishery carried on from locally built craft known as masdhonis. Trolling craft, known as vadu dhonis, also play an important role. Gillnetting for sharks and reef fishing has become popular in recent years.

##### 2.1.1 *Current data collection system*

Collection of catch statistics started in the late 1950s and has since then shown a steady improvement. Fisheries statistics are collected through island offices in all the inhabited islands (202), from freezer-carriers etc. The Statistics and Accounts section in the Ministry of Fisheries compiles all data. In the capital island of Male, fish landing and other relevant fisheries data are collected by fishery inspectors from the Male fish market. Island chiefs collect daily catch data by interviewing all skippers. These are transmitted to the atoll offices daily. The atoll offices, in turn, transmit monthly summary data to the Ministry of Fisheries. In the monthly report, catches by vessel and by island are recorded through a total enumeration system. Length frequency measurements have been included since 1983. Length measurements are recorded for skipjack and yellowfin, little and frigate tuna as well as some reef species.

\* Member countries of the Marine Fishery Resources Management Project (RAS/81/051): Bangladesh, Malaysia, Maldives, Sri Lanka, Indonesia and Thailand. Figure 1 shows the study area. Tuna and shark longlining, beach seining and live bait trolling for sail fish and marlins are the techniques employed (Marine Research Station, 198%+ RAPA/FAO, 1986; Anderson, 1986).

The Ministry of Fisheries records catch and effort statistics by gear and by species and other data as detailed below. The catch is recorded as number of fish landed and the effort as the number of day trips.

#### 2.1.1.1 Species breakdown by gear

Pole and line (motorized and sailing masdhonis):

Small and medium sized skipjack tuna, large skipjack, yellowfin tuna, Eastern little tuna, frigate tuna, reef fish.

Since 1983, reef fish have been subdivided into three further categories: I. Large (e.g. wahoo, sailfish and others); II. Medium (e.g. sharks, barracudas, large carangidae); III. Small (e.g. serranidae, lutjanidae, parrotfish, scads, carangidae)."

**Trolling** (sailing vadu dhoni)

Small and medium sized skipjack tuna, large skipjack, yellowfin tuna, eastern little tuna, frigate tuna, reef fish.

#### **Nets and other gear**

Horse mackerel, reef fish, others.

#### Row boats/handlines

This fishery for dogtooth tuna was not monitored prior to 1984, and estimation of dogtooth tuna catches commenced in 1985.

Catch data (in number of fish landed) are converted into weight by using a conversion factor for each species of tuna (average weight of each species) but a single conversion factor is used for all reef fishes. The fishing effort is estimated as the number of fishing days, as all trips are day-trips, from dawn to dusk.

#### 2.1.1.2 Data collected at fish processing centres

These consist of: registration number and name of vessel ;name of skipper; fishing ground; catch by species; (Number of each species and total weight) and cost for the delivery of fishes. Weekly summaries of these data are sent by the processing centres to the Ministry but these data are not processed.

#### 2.1.1.3 Daily weather and fishing report (Atollwise)

This daily report originates from the atoll offices and is broadcast by the Voice of Maldives. The report consists of: visual observation of weather; wind direction; number of boats engaged in fishing; total catch for the atoll concerned; best fishing grounds; migrant boats from other atolls.

#### 2.1.1.4 Data collection by fishery field officers

In 1983/84, subsequent to a FAO-sponsored training programme (TCP/MDV/2202), an attempt was initiated to introduce a sampling system for fisheries statistics in addition to the existing total enumeration system. Six fishing strata were delineated (see Figure 2). Biological sampling also commenced at selected points in 1984. This activity is now expanding with the establishment of a research section in the Ministry of Fisheries. In 1985, six field officers were recruited to sample catch and length/weight data. They were also expected to instruct boat owners on the usage of log books. Four of the officers are now working in five of the six strata where they collect data and monitor routine statistics by spot checks. Data are transmitted to the Ministry of Fisheries for processing. This sampling scheme is as yet in an experimental stage.

- Sub-group II further divided into "with" and "without" boat.

#### 2.1.1.5 Other sources of statistics

Data on catches from sports fishing are expected to be reported by tourist resorts on prescribed forms. Fishing companies have been requested to send records relating to their purchases of fresh fish to the Ministry. The customs office has also been requested to send records of fish and fish product exports on a monthly basis to the Ministry of Fisheries.

The catch statistics reported from the atoll offices could be affected by:

- errors arising from verbal communication of catch information;
- fishermen disposing of their catches directly to traders without reporting them;
- incomplete reporting of row boat catches;
- erroneous reporting by fishermen migrating from one island to another.

Despite these problems, the fact remains that the total enumeration system has been operative for nearly 30 years now and that fishermen are familiar with the obligation to report their daily catches. The system also covers, it should be noted, over 200 islands with different levels of fishing effort in each island and large variations in daily catches even within the same island. Anderson (1986), believes that to some extent these errors cancel out each other and that the catch (number of fish) and effort records are accurate to within  $\pm 15\%$ .

#### 2.1.2 Research data collection

The Marine Research Section of the Ministry of Fisheries was established in 1984. This section is still in its formative stages, though its activities have already started focusing more on field work than on desk work as was the case initially. The main objectives of the section are:

- (1) To carry out research and investigation in fisheries science, including marine biology, with the aim of establishing a scientific information "bank" which will facilitate the development and management of the fisheries resources of the Maldives.
- (2) To undertake, to the extent possible, further marine research which will assist in the conservation and management of marine resources.
- (3) To undertake systematic collection, identification, cataloguing and storage of samples of the marine flora and fauna in order to build up a reference collection.
- (4) To advise the Ministry of Fisheries and other Government departments, agencies and fishermen on the status of marine stocks, the marine environment and the need for proper conservation and management.
- (5) To promote interest and training in fisheries sciences, and the training of fisheries staff in particular and local students in general.
- (6) To liaise with fisheries and marine scientists elsewhere in furthering its objective.

(Source: Marine small-scale fisheries of the Maldives, RAPA, 1986; p. 10).

This section has now started collecting data on tuna (length frequencies, morphometrics and biological data), inventories of existing fisheries, information on bait fisheries, reef fisheries and fish aggregating devices. It also undertakes socio-economic surveys.

#### 2.1.3. Suggestions for improvement

1. The existing total enumeration system should continue. There is, however, a need to further improve the existing system in areas like better separation of reef fishes, effort directed at reef fish and tuna by each craft etc.
2. The sampling programme requires more facilities, funds and training for the field officers. Samplers in island offices need on-the-job training, and a field manual describing sampling methods is an urgent need.

3. The recently-introduced direct reporting system – from islands to the Ministry – will help reduce errors which might creep in when summaries are done at the atoll level. Available computer hardware and software facilities must be fully utilized to handle the increased volume of data flow in the Ministry. Training of staff, especially in areas like computers and statistics, is important.
4. Compilation and analysis of data could be computerized. Data collection forms must then be modified to suit the software implemented, such as that provided by the Marine Fisheries Resources Management project.
5. A fisheries census is overdue and it is necessary to determine accurately the numbers of motorized and non-motorized craft engaged in fishing operations.
6. The recently concluded socio-economic survey should form the basis for designing more detailed surveys in future. These surveys should be conducted once every five years to keep track of the changing fisheries scene.
7. Sampling of commercial species should be done in all the six strata for research purposes and for establishing conversion factors which are required for accurate monthly production estimates.

## 2.2 Sri Lanka

Sri Lanka has a coastline of 1760 km and an EEZ of 256,410 sq km. The continental shelf is narrow in most parts of the island averaging a little over 22 km. The most productive fishing grounds lie in the Palk Bay and the Gulf of Mannar (see Figure 3). Marine fisheries in Sri Lanka fall into three groups; coastal/inshore fishery, offshore fishery and deep sea fishery within 25 miles from shore. About 95% of the current fish production comes from the coastal/inshore fishery. In the inshore waters, up to 10-12 km from the shore, small to medium pelagic and demersal fishes are exploited. Beyond the inshore waters, larger fish like tuna, sharks, billfishes and other scombroides are exploited.

A variety of fishing crafts, including non-motorized and motorized teppams (log rafts), orus (outrigger canoes), vallams (large canoes), more modern craft such as the 26-28 ft and 32-34 ft boats with inboard engines and 6-8 m FRP boats with outboard engines engage in the fishery. The 1981 census placed the extent of motorization of Sri Lanka's fishing fleet at 49%. Various types of gear, including gillnets, troll lines, etc., are employed in the fishery. Deep sea fishing is still limited (Siddeek and Joseph, 1983).

### 2.2.1 Current data collection system

Fisheries statistics are collected by the Statistics Unit, Division of Planning and Programming, Ministry of Fisheries. The unit is headed by a statistician from the Department of Census and Statistics.

The original data collection system was improved by FAO (Inoue 1972) but the system has undergone several modifications since then.

The earlier system provided for a number of statistics collectors around the country. These posts have been abolished and fisheries inspectors have since been made responsible for statistics collection also.

There are 14 jurisdictional districts in the marine fisheries sector with a district fisheries extension officer (DFEO) presiding over each. Each fisheries district also has a number of fisheries inspectors (FIs), their number in any district depending on the number of fish landing centres in that district. Of the total of 200 FIs, 100 are assigned to the marine fisheries sector in 14 districts. And, of the 2,000 or so fish landing centres in the country, 140 have been chosen as sampling centres. They were chosen 12 years ago and there has been no change since then. Each FI is essentially responsible for one or two sampling centres.

The current system is a stratified two-stage sampling design: landing centres as primary sampling units and craft as secondary units. Production estimates are made for each fishery district



and then summed up to provide a national estimate. The effort in terms of number of craft is estimated. Though the number of units of gear used in fishing operations in each sampled craft is recorded, this information is not used in effort estimates. Each fishery division also undertakes monthly observations of beach seine landings.

Each FI visits landing centres twice a week as he has other duties as well. Data are stratified by three types of craft (non-motorized, inboard and outboard engined craft). Each FI's sample is a pre-determined maximum of 10 boats/types of craft. These craft were selected when the current system was introduced and have not been changed since then. The FI goes to the landing centre, usually in the morning, and collects data from boats. If he is not there when the boats return, he interviews the owner of the craft to collect landing data.

