

FISHERY AND AQUACULTURE STATISTICS IN ASIA

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**Volume II
FISHERY AND AQUACULTURE STATISTICAL
SYSTEMS AND PROGRAMS
(Papers Presented at the Workshop)**

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FISHERY AND AQUACULTURE STATISTICS IN ASIA

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SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
Office of the Secretary-General

FOREWORD

Fishery statistics is the basis for sound management of fishery resources and fishery policies planning and formulation. Fishery statistical systems in most Asian countries however, have not been receiving the proper attention it deserves, in spite of the various fora that emphasized the need to improve data compilation and application. The UN Conference on Environment and Development (UNCED) highlighted the need for fishery statistics, drawing the attention of coastal states to improve their national capacities in collecting, analyzing, and processing fishery statistics for effective resource management. The 1995 UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks as well as the 1995 Code of Conduct for Responsible Fisheries also recognized the need for reliable fishery statistics specifying the minimum essential data requirements in resource management considering the available resources.

SEAFDEC and FAO have continuously worked together, starting in the 70s, towards improving the collection, processing and dissemination of fishery statistics in Asia. Since then, considerable progress in these efforts has been accomplished by these organizations. The 1997 FAO/SEAFDEC Regional Workshop on Fishery Statistics was the ninth of a series of workshops on fishery statistics organized by FAO and SEAFDEC since 1976. One very significant achievement of this collaborative effort is the automation of data compilation and analysis which is already in progress in the region, although in some countries computerization is still at some stages of development.

Another development is the collection of aquaculture and socio-economic statistics which has already started, making the compilation of fishery statistics very comprehensive. It is also envisaged that the compilation of national economic accounts would soon be realized to be used as basis for the systematic and statistical description of the contribution of fisheries to a country's economy. Nevertheless much remains to be done. These developments, together with the improvement of the compilation of artisanal and aquaculture statistics, are captured in this Proceedings of the 1997 FAO/SEAFDEC Regional Workshop on Fishery Statistics.

The Proceedings comprised two volumes, the Report of the Regional Workshop as Volume I while Volume II contains the papers presented at the Workshop. The Report in Volume I also includes the recommendations raised during the Workshop, directed for national action and those directed for global action.

In the organization of the Workshop and the Proceedings, SEAFDEC is thankful to FAO for their continuous support, and to the participating countries as well as the regional organizations for the valuable information that went into the Proceedings.

Lastly, special gratitude is due to *Dr. Veravat Hongskul*, Senior Fishery Officer of the FAO Regional Office for Asia and the Pacific and to *Dr. Richard Grainger*, Senior Fishery Statistician of FAO Fisheries Information, Data and Statistics Unit, for their effort in organizing the Workshop and advice in the publication of the Proceedings. Also to *Mrs. Virgilia T. Sulit* and her assistant, *Miss Eileen Gayamat*, of SEAFDEC Aquaculture Department in the Philippines for the preparation of the text that went into the two volumes of the Proceedings.

To all those who, in one way or another, contributed to the publication of the Workshop proceedings, SEAFDEC is very thankful. On behalf therefore of SEAFDEC, I wish to thank everybody for their cooperation during and after the Workshop.



UDOM BHATIYASEVI
Secretary-General

FISHERY AND AQUACULTURE STATISTICS IN ASIA

EXECUTIVE SUMMARY

The FAO/SEAFDEC Regional Workshop on Fishery Statistics was convened by the SEAFDEC Secretariat and FAO in Bangkok, Thailand from 19 to 21 August 1997, in order to review the current status of fishery and aquaculture statistics in Asia; recommend ways and means to improve the collection, compilation, and dissemination of fishery and aquaculture statistics; and discuss regional efforts in strengthening the application of statistics in the region. The Workshop, attended by over 50 participants, was organized in conjunction with the First Session of the APFIC Joint Working Party on Fishery Statistics and Economics which was also held in Bangkok from 22 to 23 August 1997.

In reviewing the national fishery and aquaculture statistical systems in the region, 12 country papers were presented indicating the current status, constraints encountered in compiling statistics, and efforts planned for the improvement of collecting, compiling and disseminating statistics. The summary of issues raised by the participants indicated the need to harmonize and standardize concepts and methodologies for the collection of capture fishery and aquaculture statistics.

The participants also indicated the need to collect data on fish processing and trade as these are often lacking. The need to breakdown the number of fishers into either full-time or part-time in order to account for the total employment in the fishery sector, and also to breakdown the number according to gender, and the need to improve the accessibility and availability of statistics to the end users, were also raised. The participants however emphasized that these issues can be dealt with in their respective countries with the guidance and technical assistance from regional and international organizations concerned with fishery and aquaculture statistics in the region.

The FAO Fishery Information, Data and Statistics Unit (FIDI) which compiles global fishery statistics obtained from national reporting offices and other sources, has developed fishery databases and statistical software for worldwide application. The ARTFISH/ARTSER for example, was developed by FIDI in 1994 for processing of data from sample surveys. In compiling fishery statistics, FAO noted that some data reported by national offices sometimes lack reliability. Whenever possible, FIDI verifies these data from other sources. Thus, in order to improve the system of reporting, the participants asked FAO to make available to the region their fishery statistical software, specifically ARTFISH/ARTSER. Moreover, in order to make the application effective on a wider scale in the region, they stressed that adequate training must be provided.

SEAFDEC, for its part, published annually since 1978, the Fishery Statistical Bulletin for the South China Sea Area with the objective of providing reliable and comparable fishery statistics with standardized definitions and classifications. The compilation of the data for the Bulletin is however, constrained by the timing and long delay in returning the questionnaires by participating countries. The submission of incomplete information and incompatible standards and procedures by the participating countries led to the reduced value of the statistics to the users.

For the improvement of the compilation of data for the Bulletin, it was suggested that information on disposition of fish be included and that a pilot study be undertaken by the national offices in order to compile statistics on processing and post-harvest activities. The need to organize a working group to harmonize fishery statistics and relate this with statistics from other sectors of the national economy was suggested.

The SEAFDEC Department in Malaysia compiles and publishes the catch-effort statistics for the South China Sea area, based on questionnaires sent annually to participating countries such as Brunei Darussalam, Taiwan, Hong Kong, Indonesia, Cambodia, Malaysia, the Philippines, and Singapore. The compilation of data is constrained by the delayed, incomplete and oftentimes absence of returns. The participants indicated that the absence of data may not necessarily be due to their lack of interest in the activity. The collection of catch-effort statistics on a massive scale including program preparation and training of staff usually takes a lot of their time, manpower and financial resources. The participating countries however, re-affirmed their commitments to participate more actively in the collection of catch-effort statistics.

In the absence of reported capture and aquaculture production statistics for Asia and the Pacific, FIDI makes estimates using the best available information in addition to data submitted by countries. An analysis by FIDI of the trend for the period 1984 - 1995, indicated an increasing proportion of estimated rather than reported data for capture fisheries. A further serious problem is the lack of species definition for capture fisheries compared with aquaculture, or when species composition are available in some countries, these may not be reported to FAO. In order to improve the situation, it was suggested that field guides be developed by national offices tailored for their requirements. Other suggestions raised emphasized that computerization needs to be intensified, capabilities in application of information technology and data collection be improved, and decentralization of operations be facilitated. In order to accomplish these, it was suggested that coordinating bodies may be organized at the national and regional levels.

The SEAFDEC Department in Malaysia is also responsible for the collection of tuna statistics in the Southeast Asian region indicated as FAO area 71. The collection involves tuna and tuna-like species, such as tuna and bonitos, seerfishes, and billfishes, in seven participating countries, namely, Brunei Darussalam, Singapore, Thailand, the Philippines, Vietnam, Malaysia, and Indonesia. These countries have designated liaison officers who are responsible for the collection of tuna fishery statistics in their respective countries. In its initial efforts, SEAFDEC encountered several problems including the delayed response to the requirements for tuna statistics: tuna landings reported were not according to species, some liaison officers were not from statistics offices, and species identification for early stages of tuna species especially for yellowfin and big-eye were not available. In order to tackle the problems, a technical meeting of the liaison officers will be convened by SEAFDEC in Malaysia in December 1997. In order for the comprehensive statistics to be maintained, it was noted that data should also be collated for non-SEAFDEC member countries.

FAO, while formulating the Supplement on Aquaculture for the World Census of Agriculture Programme for 2000 (WCA 2000), proposed a revision of the present definition of aquaculture for statistical purposes. Although the participants raised some apprehensions about the proposed revised definition, specifically the inclusion of crocodiles, alligators and amphibians, they agreed to consider the new definition in order to cover in the census and regular surveys, all aspects of cultured organisms in the water as well as the activities and ownership of the reared organisms.

The Supplement has been reviewed as far as methodologies and structural information are concerned through expert and technical consultations convened by FAO. It was noted however, that the new definition of aquaculture proposed by FAO may result in delayed aggregation of capture and aquaculture statistics since some countries may need to revise the questionnaires based on the new definition. The participants considered the inclusion of the Supplement in WCA 2000, depending on their national priority. FAO will publish the Supplement for worldwide dissemination before the end of 1997.

The participants recognized the need to compile and analyze socio-economic data for the fishery sector for management purposes. They also recognized the need to determine the minimum data to be collected on regular basis. Such data may be collected by sample surveys based on the frame provided by the agriculture census. FAO also presented a case study on the collection of national economic accounts for planning and management purposes. The compilation of national accounts can be facilitated through the fishery statistics data that has been compiled by the participating countries.

FAO and SEAFDEC, together with other organizations in the region, noted the increasing concerns on the lack of timeliness and reliability of the data reported by the participating countries. In order to overcome such problems, they suggested that fishery statistics capabilities in the region be strengthened at the national level together with the development of regional mechanisms for data exchange. Areas for regional cooperative action were identified which would adopt and apply common methodologies and tools in compiling fishery and aquaculture statistics.

The participants after raising the major issues relevant to their efforts in compiling and processing the data, identified actions that should be taken at the national and regional levels. From the proposed actions, the following recommendations were formulated by the participants, directed to their respective countries as well as to regional and global organizations concerned with fishery statistics.

I. For National Action

- 1.1 In order to improve coverage and consistency, it was agreed as a priority effort that, disposition of fish production for food and non-food uses should be monitored and reported. This activity shall however need the guidance and assistance of international and regional organizations concerned with fishery statistics.
- 1.2 In connection with 1.1, it was recognized that statistics on commodity production and trade are required in order to construct national food balance sheets for assessing per caput fish supply. In addition, fish consumption statistics should also be obtained through surveys.
- 1.3 In order to make reliable statistics available to the users readily and timely, data processing should be automated to speed up the collation and dissemination of capture fishery and aquaculture statistics. Software packages such as ARTFISH were deemed useful.
- 1.4 To facilitate accessibility and availability of fishery statistics, national interagency communication as well as liaison with international bodies on statistical matters be improved. This could be accomplished through the establishment of national working group(s) comprising fisheries and other statisticians, as well as technical specialists.

- 1.5 Noting the poor responses by participating countries to the questionnaires on catch and effort statistics, countries were encouraged to fulfill their commitments to this activity of SEAFDEC/MFRDMD.
- 1.6 In view of the lack of definition for species in statistics, the difficulties in species identification at primary data collection level and the need to improve species details in statistics, particularly for the economically important species, countries were asked to give attention to the preparation of local taxonomic field guides similar to the field guide prepared for Myanmar.
- 1.7 Recognizing the need for the harmonization of fishery statistics, careful attention be given to the design of survey forms for primary data collection taking into account the local characteristics. Primary data collected should be verified locally by the enumerators.
- 1.8 To respond to the need for harmonized aquaculture statistics, countries were asked to take note of the need to collect aquaculture structure data according to the Supplement on Aquaculture to the WCA 2000.

II. For Regional and Global Action

- 2.1 For the collection of tuna statistics, a species identification guide for young tuna in the region be prepared in order to overcome the problem of identifying the species of tuna at their early stages of development, especially for yellowfin and bigeye tunas.
- 2.2 For consistent statistics on production and post-harvest processing, guidelines to standardize the collection of statistics on capture fishery production as well as the production of fishery commodities at national level consistent with international standards, be prepared.
- 2.3 In relation to the need for quantitative structural information on aquaculture, the guidelines contained in the Aquaculture Supplement being prepared by FAO for the WCA 2000 be made available as soon as possible for worldwide implementation.
- 2.4 As noted during the discussion, FAO was asked to review and revise, where necessary, its FISHSTAT AQ questionnaire to include necessary information such as specifications of the life stages in hatchery outputs.
- 2.5 In order to improve the quality and utilization of fishery statistics in the region, regional organizations and international bodies, in collaboration with FAO, were asked to initiate appropriate activities to support and complement national efforts on fishery statistics. In this relation, special attention should be focused on the following:
 - a) facilitating the application and adoption of common methodologies and tools such as ARTFISH/ARTSER package;
 - b) development of software for compilation, processing and analysis of aquaculture statistics; and
 - c) facilitating the improvement of statistics for fishery management and framework as recommended by APFIC/COMAF, particularly for catch and effort statistics.

NATIONAL FISHERY AND AQUACULTURE STATISTICAL SYSTEMS

A review of the fishery and aquaculture statistical systems in Asia was made from the national reports presented by 12 participating countries, namely, Brunei Darussalam, Bangladesh, China, Indonesia, Japan, Korea, Malaysia, Myanmar, the Philippines, Taiwan POC, Thailand, and Vietnam. The reports focused on the current status, constraints encountered in compiling statistics in their countries, and plans for the improvement of collecting, compiling and disseminating statistics.

The Workshop assessed the fishery and aquaculture statistics in the region, with a view of recommending ways and means to improve their compilation and dissemination. The summary of issues raised indicated the need to harmonize and standardize concepts as well as methodologies for the collection of capture fishery and aquaculture statistics. During the discussion, it was emphasized that such issues can be dealt with in the respective countries with the guidance and technical assistance from regional and international organizations concerned with fishery and aquaculture statistics in the region.

Generally, fishery and aquaculture statistics in the region are collected annually and compiled into national yearbook of fishery statistics. While before, the annual fishery statistics refer to catch statistics only, recently, the current efforts of the participating countries already include compilation of information on aquaculture and fishery economics although at a low scale.

The Workshop hoped to encourage participating countries to intensify the collection and compilation of aquaculture and socio-economic statistics and that the collection of information on fish processing and trade be started. This would make their national yearbooks of fishery and aquaculture statistics very comprehensive and responsive to their needs for improved management of their fishery and aquatic resources. In order to keep abreast of recent developments, the countries were also encouraged to relate fishery and aquaculture statistics to their national economic accounts.

FISHERIES STATISTICS IN BRUNEI DARUSSALAM

by

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1. INTRODUCTION

Fishery statistics in Brunei Darussalam, in one form or the other, have been collected by the Department of Fisheries since the 1940s. That was when the first ever demersal fisheries survey was conducted. The only fishery statistics collected during the following years were on demersal fisheries. In the early 1970s, when the Fisheries Act was enforced, statistics on the number of fishing gear licenses were collected. In the early 1980s, a number of statistics were collected such as the catch and effort data of artisanal fishermen, aquaculture statistics, processing statistics as well as data from major wet markets focusing on the amount, prices of marketed fish either from the local fishermen or imported. In 1984, the collection of statistics on commercial fishing was started.

The Department of Fisheries has been using fishery statistics in the formulation of fishery management and development policies as well as for sectoral development. The Department also saw a number of development in the collection of statistics for management purposes as well as for fulfilling the requirements of SEAFDEC and FAO.

2. DEPARTMENT OF FISHERIES: RESPONSIBILITY AND STATISTIC COLLECTION

The Department of Fisheries has a mission to develop and manage Brunei Darussalam's fishery resources and potentials to their optimum level with emphasis on increasing the supply of quality of fish, undertaking research and development on new and value-added products, exploring niche markets and competitiveness of the industry, and intensifying human resource development.

With the above mission, the main focus of the Department is to increase the supply of quality fish for specialized markets, through continued but gradual issuance of commercial fishing licenses. Production of quality fish can also be attained from aquaculture activities while quality fish products through processing for the niche markets abroad.

In order to support this mission, the Department operates a number of functional sections (Fig. 1) of which five sections are responsible for the collection of statistics. The attainment of the above mission of the Department can be derived from the statistics collected by the following five sections:

The Marine Fisheries Section is responsible for the collection of statistics on fishing activities in the marine waters of Brunei Darussalam including:

- fishing establishments;
- fishing boats/vessels;
- catch in quantity by fishing gear, by species;
- effort data, which include:
 - number of fishing trips/month;
 - number of hauls/sets, gill nets, traps etc. per day; and
- revenue and expenses by operators.

The Aquaculture Section collects statistics on aquaculture activities, small or commercial scale, which include:

- aquaculture establishments by type of culture;
- production by species, by establishment, by area cultured;
- area under culture;
- seed production by species; and
- revenue and expenses.

In addition to the Enforcement Section in implementing the Fisheries Acts and Regulations, the section is also collecting statistics on:

- number and type of fishing boats/vessels in terms of dimensions, tonnage, engine horsepower;
- number of fishing gears by village/district;
- number of fishermen by age groupings, by status (full-time and part-time);
- imported and exported seafood by species by month; and
- imported ornamental fish by species by month.

The Post-Harvest Section is responsible for the collection of statistics on:

- Processing establishments;
- Production of fishery products by operator, by product type; and
- Revenue and expenses for the processors.

The Marketing/Business Promotion Unit, combined recently, looks at the promotion of new fishery ventures. The marketing side of the unit has been collecting statistics on:

- Quality of fish markets by species, from local production and import;
- Price of fresh fish marketed by species from local production and import;
- Number of seafood trading establishments; and
- Wholesale and retail price of cultured fish.

3. EMPLOYMENT IN THE FISHERY SECTOR

Table 1 shows the number of persons employed in the various sectors of fisheries. The number of full-time and part-time fishermen seemed to decline in number in recent years which may be due to the fact that the number represents only recorded and licensed fishermen. The Department, however, assumes that actually there may not have been much decline on the number of fishermen over the years. The total is usually around 1,500-2,000 fishermen.

The number of fishermen employed in the commercial fishery sector seemed to increase over the years since 1984. Meanwhile, the number of persons employed in the aquaculture sector is also increasing as more and more areas have been opened up for aquaculture ventures. In the processing sector, however, the number seemed to stabilize over the years because the number of commercial operators has not changed much. The number of small-scale processors may have increased but this has not been reported.

The fishermen employed by fishing ventures are mainly from Indonesia, Malaysia and Thailand. Apart from the owners and their family members, the local people do not usually engage in fishing activities because of better working conditions on land. For the aquaculture sector, skilled workers or technicians as well as non-skilled workers mostly come from the Philippines. The processing labor component mostly come from Malaysia, that is why the quality of the product is in accordance with HALAL before these are sold in the local markets.

The number of importers have increased over the years. This is due to increasing demand for fish which local production cannot cope. On the other hand, Brunei Darussalam started to export fish in 1994 mainly aquaculture products. Recently, the export also includes capture fishes which had started to over supply the local markets. The retailers in wet fresh markets have also increased together with the number of importers.

4. FISHERIES PRODUCTION

Table 2 shows the volume and value of the fishery production from 1991 to 1995 from the three main sectors of fisheries. There is a net increase in terms of volume and value over the years, which is due to the increased activities of these sectors. There has been an increased number of new operators as well as increased efficiencies of existing operators.

5. FISH MARKETED

Table 3 shows the amount and value of fresh fish being marketed in the major wet markets in the four districts of Brunei Darussalam from 1991 to 1996 for fishes produced/caught locally as well as those imported from various countries. These data however, may not reflect the actual statistics, due to the following reasons:

- there are a number of road-side fish outlets being opened up and operated, and the sources of fish sold are not known and not covered in this collection;
- not all locally produced/caught fish are being marketed in the major markets covered in the collection;
- the amount of fish for subsistence cannot be deduced directly from the production data due to the above reasons.

Nonetheless, in 1991 and 1992, the amount and value of fish being marketed have stabilized at 5,000 mt and B\$30 million (B\$1.00 = US\$0.65, 3 October 1997), respectively. This figure increased sharply in 1993 and stabilized at 6,000 mt and B\$36 million per year. This increase is mainly contributed by the increase in the number of commercial fishing and aquaculture ventures.

6. GROSS DOMESTIC PRODUCT (GDP) FOR FISHERY INDUSTRY

Table 4 shows the GDP for the main fishery sectors from 1991 to 1995. In capture fisheries, the GDP shows big increase from B\$ 5.4 million in 1991 to B\$ 24.7 million in 1995. The abnormality in 1994 may be due to statistical artifact because there was actually a drop in catches in 1991.

For aquaculture, the same increase is seen until 1994. Abnormality is seen in 1995 when there is an increase in the production from aquaculture activities. The increase in post-harvest (processing) sector is short-lived from 1991 to 1992 and then dropped in 1993 before picking up again. This tallies well with the amount produced for the year (Table 2).

Thus, the fishery GDP contribution in the country increased from 0.2% in 1988 to 0.5% in 1994 (Source: Ministry of Finance 1994).

7. CONCLUSION

The collection of fishery statistics in Brunei Darussalam generally covers all sectors for the management and development of the country's fisheries industry. Several minor adjustments may have to be undertaken as far as collection of statistics is concerned in order to comply with the requirements of SEAFDEC and FAO, which will be dealt with in near future.

It is important to collect accurate statistical data for the sound management of fisheries, in order to assess whether the supply for fish is declining and its demand increasing, world fisheries production may be on the brink of collapse, over-exploited or depleted. For Brunei Darussalam, fisheries is a very healthy industry when the production is well below the maximum allowable harvestable limit of 20,000 mt at 30%. The Department is actually embarking to increase production from the capture fishery sector to reduce the country's dependence on imported fish. The same goes for aquaculture, in order to complement production from capture fisheries. Brunei Darussalam is also joining this bandwagon by opening up new areas for aquaculture activities whilst maintaining the coastal resource environmental balance as far as possible. The processing sector is also increasing in importance especially with the increase in the number of capture fishery licenses, and the demand for quality and value-added products.

**FIGURE 1
 ORGANIZATIONAL STRUCTURE OF FISHERIES DEPARTMENT
 BRUNEI DARUSSALAM**

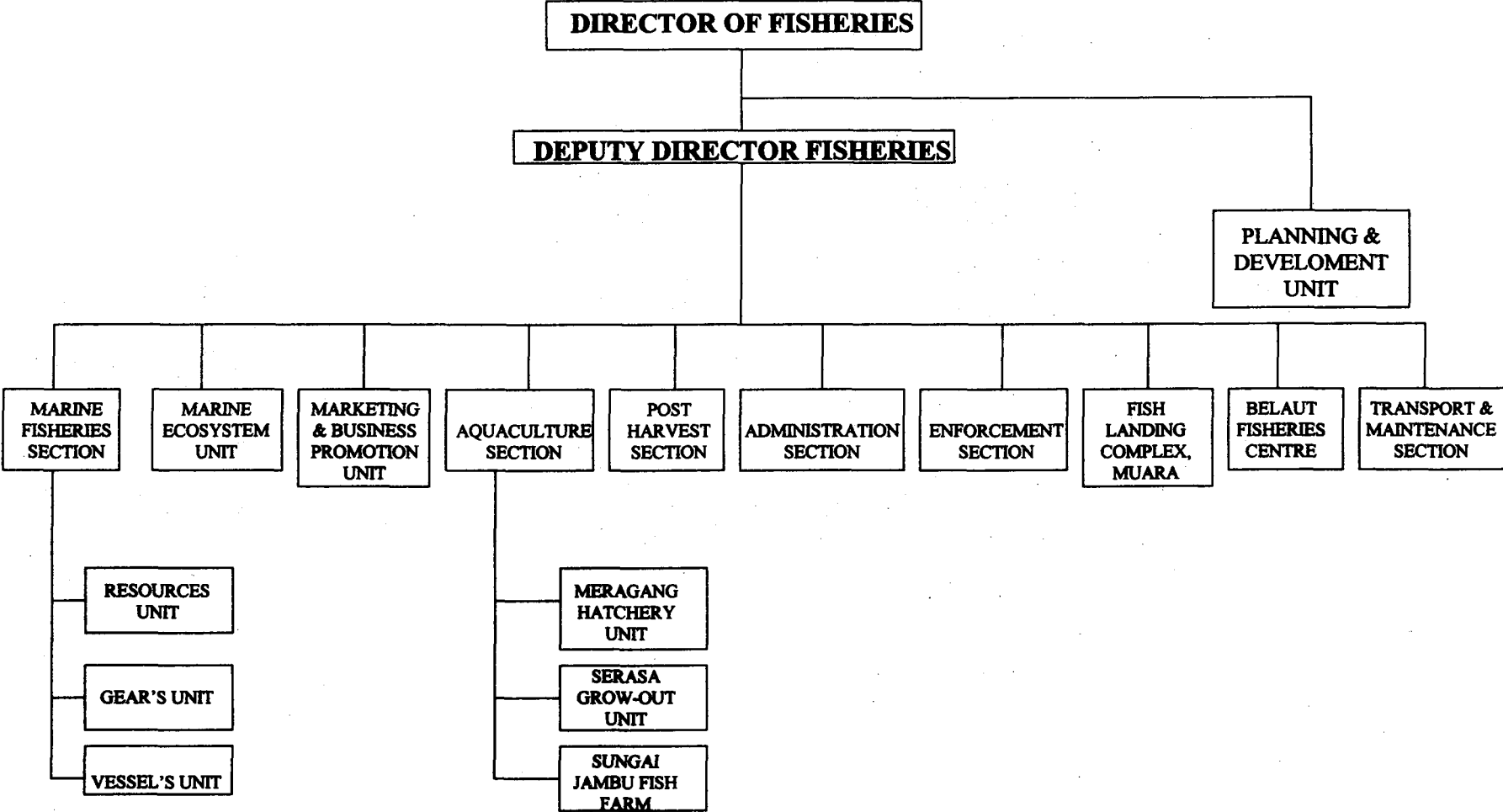


Table 1. Employment in the fisheries sector

	1991	1992	1993	1994	1995	1996
Fisheries						
• Full time	588	579	636	662	550	535
• Part time	1,227	1,412	1,225	939	795	637
• Trawlers	25	25	63	63	168	263
• Purse Seiners	36	36	36	36	-	-
Aquaculture						
• Coastal	21	21	38	43	60	72
• Inland	8	12	20	26	30	46
Post-Harvest						
• Processors	21	20	18	18	19	19
Importers	104	166	97	126	251	305
Exporters	-	-	-	-	3	8
Retailers	247	247	247	247	269	269

Table 2. Volume and value of fisheries production

	1991		1992		1993		1994		1995	
	VOLUME (mt)	B\$	VOLUME (mt)	B\$	VOLUME (mt)	B\$	VOLUME (mt)	B\$	VOLUME (mt)	B\$
CAPTURE	4,549	13.4 m	5,008	21.9 m	5,485	23.7 m	4,968	19.9 m	6,108	41.3 m
CULTURE	17	0.2 m	18	0.2 m	47	0.6 m	78	0.9 m	84	1.0 m
PROCESSING	137	1.3 m	160	1.5 m	131	1.2 m	133	1.2 m	165	1.8 m

Table 3. Fish marketed: volume and value

VOLUME IN MT

	1991	1992	1993	1994	1995	1996
LOCAL	1565	1685	1719	862	956	1439
IMPORTS	3447	3512	4962	5215	5189	4337

VALUE B\$ IN MILLIONS

	1991	1992	1993	1994	1995	1996
LOCAL	9.1	8.8	8.5	5.3	6.3	7
IMPORTS	18.9	20.3	27.4	32.1	31.6	29.3

Table 4. GDP for fisheries industry

	1995	1994	1993	1992	1991
CAPTURE	\$24.71 m	\$31.94 m	\$13.30 m	\$13.33 m	\$5.4 m
AQUACULTURE	\$0.23 m	\$0.31 m	\$0.20 m	\$0.09 m	(\$0.03 m)
POST HARVEST	\$0.58 m	\$0.51 m	\$0.24 m	\$0.40 m	\$0.32 m

Overall GDP for fisheries increased from 0.2% in 1988 to 0.5% in 1994 (EPU, Ministry of Finance)

FISHERIES AND FISHERY STATISTICAL SYSTEM IN BANGLADESH

by

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1. INTRODUCTION

Bangladesh has one of the richest fishery resources amongst the South East Asian countries and fish is the most important sources of animal protein for the rice eating people of Bangladesh. However, fish has become scarce recently while its price has increased tremendously, beyond the purchasing capacity of the common people.

Bangladesh with a total area of 147,570 square kilometers is a low lying country, relatively flat, comprising the deltaic plain of the Ganges, the Jumuna, the Brahmaputra and the Meghna systems. The country has numerous rivers and canals maintaining interconnecting channels. The contribution of fisheries to the economy of Bangladesh is substantial particularly with reference to food consumption, nutrition, employment and export. The fishery sector contributes nearly 5% to the GDP of the country. The total GNP at current market price is 1,361,632 million Taka (1 Taka = US\$0.025, 3 October 1997), and total GDP is 1,301,611 million Taka and GDP per head is Taka 10,660.

2. FISH POPULATION

The fishery sector provides part-time and full-time employment in primary, secondary and tertiary fishery related activities. These activities include fishing, aquaculture, fish trade, fish processing, and manufacture of fishing gear and fishing implements. The fishery sector provides full-time employment to 1.2 million professional fishermen and 11 million part-time fisherfolk which is about 10% of the total population. The structure of the national fishing fleets and fleet classification employed in fishery statistics is very limited. Only two research vessels, namely, R.V. ANUSHANDHANI and R.V. MACHHRANGA, are collecting data for stock assessment of shrimps, fish and other research works. The structure of the vessels is shown in Table 1.

3. FISH PRODUCTION

Historically, inland openwater was the major source of fish production in Bangladesh. It contributed about 90% of the country's fish production in the 1960s. Fish production is hampered due to natural and man-made causes, such as:

- a) unplanned flood control and irrigation projects for agricultural development avoiding fishery potentiality;

- b) continuous land erosion;
- c) water pollution;
- d) indiscriminate fishing by using harmful nets and equipment;
- e) lack of scientific and biological management of fisheries resources;
- f) over fishing to meet the demand of increased population;
- g) conversion of beel and flood plains into agricultural lands;
- h) damage of fish spawning and fishing grounds; and
- l) indiscriminate use of insecticides.

The country's fish production continued to drop to about 50% until late eighties, but it showed a very slow increasing trend since the 90s. The total fish production is shown in Table 2. Out of the total production of fish, about 97% is consumed locally while the balance is exported abroad. The annual local consumption of fish is shown in Table 3.

In Bangladesh, the amount of fish used for animal feed and other purposes is very negligible. The Bangladesh Fisheries Development Corporation (BFDC) is producing fish meal which requires about 1000 mt of trash fish annually. On the other hand, the Saudi Bangladesh Industrial and Agricultural Investment Company LTD. (SABINCO) is producing fish feed which requires about 2000 mt of trash fish.

The Fisheries Department did not import any fish for the past five years. But some private fishery farms imported about 500 million pieces of shrimp fry (*M. rosenberrgi* and *P. monodon*). On the other hand, about 3% of the total production of fish is exported abroad. The export of fish and fish products is shown in Table 4.

Total fish captured from inland water (rivers, beels, lake and flood lands) mainly by using nets (gear) - gill net, clap net, seine and drag net, lift net, cast net, longline, traps, set-bag net and others. In marine water the main gears used are - trawl net, gill net, seine net, set bag net, trammel net and other net and long line, etc. The share of the marine fish production using various fishing gear is shown in Table 5.

4. FISHERY POLICY TOWARDS AD 2010

The Government of Bangladesh recognizing the importance of the fishery sector, has the following objectives in its fishery program:

- a) to increase fish production and to improve nutritional standards;
- b) to expand employment opportunities in fisheries and ancillary industries;
- c) to improve the socio-economic condition of the fisherfolk, fish farmer and others engaged in this sector;

- d) to increase fish and shrimp exports;
- e) to improve environmental condition and public health;
- f) to increase the GDP of the country.

The national fishery goals are in consistent with the development plans of the country. These will require expanded use of aquaculture technology, increased investment, efficient institutional support, proper management of resources, and policy reforms.

The key elements of the national fishery development strategy are as follows:

- a) Inland fisheries should be given highest priority for development, promotion, conservation and management programs;
- b) Public sector to provide infrastructure facilities to the private sector to stimulate private sector investment;
- c) Fisheries institutions should improve skills through education, training, and resources mobilization
- d) NGOs should be given opportunity and encouraged to organize fishermen associations, and to be provided access to fishery resources;
- e) Special credit programs should be set-up through the NGOs and the Grameen Bank to cater to the credit needs of fishermen;
- f) Shrimp culture area to be developed and quality seeds should be made available;
- g) Extension and training activities to be strengthened for the expansion of shrimp culture; and
- h) Credit programs for extensive and semi-intensive shrimp culture to be provided.

The fisheries resources of Bangladesh are among the richest in the world and inland fishery production still ranks fourth in the world only after China, Indonesia and India. The country has vast water resources in the form of rivers, canals, estuaries, floodplains, depression (beels), ox-bow lakes (reservoirs), ponds, shrimp farms, and marine waters in the Bay of Bengal with high potentials of fish production as shown in Table 2. Inland water is inhabited with 260 native fish species, 13 exotic species of fish and 20 species of shrimps. On the other hand, the marine water is inhabited with 475 species of fish and 36 species of shrimps.

The long term fish production potential, growth prospects, fish production projected area, and average yield for different types of fisheries by the year 2010 is shown in Table 6.

The strategies for development and management of inland openwater fisheries of Bangladesh, include:

- a) Conserve and protect the fish habitat from environmental and ecological degradation;
- b) Conserve the fishery resources through implementation of fish conservation and protection law;
- c) Conserve the fishery resources through maintaining fish sanctuaries in suitable areas;
- d) Enhance of fish production and replenish depleted stocks through stocking program;
- e) Establish link canal where fish can pass in flood control area;
- f) Implement biological management of the fisheries; and
- (g) Provide credit facilities to the fishermen for purchasing nets, boats, etc.

5. FISHERY STATISTICAL SYSTEM

Before 1980, there was no statistical system for fisheries in Bangladesh. In 1980-81, the Government had taken up a program with the assistance of FAO/UNDP to assess the country's fishery resources and monitor the fish production of the country. Through the project "Fisheries Resources Survey System" (FRSS), the Government set up a Fishery Statistical System for data collection and processing. Actually, the existing "Fisheries Resources Survey System" is responsible for the assessment of the fishery resources of the country.

In the present statistical system, fishery statistics are collected according to the survey manual (survey methodology, sampling design, etc.). A catch assessment survey for each of the three sectors of fisheries viz. openwater, closedwater and marine, are undertaken. Each of the catch assessment survey is designed as a sample of one, two or three stage sampling for estimating total catches on the basis of data of sample units, which are collected by the Fishery Survey Officers (FSO). For example, the catch assessment survey of the riverine fisheries is designed to collect data on catch and for estimating the total catches by district, by month/period, by type of gear used and by species.

The Survey method makes use of three stage sampling, namely, primary, secondary and tertiary. In the first stage, sample villages will be selected; in the second stage, sample days will be selected and in the third stage, sample fishing units will be selected. For each sample village, two sample days are to be selected which will have an interval of 15 days between them. The number of sample units are to be recorded according to the number of fishing units for each type of gear, to be selected purposively or by random sampling as found suitable. The Survey Officer will record the catch data of the sampling unit in the survey form. While the FSO's are in the river to actually observe the fish catches.

The FSO thoroughly checks the recorded data in the forms, does the necessary editing and corrections, if any, and sends those to the headquarters every month by the 10th of the following month. In this way, each survey officer is collecting statistical data in 64 districts (sample location map enclosed as Annex 1) of Bangladesh. They are also collecting data from all habitats in their districts according to the survey manual.

The data collection program is supervised by Scientific Officers posted in divisional offices of Bangladesh. After the data are processed by computers at the headquarters, Senior Officers prepare the statistical year book a "Fish Catch Statistics of Bangladesh" published by the Department of Fisheries (DOF) every financial year. Fish statistics are classified according to the ISSCAAP group. DOF is regularly sending fishery statistics to FAO, Rome for publication in the FAO Year Book of Fishery Statistics.

The Ministry of Fisheries and Livestock is the key organization that controls the overall activities of the Department of Fisheries (DOF), Bangladesh Fisheries Development Corporation (BFDC), Fisheries Research Institute (FRI), etc. But none of these organizations/institutions conducts any census or statistical survey systems. The DOF also never conducts any fishery census. The Bangladesh Bureau of Statistics (BBS), also does not collect any fishery statistics, but they publish some fishery statistics in their Statistical Year Book which are compiled from the Department of Fisheries.

In many developing countries like Bangladesh, there is a problem in collecting catch and effort statistics, because fishermen dispose their catch in fishing spots. Sometimes fishermen may also use part of the gross catch for their own consumption. For this reason, international fishery bodies require catch data in the form of nominal catch. Catch and effort statistics vary from one fishery to another. For example, for riverine fisheries, collection and estimation procedure differs from beel (floodplain) fisheries. In the estimation of the daily catch total, the figure is multiplied by a daily raising factor. Catch per unit effort is defined as the amount of fish (total fish) caught by a fishing unit within 24 hours time. The sampling design, method of data collection, and estimation procedure are as stated in detail in the survey manual.

Bangladesh has developed a very impressive sea food processing and freezing industry during the last 15 years. The fish processing plants are mainly engaged in processing and freezing exportable shrimps and fish. Out of 97 processing plants in the country, only five are being operated by the public sector. Most of the plants however operate below capacity for lack of raw materials. In shrimp/fish trawl fisheries, the low value catch is usually thrown away. Some mother vessels may process fish and shrimp on board, making it difficult to get the actual statistics. In coastal aquaculture, shrimp processing plants also do not maintain proper record of fish processing statistics.

Unreliability of data due to shortcomings of the sampling procedure may be attributed to the following reason:

- a) Random or probability sampling of village (clusters) and random sampling of one day in a month are lacking (for subsistence fishing), when this is needed for valid analysis;
- b) Use of purposive sampling means that geographical extrapolation is not valid;

- c) Sample size is very inadequate for district and national estimate;
- d) Since sampling is not random (for flood land), standard errors of the estimates can not be computed;
- e) Inadequate supervision of the field staff;
- f) Insufficient manpower to collect, process and analyze data; and
- g) The frame survey (conducted in 1981) is out of date although its basic foundation may still be valid.

6. PROPOSALS TO IMPROVE NATIONAL FISHERY STATISTICS SYSTEM

In order to improve the quality of statistical output as well as the national fishery statistical system, a new Frame Survey, preferably a full Fishery Census and Data Bank was deemed necessary. However, for each of the district of Bangladesh there is only one Survey Officer who may not be able to collect data at thana basis. It is important to collect fishery statistics by thana in Bangladesh because, data user agencies and the Government needs data by thana to be able to get district wise statistics by all type of fisheries.

For this purpose, the Government submitted a project "Strengthening of Fisheries Resources Survey System" to the Planning Commission. The project, now being considered, has the following main objectives:

- a) to establish a data base for monitoring the fishery resources assessment of the country;
- b) to conduct a frame survey/fishery census for inland fisheries of Bangladesh; and
- c) to evaluate the effectiveness of the program and introduce a statistical model for fishery data collection in eight different types of water bodies at thana level.

7. MARINE FISHERY

Marine fishery includes both industrial and artisanal fisheries. Bangladesh has a coast line of 480 km, the length and territorial limit is 12 nautical miles measured seaward from the coast line. The continental shelf is under 50 m. depth zone, having good resources of fish. Bangladesh has an exclusive economic zone (EEZ) of 14,200 km² which extends 320 km (200 n mi) from base line.

Standing stock of marine resources estimated from time to time, indicated that the stock of shrimp is 4,000 mt whereas demersal and pelagic fish are 150,000 mt and 90,000 mt, respectively. Industrial fisheries consist of trawler fishing beyond 40 m depth. Artisanal fishery by mechanized and non-mechanized boat is undertaken in the coastal waters of up to 40 m depth.

At present, 56 trawlers (45 shrimp trawlers and 11 fish trawlers) are operating in the marine water capturing 4-5 thousand tons of shrimp, 10-15 thousand mt fish of commercial importance and 35-40 thousand mt trash fish. However, trash fish is usually discarded at sea.

Annual catch from artisanal fisheries is 18 thousand mt of shrimp and 235 thousand mt of fish. Based on the available information, the stock in the Bay of Bengal is being exploited almost at the maximum sustainable level. Information about the resources in the Bay particularly about the pelagic fish is however inadequate.

With proper assessment of the pelagic resources in the Bay of Bengal, production could be increased. The Marine Fisheries Section of the DOF has submitted a project proposal to strengthen the data collection and processing of statistics from artisanal and marine fisheries, where all types of artisanal marine fishery statistics will be collected and analyzed using computers.

8. FOLLOW UP OF THE NATIONAL RECOMMENDATIONS FROM THE 1994 WORKSHOP

For the strengthening of the "Fisheries Resources Survey System," the Department of Fisheries submitted in 1997 a new project proposal on the "Strengthening of Fisheries Resources Survey System", which could be an answer to the need to conduct a frame survey. A fishery census may be conducted for the collection of all types of information. This new project will benefit the country which intends to set up an appropriate statistical system for data collection up to thana level as well as establish data base for monitoring the fishery resource of the country.

Table 1. Structure of national fishing fleet

R/V ANUSANDHANI				R/V MACHHRANGA			
Principal Dimensions		Capacity		Principal Dimensions		Capacity	
Length overall	32.40 m	Fish hold	73.67 m ³	Length overall	22.50 m	Fish hold	10.00 m ³
Length b.p.	28.00 m	Fuel oil	88.22 m ³	Length b.p.	19.80 m	Fuel oil	13.00 m ³
Breadth mid.	7.50 m	Fresh water	34.53 m ³	Breadth mid.	6.00 m	Fresh water	6.0 m ³
Depth mid.	3.30 m	Freezing room	11.17 m ³	Depth mid.	2.80 m		
Gross tonnage	221.16 tons			Gross tonnage	100.00 tons		
Main engine	900 HP			Main engine	2x235 HP		
Max. trial speed	12.44 Kn			Max. trial speed	12.00 Kn		

Table 2: Fish production of Bangladesh

Source	Year-Wise Production in M.T.					
	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95
A. INLAND WATER	616,464	654,397	706,605	770,162	837,566	908,218
(a) Inland Openwater (Capture)	423,872	443,404	479,742	532,419	573,376	591,145
(1) River & Estuaries	173,410	135,355	124,843	138,746	143,425	152,782
(2) Sundarban	6,393	6,651	6,297	6,939	7,127	6,951
(3) Depression (Beels)	46,594	47,923	49,201	53,019	55,592	58,298
(4) Kaptai Lake	3,713	4,392	4,216	4,142	6,635	5,556
(5) Flood Land	193,762	249,083	295,185	329,573	360,597	367,558
(b) Inland Closewater (Culture)	192,592	210,993	226,863	237,743	264,190	317,073
(1) Ponds	163,730	181,018	195,034	202,167	222,542	267,282
(2) Ox-bow Lake (Baors)	1,357	1,544	1,682	1,803	2,201	2,460
(3) Shrimp Farm	27,505	28,431	30,147	33,773	39,447	47,331
B. MARINE FISHERIES	239,063	241,538	245,474	250,492	253,044	264,650
(b) Industrial	227,684	232,778	235,851	238,265	240,590	252,935
(a) Artisanal	11,379	8,760	9,623	12,227	12,454	11,715
COUNTRY TOTAL	855,527	895,935	952,079	1,020,654	1,090,610	1,172,868

Table 3. Fish consumption statistics

Year	Consumption (M. Ton)
1989-90	832188
1990-91	869826
1991-92	929999
1992-93	994047
1993-94	1058775
1994-95	1131182

Table 4. Export of fish and fish products from Bangladesh

Quantity in Tons
Value in Crore
Taka

Year	Frozen Shrimp		Frozen Frogleg		Frozen Fish		Dry Fish		Salted & Dehydrated Fish		Turtles/Tortoises/ Crab		Shark Fin & Fish Maws		Total		% of Total Export Earning
	Quan	Value	Quan	Value	Quan	Value	Quan	Value	Quan	Value	Quan	Value	Quan	Value	Quan	Value	
1989-90	17505	414.31	730	10.29	3484	25.58	1278	23.40	161	1.44	146	0.95	35	2.80	23339	478.77	9.62
1990-91	17985	451.22	318	7.36	5702	41.40	427	5.75	1194	13.95	405	3.22	78	3.72	26109	526.62	8.64
1991-92	16730	455.73	771	11.09	2604	30.10	892	14.11	80	1.39	938	6.52	65	5.41	22080	524.35	6.91
1992-93	19224	604.03	-	-	2704	38.31	1042	12.26	599	9.84	2800	21.60	238	14.25	26607.3	700.29	7.57
1993-94	22054	787.73	-	-	3125	51.18	2473	41.83	50	1.06	4088	36.37	45	2.79	31835	920.96	9.12
1994-95	26277	1045.67	-	-	9267	180.26	521	8.39	649	15.35	4760	40.67	212	16.60	41686	1306.94	9.38

Source: Export Promotion Bureau

Table 5. Marine fish captured by different gears

Type of Fishing	Number of Craft (Trawler/Boat)	Number of Unit (Gear/Net)	Catch in Metric Tons		
			Shrimp	Fish	Total
A. Industrial					
(1) Trawl Fishing					
a) Shrimp Trawler	41	-	2,391	4,856	7,247
b) Fish Trawler	12	-	25	4,443	4,468
TOTAL Industrial	53	-	2,416	9,299	11,715
B. Artisanal					
(1) Gill Net Fishing					
a) Mechanised	2,880	2,880	-	134,308	134,308
b) Non-mechanised	3,509	3,509	-	19,602	19,602
SUB-TOTAL	6,389	6,389	-	153,910	153,910
(2) Set Bag Net Fishing					
a) Seasonal (M.B.)	182	5,400	5,130	46,115	51,245
(N.M.B.)	2,680				
b) All Season (N.M.B.)	4,590	7,215	11,102	13,563	24,665
SUB-TOTAL	7,452	12,615	16,232	59,678	75,910
(3) Long Line Fishing					
Jew fish Long Line					
a) Mechanised	255	1,121	-	7,965	7,965
b) Non-mechanised	127				
c) Other Long Line	1,000	963	-	2,403	2,403
SUB-TOTAL	1,382	2,084	-	10,368	10,368
(4) Trammel Net Fishing	500	500	522	4,790	5,312
(5) Other Gears Fishing	1,608	2,222	1,193	6,242	7,435
TOTAL Artisanal (M.B.)	3,317	23,810	17,947	234,988	252,935
(N.M.B.)	14,014				
GRAND TOTAL					
(Industrial + Artisanal)	Trawler 53 (M.B.) 3,317 (N.M.B.) 14,014	Gill 6,389 SBN 12,615 Long Line 2,084 Other 2,222 Trammel 500	20,636	244,287	264,650

M.B. - Mechanised Boat <> N.M.B. - Non-Mechanised Boat <> SBN - Set Bag Net

Table 6. Long-term production potential and growth prospects for different

Type of Fishery	Production in 1987-88	Production in 2010		Incremental Production		Annual Growth Rate/a	
		Scenario A	Scenario B (‘000 mt)	Scenario A	Scenario B	Scenario A (%)	Scenario B
Food Plains Fishery	424.9	1,087.7	1,412.1	662.8	987.2	4.4	5.6
Pond Fishery	149.4	296.0	335.5	146.6	186.1	3.2	3.7
Coastal Aquaculture	25.2	78.8	105.0	53.6	79.8	5.3	6.7
Marine Fishery	227.6	300.0	325.0	72.4	97.4	1.3	1.6
Total =	827.1	1,762.5	2,177.6	935.4	1,350.5	3.5	4.5

< a - Annual compound growth rate in fish production from 1987-1988 to 2009-2010.

Source: Bangladesh Fisheries Sector Review Document of the World Bank (March, 1991)

COUNTRY REPORT OF INDONESIA
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1. INTRODUCTION

Indonesia is an archipelago, lying along the equator between the Indian and Pacific Oceans, extending from 6° North Latitude to 11° South Latitude and from 95° to 141° East Latitude. The country comprises 17,000 islands, of which about 3,000 are inhabited, with a total population of about 194 million in 1995. Total area covers about 1.9 million km² of land and 5.8 million km² of sea water with coast line length of around 81,000 km. The sea water itself consists of the territorial water of 3.1 million km² and the Indonesian Exclusive Economic Zone (IEEZ) of 2.7 million km².

The country is divided into 27 provinces, each province having several districts and municipalities, while each district or municipality consists of several sub-districts with several villages each. Around 300 districts, 3,000 sub-districts and 60,000 villages exist.

With this very huge area, the utilization of fishery resources has varied ways of implementation. Fishing and culture activities are dominated by small scale or artisanal fisheries, operating traditional technologies with low production inputs. In marine fish marketing, landings may make use of public places or fishing harbors, owned wharves, or scattered landing areas without having landing facilities and landing records. Therefore data collection for fishery statistical purposes, has been designed considering these complex situations.

2. GENERAL TRENDS IN THE FISHERY SECTOR

Indonesia is now on its Sixth Five-Year Development Plan (1993-1998) or on the first five year of the Second Long-Term Development Plan (1993-2018). Economic development showed that in 1995 the National Gross Domestic Product (GDP) at constant 1993 market prices reached 383,767.8 billion Rupiahs (1 Indonesian Rupiah = US\$0.00029, 3 October 1997), a national economic growth at 8.2% compared to 1994 GDP of 354,640.8 billion Rupiahs. Meanwhile the Gross National Product (GNP) reached 341,675.7 billion Rupiahs in 1994 and 366,891.9 billion Rupiahs in 1995.

Since its national economic growth increased faster compared to its population growth, there was an obvious increase in per capita GDP and GNP. In 1995 per capita GDP reached US \$1,039 an increase of 12.0% compared to 1994 which was US \$994, while the per capita GNP reached US \$893 in 1994 and US \$994 in 1995. In 1995 the fishery sector, as part of agriculture development contributed 1.6% of the national GDP at constant 1993 market prices, or 1.7% at current market prices which amounted to 5,973.6 billion Rupiahs and 7,616.0 billion Rupiahs, respectively.

Compared to the 1994 figure of 5,695.5 billion Rupiahs at constant 1993 market prices, the fishery GDP in 1995 increased by 5.6%, an increase higher than the agriculture sector which was 4.2 % in the same period. Compared to the GDP of agriculture sector which contributed 17.9%, 16.7% and 16.1%, respectively of the 1993, 1994 and 1995 national GDP at constant 1993 market prices, the fishery sub-sector's contribution increased steadily from 9.1% in 1993, became 9.6% and 9.7%, respectively, in 1994 and 1995. The figures on the national agricultural sector and fishery sub-sector GDP, per capita regional GDP and GNP in 1993-1995 are shown in Table 1 and Table 2.

According to the 1996 figures, the total number of manpower directly engaged in the primary production of fisheries in Indonesia was 4.7 million, comprising 2.5 million fishermen in capture fishing and 2.2 million fishfarmers in culture activities. The number increased at an average of 4.6% annually of the total, or 4.1 percent and 5.3 percent for fishermen and fishfarmers, respectively, in 1990-1996. The 1990 figures showed that there was a total of 3.6 million manpower comprising 2.0 million fishermen and 1.6 million fishfarmers. In spite of good progress on the mechanization and motorization program of the government, still the total number of fishermen engaged in fishing activities has increased. The number of fishermen and fishfarmers in 1990-1996, is shown in Table 3.

The national fishing fleets are dominated by non-powered, outboard motor-powered and inboard motor-powered boats with less than 30 GT engines belonging to small-scale artisanal fisheries. The 1996 figures showed that out of the total of 413,030 fishing boats operated; 244,830 or 59.3% were non-powered; 98,510 or 23.9% were outboard motor-powered; and 66,510 or 16.1% were less than 30 GT inboard motor-powered boats. The remaining 3,180 were more than 30 GT inboard motor powered which contributed only 4.6% of the total inboard motor powered boats or 0.8% of the total number of fishing boats, and were mostly operated by industrial fisheries.

The structure of fishing fleets has also shifted. The 1990-1996 figures showed that in spite of increasing number of non powered boats at an average of 1.4% per annum, there had been a decrease in the number of non-powered boats since 1994. On the other hand, the number of powered boats increased steadily at 5.9% per annum in 1990-1996. The 1990-1996, marine fishing fleets data is shown in Annex 4.

In 1996, the total fish production reached 4.5 million mt, an average increase of 6.1% per annum in 1990-1996; the 1990 fish production was 3.2 million mt. Of the 1996 total fish production, marine fishery contributed 3.5 million mt or 77.5%, while inland fishery 1.0 million mt or 22.5%.

The share of capture fishing activities in 1996 was 3.8 million mt or 84.9% of the total production compared to culture activities with only 0.7 million mt or 15.1% of the total production. Meanwhile, the average increase of marine fishing production in 1990-1996 was at 6.7%, which was higher compared to inland openwater fishing production which was at 2.4%, as well as to culture production at 5.3% per annum.

In 1996, brackishwater pond production contributed 382.4 thousand mt or 56.2% of total culture production, followed by freshwater pond, paddy field and cages culture with 173.0 thousand mt or 25.7%, 79.9 thousand mt or 11.7% and 45.7 thousand mt or 6.7%, respectively. Although cage culture had the lowest contribution, its average rate of increase was the highest (56.4%) in 1990-1996, followed by freshwater pond and brackishwater pond culture at 6.8 and 5.3%, respectively.

On the other hand, paddy field culture production decreased at average rate of 1.3% per annum. The production data by fishery sub-sectors in 1990-1996 is shown in Table 5.

Total fish consumption, calculated based on the fluctuation of production, export and import volume, reached at 3.7 million mt or 19.0 kg per capita per day in 1996. This figure increased at the average of 4.6% for the volume and 3.1% for per capita consumption per annum in 1990-1996, whereas the total fish consumption in 1990 was 2.9 million mt or 15.9 kg per capita.

As a measurement of direct human food consumption, the food balance sheet showed that the per capita per day direct fish consumption reached 16.4 kg in 1996, an average increase of 4.1% per annum in 1990-1996. These two consumption figures are still within the government target of direct animal protein intake from fish, which is 9.0 g of protein per capita per day or 26.6 kg of fish per capita per annum. The figures on fish consumption in 1990-1996 is shown in Table 6.

The total export of fishery products in 1996 reached 596.2 thousand mt valued at US \$1,892.6 million. There was an average increase of 11.4% in volume and 10.7% in value per annum in 1990-1996. Meanwhile, the total export of fisheries products in 1990 was 320.2 million mt valued at US \$1,039.7 million.

The fishery export consisted of food and non-food commodities. In 1996 the food commodities contributed 537.5 million mt or 90.2% while non-food commodities contributed 58.7 million mt or 9.8% of the total export volume, valued at US \$1,821.0 million or 96.2% and US \$71.6 million or 3.8% of the total export, respectively.

In 1996, shrimps, tunas and other fishes dominated the total exported commodities. Although shrimps contributed only 95,120 mt or 16.0% of the total export volume, its value contributed US \$1,053.4 million or 55.7% of the total export value. Tunas contributed 95,430 mt or 16.0% valued at US \$241.5 million or 12.8%, while other fishes contributed 307,600 mt or 51.6% valued at US \$407.4 million or 21.5% of the total, respectively. The export volume and value of fishery products by type of commodities in 1990-1996 are shown in Table 7 and Table 8.

The total import of fisheries products in 1996 reached 209.3 thousand mt valued at US \$148.0 million, or at an average increase of 28.4% in volume and 23.3% in value per annum in 1990-1996. On the other hand, the total import of fishery products in 1990 was 73,285 mt valued at US \$47.7 million.

Of the 1996 total import, non-food commodities consisted of fat and fish oil; fish crustacean and mollusks meal; fish feeds and others, contributing to 194,200 mt or 92.8% of the total volume, valued at US \$123.0 million or 83.1% of the total value. Fish meal which was used as one of raw materials for animal feeds reached 168,370 mt or 80.4% of total import volume, valued at US \$94.4 million or 63.8% of the total import value. The import volume and value of fishery products by type of commodities, are shown in Table 9 and Table 10.

From the 1995 total marine fish production of 3.3 million ton, the catch was dominated by ten fishing gear, namely, purse seine, drift gill net, other than hook and lines (other than long line, pole and line, and troll line), payang (seine net including lampara), raft net (lift net), set gill net, scoop net, sea weed collection, beach seine and stow net.

Each gear could catch more than 100 thousand mt per annum. Their contribution to the production was: 586.2 thousand mt (17.8%), 337.6 thousand mt (10.3%), 255.7 thousand (7.8%), 218.0 thousand mt (6.6%), 183.3 thousand mt (5.6%), 166.4 thousand mt (5.1%), 144.3 thousand mt (4.4%), 111.4 thousand mt (3.4%), 103.6 thousand mt (3.1%), and 100.9 thousand mt (3.1%), respectively. The total catch of these main fishing gear was 2.2 million mt or 67.0% of the total production. The data on marine fishery production by type of fishing gear in 1990-1995 is shown in Table 11.

3. FISHERY POLICY TOWARD 2010

Fishery development which is an integral part of the agriculture and national development, is on its Sixth Five-Year Development Plan, or on its first five-year development period (1993-1998) of the Second Long-Term Development Plan (1993-2018). The objectives of fisheries development in the Sixth Five Year Development Plan are:

- a) To improve the quality of human resources in fisheries and fishfarmers through optimal utilization of fishery resources by applying environmentally-sound science and technology and employing techniques that will increase the value of fishery products;
- b) To increase supply and distribution of fish commodities in order to increase fish consumption of the population;
- c) To encourage and create jobs and productive business opportunities;
- d) To enhance domestic industrial growth through increased supply of raw materials; and
- e) To increase foreign exchange earnings.

The focus of these objectives indicated a shift from the previous Development Plan where emphasis was on increasing production and economic growth. The present thrust stresses not only on increasing production, but also on improving quality of human resources through sustainable development in integrated agriculture business approach. To improve the quality of life of human being, means to increase income and prosperity of the fishermen and fishfarmers, as well as to provide sufficient animal-protein intake from fish for the people.

Considering the progress which has been achieved on national economic level and the impact of international economic development, the vision of fishery development for the next decade was to develop modern fisheries which could support the sustainable utilization of the fishery resource. Through training, fishermen and fishfarmers as one of the important economic players in production aspect, should have the capability to make decisions based on facts and their knowledge. Furthermore, they should have the capability to control technology as a main instrument in utilizing fishery resources in the optimal way. This will encourage the achievement of a high level of efficiency in fisheries in order to be able to play more role either in domestic or international market in the area of globalization. This will also encourage the economic development in rural areas in order to increase the income of fishermen and fishfarmers, the prosperity of rural population, and for them to take part on property alleviation.

In fishery management, Indonesia takes note of the United Nation conventions such as UNCLOS, CITES, UN Agreement on the Conservation and Management of Straddling Fish Stocks and High Migratory Fish Stocks, and the UN Code of Conduct for Responsible Fisheries. These are used as references in managing the fishery resources in addition to local conventions such as fishing right as reflected in community-based fishery management.

4. STATUS OF NATIONAL FISHERY STATISTICAL SYSTEMS

The Ministry of Agriculture (MOA) has the responsibility to collect data in agricultural aspects including fisheries. For fishery data, fishery production and fishery socio-economics surveys are conducted by the Sub-Directorate of Data and Statistics of the Directorate General of Fisheries (DGF) in collaboration with provincial and District Fishery Services. The Sub-Directorate of Data and Statistics of the DGF is structured under the Directorate of Programming.

The Provincial and District Fishery Services belong to the Local Administrative, namely the Governor, who acts as Head of First Level Region (Province) and Bupati, who acts as Head of Second Level Region (District). Under the latest regulation, the responsibility of field activities of agricultural statistics is submitted to the District Level of Local or Regional Administrative. While the Central Government (DGF) has the responsibility to guide and supervise the implementation of data collection in the field.

Fishery production survey designed in 1973-1974 has been implemented yearly since 1976 by the DGF of MOA in collaboration with Fishery Services in the regions. Although the survey is called Fishery Production Survey, the survey covers a variety of statistical items including the following:

- a) Fishery Inventory Items:
 - Fishing establishment (Culture household)
 - Fishing boat (Area of fish pond)
 - Fishing unit
- b) Production
 - Number of trip (Production input)
 - Catch (Yield)
- c) Disposition of catch
 - Disposition of catch
 - Quantity of fisheries commodities produced

The responsibilities of the statistical officials at all levels are set out as follows:

- Fishery Officer at Sub-district Fishery Office is responsible for field enumeration;
- District Fishery Service for estimation of all statistics at district level and preparation of reporting forms;

- Provincial Fishery Service for scrutiny of reporting forms and compilation of yearbook at provincial level; and
- Directorate General Fisheries (Sub-Directorate Data and Statistics) for scrutiny, tabulation and compilation of yearbook at national level.

The unit area used in the collection of fishery statistics in the survey is the district level. The survey uses the following three categories of forms:

- a) Survey forms for field enumeration;
- b) Estimation forms to be used by the District Fishery Service; and
- c) Reporting forms which to be completed by the District Fishery Service and forwarded to the DGF through the Provincial Fishery Service Office.

For statistical purposes in Indonesia, fisheries is classified into the following sectors and sub-sectors:

- a) Marine fishery
 - Capture/Fishing
 - Culture
- b) Inland Fishery
 - Capture/Fishing in open waters
 - Culture in inland waters
 - Brackishwater culture
 - Freshwater pond culture
 - Cage and pen culture
 - Paddy field (Paddy cum fish) culture

For marine fishery, a survey on fishing establishments, fishing boats and fishing units is undertaken. The complete number of powered boats and fishing gears employed is collected through the implementation of powered - boat card which can be used for a ten-year period. For the number of non-powered boats, estimation makes use of a complete list of fishing households together with the number of boats operated which are prepared at the end of each year for every sample village, while the number of fishing units by type of fishing gear for non-powered boat cards and the list of non powered fishing households are updated, and the number of fishing establishment, boat by sizes, and fishing units by type of gear are counted and recorded.

The survey on number of trips and catch is divided into three types, namely, L-I, L-II and L-III surveys. L-I survey is applied to fishing companies whose catches are mainly for export, and usually these companies have their own landing sites or wharves. As these companies keep good records of fishing operations, a special survey form is delivered to them to be filled out on monthly basis. The list of such companies is prepared by the DGF. The number of trips by fishing gear and size of boats as well as catch in quantity and value are collected through this survey.

L-II survey is applied to a major fish landing place, where more than 50 percent of the total fish landings of a district are landed. With the progress of fishing boat mechanization, the role of such major landing places will become more important in terms of the data on fish landed. For this reason, a sample survey with objective measurement is applied to ensure accuracy of catch data collected.

Two-stage sampling, using day as a primary sampling unit, and trip (boat arrival) as a secondary sampling unit is applied. In principle, one day is selected from each week as a sample day. On this day, all boat arrivals are counted and at the same time a sample of trips is selected for the measurement of catch.

L-III survey is applied to all marine fishing villages, excluding those places covered in L-II survey. Small-scale fisheries undertaken by a large number of small fishing households with non-powered or without boats are covered by this approach. The catch are landed along the sea coast and such landing places are not easily accessible.

To solve such problem, a sample survey is applied. Two-stage sampling is conducted: sample villages are selected from a sampling or survey frame, then sample households in each sampling village are conducted. L-III survey is a quarterly survey and actual field enumeration is confined to the sample fishing villages. The total catch per quarter of each type of gear is estimated as a product of total number of fishing units, average number of trips per quarter and average catch per trip. In order to estimate the number of trips and catch in a district, ratio estimation is used. The ratio is obtained by dividing the number of fishing households throughout a district by the number of fishing households in all the sample villages. The value of catch is estimated by utilizing the producer's average prices by species as recorded in monthly report of fish auction, or monthly report of fishing enterprises (L-I Survey). The average price per species is multiplied by the volume of catch.

The survey on distribution of catch and quantity of fishery commodities is undertaken because out of the total catch landed, the percentage disposed for fish processing is not known by the district fishery officers. The volume of catch disposed through various methods is estimated, based on any available information. The quantity of fishery commodities produced is estimated by applying a relevant conversion factor to the catch disposed. Estimated figures by species are counted quarterly at district level through the quarterly catch data, the percentage of catch disposed to each method, and conversion factors.

Survey methods applied to inland water fishery are exactly the same as those developed for marine fishery. However, since major fish landing places as in marine fishery are rarely seen in inland fishery, L-III survey is applied. Similarly, the survey methods for culture makes use of the L-III survey for marine fishery. Thus, the survey for culture is a sample survey. For the survey of inventory items like the number of culture households, area of fish ponds etc., a complete list of culture households is prepared for every sample village, and this survey is done on quarterly basis for sample village, within which ten sample culture households are randomly chosen. Estimation of inventory statistics and yield at district levels are done by using raising factors or ratio estimations. These ratios are obtained by dividing the number of culture households and area of ponds in a district by the number of culture households and area of ponds at all sample villages, respectively.

In order to obtain data on fishery development impact, the DGF together with the Provincial Fishery Services conducts fishery socio-economic survey on some selected areas of the country. A sample survey is applied in each location related to fishery activities predominant in that region.

As the object of the survey is the fishery household, the period covered is one calendar year (January to December). This survey collects information on socio-economic structure of fishery household, level of technology and management applied, level of household income, income distribution, cost and earning of fishery activity, economic efficiency of fishery activity, level of living condition, etc. This yearly fishery socio-economic survey is implemented in five-year basis in each location or area.

At present, because of the lack of supporting budget from local government, socio-economic surveys are only conducted in three provinces covering marine fishing, brackishwater and freshwater culture, the fishing and fish culture in open water activities. The DGF also analyses and publishes the progress of export and import data on a monthly and yearly basis. The data is collected from the Central Bureau of Statistics (CBS) data base. The publication covers data on export volume and value of fishery products by commodities, port of exportation and destination country, as well as on import by commodities, port of entry and country of origin.

Agricultural Census has been conducted by CBS since 1963 once every ten years. The last Agricultural Census held in 1993 covered all sectors of agriculture including fisheries. In the context of fisheries, the agricultural census collects the information on households, fishery enterprises, fishery villages, and fish landing places or fishing ports. Two methods were used in this census: complete enumeration covering all fishery enterprises and fish landing places or fishing ports; and sample census for collecting the information on fishery households.

The Agricultural Census is divided into two steps. Surveys are conducted on household listing, culture household land holdings, fishermen/fish farmers household income and fish landing places or fishing ports (complete enumeration), and fishery households (sample census). Then complete enumeration in fishery enterprises (culture and fishing enterprises) is undertaken to cover information on type of culture engaged or fishing gear operated, land or boat ownership, manpower, yield or fish production, fish product, distribution, production input, cost and earning data. Complete enumeration on fishing ports/fish landing places covers information on general condition of fishing port/landing place, facilities provided, and fish sold through auction places. Sample census on fishery households (fishing and culture households) covers information on household profile such as level of education of household members, housing condition, land or boat ownership, manpower, production input, and membership of cooperative.

Catch and effort data are collected and compiled through the Fishery Production Survey and published, as follows:

- Catch:
 - a) Total catch by province/coastal area;
 - b) Catch by species and province/coastal area
 - c) Catch by fishing gear and province/coastal area; and
 - d) Catch by quarter and province/coastal area.

- Effort:
 - a) Number of fishing boats by size of boat, province/coastal area;
 - b) Number of fishing units by size of boat, province/coastal area.

Although other catch and effort data are compiled, these may not be published due to unreliability of the data sent by some provinces. The data includes:

- Catch
 - a) Catch by fishing gear and species (national figure) and coastal area figure;
 - b) Catch by quarter and species (national and coastal area figure); and
 - c) Catch by quarter and type of fishing gear (national figure) and coastal area figure.
- Effort
 - a) Number of fishing units by type of fishing gears and type/size of fishing boats (national and coastal area figure);
 - b) Number of fishing trips by type of fishing gear and type/size of fishing boats (national and coastal area figure);
 - c) Number of fishing trips by type of fishing gear and province/coastal area.

On the other hand, in order to support data collection on catch and effort data for tuna fishery, an industrial tuna long-line survey is being prepared. A trial survey on this is expected to be conducted in late 1997.

5. PROBLEMS AND CONSTRAINTS

The problems and constraints in collecting fishery statistics may be divided into two categories: technical or statistical, and operational.

Technical or Statistical

The fishery production survey is applied throughout the country for more than 20 years without any basic changes in its system and method. With the standardized definition, classification and methods applied, publication of a series of yearly fisheries data and statistics with same pattern at district, provincial and national levels has been produced continuously. However, due to the rapid progress of fisheries, some improvements in the statistical system and method, as well as its coverage should be undertaken.

Since 1994, with a five-year assistance from the Government of Japan through the Japan International Cooperation Agency (JICA), some activities have been undertaken to improve the quality of fishery data and statistics. The activities include reviewing and improving the system and methods of the fishery production survey.

The following improvements are presently conducted, for the marine fishery:

- a) Improving the quality of estimation ratio used for the sample survey, by providing guidelines on data collection and sample selection of the fishery village potential survey;

- b) Development of the fishery production survey on marine culture and marine industrial fishery (tuna long line fishing); and
- c) Development of the computerization on data processing and reporting.

For its next program, the improvement of inland fisheries statistics will be undertaken in late 1997. This activity will cover the development of collecting statistics from openwater culture, industrial fisheries in brackishwater culture, and seed production. Problems may be faced in the dissemination of improved methods of collection at the regional and field levels due to budgetary constraints.

Collection of catch and effort data should be improved through the implementation a special survey or a Log Book system. In late 1997, a tuna long line fishery survey will be launched. The catch and effort monitoring through the Log Book system as part of the monitoring control and surveillance (MCS) system, is being implemented in fishing harbors by other offices of the DGF.

The data coverage of fishery statistics should be extended due to the need for decision making process as well as for planning, evaluation and investment purposes. The data needed are on fishery economics, fishery products distribution and trade, and statistics to support food balance sheet of fish consumption.

Operational

This is in connection with the efforts to provide accurate, reliable, and up to date fishery statistics. In Indonesia, there is lack of manpower available and capable, in collecting fishery statistics at the regional and field offices. This is coupled with inadequate budget and facilities to support statistical work especially budget for transportation cost for field data collection in the village areas. The improvement of data processing through computerization in provincial and district level will need more computers and statistic support offices capable of undertaking the activities.

6. PROPOSALS ON NATIONAL FISHERY STATISTICAL SYSTEMS IMPROVEMENT

To overcome the problems encountered within the fishery statistical systems in Indonesia, the following activities are proposed:

- a) Disseminating the results of the improved in Fishery Production Survey through training of regional fishery officers, who shall be tasked to disseminate the reviewed and improved systems and methods to high level fishery officers as well as to the field officers or enumerators. Funds to support the dissemination is needed as soon as the improved activities are completed.
- b) Procurement of computers and implementation of training programs for regional officers, in order to fulfill the need for computers at the provincial and district fishery offices, and to improve the capability of fishery officers in fishery statistical data processing and reporting.

- c) Improvement on catch and effort data collection through reviewing and improving the systems and methods presently applied. Technical assistance from international agencies is expected in this activity.
- d) Development of systems and methods on fishery economics, fishery product distribution and trade statistical data collection. Technical assistance from international agencies is necessary in this activity.

7. FOLLOW UP FROM THE 1994 WORKSHOP RECOMMENDATIONS

The country's program on Fisheries Information System (FIS) as a tool to disseminate fishery information through computer networking, is still in the developing stage. Activities are being carried out to develop FIS, and these include the following:

- a) Development of local area network (LAN) in DGF;
- b) Development of data base;
- c) Development of software to support the network, and;
- d) Development of human resources capability.

The FIS, once developed, will be introduced throughout the country through what is called the wide area network (WAN) connecting 27 provincial fishery services and about 300 district fishery services. The system will cover subsystems of fishery data and statistics, fishery products distribution and trade, fishery science and technology, fishery investment, fishery management and fishery infrastructure. At the initial stage, concentration will be on the development of the subsystem of fishery data and statistics, where the data source is the result of Fishery Production Survey.

The development of fishery statistical database is in line with the computerization of data processing and reporting; and system onlining the district and provincial fishery offices with the DGF. At present, the development starts with the introduction and implementation of computerized reporting systems from provincial fishery offices to DGF using diskette instead of mailing the report forms.

Table 1. National, agricultural sector and fisheries subsector GDP, 1993-1995

Item	1993 (Billion Rps)	1994 (Billion Rps)	1995*) (Billion Rps)	1993-1994 (%)	1994-1995 (%)
<u>At Constant 1993 Market Prices</u>					
- National	329,775.8 (100)	354,640.8 (100)	383,767.8 (100)	7.5	8.2
- Agricultural	58,963.4 (100)	59,291.2 (16.7)	61,766.8 (16.1)	0.6	4.2
- Fisheries Sub Sector	5,384.9 (1.6)	5,659.5 (1.6)	5,973.6 (1.6)	5.1	5.6
<u>At Current Market Prices</u>					
- National	329,775.8 (100)	382,219.7 (100)	452,380.9 (100)	15.9	18.4
- Agricultural Sector	58,963.4 (17.9)	66,071.5 (17.3)	77,639.3 (17.2)	12.1	17.5
- Fisheries Sub Sector	5,384.9 (1.6)	6,543.6 (1.7)	7,616.0 (1.7)	21.5	16.4

Notes : *) Preliminary figures

Source : Central Bureau of Statistics

Table 2. Per capita national GDP and GNP, 1993-1995

Item	1993	1994	1995	1993-1994 (%)	1994-1995
<u>At Constant 1993 Market Prices</u>					
- GDP (Billion Rps)	329,775.8	354,640.8	383,767.8	7.5	8.2
Per Capita GDP (Rps)	1,757,969.8 (US\$842)	1,859,913.2 (US\$928)	1,980,737.0 (US\$1,039)	5.8	6.5
- GNP (Billion Rps)	317,223.2	341,675.7	366,891.9	7.7	7.4
- Per Capita GNP (Rps)	1691,054.4 (US\$810)	1,791,917.7 (US\$893)	1,893,635.6 (US\$994)	6.0	5.7
<u>At Current Market Prices</u>					
- GDP (Billion Rps)	329,775.8	382,219.7	452,380.9	15.9	18.4
Per Capita GDP (Rps)	1,757,969.8	2,004,550.7	2,334,869.2	14.0	16.5
- GNP (Billion Rps)	317,223.2	367,941.1	432,798.3	16.0	17.6
- Per Capita GNP (Rps)	1,691,054.4	1,929,666.6	2,233,797.7	14.1	15.8
Mid Year Population (Thousand)	187,589	190,676	193,750	1.7	1.6

Notes : *) Preliminary figures

Source : Central Bureau of Statistics

Table 3. Number of fishermen and fishfarmers by fishery activities, 1990-1996

Unit: Person

Item	1990	1991	1992	1993	1994	1995	1996 *)	Average Increase Per Annum (%)
Fishermen/Fishing	1,994,414	2,126,000	2,208,580	2,337,190	2,315,787	2,463,237	2,529,084	4.07
- Marine	1,523,472	1,632,630	1,742,210	1,889,524	1,850,244	1,957,678	2,023,339	4.90
- Inland Openwater	470,942	493,370	466,370	447,666	465,543	505,559	505,745	1.32
Fishfarmers/Culture	1,622,296	1,845,968	1,739,307	1,969,356	2,064,119	2,104,822	2,177,907	5.25
- Brackishwater Pond	150,627	176,087	184,280	185,774	205,462	212,196	220,510	6.69
- Freshwater Pond	1,119,050	1,184,776	1,214,444	1,342,042	1,388,779	1,388,710	1,405,390	3.93
- Cages	11,111	18,392	17,828	20,933	29,731	44,804	57,155	33.36
- Paddy Field	341,508	466,713	322,755	420,607	440,147	459,112	494,853	8.81
Total	3,616,710	3,971,968	3,947,887	3,947,887	4,379,906	4,568,059	4,706,992	4.56

Notes : *) Preliminary Figures

Source : Directorate General of Fisheries

Table 4. Number of marine fishing boats by size of boats, 1990-1996

Size of Boats	1990	1991	1992	1993	1994	1995	1996	Average Increase Per Annum (%)
Non-Powered Boat	225,359	231,659	229,377	247,745	245,486	245,162	244,830	1.44
Powered Boat	119,686	123,125	129,529	141,753	150,699	159,491	168,200	5.85
- Outboard Motor	73,144	75,416	77,779	82,217	87,749	94,024	98,510	5.10
- Inboard Motor	46,542	47,709	51,750	59,536	62,950	65,467	69,690	7.03
= <5 GT	35,435	35,179	37,913	43,396	45,331	48,855	51,780	6.62
= 5 - 10 GT	6,897	7,391	7,936	9,791	9,604	9,562	10,180	7.00
= 10 - 20 GT	2,336	2,726	3,156	2,812	3,376	2,789	2,890	4.64
= 20 - 30 GT	831	909	984	1,558	1,688	1,519	1,660	13.93
= 30 - 5 GT	631	738	1,049	1,170	1,869	1,682	1,860	21.83
= 50 - 100 GT	119	185	208	351	567	687	890	41.48
= 100 - 200GT	173	272	184	213	340	253	280	14.22
= >200 GT	120	309	320	245	175	120	150	17.10
Total	345,045	354,784	358,906	389,498	396,185	404,653	413,030	3.07

Notes : *) Preliminary Figures

Source : Directorate General of Fisheries

Table 5. Fisheries production by sub sector of fishery, 1990-1996

Unit: 1,000 Ton

Sub Sector	1990	1991	1992	1993	1994	1995	1996^{*)}	Average Increase Per Annum (%)
Marine Fishery/Fishing	2,370.11	2,537.61	2,692.07	2,886.29	3,080.17	3,292.93	3,503.10	6.73
Inland Fishery	792.36	811.99	851.26	909.03	933.66	970.66	1,016.80	4.25
- Inland Openwater/Fishing	292.54	294.48	300.90	308.65	336.14	329.71	335.80	2.38
- Culture	499.83	517.51	550.37	600.38	597.52	640.95	681.00	5.34
= Brackishwater Pond	287.07	323.16	337.43	355.28	346.21	361.24	382.40	4.99
= Freshwater Pond	120.60	106.86	116.71	141.89	140.10	162.20	173.00	6.76
= Cages	4.48	6.65	8.82	26.05	33.01	39.86	45.70	56.43
= Paddy Field	87.67	80.85	87.42	77.17	78.20	77.66	79.90	-1.31
Total	3,162.47	3,349.60	3,543.33	3,795.32	4,013.83	4,263.59	4,519.90	6.13

Notes : *) Preliminary Figures

Source : Directorate General of Fisheries

Table 6. Fish consumption, 1990-1996

Item	1990	1991	1992	1993	1994	1995	1996^{*)}	Average Increase Per Annum (%)
Total Consumption (Ton)	2,856,300	2,883,783	3,160,422	3,313,388	3,534,868	3,653,389	3,739,448	4.63
Per Capita Consumption Per Annum (Kg)	15.85	16.12	17.14	17.66	18.54	18.86	19.00	3.09
Food Balance Sheet (Per Capita Consumption) Per Annum (Kg)	12.91	12.82	13.85	13.87	14.65	15.48	16.35	4.07

Notes : *) Preliminary Figures

Source : Directorate General of Fisheries
Central Bureau of Statistics

Table 7. Export volume of fisheries products by type of commodity, 1990-1996

Unit: M. Ton

Type of Commodity	1990	1991	1992	1993	1994	1995	1996 ^{*)}	Average Increase Per Annum (%)
Food	302,415	389,200	398,011	494,121	492,979	510,262	537,520	10.62
- Shrimps	94,037	95,626	100,455	98,569	99,523	94,551	95,120	0.24
- Tunas/Little Tunas/Skipjack	72,756	103,368	73,439	92,764	79,729	86,470	95,430	7.37
- Other Fishes	107,851	153,061	183,513	262,093	268,214	292,162	307,600	20.20
- Frog Leg	3,916	5,082	5,630	4,912	3,858	5,068	5,260	6.92
- Jelly Fish	2,222	4,211	2,610	3,834	4,038	4,816	5,310	22.21
- Crabs	5,123	5,907	4,693	6,081	6,884	6,490	7,010	6.64
- Others	16,510	21,945	27,671	25,868	30,733	20,705	21,790	7.32
Non Food	17,826	19,843	23,356	35,092	52,392	52,803	59,680	23.41
- Ornamental Fish	1,827	2,322	2,593	3,161	3,232	3,254	3,660	12.68
- Pearl	1	2	79	18	103	68	80	662.61
- Sea Weeds	11,788	11,305	12,047	16,562	18,689	24,958	28,460	16.73
- Coral Reefs/Shelves	1,713	1,322	2,474	1,214	1,132	1,171	1,130	1.10
- Others	2,497	4,892	6,163	14,137	29,236	23,352	25,350	57.75
Total	320,241	409,043	421,367	529,213	545,371	563,065	596,200	11.42

Notes : *) Preliminary Figures

Source : CBS, processed by Directorate General of Fisheries

Table 8. Export value of fisheries products by type of commodity, 1990-1996

Unit: US\$ 1000

Type of Commodity	1990	1991	1992	1993	1994	1995	1996 ^{*)}	Average Increase Per Annum (%)
Food	987,600	1,203,572	1,203,463	1,442,215	1,602,922	1,696,948	1,820,950	11.00
- Shrimps	690,230	769,982	764,850	876,703	1,009,738	1,037,006	1,053,420	7.49
- Tunas/Little -Tunas/Skipjack	124,748	184,525	145,968	213,818	182,200	212,983	241,450	14.83
- Other Fishes	115,771	174,371	205,239	269,029	266,151	339,098	407,360	24.31
- Frog Leg	13,340	21,144	23,597	18,455	15,014	21,634	23,780	13.95
- Jelly Fish	3,553	7,458	4,577	8,442	9,531	12,384	15,260	36.96
- Crabs	10,672	10,533	10,172	14,901	21,027	27,837	32,430	21.96
- Others	29,286	35,559	49,060	40,867	99,261	46,006	47,250	22.44
Non Food	52,079	52,091	60,072	61,533	75,797	67,041	71,620	6.04
- Ornamental Fish	7,683	6,985	7,513	8,976	9,140	9,607	10,030	4.88
- Pearl	15,576	15,876	21,631	17,521	20,873	11,710	13,630	1.80
- Sea Weeds	7,865	5,676	5,438	8,480	9,029	16,263	19,090	21.32
- Coral Reefs/Shelves	10,760	5,508	6,300	5,108	5,950	5,773	5,140	-8.47
- Others	10,195	18,046	19,190	21,448	30,805	23,688	23,730	19.30
Total	1,039,680	1,255,663	1,263,535	1,503,748	1,678,720	1,763,989	1,892,570	10.74

Notes : *) Preliminary Figures

Source : CBS, processed by Directorate General of Fisheries

Table 9. Import volume of fisheries products by type of commodity, 1990-1996

Unit: M. Ton

Type of Commodity	1990	1991	1992	1993	1994	1995	1996 ^{*)}	Average Increase Per Annum (%)
Food	7,117	3,737	15,101	12,187	14,016	14,487	15,050	43.26
- Fresh/Frozen Fish	5,043	2,692	3,523	9,703	10,552	10,454	10,800	28.47
- Canned Fish	953	382	382	935	562	371	400	3.13
- Jelly	406	342	342	272	285	496	530	8.24
- Others	715	321	10,854	1,277	2,617	3,166	3,320	544.79
Non Food	66,168	67,815	67,981	165,013	262,813	148,753	194,260	31.99
- Fat and Fish Oil	9,229	9,225	148	4,984	4,944	8,454	11,000	544.91
- Fish Meal	52,574	48,676	47,676	122,620	227,213	128,957	168,370	36.72
- Crustacean/Molluscs Meal	3,353	9,144	14,466	32,348	20,628	7,725	10,410	48.42
- Fish Feeds	591	498	397	759	749	2,712	3,100	55.04
- Others	421	272	5,294	4,302	9,279	905	1,380	311.70
Total	73,285	71,552	83,082	177,200	276,829	163,240	209,310	28.41

Notes : *) Preliminary Figures

Source : CBS, processed by Directorate General of Fisheries

Table 10. Import value of fisheries products by type of commodity, 1990-1996

Unit: US\$ 1000

Type of Commodity	1990	1991	1992	1993	1994	1995	1996 ^{*)}	Average Increase Per Annum (%)
Food	9,491	7,240	18,510	17,518	18,032	21,041	25,000	27.50
- Fresh/Frozen Fish	2,751	1,910	3,297	9,369	1,659	9,146	12,140	104.66
- Canned Fish	1,928	539	2,981	2,296	1,365	805	900	48.04
- Jelly	3,796	3,305	1,476	2,818	2,890	4,711	5,040	15.87
- Others	1,016	1,486	10,756	3,035	12,118	6,379	6,920	143.12
Non Food	38,194	45,143	46,179	91,679	118,681	94,877	123,020	26.35
- Fat and Fosh Oil	4,077	3,481	253	2,740	2,436	5,222	7,060	169.02
- Fish Meal	29,183	30,552	31,761	67,141	92,490	72,959	94,390	27.68
- Crustacean/Molluscs Meal	3,543	9,452	6,993	14,595	10,182	4,922	7,090	35.27
- Fish Feeds	387	443	363	818	579	2,783	3,270	81.78
- Others	1,004	1,215	6,809	6,385	12,994	8,991	11,210	95.44
Total	47,684	52,383	64,689	109,197	136,713	115,917	148,020	23.31

Notes : *) Preliminary Figures

Source : CBS, processed by Directorate General of Fisheries

Table 11. Marine fishery production by type of fishing gear, 1990-1995

Type of Fishing Gear	Satuan/Unit : Ton Mt						Average Increase Per Annum (%)
	1990	1991	1992	1993	1994	1995	
Total	2,370,107	2,537,612	2,692,068	2,886,289	3,080,168	3,292,930	6.80
- BED equipped shrimp nets	18,249	23,846	44,928	56,652	79,619	95,536	41.14
- Payang (included Lampara)	198,764	206,127	206,098	267,449	242,450	217,976	2.80
- Danish seine	22,172	26,161	42,394	40,981	45,618	48,071	18.68
- Beach seine	85,729	102,853	94,966	103,119	92,611	103,639	4.52
- Purse seine	395,857	441,135	488,686	515,291	611,464	586,241	8.44
- Drift gill nets	261,778	289,482	295,796	332,112	338,332	337,571	5.34
- Encircling gill nets	56,151	60,410	51,226	59,216	64,338	71,587	5.58
- Shrimp gill nets	51,629	60,106	55,883	55,468	57,983	59,757	3.25
- Set gill nets	123,645	126,009	139,926	134,138	148,784	166,424	6.32
- Trammel nets	45,987	43,095	50,693	55,883	75,870	73,089	10.74
- Boat/Raft nets	126,817	140,644	153,546	149,358	160,208	183,259	7.80
- Bagan (included Kelong)	93,338	87,850	87,980	96,865	88,364	81,421	-2.45
- Scoop nets	18,980	21,610	22,114	39,345	20,679	144,257	128.85
- Other lift nets	26,771	23,210	20,526	21,321	24,848	21,246	-3.79
- Tuna long line	40,674	33,168	33,336	29,469	40,910	58,631	10.52
- Drift long line other than tuna long line	17,101	24,662	20,936	26,299	29,844	26,372	11.31
- Set long line	52,260	53,027	50,622	56,463	78,236	69,327	7.13
- Skipjack pole and line	78,529	87,596	113,370	82,991	92,968	89,611	4.52
- Other pole and line	189,109	185,762	194,943	223,017	220,695	255,684	6.48
- Troll line	76,750	88,799	82,306	92,774	93,131	99,466	5.66
- Guiding barriers	40,574	43,915	46,641	48,688	55,200	60,437	8.34
- Stow nets	111,131	110,093	110,218	97,043	106,271	100,838	-1.68
- Portable traps	13,972	15,490	17,590	25,119	18,300	27,626	18.21
- Other traps	27,104	41,609	36,177	46,240	42,099	46,414	13.91
- Shell fish collection	35,225	34,712	39,686	41,904	49,298	51,524	8.12
- Sea weed collection	115,764	97,356	98,943	115,391	110,636	111,439	-0.21
- Muro Ami (included Mallalugis)	3,705	3,563	2,774	4,430	7,319	7,541	20.39
- Cast nets, Harpon, etc.	42,342	65,322	89,764	69,285	84,366	97,946	21.35

Source : Directorate General of Fisheries

OUTLINE OF FISHERY STATISTICS: JAPAN*

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1. SURVEY SYSTEM OF FISHERY STATISTICS

Surveys on fisheries conducted by the Statistics Department, Ministry of Agriculture, Forestry and Fisheries of Japan, are classified into four groups: production structure, fishery production, fishery economy, and marketing of fishery products. Each survey system, described below, is also summarized in Table 1.

Survey on Production Structure

The first survey on production structure was the "Special Survey on Fisheries" which was started in 1892. It covered a wide range of areas: marine traders, fishing boats, fishing gears, fishing grounds, fish catches, manufacture, marketing, fishery economy, etc. Throughout its implementation, the survey has undergone various changes, with temporal interruption during the war. After the World War II, two kinds of surveys on production structure was conducted. The fishery census, which is conducted every five years, and the fishery movement survey, which is done every year except the year when the census is conducted.

The objectives of the fishery census are: to clarify various conditions supporting basic production structure, working structure, and production industry of fisheries; and to complete basic materials for fishery politics such as improvement of the fishery structure. It also serves as a basic material for designing various surveys for fishery statistics. In this sense it is the most essential survey of all the fishery statistics surveys.

The fishery census, conducted every five years, is based on a fishery census regulation (an ordinance of the Ministry of Agriculture, Forestry and Fisheries). Since its inception, seven censuses have already been conducted, the seventh census was done in 1983. Through each census, the actual condition of fisheries, fishery production structure and so on are clarified, as these relate to the changes of various kinds of systems, national economy and world-wide fishery circumstances.

On the other hand, the fishery movement survey is done every year except the year when the fishery census is conducted. Its objectives are:

- a) to complete the basic list of fishery statistics surveys and to unify various kinds of surveys;

* An excerpt from Fishery Statistics. TA-JR-90-68, Japan international Cooperation Agency

- b) to make a basic statistics on fishery management units, fishing boats and fishery households, and;
- c) to grasp movements during a year and factors of movements of these important indices.

This survey is classified into three parts: survey on fishery management unit, survey on fishery household and survey on fishery production structure. On the other hand, the survey on management unit collects data on:

- a) the names of management units, their addresses and management of organizations;
- b) types of fisheries, fishing vessels and number of fishing days; and
- c) subsidiary businesses of fishery management unit.

The survey on fishery household collects data on:

- a) household members (sex, age);
- b) condition of work by household members of 15 years old and over; and
- c) condition of fishing employment, etc.

The fishery production structure survey is intended to look into the changing production structure of fisheries and the factors contributing to such change.

Survey on Fishery Production

The survey on fishery production is one of the most basic surveys in fisheries. The first fishery production survey was conducted in 1970, but the number of fishery products surveyed was small, thus the result was not considered very reliable. The statistics of fishery products as conducted today was first sent out in 1984. The statistics on fishery products had been what is known as tabular investigation, i.e. the survey is done by gathering reports from local offices once a year. This was also alleged as less reliable until 1950, when the modern system of statistics, which is highly accurate, was established by setting up the Fisheries Statistics Division in the Statistics and Information Department and posting specialists in fishery statistics in all government organizations up to the small units. The survey on fishery production consists of the "Statistical Survey on Marine Fishery Production", and the "Statistical Survey on Inland Water Fishery Production".

The statistical survey on marine fishery production aims to statistically grasp the actual conditions of production from marine fisheries and marine culture, and to complete the basic material for fishery politics, studies on fishery resources, and so on. The target of this survey are fishery management units and associations working on marine fisheries or cultures. The items of the survey are:

- a) number of fishing units, number of establishments of culture;

- b) culture equipment and so on;
- c) amount of fishing effort; and
- d) catches, production, and so on.

The survey is conducted every month or every three months. On the other hand, the statistical survey on inland water fishery production aims to statistically grasp the actual conditions of production from inland water fisheries and inland water culture, and to complete the basic material for fishery politics and studies on fishery resources. Catches by species of fish, catches by rivers and lakes, and so on, are also surveyed.

Survey on Fishery Economy

The survey on fishery economy have been conducted less often than those on fishery production. Before the war, the income of fishery households and contents of fishery household economy were surveyed twice through the "Survey on Fishing Village Economy" and the "Survey on Economy of Main Fishery Management Units" which were conducted in 1933 and 1938. However, these surveys were not very satisfactory. After the war the Fisheries Agency started to survey the fishery household economy in 1949 for fishery politics. Meanwhile, the Statistics and Information Department took over the "Survey on Fishery Household Economy" in 1951 and the "Survey on Fishery Enterprise Economy" in 1956.

In addition to these two surveys, which had been called the survey on fishery economy, the "Survey on Fishery Companies" was started in 1967. Its target are the companies with more than one hundred million yen capital and not involved in the earlier surveys. The "Survey on Fixed Assets for Fishing" was started in 1956 to complete the basic material for the standards in assessing fixed assets which are used for the survey on fishery economy.

The surveys on fishery household and fishery enterprise economy aim to grasp reproduction structures of fishery households and fishery enterprises, and to clarify contents of the economy. In the survey on fishery household economy (establishments under individual management using powered boats with total tonnage under 10 t) and the survey on fishery enterprises economy (management units using powered boats with total tonnage over 10 t), the condition of household members, operating condition of fisheries, condition of income and expenditures, condition of property, household expenditures and so on, are surveyed.

The survey on fishery companies aims to grasp the managing condition of fishery companies. The targets are the fishery companies with more than one hundred million yen capital. The survey on fixed assets for fishing has the same objective as the survey on fishery companies. The targets are manufacturers and stores where bodies, engines, electric appliances, freezing equipment, fishing equipment, and fishing net (nets and ropes) of fishing boats are built and sold. The main survey items are the values of the buildings and prices of equipment.

Survey on Marketing of Fishery Products

Among the surveys on marketing of fishery products, the oldest is the "Statistical Survey on Fishery Process", which began during the Meiji era. This includes the survey on the amount of processed products and the survey on processing establishments. The "Survey on Marketing of Fishery Products in Landing Areas" was also conducted since 1956. Its objective is to grasp the actual condition of the fluctuation in quantity and price of fishery products to strive for the stability of fishing management.

Since the fluctuation in price of fishery products is highly influenced by the destination of fishery products unloaded, the "Survey on Distribution of Landings by Type of Utilization" and the "Survey on Quantity of Shipment" have been conducted since 1960. These surveys are parts of the survey on marketing of fishery products in landing areas. The "Survey on Chilled Fishery Products" has been conducted since 1964, in order to assess the role of chilled fishery products on control of supply and demand.

In order to promote the plan for stability of price and improvement of marketing of fresh food, the "Survey on Marketing of Fishery Products in Consuming Areas" has been conducted since 1965. The survey items include prices by steps of arrival, wholesale, brokerage, retail, and so on, in principal cities.

The survey on marketing of fishery products in landing areas aims to grasp the market price, disposition division, quantity by destination, and so on, and to complete the basic material for supply and demand plan of fishery products, plan for price stability, improvement of marketing facilities, and so on. In the survey on price of fishery products, quantity, amount of money, price of fishery products landed by fish species are surveyed with consignees in the main landing areas.

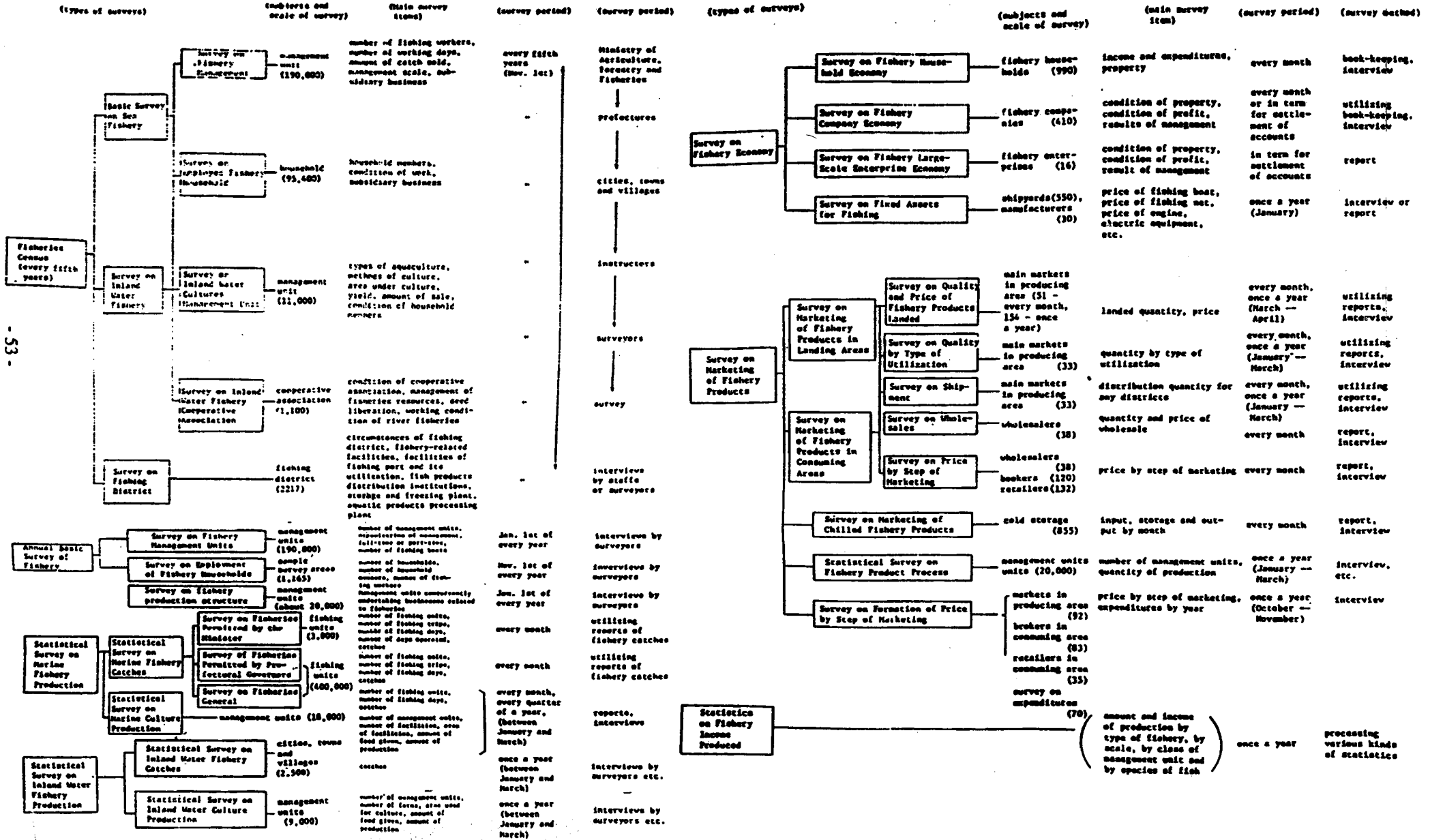
In the survey on distribution of landings by type of utilization, the quantity of fishery products landed by utilization (for fresh, for frozen, for process, directly to cold storage, and so on) are surveyed with consignees, brokers' associations, processors' associations, traders (brokers, process manufacturers, etc.) in the survey areas. In the survey on quantity of shipment, the shipment of products for other districts are surveyed with brokers, process manufacturers, and transportation facilities.

The survey on marketing of fishery products in consuming areas is a survey on wholesale marketing (survey on arrival quantity, amount of money, and so on of fresh, frozen, processed, and other products, and on arrival quantity by main producing district) with central wholesale markets in survey cities and wholesale traders.

The survey on chilled fishery products aims to grasp the actual condition, inputs, stock and outputs of refrigerators dealing with fishery products, and to complete the essential material for improvement of marketing systems, including control plan of supply and demand of fishery products, stability of prices, building plan of cooling facilities and so on.

The statistical survey on fishery process aims to complete the basic material for improvement of utility of fishery products and to plan for the stability of fishery product prices. Its targets are cooperative associations and other kinds of organizations, manufacturers, and enterprises. The number of management units by type of process, and the quantity of products in a year by kind of products and so on, are included in the survey items.

Chart of Survey System



STATUS AND PROSPECTS OF KOREAN FISHERIES

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1. SUMMARY

The Korean fisheries is highlighted by a rapid increase in annual total production until 1990 but its trend has nearly leveled off in the recent years. The total catch from coastal and off-shore fishery maintained an increasing trend; while production from aquaculture has gradually increased, the inland water fishery decreased starting in 1980. The annual total catch by group of species maintained a steady upward trend except for finfish catch which showed a decreasing trend in the recent years.

The number of fishing vessels increased gradually from year to year until 1990, then decreased in 1995. The yearly average tonnage per boat increased from 5.2 tons in 1970 to 12.2 tons in 1994. While the powered vessels increased year after year, the non-powered vessels decreased sharply from 54,270 in 1970 to 7,309 in 1994.

The total population engaged in the fishery industry sector has decreased continuously every year. Annual average income of fishery employee household has significantly increased from US \$3,200 in 1980 to US \$23,475 in 1995. The production of fishery products in recent years remained at a constant level. The total amount of import of fishes and fishery products sharply increased in recent years while the exports did not vary recently.

Korean fishery industry has been facing serious difficulty not only due to the decrease of coastal and off-shore fishery resources but also the withdrawal of deep-sea fishing vessels from the coastal country's jurisdiction areas following the extension of 200 nautical miles exclusive economic zone (EEZ). Accordingly, some suggestions are given in this report to overcome the present and future anticipated difficulties.

2. INTRODUCTION

Korea has a long history not only in terms of exploitation and utilization of fishery resources but also on management systems for the purpose of conservation of the marine living resources. The abundant fisheries around Korean peninsular made a significant contribution to the development of the Korean fishery industry. The annual production from both marine and inland water fisheries has generally kept an increasing trend until recently. But the Korean fishery industry is faced with some difficulties. Since the late 1980s, it has suffered from overcapitalization, excessive fishing pressure, and low financial returns compared with those of the other economic sectors.

The main reason for the waned fisheries is due to the overfishing of commercially important fishery resources such as highly migratory species and straddling stocks that migrate across the boundaries of the neighboring countries. This report describes the general trend in fishery production and the status of Korean fisheries for each 10-year period between 1970s and 1990s.

3. THE PRESENT STATUS OF THE KOREAN FISHERIES

In 1970 the total fish production was recorded at about 935,000 mt. The catch from coastal and off-shore fishery was 726,000 mt, accounting for 77.6% of the total production, 119,000 mt (12.8%) from aquaculture, 90,000 mt (9.6%) deep-sea fishery and 380 mt from inland water fishing. The breakdown for species group showed that finfishes were about 596,000 mt corresponding to 63.7% of the total production, 189,000 mt (20.2%) from mollusks and 117,000 mt (12.5%) from seaweeds (Table 1).

In 1980, total production has increased to about 158%, 2.4 million mt over the 1970 total production. The total catch from coastal and off-shore fishery was about 1.4 million mt, 57.0% of the total production. The total harvests from aquaculture, deep-sea fishery and inland water fishing amounted to about 540,000 mt (22.4%), 458,000 mt (19.0%) and 39,000 mt (1.6%), respectively. The total harvests by species group were about 1.5 million mt for finfishes, 524,000 mt for mollusks, 317,000 mt for seaweeds and 53,200 mt for crustaceans, accounting for 62.1%, 21.7%, 13.2% and 2.2% of the total harvest, respectively (Table 1).

The 1990 total production reached to about 3.27 million mt. This figure was 3.5 as much as the total catch of the 1980s. The catch from coastal and off-shore fishery was recorded at 1.54 million mt which corresponded to 47.1% of the total, about 925,000 mt (28.3%) from deep-sea fishery, 723,000 mt (23.6%) from aquaculture and 34,400 mt (1.0%) from inland water fishery. According to species group, finfishes were about 1.9 million mt, accounting for 57.7% of the total production, 784,000 mt (23.9%) mollusks, 442,000 mt (13.5%) seaweeds, and 119,000 mt (3.6%) crustaceans (Table 1).

The total production in 1995 was about 3.3 million mt, an increase of 0.7% over the 1990 total figure. The total catch from coastal and off-shore fishery was about 1.3 million mt, accounting for 39.4% of the total production, 1.0 million mt (31.1%) from deep-sea fishery, 935,000 mt (28.4%) for mollusks, 604,000 mt (18.4%) for seaweeds and 115,000 mt (3.5%) for crustaceans.

Korean fisheries is highlighted by a rapid increase in annual total production until 1990, a trend which has nearly leveled off in recent years. The total catch for each different fishery showed that coastal and off-shore fishery and deep-sea fishery maintained an increasing trend until 1990 but decreasing in 1995; while the catch from aquaculture continued to increase; and that from inland water fishery has gradually decreased since 1980. The annual total catch by group of species has kept a steady upward trend except finfishes catch which decreased in recent years.