An FI collects the following statistics on any sampling day:

1. Number of fishermen engaged in fishing.
2. Origin and number of migrant craft.
3. Type of craft:
  - (a) 11 m and above (offshore and deep sea) motorized craft
  - (b) 9 m (3.5 ton) motorized boats with 30 h.p. inboard engine
  - (c) 6-8 m fibreglass boats with 6-15 h.p. outboard engines
  - (d) Non-motorized traditional craft (dugout, lograft, outrigger and canoes)
  - (e) Beach seine craft (paru).
4. Types of gear and number of units.
5. Catch by species in kg. This is done by eye-estimation as weighing scales are not used. Fish species are categorized into 30 groups.
6. Fish prices (Rupees/kg) for (a) fresh or wet fish and (b) dried or processed fish.
7. Numbers of fishing craft/gear operated on the sampling day.

The DFEO is responsible for sending the following monthly summaries to the Ministry:

- number of fishing craft operating in the month,
- number of origin of migrant fishing craft,
- number of non-operating days during the month for pre-specified craft,
- production estimates,
- monthly summary of beach seine fisheries with estimated monthly production,
- ice production.

At the beginning of the year, the DFEO and the FI investigate registered fishing craft (types and numbers) and report to the Ministry.

Based on summaries from the 14 coastal districts and other interior districts (for inland fisheries) the Ministry publishes an annual report on fisheries statistics including import/export information. This report is for internal use only.

#### *2.2.2 Research data collection:*

The Marine Biological Resources Division of NARA is engaged in marine fisheries resources research. Ten scientific officers are at present working on the fisheries and biology of tuna, small pelagics, shrimps and lobster on the west and south-west coasts. Sampling for catch, effort and biological parameters in respect of these species is in progress.

### 2.2.3 *Suggestions for improvement*

1. A fisheries census is urgently needed since the last one was done in 1972.
2. In 1983, a committee appointed to look into the fisheries statistical system recommended the introduction of 60 full-time statistics collectors (SC) directly under the statistics division in the Programming and Planning section. This should be implemented.
3. The current “two-stage stratified random sampling” should be intensified—the coverage of landing centres needs to be increased as do the numbers of sampling days.
4. The use of weighing scales for estimating catches should be promoted and there should be less resort to eye-estimation, at least at sampling centres.
5. Annual fisheries statistics should be published and should include gearwise estimates of effort and production of all major species and species groups by month.
6. NARA should undertake precise and intensive sampling for important species including demersals; discrepancies between Ministry and NARA estimates should be analysed to correct the Ministry’s estimates.
7. Bimonthly or quarterly newsletters on Fls’ or SCs’ activities may be an excellent way of encouraging them. Publication of monthly production figures and other information relevant to the Ministry, to NARA and to the fishermen would be helpful.
8. Supervision of statistics collection by the DFEO or special investigators visiting the field should be strengthened.
9. Recommendations on fisheries statistics made by the committee in 1983 (i.e. to increase the number of species and species groupings from 30 to 47) should be implemented.
10. Data compilation, processing and analysis should be computerized to expedite analyses and to reduce errors arising from manual calculations.
11. In 1983, the committee recommended two simplified statistics collection forms which should replace the existing ones. These two forms were further improved upon (Sivasubramaniam, 1985) and it is recommended that they be used (see Annexures 1 and 2).
12. On-the-job training in the field by NARA staff should be provided more often to check and ensure the quality of performance of the statistics collectors.
13. The number of boats in actual operation should be recorded and used to estimate production, instead of using the number of registered boats.
14. Thematic maps should be used to visualise data quantitatively and qualitatively, so that planning/programming for fishery activities will become easier and more effective (Caddy and Bazigos 1985).

From the interviews with Fisheries Inspectors, DFEO and the Ministry, it is estimated that errors in production estimates in the present systems range from 30% to  $\pm 60\%$ . This can be reduced to  $\pm 20\%$  if these suggestions are implemented.

### 2.3 Bangladesh

Fishing is an important activity in Bangladesh, contributing roughly 5% of the GDP and 9% of the country’s export earnings. Shrimp species, in particular, are a major source of export earnings.

Fish is the main source of animal protein for the people accounting for 80% of the animal protein consumed. Per caput consumption of fish however, declined from 12 kg per annum (3.29 g per diem) in 1964/65 to 8 kg per annum (2.19 g per diem) in 1975/76. Close to 6% of Bangladesh’s population is engaged in fisheries.

Bangladesh has a 480 km coastline and one million hectares of territorial waters. Major commercial species include shrimp, hilsa, pomfret, jewfish, catfish and Bombay duck.

The marine fisheries sector in Bangladesh consists mainly of small non-motorized craft operating within 30 miles (48 km) from the shore. The main gear types used are set bagnets (42%), gillnets (33%), longlines (6%) and castnets (6%). Trawling accounts for the remaining 13%. Hilsa is a major commercial species but the estimation of actual landings is complicated by the existing system of catch disposal (INFOFISH, 1986; Shimura, 1985).

Two agencies — the Bureau of Census and Statistics and the Marine Fisheries Division (Chittagong) of the Directorate of Fisheries (DOF) — collect fisheries statistics. But quantitatively and qualitatively these statistics are far from satisfactory.

The Statistical Yearbook of Bangladesh (1983/84) has only five fishery statistics tables and of these, two are on catch statistics. One table presents a summary of catches over the previous seven years by species, another presents catch estimates over the previous 19 years but without segregation by species or species groups. The annual total catches upto 1982/83 have been estimated by a very unsatisfactory method. Example: The annual total catches from 1965/66 to 1974/75 were estimated by multiplying the per caput annual consumption (as estimated by the nutrition surveys conducted by the Dhaka university during these years) by the total population.

In 1981 the Directorate of Fisheries initiated the Fisheries Resources Survey System with technical support from FAO/UNDP, and this unit undertook the task of improving the fisheries statistical system in Bangladesh. This unit now has the function of collecting and compiling fisheries statistics.

In December 1985, at the request of the Director-General of the Bureau of Census and Statistics, FAO prepared a proposal for “an integrated system of fishery statistics in Bangladesh”. The next section discusses these proposals in some detail. The proposed integrated system is meant to ensure quick collection of reliable fisheries information required by various government departments.

### *2.3.1 Current data collection system*

The system covers nine fisheries sectors of which two relate to marine fisheries—marine artisanal fisheries and marine industrial fisheries (trawling). The other seven sectors deal with riverine fisheries, beel fisheries and boar fisheries.

#### *2.3.1.1 Marine artisanal fisheries*

There are five statistical districts for marine artisanal fisheries (see Fig. 4.) In each district, catch and effort are sampled by month, by gear type and by species, to estimate total production. Producers' prices are also collected.

There are problems in collecting effort data relating to two major fisheries—the gillnet and set bagnet fisheries. In these fisheries, the catch is commonly transported by carrier boats to landing points. Landing points are not the same every time; they change, depending upon the price that prevails at each landing point. As a result, it is difficult to collect data on the number of fishing days or hours.

A frame survey is planned, which will cover all the fishing villages once a year to collect information on the numbers and types of fishing boats, gear and fishermen. Two fisheries statistics officers (FSOs) are assigned to each district. The number of sampling days and the names of the sub-districts for sampling by gear are given in Table 1.

Statistics are being collected on 11 species or species groups: hilsa, Bombay duck, Indian salmon, pomfret, sharks and rays, jewfish, snapper, mackerel, large/small shrimp and miscellaneous fish.

Catches are recorded in kg. Other data collected include the number of fishermen on board type of gear, number of days per trip, number of trips in the preceding fortnight, number of days at sea during that period and the number of set bagnets.

The data collection form is given in Annexure 3.

Table 1

Gear Type	Sub-district	Sampling days/month
Gillnet for Hilsa	Chittagong, Cox's Bazar Khulna	4
Set bagnet for jewfish — large (seasonal)	Sonadia Island, Hatia Island, Dubla Island	2
—small	Sandwip Island, Hatia Island, Cox's Bazar	2
Longline —jewfish longline (seasonal)	Three landing sites selected from among jewfish proces- sing plants in Cox's Bazar	2
Seine net, castnet and miscellaneous	Cox's Bazar, south of Chit- tagong, north of Sandwip Island, Hatia Island and Patua- khali coast (2 sample villages in each section)	2

#### 2.3.1.2 Marine industrial fisheries (trawlers)

In the marine industrial fisheries (trawlers) sector, catch and effort data are collected from commercial trawlers (shrimp, fish and mixed trawlers) by species and by region. Two FSOs from the Marine Fisheries Division are responsible for the data collection. They send monthly summaries to the fisheries statistics unit in Dhaka.

Less than half the commercial trawlers submit the required data. Production estimated are, therefore, made by stratifying the sample by type and by size. The number of operative trawlers is checked carefully. The weight of processed shrimp on board is converted to live weight.

Data are compiled and analysed using the database programs in Dhaka to provide break-up by different categories — by fishing ground, by GRT class, by month, by type of trawler and by species. The data collection form is at Annexure 4. The form will remain unchanged for several years so that a reliable time series can be built up.

Before each fiscal year begins, an FSO visits trawl fishing companies and distributes data collection forms to trawler skippers. They are requested to return the filled-in forms at the end of each trip. The FSO checks completed forms and clarifies any doubts he might have. Catch data can often be cross-checked with export invoices of trawl company records. The FSO also collects information on the number of trips per month and the number of fishing days per trip from skippers.

For the computerised compilation of these data, five SORT keys are available in the database package — month, type of trawler, company, name of trawler and trip (date of return from a fishing trip). Monthly catch can be estimated by different categories, and several combinations of cross tabulation (example: catch summary by company and/or type of trawler) are possible. At the end of each fiscal year, an annual catch table can be generated by simple addition of monthly tables.

### 2.3.2 *Research data collection*

Four institutions are engaged in collecting fishery statistics for research purposes (BOBP, 1986). These are:

1. The Fisheries Research Institute: two stations are located on inland rivers at Chandpur and Mymensingh for hilsa studies. One station is expected to be established near Cox's Bazar for marine fisheries. There are as yet no activities on marine fishery research statistics.
2. Marine Fisheries Division of the Department of Fisheries at Chittagong and Cox's Bazar: most of the activities relate to trawl surveys for fish (pelagic /demersal) and shrimp caught by foreign vessels, mainly for stock assessment.
3. Department of Zoology, University of Dhaka: Egg and larval studies and racial studies have been conducted on hilsa.
4. Marine Sciences Division, University of Chittagong: collection of data on shrimp and finfishes to study productivity, aquaculture, fishery biology and microbiology.