From the above-mentioned data, the total catch from coastal and off-shore fishery was approximately 726,000 mt in 1970. The catch increased to about 1.37 million mt and 1.54 million mt in 1980 and 1990, respectively. In 1995, however, it was recorded to be only 1.43 million mt, indicating a decrease of 8.2% compared with the volume in 1990 (Table 1).

The main target species from the coastal and off-shore fishery include anchovy, common squids, Pacific mackerel, file fish, etc. (Table 2). There has been significant change in the annual catch for these targeted species. Until 1990, file fish took a top place in the annual total catch, reaching about 230,000 mt per annum, but decreased to about 1,800 mt in 1995. Since 1980, the catch of anchovy remained at a level of 169,000 mt and peaked to about 230,000 mt in 1995. The long term fluctuation in annual catch for the main target species such as common squids, Pacific mackerel, croakers, showed an increasing trend but the other species showed a downward trend.

The annual total catch from deep-sea fishery showed a significant increasing trend (Table 1). The 1970 catch was only about 90,000 mt. In 1980, the catch increased to 458,000 mt and the 1990 catch was doubled over the 1970 figure amounting to 925,000 mt. In 1995, the catch decreased to as much as 897,000 mt.

The commercially valuable fish species from the Korean deep-sea fishery are walleye pollock, squids, and tunas and tuna-like species, consisting of more than 83% of the annual total catch (Table 3). The total catch of walleye pollock was only 13,000 mt in 1970 but it increased tremendously to about 190,000 mt in 1980 and 337,000 mt in 1995. The catch of squids showed a fast upward trend. In 1970, the total catch was negligible to be only 900 mt, but this increased to about 21,000 mt in 1980. Its catch was significantly increased to 229,000 mt in 1990 and then it was decreased to 193,000 mt in 1995. The total catch of tunas and tuna-like species was about 61,000 mt in 1970, accounting to 68.2% of the total catch from deep-sea fishery. In 1980, it doubled nearly to 118,000 mt and was up 106% to about 242,500 mt in 1990. But the total catch declined to about 227,000 mt in 1995 (Table 3).

The annual total harvest from aquaculture has been increasing year after year (Table 1). In 1970, the total harvest was about 120,000 mt. This significantly increased to 540,000 mt in 1980 and 996,000 mt in 1995. Based on the aquaculture harvest by species group, marine finfishes was only 22 mt in 1970 and then increased significantly to 8,400 mt in 1995 (Table 4). Culture of marine finfishes commenced with yellow tail in the 1980s. Later on, commercially important fish species such as bastard halibut, sea bream, sea bass, rock fishes were cultured in the late 1980s using improved aquaculture techniques. The harvest for bastard halibut was about 1,000 mt in 1990 and 6,700 mt in 1995. The harvest from shell fish culture increased from about 75,000 mt in 1970 to 312,000 mt in 1995. Of this, oyster showed a rapid increasing trend from about 37,000 mt in 1970 to 191,000 mt in 1995, accounting for 50-70% of the production per annum. This was followed by sea mussels with a proportion of 20% on an average, of the total harvest. The seaweed harvest increased from about 44,000 mt in 1970 to 661,000 mt in 1995. Of the annual harvest, sea-mustard and laver culture increased rapidly from 6,600 mt in 1970 to 386,000 mt in 1995 and from 36,000 mt in 1970 to 193,000 mt in 1995, respectively (Table 4).

The total production from inland water fishing and fresh water culture maintained at a level of 34,000 mt in recent years (Table 4). In 1995, the total capture from inland water fishing was recorded to about 29,000 mt. The main species cultured were Israel carp using net cage, trouts and eels. The harvest in 1995 was approximately 10,500 mt for Israel carp using net cage, 2,800 mt for trout and 2,300 mt for eel, respectively (Table 5).

The total number of Korean fishing vessels registered was 68,355 in 1970, which have shown a gradually increasing trend from year to year until 1990 at a peak of 99,658 vessels (Table 6). In 1994, however, the number of fishing vessels decreased by 5.5% to 77,391.

The yearly average tonnage per boat increased from 5.2 gross mt in 1970 to 12.2 gross mt in 1994. The number of fishing vessels equipped with diesel engine power was 14,085 in 1970. The number of powered vessels peaked in 1990 with 79,365 increasing by 5.6 times since 1970 but in 1994 the number was reduced to 70,082 vessels. On the other hand, the number of fishing vessels with non-powered vessel declined rapidly from 54,270 in 1970 to 21,754 in 1990, a decrease of 60% compared with the 1970 figure. The composition of the vessel consisted of 20.6% powered vessels and 79.4% non-powered vessels in 1970. From the 1980s onward, the powered vessels were increased year after year while the non-powered vessels decreased (Table 6).

One Korean longliner participated in exploratory fishing for tunas in the Indian Ocean for the first time in 1957. Since then, the deep-sea fishing vessels that are catching not only pelagic fishes like tunas but also demersal fishes such as walleye pollock, have increased every year and peaked at a total of 810 vessels in 1990 but decreased to 637 in 1995 (Table 7). The main reason for this decline was the decrease of tuna longliners and complete withdrawal of the squid drift gillnetters in connection with the UN resolution adopted in 1992.

The total population engaged in the fishery industry sector has decreased continuously from year to year (Table 8). In 1970, the fishery employee population was estimated to be about 1,165,000 and its population in 1994 was down by 67.2% to 382,000, a decrease of about one-third of the 1970 figure. The total fishery household has also shown a significant decreasing trend every year. In 1994, it was estimated to be about 110,000, a decrease of 43.5% over the 1970 figure. The mean population per household was 6 persons in 1970 but this decreased to about 3.5 persons in 1994 (Table 8).

The annual average income of fishery household was about 2.6 million won (US \$3,245; 1\$=800 won) in 1980. In the 1990s, it significantly increased to 10 million won (= \$12,500) in 1990 and 18.8 million won (= \$23,400) in 1995, indicating approximately 4 or 7 times increase from the 1980 figure (Table 9). Annual net income from fishery activities was estimated at 1.75 million won (= \$2,190) in 1980. The fishery income in 1990 and 1992 increased to about 5.2 million won (= \$6,500) and 9.4 million won (= \$11,800), respectively (Table 9). Non-fishery income however comprised large portion of the annual fishery household economy. It was up by 5.6 times to 4.8 million won (= \$6,000) in 1990 and up by 11 times to 9.3 million won (= \$11,700) in 1992 over the 1980 figure (Table 9).

The total fishery products processed from fisheries production amounted to about 106,000 mt in 1970 (Table 10). In 1980, the figure increased to 367,000 mt which was 3.6 times as much as the 1970 volume. In 1990s, the total fishery products recorded at a level of 1.76 million mt, showing an increase of about 17 times and 5 times than those of 1970 and 1980, respectively.

The total fish products from catches of coastal and off-shore fishery peaked at 887,000 mt in 1995 (Table 10). The total products from deep-sea fishery catches were about 882,000 mt in 1990 and decreased to 782,000 mt in 1995, accounting for 50.3% and 46.9% of the annual total products, respectively. Complex processed products produced from the coastal and off-shore fishery catches, increased from 7,600 mt in 1970 to 371,000 mt in 1990, but in 1995 it decreased to 307,000 mt (Table 10). Simple processed products also kept an increasing trend and in 1995, the production was about 578,000 mt.

Frozen products (prototype frozen) as a major component of the simple processed products showed a gradual increasing trend amounting to 430,000 mt in 1995. The fishery products from deep-sea fishery catches mainly include frozen products (prototype frozen), accounting for 93.8% of the total products in 1995.

Total amount of export for fishes and fishery products was recorded to about US \$82.7 million in 1990 (Table 11). It increased to 760 million dollars in 1980 and reached to 1.7 billion dollars in 1990. The main components of the exports were live and fresh fish and tunas from deep-sea fishery accounting for 51.4% of the annual total export in 1995.

Total amount of import of fishery products was about 41 million dollars in 1980 (Table 12). That figure significantly increased to 1,318 million dollars. Among the imported components every year, raw materials for export and fishery products for domestic consumption accounted for over 50% of the total import.

4. PROSPECTS OF KOREAN FISHERIES

Korean fishery industry had developed outstandingly through catches from both coastal and off-shore fishery and deep-sea fishery, until the mid 1980s. Since then however, the fishery industry has been facing serious difficulty not only due to the decrease of the coastal and off-shore fishery resources but also because of the withdrawal of deep-sea fishing vessels from the coastal country's jurisdiction areas following the extension of 200 nautical miles exclusive economic zone (EEZ).

In conjunction with the rapid development of Korean industry in recent years, coastal zone, especially spawning and nursery areas with the nation's coastal waters has been destroyed from land reclamation and dredging for new harbors/ports. Water pollution and red tide have also given serious problems to the recruitment of the fishery resources as well as to aquaculture production. In fact, total production from coastal and off-shore fishery has leveled off at 1.5 million tons until the middle of 1980s and decreased to 1.4 million tons in 1995 despite wide expansion of fishing grounds to the East China Sea, modernization of fishing fleet, and use of new fishing equipment with improvement of fishing techniques.

Deep-sea fishery has been also waning in recent years due to the implementation of strict fishing regulations in the EEZ of the high seas and increased fishing fees in coastal nations. As a matter of fact, the 1995 total catch from deep-sea fishery showed significant decrease compared with the previous year's catch together with the decrease in number of fishing vessels.

In connection with the World Trade Organization (WTO) provision, on the other hand, Korean domestic fishery market was fully opened from July 1, 1997. Under current domestic circumstances, fishery competency is expected to be much more difficult than before.

In conclusion, there will be obstacles for the fisheries in Korea to be experienced in future as in the past years. Accordingly, the following measures should be seriously considered to overcome the future anticipated difficulties:

- a) **Protection of spawning and nursery grounds from land reclamation and dredging of harbors;**
- b) **Environmental impact assessments for various pollutants;**
- c) **Responsible fishing (optimum mesh size, prohibition of fishing small size fish, compliance of closed area and fishing season, etc.);**
- d) **Irregular fishing ban and fostering of living marine resources;**
- e) **Bio-engineering applications for aquaculture techniques;**
- f) **Enhancement of fishery resources through mass production of seedling and releasing them to the sea;**
- g) **Development of new seafood processing technology and quality improvement;**
- h) **Development of techniques for control of fish behavior;**
- i) **Establishment of reasonable management system; and**
- j) **Strengthening of international fishery cooperation and improvement of fishery business administration.**

Table 1. Total production by fisheries sector and by fishing ground of species

	1970		1980		1990		1995	
	Catch (ton)	%	Catch (ton)	%	Catch (ton)	%	Catch (ton)	%
Coastal and off-shore fishery	726,231	77.63	1,372,347	56.94	1,542,013	47.09	1,425,213	42.57
Deep-Sea fishery	89,621	9.58	458,209	19.01	925,331	28.26	897,225	26.80
Aquaculture	119,228	12.75	540,564	22.43	772,731	23.60	996,452	29.76
Inland water fishery	382	0.04	39,226	1.63	34,431	1.05	29,294	0.87
Total	935,462	100	2,410,346	100	3,274,506	100	3,348,184	100
Finfishes	595,977	63.71	1,497,879	62.14	1,887,867	57.65	1,694,827	50.62
Crustaceans	16,363	1.75	53,209	2.21	118,822	3.63	120,005	3.58
Mollusks	188,830	20.19	523,777	21.73	783,652	23.93	826,853	24.70
Seaweeds	116,655	12.47	317,189	13.16	442,208	13.50	671,471	20.05
Other aquatic species	17,637	1.89	18,292	0.76	41,957	1.28	35,028	1.05

Table 2. Catches of major fish species from coastal and off-shore fishery

	Unit: tons							
	1970		1980		1990		1995	
	Catch	Place	Catch	Place	Catch	Place	Catch	Place
Anchovy	54,047	4	169,657	3	168,101	2	230,675	1
Squids	72,219	1	108,756	5	75,293	6	200,897	2
Pacific mackerel	38,256	5	62,690	6	97,225	5	200,481	3
Hair tail	69,082	2	119,980	4	103,970	4	94,596	4
Shrimp	10,697	8	23,548	9	58,343	7	36,008	6
Covenians	55,172	3	48,843	7	42,981	8	45,198	5
Sardian	101	11	38,282	8	132,924	3	13,539	8
File fish	-		229,230	1	230,252	1	1,755	12
Jack mackerel	883	10	565	12	17,376	10	12,269	9
Blue crab	2,700	9	19,734	10	23,415	9	17,651	7
Walleye pollock	13,418	7	217,886	2	9,798	11	6,903	10
Saury	25,275	8	13,515	11	5,341	12	6,544	11

Table 3. Catches of major fish species from deep-sea fishery

Unit: tons

	1970		1980		1990		1995	
	Catch	%	Catch	%	Catch	%	Catch	%
Walleye pollock	12,708	14.18	189,774	41.42	311,703	33.69	336,810	37.54
Squids	909	1.01	21,344	4.66	228,993	24.75	193,107	21.52
Shrimps		0.00	3,422	0.75	1,839	0.20	722	0.08
Tunas	61,120	68.20	117,927	25.74	242,514	26.21	227,173	25.32
Others	14,884	16.61	125,742	27.44	140,282	15.16	139,415	15.54
Total	89,621	100	458,209	100	925,331	100	897,227	100

Table 4. Harvest of marine culture by species

Unit: tons

	1970	1980	1990	1995
Finfish	22	38	2,655	8,360
Yellow tail		7	462	159
Bastard halibut			1,037	6,733
Sea bream			228	25
Sea bass			391	193
Rock fishes			386	1,159
Others	22	31	151	91
Shell fish	74,868	282,559	325,592	312,252
Oyster	36,981	173,051	219,124	191,156
Sea mussel	6,888	61,301	9,759	75,353
Cockle, Short necked calm,	25,042	37,921	73,058	28,353
Cicina calm				
Ark shell		2,301	17,758	9,357
Others	5,957	7,985	5,893	8,033
Seaweeds	44,343	257,965	444,483	661,417
Sea mustard	6,625	196,147	269,333	386,819
Laver	35,782	56,274	97,637	192,960
Lamanaria	1,148	940	8,084	27,295
Others	756	4,519	36,815	42,025
Other aquatic species	32	85	32,614	12,318
Total	119,265	540,647	805,344	994,347

Table 5. Harvest of inland water culture by species

	Unit: tons			
	1970	1980	1990	1995
Common carps	3.0	287	1,300	714
Net cage (Israel carp)			9,487	10,481
Eel	9.4	246	1,146	2,345
Trouts	3.4	9	1,529	2,786
Snake-head fish		41	446	558
Tilapia			650	693
Others	1.4	441	1,288	2,788
Total	17.2	1,024	15,846	20,365

Table 6. Fishing vessels and fishing power

		1970	1980	1990	1995
Number of vessels		68,355	77,574	99,658	77,391
Gross tonnage		358,365	770,688	976,731	940,322
Average tonnage per boat		5.2	9.9	10.2	12.2
Powered vessels	No.	14,085	51,113	79,365	70,082
	G.T.	268,182	740,266	945,977	930,376
Non-powered vessels	No.	54,270	26,461	21,754	7,309
	G.T.	90,183	30,422	21,754	10,245
Percentage of	No.	20.6	65.9	79.6	99.3
powered vessels	G.T.	74.8	96.1	96.9	98.9

Table 7. Number of fishing vessels by fishing types in Korean deep-sea fisheries

	1970	1980	1990	1995
Tuna fishing boats	246	441	315	256
Squid fishing boats		27	230	124
Trawlers	32	241	247	225
Saury fishing boats			7	12
Others		41	11	20
Total	278	750	810	637

Table 8. Fisheries population and households

Unit: thousand

	1970	1980	1990	1995
Fishery employee population	1,165	843	523	382
Ratio to gross national population (%)	3.6	2.2	1.2	0.9
Fishery households	195	157	128	110
Persons per household	6	5.4	4.1	3.5

Table 9. Income of fishery household

Unit: 1,000 won () : US\$

	1970	1980	1990	1995
Income of fishery employee household		2,596	10,023	18,780
		3,245	12,529	23,475
Fishery income		1,752	5,216	9,437
		2,190	6,520	11,796
Non-fishery income		844	4,807	9,343
		1,055	6,009	11,678

Table 10. Production of processed fishery products

	Unit: thousand tons			
	1970	1980	1990	1995
Total	105.6	366.9	1,755	1,669
Coastal and off-shore waters products	105.6	366.9	873	886.8
Complex processed products	7.6	41.3	371	308.6
Frozen products (processed frozen)			94	74.3
Products of fish-paste products	0.4	13.1	58	107.7
Canned foods	5.3	11.1	97	63.1
Fish meal and oils	0.5	10.2	31	48.9
Seasoned products	0.9	6.2	90	14.2
Agar-agar	0.5	0.7	1	0.4
Simple processed products	98.0	325.6	502	578.2
Frozen products (Prototype frozen)	62.3	186.6	349	430.3
Processed seaweeds	11.3	43.6	32	94.4
Dried products	17.6	54.4	21	36.7
Salted and fermented products	6.2	37.4	88	16.8
Others	0.6	3.6	12	
Deep-Sea fishery products			882	781.7
Frozen products			878	771.3
Prototype frozen			770	733.3
Processed frozen			108	38
Fish meal and oils			4	10.4

Table 11. Exports of fishes and fishery products

Unit: thousand US \$

	1970	1980	1990	1995
Live and fresh fish	11,353	128,338	328,349	394,902
Frozen products	5,994	102,656	205,698	234,374
Seaweeds and pickled products	15,910	85,506	156,050	157,252
Canned foods	375	28,230	85,064	127,153
Others	11,444	62,928	266,668	316,226
Deep-sea catches	37,663	351,866	471,265	488,840
Total	82,739	759,524	1,513,094	1,718,747

Table 12. Imports of fishes and fishery products

Unit: thousand US \$

	1970	1980	1990	1995
Raw material for export		38,400	169,000	416,000
Products for the fishery			63,000	628,000
Cooperative projects				
Food materials for tourist industry			4,000	
Joint fishery products			28,000	
Fishery products for domestic consumption		2,200	104,000	274,000
Total		40,600	368,000	1,318,000

KOREAN FISHERY STATISTICAL SYSTEM
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1. INTRODUCTION

The Republic of Korea has a well-organized data collection system of fishery statistics for the purpose of providing information for the establishment of the national fishery policy. The Ministry of Marine Affairs and Fisheries (MOMAF) is responsible for the data collection of statistics from fishery authority and/or individuals including fishing companies. MOMAF sends the collected data to the Ministry of Agriculture and Forestry for compilation and publication. On the other hand, the National Fisheries Research and Development Institute (NFRDI) also collects data for various scientific purposes. The Fishery Census is being conducted whenever it is required, such as those in 1970, 1980, 1990 and 1995.

2. NATIONAL FISHERY STATISTICAL SURVEY

The survey on household in the fishing industry is conducted once a year during November 1 - November 30 to collect information on households engaged in the fishery industry. Statistical officials from the MOMAF are deployed in major landing areas to visit the households that are selected at random and collect statistical data. The procedure for collecting the data are summarized in Fig. 1.

The fishery production survey for coastal and offshore fisheries and shallow sea cultures, is conducted depending on the sale procedures of catch and harvest, which may be systematic or non-systematic sales. The systematic sales indicate that all fishery productions are trading through the Regional Federation of Fisheries Cooperatives (FFC). Production from commercial fisheries are not traded through FFC.

The total amount of production unloaded at fish markets for the systematic sale is recorded in the statistical record book. For non-systematic sales, recording is carried out by sampling survey. The procedure for collecting data on coastal and offshore fishery and shallow sea culture is shown in Fig. 2.

The survey on deep fisheries is being conducted by the Korean Deep-Sea Fisheries Association to make quick estimates of the total annual production in order to forecast the catch trends by species. All fishing vessels usually report only the catch record in weight by species to their mother companies once a week or at least by ten-day period by telegram at sea. Each company then sends monthly fishery statistics and total amount of export to the Association. The Association compiles the catch data reported by the companies and reports this data to the Ministry of Marine Affairs and Fisheries for final review and publication. The procedure of collecting data on deep sea fisheries is shown in Fig. 3.

According to Korea's fisheries law, fishermen who are engaged in the inland water fisheries with license or permission or notification have to report the amount of production to the mayor of the city or magistrate of the county where the fishermen belong. The mayor or the magistrate reports the data to the Director of Fisheries Technology Division or the Director-General of the District Maritime and Port Authority. The data are reviewed by the Director or the Director-General and reported to MOMAF. The procedure to collect data on inland water fisheries is shown in Fig. 4.

The fishery household financial status survey is similar to the survey of basic statistics on household in the fishing industry but the survey items and survey period are different. This survey is performed through out the year. The procedure of collecting data on this survey is shown in Fig. 5.

The survey on the production of processed fishery products is targeted to all processed products in volume and value. The survey is conducted semiannually. The producers of canned products, the Regional Federation of Fisheries Cooperatives and the village fisheries union must report the amount of products and trading volume to the mayor or magistrate of the country whom the producer belongs, respectively. The mayor or the magistrate reports the data to the provincial governor, who in turn report the data to MOMAF. The procedure of collecting data from this survey is shown in Fig. 6.

3. SCIENTIFIC FISHERY STATISTICAL SURVEY

The National Fisheries Research and Development Institute (NFRDI) has maintained independently a data collection system for scientific purposes. Biological surveys are carried out for some commercially important fish species. The catch and effort data for the coastal and off shore fishery, are collected through the regional fishery institute of NFRDI and fishery technology service center, weekly and monthly.

In order to collect more detailed catch and effort data, NFRDI introduced the Log Book system for deep-sea fishery. The Log Book system for the collection of fishery data from fishing vessels was set by the NFRDI. Each fishing vessel records the following items: date, position of fishing activities, fishing effort, catch in weight and in number by species. These Log Book data are delivered to NFRDI through the fishing companies. NFRDI checks the data in detail to determine whether or not there are any errors or false reports.

Some important fishes are measured only for fish length at fish market by technicians working for NFRDI. In order to collect more detailed biological data, about 30-50 fishes are purchased every month and measured at the laboratory, for length, weight, sex ratio, collection of otoliths and scales for age determination, etc.

4. FISHERY CENSUS

Fishery Censuses are carried out for the purposes of:

- a) grasping numerical information on the production system of fisheries, the employment and the living conditions of fishery workers, and providing information for fishery policies formulation;

- b) obtaining data which are used for comparison among countries; and
- c) updating the population from which samples are drawn for several kinds of fishery statistics.

The basic survey areas for the census include Gun and Gu, City and Province. The survey units are the fishery households and fishery companies, joint management, and cooperatives for their sale more than one month prior to the census. The survey items are selected on the basis of pretests such as the structural changes in Korean fisheries and the user's needs.

The Agriculture and Fisheries Statistics Information Bureau (AFSIB), Ministry of Agriculture and Forestry is responsible for the conduct of the Census. Some critical matters such as survey planning and method are examined by the central task force which consists of employees from the Bureau, Office of Fisheries (OF) and National Federation of Fisheries Cooperatives (NFFC). Supervisors and enumerators are trained by the local government (Fig. 7).

Local governments including provinces, Shi, Gun and Gu are employing some operating task force teams for the effective implementation of the census, and training the supervisors and enumerators in order to minimize statistical errors. The supervisors are selected and trained to supervise the enumerators. Those in charge of village fishery unions, and Ri's and Dong's, and fishery successors who are familiar with local affairs and fisheries, are usually asked to serve as enumerators.

The pilot survey is carried out to detect potential problems concerning census items, selection of Enumeration District (E.D.) and computation. The main survey starts after a pilot survey and the tasks for the main survey are:

- a) design of E.D.'s;
- b) preparation for list of survey units and map;
- c) training of supervisors and enumerators; and
- d) enumeration.

The enumeration sheets are collected and counted by the director of 'Eup' or 'Myun' office. If there are serious mistakes the enumeration is carried out again. The results are checked by local government survey workers and transmitted from the branch statistics office to the central government through the computer terminals. A preliminary report is published to meet the prompt needs before the final report is made. The final report is published after the complete compilation of the survey results is completed using the computer system in the central government.

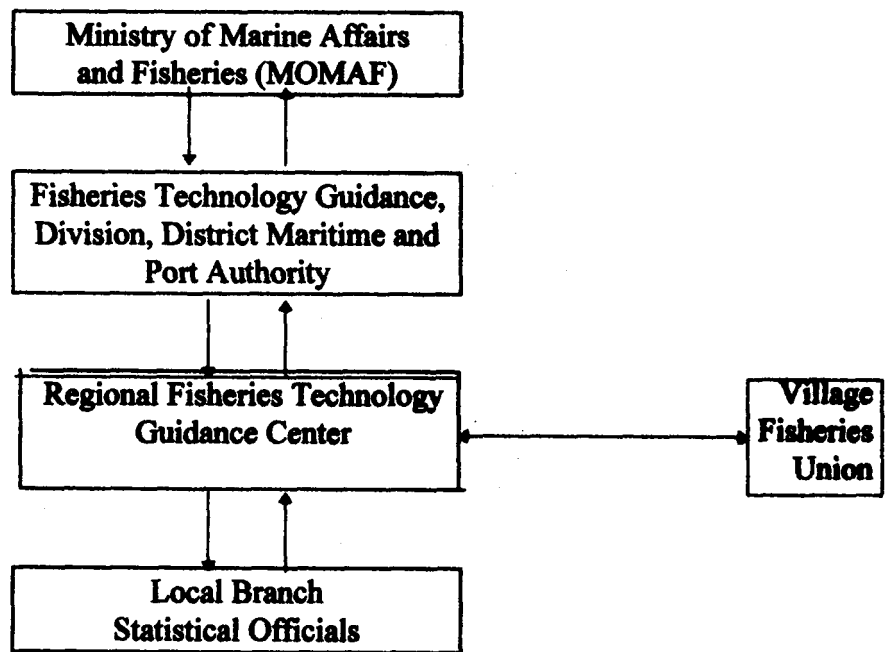


Fig. 1. The procedures to collect the data on basic statistics on household in the fishing industry

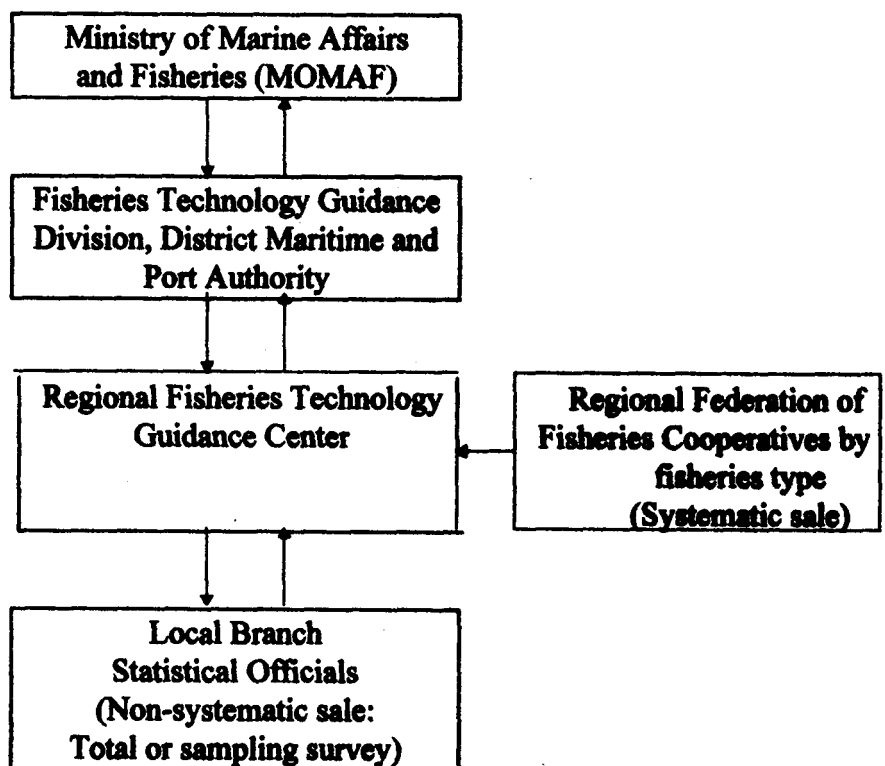


Fig. 2. The procedures to collect the data on the coastal and offshore fishery and shallow-sea cultures

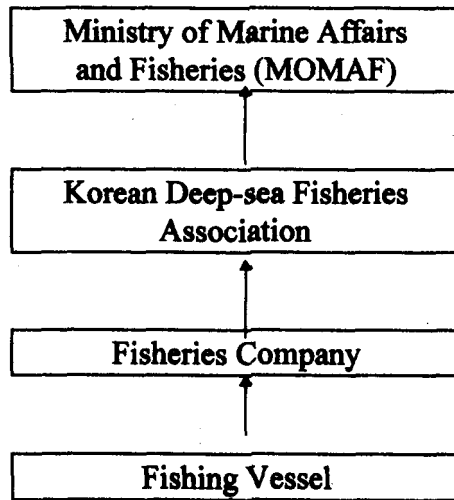


Fig. 3. The procedures to collect the data on the deep-sea fishery.

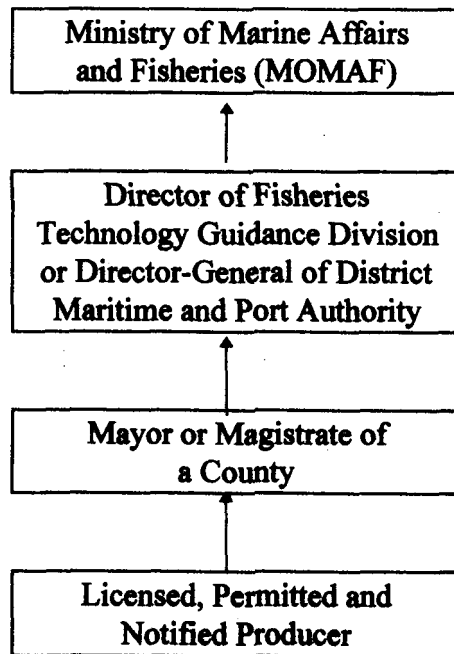


Fig. 4. The procedures to collect the data on inland water fisheries.

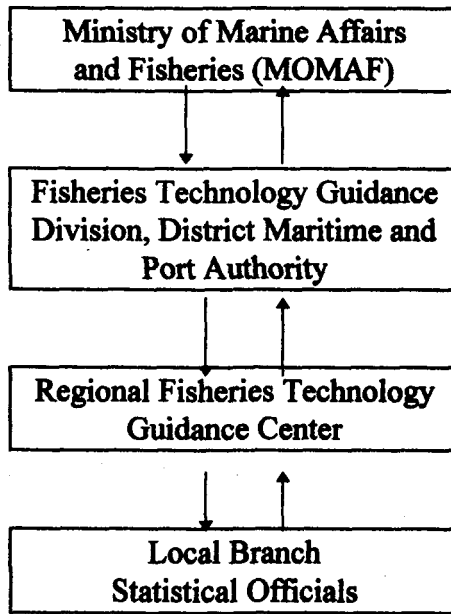


Fig. 5. The procedures to collect the data on the fishery household financial status survey

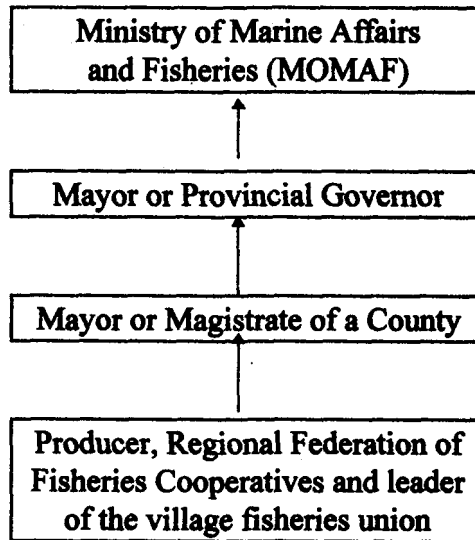


Fig. 6. The procedures to collect the data on the survey on the production of processed fishery products.

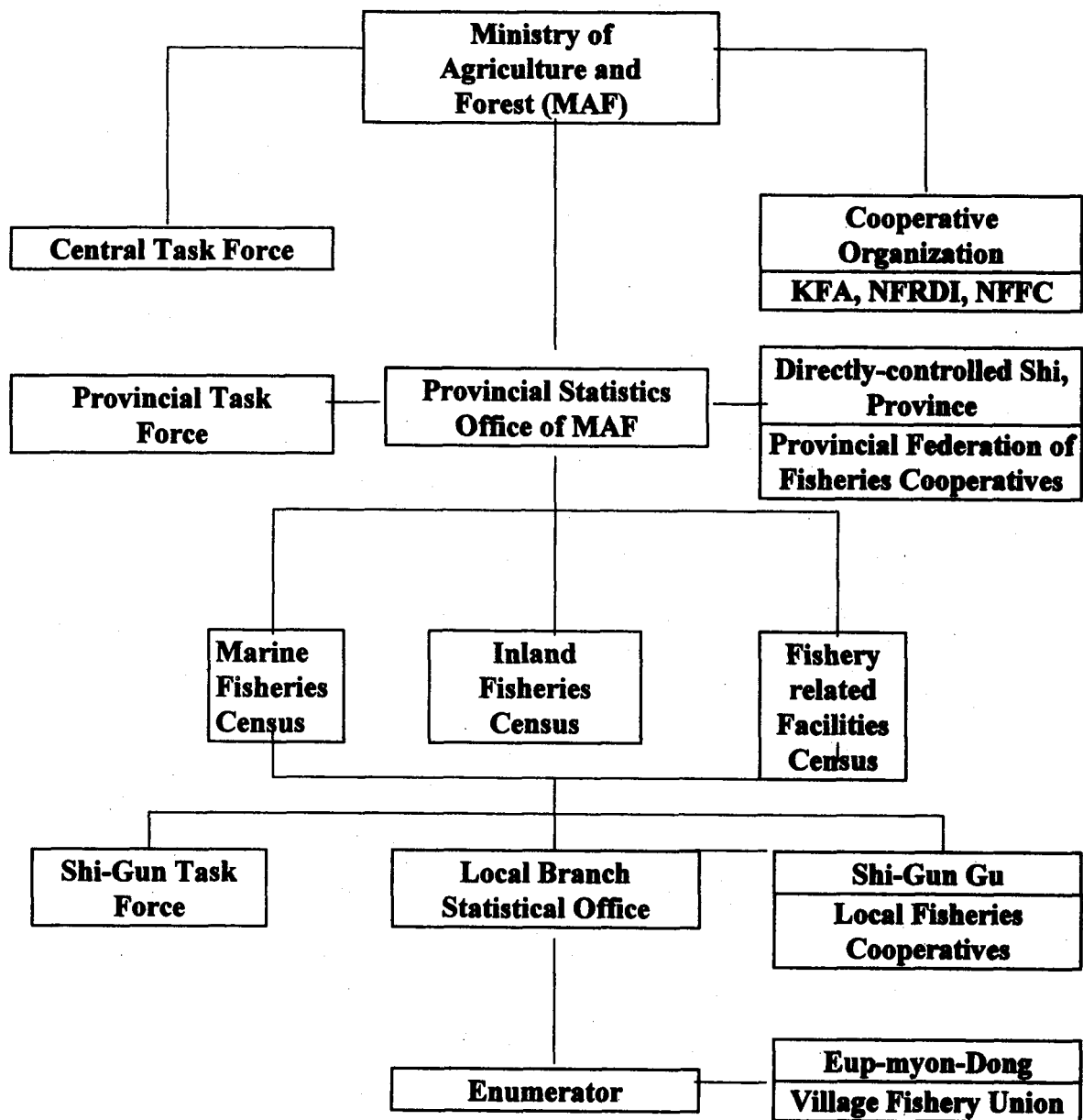


Fig. 7. The fisheries organization for fisheries census

COUNTRY REPORT: MALAYSIA
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PART I:

**CURRENT STATUS OF
FISHERY STATISTICAL SYSTEMS IN MALAYSIA**

1. INTRODUCTION

This paper presents the current status of fishery and aquaculture statistics in Malaysia. It covers the data collection system for the estimation of the annual fishery production for the country. The main organization responsible for the collection, compilation, processing and reporting the fishery statistics in Malaysia is the Department of Fisheries, Ministry of Agriculture. The trade data on fish and fishery products however, are collated and reported by the Department of Statistics Malaysia.

The statistical data collection, compilation and processing are supervised by the Fisheries Information and Management Unit based in the Fisheries Headquarters in Kuala Lumpur. This unit comprises 11 staff members. The marine fishery statistical data collection at the district and state levels are carried out by a total of 63 field staff, responsible for 65 Fisheries Districts. The field staff comprises 33 staff in Peninsular or West Malaysia, and 15 each in Sabah and Sarawak. For the aquaculture sector, a total of 102 Aquaculture Extension Assistants at the district and state levels are responsible for the statistical data collection and compilation.

2. FISHERY STATISTICAL SYSTEMS

The fishery statistics collected and collated comprise the following major aspects, namely, marine capture fisheries, aquaculture, inland water bodies, fisheries trade data. These statistics are published in the Annual Fisheries Statistics Volume 1 and 2. Data from marine capture fisheries, aquaculture and inland water bodies are published in Volume 1, while fisheries trade data are published in Volume 2.

There are basically two methods used in data collection; by observation and by inquiry. Field enumerators are stationed in the respective fishing districts. There are 63 field enumerators in all the states in Malaysia, each state having between 2 to 15 enumerators. Their main duty is to collect data on landings by the local vessels. Working manuals are prepared for the field enumerators comprising the following items:

- a) Listing of fishing gear,
- b) Catch sample,
- c) Catch estimates for the state,
- d) Catch estimates for the state,
- e) Landing value estimates, and
- f) Fishing effort data.

A list of fishing gear is obtained through monthly investigation and inquiry carried out by district. The purpose is to update the master list, taking into account any changes in the total number of fishing fleets due to seasonality, repair work, lay offs, etc. This will facilitate the routine stratified sampling in order to determine the total fishing effort for the state. The state then distributes the sample size proportionately between the districts and between gear groups.

The sample size is stratified by gear groups. On the other hand, trawlers and fish purse seiners, are further stratified into various tonnage groups as shown in Table 1. The total number of samples for each gear in each state are determined based on the total number of fishing gears in operation. The computation for sampling population is shown in Table 2.

The recommended work schedule of the field enumerators includes the following:

- a) The last 3 weeks of the month are involved in field survey, i.e. for 18 working days. The field work covers the main landing places, fishing complexes, office visits, house visits and market places. While on field trips, the field enumerators obtain the sample from observation as well as from inquiries.
- b) Observation method is employed on trawlers and fish purse seiners landing. Inquiries are normally conducted for the sample data on traditional fisheries. The field work also involves the collection and verification of the Log Book filled in by the off-shore vessels. Each enumerator covers a sample of about 10-12 samples by observation and 15-20 by inquiry each day. Thus on the average each month, a total of some 250 samples can be covered by each enumerator. This has been most workable and reasonable for one full-time enumerator.
- c) On the first week of each month, data compilation, data entry into the computer and data processing are carried out by District Fisheries Assistants at the state office to get the monthly total for the state. The state data are sent to the Department of Fisheries Headquarters in Kuala Lumpur in the form of diskettes as well as hard copy.
- d) At the Headquarters, there are 10 personnel involved in the processing, compiling, computing, data entry, tabulation and documentation of fishery statistics. The monthly total from the states are computed to get the national aggregate through a computer application system developed for this purpose.

The Log Book system was introduced in January 1989 for the detailed enumeration of the deep sea fishing vessels. The operators are imposed by regulation to fill in the Log Book and submit it to the Department of Fisheries on a monthly basis. The Log Book serves not only as a source of the catch data but also as a monitoring and assessment mechanism of the performance of the deep sea fishing vessels in Malaysia.

The cost and earning surveys for the fishery enterprises are carried out on an annual basis. A sample size of three trips for each gear is collected from every state for every month. The total sample for the state is processed and analyzed in order to represent the national data.

The information required are: (a) Gears used - main and supplementary, (b) Quantity and value of landing - by composition of fish, prawn, cuttle fish and trash fish, (c) Cost of operation per trip, (d) Maintenance costs and other related costs, (e) Capital cost, (f) Number of workers, and (g) Details of vessel. The interview is done through inquiry. Heavy reliance is placed on the information given to the enumerators.

The depreciation of fishing facilities is computed based on the following life span: (a) Hull of the wooden vessel - 15 years, (b) Hull of non-powered boat - 10 years, (c) Inboard engine - 10 years, (d) Outboard engine - 5 years, (e) Nets (3 sets) - 5 years, (f) Refrigerated Sea water System (RSW) - 10 years, (g) Radio communication sets - 7 years, and (h) Winch - 10 years.

Standard forms used in various stages of data collection include:

- a) List of the number of fishing gear in operation,
- b) Sample: Fish landing and fishing efforts, and
- c) Total sample at state level.

Computation and tabulation of the catch data are carried out at state level. The analysis of the economic performance of the main fisheries is published from time to time.

On the other hand, statistics on aquaculture are collected, compiled and processed to determine the annual aquaculture production for the country. Aquaculture production is divided into: freshwater aquaculture, and brackish/marine aquaculture. The statistics for aquaculture is further sub-divided into aquaculture systems, namely; pond culture in freshwater and brackish/marine, cage culture in freshwater and brackish/marine, freshwater culture in disused mining pools, cockle, eel, mussel and milk fish culture.

In each culture system, the following data are collected and compiled: (a) Number and area of ponds, cages, tanks and disused mining pools; (b) Number of aquaculturists by culture systems, (c) Estimated production of fish by culture system, species, state and district; (d) Wholesale and retail price of fish, prawn etc.; (e) Estimated wholesale and retail value of fish species; (f) Production by systems, species, months and states; (g) Fish/prawn fry production by government and private hatcheries; (h) Distribution of fish/prawn for public stocking; and (i) Production and value of ornamental fish.

A listing or detailed inventory of all aquaculturists are carried out annually by some 102 Fisheries Aquaculture Extension Assistants at the district levels. The data is then transmitted to the state office for checking and compilation. A brief description of the methodology is as follows:

- a) An inventory of fish ponds and farms is carried out once a year to determine the number and the total area under culture, their size, types and number of aquaculturists. The inventory is updated every month during their monthly extension visits.

- b) A 10% sample of the farms are selected for each culture system, with a minimum of 10 and a maximum of 35 farms a month. The field enumerators visit the sampled farms monthly, or either once every three or four months to determine their production. Records of monthly production by aquaculturists and by species are compiled and submitted to the state office for submission to the Headquarters.
- c) Retail and wholesale prices by species are obtained on a monthly basis from aquaculturists and from major markets in the district. The average price by species, district and state are then calculated and compiled together with the monthly data to estimate the total production for the district.
- d) Production by culture systems are then aggregated at state level to estimate the total production for the state for each month. The compiled aggregated production are then transmitted to the Headquarters for estimation of national aggregate.

The methodology employed in data collection for inland fisheries is different from the methodology adopted for aquaculture production. Inland fisheries refers to the activities for capture fisheries in public water bodies such as rivers, lakes, disused mining pools and reservoirs. However, due to the scatteredness and remoteness of some of these water bodies, sampling cannot be carried out. The data collection is mostly carried out by inquiry. The data collected from inland water bodies are categorized as catch data by species and months, and wholesale and retail price of fish.

3. TRADE DATA

Data on imports and exports of fish and fishery products are collected by the Royal Customs and Excise Department at the major exit and entry points throughout the country. The Customs Act requires all importers and exporters of goods including fish and fishery products to fill in Customs declaration forms on import and export. The Customs declaration forms are channeled to the Department of Statistics for computation and processing of the national data on import and export. These data are extracted by the Department of Fisheries for publication in Volume 2 of the Annual Fisheries Statistics on Import and Export. The import and export data extracted by the Department of Fisheries includes: (a) Quantity, value and types of imports and exports of fish and fishery products.; and (b) Import and export of fish and fishery commodities by country of origin and destination based on the harmonized system of classification for international trade.

4. PROPOSALS TO IMPROVE THE CURRENT FISHERY STATISTICAL SYSTEM

The statistical system currently in practice is satisfactory and highly credible, in spite of certain internal constraints faced by the Department. However, the data entry and processing will be improved further. One aspect is the data entry into the computer and direct computation to determine the national aggregate of fish production based on the tables as found in the Annual Fisheries Statistics. If this is accomplished, preparation of the Annual Fisheries Statistics for publication can be highly expedited.

PART II:
CURRENT AND FUTURE ECONOMIC ASPECT
OF FISHERIES IN MALAYSIA

1. INTRODUCTION

This part of the paper presents the current and future economic aspect of the fishery sector in Malaysia, and its contribution to economic development. The fishery sector in Malaysia plays a significant role in providing employment, especially in the rural areas. It is also one of the important contributors to the country's economic growth. Perhaps, more importantly, it provides protein food in the form of fish to the population. In 1995, its contribution to Gross Domestic Product (GDP) is US \$1.26 billion, about 1.51% of the total national GDP. However, its contribution to the agricultural sector is only 10.68% (Table 3).

The fishery sector in Malaysia also provides direct employment to some 82,200 fishermen and 18,466 aquaculturists, giving a total of 100,666 manpower employed in the fishery industry. This constituted about 1.24% of the total labor force in the country (Table 4). In 1995, the total number of fishing vessels in Malaysia was 34,906 units, comprising trawlers, purse seines and the traditional fishing gear as shown in (Table 4). Compared to 1994, there was an increase of 11.15% in 1995. The total number of fishing gears licensed in 1995 were 29,152 units, an increase of 12.75% compared to 1994.

2. FISH PRODUCTION

The total fish production has increased steadily at an average of 6% per annum from 978,235 mt in 1991 to 1,245,117 mt in 1995. In terms of value, there was also a marked increase from US \$741.82 million in 1991 to US \$ 1,126.09 million in 1995. This registered an average growth rate of about 15% for the same period (Table 5). In terms of quantity and value, the average growth rate per annum for marine capture fisheries for 1991 and 1995 is 5% and 13% respectively (Table 6). The quantity landed in 1991 was 911,933 mt valued at US \$676.26 million, while in 1995, the quantity landed increased to 1,108,436 mt valued at US \$1,084.36 million.

Among the fishery sectors, aquaculture has registered the highest growth in production. In 1995, the production from aquaculture was 132,742 mt, valued at US \$157.08 million. This registered an average increase per annum of about 20% compared to its production in 1991 (Table 5). Consequently, in terms of value, it showed a steady average increase of about 27% per annum from 1991 to 1995.

Malaysia is the second world largest producer of ornamental fish after Singapore. Its production in 1995 was 253.08 million pieces. This showed a market increase of an average of 33% per annum when compared to its production in 1991 (Table 5). In terms of value, it also showed a significant increase at an average of 42% per annum. A large proportion of ornamental fish produced are exported to more than 30 countries in the world.

3. FISH FOR FOOD AND NON-FOOD USE

The total amount of fish used for direct human consumption in 1995 was 765,474 mt (Table 7). The present rate of consumption increased at an average rate of 6% per annum compared to that of 1991. This is based on the per capita consumption of 39 kg in 1995 (Table 8). Consequently, the amount used for animal feeds and other purposes also showed an increase at an average rate of 4% per annum from 266,907 mt in 1991 to 318,695 mt in 1995.

4. TOTAL FISH TRADE

The total imports on fishery commodities by quantity has increased at an average rate of 2% per annum from 246,257 mt in 1991 to 260,568 mt in 1995 (Table 9). However, in terms of values, it has increased quite significantly at higher average rate of 18% per annum from US \$174.54 million in 1991 to US \$331.37 million in 1995.

The total exports of fishery commodities of Malaysia by quantity has increased at an average rate of 9% per annum from 175,216 mt in 1991, to 247,839 mt in 1995. However, in terms of value, it also showed an increase at a slightly lower average rate of 5% per annum (Table 10). The value exported in 1995 was US \$356.89 million as compared to exports in 1991 which valued at US \$268.96 million.

5. FISHERY POLICY TOWARDS AD 2010

The objectives of the National Fisheries Policy as outlined in the National Agriculture Policy III (NAP3) for the year 1997-2010 are as follows:

- a) To ensure adequate supply of fish to meet domestic demand for fresh fish as well as for the processing industries;
- b) To capitalize on export markets for some selected high value fish products; and
- c) To conserve and sustainably manage and utilize fishery resources.

6. FUTURE DEMAND

The demand for fish and fishery products is expected to continue to increase due to population growth, rise per capita consumption, as well as the growing awareness of the health benefits of fish and fishery products. The total demand for fish and fishery products in Malaysia by the year 2010, is estimated to be about 1.71 million mt. This is based on the expected increase of per capita consumption from 39 kg in 1995 to 60 kg in 2010 (Table 8). In order to meet the increasing demand for fish, the production of fish should be increased significantly. By the year 2010, the total fish production is expected to increase to 1,932,000 mt, i.e. an increase by about 56% compared to the year 1995.

Based on the increasing trend in consumption of fishery products, the demand for fishery products such as convenience fish products, fish oils, surimi and surimi-based reformulated fishery products and fish concentrated, likewise, is expected to increase quite significantly. This is based on the average annual growth rate of about 3.1% for the period 1995-2010 (Table 11), valued at US \$1,077 million.

7. STRATEGY FOR DEVELOPMENT

Malaysia has the potential resources to further increase fish supply. Consider the availability of fish resources in EEZ waters, the deep sea fisheries can be further developed to increase the current marine capture fisheries of about 1.1 million tons to about 1.5 million tons in 2010. However, as the marine capture fisheries including inshore and deep sea, have reached the maximum sustainable yield (msy), the increasing demand must be supplemented by production from aquaculture. In order to increase efficiency and productivity the following activities are planned for immediate implementation:

- a) Intensification of the efficient use of resource-friendly technology to maximize productivity;
- b) Automation and mechanization in fishing, post-harvest handling and aquaculture production to increase productivity and reduce labor dependency; and
- c) Adoption of high technology efficient culture system in aquaculture.

In addition, the market distribution and market information system for fish and fishery products will be improved in order to reduce post-harvest losses. Quality assurance practices will be upgraded. Quality control centers will be established to provide accreditation for local and exported fishery products. Market opportunities will be exploited and value-added products enhanced through product differentiation for the export niche markets.

The following strategies will be undertaken in order to strengthen the economic foundation of the country:

- a) All aspects of R & D in fishery will be strengthened. This includes:
 - intensifying R & D in development of new culture systems, fish disease prevention, fish nutrition, feed and fry production, genetic improvement, treatment of water and effluents;
 - intensifying R & D and technology transfer in post-harvest handling, quality control, packaging and processing. Research in product development will also be strengthened to tap the vast biodiversity of marine resources;
 - upgrading R & D institutions to become center of excellence in tropical marine fisheries and aquaculture; and
 - strengthening R & D institutions/industry linkages through public-private sector research collaboration and contract research.

- b) Human resource development (HRD) will be enhanced to provide skilled manpower and professionals needed by the industry. This includes the recruitment of foreign expertise such as skippers, master fishermen and gear technologists to train the locals.
- c) The present package of incentives and credit facilities will be continued. The terms and conditions of these facilities will be reviewed to improve accessibility. New incentives and innovative financing will be provided to encourage private sector to develop and operate mega fishing ports and integrated fishing complexes.
- d) The Government will continue to exercise regulatory and enforcement functions to ensure that fishery resources are efficiently and sustainably managed. The scope of the Fisheries Act 1985 will be extended worldwide. New regulations will be formulated for the accessibility and utilization of aquatic genetic resources. Monitoring, control and surveillance activities to prevent foreign fishing encroachment will be intensified.

Moreover, the cooperation with ASEAN partners through joint ventures and contractual trading arrangements will be promoted and facilitated in order to secure fish for fresh consumption and the processing industries. The promotion of sustainable development will be carried out through the following:

- a) **Managing Sustainable Production**
 - Fishermen community and related parties will be encouraged to manage and conserve fisheries resources through community-based fishery management programs
 - Inshore fisheries will continue to be regulated to conserve fishery resources
 - Surplus fisheries will be encouraged to venture into other economic sectors
- b) **Rehabilitating Depleting Fishery Resources**
 - Artificial reefs will continue to be developed while public water stocking and sea ranching will be undertaken to conserve and enhance fishery resources
 - More marine parks and marine reserves will be established to protect the natural marine ecosystem
 - Guidelines, regulations and code of practices will be introduced and enforced to ensure sustainable aquaculture practices.

Table 1. Classification of national fishing fleets

Gear	1995
Trawl nets	
less than 10 GRT	
10 GRT - 25 GRT	
25 GRT - 40 GRT	
40 GRT - 70 GRT	
70 GRT and above	
Total Trawl Nets	5,991
Fish Purse Seiners	
less than 10 GRT	
10 GRT - 25 GRT	
25 GRT - 40 GRT	
40 GRT - 70 GRT	
70 GRT and above	
Total fish purse seiners	953
Purse seiners - anchovy	118
Other seiners	858
Gill/Drift nets	19,296
Lift nets	329
Traps - stationary	196
Traps - portable	666
Hooks and lines	3,989
BAG nets	728
Push/Scoop nets	39
Barrier nets	258
Shellfish collection	310
Fish - Carriers	257
Miscellaneous	918
Subtotal - traditional	27,962
Grand total	34,906

Sources: D.O.F. Malaysia

Table 2. Computation of sample size by gear groups and districts

Number of Gears in operation	No. of Samples for 0-100 Units	Additional Samples (10%)	Total Samples
100	35	0	35 (min)
150	35	5	40
200	35	10	45
400	35	30	65
500 and above	35	40	75 (max)

Districts	No. of gears in operation	Total Sample
A	350	44
B	200	25
C	<u>50</u>	<u>6</u>
Total	600	75

Table 3. Contribution of the fishery sector to national economy Malaysia 1995

	Value in US\$
Gross National Product (GNP)	US\$87.48 billion
Gross Domestic Product (GDP)	US\$83.24 billion
Population (number)	20.69 million
GDP per head	US\$4023.00
Contribution of fisheries to GDP	US\$1.26 billion
% of contribution of fisheries to GDP	1.51%
% of contribution of fisheries to agriculture sector GDP	10.68%

Source : D.O.F. & National Bank, Malaysia

Note : Agriculture sector inclusive of agriculture, forestry and fisheries

Table 4. Employment gear, volume and value of marine capture fisheries and Aquaculture Malaysia, 1995

Gear	Fisherman (No)	%	Vessel-Gear (No)	%	Landing (Tons)	%	Value US\$Million	%
<u>Marine -Capture Commercials</u>								
Trawlers	19,657	19.5%	5,991	17%	609,298	48.9%	443.52	35.1%
Purse seiners - fish	18,217	18.1%	953	3%	162,300	13.0%	161.04	12.8%
Sub-total (Commercials)	37,874	37.6%	6,944	20%	771,598	61.9%	604.56	47.9%
Traditionals	44,326	44.0%	27,962	80%	336,838	27.1%	479.80	38.1%
Total - marine capture	82,200	81.6%	34,906	100%	1,108,436	89.0%	1,084.36	86.0%
	Aquaculturist	%	-	-	Production (Tons)	%	Value in US\$Million	%
Aquaculture*	18,466	18.4%	-	-		11.0%	176.73	14.0%
Grand-total	100,666	100%	-	-	1,245,117	100%	1,261.09	100%

Sources D.O.F. Malaysia

* Aquaculture : Production inclusive of inland - fisheries
Value inclusive of ornamental fish

**Table 5. Total fish production (marine, aquaculture and inland) Malaysia 1991-1995
(Volume in tons and value in US\$Million)**

	1991		1992		1993		1994		1995	
	Volume	Value US\$Million	Volume	Value US\$Million	Volume	Value US\$Million	Volume	Value US\$Million	Volume	Value US\$Million
Marine (Capture Fisheries)	911,933	676.26	1,023,516	933.30	1,047,350	925.55	1,065,585	986.36	1,108,436	1,084.36
Aquaculture	64,844	60.27	79,699	81.32	105,237	113.79	114,114	139.33	132,742	157.08
Inland (Capture Fisheries)	1,458	-	1,773	-	1,971	-	2,064	-	3,939	-
Ornamental fish*	(88.58 Million pieces)	5.29	(102.60 Million pieces)	6.83	(188.87 Million pieces)	13.09	(227.79 Million pieces)	16.70	(253.08 Million pieces)	19.65
Total	978,235 (Tons)	741.82	1,104,988	1,021.45	1,154,558	1,052.43	1,181,763	1,142.39	1,245,117	1,261.09

* Ornamental fish by million pieces

Sources: D.O.F. Malaysia

Table 6. Total marine capture fisheries and share of the production among various fish gears (in volume and value) Malaysia 1991-1995 (Volume in Tonnes and Value in US\$ Million)

Gear/Year	1991		1992		1993		1994		1995	
	Landing (Tonnes)	Value US\$Million	Landing (Tonnes)	Value US\$Million	Landing (Tonnes)	Value US\$Million	Landing (Tonnes)	Value US\$Million	Landing (Tonnes)	Value US\$Million
Commercials										
Trawl nets	529,543	300.50	572,395	410.23	561,942	358.80	587,928	395.46	609,298	443.52
Purse seiners - fish	133,646	100.99	134,753	117.06	160,269	144.62	156,246	150.29	162,300	161.04
Sub-total (Commercials)	663,189	401.49	707,148	527.29	722,211	503.42	744,174	545.75	771,598	604.56
Traditionals										
Purse Seiners-Anchovy	21,518	16.32	37,591	32.72	24,003	21.68	19,599	18.65	21,136	20.80
Other Seiners	22,635	27.14	26,632	35.12	20,360	31.98	24,104	33.40	22,084	38.44
Drift/gill nets	94,191	107.73	112,228	157.72	117,515	160.98	145,657	201.53	153,202	211.91
Lift nets	20,133	15.92	28,686	25.11	31,262	28.72	26,397	25.35	27,075	26.81
Traps - Stationery	3,543	5.38	3,577	6.20	3,111	5.70	4,489	10.13	5,079	13.33
Traps - portable	62,34	6.27	7,934	9.79	9,876	12.36	9,188	12.17	9,107	11.04
Hooks and lines	37,894	40.43	43,187	61.20	44,153	63.68	38,664	54.39	41,888	64.44
Bag nets	27,932	40.96	30,769	51.86	32,870	57.64	28,297	57.58	26,959	59.44
Barrier nets	2,943	1.99	3,104	2.33	3,824	3.02	4,143	3.24	2,473	1.80
Pust/Scoop nets	6,503	9.70	9,613	15.95	9,741	15.48	5,267	10.01	6,440	15.14
Shellfish collection	3,240	1.29	10,127	5.67	21,997	14.46	9,093	7.17	15,426	9.61
Miscellaneous	1,978	1.64	2,920	2.34	6,427	6.43	6,513	6.99	5,969	7.04
Sub-total (traditional)	248,744	274.77	316,368	406.01	325,139	422.13	321,411	440.61	336,838	479.80
Grand-total	911,933	676.26	1,023,516	933.30	1,047,350	925.55	1,065,585	986.36	1,108,436	1,084.36

Source: D.O.F. Malaysia

Table 7. Fisheries commodities Malaysia, 1991-1995
Total amount used for direct human consumption and
amount used for animal feed and other purposes

Year	Total amount used for direct human consumption (Tonnes)	Amount used for animal feed and other purposes
1991	582,323	266,907
1992	684,371	269,892
1993	707,986	296,378
1994	717,155	314,364
1995	765,474	318,695

Table 8. Malaysia: projected production and demand for fish in Malaysia, 1985-2010

Year	1985	1990	1995	2000	2005	2010
Population (in millions)	15.80	17.81	20.69	23.27	25.84	28.41
Consumption per capita (kg)	33	35	39	47	53	60
Demand ('000 mt)	527	621	810	1,094	1,370	1,705
Aquaculture ('000 mt)	55	52	133	250	400	600
Capture fisheries ('000 mt)	746	951	1,108	1,230	1,306	1,332
Total Fish Supply ('000 mt)	801	1003	1,241	1,480	1,706	1,932
Total Food Fish ('000 mt)	500	565	765	982	1,223	1,439
Self-Sufficiency Level (%)	95	91	94	90	89	84
Export for food items ('000 mt)	149	145	185	152	155	80
Import for food items ('000 mt)	176	201	230	264	302	346

Source: National Agriculture Policy (1997-2010), Malaysia

MALAYSIA:

Table 9. Annual series of fishery commodities import by type, quantity and value
(Quantity in Tons and Value in US\$ Million)

Description of Commodity	1991		1992		1993		1994		1995	
	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)	Quantity (Tonnes)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)
Live Fish	332	7.99	1,841	15.36	1,043	9.15	1,123	21.69	964	22.52
Fish, Fresh, Chilled or Frozen	154,835	80.73	174,058	134.87	176,389	150.45	176,197	158.47	164,389	163.22
Fish, Dried, Salted, in Brine: Smoked Fish	12,989	10.73	11,080	9.50	13,047	10.19	12,600	8.88	9,783	9.33
Crustaceans and Molluscs, Fresh, Chilled, Frozen, Salted, Dried	41,630	35.76	39,076	52.45	33,075	53.31	37,086	66.90	38,151	79.72
Fish, Crustacean & Molluscs, Prepared or Preserved, N.E.S.	17,261	28.24	16,057	26.78	15,559	31.24	19,353	33.80	16,744	33.20
Fats & Oils & Their Fractions, Of Fish or Marine Mammals, Not Chemically Modified	433	0.42	485	0.34	538	0.54	1,207	1.43	2,640	2.52
Flours, Meals and Pellets, Of Fish Or Of Crustaceans, Molluscs Or Other Aquatic Invertebrates, Unfit for Human Consumption	15,995	6.60	11,511	5.13	19,477	9.90	25,935	13.36	25,200	14.13
Miscellaneous	2,780	4.07	5,772	3.97	2,503	4.00	2,379	3.92	2,697	6.73
TOTAL	246,257	174.54	259,881	248.40	261,631	268.79	275,880	308.45	260,568	331.37

MALAYSIA:

Table 10. Annual series of fishery commodities export by type, quantity and value
(Quantity in Tons and Value in US\$ Million)

Description of Commodity	1991		1992		1993		1994		1995	
	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)	Quantity (Tons)	Value US\$(Million)
Live Fish	5,613	10.63	12,133	18.24	6,326	30.84	6,115	22.02	4,683	23.31
Fish, Fresh, Chilled or Frozen	44,333	24.64	50,323	33.96	41,526	32.20	48,407	33.53	56,923	31.91
Fish, Dried, Salted, in Brine: Smoked Fish	1,741	2.29	1,417	2.01	1,065	1.87	1,221	1.84	1,049	1.93
Crustaceans and Molluscs, Fresh, Chilled, Frozen, Salted, Dried	80,588	140.45	88,633	141.07	98,919	123.39	144,963	143.73	99,086	163.30
Fish, Crustacean & Molluscs, Prepared or Preserved, N.E.S.	22,699	81.98	36,199	95.80	44,087	116.06	36,370	122.21	23,494	113.78
Fats & Oils & Their Fractions, Of Fish or Marine Mammals, Not Chemically Modified	978	1.17	27	0.02	25	0.04	152	0.09	15	0.05
Flours, Meals and Pellets, Of Fish Or Of Crustaceans, Molluscs Or Other Aquatic Invertebrates, Unfit for Human Consumption	8,782	3.76	6,407	3.12	6,896	2.91	4,274	1.72	3,988	1.66
Miscellaneous	10,481	4.04	10,840	5.99	7,345	4.27	5,220	5.36	58,601	20.95
TOTAL	175,216	268.96	205,979	300.20	206,189	311.57	246,723	330.51	247,839	356.89

**Table 11. Malaysia: forecast of the food sector value added, 1995-2010
(RM Million in 1978 Prices)**

Item	1995		2000		2005		2010		Average Annual Growth Rate			
	RM Million	%	RM Million	%	RM Million	%	RM Million	%	1995-2000	2000-2005	2005-2010	1995-2010
Food Commodities	664	15.0	706	13.3	738	11.8	761	10.4	1.2	0.9	0.6	0.9
Padi Livestock	855	19.4	1,011	19.0	1,135	18.2	1,267	17.3	3.4	2.3	2.2	2.7
FISHERY	1,800	40.8	2,174	40.8	2,507	40.1	2,838	38.6	3.8	2.9	2.5	3.1
Vegetables	634	14.4	827	15.5	1,071	17.1	1,412	19.2	5.5	5.3	5.7	5.5
Fruit	464	10.5	606	11.4	796	12.7	1,065	14.5	5.5	5.6	6.0	5.7
Total	4,417	100.0	5,324	100.0	6,247	100.0	7,343	100.0	3.8	3.2	3.3	3.4
Share to Agriculture's GDP (%)		27.2		29.1		30.4		31.5				

Sources: National Agriculture Policy (1997 - 2010), Malaysia

US\$1 = RM2.60 (1997)
RM = Ringgit Malaysia

Table 12. Malaysia: projected value-added for fishery products, 1995-2010, Malaysia

Year	Value-Added (RM million in 1978 price)	Percentage of annual growth (percentage)
1995	1,800	-
2000	2,174	3.8
2005	2,507	2.9
2010	2,838	2.5

Source: Economic Planning Unit, Prime Minister Department, 1996, Malaysia

US\$1 = RM2.60 (1997)
RM = Ringgit Malaysia

**PRESENT STATUS OF
FISHERY STATISTICS IN MYANMAR**

by
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1. INTRODUCTION

Before the year 1983, the Ministry of Agriculture and Forest and the Ministry of Cooperatives were responsible for the development of fisheries in Myanmar. In 1983 the Ministry of Livestock Breeding and Fisheries (MLBF) was formed and took the responsibilities for the development of fisheries in Myanmar. The Department of Fisheries (DOF), under the MLBF is responsible for the management of fisheries, conservation of resources, providing extension services, conducting researches, and compilation of the national statistics in fisheries. The Planning and Statistics Section under the Department of Fisheries is responsible for the compilation of the fish production from the state and division levels and township levels. The fish production (Table 1) was estimated based on the 1991-1992 production.

2. TYPE OF FISHERIES

Fisheries in Myanmar are divided into freshwater fisheries and marine fisheries. Freshwater fisheries is mainly fish culture fisheries, leasable fisheries, open fisheries and flood fisheries, while marine fisheries is classified into on-shore, in-shore, and off-shore fisheries.

Freshwater fisheries is dependent on the riverine system of the country. There are four main rivers, namely the Ayeyarwady river which is about 2150 km long, the Chindwin River about 844 km long, the Sittaung River about 563 km long and the Than Iwin River about 2400 km-long, all enriched with natural resources and are very important for the open and flood fisheries of the country.

The inundated flood plains are estimated to form water surface of about 6.0 million hectares for a period of 4-5 months a year. The total number of leasable fisheries in Myanmar is about 3743 of which 3374 are exploitable to date. On the other hand, the total area of fish ponds in 1996-1997 was about 40193.93 ha.

The coast line of Myanmar is about 2831 km long. The continental shelf covers about 33000 km² in Yakhine coast, 105000 km² in Delta region, and 84000 km² in Taninthayi coast.

3. FISH PRODUCTION

The status of fish production for the Union of Myanmar from 1992-1993 to 1996-1997 is shown in Table 1.

4. LICENSED OFF-SHORE FISHERIES (1996-1997)

<u>No.</u>	<u>Particulars</u>	<u>No. of Vessels</u>
1	trawls	621
2	purse seines	21
3	surrounding gill nets	38
4	trammel gill nets	421
5	long line	4
6	squid	13
	TOTAL	1118

5. LICENSED IN-SHORE FISHERIES (1996-1997)

1	Number of Mechanized boat	16605
2	Number of non-mechanized boat	6745
3	Number of Gears	23640

6. EXPORT DATA

Data on fishery export are collected by the Department of Customs, while the Planning and Statistics Section compile and process such data. The export data (1996-1997) are as follows:

<u>No.</u>	<u>Particulars</u>	<u>Metric tons (mt)</u>	<u>Value (US \$)</u>
1	Fish	41068.32	45971127
2	Prawn	12827.80	95607067
3	Others	10504.70	21474628
	TOTAL	67400.82	163052822

7. TCP/MYA/4553 PROJECT

The current fishery statistics system in the Union of Myanmar does not conform with the concept as it was designed. It lacks systematic, consistent procedure and methodology as far as information acquisition is concerned. Therefore the reliability of the interpreted information could also be questioned. The available data are thus unsuitable for fishery management purposes.

The Technical Cooperation Program of FAO has been requested to assist the Government by providing technical assistance to renew and revamp the present fishery statistical system to conform with international practices and to create a reliable data base to facilitate decision - making in fishery management. The objectives of the project are:

- a) To reformulate and strengthen the current fishery statistical system by improving a reliable coverage of biological, technological and socio-economic activities of the country's marine and inland fisheries and aquaculture; and
- b) To introduce a computerized fishery information data base.

The work plan of the project includes: Marine Fisheries (Yangon Division, Sittwe, Myeik), Inland Fisheries (Mandalay Division), Aquaculture Fisheries (Tonetay).

8. PROJECT ACTIVITIES (NOVEMBER 1995 TO AUGUST 1997)

a) Computer Training

Training of ten staff at MCC Computer Centre is listed as follows:

<u>No.</u>	<u>Name</u>	<u>Section</u>
1	Daw Ma Ma Lay	Planning and Statistics
2	U Saw Thaug Khine	"
3	U San Win	"
4	Daw Myint Myint Soe	"
5	Daw Aye Aye Moe	"
6	Daw San San Yee	"
7	Daw Poe Poe Kyi	DG Office
8	Daw Hla Hla Kyu	Quality Control
9	Daw Su Su Lwin	Planning and Statistics
10	U Myint Pe	National Taxonomist

b) Marine Fisheries in Yangon Division

Data from industrial fisheries is collected using landing forms from Ahlone jetty, Nyaung Dan jetty and Kyi Myint Daine jetty. The 1996-1997 fish production is shown in Table 2. On the other hand, the list of industrial fisheries vessels in Yangon Division is shown in Table 3.

c) Artisanal Fisheries in Yangon Division

The first survey of artisanal fisheries in Yangon Division was conducted in November 1996. Results indicated that forty fishing villages use fish gear and long line, trammel gill net for fish, trammel gill net for prawn, tiger mouth, drift net and set net (same design as the tiger mouth). The average catch/month was 407.99 mt. The data was processed using the GRANK program of FAO.

d) **Marine Fisheries in Sittwe Township**

NPD recommended to start the survey in Sittwe township. This was conducted by the head office staff namely Daw Ma Ma Lay, Daw Thidar Aye, and U San Win. The survey period was from 26 July to 1 August 1997 (bad weather).

e) **Industrial Fisheries in Sittwe Township**

Data from industrial fisheries is collected from the landing forms of the Marine Product Comity. The data collected from industrial fisheries are shown in Table 4.

f) **Artisanal Fisheries in Sittwe Township**

A reconnaissance survey was started at Sittwe township in order to collect the data on artisanal fisheries. There are 37 fishing villages in the township. From the list of licensed boat and gear, fishermen were interviewed by the staff of the DOF from Sittwe township. The data were processed and analyzed using the GRANK software, the program presented and all detail data attached. Two criteria for GRANK are used such as total number of boat and fishermen. Number of gears was not suitable for analysis because the units of gear used were not the same.

g) **Future Work Programme (August-November 1997)**

- i) Frame survey in Yangon Division for artisanal fisheries in August or September;
- ii) Sample survey for catch and effort in Yangon division in September-November;
- iii) Reconnaissance survey in Mandalay for inland artisanal fisheries for both capture and culture in September;
- iv) Frame survey for aquaculture in Mandalay division in September/October; and
- v) Inputting of industrial landings data in the computer for one whole year.

9. CONCLUSION

The fishery sector is considerably important in Myanmar's economy as fish constitutes a major source of animal protein in the diet of the people and is the fifth largest source of foreign exchange earning after timber, rice, industrial and minerals. Fishery statistics is important in fishery management, thus, the formulation and strengthening of fishery statistics survey, is very useful for the fishery management of Myanmar.

Table 1. Status of fish production for Myanmar

Thousand of (M.T.)				
No.	Year	Fresh water fisheries	Marine fisheries	Total
1	1992-93	193.7	597.6	791.3
2	1993-94	210.9	599.90	810.8
3	1994-95	220.12	602.88	823.00
4	1995-96	217.99	455.43	673.42
5	1996-97	237.42	635.54	872.96

Table 2. Industrial fisheries data in 1996-1997

(M.T.)				
Month	Ahlong	Nyaung dan	Kyi myint daine	TOTAL
April	1619.869	2676.376	1121.825	5418.07
May	1373.296	2862.531	302.0925	4537.92
June	760.9466	576.4252	186.155543	1523.526
July	1017.317	105.814	336.2208	1459.352
August	1690.085	1258.011	233.0195	3181.116
September	1301.447	2139.142	280.8644	3721.453
October	2021.57	3923.937	209.0154	6154.523
November	1722.744	3231.41	196.7684	5150.922
December	1830.517	4227.662	578.0581	6636.238
January	1647.73	3855.354	924.2398	6422.324
March	1887.67	4374.626	1273.687	7535.984
TOTAL	18237.82	33049.08	5062.284	56369.16

Table 3. Industrial fisheries vessels in Yangon Division

No.	Name of vessel	Owner	GRT	HP	Length of boat	Type of gear	Fisher men	Catch/m (mt)
1	HS 4	MFE	6.7	240	60 ft	Trawl	10	1.331
2	HS 6	MFE	6.7	240	60 ft	Trawl	11	1.051
3	HS 7	MFE	6.7	240	60 ft	Trawl	10	0.674
4	HS 8	MFE	6.7	240	60 ft	Trawl	10	0.542
5	Aungya danarmoe	U Kyaw Min	9	45	54 ft	Trawl	8	0.085
6	Koung myataung	Trawl co	31.4	280	50.25 ft	Trawl	11	bad condition
7	T 22	Trawl co	9	180	33	Trawl	5	"
8	T 17	Trawl co	9	85	33	Trawl	4	"
9	T 21	Trawl co	9	85	33	Trawl	4	"
10	T 27	Trawl co	9	85	33	Trawl	5	"
11	T 25	Trawl co	9	85	33	Trawl	5	"
12	T 31	Trawl co	9	85	33	Trawl	5	"

Table 4. Industrial fisheries of the Marine Product Comity

No.	Particulars	Number of Vessels
1	trawls	290
2	trammel gill nets	2
3	surrounding gill nets	2
4	purse seine	5
5	long line	1
	TOTAL	300

Gear tonnage groups

0-40	14
41-80	93
42-120	144
121-160	42
160 above	7
TOTAL	300

FISHERY STATISTICS IN THE PHILIPPINES

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I. INTRODUCTION

Mother nature has blessed the Philippines with rich fishery resources. Being an archipelago of 7,107 islands, the country has vast marine territorial waters spanning 220 million hectares and a coastline stretching to 17,460 kilometers. It is no wonder then that fish, along with rice, has been a staple food for the Filipinos. At present, however, the threat of depleted fishery resources especially in municipal waters, has become imminent due to the abuses committed by some irresponsible fishermen who wantonly practice illegal and unsustainable methods of fishing.

Cognizant of the problem facing the industry, the government has taken concrete steps to conserve, protect and rehabilitate the country's marine resources. With the declining fish catch production in commercial and municipal fishing, inland fishing has been tapped to fill-up the vacuum, in marine fishing.

For the government planners and decision makers to come up with well-planned strategies and policies for effective fishery resource management, the need for accurate, reliable and timely fishery statistics cannot be discounted. As input to this regional workshop on fishery statistics, this paper briefly presents the status of fishery statistics in the Philippines with emphasis on the following:

- General Trends in the Fishery Sector
- Status of National Fishery Statistical Systems
- Fishery Policy Towards AD 2010

2. GENERAL TRENDS IN THE FISHERY SECTOR

In 1996, agriculture and fishery combined accounted for 20.93% of the GDP at constant (1985) prices (Table 1). The fishery sector alone contributed 3.89 to 4.50% to the GDP from 1990 to 1996. In the same period, growth in the fishery sector was attributed mainly to the production growth of the aquaculture sub-sector.

While commercial fish catch has increased slightly, municipal fish catch continued to decline due to the depletion in municipal fishery resources during the same period. From 1990 to 1996, the Gross Value Added (GVA) of the fishery sector at constant prices has grown by 7.01% from P30.78 to P32.94 billion.

As of April 1997, the total labor force of the Philippines was reported at 28.1 million. Of this, about 1.2 million Filipinos derived their livelihood mainly from fisheries. In order to protect the interests of the fisherfolk, the government through the Philippine Senate enacted on 5 August 1997, the Fisheries Code which seeks to achieve food security for all Filipinos by rationalizing the utilization, management, development, conservation and protection of fishery resources through the application of environment friendly technology. The code also granted exclusive rights to small-scale fishermen and fishery cooperatives to fish in municipal waters within seven kilometers from the shoreline while small and medium-sized commercial fishing vessels may operate from the seven-kilometer to fifteen-kilometer range from the shoreline.

The total fish production of the country increased slightly from 1990 to 1995, then took a slight dip in 1996 (Table 2 & Figure 1). The decrease was mainly attributed to the depletion of fishery resources particularly in municipal waters. On the other hand, the total value of production from commercial, municipal and aquaculture fishing showed an increasing trend from P52.17 billion in 1990 to P83.13 billion in 1996 at current prices.

Commercial fish production has been increasing from 1991 to 1995 at an average growth rate of 5%. In 1996, however, it dropped by 1.59%. The biggest production was recorded in 1995 at 893.23 thousand mt. Over the years, the purse seine continued to capture about 50% of the total commercial production, followed by ringnet at about 17% (Table 3).

In contrast to the performance of commercial fishing, municipal fish production has been on the decline from 1992 up to 1996 at an average rate of decrease of 4.51%. The biggest drop in production was recorded in 1993 at 6.49%. Of the total marine municipal production, about 30% was captured using gillnet and about 20% by hook and line. Aquaculture on the other hand, continued to enjoy positive growth rate at an average of 6.55%. The biggest production was noted in 1996 at 980.86 thousand mt.

From 1990 to 1995, municipal fishing has accounted for the biggest, but declining share of 45.2 to 32.8% of total fishery production among the three major sectors. In 1996, however, aquaculture production surpassed municipal production by 71 thousand mt. The dramatic increase in aquaculture production from 1990 to 1996 indicate the subsector's potential as a significant contributor of the foodfish supply and as a major source of dollar export earnings.

Aside from catering to local fish demand, the fishery sector has contributed to the national economy through the export of processed fishery products to different countries in the world, with Japan and the USA as the major destinations. The top fish exports are tuna, shrimps, mackerel and milkfish. During lean production months, however, the country in turn imports some fish species such as tuna and mackerel to meet the needs of local fish canners. Since 1990, the balance of trade and fishery products has always been favorable to the country (Table 4), with an average net earnings of about 11.3 billion pesos (34.40 Philippine Pesos = 1 US\$, 3 October 1997).

The combined average production of fresh fish, crustaceans and mollusks from 1990 to 1996 amounted to about 2.27 million mt (Table 5) while that of import reached only to 131.32 thousand mt. Of the total gross supply of 2.40 million mt, 71.62% went to net food disposable, 23.59% to processing, 2.59% to feeds and wastes and 2.20% to exports. For fresh fish, crustacean and mollusks, a sizeable portion of their gross supply was credited to net food disposable. For exports, the crustacean group had the biggest % share to gross supply at 17.09%.

3. STATUS OF NATIONAL FISHERY STATISTICAL SYSTEM

The National Fishery Statistical System, is a sub-system, of the Agricultural Statistical System (AGSTATs) which, in turn, is a part of the different statistical agencies in the country whose primary functions are the generation, processing, analysis, and dissemination of official statistics. The various statistical activities are being coordinated by the National Statistical Coordination Board (NSCB). The NSCB is the highest policy-making and coordinating body on statistical matters. It is empowered to review all budgetary proposals involving statistical operations of all government agencies belonging to the system.

The government agencies directly involved in the generation of fishery statistics are the National Statistics Office (NSO) and the Bureau of Agricultural Statistics (BAS) of the Department of Agriculture (DA). The NSO is responsible for conducting the Census of Fisheries every ten years, the latest of which was done in 1991. On the other hand, the BAS is mandated to conduct regular intercensal production surveys, and to compile, analyze and officially disseminate fishery statistics.

The BAS, through its Provincial Operation Center (POCs), updates the list and area frames, and conducts regular production surveys and monitoring activities. In 1991 and 1992, commercial and municipal landing centers in 65 provinces and cities were listed, while in 1992, aquafarms in 77 provinces and cities were also listed. In 1996, the list frame of commercial and municipal landing centers in selected provinces were updated. For 1997, the frame updating for aquaculture farms in 23 top-producing provinces is targeted to be completed by September.

The regular fishery surveys of BAS include the every-other-day collection of data on commercial and municipal fish catch unloaded at sample landing centers in 65 provinces. Data collected include volume and price of fish catch and price by fishing ground by fishing gear and by species. Starting in 1997, the data on fishing effort will be compiled.

In the case of aquaculture, semestral surveys are conducted in 23 top-producing provinces. For the rest of the aquaculture provinces a survey of key informants is done. This involves the collection of data on production, prices, harvest area, farm practices and major inputs from a few key informants carefully selected based on their knowledgeability of the local aquaculture situation.

For the regular objective surveys, data collectors interview sample operators of fishing boats and aquafarms using structured questionnaires. Accomplished questionnaires are edited and computer processed at the Provincial Operation Centers (POCs). The generated provincial estimates are sent to the regional offices (ROCs) of BAS for review, and then to the Central Office for further review, consolidation and estimation of the national level data.

Dissemination of fishery statistics to the policy makers, researchers and other data users is being done mainly through the publication of quarterly performance reports, occasional situation reports of important species, and fishery statistical handbooks. Among the recent publications released by the Fishery Section of BAS are the following:

- Fishery Statistics 1986-1995
- Fishery Statistics, 1995
- Commercial Fishery Production Statistics, 1995
- Marine Municipal Fishery Statistics on the 12 FSP Priority Bays, 1995
- 1995 Roundscad Situation Report
- 1995 Tuna Production Performance Report
- Fishery Statistics Bulletin - 1996 Production

While BAS generates primarily fish production and price data, other agencies in the government and private sectors likewise generate other fishery data through their researches or as products of their regulatory functions. Among the agencies involved in the generation of fishery data are the following:

- a) Bureau of Fisheries and Aquatic Resources (BFAR) - under the Department of Agriculture (DA), BFAR is tasked to formulate plans for the proper management and utilization of the country's fishery and aquatic resources. It also renders technical assistance in the implementation of fishery programs and provides advisory services in the proper procurement, construction and operation of commercial fishing vessels.
- b) Bureau of Agricultural Research (BAR) - also under the DA, BAR coordinates all agricultural researches and ensures that they are undertaken for maximum utility to agriculture.
- c) Philippine Fisheries Development Authority (PFDA) - an agency attached to the DA, PFDA is mandated to promote the growth of the fishery industry and to improve the efficiency in the handling, processing, marketing and distribution of fish and fishery products through the establishment and administration of fish ports, fish markets and other infrastructure.
- d) National Agricultural and Fishery Council (NAFC) - a policy-making body attached to the DA NAFC is responsible for the coordination of food production programs of the country. NAFC supervises, coordinates and evaluates the implementation of food self-sufficiency program of the government and gathers data on the progress of the various programs and field operations of the DA.
- e) Chamber of Fisheries and Aquatic Resources (CFAR) - a non-stock, non-profit organization, CFAR intends to unite the various sectors of the fishing industry such as the fishing operators, aquaculturists, fish processors, tropical fish producers, fish traders, fish workers and their families into one solid, cohesive organization for the enhancement of the industry's economic growth and development.

Users of fishery statistics generated by the aforementioned agencies have complained on the lack of a centralized source of baseline fishery information. Recognizing that a faster and more efficient way of disseminating fishery statistics to the users is through the development of an efficient computerized network, BAS as the government's principal agricultural information service center is strengthening the capability of its POCs.

This move is aimed at servicing the agricultural and fishery statistics needs of users in the provinces. Computer units are already installed in most of the POCs. Its vision, in this aspect, is the development of field-oriented computer systems designs which will be integrated into a central unit computer system. The upgrading of the BAS computer system will include direct linkage with computer systems installed at the Department of Agriculture (DA), to allow DA analysts to have an access system to the BAS information network.

In addition, the government, through the Fisheries Sector Program (FSP) established the Philippine Fisheries Information System (PHILFIS) at BFAR. The BAS together with BFAR, PFDA and the DA, is part of the inter-agency task force responsible for the development and maintenance of PHILFIS. As a repository of fishery data, PHILFIS is composed of data subsystems which includes information on habitat such as fish sanctuaries, environment, biological socio-economic data, fishery resources on production and stock assessment, research and technology, policies, plans and programs, marketing information, and infrastructure and support services. In 1998, PHILFIS will be fully operational and it is expected to be the center of a well-distributed fishery network information system in the country which will facilitate information exchange among fishery related agencies and data users.

The fishery statistics compiled by BAS are also being disseminated through the Electronic Agribusiness Statistical Information Bulletin Board (EASIBOARD) of the Philippine Statistical Association (PSA). This was developed through the Agribusiness System Assistance Program (ASAP) which was a joint undertaking of the DA and the United States Agency for International Development (USAID). The EASIBOARD caters to the data needs of agribusiness entrepreneurs who do not have so much time to go to the different statistics generating agencies. The system includes information on the different business establishments, employment and compensation, export and import statistics, and production and prices of all agricultural commodities provided by BAS. With their computers linked to EASIBOARD, users have easy online access to a data bank and other information network systems. Starting in September 1997, EASIBOARD can be accessed through the INTERNET.

4. FISHERY POLICY TOWARDS AD 2010

Recognizing the importance of the fishing industry to the national economy, the Philippines launched a fishery production program to enhance the productivity of the country's fishery resources within ecological limits. The "Gintong-Ani Program" (literally translated as Golden Harvest) for fisheries focuses on aquaculture because of its vast potential for increasing the country's total foodfish supply. Specifically, the program seeks to increase productivity of priority species like milkfish, tilapia, carp, shrimps, seaweeds and crabs.

In support to the Gintong-Ani Program, the following projects have been started:

- a) Milkfish Broodstock Development Program, to address the milkfish fry shortage;
- b) Seaweed Development Program, to arrest the deterioration of and improve the genetic quality of *Eucheuma* seedlings;
- c) Tilapia/Carp Fingerling Production and Dispersal, to insure a continuous supply of fish in inland waters;
- d) "Operasyon Sagip Sugpo" (literally translated as Operation: Save the Prawn), to rehabilitate the prawn industry which suffered huge losses due to the deleterious effects of luminous bacteria; and
- e) Nationwide Assessment, Management and Seed Production of Crab Resources, to provide alternative livelihoods to fisherfolk by developing the technology for crab culture and fattening.

Also in the pipeline is the Philippine Fisheries Management Project (PFMP) which will be funded by ADB-OECF. The PFMP was conceived to carry out the following:

- a) Promotion of fishery conservation and management in the Philippines especially for the coastal resources in identified bays through the sustained implementation of a fishery management program;
- b) Pursuing initiatives intended to alleviate poverty among coastal fisherfolk in selected bays; and
- c) Strengthening capabilities of regional and local government units (LGUs) in their implementation of community-based coastal resource management (CRM) program.

The success of these programs will greatly depend on the cooperation of all government agencies, including the local government units (LGUs), and private institutions involved in the planning coordination and project implementation. On the part of BAS, efforts have been made to improve the accuracy and reliability of fishery statistics so that development projects such as those cited above, can be properly planned and evaluated.

5. CONCLUSION

Fishery statistics in the Philippines is important because of the sector's sizable contribution to the national economy. Over a million Filipinos depend mainly on the industry for their livelihood. In support to the fishery industry, the government launched two major fishery projects, namely:

- “Gintong Ani” for Fisheries through the DA, a project which is geared towards increasing production in aquaculture within sustainable limits; and
- Philippine Fisheries Management Project through the DA’s Fisheries Sector Program (FSP) which aims to conserve the marine fishery resources through sound management.

The FSP and the “Gintong Ani” for Fisheries Programs have provided substantial funding support to the BAS to improve the methods of data generation, sampling designs and estimation procedures. In response, BAS sees to it that frame updating is conducted; sampling designs reviewed; survey instruments improved; and data validation techniques initiated.

Dissemination of fishery statistics has been enhanced with the creation of the Philippine Fisheries Information System (PHILFIS) at BFAR and the EASIBOARD of the PSA. These systems will hopefully improve and accelerate data retrieval and information exchange among various fishery institutions and agencies.

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**Table 1. Gross National Product (GNP), Gross Domestic Product (GDP) and
Gross Value Added (GVA) in Agriculture and Fisheries
Philippines, 1990-1996**

ITEM	1990	1991	1992	1993	1994	1995	1996
In Billion Pesos at 1985 Constant Prices							
GNP	720.95	724.75	737.14	746.92	786.14	825.16	881.59
GDP	720.69	716.52	718.94	734.16	766.37	802.87	846.90
GDP/Head ('000 Pesos)	11.83	11.50	11.27	11.25	11.47	11.75	12.11
Gross Value Added							
Agriculture & Fishery	153.41	158.22	159.38	163.56	168.42	171.32	177.27
Fisheries	30.78	32.00	32.38	32.82	33.20	33.85	32.94
Growth Rate (%)	3.90	3.96	1.17	1.37	1.14	1.98	-2.71
Percent Share of Fisheries on:							
GNP	4.27	4.42	4.39	4.39	4.22	4.10	3.74
GDP	4.27	4.47	4.50	4.47	4.33	4.22	3.89
GVA in Agriculture & Fishery	20.07	20.22	20.31	20.07	19.71	19.76	18.58

Source: National Statistical Coordinating Board (NSCB)

Table 2. Fish production and value by fishery sector, Philippines, 1990-1996

SECTOR	1990	1991	1992	1993	1994	1995	1996
PRODUCTION (‘000 MT)	2,503.55	2,598.97	2,625.61	2,631.94	2,720.99	2,784.31	2,769.18
Commercial	700.56	759.81	804.87	824.36	859.33	893.23	879.07
Municipal	1,131.87	1,146.76	1,084.36	1,013.96	992.58	972.04	909.25
Marine	895.04	913.52	854.69	803.19	786.85	785.37	731.31
Inland	236.83	233.24	229.67	210.77	205.73	186.67	177.94
Aquaculture	671.12	692.40	736.38	793.62	869.08	919.04	980.86
Growth Rate (%)							
Commercial		8.46	5.93	2.42	4.24	3.94	-1.59
Municipal		1.32	-5.44	-6.49	-2.11	-2.07	-6.46
Aquaculture		3.17	6.35	7.77	9.51	5.75	6.73
VALUE (Billion P)	52.17	60.03	65.44	70.21	80.19	83.05	83.13
Commercial	12.41	15.24	16.80	18.02	20.71	23.06	24.55
Municipal	19.29	22.13	22.65	22.03	24.48	26.46	25.37
Marine	16.73	19.61	19.44	20.12	22.33	24.33	23.33
Inland	2.56	2.52	3.21	1.91	2.15	2.13	2.04
Aquaculture	20.47	22.66	25.99	30.16	35.00	33.53	33.21

Source: Bureau of Agricultural Statistics (BAS)

Table 3. Fishery production by gear, Philippines, 1992-1995

ITEM	1992	1993	1994	1995
COMMERCIAL				
Production	804,866	824,356	859,330	893,230
GEAR USED				
Purse Seine	467,438	425,261	400,246	459,229
Ringnet	109,418	138,195	182,614	145,676
Trawl	90,547	86,965	88,423	66,089
Bagnet	53,396	53,889	76,499	77,891
Danish Seine	45,342	78,061	74,509	93,325
Others	38,725	41,985	37,039	51,020
PERCENT SHARE				
Purse Seine	58.08	51.59	46.58	51.41
Ringnet	13.59	16.76	21.25	16.31
Trawl	11.25	10.55	10.29	7.40
Bagnet	6.63	6.54	8.90	8.72
Danish Seine	5.63	9.47	8.67	10.45
Others	4.81	5.09	4.31	5.71
MARINE MUNICIPAL				
Production	854,687	803,194	786,847	785,369
GEAR USED				
Gillnet	283,854	249,860	249,710	258,021
Hook & Line	153,157	166,792	183,902	187,502
Fish Corral	66,829	48,943	38,155	31,056
Beach Seine	55,673	44,850	57,216	40,101
Ringnet	34,294	34,955	32,308	40,516
Others	260,880	257,794	225,556	228,173
PERCENT SHARE				
Gillnet	33.21	31.11	31.74	32.85
Hook & Line	17.92	20.77	23.37	23.87
Fish Corral	7.82	6.09	4.85	3.95
Beach Seine	6.51	5.58	7.27	5.11
Ringnet	4.01	4.35	4.11	5.16
Others	30.52	32.10	28.67	29.05

SOURCE: Bureau of Agricultural Statistics (BAS)

Table 4. Export and import statistics of major species, Philippines, 1990-1996

ITEM	1990	1991	1992	1993	1994	1995	1996
EXPORT							
Quantity (MT)							
Mackerel	313	1,450	771	2,155	2,240	1,106	695
Milkfish	867	415	637	717	288	254	173
Seaweeds	35,346	28,541	22,756	23,574	24,826	38,246	36,780
Shrimps and Prawns	25,205	30,462	23,623	2,273,404	22,418	18,258	13,514
Tuna	54,320	51,233	50,285	71,975	78,410	68,297	28,737
Sub-total	116,051	112,101	98,072	2,371,825	128,182	126,161	79,899
Others	26,988	32,838	33,843	2,208,080	43,898	43,585	84,774
Grand Total	143,039	144,939	131,915	163,745	172,080	169,746	164,673
Value ('000 Pesos)							
Mackerel	12,803	79,737	43,244	108,211	111,401	59,441	36,032
Milkfish	61,435	29,500	45,552	54,836	23,224	22,954	13,739
Seaweeds	1,192,331	590,342	480,361	498,380	581,945	2,136,659	2,438,598
Shrimps and Prawns	5,435,952	7,458,757	5,347,417	6,102,766	6,411,535	5,653,057	3,988,915
Tuna	2,763,036	3,154,086	2,589,163	4,090,953	4,400,164	3,987,948	1,888,391
Sub-total	9,465,557	11,312,422	8,505,737	10,855,146	11,528,269	11,860,059	8,365,675
Others	2,063,170	2,736,493	2,584,569	3,218,875	3,499,065	3,796,744	6,744,873
Grand Total	11,528,727	14,048,915	11,090,306	14,074,021	15,027,334	15,656,803	15,110,548
IMPORT							
Quantity (MT)							
Mackerel	375	12,639	31,279	50,541	56,808	59,955	101,257
Milkfish			9	65	19	79	72
Seaweeds							1,119
Shrimps and Prawns			9	65	19	79	72
Tuna	21,695	42,373	53,481	37,450	32,801	54,389	52,379
Sub-total	22,070	55,012	84,778	88,121	89,647	114,502	154,899
Others	174,045	138,623	136,767	120,774	151,547	155,711	107,688
Grand Total	196,115	193,635	221,545	208,895	241,194	270,213	262,587
Value ('000 Pesos)							
Mackerel	2,712	434,143	270,359	417,986	434,143	390,877	735,807
Milkfish			1,103	6,456	2,560	7,965	2,729
Seaweeds							25,764
Shrimps and Prawns			1,103	6,456	2,560	7,965	2,729
Tuna	417,907	923,091	883,058	639,248	569,956	881,408	842,616
Sub-total	420,619	1,357,234	1,155,623	1,070,146	1,009,219	1,288,215	1,609,645
Others	1,433,124	966,155	1,340,756	1,179,043	1,496,248	1,635,375	1,568,485
Grand Total	1,853,743	2,323,389	2,496,379	2,249,189	2,505,467	2,923,590	3,178,130
BALANCE OF TRADE ('000 Pesos)	9,674,984	11,725,526	8,593,927	11,824,832	12,521,867	12,733,213	11,932,418

SOURCE: National Statistics Office (NSO)

Table 5. Supply and utilization accounts, Philippines, 1990-1995

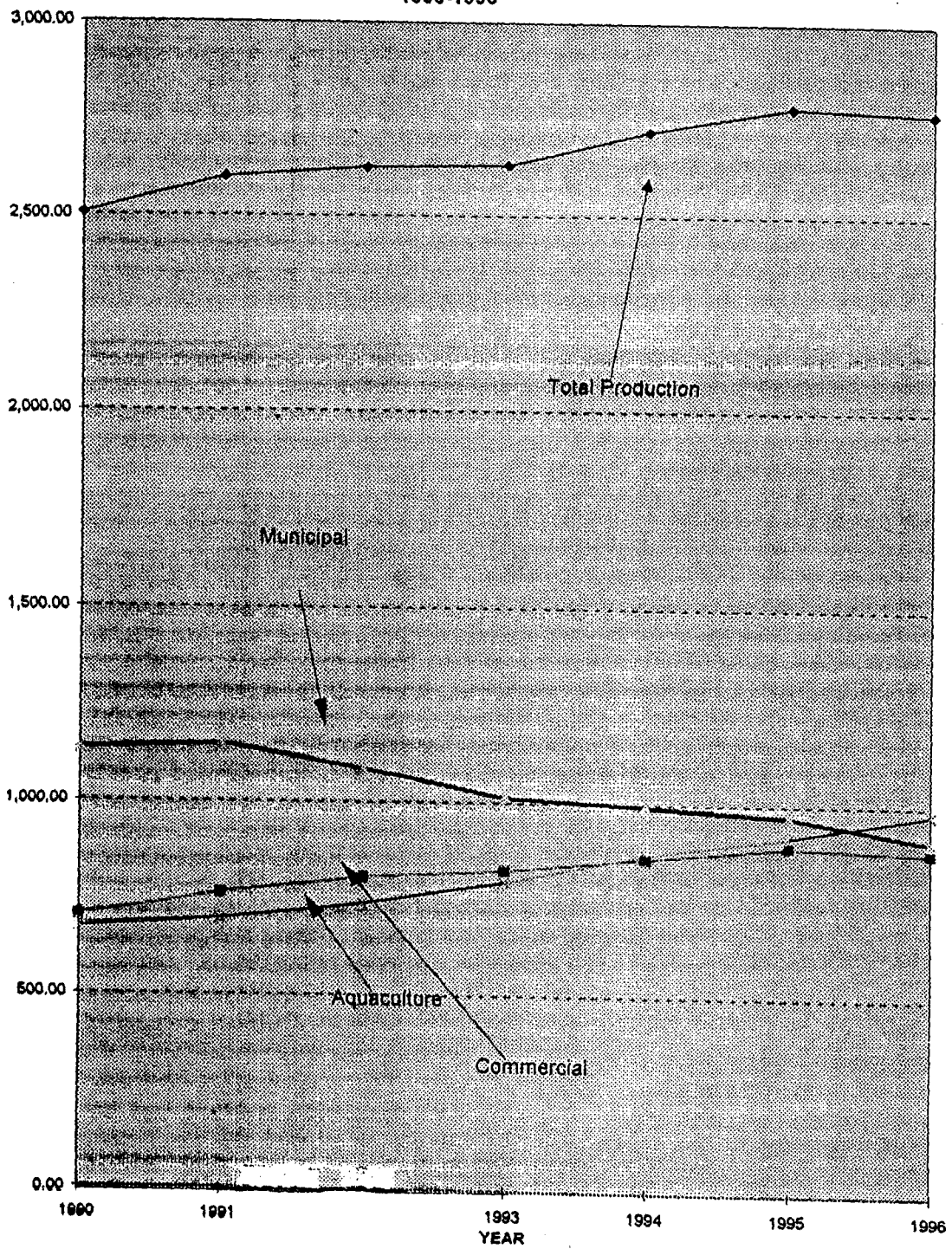
(In Metric Tons)

YEAR	SUPPLY			UTILIZATION			Net Food Disposable		
	Production	Imports	Gross Supply	Exports	Feeds & Wastes	Processing	Total	Per Capita	
								Kg./Yr.	Grams/Day
FRESH FISH									
1990	1,869,960.00	130,995.34	2,000,955.34	19,124.61	56,098.80	567,211.52	1,358,520.41	2.10	60.54
1991	1,970,295.00	146,835.45	2,117,130.45	17,033.12	59,108.85	599,668.80	1,441,319.68	22.92	62.80
1992	1,851,652.00	142,731.38	1,994,383.38	15,408.06	55,549.56	557,126.72	1,366,299.04	21.26	58.25
1993	1,831,102.00	115,450.71	1,946,552.71	34,664.22	54,933.06	547,457.60	1,309,497.83	20.01	54.83
1994	1,861,759.00	118,624.25	1,980,383.25	32,916.74	55,852.77	558,686.72	1,332,927.02	19.42	53.22
1995	1,875,576.00	132,875.03	2,008,451.03	35,096.20	56,267.28	566,077.44	1,351,010.11	19.69	53.95
Average	1,876,724.00	131,252.03	2,007,976.03	25,707.16	56,301.72	566,038.13	1,359,929.02		
% Share to Gross Supply				1.28	2.80	28.19	67.73		
CRUSTACEAN									
1990	112,047.00	9.04	112,056.04	29,868.16	1,680.71	-	80,507.17	1.31	3.59
1991	112,874.00	1.31	112,875.31	31,953.35	1,693.11	-	79,228.85	1.26	3.45
1992	180,568.00	10.73	180,578.73	25,178.19	2,708.52	-	152,692.02	2.38	6.51
1993	179,597.00	92.77	179,689.77	24,535.98	2,693.96	-	152,459.84	2.33	6.38
1994	173,050.00	69.40	173,119.40	27,052.60	2,595.75	-	143,471.05	2.09	5.73
1995	173,890.00	56.81	173,946.81	20,728.36	2,608.35	-	150,610.10	2.20	6.01
Average	155,337.67	40.01	155,377.68	26,552.77	2,330.07	-	126,494.84		
% Share to Gross Supply				17.09	1.50		81.41		
MOLLUSK									
1990	227,906.00	-	227,906.00	2,992.65	3,418.59	-	221,494.76	3.60	9.87
1991	229,378.00	20.12	229,398.12	228.51	3,440.67	-	225,728.94	3.59	9.84
1992	241,444.00	148.20	241,592.20	332.71	3,621.66	-	237,637.83	3.70	10.13
1993	254,368.00	0.03	254,368.03	94.26	3,815.52	-	250,458.25	3.83	10.49
1994	244,930.00	1.81	244,931.81	-	3,673.95	-	241,257.86	3.52	9.63
1995	220,866.00	0.87	220,866.87	189.10	3,312.99	-	217,364.78	3.17	8.68
Average	236,482.00	28.51	236,510.51	639.54	3,547.23	-	232,323.74		
Share to Gross Supply				0.27	1.50		98.23		
FRESH FISH, CRUSTACEANS & MOLLUSK									
1990	2,209,913.00	131,004.38	2,340,917.38	51,985.42	61,198.10	567,211.52	1,660,522.34	27.01	74.00
1991	2,312,547.00	146,856.88	2,459,403.88	49,214.98	64,242.63	599,668.80	1,746,277.47	27.77	76.09
1992	2,273,664.00	142,890.31	2,416,554.31	40,918.96	61,879.74	557,126.72	1,756,628.89	27.34	74.89
1993	2,265,067.00	115,543.51	2,380,610.51	59,294.46	61,442.54	547,457.60	1,712,415.92	26.17	71.70
1994	2,279,739.00	118,695.46	2,398,434.46	59,969.34	62,122.47	558,686.72	1,717,655.93	25.03	68.58
1995	2,270,332.00	132,932.71	2,403,264.71	56,013.66	62,188.62	566,077.44	1,718,984.99	25.06	68.64
Average	2,268,543.67	131,320.54	2,399,864.21	52,899.47	62,179.02	566,038.13	1,718,747.59		
% Share to Gross Supply				2.20	2.59	23.59	71.62		

SOURCE: Bureau of Agricultural Statistics (BAS)

(' 000 MT)

Figure 1. Fish Production by Sector, Philippines, 1990-1996



FISHERY STATISTICS OF TAIWAN

by

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1. GENERAL TRENDS IN THE FISHERY SECTOR

Gross National Product (GNP), i.e., Gross Domestic Product GDP plus net factor income from foreign trade, amounted to US \$275 billion in 1996. Nominal GNP rose to 4.6% from 1995. Keen foreign demand prompted exports of Taiwan to surge. GDP totaled US \$273 billion, up 4.9% from 1995. The per capita GDP in 1996 was US \$12,771 (up from US \$12,264 in 1995). The contributions of fisheries to the GDP has decreased from 0.81% in 1992 to 0.72% in 1996 due to constraints in fishery development.