### 2.3.3 *Suggestions for Improvement*

1. To ensure good quality data on a continuing basis, three aspects require attention:
  - a. Training and supervision of FSOs to minimize errors in the data. Currently the error is estimated to be in the  $\pm 30\%$  range.
  - b. Training on sample survey techniques for statistical officers.
  - c. Periodic checking of the survey systems by sampling experts.
2. Existing sample sizes (in number of sampling days, number of boats and villages covered) are small. More intensive sampling should be considered. Meanwhile the data collected by FSOs need to be viewed cautiously.
3. The carrier boat system for landing catches in the marine artisanal fisheries sector makes it essential to develop a methodology for the reliable estimation of effort.
4. The carrier boat system creates yet another problem – correct estimate of production from the marine sector, as the catches might be landed in an estuarine or a riverine landing centre. This factor requires to be quantified and taken care of.
5. The number of days per trip varies considerably between one and 15 days. It is necessary to evolve and use an accurate average trip duration for estimating production.
6. Collection of shrimp larvae for culture must be investigated. The density of stocking and the total areas under culture must be estimated so that shrimp resources can be correctly assessed and appropriate management measures initiated.
7. The entire data processing should be computerized and the statistics and research staff trained in the use of computers already available in the Directorate of Fisheries.
8. Fisheries statistics should be collected by the Directorate of Fisheries and not by the Bureau of Census and Statistics.
9. A log book should be placed on every commercial trawler and the submission of completed returns made obligatory before a trawler's licence is renewed.
10. The present research statistics programme is inadequate. A comprehensive sampling programme covering various major species is essential. Several sub-stations for research sampling (each with an adequate budget) are required. More marine biologists are required for proper coverage of various areas and of major fish species.

## 2.4 Thailand (West Coast)

The length of the coastline on the western coast of Thailand is about 740 km. The fishing area of the continental shelf from the coast to the 100 m depth contour is about 44,000 sq km. Though there are good fishing grounds right up to the 100 m contour, most fishing activities are confined to the near-shore area up to a depth of about 90 m.

Prior to 1961, fishing on the west coast of Thailand was largely artisanal and confined to the coastal waters. With the migration of fishermen and fishing craft from the Gulf of Thailand to the west coast, gear types such as purse seines and gillnets were introduced into the area for inshore pelagic species. In addition to these, extensive use of fishing gears like trawls and push nets for demersal species have contributed to the rapid expansion of marine capture fisheries on the west coast of Thailand.

The gradual motorization of fishing craft and innovations in fishing gear have extended fishing grounds further from the shore and catches have increased steadily. The light luring purse seine was introduced in 1973 and has now replaced more conventional gear. Since the early 1970s, the numbers of registered trawlers, Chinese purse seiners and anchovy purse seiners have declined considerably while the number of luring purse seiners has increased. (Bhatia, Wongchitsue and Chantawong, 1983.)

### 2.4.1 *Current data collection system*

The Fisheries Statistics Section of the Fishery Policy and Planning Division, Department of Fisheries, Ministry of Agriculture and Cooperatives, is the agency responsible for routine fisheries statistics collection. There are 268 district offices, 58 provincial offices and 30 fisheries research stations under the Department of Fisheries. The statistics section has 8 supervisors and 70 field officers, located in the provincial offices mostly in the coastal areas.

Of the 24 provinces in Thailand, six are located on the west coast (see Figure 5).

There are four routine surveys that relate to marine fisheries. Data for all these surveys are collected by field enumerators through regular visits to sampling centres.

#### 2.4.1.1 Marine fisheries product survey:

The object of this survey is to provide catch (by species or species group, gear, area and month) and effort (number of trips, days, hours) data for fish stock assessment. There are four different surveys under this group:

(a) Log book survey (major fishing gear survey). This is mainly aimed at large-scale (offshore) fisheries. Though the number of fishing units in this sector is limited, its productivity is high, accounting for more than 60% of the total catch. The survey commenced in 1969 and covered five major gear types—otter board trawl, pair trawl, Thai purse seines, Chinese purse seines and bamboo stake traps. The number of gear types covered was increased to 11 in 1973. A minimum fishing unit is one set of the operating unit. Example: in the case of pair trawling, two boats constitute one fishing unit. The classification of fishing units by stratum is given in the table below.

In each stratum, simple random sampling is used to select sample fishing units. Fishermen on the selected craft are requested to record the total catch for each trip in the log book provided by the DOF. Enumerators visit these fishermen regularly to collect data and forward them to the Fisheries Statistics Section, Bangkok, for processing.

(b) Fishing community survey: This survey covers small-scale (coastal) fisheries. It adopts a stratified two-stage sampling technique with the fishing village as the primary sampling unit and the craft type as the secondary sampling unit. A motorized boat is assigned a weighting factors of 2 and a non-motorized boat, a factor of 1.

Fishing villages are selected at random from each sub-province. Enumerators then list all the gear types used in the sampling villages. Gear not covered under the major fishing gear survey (11 types) is also covered under this survey.

## Fishing gear by stratum

S.No.	Fishing Method	Stratum
1.	Otter board trawl	less than 14 m 14—18 m <b>18—25 m</b> more than 25 m
2.	Pair trawl	<b>less than 14 m</b> 14—18 m 18—25 m more than 25 m
3.	Thai purse seine	<b>less than 14 m</b> 14 m or more
4.	Beach trawl	No stratification
5.	Chinese purse seine	
6.	Anchovy purse seine	
7.	Mackerel encircling gill net	
8.	King mackerel gillnet	
9.	Push net	
10.	Luring purse seine	
11.	Bamboo stake traps	

This survey is conducted annually. The required information is obtained through interviews with selected fishermen in sample fishing villages. This survey is likely to be replaced by a log book survey as the latter provides more accurate information.

(c) Coastal culture survey: This does not relate to marine fisheries.

(d) Miscellaneous marine products survey: This survey aims at estimating the production of miscellaneous marine products from fishing methods other than those covered under the log book and fishing community surveys. The products covered include seaweed, sea cucumber, jelly fish and turtle eggs. The survey is done annually and no specific questionnaire is employed. Enumerators contact local people and collect the required information.

### 2.4.1.2 Fish landing place survey

The purpose of this survey is to estimate monthly landings and the proceeds from the sale of various fish by species in 36 landing centres of which seven are located on the west coast. About 10 per cent of all vessels landing are surveyed by enumerators in the course of this survey. Data collected are: number of fishing vessels, weekly landings and sale value of landings. Information is collected through pier owners and dealers.

### 2.4.1.3 Fishing vessel survey

Data for this survey are collected on the fishing gear survey forms issued by the provincial fisheries office and are sent to the fisheries statistics section.

### 2.4.1.4 Associated fisheries industry survey

The industries covered under this survey include shipyards, docks, ice plants, cold storages, processing plants and fish meal plants. Data is collected monthly and is done on a total enumera-

tion basis except in the case of fish/shrimp paste plants, dry shrimp/squid plants and salted fish plants. In these cases a 10% sample is taken.

The Fisheries Statistics Section publishes four annual statistical bulletins based on these surveys – *fisheries factory statistics*, *marine fisheries statistics (based on sample survey)*, *the landing place survey* and *freshwater fishfarm production*.

In 1985, the Department of Fisheries and the National Statistics Office jointly carried out a census of marine fisheries. The objectives of the census are: (i) to determine the basic structure of the fisheries; (ii) to provide the data necessary for formulating policies and plans for national fisheries development and (iii) to update the current fisheries frame for better sampling design. The census covered, on a total enumeration basis, all establishments and fishing households in the marine fisheries sector and included the processing and marketing of fishery products as well.

#### 2.4.2 Research data collection

On the west coast of Thailand, only the Phuket Marine Fisheries Station (under the Department of Fisheries) engages in research statistics collection. The Institute collects catch/effort and biological data on 10 selected species by systematic, stratified random sampling.

#### 2.4.3 Suggestions for improvement

1. Fishermen tend to under-report catches to avoid a higher incidence of taxation. It may be worthwhile for the DOF to undertake a campaign to impress upon fisherfolk the need for accurate fisheries statistics. Lower taxes, especially for small-scale fisheries, might result in more accurate data collection (Cheunpan, 1986).
2. The current statistics collection system does not reflect the changes caused by the rapid development of fisheries. The sampling design needs to be modified to match current fisheries. The results of the 1985 census could be utilized to work out the required modifications. Sampling designers should visit landing places and interview fishermen so that they learn more about new techniques and the current fisheries scene (Cheunpan, 1986).
3. Better species separation in the tuna group is required. There are discrepancies in the figures reported for tuna catches by the research and statistics divisions. These will have to be investigated and reconciled.
4. Catch and effort data relating to the offshore fishery are adequate for stock assessment purposes, but the same is not the case with the inshore fishery. Reason: inadequate coverage of landing points since there are not enough field officers (SEAFDEC, 1986).
5. Statistical methods to detect errors need to be developed. Improvements are required in the data collection system for small-scale fisheries and in the training of field personnel.
6. The classification of fishing gear was established in 1969. It needs to be revised to reflect the current situation. This could be done by using the results of the 1985 fisheries census. The need for a fresh classification of gear is underscored by the multiplicity of gear types in use.
7. Catch and effort data on distant fisheries should be collected probably under the associated fisheries industry survey.
8. Duplication of data has been noticed in some cases as data are collected both at landing points and at processing plants. It is desirable to collect at one point or to cross-check data from the two sources and adjust the figures if necessary.
9. Costs and earnings statistics on trawlers are required for cost analysis and MEY (maximum net economic yield) calculations. These data assume importance, as trawling is the major component of the national fisheries.
10. The recent introduction of computers into the fisheries statistics system could be utilized to speed up the preparation of official statistics and to reduce compiling/computing errors.



11. The mobile laboratory for measuring and examining samples was extremely useful to the research statistics sector and steps should be taken to replace a damaged vehicle. Samplers in this sector require additional training.