There were 303,153 fishermen of whom 183,367 (60.49%) are full-time fishermen, and 119,786 (39.51%) part-time, 19,002 were engaged in the far-seas, 67369 in offshore, 105,456 in coastal areas, 22,673 in marine culture, 3,727 in inland water fishing fisheries, and 84,926 in inland culture. To solve the problem of labor shortage, more foreign crew are permitted to employ in the country's fishing industry. However, this has not solved the problem of shortage of skilled labor (officers, fishing masters and engineers), as recruitment of domestic apprentices is low due to more choices of jobs on shore.

Fishermen, on the average belong to the older group. Since fishing involves very hard work, less and less Taiwanese want to work in this activity, resulting in a shortage of local labor and the influx of immigrant workers from neighboring countries. The annual income of local fishermen averages around US \$5,940. Workers in processing plants are also normally found to be in the older age group as the younger generation prefers to take up higher skilled and more paying jobs. All these factors play a significant role in lowering the productivity in the processing of fishery products. Low pay compared to other jobs, hazard encounters like typhoons and pirates, and home-sickness are among the reasons why many boat crew move to other jobs. During out of fishing seasons, there is not much catch by the fishermen, so they stop fishing and do secondary job, like farming, factory working, masonry and return during the fishing season.

The number of total fishing boats in 1996 reached 28,111 showing a decrease of 1,611 (-5.42%) compared with 29,722 in 1995. The total tonnage in 1996 reached 856,410.56, showing a decrease of 43,805.94 (-4.87%) compared with the tonnage of 900,216.20 in 1995.

The number of total new built fishing vessels in 1996 was 360, showing a decrease of 6 (-0.27%) compared with 366 in 1995. The total tonnage in 1996 reached 10,304.25, showing a decrease of 5,601.00 (-35.21%) compared with the tonnage of 15,905.25 in 1995.

The number of total powered fishing boats in 1996 was 13,020 showing a decrease of 869 (-6.26%) compared with 13,899 produced in 1995. The total tonnage in 1996 reached 885,730.42 showing a decrease of 13,786.10 (-1.53%) compared with the tonnage of 899,516.52 in 1995.

The number of total non-powered sampans in 1996 was 1,081 showing a decrease of 42 (-3.74%) compared with 1,123 in 1995. The number of total powered rafts in 1996 was 12,503, showing a decrease of 542 (-4.0%) compared with 13,034 in 1995. The number of total non-powered rafts in 1996 was 1,507, showing a decrease of 169 (-10.08%) compared with 1,676 in 1995.

Tuna long liners accounted for the maximum tonnage (around 44%) in 1996 followed by otter trawlers (around 18%), squid jiggers (around 11%), purse seiners (around 6%) and Bull Trawl (around 4%). Most vessels are relatively new and technologically sophisticated.

2. FISH PRODUCTION (1990-1996)

The total fishery production in 1996 reached 1,239,635 mt, showing a decrease of 57,251 mt, (-4.41%) compared with the production of 1,296,886 mt, in 1995 (Table 1). The total value in 1996 reached US \$3,542 million showing a decrease of US \$120 million (-3.28%) compared with the value of US \$3,662 million, in 1995 (Table 2).

The total consumption increased from 1,124,129 mt in 1990 to 1,144,087 mt in 1993 after which there has been a sharp fall to 950,546 mt in 1996 (Table 3).

Imported fishery products in 1996 totaled 508,044 mt, valued at US \$688 million showing a decrease of 45,876 mt, but increase in value about US \$50 million as compared with that of 1995 (Table 4). Import of edible fishery products in 1996 was valued at US \$376 million, US \$120 million less than in 1995. The quantity of edible imports was 130,123 mt, 1,085 mt lower than the quantity imported in 1995.

The quantity of shrimp imported in 1996 was 22,880 mt, 581 mt less than the quantity imported in 1995. Valued at US \$101 million, US \$3 million less than the value in 1995 value, shrimp imports accounted for 27 percent of the value of total edible imports. Imports of Halibut were 13,350 mt, 2,562 mt less than the 15,912 mt imported in 1995. Imports of Salmon amounted to 11,858 mt, an increase of 1,509 mt from 1995. Import of non-edible fishery products was valued at \$317 million, \$235 million more than the record \$282 million imported in 1995 (Table 4).

The exports totaled 419,212 mt, valued at US \$1,336 million showing a decrease of 46,489 mt, and decrease in value about US \$104 million, as compared with that of 1995. Tuna and eel comprised a major share of 70% in exports from Taiwan in 1996. Of these two major species, tuna decreased its share in Taiwan's total marine exports from 49% in 1995 to 47% in 1996. The main species targeted are albacore, bigeye, yellowfins, skipjack and marlins. About 90% of the catch by albacore longliners and purse seiners is exported to Japan, USA, Thailand and Europe for canning. Albacore that makes up 85% of the fish caught by albacore longliners and landed in foreign-based ports, is exported to USA and Thailand.

Bigeye, yellowfin and marlins caught by ultra low temperature longliners are sold to the Japanese sashimi market, whereas in recent years small portions have been shipped back to Taiwan for domestic consumption. Skipjack and yellowfin caught by purse seiners are all sold to the USA, Thailand, Japan and Europe for canning. In terms of unit value realization, tuna had a very low unit value realization of US \$2.9 per kg.

In spite of being the second largest contributor to the total exports (24%), eel commanded a very high export value of US \$17.2 per kg in 1996. Although its export volumes have dropped, it had increased its unit value from US \$9.7 per kg in 1990 to US \$22 per kg in 1995 and finally to US \$17.2 per kg in 1996. The share of shrimps in Taiwan's total export decreased from 11% in 1990 to 3.4% in 1996 and its unit value per kg increased marginally from US \$8.3 per kg to US \$9.9 per kg, respectively (Table 5).

Fish production from 1990 to 1996 for far sea fisheries (Tables 6, 6a, 6b) comprises the following:

- a) Otter Trawling. The total catch in 1996 was 53,797 mt, showing a decrease of 343 mt (-0.63%) as compared with 54,140 mt, produced in 1995.
- b) Bull trawling. The total catch in 1996 was 45,861 mt, showing a decrease of 9,598 mt, (-17.31%) as compared with 55,459 mt, produced in 1995.
- c) Purse seine for tuna. The total catch in 1996 was 188,742 mt, showing an increase of 1,927 mt, (+1.03%) as compared with 186,815 mt produced in 1995.
- d) Tuna long line. The total catch in 1996 was 215,182 mt, showing a decrease of 8,259 mt, (-3.70%) as compared with 223,441 mt produced in 1995.
- e) Squid jigging. The total catch in 1996 was 138,172 mt, showing a decrease of 16,190 mt, (-10.49%) as compared with 154,362 mt, produced in 1995.
- f) Torch light net for saury. The total catch in 1996 was 8,236 mt, showing a decrease of 5,536 mt, (-40.20%) as compared with 13,772 mt, produced in 1995.

Production from 1990 to 1996 for offshore fisheries Tables 6, 6a, 6b) comprises:

- a) Purse seine. The production of 16,44 mt, showing an increase of 2,674 mt (+19.42%) as compared with 13,770 mt produced in 1995.
- b) Purse seine for mackerel. The production of 77,075 mt, showing an increase of 15,114 mt, (+24.39%) as compared with 61,961 mt produced in 1995.
- c) Torch light net. The production of 16,960 mt, showing a decrease of 1,673 mt, (-8.98%), as compared with 18,633 mt, produced in 1995.
- d) Drag net. The production of 93,809 mt, showing an increase of 1,210 mt (+1.31%) as compared with 92,599 mt produced in 1995.

- e) Gill net. The production of 13,825 mt, showing a decrease of 2,799 mt (-16.84%) as compared with 16,624 mt produced in 1995.
- f) Tuna long line. The production of 22,258 mt, showing a decrease of 10,433 mt, (-31.91%) as compared with 32,691 mt produced in 1995.
- g) Miscellaneous fish long line. The production of 8,723 mt, showing a decrease of 3,152 mt (-26.54%) as compared with 14,936 produced in 1995.
- h) Poles and lines boote. The production of 1,467 mt, showing an increase of 125 mt (+8.52%) as compared with 1,467 mt produced in 1995.

Production from 1990 to 1996 for coastal fisheries (Tables 6, 6a, 6b) comprises:

- a) Set net. The production of 11,554 mt, showing a decrease of 26 mt, (-0.22%), as compared with 11,580 mt, produced in 1995.
- b) Beach seine. The production of 434 mt, showing an increase of 544 mt, (-55.62%), as compared with 978 mt, produced in 1995.
- c) Torch light net. The production of 1,620 mt, showing a decrease of 180 mt (-10.00%), as compared with 1,800 mt, produced In 1995.
- d) Gill net. The production of 13,526 mt, showing a decrease of 363 mt, (-2.61%), as compared with 13,889 mt, produced in 1995.
- e) Pole and lines boote. The production of 2,957 mt, showing an increase of 119 mt, (+4.19%) as compared with 2,838 mt, produced in 1995.
- f) Long line. The production of 1,265 mt, showing a decrease of 451 mt, (-26.28%), as compared with 1,716 mt, produced in 1995.
- g) Spear fishing. The production of 631 mt, showing a decrease of 662 mt, (-51.20%), as compared with 1,293 mt, produced in 1995.

On the other hand, the production from inland fisheries of 443 mt, showing a decrease of 768 mt, (-63.42%) as compared with 1,211 mt, produced in 1995 (Tables 6, 6a, 6b).

3. FISHERY POLICY TOWARD AD 2010

In order to approach the goals of the National Fisheries Programme, the Taiwan Fisheries Bureau plans to facilitate the following:

- a) Development of seafood products with competency and a marketing system with business administration;
- b) Creation of stable environment for fisheries development; the establishment of wealthy and beautiful villages for fishermen with cultural focus; and

- c) **Strengthening consumers' faithfulness and support for local fisheries.**

On the other hand, the goals of "The Cross-Century Agriculture Development Program" by the Council of Agriculture are:

- a) **To develop modern agriculture with efficiency and stability;**
- b) **To establish self-sufficient and beautiful villages for farmers and fishermen with wealth and nature; and**
- c) **To improve the welfare for farmers and fishermen with faithfulness and dignity.**

The program will also implement the following management aspects:

- a) **The number of coastal and off-shore fishing boats will undergo annual reduction, enabling individual fishing boats and fishermen to improve their productivity and profitability;**
- b) **Coastal fisheries has been diversified to recreational fishing and appropriate steps are being taken for the prevention of pollution in coastal areas;**
- c) **On the high seas within the exclusive economic zones of other coastal nations, the distant water fishing vessels will participate in the exploitation of marine fishery resources through international fishery cooperation. Distant water fisheries will become means of strengthening the international relationship; and**
- d) **Aquaculture is now being focused on high value marine species and the proportion of production by fresh water aquaculture is being gradually reduced. Water recycling is being promoted in aquaculture and sea ranching is increasingly being used along with improved management of fish ponds in order to achieve harmony between aquaculture and environment.**

4. STATUS OF NATIONAL FISHERY STATISTICAL SYSTEMS

The Taiwan Fisheries Bureau (TFB) has the obligation to process fishery statistics for the Taiwan area and its Fifth Division is responsible not only for the survey system, methodology and program tabulation but also for scrutinizing the data, and the compilation and publication of such data. The sub-district office fishermen's association and fish markets complete the reporting forms (questionnaires) monthly or yearly from formal or informal records or investigations following the standard methods in the fishery statistical handbook. The data is transferred to the district levels according to the time schedule and tabulation program. The completion of reporting forms is done initially by the Fishery Section and Kaohsiung Municipal Fisheries Department at the district level, with analysis and estimation. The data are inputted in computer data base and the diskettes are forwarded to Fifth Division of TFB for further scrutiny and aggregation.

Landing fishery production overseas is collected by Kaohsiung Municipal Fishery Department and TFB through the landing port agency with self-enumeration procedure. In fishery exports and import statistics, electronic media data come from the Statistical Department of the Directorate General of Customs of the Ministry of Finance. The data are processed, analyzed and tabulated using computers at the TFB.

All data are finally transferred to the Provincial (or Municipal) fishery administration where summarization is made, and monthly and annual reports are published. As far as the data are concerned, there are 21 major items included in the regular reporting system. The other information, in addition to production and marketing, included in the system are: basic composition of fishermen's association and their membership, employees, or reported data.

For the socio-economical survey, purposive sampling is used to collect data with interview by visiting the household and fishing company by a surveyor. Data are double checked for quality of data using trade statistics of foreign countries as reference.

For the aquaculture information system, the data are collected by a geographical information system through air photo, pond site surveys using purposive sampling and registered licenses. The statistics of aquaculture information system are not normal statistics reported annually and are only used as reference of the basic fishery statistics. On the other hand, fishery management information system makes use of licensed data of registered fishing boats and fishermen and other related information as references.

For fish market information system, the data from product and consumer markets related to the daily auctions, are sent to the data processing centers of TFB by telephone for compilation and information processing. The market information system provides a form of the transaction data of the consumers and producers rather than statistical reporting.

For the purpose of data processing, many computer systems are used, and beginning in 1980, fishery statisticians rely on computer-generated information for their data requirements. Statistical system has become directly involved with compilation and analysis using packaged software and training program, starting with the main frame to personal or notebook computers. All data sets are keyed-in, processed, tabulated, exchanged using communication equipment, and stored in the computers.

5. FISHERY CENSUS

The agricultural, forestry, fishery and husbandry census is done in accordance with the Law of Statistics, and listed as the basic investigation of the national situation. Since 1956, the census is conducted every five years. A survey is conducted in every Gregorian year with the final digit coinciding with "5". Its main purpose is to collect information on resources distribution, production structure, the characteristics of labor force, the capital equipment, and the real situation of the management system.

A commission handles the census, which generally comprised scientists, administrators and experts in fisheries, and sponsored by Directorate-General of Budget, Accounting and Statistics of the Executive Yuan. Under the Commission, techniques study team is organized for reviewing and deciding the related programs, plans and rules. In this operational system, four hierarchical parts are differentiated to facilitate the census procedure.

The Directorate-General of Budget, Accounting and Statistics is in charge of the whole system. The questionnaires are distributed to temporary surveyors for them to visit the fishery households or companies. An incipient data processing is then carried out by the regional work team.

The regional work teams are usually established as subsidiaries of the town administration. From the top to the lower level of the system, there are county and provincial (or municipal) statisticians working on the verification of the reliability, consistency and reasonableness of the data in order to guarantee their quality. The items on the fishery section of the survey, are as follows:

- a) The general situation, which includes the composition of fishermen's families, the number of working days, organizational type, characters for the managers, workers employed, main objects managed;
- b) Fishing equipment and how it works;
- c) Area of plantation, the equipment used, and how it is planted; and
- d) The will to engage in fishery, the incidental difficulties and demand.

Fishery census is completed by population counts biennially and collected by sample survey once every five years. The last census undertaken in 1996 included information obtainable in calendar year 1990. The population counts of nationwide sample was surveyed through interview procedure of household and self-enumeration of company rather than sample surveys as in 1991.

The fishery census makes use of an IBM 3090 main frame while the fishery basic statistics collected from stations, are processed by Intel-80486 IBM compatible personal computers (PCs). The fishery resource survey data are processed using the Unix system of the workstation or PCs. The fishery management information system by IBM 9221 mainframe through the fishery authority online. The system for integral management of fishing boats and fishermen, market price information are processed by value added network of a central database in a PC, aquaculture information system by PC BBS and others mostly by PC with Statistics Analysis System (SAS) and application programs. Unfortunately, the data sharing in fishery statistics is difficult because these are stored in different systems and their retrieval could be time-consuming.

At present, a large computer fishery network has been designed for fishery statistics and information. Its scope contains a wide area network of main frame computers, local area network of personal computers and end-user personal computers that are hooked up as an integral system, by communication facilities. World wide web (www) is available for information exchange (www.tfb.gov.tw).

6. CATCH-EFFORT AND FISH PROCESSING STATISTICS

Presently, there are about 450 small tuna longliners (50-70 GRT) from Taiwan operating in the waters of Indonesia, the Philippines, Malaysia, Federated States of Micronesia, Guam, Palau, Solomon Islands, Marshall Islands etc. In view of the seasonal catch rates of fish from these waters, some of the tuna longliners shift to other neighboring countries in the South China Sea area from time to time, depending on their respective catch information. The total catch for the small longline as a whole in 1996 was estimated at about 50,000 mt. The data for catch and effort statistics are collected by means of a self-enumeration telegraphic station.

The appropriate questionnaires are prepared previously as tools for the daily operation situation in fishing reported from boat owners or captains. Samples are selected by means of purposive sampling. Being aware that timely collection, compilation and analysis of data are fundamental to the effective conservation and management of small longline fisheries, the country will do its best to reinforce the collection system for small longline fisheries data. After 1 July 1996, the data collecting and processing center which was formerly designated to the Institute of Oceanography, National Taiwan University (NTU), had been endorsed to the Overseas Fisheries Development Council (OFDC). After 1 July 1997, the said collection was again endorsed finally to the TFB. Only data verified by TFB and preliminarily processed by OFDC will be provided to the individual scientists of NTU for stock assessment and biological research purposes. This new arrangement would hopefully increase the efficiency of data collection and verification of the collected data. In this connection, the TFB needs to strengthen its manpower and enrich its experience with other competent agencies. The domestic industries will also be involved in statistics and data collection. To enhance the cooperation with regional fishery management organizations, collection and exchange of data will continue to be based on the consistent policy.

Some fishing-based statistics are also collected by National Taiwan University, National Taiwan Ocean University and other related academic institutions. Publications of their data include the Annual Report of Effort and Catch Statistics by Area on Taiwan Demersal Fish Fisheries; Annual Catch Statistics of Taiwanese Tuna Longline Fishery; Statistics of Deep Sea Jigging Fishery of Squid in Southwest Atlantic Region; and Report on Catch Statistics and Resource Survey of Offshore and Coastal Fishery. These are published by TFB from the data collected by the said academic organizations.

Four major groups of fish products are produced from the local fish processing industry. These are: canned products; frozen and cold storage products; smoked, dried and salted products; and dried/seasoned, fish, fin, mullet roe, fish paste, others. In 1996, canned fishery products totaled 11,826 mt which was valued at US \$22 million. Frozen and cold storage products were 162,244 mt, valued at US \$295 million; smoked products were 366 mt, valued at US \$2.9 million; dried and salted products were 12,298 mt, valued at US \$67 million; dried/seasoned products were 4,542 mt, valued at US \$51 million; and fish paste products were 7,837 mt, valued at US \$22 million. On the other hand, processed fishery products not for human food were 34,489 mt and valued at US \$14 million.

The fish processing industry in Taiwan can be grouped into two categories in terms of the scale of operation, viz factories which are export oriented and manufacture high value added products for the overseas markets, and factories which are small and medium in operational-size but produce traditional fish products for local demand and regional markets. The number of fish processing plants were 834 in 1996, representing an increase of 87 compared with that of 1995. Of this total number, 592 were cottage industries, 220 were Product Inspection Bureau classified plants, and 22 were licensed plant.

There are 21 local fishing sections in 21 counties in Taiwan Province, and one Kaohsiung Municipal Fishery Department. Some 18 of these are attached to the Agriculture Bureau or Construction Bureau of the county government. At present, fishery statistics, including data collection and processing is an official routinary work of the Fishery Section. Fishery statistics belong to agriculture statistics, and is featured in the yearly report to the District Magistrate and Director of Agriculture. There are no full-time employees at the sub-districts.

The work is done by the local veterinarian or any member of the office. Since there are few inland fisheries operated in Taiwan, 37 fishermen's associations and their offices along the coast of Taiwan are utilized as major fishery collection center of statistical data.

7. PROPOSALS TO IMPROVE NATIONAL FISHERY STATISTICAL SYSTEMS

- a) Invitation of experts, scholars, professions of fishery and related fields to attend meeting on open issues and update the information of the fisheries yearbook of Taiwan area;
- b) Provision of extensive training to the country's surveyors and building up of a well-defined statistical system for capture fisheries. Implementation of sample investigative data to rectify the fisheries yearbook of the Taiwan area;
- c) Release of fishery periodicals and booklets for surveyor's reference;
- d) Continuous updating of the information to identify and clarify ambiguous points;
- e) Release of operation manuals on fishery surveying information system to help surveyors on system utilization; and
- f) Building up of computer and communication systems, and of information exchange to enhance the related database of fishery statistics.

Table 1. Fisheries Production, 1990-1996

Unit : MT

Type of Fisheries (Year)	Grand Total	Far Sea Fisheries	Offshore Fisheries	Coastal Fisheries	Marine Culture	Inland Culture	Inland Fishing Fisheries
1990	1,455,495	766,985	292,391	48,362	36,507	3,494	307,756
1991	1,316,651	714,263	266,945	41,231	31,192	2,327	260,693
1992	1,326,981	737,638	280,513	45,401	33,958	1,782	227,690
1993	1,423,971	834,965	258,601	43,443	35,105	1,688	250,170
1994	1,255,273	683,780	242,272	39,800	33,185	1,456	254,780
1995	1,296,886	709,543	255,981	43,518	33,230	1,211	253,404
1996	1,239,635	668,979	256,654	41,033	34,889	443	237,636

Table 2. Fisheries Value, 1990-1996

Unit : Thousand N.T. \$

Type of Fisheries (Year)	Grand Total	Far Sea Fisheries	Offshore Fisheries	Coastal Fisheries	Marine Culture	Inland Culture	Inland Fishing Fisheries
1990	89,154,163	35,248,572	18,234,546	3,960,095	3,040,645	180,376	28,489,929
1991	83,526,072	32,203,991	17,457,328	3,516,865	2,597,564	91,686	27,658,639
1992	83,715,433	34,622,193	16,393,842	3,326,754	3,086,938	80,605	250,170
1993	93,175,224	42,700,613	17,285,500	3,270,613	3,463,073	102,554	26,352,871
1994	89,201,376	36,046,903	16,083,584	3,430,129	3,083,369	74,321	30,483,070
1995	100,565,749	43,084,074	16,930,516	3,978,190	3,183,258	58,738	33,330,973
1996	97,265,187	43,827,522	16,585,511	4,256,372	3,135,683	34,160	29,425,939

Table 3. Total amount used for human consumption in Taiwan**Unit: KG**

Year	Total of Fisheries Production	Total of Export	Total of Import	Total of nonedible	Domestic sales
1990	1,455,495,000	391,315,349	530,073,906	470,124,222	1,124,129,335
1991	1,316,651,000	416,969,402	499,238,539	435,542,798	963,377,339
1992	1,326,981,000	342,163,396	484,984,012	399,163,826	1,070,637,790
1993	1,423,971,000	382,294,688	592,569,216	488,158,322	1,146,087,206
1994	1,255,273,000	419,873,544	581,720,371	459,824,292	957,295,535
1995	1,296,865,000	465,700,609	553,919,753	424,880,722	960,203,422
1996	1,239,635,000	419,212,389	508,043,923	377,920,057	950,546,477

Table 4. An analysis of import of major product groups/species

Q: Qty: Mt
V: Value: Million US \$
P: Unit Value: US\$/kg

Name of the product group/species	1990			1991			1992			1993		
	Q	V	P	Q	V	P	Q	V	P	Q	V	P
Eel	1,262	41	32.5	752	40	53.2	755	33	43.7	477	20	41.9
Shrimp*	5,161	29	5.6	6,289	33	5.2	13,355	56	4.2	19,217	78	4.1
Salmon	174	1	5.7	405	1	2.5	736	3	4.1	3,182	13	4.1
Halibut	9,104	11	1.2	11,869	14	1.2	13,591	24	1.8	17,044	26	1.5
Oth. fish**	471,612	268	0.6	429,888	274	0.6	398,975	259	0.6	492,006	273	0.6
Other	42,761	124	2.9	50,036	142	2.8	57,572	173	3.0	60,643	187	3.1
Total Marine Exports	530,074	473	0.9	499,239	504	1.0	484,984	548	1.1	592,569	597	1.0

Name of the product group/species	1994			1995			1996		
	Q	V	P	Q	V	P	Q	V	P
Eel	941	30	31.9	1,298	39	30.0	1,124	34	30.2
Shrimp*	25,104	103	4.1	23,461	98	4.2	22,880	101	4.4
Salmon	7,016	22	3.1	10,349	28	2.7	11,858	30	2.5
Halibut	5,171	24	1.6	15,912	26	1.6	13,350	23	1.7
Oth. fish**	467,670	248	0.5	435,147	262	0.6	386,419	280	0.7
Other	65,818	206	3.1	67,753	208	3.1	72,413	220	3.0
Total Marine Exports	581,720	633	1.1	553,920	661	1.2	508,044	688	1.4

* incl. Striped prawn, grass shrimp

** incl. Yellow fin, blue fin, southern blue fin, longfinned, big eye and other tuna and Skipjack

Table 5. An analysis of export of major product groups/species

Q: Qty: Mt
V: Value: Million US \$
P: Unit Value: US\$/kg

Name of the product group/species	1990			1991			1992			1993		
	Q	V	P	Q	V	P	Q	V	P	Q	V	P
Eel	46,933	455	9.7	46,097	563	12.2	44,696	582	13.0	37,797	618	16.4
Tuna [#]	193,054	396	2.1	201,058	364	1.8	161,587	330	2.0	202,975	370	1.8
Oth. fish	40,734	86	2.1	48,243	106	2.2	41,720	102	2.4	45,109	107	2.4
Squid	40,988	70	1.7	35,229	76	2.2	27,712	74	2.7	32,167	77	2.4
Shrimp*	17,183	142	8.3	17,157	141	8.2	12,424	122	9.8	6,631	61	9.2
Other	52,423	106	2	69,185	123	1.8	54,025	110	2.0	57,616	114	2.0
Total Marine Exports	391,315	1,255	3.2	416,969	1,373	3.3	342,164	1,320	3.9	382,295	1,347	3.5

Name of the product group/species	1994			1995			1996		
	Q	V	P	Q	V	P	Q	V	P
Eel	23,732	448	18.9	15,442	340	22.0	18,239	314	17.2
Tuna [#]	239,715	588	2.5	286,651	734	2.6	218,123	623	2.9
Oth. fish	54,191	132	2.4	57,430	159	2.8	31,040	83	2.7
Squid	32,898	60	1.8	28,242	61	2.2	28,105	59	2.1
Shrimp*	5,196	54	10.7	4,815	52	10.8	4,558	45	9.9
Other	64,142	120	1.9	73,121	146	2.0	119,147	211	1.8
Total Marine Exports	419,874	1,402	3.3	465,701	1,492	3.2	419,212	1,335	3.2

[#] incl. Yellow fin, blue fin, southern blue fin, longfinned, big eye and other tuna and Skipjack

* incl. Striped prawn, grass shrimp

Table 6. Fisheries production and value by type of fisheries (1990-1992)

Unit:Quantity: M.T.
Value:Thousand N.T. \$

Type of Fisheries	Year	1990		1991		1992	
		Quantity	Value	Quantity	Value	Quantity	Value
Grand Total		1111232	57623589	1024766	53269869	1065333	54423394
Far Sea Fisheries		766985	35248572	714263	32203991	737638	34622193
Otter Trawl		97145	4277440	86115	3814168	40064	2006836
Bull Trawl		104128	4319067	98775	4269631	71375	3606226
Purse Seine for Tuna		124599	3013627	107062	2456971	165879	4182712
Tuna Long Line		155921	9993993	134574	7880426	237132	16256080
Gill Net of Large Mesh Size		125112	6248412	90982	5090863	25551	1331060
Squid Jigging		88254	4685110	124176	5753720	151535	5828660
Squid Gill Net		38034	2110795	51326	2555221	11053	456489
Torch Light Net for Saury		31877	548283	19473	331041	34235	917847
Coral Fishing		-	-	-	-	-	-
Other Far Sea Fisheries		1915	51844	1780	51951	814	36644
Offshore Fisheries		292391	18234546	266945	17457328	280513	16393842
Purse Seine		9826	357793	6605	177342	13887	507136
Purse Seine for Mackerel		53897	1077930	42734	950478	60858	1315625
Torch Light Net		34132	2164571	24292	1803318	23156	1247123
Drag Net		120697	8713733	125259	9112550	110960	7264788
Gill Net		22307	2080286	19921	2055720	17476	1836745
Driving-in Net		484	7540	379	7128	325	10500
Other Offshore Nets		4650	631131	4322	490937	2350	222263
Tuna Long Line		21292	1693263	23960	1648665	29043	1990738
Misc. Fish Long Line		13847	818751	12957	676159	16993	1578420
Troll Line		3945	285655	3699	248053	2288	104425
Pole and Lines Boote		5173	322954	1602	217796	1462	163392
Other Angling		322	18656	403	36850	470	46664
Coral Fishing		1	1150	-	-	-	-
Other Offshore Fisheries		1821	61132	812	32332	1245	106025
Coastal Fisheries		48362	3960095	41231	3516865	45401	3326754
Set Net		7026	340257	8311	481326	10537	601415
Beach Seine		773	82476	427	38331	432	47075
Torch Light Net		5474	538662	3081	344330	2544	148401
Gill Net		17472	1323602	14183	1161767	15405	1038331
Other Coastal Nets		4981	500550	3472	341940	4077	490138
Pole and Lines Boote		3890	247886	2556	173644	2999	162070
Long Line		2460	280249	2635	304147	1396	109266
Other Angling		497	28864	563	25433	624	32105
Spear Fishing		1862	259591	2151	282416	1894	174044
Sport Fishing		441	42306	495	44324	263	23391
Other Coastal Fisheries		3486	315653	3358	319207	5228	500518
Inland Fishing Fisheries		3494	180376	2327	91686	1782	80605
Inland Water Fishing		2075	98824	1130	36400	743	29716
Reservoir Fishing		1179	67687	1054	51443	980	48192
Other Inland Fishing		241	13865	143	3844	58	2697

Table 6a. Fisheries production and value by type of fisheries (1993-1996)

Unit: Quantity: M.T.
Value: Thousand N.T. \$

Type of Fisheries	1993		1994		1995		1996	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Grand Total	1138696	63359280	967308	55634937	1010231	64049342	967110	64703565
Far Sea Fisheries	834965	42700613	683780	36046903	709543	43084074	668979	43827522
Otter Trawl	44184	1913636	35400	2000297	54140	2764774	53797	3153206
Bull Trawl	79100	3482080	61947	3491623	55459	3449553	45861	3055381
Purse Seine for Tuna	176666	3622608	182555	4357325	186815	3881684	188742	3570215
Tuna Long Line	300193	28398147	209319	20282828	223441	25359200	215182	27989934
Gill Net of Large Mesh Size	-	-	-	-	-	-	-	-
Squid Jigging	197494	4615064	158303	5065696	154362	6478838	138172	5114898
Squid Gill Net	-	-	-	-	-	-	-	-
Torch Light Net for Saury	36435	633975	12550	251004	13772	330528	8236	222365
Coral Fishing	-	-	-	-	-	-	-	-
Other Far Sea Fisheries	892	35103	23706	598130	21553	819498	18989	721523
Offshore Fisheries	258601	17285500	242272	16083584	255981	16930516	256654	16585511
Purse Seine	11092	519390	5366	268798	13770	487615	16444	403461
Purse Seine for Mackerel	63849	1781941	71941	1048922	61961	1785923	77075	2274057
Torch Light Net	16897	982081	21542	1257623	18633	979658	16960	819180
Drag Net	103594	7293843	77483	6023970	92599	6536107	93809	6786404
Gill Net	12224	1410675	17275	2348564	16624	2202622	13825	2010468
Driving-in Net	531	41143	576	89118	166	6760	403	46108
Other Offshore Nets	414	37746	300	40862	449	92841	-	-
Tuna Long Line	27287	2402609	22698	2378278	32691	2942663	22258	2063630
Misc. Fish Long Line	13558	2301420	14936	1648668	11875	1248762	8723	1417660
Troll Line	5112	160248	3353	183335	336	22176	392	78655
Pole and Lines Boote	1657	181653	2206	307984	1467	236645	1592	259398
Other Angling	815	82494	1113	123727	721	88135	932	120680
Coral Fishing	-	-	-	-	-	-	-	-
Other Offshore Fisheries	1542	90258	3485	363736	4690	300612	4242	305811
Coastal Fisheries	43443	3270613	39800	3430129	43496	3976013	41033	4256372
Set Net	12008	706813	13143	831139	11558	669856	11554	788623
Reach Seine	684	100750	611	84286	978	129049	434	59028
Torch Light Net	1083	117015	734	66813	1800	189958	1620	188356
Gill Net	17264	1340859	14387	1269521	13889	1195016	13526	1344211
Other Coastal Nets	1927	156735	1682	216905	2763	439386	3758	439709
Pole and Lines Boote	2366	175777	2800	261469	2838	253740	2957	338028
Long Line	988	117125	503	63531	1716	165871	1265	204625
Other Angling	726	50592	913	90324	825	64642	947	67191
Spear Fishing	1238	167748	1355	199596	1293	141644	631	107845
Sport Fishing	277	22986	286	28066	168	16410	306	27739
Other Coastal Fisheries	4882	314214	3385	318479	5669	710442	4034	691017
Inland Fishing Fisheries	1688	102554	1456	74321	1211	58738	443	34160
Inland Water Fishing	467	32832	651	32797	505	23884	35	5493
Reservoir Fishing	964	51032	547	23064	482	22617	385	25156
Other Inland Fishing	257	18690	259	18460	225	12237	24	3512

Table 6b. Fisheries production by type of fisheries (1993-1996)

Unit: Quantity: M.T.

Type of Fisheries	Year	1993		1994		1995		1996	
		Quantity	%	Quantity	%	Quantity	%	Quantity	%
Grand Total		1138696	100.00%	967308	100.00%	1010231	100.00%	967110	100.00%
Far Sea Fisheries		834965	73.33%	683780	70.69%	709543	70.24%	668979	69.17%
Otter Trawl		44184	3.88%	35400	3.66%	54140	5.36%	53797	5.56%
Bull Trawl		79100	6.95%	61947	6.40%	55459	5.49%	45861	4.74%
Purse Seine for Tuna		176666	15.51%	182555	18.87%	186815	18.49%	188742	19.52%
Tuna Long Line		300193	26.36%	209319	21.64%	223441	22.12%	215182	22.25%
Gill Net of Large Mesh Size		-	-	-	-	-	-	-	-
Squid Jigging		197494	17.34%	158303	16.37%	154362	15.28%	138172	14.29%
Squid Gill Net		-	-	-	-	-	-	-	-
Torch Light Net for Saury		36435	3.20%	12550	1.30%	13772	1.36%	8236	0.85%
Coral Fishing		-	-	-	-	-	-	-	-
Other Far Sea Fisheries		892	0.08%	23706	2.45%	21553	2.13%	18989	1.96%
Offshore Fisheries		258601	22.71%	242272	25.05%	255981	25.34%	256654	26.54%
Purse Seine		11092	0.97%	5366	0.55%	13770	1.36%	16444	1.70%
Purse Seine for Mackerel		63849	5.61%	71941	7.44%	61961	6.13%	77075	7.97%
Torch Light Net		16897	1.48%	21542	2.23%	18633	1.84%	16960	1.75%
Drag Net		103594	9.10%	77483	8.01%	92599	9.17%	93809	9.70%
Gill Net		12224	1.07%	17275	1.79%	16624	1.65%	13825	1.43%
Driving-in Net		531	0.05%	576	0.06%	166	0.02%	403	0.04%
Other Offshore Nets		414	0.04%	300	0.03%	449	0.04%	-	-
Tuna Long Line		27287	2.40%	22698	2.35%	32691	3.24%	22258	2.30%
Misc. Fish Long Line		13558	1.19%	14936	1.54%	11875	1.18%	8723	0.90%
Troll Line		5112	0.45%	3353	0.35%	336	0.03%	392	0.04%
Pole and Lines Boote		1657	0.15%	2206	0.23%	1467	0.15%	1592	0.16%
Other Angling		815	0.07%	1113	0.12%	721	0.07%	932	0.10%
Coral Fishing		-	-	-	-	-	-	-	-
Other Offshore Fisheries		1542	0.14%	3485	0.36%	4690	0.46%	4242	0.44%
Coastal Fisheries		43443	3.82%	39800	4.11%	43496	4.31%	41033	4.24%
Set Net		12008	1.05%	13143	1.36%	11558	1.14%	11554	1.19%
Beach Seine		684	0.06%	611	0.06%	978	0.10%	434	0.04%
Torch Light Net		1083	0.10%	734	0.08%	1800	0.18%	1620	0.17%
Gill Net		17264	1.52%	14387	1.49%	13889	1.37%	13526	1.40%
Other Coastal Nets		1927	0.17%	1682	0.17%	2763	0.27%	3758	0.39%
Pole and Lines Boote		2366	0.21%	2800	0.29%	2838	0.28%	2957	0.31%
Long Line		988	0.09%	503	0.05%	1716	0.17%	1265	0.13%
Other Angling		726	0.06%	913	0.09%	825	0.08%	947	0.10%
Spear Fishing		1238	0.11%	1355	0.14%	1293	0.13%	631	0.07%
Sport Fishing		277	0.02%	286	0.03%	168	0.02%	306	0.03%
Other Coastal Fisheries		4882	0.43%	3385	0.35%	5669	0.56%	4034	0.42%
Inland Fishing Fisheries		1688	0.15%	1456	0.15%	1211	0.12%	443	0.05%
Inland Water Fishing		467	0.04%	651	0.07%	505	0.05%	35	0.00%
Reservoir Fishing		964	0.08%	547	0.06%	482	0.05%	385	0.04%
Other Inland Fishing		257	0.02%	259	0.03%	225	0.02%	24	0.00%

Table 7. Fisheries value by type of fisheries (1990-1992)

Type of Fisheries	Year	Value: Thousand N.T. \$					
		1990		1991		1992	
		Value	%	Value	%	Value	%
Grand Total		57623589	100.00%	53269869	100.00%	54423394	100.00%
Far Sea Fisheries		35248572	61.17%	32203991	60.45%	34622193	63.62%
Otter Trawl		4277440	7.42%	3814168	7.16%	2006836	3.69%
Bull Trawl		4319067	7.50%	4269631	8.02%	3606226	6.63%
Purse Seine for Tuna		3013627	5.23%	2456971	4.61%	4182712	7.69%
Tuna Long Line		9993993	17.34%	7880426	14.79%	16256080	29.87%
Gill Net of Large Mesh Size		6248412	10.84%	5090863	9.56%	1331060	2.45%
Squid Jigging		4685110	8.13%	5753720	10.80%	5828660	10.71%
Squid Gill Net		2110795	3.66%	2555221	4.80%	456489	0.84%
Torch Light Net for Saury		548283	0.95%	331041	0.62%	917487	1.69%
Coral Fishing		-	-	-	-	-	-
Other Far Sea Fisheries		51844	0.15%	51591	0.10%	36644	0.07%
Offshore Fisheries		18234546	51.73%	17457328	32.77%	16393842	30.12%
Purse Seine		357793	1.02%	177342	0.33%	507136	0.93%
Purse Seine for Mackerel		1077930	3.06%	950478	1.78%	1315625	2.42%
Torch Light Net		2164571	6.14%	1803318	3.39%	1247123	2.29%
Drag Net		8713733	24.72%	9112550	17.11%	7264788	13.35%
Gill Net		2080286	5.90%	2055720	3.86%	1836745	3.37%
Driving-in Net		7540	0.02%	7128	0.01%	10500	0.02%
Other Offshore Nets		631131	1.79%	490937	0.92%	222263	0.41%
Tuna Long Line		1693263	4.80%	1648665	3.09%	1990738	3.66%
Misc. Fish Long Line		818751	2.32%	676159	1.27%	1578420	2.90%
Troll Line		285655	0.81%	248053	0.47%	104425	0.19%
Pole and Lines Boote		322954	0.92%	217796	0.41%	163392	0.30%
Other Angling		18656	0.05%	36850	0.07%	46664	0.09%
Coral Fishing		1150	0.00%	-	-	-	-
Other Offshore Fisheries		61132	0.17%	32,332	0.06%	106025	0.19%
Coastal Fisheries		3960095	11.23%	3516865	6.60%	3326754	6.11%
Set Net		340257	0.97%	481326	0.90%	601415	1.11%
Beach Seine		82476	0.23%	38331	0.07%	47075	0.09%
Torch Light Net		538662	1.53%	344330	0.65%	148401	0.27%
Gill Net		1323602	3.76%	1161767	2.18%	1038331	1.91%
Other Coastal Nets		500550	1.42%	341940	0.64%	490138	0.90%
Pole and Lines Boote		247886	0.70%	173644	0.33%	162070	0.30%
Long Line		280249	0.80%	304147	0.57%	109266	0.20%
Other Angling		28864	0.08%	25433	0.05%	32105	0.06%
Spear Fishing		259591	0.74%	282416	0.53%	174044	0.32%
Sport Fishing		42306	0.12%	44324	0.08%	23391	0.04%
Other Coastal Fisheries		315653	0.90%	319207	0.60%	500518	0.92%
Inland Fishing Fisheries		180376	0.51%	91686	0.17%	80605	0.15%
Inland Water Fishing		98824	0.28%	36400	0.07%	29716	0.05%
Reservoir Fishing		67687	0.19%	51443	0.10%	48192	0.09%
Other Inland Fishing		13865	0.04%	3844	0.01%	2897	0.00%

Table 7a. Fisheries value by type of fisheries (1993-1996)

Type of Fisheries	Value: Thousand N.T. \$									
	Year		1993		1994		1995		1996	
	Value	%	Value	%	Value	%	Value	%		
Grand Total	63359280	100.00%	55634937	100.00%	64049342	100.00%	64703565	100.00%		
				%						
Far Sea Fisheries	42700613	67.39%	36046903	64.79%	43084074	67.27%	43827522	67.74%		
Otter Trawl	1913636	3.02%	2000297	3.60%	2764774	4.32%	3153206	4.87%		
Bull Trawl	3482080	5.50%	3491623	6.28%	3449553	5.39%	3055381	4.72%		
Purse Seine for Tuna	3622608	5.72%	4357325	7.83%	3881684	6.06%	3570215	5.52%		
Tuna Long Line	28398147	44.82%	20282828	36.46%	25359200	39.59%	27989934	43.26%		
Gill Net of Large Mesh Size	-	-	-	-	-	-	-	-		
Squid Jigging	4615064	7.28%	5065696	9.11%	6478838	10.12%	5114898	7.91%		
Squid Gill Net	-	-	-	-	-	-	-	-		
Torch Light Net for Saury	633975	1.00%	251004	0.45%	330528	0.52%	222365	0.34%		
Coral Fishing	-	-	-	-	-	-	-	-		
Other Far Sea Fisheries	35103	0.06%	598130	1.08%	819498	1.28%	721523	1.12%		
Offshore Fisheries	17285500	27.28%	16083584	28.91%	16930516	26.43%	16585511	25.63%		
Purse Seine	519390	0.82%	268798	0.48%	487615	0.76%	403461	0.62%		
Purse Seine for Mackerel	1781941	2.81%	1048922	1.89%	1785923	2.79%	2274057	3.51%		
Torch Light Net	982081	1.55%	1257623	2.26%	979658	1.53%	819180	1.27%		
Drag Net	7293843	11.51%	6023970	10.83%	6536107	10.20%	6786404	10.49%		
Gill Net	1410675	2.23%	2348564	4.22%	2202622	3.44%	2010468	3.11%		
Driving-in Net	41143	0.06%	89118	0.16%	6760	0.01%	46108	0.07%		
Other Offshore Nets	37746	0.06%	40862	0.07%	92841	0.14%	-	-		
Tuna Long Line	2402609	3.79%	2378278	4.27%	2942663	4.59%	2063630	3.19%		
Misc. Fish Long Line	2301420	3.63%	1648668	2.96%	1248762	1.95%	1417660	2.19%		
Troll Line	160248	0.25%	183335	0.33%	22176	0.03%	78655	0.12%		
Pole and Lines Boote	181653	0.29%	307984	0.55%	236645	0.37%	259398	0.40%		
Other Angling	82494	0.13%	123727	0.22%	88135	0.14%	120680	0.19%		
Coral Fishing	-	-	-	-	-	-	-	-		
Other Offshore Fisheries	90258	0.14%	363736	0.65%	300612	0.47%	305811	0.47%		
Coastal Fisheries	3270613	5.16%	3430129	6.17%	3976013	6.21%	4256372	6.58%		
Set Net	706813	1.12%	831139	1.49%	669856	1.05%	788623	1.22%		
Beach Seine	100750	0.16%	84286	0.15%	129049	0.20%	59028	0.09%		
Torch Light Net	117015	0.18%	66813	0.12%	189958	0.30%	188356	0.29%		
Gill Net	1340859	2.12%	1269521	2.28%	1195016	1.87%	1344211	2.08%		
Other Coastal Nets	156735	0.25%	216905	0.39%	439386	0.69%	439709	0.68%		
Pole and Lines Boote	175777	0.28%	261469	0.47%	253740	0.40%	338028	0.52%		
Long Line	117125	0.18%	63531	0.11%	165871	0.26%	204625	0.32%		
Other Angling	50592	0.08%	90324	0.16%	64642	0.10%	67191	0.10%		
Spear Fishing	167748	0.26%	199596	0.36%	141644	0.22%	107845	0.17%		
Sport Fishing	22986	0.04%	28066	0.05%	16410	0.03%	27739	0.04%		
Other Coastal Fisheries	314214	0.50%	318479	0.57%	710442	1.11%	691017	1.07%		
Inland Fishing Fisheries	102554	0.16%	74321	0.13%	58738	0.09%	34160	0.05%		
Inland Water Fishing	32832	0.05%	32797	0.06%	23884	0.04%	5493	0.01%		
Reservoir Fishing	51032	0.08%	23064	0.04%	22617	0.04%	25156	0.04%		
Other Inland Fishing	18690	0.03%	18460	0.03%	12237	0.02%	3512	0.01%		

COUNTRY PAPER: THAILAND

PART I:

THAILAND FISHERY AND ITS STATISTICS

by

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1. INTRODUCTION

Thailand is one of the Southeast Asian countries with a total land area of 513,115 km². It shares a border with Myanmar and Laos to the north, Cambodia and Laos to the east, Myanmar and the Indian Ocean to the west, and Malaysia and the Gulf of Thailand to the south. The total coastline is approximately 2,614 km long. The Kingdom of Thailand is divided into 76 administrative provinces called "Changwad". Each Changwad is further divided into several Amphoes (districts) and each Amphoe is subdivided into Tambon (sub-district). Each Tambon consists of about 5-10 Moobans (villages). In 1996, there were 774 Amphoes, 7,255 Tambons and 66,974 Mooban in the country. The total population is about 60 million.

Although the fishery sector contributed only 1.7% to the total GDP in 1995, since 1993 Thailand has been the world's leading fish and fish products exporting country, with annual export valued at 116.6 billion Baht (US \$4.7 billion) in 1995. Therefore, fisheries is placed as a primary important source of animal protein food as well as a means of earning foreign exchange.

2. GENERAL TRENDS IN THE FISHERY SECTOR

During the last decade Thailand's economy had expanded rapidly and according to the National Economy and Social Development Board (NESDB), the real gross national product (GNP) and gross domestic product (GDP) had reached 4,107.4 billion Baht (US \$164.3 billion) and 4,202.8 billion Baht (US \$168.1 billion) respectively, in 1995. The per capita GDP was about 70,754 Baht (US \$2,830) in the same year. The fishery sector's contribution to the GDP slightly increased from 1.5% in 1990 to 1.7% in 1995.

Results of the 1995 Marine Fishery Census indicated that there were 2,579 marine fishing villages scattered in the 24 coastal provinces of Thailand. The total number of marine fishery establishments was 80,704. Of these, 62.2% were engaged in marine capture fishery, 34.2% in coastal aquaculture, and 3.6% in both activities.

For those engaged in marine capture fishery, the total number of establishments was 53,112. Of these, the number of small-scale establishments employing traditional gears and fishing on subsistence basis was the largest group. They accounted for 89.7% of the total, whereas the number of commercial fishery establishments was only 10.3%. One half of the total small-scale fishery establishments used gill nets which were mainly shrimp gill net (39.1%) and crab gill net (27.6%). The most popular gear used among the commercial fishery establishments was otter board trawl which accounted for 38.9% of the total number of gear used.

For coastal aquaculture, the total number of establishments was 30,528 covering a culture area of 447,553 rais (71,608 hectares). Shrimp culture has been very predominant in Thailand with 25,210 establishments (82.6%) and culture area of 421,282 rais (94.1%). The other culture species were fish, mollusks and crabs. Their number of establishments accounted for 9.8%, 9.3% and 1.2% of the total coastal aquaculture establishments, and culture areas of 1.0%, 3.5% and 1.4%, respectively.

Since 1985, the structure of marine fisheries has changed dramatically. Consequently, the proportion of marine capture fishery establishments decreased from 86.6% in 1985 to 72.2% in 1990 and decreased continuously to 62.2% in 1995, whereas the proportion of coastal aquaculture establishments considerably increased from 10.2% in 1990 to 25.4% and increased continuously to 34.2% in 1995. This was attributed to the rapid increase of shrimp farming by 4.5 folds while the number of those who were engaged in other types of culture was also slightly increased.

From the 1995 census, the total number of fishing boats was 54,538. Of these, 66.8% was outboard-powered boats, 28.0% were inboard-powered boats and 5.2% non-powered boats. The non-powered and outboard powered boats are without tonnage and mostly operating with traditional gear near the coast. On the other hand, of the 15,282 inboard-powered boats, the total number of small size boats with less than 10 gross tonnage (G.T.) accounted for 45.3%, the medium size with 10-49 G.T. 42.8%, and large size with 50 G.T. and over, accounted for 11.9%.

During 1990-1995, the number of outboard powered boats considerably increased by 16.9%, whereas the number of non-powered boats significantly decreased by 43.2%. The inboard-powered boats of less than 10 G.T. also decreased by 17%. It was remarkable that the number of inboard powered boats with 10-49 G.T., and 50 G.T. and over, increased by 0.1% and 22.5%, respectively.

The 1995 Marine Fishery Census indicated that there were 80,566 marine fishery operator's households and 29,302 employees' households. The total fishery population was 535,210 of which 51.3% were male and 48.7% female. The number of fishermen who were directly engaged in fishing and coastal aquaculture as of census date was 157,377, comprising 132,718 (84.3%) male and 24,659 (15.7%) female. Majority of them accounting for 123,512 (78.5%) worked full-time while 33,865 (21.5%) worked part-time. Fishermen, residing on fishing boats or working at sea having no home on land, were excluded in 1995 census.

As for marine fishery labor force, the total number of fishermen during peak season was 161,667, comprising 47.5% family members and 52.5% employees, mostly non-local employees.

The total permanent aquaculture workers was 82,890 mostly local employees. Some 53% of the total fishermen (including coastal aquaculture worker) finished lower elementary school, 25.8% finished upper elementary, while 10.6% had no education or completed under lower elementary school only.

During 1990-1995, the total number of fishermen during peak season slightly increased by 3.3% from 156,573 in 1990 to 161,667 in 1995. Aquaculture workers also increased sharply by 52% in 1990 to 82,890 in 1995. This was due to the rapid increase of the number of shrimp farms in the country in the mid-1990s.

Over the past decades, Thailand has been the top ten world's leading fish producer. According to the Department of Fisheries (DOF), the total fishery production considerably increased by 28.6% from 2.8 million mt in 1990 to 3.6 million mt in 1995. Its value also remarkably raised from 41.4 million Baht (US \$1.6 million) to 88.3 million Baht (US \$3.5 million) during the five year period (1990-1995). This was due to the increase of shrimp production with prices higher than other species of fish.

Of the total fish production of 3.6 million mt in 1995, 79.8% came from marine capture fishery, 9.6% from coastal aquaculture, 6.9% from inland capture fishery, and 3.7% from freshwater culture. The proportion of production from marine capture fishery significantly declined from 84.8% in 1990 to 79.8% in 1995, whereas coastal aquaculture increased from 6.9% to 9.6% during the same period. Furthermore, the proportion of inland fishery production (both capture and culture) slightly increased from 8.3% in 1990 to 10.6% in 1995.

Marine production are utilized for food and non-food consumption. Of the total marine catch of 2.8 million mt in 1994, 52.2% was processed to other fishery products, 32.2% converted to fishmeal and animal foodstuff while the remaining of 15.6% was used for fresh consumption. The introduction of trawl nets and purse seines over the decades has largely influenced the increase of the total marine catch. During 1990-1994, the total catch from otter board trawl alone increased by 18.2% from 1.1 million mt in 1990 to 1.3 million mt in 1994, and purse seines by 22.1% from 175,512 mt in 1990 to 924,914 mt in 1994. In addition, the figures in 1994 showed that 46.4% of the total production were caught by otter board trawl, followed by 33.0% by purse seines and 20.6% by other fishing gears.

Since 1993, fishery products has ranked as the top ten export commodities of Thailand. According to the DOF yearbook, marine/frozen products constituted the largest export items in terms of value (58.0%) which were mainly frozen shrimps, followed by 31.3% canned products. The live fish shared only 0.3% of the total export value. During 1990-1995, exports of fish and fishery products increased by 31.8% from 904,973 mt (live weight) in 1990 to 1.2 million mt in 1995, or in value by 90.8% from 61.1 billion Baht (US \$2.4 billion) to 116.6 billion Baht (US \$4.7 billion) during the same period.

Trade balance was made up of imports of fish and fishery products which increased by 71.9% from 507,737 mt (live weight) in 1990 to 872,828 mt in 1995, or in value by 6.3% from 20.6 billion Baht (US \$82.4 million) in 1990 to 21.9 billion Baht (US \$87.6 million).

3. POLICIES AND ACTION PLANS TOWARD AD 2010

The DOF has established a policy concerning commercial marine fishery with emphasis on the effective management of marine resources maintaining optimum sustainable yield and rehabilitation of degraded fishery resources. To achieve such policy, strategies and action plans for the management of marine resources in the year 2010 will emphasize on upgrading of the administrative and managerial capabilities.

In order to conserve the country's marine fishery resources, the strategies and action plans for the management of commercial marine fisheries were conceived as follows:

- a) speed up the amendment of laws, rules, regulations and restrictions, particularly disparate regulations conceding the control of fishing activities and fishing fleets that have caused problems on the conservation and the development of fishery resources, and hinder effective enforcement;
- b) encourage the formation of associations among small-scale fishermen;
- c) strengthen the enforcement of fishery regulatory measures;
- d) improve the collection of fishery statistics information;
- e) prevent the further degradation of resources by limiting the number of fishing boats and regulating the mesh size;
- f) monitor and improve the quality of water resources, as well as prevent and solve pollution problems which may have impacts on the fishery resources, aquatic reserved areas, areas of historical importance and tourist areas;
- g) install artificial reefs in appropriate coastal areas to act as sanctuaries, spawning and seed bed areas and to reduce conflict between trawlers and small-scale fishermen;
- h) speed up research support for rehabilitation and conservation management issues;
- i) disseminate knowledge to fishermen, fishery-related operators and the public about conservation and utilization of marine fishery resources to ensure maximum benefits;
- j) formulate area/community-based master plans for fishery resources management at the provincial level, as well as set up a coastal resource information center; and
- k) speed up the demarcation of coral reef zones including the rehabilitation of coral reef resources and formulate criteria for undertaking activities in them, as well as issue rules and restrictions on the possession of corals.

On the other hand, the policy and strategies for the management of coastal fishery resources were also drawn up. Under the rural development plan, improvement are carried out by upgrading the infrastructure of the fishing communities, increasing education opportunities, improving health care, and providing better employment opportunities.

Extension services shall be conducted on the improvement of catch and post-harvest processing and extra income earning by housewives through handicraft work. Mariculture is also introduced in the fishing communities as a means of enhancing income and providing new employment opportunities. The major species for mariculture are oyster, mussels and finfish. Diversification of employment into other job areas such as the post-harvest industries, is encouraged. Attempts have been made to establish cooperative schemes for the improvement of financial management.

Public campaign on conservation and sustainable use of aquatic resources have become more important, as these resources have been generally depleted with the increasing number of fishermen and more efficient fishing methods. An education program for the public, as well as direct communications for the fishermen, are among the steps to be taken by the government.

Traditionally, resources management is carried out by the local authority and fishery officers. Thailand has no record of traditional fishing rights such as those that exist in some of the island nations in the Pacific. Increasing exploitation of the coastal resources by various means has led to the decline in productivity and degradation of the habitats. Pilot projects on community-based resource management have been established in several communities in Thailand which include self enforcement and protection of their fishing resources, and the establishment of cooperatives for sharing of profit and responsibility.

Thailand lacks information regarding coastal resources, small-scale fishing practice, fishery statistics and bio-socioeconomics of small-scale fishery communities for planning purposes. Coastal habitats such as coral reefs, grass beds and mangrove-fringe estuaries are critical for fishery resources management but their importance is only the beginning to gain recognition. The rapid coastal development has destroyed or changed the coastal environments rendering them unsuitable for marine lives thus, an understanding of coastal ecology and its human impact is urgently needed. This led to the plan to carry out research on the integration of the multiple uses of the coastal resources.

Realizing the present impact of the extension of national jurisdiction of neighboring countries, the issue on the importance of Thai overseas fishery to the national economy was raised. In order to solve the problems encountered, the government has established the following policies.

At a regional level

- a) Encourage cooperation in the exploitation of allowable marine living resources in ASEAN to achieve optimum sustainable use;
- b) Study and set up standard measurements for the development and management of migratory fish stocks and straddling fish stocks; and
- c) Encourage cooperation in the development and management of shared stocks in the ASEAN region.

At the national level

- d) **Promote and encourage overseas fishery through intensification of access negotiations with foreign countries, by government initiatives;**
- e) **Develop and manage overseas fishery by incorporating this into the national social and economic development plan;**
- f) **Promote and support capital investment for fishermen to modify their fishing vessels and make these capable for operation in distant and new fishing grounds;**
- g) **Protect the investment of private companies in foreign countries through fishery cooperation; and**
- h) **Amend the Fishery Act to enforce punishment for skippers and fishing vessel owners violating the laws and regulations of foreign countries.**

It is very likely that a rapid decline in the genetic diversity of wild and domesticated stocks would result from the introduction of new aquaculture breeds. The DOF is now conducting a genetic-biodiversity program to develop suitable research leading to an economically sustainable genetic conservation. Fish stocking programs in small reservoirs and community fish ponds of less than 5,000 hectares, shall be continued in order to increase fish production where natural recruitment is difficult, but management is simple.

Effective fishing regulations, such as those for closed seasons and restricted areas must be continued. Destructive fishing must be prohibited. Scientific cooperation between biologists and fishermen must be facilitated. Since the ecological system in inland water is dynamic, information on catches, fishing effort, and some useful scientific data will be collected. In order to attain a sustainable inland capture fishery development and management for the year 2010, four major components shall be actively involved. These include the fishery resources, the communities, socio-economic and institutional sustainabilities. Finally, trade-offs between economic benefits from fish production will have to be balanced with fishery conservation and abundance of fish stocks.

On the other hand, the Thai Government formulated an important policy related to marine shrimp culture, which comprises:

- a) **Limiting the total culture area to the existing 76,000 hectares;**
- b) **Converting traditional and semi-intensive culture system to intensive culture;**
- c) **Enforcing shrimp farms to treat discharged water before releasing them to the environment;**
- d) **Implementing sea-water irrigation systems in all major areas of shrimp culture, in order to increase the quantity available and to improve its quality and the effluents as well;**

- e) Strengthen hatchery and farm regulations to ensure shrimp production quality;
- f) Establish production investigation laboratory in every coastal province to investigate antibiotic residues before harvesting and sale of the produce to cold storage operators; and
- g) Undertake research on marine shrimp spawner maturation in captivity to minimize the use of wild spawners.

4. STATUS OF NATIONAL FISHERY STATISTICAL SYSTEMS

The statistical system of Thailand is decentralized. Each ministry has its own statistical unit to collect statistics for administrative purposes. There are three government agencies which are responsible for collecting, compiling and disseminating fishery statistics, the National Statistics Office (NSO), DOF, and the Fish Marketing Organization (FMO).

- a) NSO is a government agency with a departmental status under the Office of the Prime Minister. It plays a leading role in producing basic statistics at national and regional levels while serving as the coordinating body for all statistical activities of government agencies. The main responsibility of NSO is to conduct all censuses and large-scale surveys such as labor force survey, socio-economic survey, etc. The Marine Fishery Census is one of the statistical activities of the NSO.
- b) The DOF is one of the government agencies under the Ministry of Agriculture and Cooperatives. Its statistical unit, the Fisheries Economics Division, is responsible for collecting, compiling and disseminating all current fishery statistics.
- c) FMO is a state enterprise under the Ministry of Agriculture and Cooperatives. The fishery statistics collected by FMO includes quantity and value of fresh fish landing at various fish markets and fishing ports, by species, aquatic animal price, number of fish wholesalers, etc.

5. FISHERY CENSUS

The marine fishery census of Thailand was conducted three times: in 1967, 1986 and 1995, by the NSO in collaboration with the DOF. However, inland fishery census has never been carried out.

The objectives of the 1995 marine fishery census were:

- a) To collect data on basic economic structure of marine capture fishery and coastal aquaculture and socio-economic characteristics of marine fishery households, fishery employees' households, fishermen and aquaculture workers; and
- b) To provide data to be used as a sampling frame for other related surveys.

The marine fishery census covered all marine capture fishery and coastal aquaculture households/establishments and fishery employees' households (excluding foreign fishery employees' household) located in the 24 coastal provinces in the central and the southern parts of the country. Complete enumeration by interview method was applied in this census.

Approximately 920 enumerators were set out to list all households in the area covered (3,500 enumeration districts). This is in order to identify the fishery household/establishments and the fishery employees' households. Subsequently, the detailed information are included in the items for interview.

Specifically, the data collected from marine fishery households/establishments and fishery employees; households include the following:

- a) Marine capture fishery/coastal aquaculture management to include type of management, type of fishery engaged, and number of persons engaged;
- b) Marine capture fishery to include fishing boat (type of boat, length of boat, gross tonnage, type of equipment installed, ownership of boat, etc.), main fishing gear, and main fishing areas, etc.;
- c) Coastal aquaculture to include type of culture and species; and area under culture and tenant status, method of culture, etc.;
- d) Socio-economic characteristics of fishery household;
- e) Members of fishery household;
- f) Socio-economic characteristics of fishery employees' household; and
- g) Member of fishery employees' household.

All census data are processed by the mainframe computer at the central office but data from listing form, are processed using micro computers at the provincial statistical offices, for the preliminary report. The 1995 census publications are as follows:

- a) Preliminary report.;
- b) Final report of 6 series: the report of the coastal zone 1-5 and the whole country (24 coastal provinces); and
- c) Two additional reports: 1995 Marine Shrimp Culture, and 1995 Marine Fishery Indicators of Thailand.

6. CURRENT FISHERY STATISTICS SURVEYS

The annual regular surveys conducted by DOF are classified as follows:

- I. Marine Production Survey, divided into six surveys:
 - a) Log Book survey (Major fishing gears production survey)

- b) Fishing village production survey (Fishing gears other the major fishing gears production survey);
- c) Coastal aquaculture production survey; and
- d) Marine aquatic animals collecting production survey.

These four surveys provide the principal information on marine production. However, such information do not usually reveal the complete profile of the marine fishery industry. Therefore, another two surveys are added:

- e) Marine fish landing place survey; and
- f) Associated fishery industry survey.

II. Freshwater (Inland) Production Survey, divided into four surveys:

- a) Freshwater culture production survey;
- b) Luring pond or small water tank survey;
- c) Natural water tank survey; and
- d) Freshwater fish landing place survey.

The objective of the Log Book Survey (Major Fishing gears production survey) is to collect data on monthly catch and fishing effort of nine major fishing gear, i.e., Otter board trawl, Pair trawl, Beam trawl, Purse seine, Anchovy purse seine, King mackerel gill net, Mackerel encircling gill net, Push net and Bamboo stake trap, in 22 coastal provinces. The data are used to estimate the total production of these fishing gear to determine the data from large-scale fishery, and conduct a stock assessment of the marine natural resources.

Sample survey by interview method was used for the Log Book survey. The fishing units registered at DOF for operating the nine major types of fishing gear mentioned above, are used as the sample units. Selection is by random from each type of fishing gear except otter board and pair trawl which are drawn from the group of boat sizes. Consequently, the operators of the sample units are interviewed every month by the provincial fishery enumerators about catch and fishing effort on a monthly basis, i.e., quantity of monthly catch by species, number of trips a month, number of fishing days and hauling per trip, etc. All survey data are then sent to the DOF central office for processing.

The objective of the Fishing Village Production Survey is to collect data on quantity and value of annual catch of all fishing gear except the nine major fishing gears in the Log Book survey, and on the fish species composition of the catch. The data are used to estimate the total production from small-scale fishery. The sample survey is based on two-stage random sampling where the first stage is the fishing village selected randomly from the census frame. The provincial fishery enumerators visit the head of the sample villages for the listing of the heads of fishing households, grouped by fishing gear employed.

For the second stage, five fishing households are selected from each type of fishing gears in the list by simple random sampling. The sample heads are interviewed for the detailed information on the number of fishing months, number of trips per month, quantity of catch per trip, percentage of fish species, composition of catch, etc. The field work is conducted once a year, and all data are sent for processing at the DOF central office.

The objective of the Coastal Aquaculture Production Survey is to collect data on production and culture area of shrimps, fish, horse mussel, sea mussel, bloody cockle and oyster farming. The data is used for the estimation of coastal aquaculture production.

Here, the enumerators from the provincial fishery offices update the list of aquaculture farms in the sub-districts, prepared by the central office, by interviewing the heads of the sub-districts. The sample farms are randomly selected from each sub-district farm list, using the following pattern:

<u>Total no. of farms in sub-district</u>	<u>No. of farms selected</u>
1-5	All
6-25	5
26 and over	20% of total farms

The enumerators then interview the operators of the sample aquaculture farms for detailed information. All completed questionnaires are sent to DOF central office for data processing.

The objective of the Marine Aquatic Animals Collecting Production Survey is to collect data on marine production of collecting natural shellfish (excluding shellfish culture), collecting of seaweeds, sea cucumber, jellyfish, etc. These data are used to estimate the production of aquatic animals collected from marine sources.

The objective of the Marine Fish Landing Place Survey is to collect data on fishing boats landed and their production at landing places, and quantity and value of catch landed by fish species and fishing gears. Sample survey by interview method is used, and for the first step, the provincial fishery enumerators visit all marine fish landing places for the recording of the total number of fishing boats, by size of boat and fishing gear employed, landing at these places every day in a month. Fishing boats which called at a particular selected landing place, are then randomly selected according to size and fishing gear employed, and interviewed for their catch landing at a sampling day of every week. All monthly data are sent for processing at the DOF central office, and in order to get the annual production landing.

The objective of the Associated Fisheries Industry Survey is to collect data on the associated fishery industries such ship yards, docks, ice plants, cold storage, processing plants, fish meal plants, and their production capacity, etc. Complete data enumeration is used for all associated industries while random sampling is used for the fish processing industries, i.e., fish/shrimp paste plants, dry shrimps/squid and salted fish plants, selected at 10% of the total number. The samples are then considered for enumeration.

On the other hand, the objective of the Freshwater Culture Production Survey is to collect data on cultured species, production and culture area of four farming practices, i.e., pond culture, paddy field culture, ditch culture, and pen/cage culture.

For the first step, the enumerators update the list of freshwater culture farms in sub-districts, prepared by the central office. Then, the sample farms were randomly selected from each type of farm practices and cultured species using 10% of the total farms in each group. Exceptions were that of "sepat siam" farms, the samples of which were selected at 5% of the total number of farms. The enumerators then interview the operators of the sample fish farms for the detailed information. This is carried out once a year, and all completed questionnaires are sent to the DOF central office for data processing.

The objective of the Luring Pond or Small Water Table Survey is to collect data on fish catch from luring ponds or small water tanks. The farmers should have been granted permission from the government to culture in these small water tanks. The data collected are for size of luring ponds, quantity, value and species of catch, etc. A 10% sample of the luring ponds in each district is drawn at random, from the list of operators receiving fishing permission by the District Fisheries Office. Then, the fishermen fishing in the sample ponds are interviewed for the catch information.

The objective of the Natural Water Tank Survey is to collect data on fish catch from the natural water tanks. The data collected includes quantity and value of fish catch, fish species, fishing gear operated, etc. The enumerators first update the list of all natural water tanks classified into three types: large scale water tanks such as reservoirs and lakes; public water bodies such as swamps; and water tanks constructed under the national rural job-raising program.

The natural water tanks of each type are grouped by water area size of the tanks and randomly selected at 10% of each total group. Then the provincial fishery enumerators interview the operators for the detailed information from fishermen engaged in fishing in the sample natural water tanks.

The objective of the Freshwater Fish Landing Place Survey is to collect data on freshwater fish catch landed at freshwater fish landing places. The items collected include the number of fishing boats at landing places, quantity and value of catch, etc. These data are used for the development of information on animal protein as food source, occupation, and extension. The method of data collection is similar to that of the marine fish landing place survey.

Lastly, information on fishing vessel statistics are compiled from the fishing gear registration forms issued by the provincial fishery offices. These are sent out to the DOF central office for data processing annually.

7. FOLLOW-UP TO THE NATIONAL RECOMMENDATIONS FROM THE 1994 WORKSHOP

The recommendations affecting the statistical system in Thailand during the 1994 Workshop, which aimed to improve the collection and compilation of fishery statistics, were as follows:

- a) Training course on the use of computer on-line system for data processing at central and provincial levels should be conducted,

The NSO of Thailand regularly organize several in-service training courses for its staff, the personnel of other government agencies and state enterprises. The training courses covered statistical methods and computer data processing. The main objectives of the training are to develop the expertise and skills of the statistical personnel. However, the regional training course in statistical methods on specific subject, e.g., fishery statistics, is needed for improving the statistical skills, regional standardization, and coordination of the statistical staff.

- b) Regional training course on the analysis of catch statistics should be conducted so that the analysis can be included in the statistics yearbook of each country.

This regional training course is needed and essential for the development of their knowledge and skills of fishery statisticians. However, the course has never been organized by any agency or organization in the country.

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PART II:

GENERAL TRENDS IN THE FISHERY SECTOR

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1. CONTRIBUTION OF THE FISHERY SECTOR TO NATIONAL ECONOMY

Thailand has a total population of 60 million, with Gross Domestic Product (GDP) of 2,941,183 million Baht (1 Baht = US\$ 0.028, 3 October 1997) and Per Capita Income of 69,147 Baht in 1995. Fishery accounts for 1.7% of the country's GDP or 15.2% of the agricultural sector's GDP. Fishery in Thailand has developed rapidly during the last few years. It now contributes largely to the economic development of the country in various aspects. Fishery products is a major source of protein for the Thai people; the annual average consumption is approximately 27 kg per person.

The development of marine fishery leads to the establishment of several linkage industries. The marine product processing industry in Thailand, for example, has been developed before any other country in the region could develop theirs. The industry expanded so rapidly that domestic raw materials became inadequate and had to be imported from abroad. Recently, Thailand became the world's largest exporter of fishery products, accounting for 10% of the total export in 1995.

The 1995 Census of Marine Fishery revealed that the total number of fishery households and employees' households in the country was 109,635. This comprises 50,312 households exclusively engaged in capture fishery; 27,388 households engaged in coastal aquaculture; 3,001 engaged in both marine capture fishery and coastal aquaculture; and 28,934 households were fishery employees. On the whole, the total population in marine fishery was recorded at 535,210 persons.

The fishery census did not include inland fishery. So far, no data has been compiled from this sector, for reference. Thus, it is most difficult to estimate the labor force employed in inland fishery. As a matter of fact, most rice-growing farmers also catch fish, in other words they could also be considered as part-time fishermen. Many rice farmers catch freshwater fishes as a routine activity, for their own domestic consumption.

A survey on freshwater fishfarm production has been conducted since 1974, unfortunately the number of aquaculturists and employees were not recorded in the survey. The number of productive fishfarms however, were recorded, which showed a continuous increasing trend from 61,980 farms in 1990 to 161,504 farms in 1994. The data also indicated that at least 300,000 persons were engaged in freshwater aquaculture in 1994.

Fishing fleets are classified into three broad categories, namely, non-powered boat, outboard-powered boat, and inboard-powered boat. The inboard-powered boat is classified further by tonnage. Thus, the size of inboard-powered boats, classified by gross tonnage, are as follows: less than 5 G.T., 5-10 G.T., 10-20 G.T., 20-30 G.T., 30-50 G.T., 50-100 G.T., and 100 G.T. and over.

The 1995 Census of Marine Fishery also revealed that the total number of fishing boats was 54,715. Of this total, outboard-powered boats comprised the largest group with 36,634 or 67% of the total, followed by the inboard-powered boats, accounting for 14,965 or 27%. The third type of fishing boats, the non-powered boats accounted for 3,116 or 6%.

The production from fisheries in Thailand demonstrated remarkable growth over the last three decades. Thailand is now ranked among the top ten largest fishing nations of the world. Its fishery production exceeded 2 million mt for the first time in 1977. Thereafter it encountered some set backs but recovered to over 2 million mt in 1983 and increased to 3.5 million mt in 1994.

The country's marine fishing ground within its exclusive economic zone (EEZ) lies in part of the Andaman Sea, covers a total area of about 316,000 km² with a coastal line of 2,630 km. Before the 1977 proclamation of the EEZ of many countries, Thai fishing fleets operated in four fishing grounds: The Gulf of Thailand, the Andaman Sea, the South China Sea, and the Bay of Bengal. Thailand had lost over 300,000 km² of traditional fishing grounds, due to establishment of the EEZs.

In 1994, the total marine catch was 2.8 million mt, valued at 36,337 million Baht (Table 1). Compared with 1990 figures, it increased by 20% in volume and 75% in value. Of the total marine catch, about 70% is caught in the Thai waters and the rest in the waters of other countries. The major type of fishing gear used were otter board trawl, purse seine, and anchovy purse seine. All these accounted for 87% of the total volume of marine products caught in 1994 (Table 2).

The major fishing grounds of Thailand include:

- a) Natural water bodies, i.e. rivers, canals, swamps, and lake etc.;
- b) Man-made water bodies, i.e. reservoirs, and fish ponds, the area of these two fishing grounds in 1994 totaled 455,924 hectare; and
- c) Inland culture area, which spread all over the country. The number of freshwater fish farms in 1994 was 161,504 with a total area of 72,491 ha.

The total production from both capture and culture in 1994 was 373,000 mt, valued at 9.7 million Baht (Table 1). Of this total production, the former contributed about 202,600 mt while the latter, about 170,400 mt. It should be noted that the total production based on the statistical records, may be low because the number of individuals who fish for domestic consumption and for supplementary income, were not officially recorded.

The total area for shrimp culture in 1994 was 74,077 ha, increasing from that of 1990 by 13.4%. The Department of Fisheries (DOF) has a policy to limit the total culture area which should not exceed 76,000 ha in order to maintain an environmental balance. The development of this fishery emphasized on technology improvement and increase in productivity, rather than on area expansion.

The production from shrimp culture in 1994 was 263,446 mt, valued at 39,845 million Baht (Table 3), increasing by 123% in volume and 177% in value from those in 1990. The rapid development of the intensive culture system resulted in increased productivity from 1,809 kg per ha in 1990 to over 3,557 kg per ha in 1994.

On the other hand, grouper and sea bass are the main species cultured in ponds and in cages. In 1994, the production of grouper was 710 mt, valued at 202 million Baht (Table 4), increasing by 69% in volume and 274% in value from those in 1990. The production of sea bass was 2,503 mt, valued at 238 million Baht (Table 4), increasing by 106% in volume and 164% in value compared to those in 1990.

Blood cockle, green mussel, oyster and horse mussel are the main shellfish species cultured. In 1994, the number of farms and culture area were as follows: 558 farm, 2000 ha for blood cockle; 754 farm, 341 ha for green mussel; 2,413 farm, 1324 ha for oysters; and 61 farm, 74 ha for horse mussel. The production and volume of these species during 1990-1994 are shown in Table 5. Only blood cockle showed a decreasing trend while production of oysters and green mussels substantially increased during the same period.

Recently, fishery industries in Thailand have become more and more important to the national economy. In 1994, the disposition of freshwater fish fresh for local consumption was (79.8%), salted and dried (10.9%), steamed or smoked (3.5%) fish sauce and fermented (5.8%) (Table 6). For marine catch, fresh consumption was 15.6%, fresh chilled and frozen (26.0%), canned (15.4%), fish sauce and shrimp paste (3.4%), salted and dried (6.9%), steamed and smoked (0.3%), and fish meal (32.2%), as shown in Table 6.

Fish processing industry has grown rapidly in the last two decades especially the cold storage and canning plants. In 1994, the number of cold storage, canning plants, fish sauce, fishmeal plants were 129, 52, 104 and 115, respectively. In addition, there were other 2,396 small traditional processing plants.

Thailand has had a positive trade balance in fishery products, both in volume and value. The growth of fishing exports and imports during 1990-1996 has been remarkable. In 1996, the volume and value of fishery products exported was 1,146,946 mt valued at 110,781 million Baht (Table 7), 1.7 times more in volume and 3.4 times in value than in 1990. The most important components of the export products were shrimps, canned tuna, squid and cuttlefish. Shrimps were mainly exported to Japan and USA, while canned tuna were exported to the for EU and also to the USA. Furthermore, squid and cuttlefish were for Japan and Italy, and fresh or frozen fish were shipped mainly to Malaysia and Singapore.

Meanwhile, Thailand is also the top importer of fresh/chilled/frozen tuna in the world. In 1996, the total volume and value of imports was 797,386 mt valued at 22,425 million Baht (Table 8), respectively 3.5 times and 3.2 times in volume and value, respectively, compared to the data in 1990.

2. FISHERY CENSUS

The marine fishery census was conducted in 1967, 1985, and 1995 by NSO and DOF. The objectives of the 1995 census are to:

- a) Collect data on basic economic structure of marine capture fishery and coastal aquaculture;
- b) Collect data on socio-economic characteristics of fishery establishment, fishery employees' households and demographic characteristics of fishermen; and
- c) Provide data to be used as a sampling frame for related surveys.

The 1995 Marine Fishery Census covers all marine capture fishery and coastal aquaculture establishments as well as fishery employees' households which are located in the 24 coastal provinces in the central and the southern parts of the country. Complete enumeration by interview method is applied in the census.

All census data are processed using a main frame computer at the NSO Head Office. For the preliminary reports, data are processed using micro-computers (PCs) at the local level. The Fishery Statistics Sub-division under the Fishery Economic Division, DOF, is responsible for the development of the fishery statistical collection system, computerization and publication of fishery statistical yearbook and other statistical reports. In order to compile and compute fishery data, PCs are also used at the Head Office. There is a plan to have these computers connected on-line from the Central Office to the local levels in order to expedite the computation and compilation of fishery statistics. Results of the 1995 census were published in two volumes. A preliminary report presenting the data in list form and the final report of two series showing statistics covering the coastal zone and statistics covering the whole Kingdom, comprising 24 provinces.

Production data from marine fisheries in Thailand has been estimated by the Fisheries Statistics Sub-division from the results of the Marine Fishery Production Survey. The Survey is classified into four sections, as follows:

- a) Production from major fishing methods of fishing gear;
- b) Production from fishing gear used by fishing communities other than the major fishing methods;
- c) Production from coastal aquaculture; and
- d) Production from particular fishing methods other than the first three aforementioned sections.

Using the results from the 1967 Marine Fisheries Census, a new marine fishery production survey was designed and a sample survey was launched in 1969. The commencement of the new survey was considerably delayed due to certain difficulties including sourcing of the budget as well as in recruiting and training of field personnel.

The main objective of the production survey is to secure the data necessary for fishery administration and fish stock assessment by providing catch data by species and fishing efforts for each type of fishing gear. The survey commenced in May 1969 and covered catch from marine fishery leaving out the coastal culture. Unfortunately, the new survey in 1970 again encountered shortage in budget, thus, the survey covering the entire calendar year 1970 was not fully implemented until 1971. The survey is being conducted utilizing the DOF field setup with about 70 enumerators. The survey covers all types of marine fishery including mariculture and brackishwater culture.

Marine fisheries in Thailand is broadly classified into:

- a) Large scale or off-shore fishery where the number of fishing units is relatively limited by productivity per fishing unit is quite high;
- b) Small-scale or coastal fishery which are scattered along the entire coast of the country but productivity is generally low;
- c) Coastal culture in certain limited areas; and
- d) Specialized fishery e.g., collecting shellfish, sea cucumber, etc.

Four types of marine production surveys are being implemented, as follows:

- a) Logbook Survey which covers otter-board trawl, pair trawl, beam trawl, Thai purse seine, Chinese purse seine, anchovy purse seine, luring purse seine, king mackerel gill nets, mackerel encircling gill nets, and push nets;
- b) Fishing community survey which covers all types of fishing methods not covered by the Log book survey;
- c) Coastal Culture Survey; and
- d) Specialized Survey.

The Coastal Culture Survey covers shrimp culture, blood cockle culture, sea mussel culture, and horse mussel culture. On the other hand, the Specialized Survey includes data from the collection shellfishes, seaweeds, sea cucumber, jellyfishes, surf clam, and turtle eggs.

3. LOG BOOK SURVEY

This survey is applied to all major types of fishing methods. In 1971, the country's estimated catch recorded through the Log Book Survey was about 70% of the total catch. When the survey was commenced in 1969, it covered only otter-board trawl, Thai purse seine, Chinese purse seine, and bamboo stake trap. However, after 1983, the number of fishing methods was increased to eleven. In the future, the coverage of the Log Book Survey may be expanded to include some of the fishery which are currently being covered by the Fishing Community Survey. The reasons for this expansion are: (a) compared with the Fishing Community Survey, the Log Book Survey provides estimates with greater accuracy; and (b) for the estimation of the fishing effort, the Log Book Survey is much easier to use than the Fishing Community Survey.

In the Log Book Survey, a fishing unit is regarded as a sampling unit. A fishing unit is defined as a technical unit for a fishing operation normally consisting of boats, gear and crew. In the case of pair trawl, two boats form one fishing unit. As for the Chinese purse seine, one mechanized boat and two non-powered boats are regarded as a fishing unit. On the other hand, each set of bamboo stake trap is considered as a fishing unit.

The operator of a sample unit is requested to keep a record of catch and fishing efforts for each trip by means of a log book. Such record is verified by an enumerator using the invoice of fish transactions maintained by the operators. However, in the case of beam trawl and push net fishing, where the operators do not always keep the invoice of fish transactions, a sample operator is asked to provide the number of fishing days and average catch per day in a previous month. The catch is then estimated from the information provided by the operators.

Four types of questionnaires are used for the Log Book Survey, in order to fix the operational conditions of each fishery. These are for: otter-board trawl and pair trawl; Thai purse seine, Chinese purse seine, anchovy purse seine, mackerel encircling gill net, king mackerel gill net, and luring purse seine; bamboo stake traps; and beam trawl and push nets.

4. FISHING COMMUNITY SURVEY

This survey is applied to small-scale fisheries employing a variety of small fishing gear. A fishing community, identified during the 1967 and 1985 Marine Fisheries Census, is used as a sampling unit. For purposes of fishery statistics, the entire coasts of Thailand is divided into five regions as described previously in the survey of fishery inventory items. Within each region, fishing communities are stratified into A and B in terms of the weighted number of boats. The enumeration for each sample fishing community is done only once a year in January in order to estimate catch by gear and by species in the previous year by using the following steps.

- a) A complete list of the fishing households in the previous year is prepared with the help of the chief of the community or of fishermen who are acquainted with the fishery status of the community;
- b) For each fishing household, the type of fishing method employed in the previous year is recorded;
- c) Based on the results of the listing survey, at least five fishing households are selected at random from each type of fishing method;
- d) An enumerator visits the sample fishing households and records the data from such survey items as fishing season, the total number of months in operation, the average monthly catch and species composition in terms of percent of the total; and finally
- e) Using this information, an annual catch by species for each sample fishing household, is estimated.

5. COASTAL CULTURE SURVEY

The coastal culture survey is done in order to estimate the total annual production of each type of culture, e.g., shrimp farming, sea mussel farming, blood cockle farming, horse mussel farming; and to estimate the yield per unit area (per rai) for each type of culture. Collection of data is done through listing and sampling surveys.

The list of types of culture from the previous year is prepared at the Central Office. The enumerator brings the list to the chief of a "tambon" where it is reviewed and revised. In case the complete list is not available from the chief of a "tambon", a new list is prepared with the help of the owner of the coastal culture farming or someone who is acquainted with the coastal culture farming in a "tambon."

A sample survey is undertaken simultaneously with the listing survey by interviewing a sample farmer on their yield during the previous year. The sample farmer is systematically selected for each "tambon." The estimate for the total yield gives the total annual production of culture farm by type and yield per unit area (per rai) for each type of culture farm.

6. SPECIALIZED SURVEY

This survey is undertaken in order to estimate the annual production from shellfish collection together with other coastal culture, e.g., seaweed, sea cucumber, jellyfish, turtle eggs. The staff of the Fisheries Statistics Section visit the fishing villages identified every January and collect the respective production data from the previous year. No specific questionnaire is used for the survey. However, in order to avoid any unreasonable error, the enumerators are urged to contact as many local people as possible including fishermen. From them, the catch data is collected and the total annual production of shellfish, jellyfishes, sea cucumber, seaweed, turtle eggs are reported.

7. INLAND FISHERY PRODUCTION SURVEY

Two types of inland fishery survey are being implemented, namely, the freshwater culture survey and inland capture fisheries survey. The freshwater culture survey aims to estimate the total annual production of each species and type of culture, e.g. pond culture, paddy field culture, ditch culture and pen or cage culture; and to estimate the yield per unit area for each type of culture. Collection of data is done through listing and sample surveys.

The list of type of culture from previous year is prepared at the Central Office. The enumerator bring the list to survey areas where it is reviewed and revised. A sample survey is undertaken simultaneously with the listing survey by interviewing a sample farmer on their yield during the previous year. The sample farmer is systematically selected for each survey area. The estimate for the total yield gives the total annual production of culture farm by type and yield per unit area for each type of culture farm.

The inland capture fishery survey aims to estimate the annual production of each type and size of water bodies, e.g. reservoir, lake, swamp and communities pond. Collection of data is done through listing and production surveys, where nationwide water body listing is carried out every five years. Production survey by means of random sampling survey by type and size of water bodies, is also carried out.

Table 1. Fisheries production of Thailand by sub-sectors, 1990-1994.

Year	Total		Marine Fishery				Inland Fishery			
	Quantity (1000 tons)	Value (mil. baht)	Capture		Coastal Aquaculture		Capture		Culture	
			Quantity (1000 tons)	Value (mil. baht)	Quantity (1000 tons)	Value (mil. baht)	Quantity (1000 tons)	Value (mil. baht)	Quantity (1000 tons)	Value (mil. baht)
1990	2,786	41,396	2,362	20,738	193	14,754	127	3,302	104	2,602
1991	2,968	53,026	2,479	26,404	230	20,362	136	2,391	123	2,969
1992	3,240	65,545	2,736	32,833	229	26,235	132	2,999	142	3,478
1993	3,385	78,407	2,753	36,224	296	33,603	175	4,490	162	4,090
1994	3,523	87,001	2,804	36,337	346	40,962	203	4,806	170	4,897

Source: Fisheries Economics Division, Department of Fisheries.

Table 2. Catch of marine fishery by types of fishing gear, 1990-1994.

Fishing Gear	1990		1991		1992		1993		1994	
	(tons)	%	(tons)	%	(tons)	%	(tons)	%	(tons)	%
Otter board trawl	1,092,394	46.2	1,204,913	48.6	1,256,724	45.9	1,352,033	49.1	1,300,008	46.4
Pair trawl	175,683	7.4	193,294	7.8	230,166	8.4	252,552	9.2	212,613	7.6
Beam trawl	242	0.0	347	0.0	225	0.0	323	0.0	1,285	0.0
Purse seine	611,831	25.9	617,303	24.9	675,262	24.7	701,630	25.5	769,509	27.4
Anchovy purse seine	145,681	6.2	120,508	4.9	161,544	5.9	152,850	5.6	155,405	5.5
King mackerel drift gill net	17,317	0.7	14,935	0.6	21,985	0.8	19,377	0.7	15,225	0.5
Mackerel encircling gill net	17,207	0.7	14,413	0.6	12,828	0.5	10,663	0.4	18,323	0.7
Other gill net	57,462	2.4	52,260	2.1	53,949	2.0	55,082	2.0	52,517	1.9
Push net	14,176	0.6	22,094	0.9	20,974	0.8	21,146	0.8	24,821	0.9
Other mobilnet	30,588	1.3	40,445	1.6	40,222	1.5	39,815	1.4	42,172	1.5
Squid light luring	25,845	1.1	25,730	1.0	24,040	0.9	25,974	0.9	26,174	0.9
Hook	6,884	0.3	6,630	0.3	6,249	0.2	5,689	0.2	5,279	0.2
Stationary gear	35,161	1.5	35,569	1.4	34,411	1.3	32,295	1.2	36,870	1.3
Others	131,747	5.6	130,166	5.3	197,773	7.2	83,057	3.0	144,225	5.1
Total	2,362,218	100.0	2,478,607	100.0	2,736,352	100.0	2,752,486	100.0	2,804,426	100.0

Source: Fisheries Economics Division, Department of Fisheries

Table 3. Production of marine shrimp culture, 1990-1994

Year	Area (hectare)	Production (tons)	Value (mil. baht)
1990	65,338	118,227	14,365
1991	76,185	162,070	19,834
1992	73,621	184,884	25,500
1993	72,701	225,514	32,425
1994	74,077	263,446	39,845

Source: Fisheries Economics Division, Department of Fisheries

Table 4. Production of brackishwater fish culture, 1990-1994

Year	Grouper		Sea bass	
	Volume (tons)	Value (mil. baht)	Volume (tons)	Value (mil. baht)
1990	421	54	1,214	90
1991	366	99	1,650	132
1992	965	317	2,591	186
1993	756	214	2,747	178
1994	710	202	2,503	238

Source: Fisheries Economics Division, Department of Fisheries

Table 5. Production of shellfish culture, 1990-1994

Year	Bloody cockle		Green mussel		Oyster		Horse mussel	
	Volume (tons)	Value (mil. baht)	Volume (tons)	Value (mil. baht)	Volume (tons)	Value (mil. baht)	Volume (tons)	Value (mil. baht)
1990	12,299	79	58,380	36	1,370	25	933	2
1991	26,442	157	34,455	88	3,311	49	1,092	2
1992	18,804	120	14,032	44	3,774	54	4,003	8
1993	20,577	124	24,391	74	17,810	576	3,572	7
1994	11,324	83	43,082	150	19,273	523	4,836	11

Source: Fisheries Economics Division, Department of Fisheries

Table 6. Fish utilization by disposition channel, 1994.

Disposition	Percentage of fish utilization	
	Marine fish (%)	Freshwater fish (%)
1. Human consumption	67.8	100.0
- Fresh	15.6	79.8
- Fresh chill & frozen	26.0	-
- Canning	15.4	-
- Steamed or Smoked	0.3	3.6
- Fish sauce, fermented & shrimp paste	3.4	5.8
- Salted & dried	6.9	10.9
- Others	0.2	-
2. Fish meals & Animal stuff	32.2	-
Total	100.0	100.0

Source: Fisheries Economics Division, Department of Fisheries

Table 7. Export of fishery products by commodity, 1990-1996.

Commodities	Quantity: Ton Value: Million baht													
	1990		1991		1992		1993		1994		1995		1996	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Total	904,978	61,070	1,087,395	78,463	1,006,141	82,469	1,115,078	91,018	1,214,946	110,285	1,192,560	110,781	1,146,946	110,781
1. Aquatic Animal Live	1,928	162	1,947	164	3,841	286	5,895	367	6,207	395	6,592	662	8,974	662
- Fish	1,928	162	1,947	164	3,275	263	4,073	294	4,602	320	4,881	486	5,877	486
- Others	-	-	-	-	566	23	1,822	73	1,605	75	1,711	177	3,097	177
2. Fresh and Frozen	338,995	29,569	421,088	40,368	386,877	45,535	489,840	52,010	535,705	64,843	541,989	60,120	526,707	60,120
- Fish	191,990	4,540	237,007	8,141	191,918	8,073	281,584	8,196	286,388	8,454	309,746	9,574	306,833	9,574
- Shrimps	84,724	20,454	121,241	26,681	130,519	31,696	148,887	37,842	187,069	49,156	175,091	43,402	161,462	43,402
- Crabs	289	21	380	38	1,036	115	1,113	111	2,005	177	1,907	185	1,660	185
- Squids	61,992	4,554	62,460	5,508	63,404	5,652	58,256	5,862	60,243	7,056	55,245	6,958	56,752	6,958
3. Salted Dried and Smoked	27,216	1,980	28,289	2,071	25,238	2,199	24,861	2,604	20,412	1,805	22,646	1,734	21,823	1,734
- Fish	20,542	515	22,553	669	19,426	668	18,952	921	15,925	597	18,235	801	18,858	801
- Shrimps	2,605	411	2,748	554	2,251	445	3,320	778	2,945	690	3,181	574	2,084	574
- Crabs	135	17	223	31	159	26	159	25	100	20	155	20	66	20
- Squids	3,934	1,037	2,765	816	3,402	1,060	2,430	879	1,442	498	1,075	339	815	339
4. Fresh, Frozen and Salted	10,574	552	17,338	952	11,660	759	8,556	720	13,809	896	9,844	1,106	15,702	1,106
- Molluscs	863	52	723	67	817	67	792	68	1,253	144	773	144	1,005	144
- Others	9,711	500	16,615	885	10,843	692	7,764	653	12,556	752	9,071	962	14,697	962
5. In Airtight Containers	329,097	22,351	391,611	26,917	366,486	25,918	373,928	27,470	426,173	34,463	404,272	37,597	364,871	37,597
- Sardine	13,688	419	28,090	867	25,853	800	33,387	1,022	33,339	1,033	41,667	1,215	35,707	1,215
- Tuna	232,972	13,717	272,800	16,131	243,591	13,438	229,906	13,063	268,974	15,620	221,244	12,383	188,434	12,383
- Other fish	28,779	1,435	36,455	1,840	40,531	2,035	54,648	2,571	60,712	3,159	69,825	3,941	62,421	3,941
- Shrimps	29,107	4,791	35,582	6,388	39,316	7,825	42,650	9,378	50,666	13,302	58,755	18,707	67,248	18,707
- Crabs	10,041	1,313	9,827	1,176	9,713	1,337	8,779	1,151	6,903	992	8,008	1,023	6,157	1,023
- Squids	4,818	286	4,471	310	2,470	168	1,135	78	365	38	108	59	670	59
- Asari	9,692	390	4,386	205	5,012	315	3,423	207	5,214	320	4,655	268	4,234	268

Table 7. Export of fishery products by commodity, 1990-1996 (cont'n)

Commodities	Quantity: Ton Value: Million baht													
	1990		1991		1992		1993		1994		1995		1996	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
6. Not in Airtight Containers	31,741	2,667	37,659	2,960	39,115	2,608	32,338	2,395	26,329	2,078	25,061	2,134	25,544	2,134
- Sardine	110	8	243	24	142	17	347	31	691	40	394	17	437	17
- Tuna	25,430	1,922	32,477	2,285	35,482	2,113	28,580	1,866	22,880	1,626	20,921	1,683	21,863	1,683
- Squids	4,327	630	4,025	586	2,692	412	3,020	462	2,306	365	3,312	374	2,725	374
- Asari	1,874	106	914	65	799	66	391	37	452	47	434	60	519	60
7. Prepared or Preserved	3,287	203	4,796	447	6,614	695	5,435	623	7,645	906	7,842	1,101	9,254	1,101
- Lobster	-	-	22	4	14	4	2	1	5	1	45	24	68	24
- Awabi	-	0	35	8	45	4	45	6	19	2	40	0	1	0
- Others	3,287	203	4,739	435	6,555	687	5,388	617	7,621	940	7,757	1,077	9,185	1,077
8. Fish Meal	13,051	137	8,127	80	1,502	16	2,045	23	1,678	26	1,068	8	601	8
9. Fish Sauce	16,002	288	17,152	309	18,968	346	18,321	343	20,826	383	25,242	466	24,061	466
10. Fish Oil	-	-	-	-	-	-	-	-	83	2	47	0	8	0
11. Oyster Sauce	-	-	-	-	-	-	-	-	512	24	554	34	644	34
12. Seaweed & Agar-agar	137	34	101	33	103	33	103	35	112	44	130	48	109	48
13. Others	132,950	3,127	159,287	4,163	145,737	4,075	153,756	4,428	155,455	4,419	147,273	5,770	148,648	5,770

Source: Fisheries Economics Division, Department of Fisheries

Table 8. Import of fishery products by commodity, 1990-1996

Commodities	Quantity: Ton Value: Million Baht													
	1990		1991		1992		1993		1994		1995		1996	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Total	507,737	20,653	724,668	27,353	713,967	24,569	760,919	21,629	893,588	21,329	872,828	21,925	797,386	22,425
1. Fresh and Frozen	431,403	19,053	611,036	25,271	580,372	21,945	560,040	17,818	615,275	16,525	603,395	16,699	553,616	6,819
- Fish	426,973	18,770	598,419	24,538	563,886	20,720	539,366	16,294	568,944	13,967	560,297	12,444	510,385	12,670
- Shrimps	1,361	175	6,010	349	3,495	437	4,824	717	7,367	853	9,954	1,652	9,344	1,561
- Crabs	607	63	969	165	2,711	445	1,831	235	2,063	217	2,772	555	2,629	540
- Squids	2,462	45	5,638	218	10,280	344	14,019	571	36,901	1,487	30,372	2,048	31,258	2,048
2. Salted, Dried and Smoked	1,981	167	3,286	214	3,935	198	7,121	383	4,241	213	3,592	106	2,169	95
- Fish	363	26	38	11	567	33	1,361	50	2,648	76	3,072	79	1,514	64
- Shrimps	94	6	10	1	1	1	-	2	3	61	4	-	0	
- Crabss	149	12	314	39	3	0	53	6	34	5	56	9	37	7
- Squids	1,375	124	2,924	162	3,364	163	5,707	327	1,538	129	403	14	618	23
3. Fresh, Frozen and Salted	32,634	132	36,925	149	43,178	222	36,674	179	42,965	256	43,227	247	28,641	197
- Molluscs	32,388	125	36,808	144	43,123	217	36,163	172	41,404	228	42,142	185	28,097	137
- Others	246	6	117	5	55	6	511	7	1,561	29	1,085	62	544	60
4. In Airtight Containers	8,045	204	10,667	136	7,943	151	6,252	176	10,684	242	7,883	202	6,820	191
- Fish	1,279	82	57	10	138	13	264	21	299	25	157	16	462	28
- Shrimps	5,813	30	9,761	48	6,948	55	4,981	58	9,035	79	6,711	83	5,461	65
- Crabs	951	91	788	75	638	72	947	93	1,348	138	983	102	864	95
- Others	2	0	61	3	219	11	60	4	2	1	32	1	33	3
5. Fish meal	-	-	-	-	-	-	124,130	2,015	189,964	2,791	171,467	2,627	160,554	2,815
6. Fish oil	4,429	80	5,304	73	4,021	62	4,113	74	5,880	103	8,785	149	8,181	139
7. Oyster Sauce	237	7	190	5	233	8	277	11	336	12	359	12	373	14
8. Seaweed & Agar-agar	434	225	433	227	582	304	684	330	899	463	914	424	1,226	567
9. Other	28,574	785	56,827	1,277	73,703	1,680	21,628	644	23,339	722	33,188	1,457	35,791	1,587

Source: Fisheries Economics Division, Department of Fisheries

STATISTICAL DATA ON VIETNAMESE FISHERIES

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1. INTRODUCTION

Vietnam has a long coastline of 3,260 km with 112 river mouths and canals. Its Exclusive Economic Zones covers 1,000,000 km², scattered in the 4,000 small and large islands, from straits, bays and lagoons where marine resources are in great abundance.

From the available data the annual total allowable fish catch is 1.2 to 1.4 million mt. In addition to finfishes, about 50,000-60,000 mt of high-value shrimps and 30,000-40,000 mt of cuttlefish can be harvested annually from the Vietnamese waters. There are also mollusks, e.g., arcshell and scallops as well as seaweeds.

Aquaculture potential is great with about 1.4 million ha of inland water surface areas including over 30,000 ha of tidal areas; 40,000 ha of reservoirs, rivers and streams; 60,000 ha of rice field and low laying areas. Additionally, there are over 80,000 ha of strait and bays, natural lagoons which would be tapped for aquaculture development.

Vietnam fisheries sector has gained remarkable records of increased production and trade which led to the strengthening the power of fishery production, increasing national accumulation and contribution to national economy. The annual increase of the fishery sector in the total national GDP during 1992-1995 is about 3%. The contribution of fisheries to Vietnam economy in 1995-1996 (100 VND = US\$ 0.009, March 1997), is shown below:

	<u>1995</u>	<u>1996</u>
GAP (1,000 Million VND)	222.800	258.609
GDP per capital (Million VND)	3,028.000	3,495.000
Contribution (Million VND)	67,600.000	69,680.000

The fishery sector has provided jobs for a number of people, the annual increase recorded in 1995 was at 162.9% compared with that of 1990. The labor force in the fishery sector in 1995-1996, is shown below:

	<u>1995</u>	<u>1996</u>
Total number of laborers (1000 people)	1,860.000	3,030.000
Of which the number of fishermen were	270.587	420.000

The number of fishing boats in 1990 and 1995, are shown below:

	<u>1990</u>	<u>1995</u>
Total (Unit)	72,328.000	95,700.000
In which:		
+ Motorized boat	41,247.000	68,000.000
Total horse power	724,300.000	1,500,000.000
+ Non-motorized boat	31,081.000	27,700.000

Since the in-shore marine resource has been over exploited, Vietnam has limited the increase of its small fishing boats and catching activities in the shallow area; and strengthened the fishing effort by investing in bigger engine fishing boats for offshore fishing. Due to the said limitation, the average increase of boat power was from 18 HP in early 1991 to only 22 HP in 1995. The number of boats with over 60 HP has however increased annually from 400 to 800 boats.

Vietnam fishery production has increased recently. The production output of fisheries reached 140.3% in 1996 compared to 1990 (Table 1). The export value in 1996 increased by 326.83% compared with the 1990 data (Table 1).

Sea products is one of the important food for the Vietnamese. The fish consumption per capita in 1996 was estimated at 11.6 Kg/capita (equivalent to 30% animal protein per meal). The total fish production for domestic consumption was over 800,000 mt. Fish for meal production and other consumption was over 300,000 mt.

2. FISHERY POLICIES TOWARDS YEAR 2010

The key objectives for the year 2010, include increase in total fish production, as shown below:

	<u>2000</u>	<u>2010</u>
Total fish production	1,600,000 mt	2,200,000 mt
In which:		
- Marine capture (mt)	1,000,000	1,200,000
- Inland & brackish Aquaculture (mt)	600,000	1,000,000
- Export value (USD Million)	1.0	2.2
- Number of laborers	4,000,000	6,000,000

In marine capture fisheries, the goal is to maintain the existing number of fishing fleet so that the production output will be stable at 700,000 mt per year in shallow water. On the other hand, the country's development program also includes upgrading of off-shore fishing fleets in terms of horse power from 90 HP up and installation of modern equipment and efficient fishing gear for catching high value species such as: cuttlefish, tuna, etc.

Fishery legislation should be strengthened to include regulations on species catching, prohibited areas, prohibited time of catching, and conservation of broodstock, construction of natural conservation area, protected areas for resource reproduction, and catching quota for each area and each species.

Aquaculture development is one of the key strategies of the fishery sector of Vietnam. The program includes efforts to speed up the survey, investigation, planning, programming of aquaculture projects at the national and provincial levels. Such development plan shall be carried out in combination with rational and effective use of the water surface areas, providing attractive labor opportunities to the people, population relocation, and eco-environment protection.

Taking into consideration a household family as an autonomous economic unit and as a key role for aquaculture development, state owned enterprises are taking main role on supporting services for aquaculture. The program also aims to link the scientific research and technical application with production and marketing. For the brackishwater and marine ventures, improved extensive culture, semi-intensive and intensive culture with sustainable technology will be adopted. More investments will be put in from the year 2000 and beyond.

The major species for aquaculture are black tiger shrimp, white shrimp in combination of local shrimp fry. A program to develop other culture species such as crab, seaweeds, ark shell, clam, scallop, snails, green turtle, grouper, red snapper, lobster, pearl, is also being planned.

The government recognized the need to upgrade its existing processing facilities, line processing facilities with material supply area. The processing and product conservation program is aimed at improving the quality of high economic value products using attractive packaging. The program will fully take advantage of material supply sources and minimize post-harvest losses; limit the material export and shift to products processed for the supermarket; and expand processed products, including instant product, surimi, canned products, fish ball, fish meal, meeting the requirements for quantity and quality of products for domestic market.