## 2.5 Malaysia (West Peninsular)

The marine fishery on the west coast of Peninsular Malaysia is largely a coastal fishery for two reasons: shallow waters (less than 100 m depth) and a limited exclusive economic zone. The marine fisheries sector employs 47,000 fishermen working on 18,000 craft. West Peninsular Malaysia contributes 72% of the fish landings of Peninsular Malaysia. Landings have increased from 243,620 tin 1969 to 442,173 tin 1983. The 1983 production was a peak and it coincided with a peak in pelagic landings which increased from 103,645 tin 1969 to 148,672 tin 1983. Demersal landings too increased sharply in the same period, from 74,238 t to 171,812 t. Prawns (50,512 t in 1983) constitute 11 % of total landings. Trawlers account for most of the prawn catch but their contribution has decreased with the intensification of management measures. In contrast, catches by driftnets and bagnets have increased. The average landing on the west coast of Peninsular Malaysia in the last five years (446,000 t) has regularly exceeded the maximum sustainable yield (345,000 t).

A variety of fishing gear, ranging from otter trawls and purse seines to driftnets, bagnets, portable traps, hook and line, fishing stakes and liftnets, is employed in West Peninsular Malaysia. Trawls contribute the most to the catch with 44%, followed by purse seines (17%), driftnets (9.5%) and hook and line (1.8%) (Fisheries Department 1983).

Eight of the 13 states in Malaysia are located on the west coast. Of the 27 fisheries assistants (FAs), 19 are located on the west coast. Figure 6 shows the locations of FA districts.

### 2.5.1 *Current data collection system*

Fisheries statistics are collected and compiled by the Fisheries Department, Ministry of Agriculture. The Fisheries Management Information System (FMIS) Unit of the department is responsible for the collection and analysis of fisheries data and for management. The FMIS unit is headed by a senior fisheries officer. He is assisted by three fisheries officers. There are eight fisheries assistants and one assistant fisheries officer for data tabulation and processing and documentation. The data are first compiled at the state level at the state fisheries office. State level summaries are then compiled at the FMIS unit to generate national level data. The current data collection system comprises the following:

2.5.1.1 Number of fishermen by ethnic group: Compiled from licenses issued by the Fisheries Department to boat owners.

2.5.1.2 Number of licensed fishing boats: Obtained from the same source as above. The information compiled includes: boat registration number; date of first registration; name and address of boat owner; type of propulsion; trade name and horse power of engine; dimensions of the boat; operational base of the boat; main and subsidiary gear; and number of crew members by ethnic group. The information is sent by the District Licensing FA to the headquarters for compilation and monthly tabulation.

2.5.1.3 Licensed fishing gear: This information is obtained from monthly gear license records. The classification of gear follows the International Standard Statistical Classification of Fishing Gear, with one exception: Malaysia does not differentiate between "seine nets" and "surrounding nets".

2.5.1.4 Estimated fishing gear in operation: A frame survey is carried out every two years to determine the gear population in operation by type of gear. This is necessary to keep a check on the number of unlicensed boats and gear in operation and to reduce under estimation of total production. The survey also investigates seasonal operation of gear, inter- and intra-state migration of boats and landings by foreign registered craft. Survey items include types of gear (main and secondary); type of propulsion (non-powered, inboard, outboard) and tonnage of craft.

2.5.1.5 Landings of marine fish and fishing effort: These are estimated through observations and enquiry of the FAs at landing centres. Special survey forms are used to record the required information. Survey items are: catch by species, number of trips, fishing days and number of hauls; for all types of gear. Gear is categorized into commercial gear (trawls, purse seines) and traditional gear (gillnets, driftnets, liftnets, traps, hook and line, bagnets, push/scoop nets, barrier nets). Commercial gear is further stratified by vessel tonnage class: below 10 GRT, 10-24.9 GRT, 25-39.9 GRT, 40-69.9 GRT, 70 GRT and above.

Sampling is designed on the basis of number of fishing gear by type, days available for sampling in a month and the number of FAs in an area. The average sample size is 520 boats in each FA district. This is stratified by fishing gear. Within each stratum, boats are sampled randomly with replacement to avoid duplication. Only catch data are actually collected. Other information is elicited through interviews with skipper/crew.

2.5.1.6 Prices of marine landings in both wholesale and retail markets are collected by FAs through twice-monthly visits to the markets. Wholesale and retail values are estimated by gear group, by grade of fish and by district. The average wholesale and retail prices of selected species of freshwater fish are also obtained. Ex-vessel prices of selected species are collected through interviews with fishermen.

2.5.1.7 Daily production of ice factories and storage capacities available with refrigeration facilities are collected by FAs through visits to the concerned establishments.

2.5.1.8 Actual revenues of state and federal governments, comprising license fees, proceeds from the sale of confiscated boats, and boat transfer fees and fines are collected regularly.

2.5.1.9 Statistics on imports and exports of fishery products are obtained from the Statistics Department of Malaysia.

#### 2.5.1.10 Occasional and *ad hoc* surveys

Apart from these routine surveys, the following surveys are conducted periodically.

1. Surveys and studies on socio-economic aspects of fisheries and fisherfolk are done on an *ad hoc* basis.

2. *Costs and earnings statistics on important fisheries* are collected to estimate margins and cost-benefit ratios. From 1986, these data are to be collected regularly using standard forms distributed through FAs.

3. In 1983, a census was conducted on fisherfolk households in important districts. Items surveyed included: size of household, educational level, age, marital status, ownership of house or land, occupational status, income level, sharing system, area of operation, landings and gear. The census was done by enumerators recruited specially for the purpose. All fishery districts could not be covered due to limitations of manpower and time.

The census was carried out jointly by the Department of Fisheries and the Fisheries Development Authority of Malaysia. It covered 45% of fisherfolk households in Peninsular Malaysia (18,035 units and 22,165 fishermen). The next census will cover districts not covered by the 1983 census.

4. In 1984, the Department of Fisheries, the Fisheries Development Authority and the Agriculture University of Malaysia carried out a fish marketing survey to

- determine whether fish marketing arrangements were satisfactory.
- elucidate the role of traders in price determination, and
- recommend an efficient marketing system.

Respondents to the survey were: producers at landing complexes, wholesalers and retailers and importers/exporters.

### 2.5.2 Research data collection

The Fisheries Research Institute, Penang, is the only institution engaged in data collection for research purposes in west Peninsular Malaysia. Catch/effort and biological data on 10-12 species of fish, shrimp and cockles are collected by the FRI by systematic, stratified random sampling for the purse seine and trawl fisheries. Other activities of the FRI include: monitoring trawl surveys; exploratory fishing; sampling of commercial landings; biological investigations on selected species; trash fish analysis; mariculture; and tagging experiments on mackerels (BOBP, 1986).

### 2.5.3 Suggestions for improvement

1. The number of landing centres covered should be increased as also the number of sampling days. More FAs are required and it might be necessary to upgrade existing FAs' capabilities through on-the-job training. Comprehensive field manuals are also necessary.
2. Most respondents in various surveys are suspicious of the reasons for data collection. Fishermen need to be reassured that this data collection has nothing to do with income tax.
3. The estimation of total production and MSY for pelagic fishes is problematic in the absence of adequate effort statistics. There is an urgent need for better collection of effort data.
4. No comprehensive or special fisheries census on a country-wide scale has been conducted as yet. Some aspects of fisheries are addressed by the population census and the agriculture census but the need for a specific, full-scale fishery census cannot be over-emphasized.
5. The *Annual Fisheries Statistics* (AFS) as now published contains very detailed cross-tabulations, etc. There is, nonetheless, a need for a simple, compact yearbook on fisheries statistics with graphs, charts etc., to be published along with AFS.
6. Research statistics collection must be improved to provide better catch and effort estimates on commercially important species for stock assessment purposes.
7. Samplers engaged in data collection for research require further training in sampling techniques; the active involvement of fishery biologists in the sampling programme will help improve the quality of research statistics. It might also be more useful for FRI to set up statistics sub-stations along the coast than to send samples from Penang for data collection.

## 2.6 Indonesia (Sumatra, north of the Equator excluding Riau)

The area covered by the Marine Fishery Resources Management project (RAS/81/051) constituted only 1.7% of Indonesia's exclusive economic zone. The fisheries in this area are, however, important. Almost all the fish caught goes for local consumption. Though bottom trawling was banned in 1980, the production of shrimp and demersal finfish appears to have climbed back to the pre-1980 level with significant increase in seine nets, gill nets, trammel nets and traps. Larger motorized vessels are involved in the purse seine fishery for tunas, mackerels and scads while medium-sized vessels, probably on the west coast, are conducting troll fishing for tunas and gillnetting for smaller pelagics and demersals. The majority of the smaller motorized and non-motorized craft engage in seine, gillnet, trammel net, cast net, push net and trap fishery for demersals and pelagics, mainly along the east coast of Sumatra.

### 2.6.1 Current data collection system

The existing system for fishery statistics collection is based on "A standard statistical system for current fishery statistics in Indonesia," designed under a FAD project. The system was introduced in 1976, and parts of it have been modified since then to better suit the realities on the ground.

The system follows the national jurisdiction system — province-district-sub district-village-landing centre—with the last unit (landing centre) added to the jurisdictional hierarchy. There are two provinces, Aceh and North Sumatra, and 18 fishery statistical districts in the project area (see Figure 7).

The Central Bureau of Statistics (CBS) (part of the Prime Minister's office), and the Directorate General of Fisheries (DGF) in the Ministry of Agriculture are responsible for data collection, and one officer from both agencies is outposted in each sub-district.

The DGF collects routine statistics under five heads while the CBS is responsible for the fishery census. Figure 8 shows the major concepts embodied in the standard system for fisheries statistics in Indonesia.

The five surveys under the DGF are:

#### 2.6.1.1 Catch and effort survey to estimate production

Data are collected on 73 species/species groups, by 29 gear types.

Three different types of catch/effort surveys are carried out:

(a) L-II survey (fishing company survey): This survey covers about 30 fishing companies in Indonesia, and collects information on exports. The companies keep accurate records and only one form (SL-3) is required to be submitted to the DGF.

(b) L-II survey (major landing places survey): This survey covers major fish landing centres where large quantities of catch are landed by trawlers, purse seiners, drift gillnetters, longliners and pole and line craft. Nearly 100 landing centres are covered under this survey. The survey form is at Annexure 5.