The government policy also aims to complete and put into operation the development of infrastructure facilities such as: jetty system, water and fuel supply, cold storage, etc. as well as the rehabilitation and enhancement of existing fishing ports and landing sites.

Other goals include:

- a) Dredging the estuaries for fishing boats covering areas from typhoons;
- b) Survey and re-assessment of ship repair and building capabilities for the fishery sector;
- c) Complete investment in state owned mechanical boat facilities in Haiphong, Da Nang, Ho Chi Minh City and some composite boat making plants;
- d) Deep investment in 30 boat repair and building units in most provinces;
- e) More investment and upgrading the electrical and refrigeration units; and
- f) Upgrading the packaging and fishing net making plants.

The government has drawn up proposals for the implementation of the various policies it had developed. These include:

a) **Institutional strengthening**

This focuses on the creation of favorable conditions for multi-economic modes to develop market oriented products, under the state management; the completion of the fishery legislation in Vietnam; the establishment of the complete policies for fishery development; the establishment of a concrete policy on fishery resources protection such as regulation on limited catching area or catching seasons, prohibited species for catching areas or catching seasons, prohibited species for catching, and treatment of violation cases.

In addition, the government also intends to disseminate the information for the people's awareness; the re-organization of the fishery structure and personnel and strengthening the capabilities of staff, workers, fishermen, through training in order to keep up with fishery development; the strengthening of information on the scientific, technical and economic aspects of fishery sector; revision of administration of issuing licenses such as Trade license, Fishing boat license, enacting legal paper, servant assessment, preparing economic and technical norms, and procedure for project evaluation. This is envisioned to create a suitable administration with efficient operations without corruption.

b) **Strengthening the science and technology to speed up production**

This effort aims to continue to conduct key investigation, to speed up the research and application of technology, especially biotechnology, advanced techniques in catching, aquaculture processing, mechanical services, etc. Attention should be given to the methods of reasonable production, conservation of raw material as well as fuel and materials consumption.

c) **Strengthening fisheries planning**

This is aimed at continuing the key investigation and planning of the fishery sector, making plans for each region, province and project. This also includes determining the guidelines for the development of the sector, and giving out concrete steps to implement these plans. At the same time, monitoring the implementation of plans and making timely suggestions in order to re-adjust the plans accordingly.

3. THE EXISTING FISHERY STATISTICAL SYSTEM

The Ministry of Fisheries of Vietnam is collecting the statistical data from provinces. The units under the Ministry collate the periodical report like monthly, quarterly and annual reports. However, fisheries has its own characteristics in terms of its multi-economic modes. Many people are engaged in fisheries and in many trading companies operating in the sea, rivers, lakes, lagoons.

Widely, the nation is characterized by the existence of few professionals and techniques, and outmoded equipment. In the units of the Ministry and provincial departments, there is not a section specializing in statistical works. Hence, statistics collection is normally being done concurrently by the functional department. There is also no training course on the collection of fishery statistics. Therefore, statistical data collected from provinces are insufficient and lacks the proper timing. Also, the treatment of the statistical data may be slow and could be inaccurate.

Since statistical data collection are insufficient and incomprehensive, the data does not reflect the status of the production capability of the entire economic modes engaged in fishery activities. In data processing, statistical data are taken from collected documents of the provinces, agencies and other units under the General Department of Statistics, Ministry of Trade, General Department of Custom, INFOFISH Review. From these sources, staff of the Ministry doing the statistical work make comprehensive statistical reports that be useful in the management of the sector's production and information related to the business ventures of the Government.

In order to improve the country's statistical fishery system and keep up with the growing demand of users in line with industrialization and modernization, the government focuses its attention on the organization structure to be completely reorganized from the ministerial, provincial, and district levels as well as from companies, enterprises and collective units. This is aimed at establishing the system of collection and processing of statistical data on fisheries. A Central-based office will be set up in the Ministry of Fisheries, and substations to be formed in provinces, cities and production bases under the Ministry, provincial departments and collective units, using facilities from the communication network of the fishery sector. In addition, a format of norms, periodical, monthly, quarterly, and annual reports will be formulated for the general assessment of the production capabilities of the sector; an investigation and collection of statistical data and in general, evaluation of the production effort of the multi-economic modes engaged in fisheries will be conducted; and training of staff on statistical work from central to provincial levels with high degree of professionalism, skills and information, will be conducted.

However, the Government also recognized that the country's fishery statistical system, the collection of fishery statistics, and the economic constraints, have not been improved recently, at least starting from 1994. Strengthening the fishery statistical capabilities is one of the most important tasks included in improving the resource management capability of the country during the period 1996-2000.

Table 1. Vietnam: Fishery production, consumption and export (1990-1996)

YEAR	1990	1991	1992	1993	1994	1995	1996
Total Production	978880	1062163	1080279	1170529	1287166	1141990	1373550
Catching (Ton)	672130	714253	721681	796057	889998	954640	962500
Domestic							
Consumption and fish-source (Tons)	306750	347910	358598	374472	397168	459950	411000
Export							
Value (USD1000)	205000	262334	305163	368435	458200	550600	670000
Export Volume (Tons)	49332	64700	79609	94825	110800	127700	150500

FAO FISHERY STATISTICS PROGRAMME

The Fishery Information, Data and Statistics Unit (FIDI) of FAO collates a comprehensive global fishery and aquaculture statistics from the data submitted by national reporting offices. When data seemed inaccurate, FIDI verifies them from existing sources or when data are not provided, FIDI would make estimates based on the most reliable information. The Workshop noted that the absence of data or inaccurate reporting of data may have been attributed to the unsustainable system of data collection, especially in Southeast Asia. In order to help solve this problem, FAO extends technical assistance to many countries, in the form of generic computer software development, formulation of methodological guidelines, and assistance in the conduct of training at the national level on fishery and aquaculture statistical systems.

The various international initiatives since the 1994 Regional Workshop on Fishery Information and Statistics in Asia, indicated increased concern for the improvement of fishery management, and specifically the collection of reliable fishery and aquaculture data. In response to these initiatives, countries in the region are exerting efforts to improve their compilation of fishery and aquaculture statistics. This has been indicated in the country papers presented during the Workshop.

FAO continues to facilitate the collection of fishery and aquaculture data through the formulation of databases and the development of new software packages for fishery statistical purposes. The most recent is the ARTFISH/ARTSER which will hopefully assist participating countries in their efforts to compile systematic fishery and aquaculture statistics.

FAO will also promote the implementation in the region of the concepts and methodologies contained in the Aquaculture Supplement for the World Census of Agriculture Programme for 2000. The Supplement which is being finalized by FAO will be disseminated before the end of 1997. This is discussed in detail in another section of the Proceedings.

CURRENT FAO FISHERY STATISTICS PROGRAMME

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1. INTRODUCTION

FAO is the only source of comprehensive global fishery statistics and most reviews of the state of world fisheries, past trends and future prospects rely on FAO statistics. FAO analyses these statistics in order to monitor many aspects of the world fisheries such as fishery production from capture fisheries and aquaculture, fish production and trade of fishery commodities, fish consumption, fishing fleets, and employment in fisheries. On the basis of these analyses, FAO prepares advice on fishery policy to member countries, reviews trends and outlines prospects of the contribution of fish to food security. The contribution of fish to national food supply (particularly for its protein) is monitored for all countries of the world and this necessitates collating information on production, disposition of catches to food and non-food uses, and production and trade of fishery commodities.

2. THE NATIONAL COMPONENT

Building up data on world fisheries requires an international effort and cooperation. International classification and standardized data submission procedures have to be maintained in order to ensure that the collected statistics are comparable across countries so as to allow for summation and analyses at both regional and global levels.

FIDI, the FAO Fishery Information, Data and Statistics Unit, is responsible for the collection of global fishery statistics. Statistics on catches and landings have been collated by the FAO since 1950. Data on number of fishermen and fishing fleet statistics became available since 1970, data on production and trade in fishery commodities since 1976, and aquaculture production and value statistics since 1984.

Fishery statistics are usually obtained from national reporting offices and, wherever possible, verified from other sources. Annually all countries receive at least the FISHSTAT National Summary (NS1) questionnaire for reporting of data on fish production. This form is viewed as the absolute minimum reporting required. Most countries however receive a number of additional questionnaires related to trade, export, aquaculture, etc. The list of the questionnaire sent out by FAO to countries in the Asia-Pacific region is given as Annex 1.

In addition, FAO data concerning the nominal catch of fish included in ISSCAAP (International Standard Statistical Classification of Aquatic Animals) group 36 (tunas, bonitos and billfishes) are generally reviewed in collaboration with the regional agency concerned with tuna statistics, in addition to the reporting by countries themselves. In the absence of reported (catch) data, or when the reported data is thought unreliable, FAO tries to estimate the likely production using data from other sources (trade figures, national statistical publications, research publications, etc.). If no other data is available for a reliable estimate, the value of the preceding year is simply repeated.

The resulting statistics are stored in databases and disseminated through annual publications such as the FAO Yearbooks of Fishery Statistics, for catches and landings, aquaculture and commodities (and less frequent for the fleet statistics). The data are also made available in electronic form by the distribution of diskettes with yearly updated platform independent databases with time series: FISHSTAT PC, AQUACULT PC and FISHCOMM PC. Aggregated data are also available through the FAO Internet site, from where databases can be queried or down loaded.

3. FAO FISHERIES DATABASES

The following databases are maintained by FIDI:

a) **Nominal catch and landings**

This database contains the volume of fish catches landed by country of capture, by species or a higher taxonomic level (ISSCAAP groups), and by FAO major fishing areas. Volume is measured in tons for all items except aquatic mammals, alligators and crocodiles, which are measured by number of animals, and pearls, shells, corals and sponges which are measured in kilograms. Weights are of the whole animal (live weight), a diagram with the catch concepts is given as Annex 2. Coverage includes harvest by commercial, artisanal and subsistence fisheries, including aquaculture.

Disaggregation of FAO's total fishery production statistics into capture fishery and aquaculture components has been completed for the period 1984-1995. It is planned to publish capture fishery statistics separately in Vol. 82 of the Yearbook of Fishery Statistics to be published in 1998, possibly together with aquaculture production statistics. It is planned eventually to disaggregate the total fishery production statistics for the remaining period 1950-1983 and, as a first step, time series of aquaculture production statistics are being extended to cover this period. Volume 82 of the Yearbook will carry a different name from the current "catches and landings", depending on what is included.

b) **Aquaculture production of fish**

This database system is still under development. One problem is obtaining a universally acceptable and permanent definition of aquaculture for data collection. An important objective for the aquaculture database is to include the collection of data on aquaculture production units (surface area of growing waters, number of cages, number of pens, etc.) and type of culture in addition to the existing statistics on production quantity (in live weight)

In addition, the price per kilogram by species, country and environment (fresh/brackish/seawater) should also be included. The same coding scheme and record format used for nominal catches and landings is being used to store these data.

c) Fishery commodities

This database contains statistics on the annual production of fishery commodities as well as imports and exports (including re-exports) of fishery commodities by country and commodity description (including processing method) in terms of volume and value. The data are coded using the FAO International Standard Statistical Classification of Fishery Commodities (ISSCFC) which is derived from the United Nations Standard International Trade Classification (revision 3) and linked to the Harmonized Commodity Description and Coding System (HS) of the World Customs Organization (WCO).

The quality of these data varies depending on each country's ability to collect and compile such statistics. FIDI uses all the verification information at its disposal, such as foreign trade statistics, industry and commodity reports to evaluate data accuracy and completeness, and corresponds with the countries when data are questionable. Production statistics of fishery commodities, refer to the quantities of preserved and processed fishery commodities, produced both ashore and on-board vessels utilizing catches from commercial fisheries and aquaculture production. Products from imported raw materials are also included. Data are expressed in tons and refer to the net weight of the commodities, i.e., excluding the weight of the container.

Statistics include species from which the commodity is produced, the commodity form (whole, filleted, shucked, etc.) and form of preservation (fresh, frozen, canned, cured, meal, etc.). They do not include aquatic plants, mother-of-pearl and other shells, pearls, corals and sponges, turtles, frogs and crocodiles. Product such as costume jewelry and fish leather are also excluded. International trade statistics for preserved and processed fishery commodities, refer to the quantities and values of annual imports and exports (including re-exports when applicable) of fish and fishery products. Quantities are expressed in tons (product weight), and values are expressed in thousand US\$. The conversion from national currencies into US\$ is done by applying average annual exchange rates from the International Monetary Fund (IMF).

Import and export trade statistics are obtained primarily from country reports provided to FAO in published form or on magnetic computer tapes. About 60 countries, including the major trading nations, provide data on magnetic tapes. Country of origin for imports or country of destination for exports are not included in the database. Data refer to the calendar year, except for a few countries which report data on a split year basis (in which case data are shown under the calendar year in which the split year ends).

d) Fleet statistics

FIDI collects annual statistics by country on the number and total tonnage of fish catching, processing, and support vessels utilized in commercial, subsistence and artisanal fisheries.

The data are reported by size of vessel measured in gross registered tons (GRT) and by type of vessel according to some 50 types of vessel defined in the International Statistical Classification of Fishery Vessels (ISCFV). Data for calendar years 1970 to 1995 constitute the series that have been collected, compiled and edited. Data for the years 1970, 1975, and 1977 to 1991 have been published.

Fishing fleet data are collected in several ways. The primary means is to collect the data directly from each country through a questionnaire and exploratory notes. For non-reporting countries and countries submitting incomplete data, other sources are used such as national publications, international fishery magazines, FAO fishery country profiles, FAO projects, and the Lloyd's Register of Shipping. The latter contains the number and total gross tonnage (GT) of insured vessels but does not include vessels under 100 GT. Therefore, a large portion of the fishing fleets for most countries is excluded from this publication. The same also applies to most fishing vessels of Southeast Asia which are smaller than 100 GT.

e) Employment statistics

This database contains statistics on the number of commercial and subsistence fishers for the period 1970-1995. It is collected on an annual basis by means of a questionnaire which requests separation of the number of workers according to the time devoted to fishing as an occupation (full-time, part-time, occasional). Based on the revision of the International Standard Classification of Occupations, information on the number of people engaged in commercial aquaculture including the disaggregation of employment data by gender, is also collected since 1990.

f) Apparent consumption of fish and fishery products

FIDI is responsible for supplying annual statistics of supply/utilization accounts for eight groups of primary fishery commodities and nine groups of processed products. The per caput supply are derived from the food balance sheets which indicates the import, export, production and other uses of fishery products. In FAO's work, these data are required to meet the requests of its statutory bodies to keep the world's food and nutrition situation under constant review, to update FAO's analytical work in the field of food security, and to provide the statistical base for the projections of demand, supply and other assessment studies. The derived consumption statistics are as good as the basic catch, utilization, trade, and production data on which they are based. Therefore trends in some cases may reflect the improved primary data rather than real changes to food intake.

Statistics on production and trade of aquatic organisms which are not utilized for food are in principle, included in the FAO statistics. Some trade statistics on ornamental fish are also made available. Although the questionnaire for aquaculture production statistics includes production of ornamental fish, in reality no country has ever reported on them. The same applies to catches for research purposes which FAO recommends should be included in capture fishery production statistics because these are very rarely reported. "Sharks for their fins" should certainly be included in catch statistics, but again they are often omitted, particularly when the sharks are finned and most of the carcass discarded. Shark fins are generally included in trade statistics but are often not specifically identified as such. Attempts should be made in the future to report on sharks caught for all purposes.

4. TECHNICAL ASSISTANCE

From the above it is clear that FAO is extremely dependent upon the data provided by national sources and this is where many problems lie. It is known that despite FIDI's corrective actions, editing and queering, the data received at FAO HQ are, at times, of unacceptable quality and/or completeness. This may be mainly attributed to the lack of regular and self-sustained data collection systems at national level. This is a serious problem, not so much for FAO, but mainly for the countries concerned. It is clear that countries need to collect fishery statistics for their own national interest, for policy-making, planning, fisheries management, etc. The provision of statistics to FAO (and regional fishery bodies), is only of secondary importance. The usefulness of the national statistics is dependent on their accuracy and completeness. In view of the current status of fishery statistics, it is for the greatest importance that the fishery statistical system is reviewed and improved.

At the national level, FAO provides technical assistance to countries in enhancing their capacity to collect, process and analyze fishery statistical data. Due to its institutional mandate, such enhancements are limited to systems to collect and process statistics of catches, landings and aquaculture, which are generally the prime responsibility of line agencies with which FAO cooperates. One of the primary objectives of the technical assistance efforts is to bridge the existing gap between nationally submitted statistics and FIDI's global and regional databases, particularly in the sector of artisanal fisheries and more specifically for inland water fisheries. Such activities include:

- a) the development of generic computer software which can be tailored to meet the needs of national fishery statistical systems while complying with international standards and requirements;
- b) the provision of methodological guidelines in applied fishery statistics and computing; and
- c) holding of training courses and workshops at national level focusing on integrated fishery statistical systems as well as the methodological and operational aspects of catch and effort statistical surveys.

5. FISHERY STATISTICAL SOFTWARE

A major effort has been put into the production of software packages for the statistical monitoring of fisheries. The present ARTFISH/ARTSER program (MS DOS version 2.0), developed by FIDI in 1994, is a general purpose system designed to handle sample-based surveys operating with varying sampling scenarios and estimation approaches. The underlying methodology of the program is a generalized approach taken from the analysis of many fishery statistical surveys found in the world. Its data management component (ARTFISH) caters for stratification in space and time, organization of collected data into databases, and the estimation for total catch, fishing effort, prices and values with a wide range of indicators for various sources of variation. It can be customized to a very large extent to adapt to local fishing practices. Its reporting component (ARTSER) operates with estimated data and provides users with tables and graphical presentations, and interfaces with commonly used applications software.

Experience has shown that a statistical system for artisanal fisheries is central to various other biological and socio-economic systems which, though of a different data scope, require interfaces with basic estimates on catch, fishing effort, prices and values. Thus, the underline concept of ARTFISH is that it provides a single depository of basic data, which can be used by other systems without duplicating or conflicting problems.

The present situation in most countries particularly in Africa, indicates that, for the next decade, the statistical infrastructure and the qualifications and skills of national staff will require simple, self-sustained and flexible tools of the ARTFISH type, supplemented with basic training and low-cost technical advice. FIDI has in its plans the implementation of a fully integrated ARTFISH/ARTSER Windows version, which will be ready for distribution by the end of 1997. Functionally, the Windows version is expected to offer the known advantages of a system operating under Windows, that is better screen handling, more flexible selection of system configuration and options, easy integration with other software applications, etc. Moreover, the Windows version is expected to offer users a complete suite of statistical services including:

- a) **ARTPLAN:** A survey planner that will assist in the design of a sample survey. This software component will operate on parameters supplied by users and generate a simulated fishery which will then be used for testing and evaluating alternative sampling scenarios. This technique can be effectively used in order to anticipate commonly occurring shortcomings related to accessibility to landing sites, time schedule of sampling, frequency sample size, mobility, and cost-benefit tradeoffs.
- b) **ARTFISH/ARTSER for Windows.** Functionally this component will follow the same methodological approach used by its MS DOS equivalent. However, it will provide enhanced system functions, more transparent handling of data inter-relations, and much improved reporting features and integration with internationally utilized computer standards, including reporting national statistics in standard format to FAO or other international bodies.
- c) **ARTHELP.** Help on-line tutorial. The above two components will be fully described and supported by a comprehensive set of documents, slides, and graphics which will be interactive and provide users with tutorial and help functions to the depth of knowledge they are willing and able to obtain.
- d) **ARTBIEC.** Bio-economic component. This will consist of a number of supplementary modules, each focusing on a specific applications sector. It is envisaged that special procedures should be developed for linking the ARTFISH estimates with samples of length-frequency and other important biological data, whereas other modules will provide linkages to socio-economic information.

The above plan also envisages the collaboration of FIDI with other fishery institutions in member countries or on regional level showing interest and willingness to participate in the systems development. The multi-lingual requirements of the software, the amount of work required for the fourth component (ARTBIEC), and the obvious advantages of a jointly issued product (dissemination, installation, training, technical advice, troubleshooting), have already been taken into consideration. Potential partners (such as ORSTOM, DANIDA) will shortly be contacted in this respect.

FAO QUESTIONNAIRES ON FISHERY STATISTICS

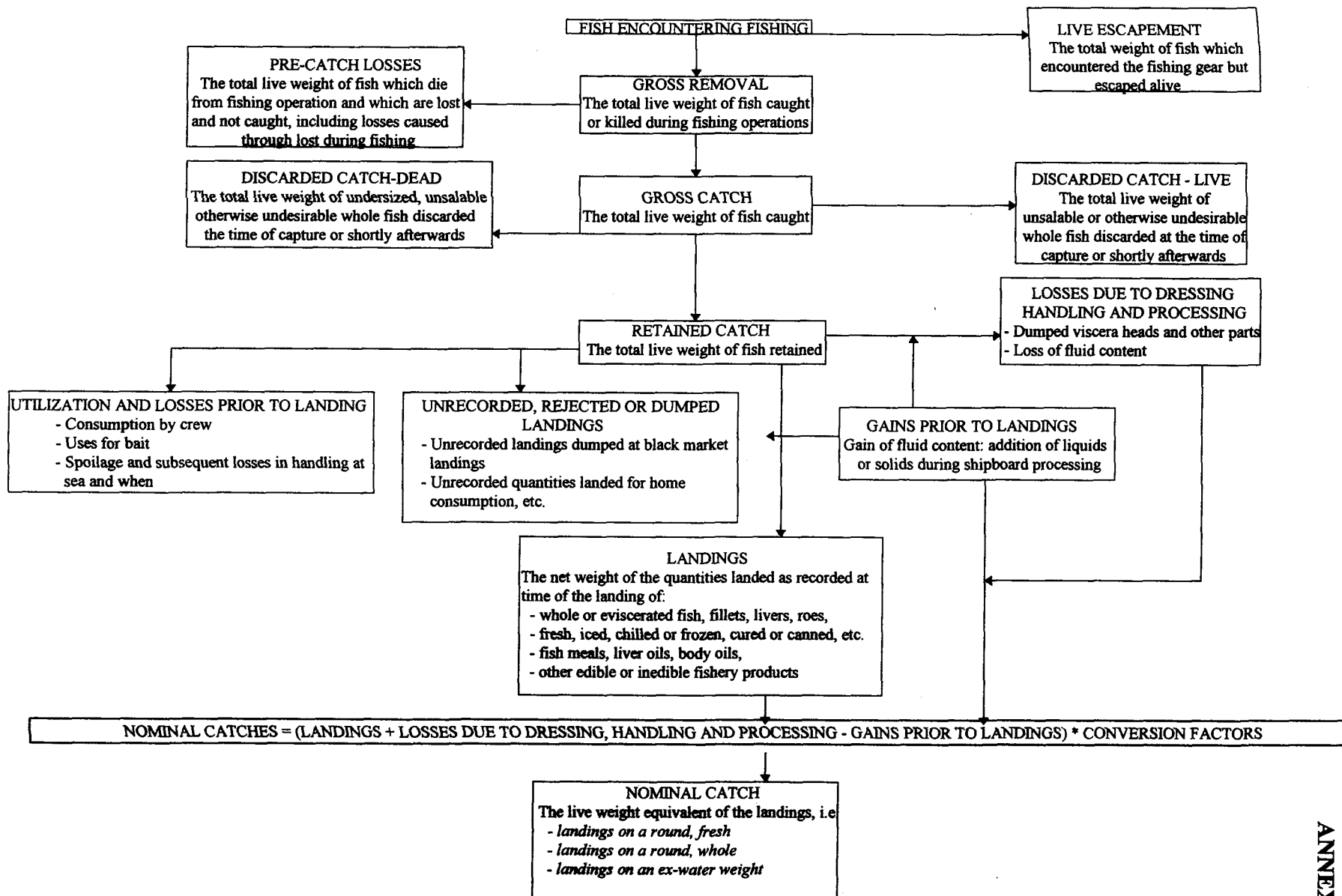
FAO questionnaires sent out annually to countries in the Asia-Pacific:

FISHSTAT NS 1	(National Summary)
FISHSTAT NS 2	(Inland Catch) - only for landlocked countries
FISHSTAT NS 6	(Aquatic mammals)
FISHSTAT NS 7	(Crocodiles and alligators)
FISHSTAT NS 8	(Pearls, shells, corals and sponges)
FISHSTAT NS 9	(Aquatic Plants)
FISHSTAT AQ	(Aquaculture production)
FISHSTAT CF	(Conversion factors)
FISHSTAT FC 1	(Fishery commodities)
FISHSTAT FF	(Fishery Fleet)
FISHSTAT FM	(Fishermen)
FISHSTAT IW	(Inland waters)
FISHSTAT TR	(Importations and Exportations)
FISHSTAT 51 A	(Indian Ocean, Western - Summary)
FISHSTAT 57 AB	(Indian Ocean - Summary)
FISHERMEN	(Commercial and Subsistence)
FISHSURV REC	(Recreational Fishery)

Disposition of nominal catches:

STATLANT 08 A	(Southern Ocean - Summary)
STATLANT 08 B	(Southern Ocean - Catch/Effort)
STATLANT 21 A	(NAFO - Summary)
STATLANT 21 B	(NAFO - Catch/Effort)
STATLANT 27 A	(ICES - Summary)
STATLANT 27 B	(ICES - Catch/Effort)
STATLANT 34 A	(CECAF - Summary)
STATLANT 34 B	(CECAF - Catch/Effort)
STATLANT 37 A	(GFCM - Summary)
STATLANT 37 B	(GFCM - Catch/Effort)
STATLANT 41 A	(Atlantic, Southwest - Summary)
STATLANT 41 B	(Atlantic, Southwest - Catch/Effort)
STATLANT 47 A	(Southeast Atlantic - Summary)
STATLANT 47 B	(Southeast Atlantic - Catch/Effort)
STATPAC 87 A	(PCSP - Summary)

CATCH CONCEPTS DIAGRAM



**RECENT INTERNATIONAL INITIATIVES
WITH IMPLICATIONS FOR FISHERY STATISTICS**

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1. INTRODUCTION

This document provides information on various developments since the 1994 Regional Workshop on Fishery Information and Statistics in Asia, at the global level which may have implications for fishery statistics, particularly as a basis for fishery management. The number of such initiatives and the high level at which they have been recommended indicated increased concern for the state of world fisheries and the need to improve current fishery management approaches. Of particular relevance to statistics, is the incorporation of the precautionary approach in the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks and the FAO Code of Conduct for Responsible Fisheries which should lead to greater incentives of the nations to collect reliable fishery data.

2. UN AGREEMENT ON STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

The UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks¹ specifies clearly the roles and responsibilities for regional fishery agencies and flag states in the collection and exchange of data necessary to meet stock assessment requirements and support management objectives for straddling fish stocks and highly migratory fish stocks. Annex I of the Agreement, titled Standard Requirements for the Collection and Sharing of Data, provides an important specification of the minimum data requirements for the conservation of fish stocks. Article 48 of the Agreement specifies that the Annexes to the Agreement may be revised from time to time by states' parties based on scientific and technical considerations, hence these requirements can be amended as the need arises (Annex I of the Agreement is reproduced as an appendix to this paper).

The Agreement was adopted by the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks at its Sixth Session on 4 August 1995, had 59 signatories. Thirty instruments of ratification or accession are required for the Agreement to come into force, and as of 23 May 1997 there were 14² (Table 1).

¹ Agreement for the implementation of the Provisions of the United Nations Convention on the Law of the Sea, 10 December 1982, Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

² Information provided by the United Nations Division for Ocean Affairs and the Law of the Sea (DOALOS)

3. FAO COMPLIANCE AGREEMENT

In another development, twenty-five acceptances are required in order for the Agreement³ to come into force. So far ten acceptances have been received (Table 2). Under the FAO Compliance Agreement, specifically Article VI requires parties to exchange information on vessels authorized by them to fish on the high seas and obliges FAO to facilitate this information exchange. For this purpose, FAO has developed a prototype database, known as the High Seas Vessels Authorization Record (HSVAR).

In October 1995, a Circular State Letter (G/FI-24/PR) was sent to all states which had accepted the Agreement, informing them that FAO had developed a prototype database and requesting those states to provide data on vessel authorizations to facilitate testing. FAO could grant access to the prototype database to countries providing data so that feedback can be obtained from potential users. So far two states (Canada and the USA) have provided such vessel authorization data and over 600 vessel records are in the database.

4. CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

The Code of Conduct for Responsible Fisheries was adopted on 31 October 1995 during the FAO Conference at its Twenty-eighth Session which also reflected particularly these concerns. The Code stressed the essential need for reliable data as a basis for effective fishery management and policy making. Paragraphs 7.4.1 - 7.4.7 deal with data gathering and management advice, and the responsibilities of States and sub-regional or regional fishery management organizations in relation to these.

Paragraph 4.1 states that FAO will monitor the application and implementation of the Code and its effects on fisheries and that all the states and relevant international organizations, whether governmental or non-governmental should actively cooperate with FAO in this effort. As part of its program of promoting implementation of the Code, FAO has proposed to potential donor countries an Inter-regional Programme of Assistance to Developing Countries. One such sub-program is concerned with Upgrading Capabilities for Reporting on Fishery Statistics and comprises three activities:

- a) Design of a generic catch and effort data collection and reporting system for use by distant water fishing nations and coastal states fishing straddling fish stocks and highly migratory fish stocks;
- b) Bringing existing statistical systems into conformity with the agreed system through a series of workshops conducted with or by regional fisheries bodies; and
- c) Establish a reporting system that will allow rapid transfer of data between countries, regional fisheries bodies and FAO.

³ Agreement to Promote Compliance with internationally Agreed Conservation and Management Measures by Fishing Vessels on the High Seas

Donor funding is being sought for the program and has already been secured for some components. Also, the FAO Fisheries Department has been requested to report to COFI and to the United Nations General Assembly on the implementation of the Code. Feedback from regional fisheries organizations such as APFIC and SEAFDEC will be an important component of this.

5. KYOTO DECLARATION AND PLAN OF ACTION

At the International Conference on the Sustainable Contribution of Fisheries to Food Security (4-9 December, Kyoto, Japan), 95 states adopted a Declaration and Plan of Action which were conveyed to the UN, FAO, UNCSD (UN Commission on Sustainable Development), the 1996 FAO World Summit, and other relevant international organizations for their consideration and endorsement. Although not binding, the Plan of Action is an agreed set of tasks, many of which are of relevance to CWP and its participating organizations. The Plan of Action is as follows:

[We, the 95 States....]... HAVE AGREED that a set of immediate actions should be taken, without prejudice to the rights and obligations of States under international law, either directly or in cooperation with other States, or through the Food and Agriculture Organization of the United Nations (FAO) in cooperation with other appropriate intergovernmental organisations and/or regional fishery management organisations or arrangements. These immediate actions are:

1. *To assess and monitor the present and future levels of global, regional and national production, supply and demand of fish and fishery products and their effects on food security, employment, consumption, income, trade and sustainability of production.*
2. *To enhance subregional and regional cooperation and establish, where it is considered appropriate, subregional and regional fishery conservation and management organizations or arrangements for straddling fish stocks and highly migratory fish stocks; and cooperate to strengthen, where necessary, existing subregional and regional fishery conservation and management organizations and arrangements in order to carry out their assigned tasks.*
3. *To conduct, within their competencies and, where appropriate, in cooperation with regional and other intergovernmental organizations, integrated assessments of fisheries in order to evaluate opportunities and strengthen the scientific basis for multispecies and ecosystem management.*
4. *To identify and exchange information on potential mechanisms to reduce excess fishing capacity and implement action on programs to reduce excess capacity, where and when appropriate, as soon as possible.*
5. *To develop, promote and facilitate the exchange of information on the use of efficient and standardized methodologies for the study of social, cultural and economic characteristics of fishing and associated activities; and, in particular, attempt to develop methods designed to permit verifiable indicators of the importance of such characteristics and their interaction and compatibility with management objectives.*

6. *To promote allocation of human and financial resources for an international program to investigate the effectiveness of multispecies management of commercial fishery resources.*

7. *To increase efforts to estimate the quantity of fish, marine mammals, sea birds, sea turtles and other sea life which are incidentally caught and discarded in fishing operations; assess the effect on the populations or species; take action to minimize waste and discards through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques; and exchange information on methods and technologies to minimize waste and discards.*

8. *To promote the exchange of information amongst research institutes and other relevant entities aiming to: (i) increase opportunities for the sustainable use of unexploited or underexploited species as human food; and (ii) promote and support research activities in order to ensure improvement in scientific knowledge of existing fishery resources.*

9. *To strengthen coordination of national and international research programs aiming to simulate environmentally sound aquaculture and stocking, giving emphasis to the development of international guideline for the development and management of activities in particular on: (i) the impacts on the environment and biodiversity; (ii) the application of biotechnology; and (iii) the health of cultured stocks.*

10. *To provide and coordinate technical and financial assistance programs for developing countries, in particular low-income food-deficit countries (LIFDCs) and small island developing States and encourage cooperation between these countries, in order to achieve the contribution of fisheries to food security through, inter alia: (i) a rapid transfer of technology and know-how in enhancement in inland and marine waters; (ii) an upgrade and increase of the capabilities needed to minimize post-harvest losses; and (iii) ensuring improved control of fishing activities within areas under national jurisdiction.*

7. SUGGESTED ACTION

The purpose of this paper is to provide information on developments in international initiatives relevant to fishery statistics which have taken place since the previous Regional Workshop in 1994. The Workshop may wish to comment on the aspects of these initiatives which are relevant to Asia and the Pacific and consider their implications and how their implementation might be best promoted and monitored.

AGREEMENT FOR THE IMPLEMENTATION OF THE PROVISIONS OF THE
UNITED NATIONS CONVENTION ON THE LAW OF THE SEA
OF 10 DECEMBER 1982
RELATING TO THE CONSERVATION AND MANAGEMENT OF
STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

ANNEX I
STANDARD REQUIREMENTS FOR THE COLLECTION
AND SHARING OF DATA

Article 1

General principles

1. The timely collection, compilation and analysis of data are fundamental to the effective conservation and management of straddling fish stocks and highly migratory fish stocks. To this end, data from fisheries for these stocks on the high seas and those in areas under national jurisdictions are required, and should be collected and compiled in such a way as to enable statistically meaningful analysis for the purposes of fishery resource conservation and management. These data include catch and fishing effort statistics and other fishery-related information, such as vessel-related and other data for standardizing fishing effort. Data collected should also include information on non-target and associated or dependent species. All data should be verified to ensure accuracy. Confidentiality of non-aggregated data shall be maintained. The dissemination of such data shall be subject to the terms on which they have been provided.
2. Assistance, including training as well as financial and technical assistance, shall be provided to developing States in order to build their capacity in the field of conservation and management of living marine resources. Assistance should focus on enhancing capacity to implement data collection and verification, observer programmes, data analysis and research projects supporting stock assessments. The fullest possible involvement of developing State scientists and managers in conservation and management of straddling fish stocks and highly migratory fish stocks should be promoted.

Article 2

Principles of data collection, compilation and exchange

The following general principles should be considered in defining the parameters for collection, compilation and exchange of data from fishing operations for straddling fish stocks and highly migratory fish stocks:

- (a) States should ensure that data are collected from vessels flying their flag on fishing activities according to the operational characteristics of each fishing method (e.g., each individual tow for trawl, each set for long-line and purse-seine, each school fished for pole-and-line and each day fishes for troll) and in sufficient detail to facilitate effective stock assessment;
- (b) States should ensure that fishery data are verified through an appropriate system;
- (c) States should compile fishery-related and other supporting scientific data and provide them in an agreed format and in a timely manner to the relevant subregional or regional fisheries management organization or arrangement where one exists. Otherwise, States should cooperate to exchange data either directly or through such other cooperative mechanisms as may be agreed among them;
- (d) States should agree, within the framework of subregional or regional fisheries management organizations or arrangements, or otherwise, on the specification of data and the format in which they are to be provided, in accordance with this Annex and taking into account the nature of the stocks and the fisheries for those stocks in the region. Such organizations or arrangements should request non-members or non-participants to provide data concerning relevant fishing activities by vessels flying their flag;
- (e) Such organizations or arrangements shall compile data and make them available in a timely manner and in an agreed format to all interested States under the terms and conditions established by the organization or arrangement; and
- (f) Scientists of the flag State and from relevant subregional or regional fisheries management organization or arrangement should analyze the data separately or jointly, as appropriate.

Article 3

Basic fishery data

1. States shall collect and make available to the relevant subregional or regional fisheries management organization or arrangement the following types of data in sufficient detail to facilitate effective stock assessment in accordance with agreed procedures:
 - (a) Time series of catch and effort statistics by fishery and fleet;
 - (b) total catch in number, nominal weight, or both, by species (both target and non-target) as is appropriate to each fishery. [Nominal weight is defined by the Food and Agriculture Organization of the United Nations as the live-weight equivalent of the landings];

- (c) discard statistics, including estimates where necessary, reported as number or nominal weight by species, as is appropriate to each fishery;
 - (d) effort statistics appropriate to each fishing method; and
 - (e) fishing location, date and time fished and other statistics on fishing operations as appropriate.
2. States shall also collect where appropriate and provide to the relevant subregional or regional fisheries management organization or arrangement information to support stock assessment, including:
- (a) composition of the catch according to length, weight and sex;
 - (b) other biological information supporting stock assessments, such as information on age, growth, recruitment, distribution and stock identity; and
 - (c) other relevant research, including surveys of abundance, biomass surveys, hydro-acoustic surveys, research on environmental factors affecting stock abundance, and oceanographic and ecological studies.

Article 4

Vessel data and information

1. States should collect the following types of vessel-related data for standardizing fleet composition and vessel fishing power and for converting between different measures of effort in the analysis of catch and effort data:
- (a) vessel identification, flag and port of registry;
 - (b) vessel type;
 - (c) vessel specifications (e.g., material of construction, date built, registered length, gross registered tonnage, power of main engines, hold capacity and catch storage methods); and
 - (d) fishing gear description (e.g., types, gear specifications and quantity).
2. The flag State will collect the following information:
- (a) navigation and position fixing aids;
 - (b) communication equipment and international radio call sign; and
 - (c) crew size.

Article 5

Reporting

A State shall ensure that vessels flying its flag send to its national fisheries administration and, where agreed, to the relevant subregional or regional fisheries management organization or arrangement, logbook data on catch and effort, including data on fishing operations on the high seas, at sufficiently frequent intervals to meet national requirements and regional and international obligations. Such data shall be transmitted, where necessary, by radio, telex, facsimile or satellite transmission or by other means.

Article 6

Data verification

States or, as appropriate, subregional or regional fisheries management organizations or arrangements should establish mechanisms for verifying fishery data, such as:

- (a) position verification through vessel monitoring systems;
- (b) scientific observer programmes to monitor catch, effort, catch composition (target and non-target) and other details of fishing operations;
- (c) vessel trip, landing and transshipment reports; and
- (d) port sampling.

Article 7

Data exchange

1. Data collected by flag States must be shared with other flag States and relevant coastal States through an appropriate subregional or regional fisheries management organizations or arrangements. Such organizations or arrangements shall compile data and make them available in a timely manner and in an agreed format to all interested States under the terms and conditions established by the organization or arrangement, while maintaining confidentiality of non-aggregated data, and should, to the extent feasible, develop database systems which provide efficient access to data.
2. At the global level, collection and dissemination of data should be effected through the Food and Agriculture Organization of the United Nations. Where a subregional or regional fisheries management organization or arrangement does not exist, that organization may also do the same at the subregional or regional level by arrangement with the States concerned.

Table 1. Fourteen instruments of ratification or accession to the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks (as of 23 May 1997)

Country or Area	Date of Ratification/Accession
Tonga	31 July 1996
Saint Lucia	9 August 1996
United States of America	21 August 1996
Sri Lanka	24 October 1996
Samoa	25 October 1996
Fiji	12 December 1996
Norway	30 December 1996
Nauru	10 January 1997
Bahamas	16 January 1997
Senegal	30 January 1997
Solomon Islands	13 February 1997
Iceland	14 February 1997
Mauritius	25 March 1997
Micronesia	23 May 1997

Table 2. Ten acceptance to the Agreement to Promote Compliance with Internationally Agreed Conservation and Management Measures by Fishing Vessels on the High Seas (as of 23 May 1997)

Country or Area	Date of Acceptance
Canada	20 May 1994
Saint Kitts and Nevis	24 June 1994
Georgia	7 September 1994
Myanmar	8 September 1994
Sweden	25 October 1994
Madagascar	26 October 1994
Norway	28 December 1994
United States of America	19 December 1995
Argentina	24 June 1996
European Community	6 August 1996

**FOLLOW-UP BY FAO TO THE
RECOMMENDATIONS FROM THE 1994 REGIONAL WORKSHOP
ON FISHERY INFORMATION AND STATISTICS IN ASIA**

by
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The recommendations from the 1994 Regional Workshop on Fishery Information and Statistics in Asia which were addressed to FAO are reproduced from the Proceedings Report (Doc. FAO/SEAFDEC/Inf.3) in **bold font** below, with information on the follow-up presented in *italics*.

2) Regional and International Levels

2.1 FAO in cooperation with SEAFDEC should work on the standardization of the classification used for collating fishery products, production and fish trade statistics for the region.

FAO and SEAFDEC/MFRD have discussed how to improve compatibility between their respective commodity classifications, taking into account the particular requirements for the Southeast Asian region. Some SEAFDEC commodity categories (e.g. boiled fish, powdered/flaked fish) are not identified in the FAO classification or in the Harmonized Commodity Description and Coding System (HS). FAO is increasingly moving towards the HS classification while more countries report fishery production and trade statistics using this classification. There are, however, considerable shortcomings in the HS classification which include a lack of species definition for most commodities originated outside the Atlantic area and processing methods used outside Europe and the United States. It is a priority for FAO to try to have the classification modified by the World Customs Organization (WCO) so as to provide a more comprehensive and balanced description of fishery products.

2.2 In order to fully utilize the potentials of computerization, the current wide diversity of computer hardware and software used by the national agencies should be made compatible.

Moreover, compatible standard procedures and formats should be developed for reporting fishery statistical data at regional level using electronic and magnetic media. FAO/RAPA should organize such a work in cooperation with SEAFDEC.

FAO has developed a catch and effort data collection and processing system for artisanal fisheries which has been implemented in several countries. The present ARTFISH/ARTSER MS DOS version 2.0, developed by FIDI in 1994, is a general-purpose system designed to handle sample-based surveys operating with varying sampling scenarios and estimation approaches.

Its data management component (ARTFISH) caters for stratification in space and time, organization of collected data into databases of primary statistics according to the data collection schemes in use, and the derivation of total estimates for catch, fishing effort, prices and values. Its reporting component (ARTSER) operates with estimated data and provides users with consolidated tabulations, graphical presentations and interfaces with commonly used application software.

As regards submission of national data in electronic form to FAO, about 80 countries now submit fishery commodity trade statistics to FAO in electronic form on tapes together with trade statistics on agriculture and forestry commodities. These statistics are generally collected by the national customs authorities and submitted to FAO using the HS. The HS, which has now been adopted as the national commodity classification by about 150 countries, comprises a six-digit standard classification code together with a non-standard two or three-digit code which can be defined nationally to provide additional detail to the commodity description. The change to electronic submission has greatly reduced the workload for database updating, but this has been offset to some extent by the increases in data quantity and the need to correct errors in formats used.

In contrast to improving the reporting of trade statistics, submission of catch and aquaculture statistics to FAO in electronic form (i.e. ASCII or spreadsheet files on diskette as e-mail attachments, or by FTP transfer) is still negligible. Only about 10 countries are reporting these data to FAO. Moreover, FAO has requested countries in the past to use the Eurostat format, but very few use this for submission to FAO (even of the EU countries). For catch data, FAO now suggests that countries use the Eurostat format, but emphasizes that submission of data in any electronic form is strongly encouraged, provided the format is clearly specified. The advantage of specifying the Eurostat format even if it is not used is that it clearly specifies the data structure required.

Given that format, FAO is proposing¹ two additional fields to cater for the value and the currency unit. This is in order to collate value statistics for capture fishery production (as is done for aquaculture). The modified version of the Eurostat format proposed is given in the Appendix.

4. Fishery Statistical Bulletin for the South China Sea Area

4.1 The classification of fishery commodities on disposition of catch, fish processing and exports by fishery commodity should be revised as proposed by SEAFDEC/MFRD and supported by FAO.

This has not been undertaken by FAO which is adopting the HS classification (see 2.1 above). However, if the SEAFDEC Bulletin were to present statistics according to the product categories suggested by MFRD, it would be easier for FAO to make proposals to the WCO for improvements to the HS.

¹ See document APFIC: JWPFS/97/2

5. Socio-economic Statistics

- 5.1 Participating countries and FAO should consider the collection and publication, as soon as feasible, of data on catch value at the landing place.**

As mentioned under 2.2 above, FAO plans to request data on capture fishery production value statistics from 1997 onwards. This will complement the value data already collected for aquaculture production. Catch value will be included in the suggested format for reporting in computer-readable form.

6. Aquaculture Statistics

- 6.1 For resource management purposes, it would be more useful and more reliable to obtain and report separate statistics on capture fisheries and aquaculture production, rather than subtracting aquaculture data from total catch to obtain capture production figures. Until this change can be made and for greater clarity, the current FAO Yearbook should be labeled as "Fishery Production Statistics Including Aquaculture", rather than "Catches and Landings".**

Disaggregation of FAO's total fishery production statistics into capture fishery and aquaculture components has been completed for the period 1984-1995, and these statistics are temporarily being disseminated in the computerized dissemination package AQUACULT PC. FAO is planning to publish capture fishery statistics separately in Vol. 82 of the Yearbook of Fishery Statistics, possibly together with aquaculture production statistics. It is planned eventually to disaggregate the total fishery production statistics for the remaining period 1950-1983 and, as a first step, time series of aquaculture production statistics are also being extended to cover this period. Thus, Volume 82 of the Yearbook will carry a different name from the current one, and this will depend on what information is included.

- 6.2 On the criteria on units of measure for aquaculture facilities, it was recommended that "hectares" should be used for ponds and pens while "cubic meters" for cages.**

Hectares are used for ponds and pens while cubic meters are used for cages. However, this has always been the case applied by FAO.

- 6.3 Many participating countries endorsed the proposed amalgamation of "brackishwater" and "marine" aquaculture to "coastal aquaculture" to avoid confusion and simplify statistical work.**

This has been discussed within FAO and the general view is that such an amalgamation would not reduce confusion. Unlike the FAO major fishing area designations which are purely geographical, the environment classification in the FISHSTAT AQ questionnaire for aquaculture, comprising marine water, brackishwater and inland water elements, is based on salinity. This is believed to provide additional, rather than conflicting information.

- 6.4 Participating countries should make greater efforts to specify returns of aquaculture production by species and not to aggregate them into simply groups like “natantian decapods” or “cyprinidae”, as the case may be.**

FAO is starting to tackle the problem of a lack of species detail in reported aquaculture production through dialogue with countries and through a special study for African countries. In some cases countries are able to specify the species more precisely than they have been doing, but in other cases the basic data do not permit a better description.

- 6.5 The instructions for completion of the FAO questionnaire should be improved by giving more guidance on the designation of type of fisheries, on type of production by environment, and to explain that “cultured ornamental fish” should be reported as “aquaculture”, where feasible.**

FAO is currently refining the definition of aquaculture and one element of this is the development of a list of fish production practices classified as either capture fisheries (with or without stock enhancement) or aquaculture.

**FORMAT FOR FISHSTAT NS AND STATLANT A SUBMISSIONS
OF CATCH QUANTITY AND VALUE DATA**

Magnetic data

Computer tapes: Nine track with a density of 1 600 or 6 250 BPI and EBCDIC or ASCII coding, preferably unlabelled. If labelled, an end-of-file code should be included.

Floppy discs: MS-DOS formatted 3, 5" 1, 4 Mbyte discs or 5,25" 360K or 1,2 Mbyte discs.

Record format

Byte Nos.	Item	Remarks
1 to 4	Country (ISO 3-alpha code)	e.g. FRA = France
5 to 6	Year	e.g. 90 = 1990
7 to 8	FAO major fishing area	e.g. 27 = Northeast Atlantic
9 to 15	Division	e.g. Iva = ICES IV a
16 to 18	Species	3-alpha identifier
19 to 26	Catch quantity	Metric tons
27 to 40	Catch value	In local currency
41 to 43	Local currency (ISO 3-alpha code)	e.g. FRF = French Franc

Notes:

- (a) All numeric fields should be right justified with leading blanks. All alphanumeric fields should be left justified with trailing blanks.
- (b) The catch quantity is to be recorded in the live weight equivalent of the landings to the nearest metric ton.
- (c) The catch value is to be specified whole units of the local currency.
- (d) Quantities (bytes 19 to 26) of less than half a unit should be recorded as '-1'.
- (e) Unknown quantities (bytes 19 to 26) should be recorded as '-2'.

**RECENT FAO ACTIVITIES RELATED TO
BY-CATCH AND DISCARD ISSUES**
by
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1. INTRODUCTION

The requirement for data on the discarded component of the catch has been clearly stated in numerous fora, documents and international initiatives, most notably in the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks¹ and the FAO Code of Conduct for Responsible Fisheries.

This paper provides brief reports on two recent FAO activities related to this subject, the Technical Consultation on Reduction of Wastage in Fisheries (28 October - 1 November 1996, Tokyo, Japan) and a study of shark catches (mainly by-catches) undertaken by FAO in response to a request from CITES.

2. TECHNICAL CONSULTATION ON REDUCTION OF WASTAGE IN FISHERIES

The Consultation in its Report² noted that Annex 1 of the UN Agreement details requirements for the collection of data, including the following:

Article 3.1 - "States shall collect data on "total catch in number, nominal weight, or both, by species (target and non-target)..." and "discard statistics, including estimates where necessary; reported as number or nominal weight by species..." [3.1 (b) (c)].

Article 6 - "States... should establish mechanisms for verifying fisheries data "through "scientific observer programmes to monitor catch, effort, catch composition (target and non-target) and other details of fishing operations" [6 (b)].

Annex I details additional requirements as to the type and accuracy of the data to be collected.

¹ Agreement for the implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

² Report of the Technical Consultation on Reduction of Wastage in Fisheries, Tokyo, Japan, 28 October - 1 November 1996. FAO Fisheries Report No. 547. Rome. FAO. 1996. 27p.

Annex I further requires States to share data at the regional level through regional organisations and calls upon the UN FAO to collect and disseminate data at the global level [Article 7].

With respect to the collection of data from fisheries on the high seas, the Agreement places strengthened obligations on flag States. Article 18 obligates flag States to establish "requirements for recording and timely reporting of... catch of target and non-target species..." [18.3 (e)]; "requirements for verifying the catch of target and non-target species through such means as observer programmes..." [18.3 (f)]; and the implementation of "inspection schemes", "monitoring systems" and "observer programmes" involving observers from both the flag State and other States [18.3 (g) (i-iii)]. The Agreement places considerable weight on the obligation to collect data in high seas fisheries in relation to the compliance and enforcement provisions contained in Articles 19-23 [Article 21.11].

In relation to data collection, the Consultation (Report paragraphs 32 and 33) stated that it felt strongly that improvement of regional and global estimation of discard levels could best be accomplished by more and better information from the national and regional fishery sector levels and it "recommended that data on discards be collected nationally and then collated by FAO, for the individual fisheries, and that it be published".

3. FAO SHARK CATCH/BY-CATCH STUDY

CITES Resolution Conf. 9.17 was addressed to several agencies at different levels. Although some actions have already been taken, sometimes these led to parallel endeavors and duplicating requests to countries. Specifically therefore, CITES asked the following responsible agencies to get to action:

- a) FAO (a global body), to collect and assemble data on sharks;
- b) Regional fisheries organisations, to do the same; and
- c) Itself, for information on sharks from its Parties.

Thus, the US National Marine Fisheries Service collated and analyzed shark data from around the world. In a related development, the IUCN held a meeting of shark experts in July 1996.

FAO will respond to the request of CITES by undertaking some work on shark fisheries. This activity will be mainly funded from extra-budgetary sources. Meanwhile, the project "Sustainable Contribution of Fisheries to Food Security" to be funded by the Government of Japan and executed by FAO, contains a component for investigating the biological and trade status of sharks. Also, using Japanese Trust Fund and FAO resources, an inquiry was undertaken for the collection of species-specific catch data for sharks (including data on discards and recreational catches) for recent years, and any available information on the status of shark stocks from national sources. So far, national reports have been received from 28 countries.

In addition, experts on elasmobranchs have been approached for more information. The data and information received from these and other sources have been reviewed, and a report is being prepared which will hopefully provide a brief synopsis for each species.