There are nearly 5,000 marine fish landing centres in Indonesia but it is estimated that half the catch is landed at the major landing centres. As motorization of the fishing fleet gathers momentum, the importance of major landing centres increases.

The survey adopts a two-stage sampling design with the day as the primary sampling unit and the number of trips as the secondary unit. Sampling is done once a week. On the sampling day, the number of craft engaged in fishing and the catch by species from sampled boats are recorded.

Total production is evaluated as follows. The sample catch, multiplied by the raising factor (raising factor—total number of boats operating/number of sampled boats), is multiplied by species, by boat type and by gear. Second, monthly production, estimated by multiplying total sample production and the raising factor (raising factor—total number of operating days\*/number of sampling days), is classified by species, by boat type and by gear (Form EL-2 is used).

(c) L-III survey (fishing village survey): This survey covers all marine fishing villages other than those covered under the L-II survey. The survey form is at Annexure 6. A large number of fisherfolk households, operating unpowered boats or having no boats at all, engage in small-scale fishery and the catches are landed all along the coastline. Not all the landing points are easily accessible.

The agriculture census conducted by the CBS in 1975 listed all fishing villages and the number of fisherfolk households in each of them. A DGF survey on marine villages (1974) also provided similar data. These data are used to plan the L-III survey.

This survey is based on "cluster sampling" with the marine village (landing place) as the sampling unit. Probability proportional to the size of marine fishing villages, is used to select sample villages in each district.

The L-III survey is a quarterly survey. Survey form SL-2 is used to list fishery households and fishing units. The estimated total quarterly production in a district (Form CL-6) is given by:

\* The existing system actually uses the total number of days in the month. But this will give accurate estimates only if fishing is done on all days of the month. It is, therefore necessary to use the number of operating days in the month. Annual production is estimated by summing monthly estimates.

Total catch in all sampled households in the district per trip, per fishing unit per quarter (Form SL-6) x Average number of trips/quarter (Form SL-6) x Total number of fishing units in sampled households (Form SL-6) x Raising factor.

Raising factor—total number of fishing households in the district/total number of households in the sample villages.

#### 2.6.1.2 Fishing vessel survey

A power boat card (Form SL-1) has been used since 1974 for motorized boats. The records contain: name of province, district and sub-district; card number and name of boat; type of engine (inboard or outboard); tonnage and horse power; material of construction of the boat; fuel type and name of engine; dimensions and year of construction; name and address of the owner, type of fishing gear used and fishing license number. Any changes in the record are required to be communicated to the DGF once a year. Listing of non-motorized boats is done on Form SL-2 as briefly discussed under the L-III survey.

#### 2.6.1.3 Survey of disposed catch and fishery commodities.

This survey aims at estimating the amount of catch disposed and the quantity of fisheries commodities produced by species. The amount of catch disposed of is estimated by multiplying total catch by the rate of disposal. The rate of disposal is obtained through district fisheries officers. Fisheries commodities production is estimated by multiplying the amount of catch disposed and the conversion rate. The conversion rate is obtained from enterprises engaging in fisheries commodities production.

#### 2.6.1.4 Economic Survey

The DGF did one fishery economic survey in the Sumatra area (1977) covering marine fisheries in Malacca Strait and the west coast of south Sulawesi. The methodology adopted was complete enumeration. The survey covered costs and earnings of fisheries enterprises to estimate production and profits; and the income and expenditure of small fishery households to determine the living and working conditions of small-scale fishermen.

#### 2.6.1.5 Fish marketing survey

The DGF undertook two marketing surveys in the Sumatra area (Aceh province) — one on the marketing of milkfish juveniles (1977) and the other on the demand and supply of fisheries products in the domestic market (1979), both in collaboration with the Faculty of Economics, Gajah Mada University.

The Directorate of Planning and DGF publish *fisheries statistics of Indonesia* (brought out annually for the past 15 years) and *international trade statistics of fisheries commodities* (published annually for the past eight years).\*

#### 2.6.2 Research data collection

A systematic sampling programme on tuna (catch, effort, and length frequency) has been implemented in the Padang and Banda Aceh areas by the Marine Fisheries Research Institute. This apart, there are no sampling programmes under implementation in the Sumatra area. Sampling programmes for scads and mackerels at Asahan, Belawan Larjsa, Lokh Sumawe and Banda Aceh, established under the Marine Fishery Resources Management project (RAS/81/051), appear to have been discontinued with the termination of that project.

#### 2.6.3 Suggestions for improvement

Though the current system is appropriately designed, a number of improvements are still required.

- Provincial fishery statistics bulletins are also available.

1. Survey forms now in use need to be simplified. The existing forms are often too detailed and complicated for use by fishermen or enumerators. False reporting, errors caused by misunderstanding and incomplete forms crop up frequently. Often, the DGF has to mail back the forms to the District Fisheries Office for rectifications, leading to delays in the transfer of data to the DGF.
2. There are not enough trained personnel for statistics collection in the District Fisheries Offices or in the Provincial Fisheries Service. For most enumerators, statistical enumeration is only a secondary responsibility as they have other duties to perform as well. Trained full-time enumerators are urgently required.
3. Fisheries economic and marketing surveys must be undertaken on a regular basis to provide the appropriate knowledge frame for planning and decision-making for fisheries development.
4. There are large discrepancies between statistics in the census reports and in the regional reports. Improved training of field officers would minimize these.
5. More precise and detailed investigations of the species composition of catches are required. Data must also be collected on the number of fishing trips by gear.
6. Total production is over-estimated because the number of days in the month is used as the raising factor instead of the number of actual fishing days in the month. This should be corrected.
7. There are reports that species have been wrongly identified. Field officers should be trained in species identification.
8. A regular research sampling programme for catch, effort and biological characteristics is required in Sumatra for which also a sub-station would be required.

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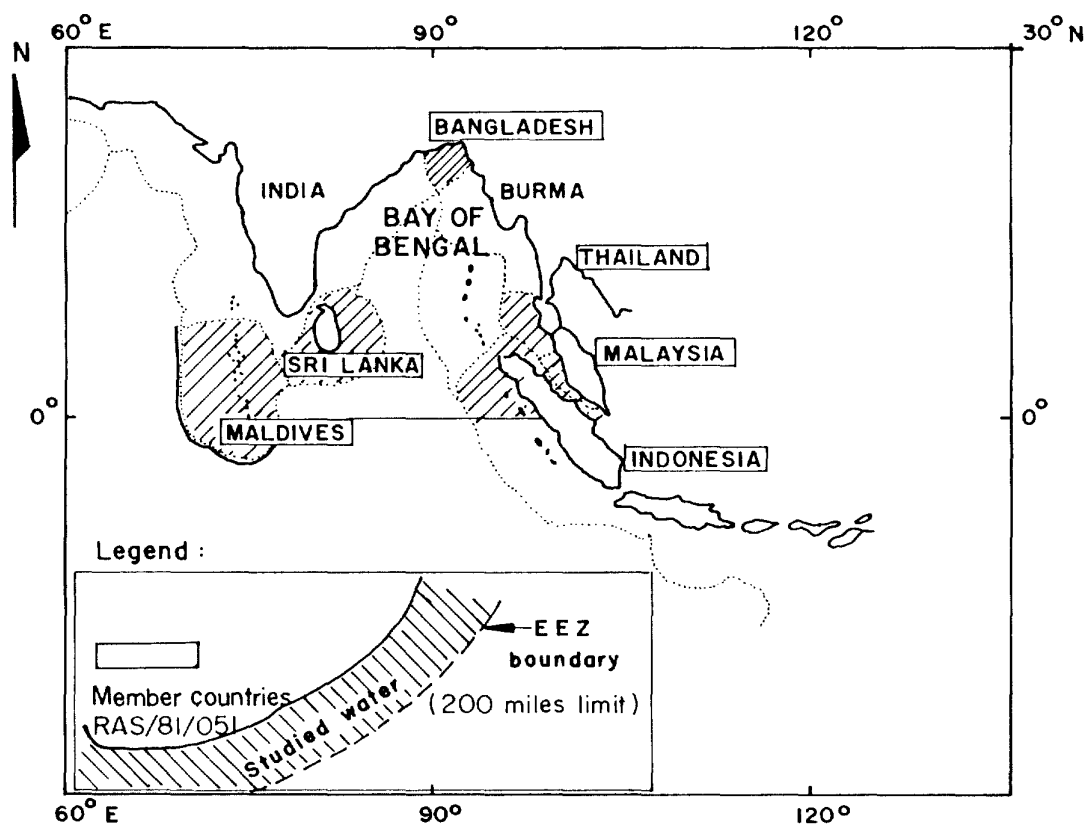


Fig. 1 Map of study area in the Bay of Bengal region (Based on Sivasubramaniam, 1985)

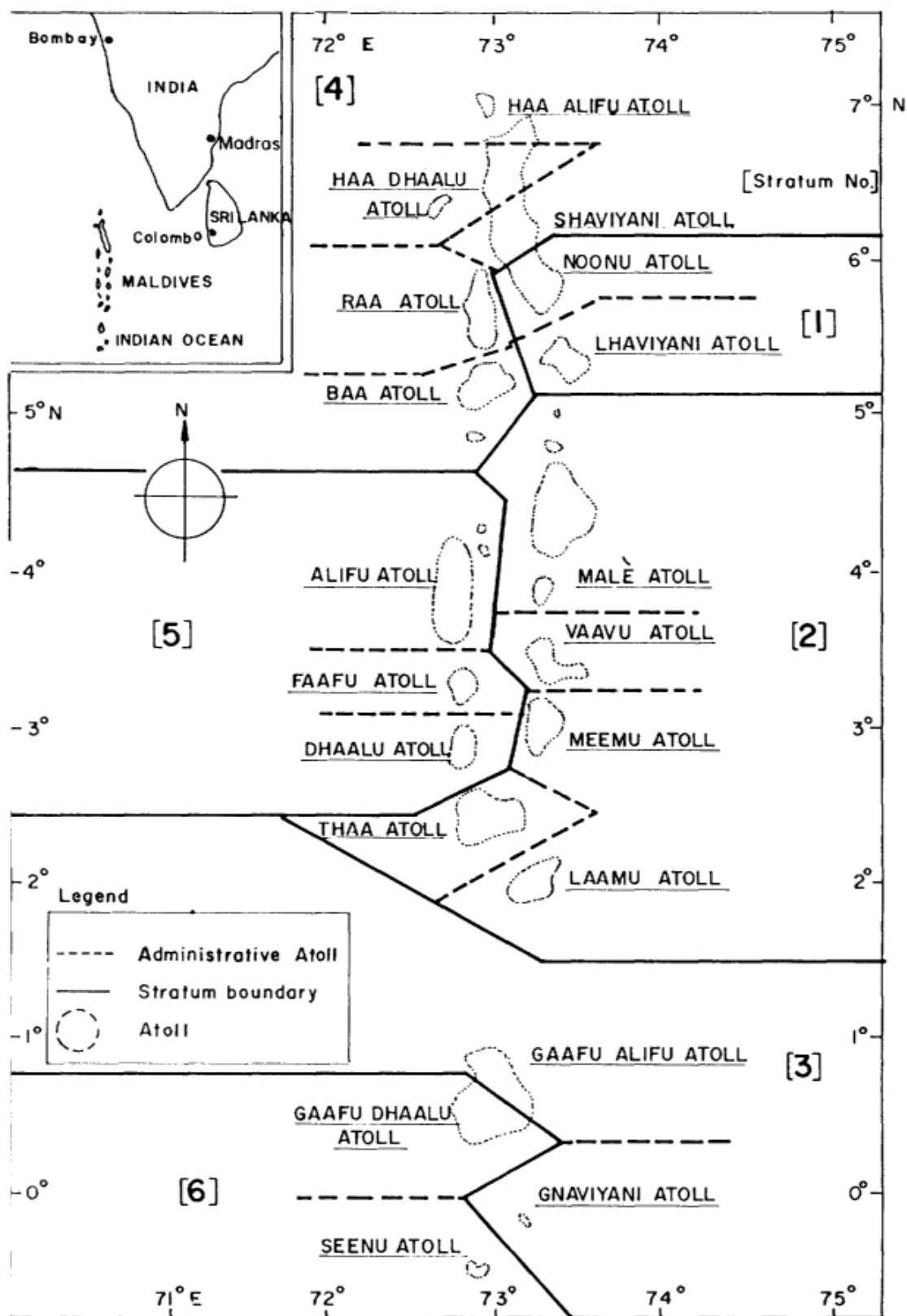


Fig. 2

Marine fishery statistical districts in Maldives.

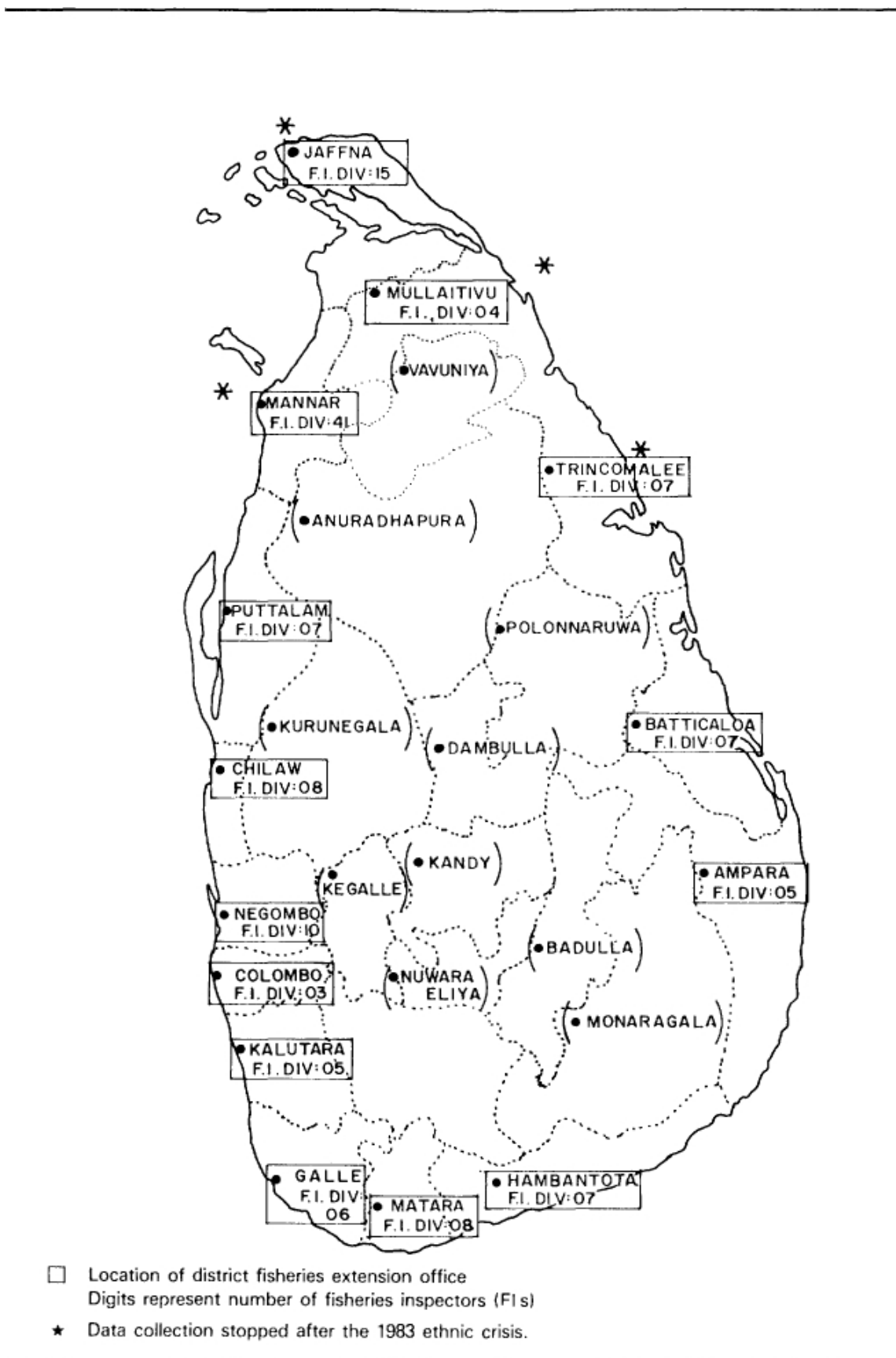


Fig. 3 Marine fishery statistical districts in Sri Lanka (Based on Ministry of Fisheries).

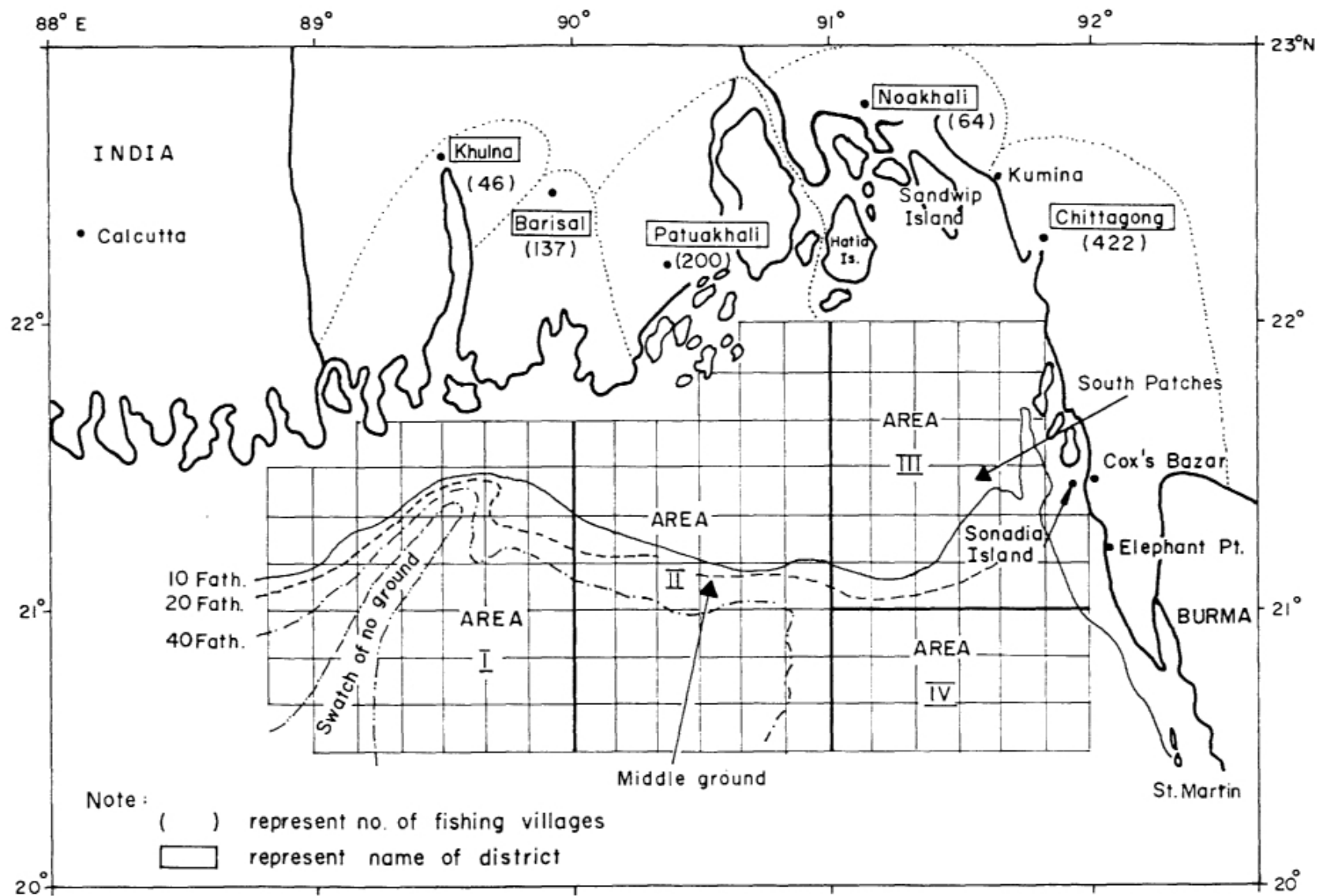


Fig. 4

Marine fishery statistical districts in Bangladesh.

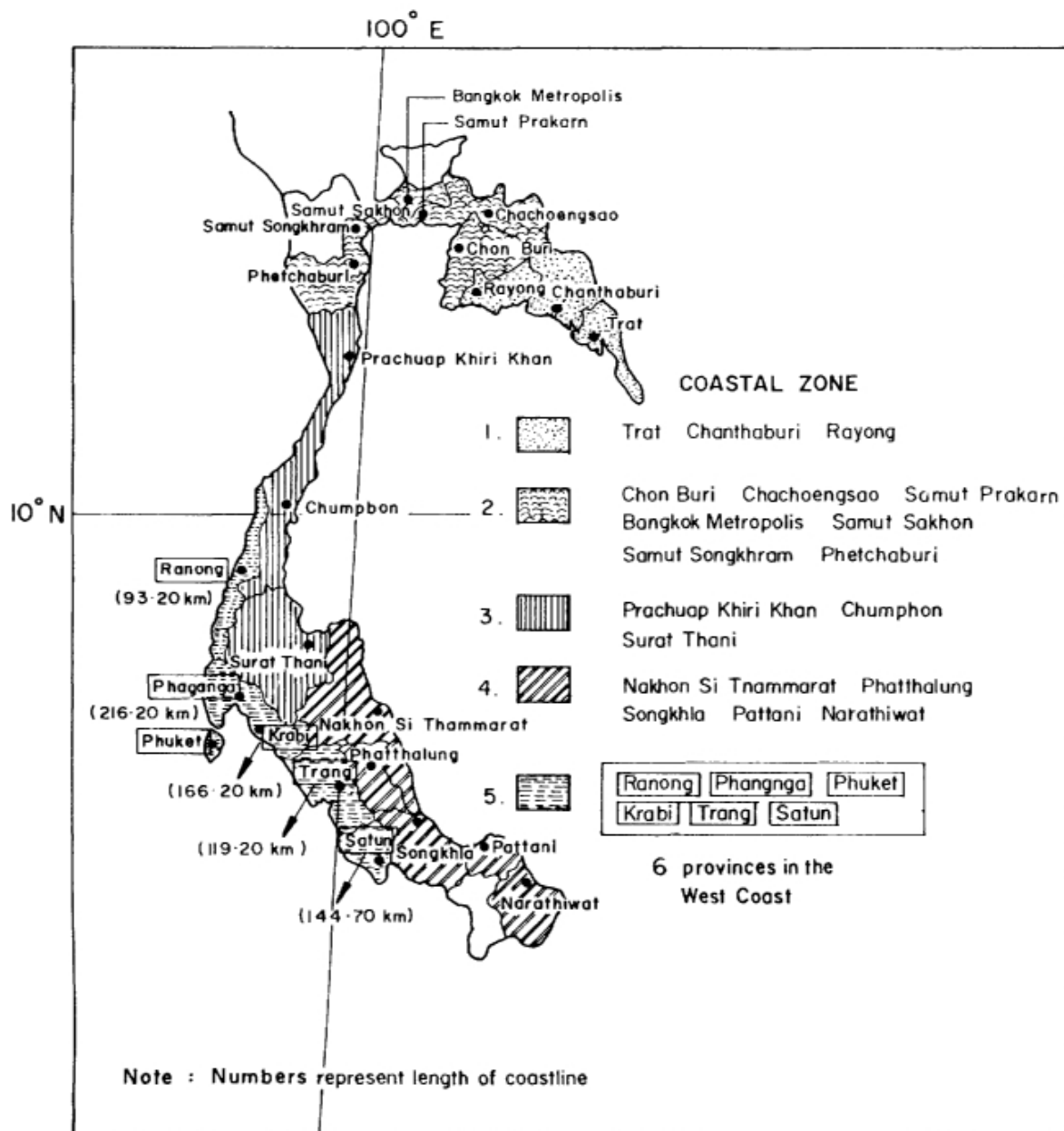


Fig. 5 Marine fishery statistical districts in Thailand (West) (From the Preliminary report : 1985 Census)



Fig. 6 Marine fishery statistical districts in Peninsular Malaysia.



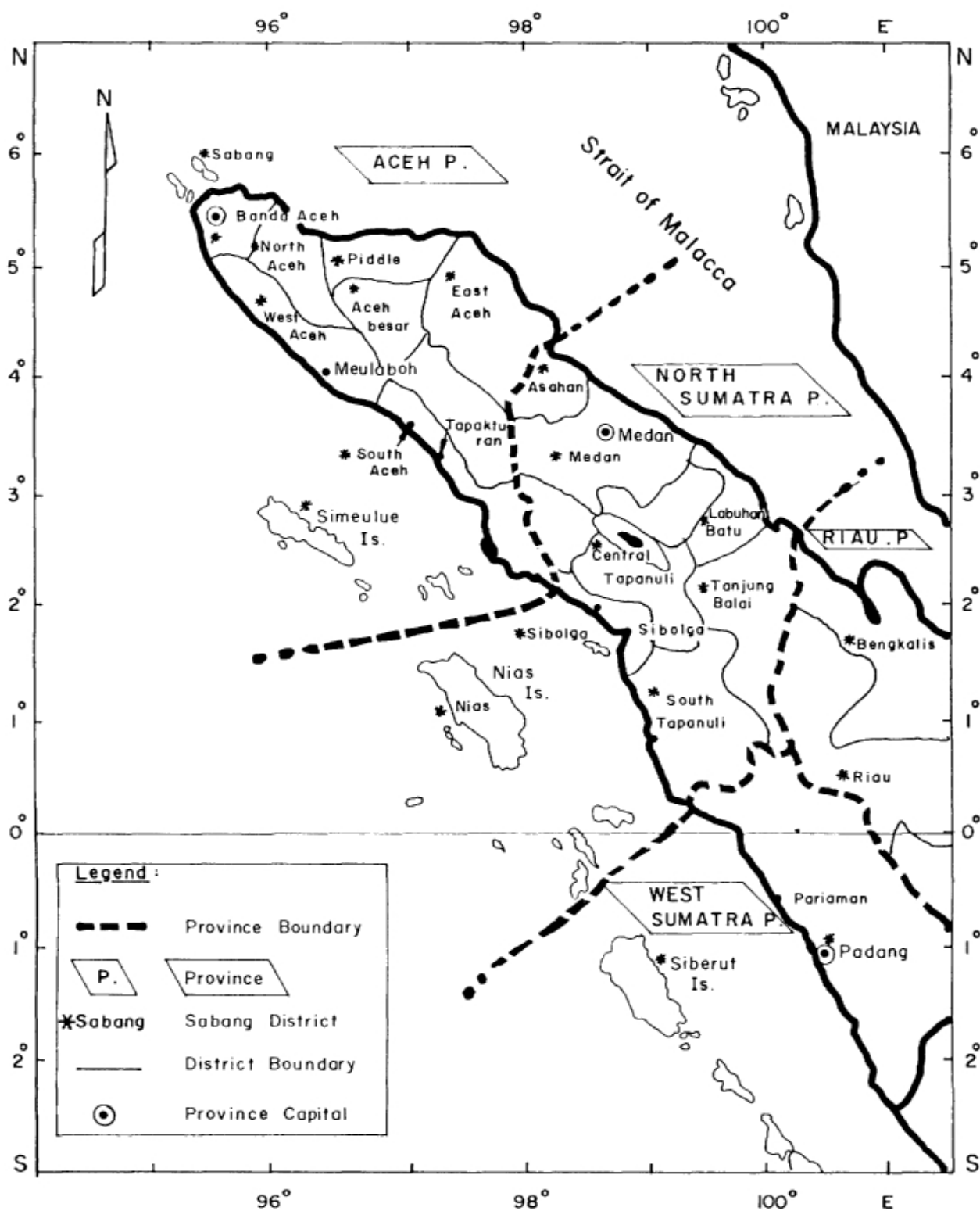


Fig. 7 Marine fishery statistical districts in Indonesia (northern Sumatra).

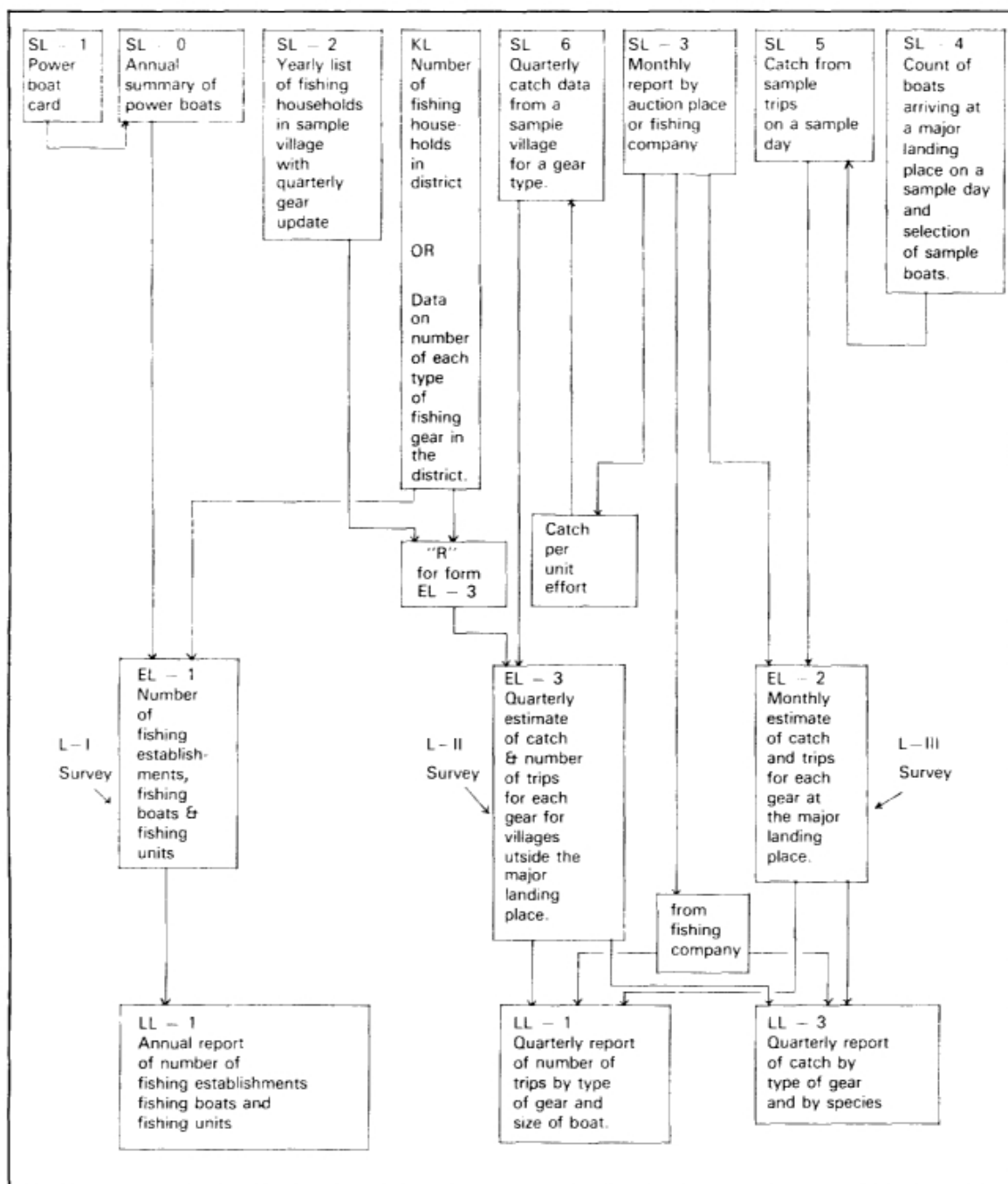


Fig. 8 Major components of the Standard System for fishing statistics (from Yamamoto, 1980)

# Annexure 1

## FRAME SURVEY FORM (SRI LANKA) (Bimonthly or Quarterly Tabulation)

DFEO Division

Selected landing centre

Enumerator

	Purse seines size — mesh size	Large mesh gillnet				Small mesh gillnet				Bottom set net				Long line				Bottom long line			
		Mechanized	Non-mechanized	Mesh sizes, No. of pieces of nets per boat	No. of fishermen	Mechanized	Non-mechanized	Mesh sizes, No. of pieces of nets	No. of fishermen	Mechanized	Non-mechanized	Size and mesh sizes, No. of pieces of nets	No. of fishermen	Mechanized	Non-mechanized	No. of hooks	No. of fishermen	Mechanized	Non-mechanized	Size and No. of hooks	No. of fishermen

34' + 38'

3½tonlBboats

17 . 23 ft. OB boats

Beach seine craft

Oru with outrigger

Oru without outrigger

Thonnies with outrigger

Thonnies without outrigger

Vallam with outrigger

Vallam without outrigger

Theppam

Kattumaram

Others

Average duration of each trip

Average number of trips/month

If migrating — How many

What period

Where to

## Annexure 1 (Contd.)

Pole and Line				Hand Line		Trawl		Beach Seine		Stake seine net		Traps			
Mechanized	Non-mechanized	No. of poles used	No. of fishermen	Mechanized	Non-mechanized	Size and no. of hooks	No. of fishermen	Mechanized	Non-mechanized	Net size and mesh sizes	No. of fishermen	Mechanized	Non-mechanized	Size and no. of traps	No. of fishermen

## 33

- 1) Others — Specify e.g. **Liftnet** for line bait; scoopnets with lures for flying fish squids etc.
- 2) Specify — **e.g. castnet, tidal traps harpooning etc.**
- 3) Specify — **Handpicking/diving for holothurians, lobsters, chanks oysters etc.**

**Mechanized**

Annexure 2

RECORD FORM FOR DAILY LANDINGS IN THE SELECTED CENTER (SRI LANKA)

DFEO Division :  
Selected landing centre :

Type of Fisheries :  
IB 30' /30' /OB-FRP17 to 23 ft/OB-Traditional  
  
NM/BS/No craft

Date  
Total no. of the same type of boats  
operated l

Boat sampled	1	2	3	4	5	6	7	8	9	10
Identification of boats										
Type of gear lname of gear/mesh size etc.)										
No. of pieces of nets/hooks										
No. of fishermen										
Time of departure-arrival										
Area of fishing										

Estimations

Average  
Price per kg.

Fish varieties

Weight in Kg.

2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										
15.										
16.										
17.										
18.										
19.										
20.										

### Annexure 3

#### DATA COLLECTION FORM FOR CATCH ASSESSMENT SURVEY IN MARINE ARTISANAL FISHERIES (BANGLADESH)

Form — M1 : Sample Catch Record

District .

Date

Day

Month

Year

Upa Zila

Survey Office

Landing center or Fishing Village .

Type of  
gear used

No. of all  
landings

No. of  
sample landings

Serial No.

No. of fisherman on board

Fishing boat moterized/non-m.

Local name of gear used

No. of days of this trip

No. of trips during past 15 days

No. of days on the sea during past 15 days

No. of setbag nets

Catch by species

07 Hilsa

08 Bombay duck

09 Indian salmon

10 Pomfret

11 Sharks\_&\_rays

12 Jew\_fish

13 Snapper

14 Mackerel

15 (Specify)

16 Large\_shrimp

17 Small\_shrimp

18 Miscellaneous

Total

Producers

price in

1k. Kg.

## Annexure 4

### REPORT FORM FOR DEEP SEA FISHING TRAWLER (BANGLADESH)

(Official use only)

#### INSPECTION/OBSERVATION REPORT OF DEEP SEA FISHING TRAWLERS (Official use only)

Date of inspection :

1. Name of the trawler inspected
2. Name and address of the owner/company
3. Type of trawler : Shrimp trawler/Fish trawler/Mixed trawler
4. Gross tonnage \_\_\_\_\_ tons
5. Whether possessing valid fishing license : Yes/No

#### OBSERVATION

6. (a) Date of departure for the last fishing trip \_\_\_\_\_
- (b) Date of arrival from the last fishing trip \_\_\_\_\_

7. Number of actual fishing days \_\_\_\_\_

8. Average number of hauls per day: \_\_\_\_\_
- Average hours of each haul per day \_\_\_\_\_

10. Catch data of the last fishing trip

(a) *Shrimp*

Species	Weight in Kg.	
	H.L.	HO.
<u>Tiger shrimp</u>	_____	_____
<u>White shrimp</u>	_____	_____
<u>Pink shrimp</u>	_____	_____
<u>Brown shrimp</u>	_____	_____
<u>Small shrimp</u>	_____	_____
<u>Lobster</u>	_____	_____
<u>Shrimp total</u>	_____	_____

9. Fishing ground

Latitude \_\_\_\_\_ N.

Longitude \_\_\_\_\_ E.

(b) *Fish*

Species	Weight in Kg
<u>Pomfret</u>	_____
<u>Indian salmon</u>	_____
<u>Snapper</u>	_____
<u>Grun</u>	_____
<u>Flat/sole fish</u>	_____
<u>Catfish</u>	_____
<u>Mackerel</u>	_____
<u>Tuna</u>	_____
<u>Sharks/rays</u>	_____
<u>Squids/Cuttlefish</u>	_____
<u>Others</u>	_____
<u>Fish total</u>	_____

11. Number of shrimp nets used

Mesh size at cod-end : \_\_\_\_\_ mm.

Number of fish nets used

Mesh size at cod-end : \_\_\_\_\_ mm.

Length of head rope \_\_\_\_\_ M.

Gear used: Single/Double

12. Number of officers and crew on board :

*Local*

*Foreign*

Officer

Crew

Total

13. Expected date of departure for the next fishing trip

14. Remarks :

Name and signature of inspecting officer

Date



## ESTIMATION FROM EL-2

Name of Major Landing Center

Month

Ratio Estimation ☐ RE

Simple Estimation ☐ SE

National Name

[illegible]

RE: From Form AL-3. SE: Please calculate based on sample total

3. Estimation of Total catch (This T is entered into 1 above)

Estimated No. of  
Tripe(2) x R

(2)

(3)

3.1 RatioEstimation:  $T \quad Y_x \quad B = X$   
 $A$

Note: Y to be taken from SL-3.

### 3.2 Simple Estimation: $T = B \times R =$

$$\text{Raising factor } R = \frac{\text{Total No. of Days in a Month}}{\text{No. of Sample Days}}$$

## 4. Conversion of Local Name of Species into National Name and Rounding of Kg. Figure into Ton Figure

[illegible]

Annexure 6

SURVEY FORM (L-III): ESTIMATION OF NO. OF TRIPS AND TOTAL CATCH (INDONESIA)

ESTIMAT(ON FORK EL-3]

Province District  
Year Quarter

Type of Fishing Gear  
Local Name  
National Name

2. Estimation

Name of Sample Village	No. of Trips by Size of Boat				Catch by species (Local Name)											
III	—	(2.11)	(2.21)	(2.3)	(2.41)	(3.1)	(3.2)	(3.31)	13.41	(3.51)	13.61	(3.7)	(3.81)	(3.91)	13.10)	(3.11) 13.12)

38

Sample Total (AI

Estimation for District  
(AI x R

From Form KL

Raising factor : R = 
$$\frac{\text{Total No. of Fishing Establishments throughout District*}}{\text{No. of Fishing Establishments throughout Sample Village}}$$

3. Conversion of Local Name of Species into National Name and Rounding of Kg Figures into Ton Figures

Total By National Name of Species

catch in Kg.  
catch in Ton

## *Publications of the Bay of Bengal Programme (BOBP)*

The BOBP brings out six types of publications.

*Reports* (BOBP/REP/....) describe and analyze completed activities such as seminars, annual meetings of BOBP's Advisory Committee, and projects in member-countries for which BOBP inputs have ended.

*Working Papers* (BOBP/WP/...) are progress reports that discuss the findings of ongoing BOBP work.

*Manuals and Guides* (BOBP/MAG/...) are instructional documents for specific audiences.

*Miscellaneous Papers* (BOBP/MIS/...) concern work not originated by BOBP—but which is relevant to the Programme's objectives.

*Information Documents* (BOBP/INF...) are bibliographies and descriptive documents on the fisheries of member-countries in the region.

*Newsletters* (*Bay of Bengal News*), issued quarterly, contain illustrated articles and features in non-technical style on BOBP work and related subjects.

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