The said report shall contain the following information:

- a) A brief summary of the biology and geographical range;
- b) A description of its reproductive potential, growth rates, size of young, size of litters, longevity and location of nursery areas, and information which can together indicate how a species will respond to exploitation;
- c) Documentation of the impact of shark fisheries; and
- d) A status category to indicate a species' vulnerability to fisheries.

The report is currently being reviewed by FAO. It may be utilized as a working document during an expert consultation on the biological and trade status of sharks to be held in 1998. This forum is expected to prepare the technical guidelines and a draft plan of action for an intergovernmental Consultation on Sharks. The Plan of Action adopted by this Consultation will be addressed to the FAO Committee on Fisheries (COFI). The expert consultation will also advise to some extent, the FAO response to CITES Resolution 9.17.

SEAFDEC FISHERY STATISTICAL BULLETIN

The regional workshops on fishery statistics which the Southeast Asian Fisheries Development Center (SEAFDEC), in collaboration with various regional and international organizations notably FAO, has been conducting since 1976 had initiated the publication of the Fishery Statistical Bulletin for the South China Sea Area since 1978. The ultimate objectives of the series of workshops are: to unify the statistical standards of collection, compilation and processing of fishery and aquaculture data; and to facilitate regional comparativity and compatibility of fishery and aquaculture statistical systems in the region.

The compilation of the data for the Bulletin is constrained by the long delay in returning the questionnaires by participating countries. For this reason, the latest Bulletin published in 1997 contains data only for 1994. The participating countries were apprised that, the submission of incomplete data and incompatible methodology reduces the usefulness of these information. In a related development, SEAFDEC took note of the need to improve the compilation of data for the Bulletin by unifying the source of data in order to avoid conflicting figures, a situation experienced when some participating countries have more than one agencies compiling and submitting fishery statistics to SEAFDEC for the Bulletin.

SEAFDEC continues to be active in promoting the systematic compilation and dissemination of fishery and aquaculture statistics in the region. In addition to the publication of the Bulletin, the SEAFDEC Department in Malaysia is responsible for the collection of tuna statistics, specifically for tuna and tuna-like species such as tunas and bonitos, seerfishes and billfishes, and also catch-effort statistics, in the Southeast Asian region. The Department in Thailand also compiles socio-economic statistics which will be intensified in future. The Department in Singapore shall also be tasked to compile data on fish processing, while the Department in the Philippines shall facilitate the implementation of the Supplement on Aquaculture to the World Census of Agriculture Programme for 2000.

**SEAFDEC FISHERY STATISTICAL BULLETIN FOR
THE SOUTH CHINA SEA AREA**

by

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1. INTRODUCTION

At the regional level, the Southeast Asian Fisheries Development Center (SEAFDEC) has initiated a fishery statistical program as early as 1976. The Fishery Statistical Bulletin for the South China Sea Area is being published annually by SEAFDEC since 1978 starting with the statistics for 1976. The Bulletin is aimed at providing reliable and comparable fishery statistics with standardized definitions and classifications to facilitate the exchange of information for the management of fishery resources and the planning of various fishery development programs for countries bordering the South China Sea. It has been recognized as a valuable source of reference on fishery statistics in the region and is well-accepted by all organizations and agencies as well as personnel concerned with the management and development of fisheries in Southeast Asia.

2. DEVELOPMENT OF SEAFDEC FISHERY STATISTICS PROGRAM

During the first SEAFDEC Technical Workshop on Fishery Statistics, convened in 1976, SEAFDEC agreed to arrange a working party comprising international experts and national statisticians to finalize the content and format of the proposed Fishery Statistical Bulletin for the South China Sea Area.

Thus, the Second Technical Workshop on Fishery Statistics was convened in 1977 in order to: establish a clear definition for every statistical item based on FAO definitions, if available; review the proposed statistical tables and to layout the exact format of each table; examine and finalize classifications to be used for the Bulletin and to establish a clear definition of each statistical category; and work out questionnaires by which data required for each table are to be reported by the national fishery offices.

Then the Third Technical Workshop on Fishery Statistics was convened in 1978 in order to: review the first issue of the Bulletin with a view of improving its contents for the subsequent issues; and exchange views and experiences on national fishery statistics with particular reference to the collection of statistics on small-scale fishery.

In 1979, the Fourth Technical Workshop on Fishery Statistics was convened in order to review the second issue of the Bulletin with a view of improving its contents for the subsequent issues, and to exchange views and experiences among national fishery statisticians and researchers as well as stock assessment specialists, on matters with particular reference to fishing effort statistics.

The Fifth Workshop convened in 1980, discussed among others, stock assessment and relevant statistics particularly catch-effort data. The results of the Workshop were further discussed during the Seminar on Stock Assessment of Pelagic Resources with Emphasis on Shared Stocks which was held in 1981. The Seminar, which aimed to improve the existing method for stock assessment of the pelagic fisheries in the region also recognized the usefulness of compiling catch and effort data in relation to stock assessment of the fishery resources for the area.

In 1986, the Sixth Regional Workshop on Fishery Statistics was convened to: discuss the requirements for fishery statistics of fishery administrators and researchers in each participating country; review current practices on the collection and compilation of fishery statistics in each participating country and exchange experience in improving the fishery statistics; review the contents of the Bulletin and suggest improvements for the convenience of various users; and discuss constraints in improving fishery statistics in the region.

The Seventh Regional Workshop on Fishery Statistics was organized in 1989. The workshop aimed to: examine the methods by which statistics are collected in participating countries, their coverage and reliability; consider means to encourage the cooperation between statistical collecting agencies, e.g., SEAFDEC and FAO and to examine the possibility of a joint approach with national authorities for data collection; and review special problems in the collection and classification of data.

Thus, for the period from 1976 to 1989, seven regional workshops were organized from which a positive outcome was the Annual Fishery Statistical Bulletin for the South China Sea Area, published by SEAFDEC. In summary, the development of statistics program in the region tackled in the workshops discussed the following:

- a) standard classifications and definitions of fishery statistics for every statistical item based on FAO definitions, if available;
- b) the standard units of measurement used in the Bulletin;
- c) the standard symbols and abbreviations used throughout the tables in the Bulletin;
- d) the aggregated summary of fishery production into sub-sector of marine fishery, inland fishery and aquaculture;
- e) the classification of fishing establishments by type of management;
- f) the aggregated aquaculture production statistics into sub-sector of mariculture, brackishwater culture and freshwater culture by type of culture;
- g) the classification of disposition of catch which should follow FAO's classification for the three sub-sectors;
- h) the revised and modified classification;
- i) the adopted classification of fishing boat;
- j) the adopted standard classification of fishing gears;
- k) the retention of statistics on export and import in terms of countries of destination and origin only for the top ten most valuable fishery commodities;
- l) the provision of statistics on marine fishery by sub-areas;
- m) the inclusion of a comparative data on general demographic, geographic and economic conditions of the countries concerned;
- n) the inclusion of statistics on price of fresh fish and summary statistics by type of fishing gears;
- o) the revised statistics on export by countries of destination and import by countries of origin;

- p) the inclusion of a brief diagrammatic presentation and analysis of the major statistics;
- q) the inclusion of catch-effort statistics in the Bulletin;
- r) the revision of the current practices for the collection and compilation of fishery statistics in each participating country;
- s) the amended standard classification for fishing gear in the region;
- t) the revision of the standard classification of fish species;
- u) the revised species classification for small tuna;
- v) the accepted definition of aquaculture and fish propagation;
- w) the agreement to publish the catch-effort statistics for the South China Sea Area separately from the Bulletin; and
- x) the revision of the standard classifications of fishing gear and species in order to meet the current situation of fisheries in the region.

Other issues tackled during the series of workshops also included the following:

- a) the need to establish an appropriate classification for aquaculture;
- b) the revised definition of fisheries and aquaculture and development of statistical tables suitable for comparative analysis of productivity among the countries concerned;
- c) the examination of the methods by analysis of productivity among the countries concerned;
- d) the examination of the methods by which statistics are collected in participating countries, their coverage and reliability;
- e) the adoption of the geographical basis for reporting of data as proposed by FAO, i.e., the boundaries of fishing areas 57 and 71 with several minor modifications; and
- f) the revision of the classification of marine species and the modification of the SEAFDEC codification of species in line with the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP).

Nevertheless, there existed a growing demand to improve the content of the Bulletin in order to meet the requirements of fishery administrators and researchers in the region.

3. THE 1994 REGIONAL WORKSHOP ON FISHERY INFORMATION AND STATISTICS IN ASIA

The Regional Workshop on Fishery Information and Statistics in Asia was convened in 1994, in collaboration with the ASEAN-EEC Aquaculture Development and Coordination Programme (AADCP), the Asia and Pacific Commission on Agricultural Statistics (APCAS), the Bay of Bengal Programme (BOBP), the FAO Fisheries Department, the FAO Regional Office for Asia and the Pacific (FAO/RAPA), the Mekong Committee, the Network of Aquaculture Centres in Asia-Pacific (NACA), and the Strategy for International Fisheries Research (SIFR). The Workshop aimed to:

- a) review the current status of fishery information and statistics programs and services available to users in Asia;
- b) discuss the requirements for improvements of the collection, compilation and dissemination of fishery and aquaculture statistics information in the region; and

- c) recommend ways and means for international cooperation and coordination in supporting and supplementing national efforts in information dissemination and exchanges.

A suggestion was presented to this Workshop by the SEAFDEC/Marine Fisheries Research Department (SEAFDEC/MFRD), to amend the classification of fishery commodities in the Statistical Bulletin. The amendment was based on the results of a survey on fish products in Southeast Asia which SEAFDEC/MFRD conducted in 1985 and 1989. Specifically, the suggested amendments were as follows:

- a) Product categories should include "powdered/flaked" as this is now produced in Thailand as prawn dust and in Malaysia as fish floss;
- b) Under Fish Processing, Dried/salted/smoked category should be changed to "Dried/smoked" since salting is a necessary part in processing; and
- c) Listing of fish products in the Sections on Disposition of Fish and Fish Processing should include "Cured and Comminuted Products," and that Comminuted should be reclassified into "Surimi and other Comminuted Products."

SEAFDEC/MFRD further proposed that the definition of items listed under "Miscellaneous Category" be clarified, as cultured aquarium plants and seaweeds are utilized differently. Seaweeds, for example is important commercially for human food. Brown algae, on the other hand, is used either as human food, animal feed or as fertilizer. Specifically, it was also suggested that data on red seaweeds of Southeast Asia be recorded in a separate column to give emphasis on this products which is gaining popularity in the region.

The Workshop discussed the actions required to improve the collection and compilation of fishery statistics in Asia, based on the problems and constraints identified by the participating countries. Recommendations were brought up for the national as well as for the regional and international levels. At the regional and international levels, the recommendations were as follows:

- a) FAO in cooperation with SEAFDEC should work on the standardization of the classification used for collating fishery products, production and fish trade statistics for the region;
- b) In order to fully utilize the potentials of computerization, the current wide diversity of computer hardware and software used by the national agencies should be made compatible;
- c) Compatible standard procedures and formats should be developed for reporting fishery statistical data at regional level using electronic and magnetic media. FAO/RAPA should organize such a work in cooperation with SEAFDEC; and
- d) Participating countries should strive to submit complete and accurate data, and to make use of the database package developed by FAO and SEAFDEC for faster reporting of data.

Specifically for the Fishery Statistical Bulletin for the South China Sea Area, the classification of fishery commodities on disposition of catch, fish processing, and exports by fishing commodity should be revised as proposed by SEAFDEC/MFRD.

As follow-up to the recommendations of the 1994 Regional Workshop on Fishery Information and Statistics in Asia, the implementation for the SEAFDEC Fishery Statistics Program had already been carried out to some extent. The Fishery Statistical Bulletin for the South China Sea Area was revised taking into consideration the new classification of fishery commodities on disposition of catch, fish processing and exports by fishing commodity following the proposal by SEAFDEC/MFRD.

4. DATA COLLECTION AND COMPILATION

Data for the Bulletin are collected using a set of questionnaires. Together with the notes for their completion, the questionnaires are sent to the participating countries at the beginning of each year with the exception of Cambodia. For Indonesia, two separate questionnaires are sent to the Directorate General of Fisheries and to the Central Bureau of Statistics.

The completed questionnaires are returned to SEAFDEC by the participating countries. The data received from each country are checked against the entries in a country's yearbook, i.e., the Fishery Statistical Yearbook as in the case of Indonesia and Taiwan, if available. The data are then ~~compiled~~ and processed by SEAFDEC using Microsoft EXCEL software. Since the compilation of data has not yet been possible for Vietnam and Cambodia, the statistics on their annual fishery production are obtained from the FAO Yearbook of Fishery Statistics.

5. PROBLEMS, CONSTRAINTS, AND RECOMMENDATIONS

The major problem in the publication of the Bulletin is the timing and the long delay in returning the questionnaires causing much reduced value of the statistics to the users. Other problems included submission of incomplete and incorrect information.

In order to expedite the publication of the Bulletin, statisticians from the participating countries are encouraged to submit data to SEAFDEC within the indicated submission period, i.e., not later than July of each year. Another way to solve this problem is to fully utilize the potentials of computerization. However, this would need harmonization of the current wide diversity of computer hardware and software used by the national agencies which should be made compatible. Moreover, compatible standard procedures and formats should be developed for reporting fishery statistical data at regional level using electronic and magnetic media through the cooperation of FAO and SEAFDEC.

Also, the staff responsible for compiling the questionnaires should check carefully all data before these are submitted to SEAFDEC. Furthermore, national agencies responsible for fishery statistics in each country should accomplish all items in the questionnaires with the available data. In addition, the latest issues of the respective country's National Yearbook of Fishery Statistics, if available, should be provided as early as possible to SEAFDEC, in order to facilitate compilation and counter-checking of the data.

CATCH AND EFFORT STATISTICS

Catch statistics, derived from marine and inland capture fisheries, have been collected by most countries in Southeast Asia. However, some countries encountering financial constraints, have stopped compiling data on catch value or ceased to publish catch data by fishing gear. The catch and effort statistics therefore, from the region have been incomplete. It was for this reason that many international initiatives implied the collection and compilation of timely and reliable statistics on catch and fishing effort for the rational management of the region's fishery resources.

The establishment of the Exclusive Economic Zones (EEZs) on the other hand, has resulted in loosing the traditional fishing grounds by some countries or the expansion by others. Some countries however, could not fully utilize the capacities of their fishing grounds because of technical and economic reasons. Thus, "joint ventures" became an important economic activity among countries concerned. An issue is now being raised regarding the compilation of catch data from fishery joint ventures, for these may have been either "not reported" or "double-counted," in some cases.

FAO noted the deteriorating quality of data compiled from artisanal fisheries compared with those from aquaculture. When countries fail to provide complete or reliable data, FAO makes the best estimates from best available information. Recently, the proportion of FAO-estimated data compared to reported data has increased, suggesting that the quality of statistical system employed by the reporting countries may not be in good state. In order to improve the management of data collection, FAO has formulated guidelines on the collection of fishery data for artisanal fisheries.

FAO also encouraged the improvement of the compilation of data on fish by-catch as well as the discarded component of the catch, to be collected nationally for individual fisheries. This includes compilation of data on shark by-catch, which is an offshoot of the Convention on International Trade in Endangered Species (CITES).

**REVIEW AND THE PRESENT STATUS OF
THE CATCH-EFFORT STATISTIC FOR
THE SOUTH CHINA SEA AREA**

by

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1. INTRODUCTION

The responsibility to publish the Catch-Effort Statistics was transferred to Marine Fishery Resources Development and Management Department (MFRDMD) of SEAFDEC during the Sixteenth Meeting of the SEAFDEC Program Committee in 1993. That time, the Committee felt that it was very appropriate for MFRDMD to collect the catch and effort data on the grounds of scientific work and research. Prior to the transfer of responsibility, the publication of catch-effort statistics had been undertaken by the Training Department (TD) of SEAFDEC since 1981. In order to carry out the new task, MFRDMD revised the previous format used by TD for the collection and compilation of the Catch-Effort Statistics for the South China Sea Area. After discussion with the SEAFDEC Secretariat and Training Department of SEAFDEC, MFRDMD presented the revised format for consideration during the 1994 Regional Workshop on Fishery Information and Statistics in Asia in.

2. DATA COLLECTION, COMPILATION AND PUBLICATION

The main objective of the compilation and publication of Catch-Effort Statistics for the South China Sea Area is to provide available statistical information to scientists in the region.

A set of "Questionnaire and Notes on Completion of the Questionnaire" is sent each year to the participating countries, namely, Brunei Darussalam, Taiwan, Hong Kong, Indonesia, Cambodia, Malaysia, the Philippines, Singapore, Thailand and Vietnam for them to complete. The instruction is for the participating countries to return to MFRDMD the accomplished questionnaires for compilation and processing. The publication of Catch-Effort Statistics Bulletin for the year being considered is totally based on the returned questionnaires.

3. PRESENT STATUS

To date, the questionnaires for the year of 1992 and 1993 have already been sent to the countries concerned and some completed questionnaires have been sent back to MFRDMD. Initial results of the responses have been compiled as follows:

(1) **Catch-effort Statistics Data for 1992**

i. **Annual Catch-effort**

a) Catch and Fishing Effort by Type of Fishing Gear

Anchovy Purse Seine: *Thailand*
Thai Purse Seine: *Thailand*
Fish Purse Seine: *Malaysia*
Otter Trawl: *Malaysia and Thailand*
Pair Trawl: *Thailand*
Beam Trawl: *Thailand*
Spanish Mackerel Drift Gill Net: *Thailand*
Mackerel encircling Gill Net: *Thailand*
Bamboo Stake Trap: *Thailand*
Engine Boat Push Net: *Thailand*

b) Catch and Fishing Effort by Type of Fishing Gear and Size of Management

Fish Purse Seine: *Malaysia*
Otter Trawl: *Malaysia and Thailand*
Pair Trawl: *Thailand*

ii. **Monthly Catch-effort Data**

a) Catch and Fishing Effort by Type of Fishing Gear and by Month

Anchovy Purse Seine: *Thailand*
Thai Purse Seine: *Thailand*
Otter Trawl: *Thailand*
Pair Trawl: *Thailand*
Beam Trawl: *Thailand*
Spanish Mackerel Drift Gill Net: *Thailand*
Mackerel Encircling Gill Net: *Thailand*
Bamboo Stake Trap: *Thailand*
Engine Boat Push Net: *Thailand*

b) Catch and Fishing Effort by Type of Fishing Gear, by Month and by Size of Management

Otter Trawl: *Thailand*
Pair Trawl: *Thailand*

iii. **Specific Data on Catch-Effort**

Hong Kong

a) Annual Catch and Effort by Type of Fishing Gear

Purse seine, Stern Trawler, Pair Trawl, Shrimp Trawl, Gill Net and Line

iv. **Response from countries**

Brunei Darussalam - Catch-Effort data not available

Taiwan - no reply

Indonesia - no reply

Kampuchea - no reply

Philippines - Catch-Effort data not available

Singapore - Catch-Effort data not available

Viet Nam - no reply

Considering the aforementioned 1992 responses, four out of 10 participating countries did not give any response while three countries mentioned that the catch-effort data were not available. Thailand gave the catch-effort data written in Thai characters, which brought some difficulties in translating, although MFRDMD sought the assistance from TD for translating the information before the original data were compiled. Hong Kong gave the overall landing only for 1992 following a specific format.

(2) **Catch-effort Statistics Data for 1993**

i. **Annual Catch-Effort**

a) Catch and Fishing Effort by Type of Fishing Gear

Fish Purse Seine (One Boat): *Taiwan, Brunei and Malaysia (Peninsular)*

Otter Trawl: *Taiwan, Brunei and Malaysia (Peninsular)*

Pair Trawl: *Taiwan*

Drift Gill Net: *Malaysia (Peninsular)*

Hook-and-Line: *Taiwan and Malaysia (Peninsular)*

b) Catch and Fishing Effort by Type of Fishing Gear and Size of Management

Fish Purse Seine (One Boat): *Taiwan (Unit) and Malaysia (Peninsular)*

Otter Trawl: *Taiwan (Unit) and Malaysia (Peninsular)*

Hook-and-Line: *Taiwan (Unit)*

ii. **Monthly Catch-Effort Data**

a) Catch and Fishing Effort by Type of Fishing Gear and by Month

Fish Purse Seine (One Boat): *Brunei and Taiwan* (Catch)

Otter Trawl: *Brunei and Taiwan* (Catch)

Pair Trawl: *Taiwan* (Catch)

Hook-and-Line: *Taiwan* (Catch)

iii. **Specific Data on Catch-Effort**

Indonesia

a) Annual Catch and Effort (Unit) by Type of Fishing Gear and by Area:

BED Equipped Shrimp Net, Seine Net (Payang includes Lampara), Seine Net (Danish Seine), Seine Net (Beach Seine), Purse Seine, Gill Net (Drift Gill Net), Gill Net (Encircling Gill Net), Gill Net (Shrimp Gill Net), Gill Net (Set Gill Net), Gill Net (Trammel Net), Lift Net (Boat/Raft Net), Lift Net (Bagan includes Kelong), Lift Net (Scoop Net), Lift Net (Other Lift Net), Hook-and-Line (Tuna Longline), Hook-and-Line (Drift Longline other than Tuna Longline), Hook-and-Line (Set Longline), Hook-and-Line (Skipjack Pole and Line), Hook-and-Line (Other Pole and Line), Hook-and-Line (Troll Line), Trap (Guiding Barrier), Trap (Stow Net), Trap (Portable Trap), Trap (Other Traps), Shellfish Collection. Seaweed Collection, Muro Ami included Mallugis and Others (Harpon, Cast Net, etc.)

iv. **Response from other countries**

Hong Kong - no reply

Kampuchea - no reply

Philippines - Catch-Effort data not available

Singapore - Catch-Effort data not available

Thailand - no reply

Viet Nam - no reply

For the 1993 responses, four out of 10 countries still did not give any response while two countries mentioned that the catch-effort data in their countries, were not available. Malaysia gave data of the catch-effort for Peninsular area only while Indonesia started to give the annual landing of 1993 in a specific format.

4. PUBLICATION

The Catch-Effort Statistics Bulletin for 1992 has already been published and will be distributed to respective countries as soon as possible. The next publication is for the year 1993 and SEAFDEC/MFRDMD is still waiting for the response from Thailand before the Bulletin could be printed.

The response in the questionnaires, showed that statistics and data collecting system of the participating countries is still in developing stages. The implementation of computer systems in some countries for retrieving and processing the statistical data could hopefully overcome this weakness.

SEAFDEC/MFRDMD believes that all countries will give their cooperation and provide complete information as required in the future. Based on the present format of the Catch-Effort Statistics Bulletin, which is suitable for both artisanal and industrial fisheries, SEAFDEC/MFRDMD asked participating countries to give their full cooperation for the publication of the Bulletin.

5. FUTURE TASKS

In order to improve the collection and compilation of catch and effort statistics, the following activities will be undertaken as soon as possible:

- a) SEAFDEC/MFRDMD will organize a technical group meeting among the officers who handle the collection of fishery statistics in the participating countries;
- b) SEAFDEC/MFRDMD will exert efforts to ensure the systematic compilation of Catch-Effort Statistics for the South China Sea Area which is an essential element for effective fishery policy development and management in the region, and in line with the Code of Conduct For Responsible Fisheries; and
- c) The questionnaire for the 1994 data will be sent to the participating countries immediately after this 1997 Workshop.

**QUALITY OF CAPTURE FISHERY AND
AQUACULTURE PRODUCTION STATISTICS
FOR ASIA AND THE PACIFIC**

by

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1. INTRODUCTION

Fishery statistics play an important role in the formulation of policies, sectoral development plans and fishery management, and much effort has been expended in trying to improve national fishery statistical collection and processing systems. The purpose of this paper is to review the FISHSTAT NS1 total production statistics and the FISHSTAT AQ aquaculture production statistics for the Asia and the Pacific, reported to FAO; and to comment on the quality of these statistics, to identify some of the problems and recommend possible remedies.

2. FAO FISHERY STATISTICS

The Fishery Information, Data and Statistics Unit (FIDI) of FAO collates statistics on total fish and shellfish production using the FISHSTAT NS1 questionnaire and disseminates them through the FAO Yearbook of Fishery Statistics: Catches and Landings in computerized form as FISHSTAT PC. The statistics are for total production from wild and farmed stocks in terms of weight (value data are not at present collated by FIDI) and thus include aquaculture production. For the years from 1984 onwards, these statistics have been disaggregated into capture fishery production and aquaculture components. The statistics considered here are for all aquatic organisms with the exception of mammals, crocodiles, pearls, sponges and plants. Aquaculture production statistics in terms of weight and value have been collated separately by FIDI since 1984 using the FISHSTAT AQ questionnaire and are published as FAO Fisheries Circular No. 815 which is revised annually, but are not considered further here.

In cases where data are not reported or are considered unreliable, FIDI makes estimates using the best available information which in the worst situation can be a repeated value from an earlier year. Such estimated values are identified as such with footnotes ("F" or "R") in the FAO publications. Thus, the proportion of the total production which is accounted for by estimated data provides a general indicator of the quality of the statistical data compiled by national agencies. It must be stressed that this is not a definitive measure of the quality of the statistics (undoubtedly some reported statistics which are adopted by FIDI are erroneous), but it is one useful indicator of the general quality of the data, at least in terms of the completeness of reporting.

Figures 1-4 show the trends in Asia and the Pacific inland and marine production from capture fisheries and aquaculture since 1984, with the components based on the reported data and estimated data identified. For example in 1995, out of a total marine capture fishery production of 39.4 mt, estimated catches accounted for 2.9 million mt, or about 8% of the total (Figure 1). Whereas for marine capture fishery statistics, the proportion based on estimates has increased somewhat since 1984, for inland capture fisheries (Figure 2), the estimated component has more than doubled, indicating a marked deterioration. In contrast, aquaculture statistics have not been deteriorating (Figures 3 and 4). Tables 1-4 show the main countries for which production statistics are estimated and these are the Democratic People's Republic of Korea, Vietnam, China, Taiwan and Myanmar for capture fisheries. The main species for which data are estimated for capture fisheries are grouped categories such as marine fishes *nei* and freshwater fishers *nei*, as well as skipjack and yellowfin tunas (Tables 5 and 6).

A major problem for the Asian region is the very high proportion of production which is reported as grouped species items. Whereas for aquaculture, most production is reported for individual species (Figures 7 and 8), this is far from the case for capture fishery production. Only 48% of marine capture production in 1995 was described in terms of individual species compared to 59% in 1984 (Figure 5). For inland capture fisheries the situation is appalling, with virtually no species definition available at all and over 80% of production not even defined to the family level (Figure 6).

3. ACTION REQUIRED

The Workshop was asked to comment on why the quality of capture fishery production statistics from Asia and the Pacific has deteriorated in recent years, and why the species detail for capture fisheries production is also lacking for Asia. Understanding the reasons for these problems is essential, in order to determine how the data can be improved.

Table 1. Countries for which FAO marine capture fishery production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Korea D P Rp	1,606,508	0	1,606,508
Viet Nam	649,033	118,947	767,980
China Taiwan	481,567	410,413	891,980
Myanmar	204,011	403,111	607,122
Australia	59,420	152,817	212,237
Kiribati	24,111	886	24,997
Solomon Is	15,657	34,295	49,951
Papua N Guin	12,153	0	12,153
Micronesia	4,583	10,832	15,415
Fiji	4,571	24,218	28,789
Vanuatu	2,790	0	2,790
Palau	967	479	1,446
New Caledonia	417	3,104	3,521
Marshall Is	142	96	237
Nauru	105	261	366
Pitcairn	4	2	7
Guam	3	411	414

Table 2. Countries for which FAO inland capture fishery production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Viet Nam	110,983	20,600	131,583
Korea D P Rp	99,217	0	99,217
Myanmar	47,046	97,315	144,360
Laos	16,758	3,167	19,925
Bhutan	308	0	308
Mongolia	84	37	122

Table 3. Countries for which FAO marine aquaculture production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Korea D P Rp	50,242	16,667	66,908
Viet Nam	39,517	0	39,517
China Main	5,500	2,198,129	2,203,629
Sri Lanka	1,633	555	2,188
Thailand	343	274,569	274,912
New Zealand	107	49,425	49,531
Kiribati	43	0	43
Australia	11	15,314	15,325
Solomon Is	5	2	7
Guam	4	9	14
Fiji	4	6	10
Papua N Guin	2	0	2
Myanmar	1	1	2
Philippines	1	32,710	32,711

Table 4. Countries for which FAO inland aquaculture production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Viet Nam	143,967	2,000	145,967
India	50,000	1,253,239	1,303,239
Korea D P Rp	12,833	0	12,833
Myanmar	12,411	37,250	49,661
Laos	12,200	0	12,200
Cambodia	7,578	0	7,578
Sri Lanka	3,417	0	3,417
Thailand	471	133,203	133,674
Philippines	88	350,114	350,202
Bhutan	27	5	32
Pakistan	16	13,052	13,068

Table 5. Main species items for which FAO marine capture fishery production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Marine fishes nei	2,349,989	6,578,966	8,928,955
Marine crabs nei	154,261	182,462	336,723
Skipjack tuna	116,976	1,019,846	1,136,821
Sharks, rays, skates, etc.	60,870	181,018	241,889
Yellowfin tuna	60,869	461,082	521,951
Natantian decapods nei	59,234	434,452	493,686
Albacore	46,327	84,681	131,008
Common squids	35,578	159,388	194,966

Table 6. Main species items for which FAO inland capture fishery production statistics for Asia and the Pacific are based at least partly on estimated rather than reported data

Country	Estimated	Reported	Grand Total
	Average 1990-95 - t		
Freshwater fishes nei	272,321	2,053,621	2,325,942
Cyprinids nei	1,842	39,278	41,120
Freshwater crustaceans nei	233	197,516	197,750

Figure 1: Capture fishery production in marine waters for Asia and the Pacific showing reported and estimated components

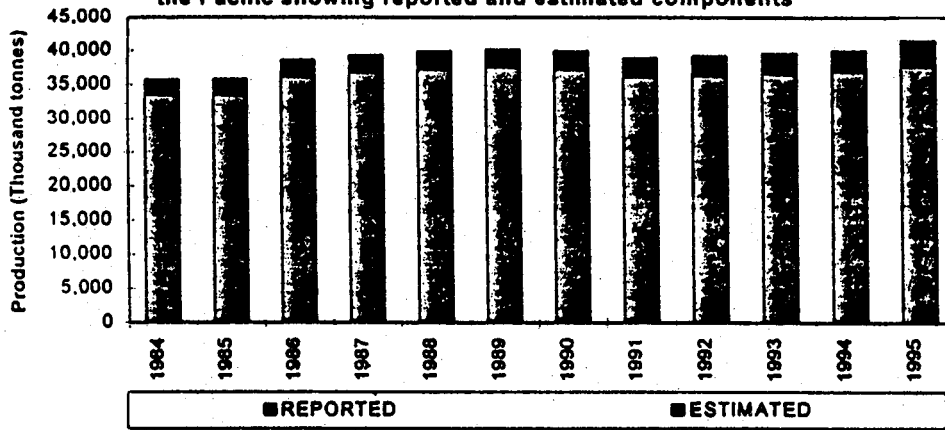


Figure 2: Capture fishery production in inland waters for Asia and the Pacific showing reported and estimated components

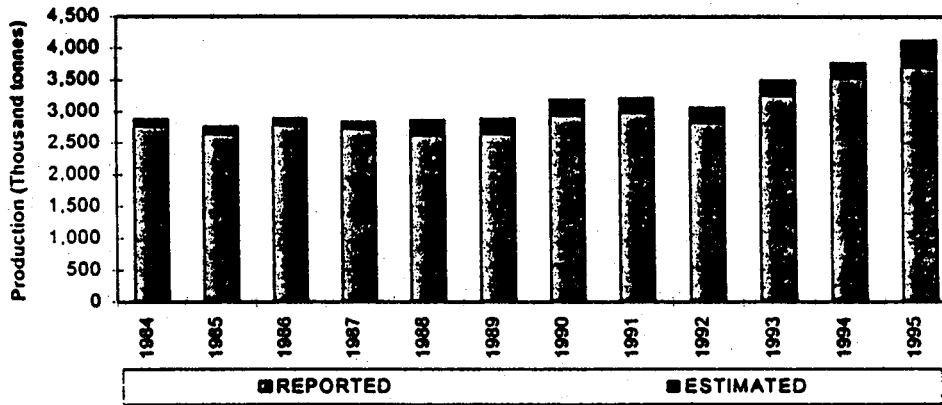


Figure 3: Aquaculture production in marine waters for Asia and the Pacific showing reported and estimated components

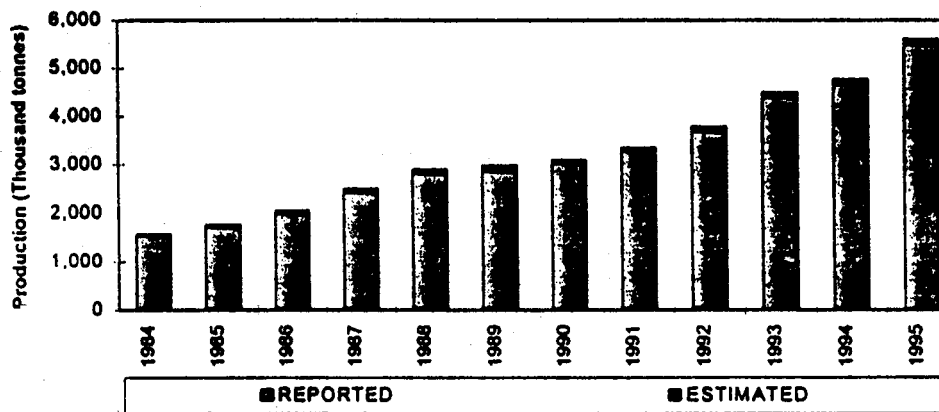


Figure 4: Aquaculture production in inland waters for Asia and the Pacific showing reported and estimated components

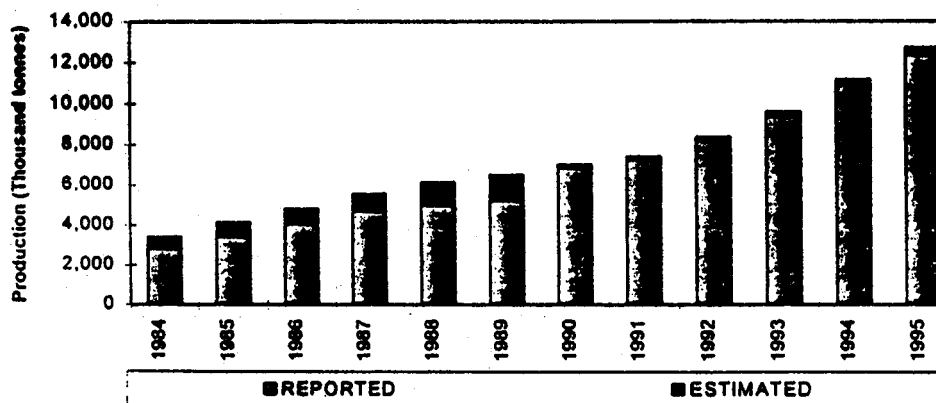


Figure 5: Capture fishery production in marine waters for Asia and the Pacific by level of taxonomic detail

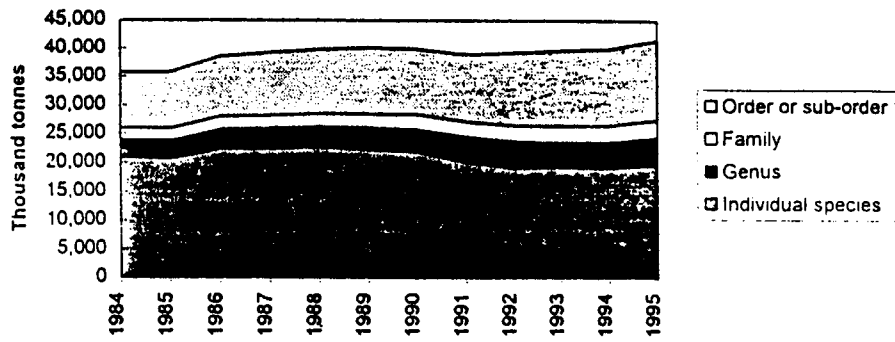


Figure 6: Capture fishery production in inland waters for Asia and the Pacific by level of taxonomic detail

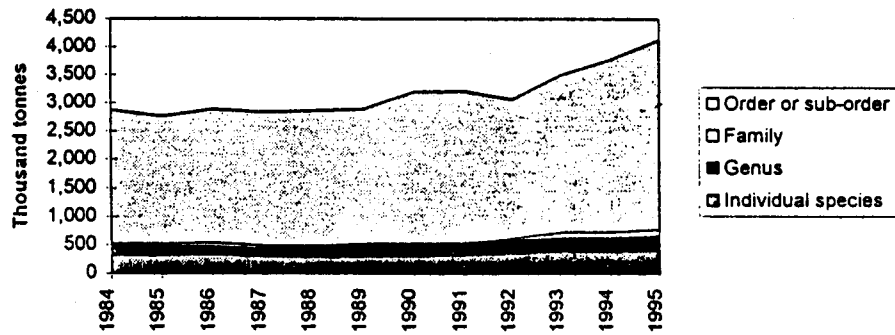


Figure 7: Aquaculture production in marine waters for Asia and the Pacific by level of taxonomic detail

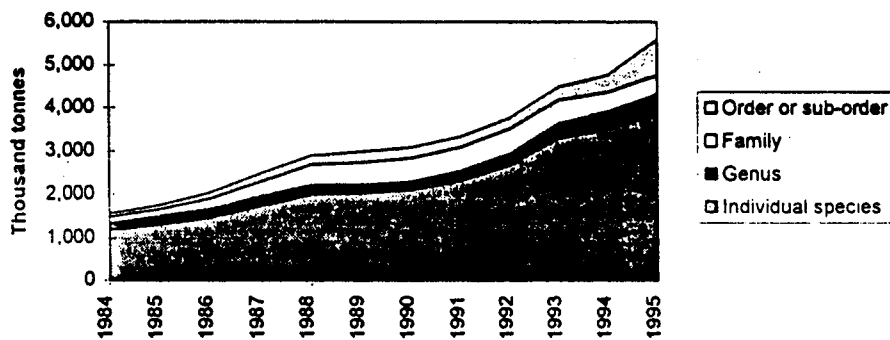
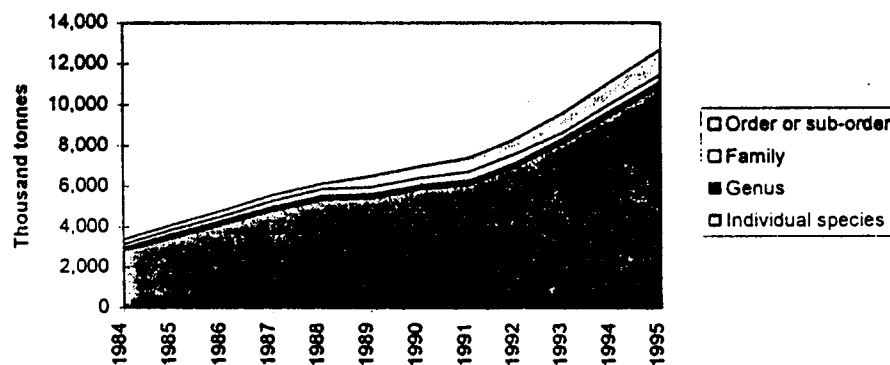


Figure 8: Aquaculture production in inland waters for Asia and the Pacific by level of taxonomic detail



NATIONALITY OF CATCH
by
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1. INTRODUCTION

In 1954 the United Nations Statistical Commission decided that fish catches should be assigned to the country of the flag flown by the fishing vessel. This concept was adopted by all member agencies of the Coordinating Working Party on Fishery Statistics (CWP) at its Ninth Session. The concept is defined more precisely at the CWP's Tenth Session, as follows:

The flag of the vessel performing the essential part of the operation catching the fish, should be considered the paramount indication of the nationality assigned to the catch data and this indication overridden only when one of the following arrangements between a foreign flag vessel and the host country exists:

- a) *the vessel is chartered by the host country to augment its fishing fleet; or*
- b) *The vessel fishes for the country by joint venture contract or similar agreements (as opposed to the ad hoc practice of a vessel selling catches to a foreign vessel or landing catches at a foreign port) and the operation of such vessel is an integral part of the economy of the host country.*

When governments negotiate joint ventures or other contracts in which the vessels of one country land their catches at ports of another country or unload their catches to vessels of another country and the one of the above-mentioned criteria is applicable, the assignment of nationality to such catches and landings data should be specified in the agreement.

Although in recent years national authorities and international agencies have been experiencing difficulties in certain cases in assigning a nationality to catches, this concept still valid at present. However, it should be considered that international joint-venture arrangements in world fisheries have increased considerably, both in number and in economic importance, with a great variety of new situations in recent years and such arrangements are often a source of difficulty in assigning the nationality to the catch.

2. STATISTICS FROM JOINT VENTURES

For the purpose of this paper, the term "joint-venture" is used in its general sense, i.e. an association of two or more parties, whether private or governmental, in order to undertake a commercial project in the fishery sector and to share in the risks and profits of that project. The term covers a multitude of different arrangements.

In certain countries joint-ventures are operated through government agencies or state controlled companies. In other cases, joint-ventures are run by commercial enterprises pursuing direct economic benefits. When each of the parties holds a proportion of the capital shares, the arrangement is called an "equity joint-venture". When the relationship between the parties is governed by contractual relations, the arrangement is called "contractual joint-venture."

FAO has recently reviewed some specific situations in which difficulties in assigning a nationality existed and led to misreporting and double counting. This is the case of New Zealand, Namibia, Peru, and probably Argentina, where statistics of catches taken under joint-ventures or concession agreements between these countries and a number of countries, including Japan, Rep. of Korea, Taiwan, etc., were over-reported.

In the case of New Zealand, the problem had first been emphasized only a few years ago by anomalies in the food balance sheets constructed by FAO to estimate fish consumption. As of 1 April 1978, when the New Zealand 200 mile EEZ was declared, a number of joint-venture agreements were approved and these arrangements continue until 1 April 1983, when a "deepwater trawl policy" was introduced, allocating quotas to New Zealand-owned companies. These companies were permitted to catch their quotas using foreign chartered vessels and/or their trawlers. Squid jigging and purse seining charter agreements continued as before. In accordance with generally recommended practice, also accepted by FAO, these quantities caught by foreign fishing boats under charter arrangements have been recorded by the local authorities as New Zealand production. Some of the catches taken by these foreign vessels are landed in countries other than New Zealand, and these quantities are treated in the New Zealand statistics as exports.

Unfortunately, these same catches are, in many cases, also reported as national catches (instead of national imports) in order to avoid import duties, by the flag states of the foreign fishing vessels operating in the New Zealand waters under the joint-venture agreements. This, of course, has the effect of greatly inflating the reported catch figures in the Southwest Pacific (Area 81). This problem was however solved, in agreement with the New Zealand fishery authorities, who provided FAO with data on catches by vessels from other countries fishing in New Zealand waters under charter or license agreements, broken down by country, species, and quantity landed in New Zealand and outside New Zealand.

A similar situation pertained to Namibia, where the fishery management authorities allocated catch quotas to Namibian companies, which often enter into joint-ventures with foreign companies providing the vessels. There was some double reporting of catches (which are all landed in Namibia) which was subsequently resolved by asking Namibia to separate catches by flag of vessel.

In the case of Peru, the quantities over-reported referred exclusively to the giant squid (*Dosidicus gigas*). In April 1994, a Reorganization Plan for the rational and sustained exploitation of the giant squid was approved. This plan seeks to maximize economic benefits resulting from the harvesting of this resource, by using its high availability to cover the sector's requirements for research reorganization, planning and development. As a result of these measures, the Ministry of Fisheries has so far received money from fishing concessions, awarded through public tenders, issued to foreign flag vessels using special tackle for the harvesting of this species. These large quantities (60,998 mt in 1991, 93,852 mt in 1992, 132,586 mt in 1993 and 167,132 mt in 1994) misreported by the Peruvian fishery authorities under the Peruvian catch, were removed because they were already included under the catch of foreign flag vessels, in particular Korean, Japanese and Taiwanese vessels.

With regard to the Argentinean catch data, it will be necessary to investigate if the quantity (or part) produced by Asian jigger boats (about 100,000) under a charter regime, is also recorded in the statistics of the chartered flags of Japan, Taiwan and Rep. of Korea, fishing with 44, 13 and 11 jigger vessels, respectively.

In spite of the clear statements made at previous CWP sessions, an increasing number of instances of ambiguous or incorrect recording of the nationality of catches have been identified and this problem appears to be becoming more serious. This is closely associated with the growing incidence of joint ventures both at the national and the private company levels.

The situation is further complicated by the insistence of some countries to record joint venture catches within their own EEZs under their national catches regardless of the flag of the vessels concerned. Also by the requirement to record exchanges of quotas under the country providing the quota and not under the flag country of the vessels concerned. In the view of the CWP, this tends to distort the catch statistics and confuses the requirements for statistical and management purposes.

In accordance with the provisions of the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, it was accepted that the flag State has the responsibility of monitoring and reporting the activities of its vessels wherever they may operate. CWP accordingly reaffirmed its belief that the flag of the vessel catching the fish should be the overriding factor in deciding the nationality of the catch. Only in very clear circumstances, for example when a vessel is operating under documented charter by the country concerned, should the catch be recorded under the nationality of that country.

3. RECOMMENDATIONS

The CWP at its Seventeenth Session (Hobart, Australia, 3-7 March 1997) again reviewed its nationality definition in the light of recent difficulties such as those outlined above. The CWP, recognizing that its definition of nationality of catch may give a false impression, suggested that reporting by States other than the flag State is always an acceptable alternative to reporting by the flag State. The CWP stressed that reporting by the flag State of the vessel concerned is always the preferred option.

The CWP therefore affirmed that, in conformity with the UN Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, the responsibility of reporting catches lies with the flag nation. Thus:

- a) The CWP recommended that the label (country) under which catches are reported may be designated by agreement. The flag country of the vessels making the catch should always take precedence.
- b) To facilitate reporting by the flag State, the CWP strongly encouraged the establishment of reporting arrangements between the countries whose vessels catch the fish and those in whose waters the catches were taken. It was recognized, however, that this presents severe problems for some countries where distant water catches may not be reported to the flag State of the vessels concerned.
- c) In such cases as in (b) above, the nations reporting the catches should report catches by vessels of different flag States separately in order to facilitate the detection of double counting or non-reporting.

4. SUGGESTED ACTION

The Workshop was invited to consider whether the procedure for assigning nationality to catch as recommended in this paper, is readily applicable in Asia and the Pacific. They were also asked to identify particular problems which could be anticipated on the implementation of the recommendations.

GUIDELINES FOR THE COLLECTION OF FISHERY DATA FOR ARTISANAL FISHERIES

by

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1. INTRODUCTION

While the statistical monitoring of fisheries is one of the essential elements for effective fishery policy and management, it is also recognized that data collection methods and data management approaches ought to be cost-effective, realistic and within the manpower, financial and operational capacity of the fishery administration. This means that the methodological and statistical merits of a data collection approach constitute only part of the criteria to be used for its implementation, while equal emphasis should be placed on operational robustness, flexibility in handling changes in the industry, and replacement, to the maximum extent possible, of routine manual operations by automated procedures.

There is a clear distinction between data collection methods for industrial and artisanal fisheries. In the industrial sector, data on catches and landings as well as detailed information on fishing operations, are usually compiled by the operators themselves, through a system of logbooks and/or landings declaration documents, or are recorded by national employees/observers on board fishing vessels when an observer program is in place. Thus, in general, data on industrial fisheries are collected by means of complete enumeration techniques using the fishing vessel as the primary statistical unit. Compilation and submission of such data is often regularized by making the data availability and/or its submission a conditional element in the licensing process.

In the case of artisanal fisheries complete enumeration of landings and fishing effort is not operationally achievable. This results from the fact that, in general, landings are not concentrated on main ports but are dispersed along the coastline, thus requiring a great number of highly mobile data collectors for a complete statistical coverage of all landings and on a daily basis. In theory, such a census approach should result in very accurate results, but its implications in human resources and logistical costs would defeat its utility and purpose, especially if estimates of measured and accepted accuracy, can be obtained by means of alternative and far cheaper sample-based data collection schemes.

This note provides an overview of the basic methodological and operational concepts of the statistical monitoring of artisanal fisheries, with specific reference to shore-based sampling surveys. It describes common characteristics of data collection methods, discusses standard procedures for the derivation of estimates from sample magnitudes, and briefly outlines commonly used approaches for the storage/processing of collected basic data.

2. DATA COLLECTION METHODS FOR ARTISANAL FISHERIES

Major aspects: The space and time context. The boat/gear context. Basic catch/effort relationship. Estimation of total catch through three sampling surveys and a census. Combining the information obtained from the surveys.

The space and time context

In most cases, monitoring of artisanal fisheries has as its target the derivation of estimates of total landings, species composition, and fishing effort by boat and gear type, during the period of a calendar month. Since total statistical coverage in space and time is not achievable, data collection is limited to a representative number of landing sites and takes place on pre-selected sampling days. Due to the usually wide variation in fishing patterns, fishing grounds, type of fishing craft and fishing methods, and other factors affecting catch rates and species composition, sampling and estimating approaches, are performed within the context of a limited geographical area, commonly referred to as "minor stratum". The definition of minor strata allows for more homogeneity in the target population of landings and fishing activities, since it is based on methodological and operational criteria and is independent of other types of geographical partitioning that may be in place for administrative purposes. Thus, in general, the time frame of a sample-based system is a calendar month, and the lowest geographical level at which estimates are computed is the minor stratum.

The boat/gear context

It is generally accepted that different types of fishing craft, fishing gear and fishing method result in different catch rates and species composition. As a result of that, basic approaches in sampling and estimating are each applied within the context of a specific boat/gear type, or of a group of boats/gear for which it has been verified that no statistically significant differences should be expected.

The basic catch/effort relationship

The underlying principle in estimating total catch for a specific boat/gear type, is that the actual total catch can be expressed as the Catch Per Unit of Effort (CPUE) multiplied by the actual total effort exerted by this boat/gear. It is thus assumed that if reliable estimates for the CPUE and the total effort are available, the same relationship can be used for estimating total catch by each boat/gear type. The question then arises as to what types of sampling schemes should apply in order for the CPUE and fishing effort to be estimated in a statistically reliable and, at the same time, cost-effective manner.

Estimation of total catch requires three sampling surveys and a census

For the estimation of CPUE from samples, one sampling survey is required, by means of which a limited number of landings will be recorded by the data collectors during pre-selected sampling days and used for:

- a) formulation of species proportions with respect to the total catch; and
- b) formulation of a sample overall CPUE by dividing the total catch by the associated fishing effort.

This approach, also referred to as “landings or CPUE survey” involves sampling in space (a limited number of landing sites will be visited), and sampling in time (landing sites will be visited on pre-selected sampling days).

As regards the estimation of total effort, this constitutes a more complex task requiring the parallel implementation of two sampling surveys and the availability of accurate data on the total number of boats and gear operating in the areas covered by the statistical system. The first sampling survey for effort aims at establishing average boat and gear activity ratios for each boat/gear type, that is finding the proportion of fishing units that have been fishing during a sampling day. This approach is referred to as “boat/gear activity survey” and involves sampling in space and time, in a manner similar to that for the CPUE.

The second sample survey is used for the compilation of days related to the average number of days that fishing units of a specific boat/gear type would be active during the month. Active days may vary for different boat/gear types and for different minor strata. This information is usually based on empirical data supplied by the data collectors.

The third survey, commonly referred to as “frame survey”, is usually conducted every year in order to set-up total numbers of boats and gear that are operational in the geographical area covered by the statistical program. Frame surveys are based on a census approach, by visiting all landing sites and recording the total number of operational boats and gear for each boat and gear type.

Combining the information obtained from the surveys

The two sample-based surveys for effort (boat/gear activity and active days surveys), combined with data from the frame survey, provide the necessary parameters for estimating total effort by each boat/gear type. By multiplying the boat/gear activity ratio by the total number of boats/gear, the indication of the total number of fishing units that are expected to be fishing on any given day can be obtained. This indicator is then multiplied by the number of active days in order to determine the total fishing effort during the month. The estimated total catch is then expressed as the product of the estimated total effort and the overall CPUE formulated by means of the sample-based survey for CPUEs. Species composition is subsequently derived by using the estimated total catch and the sample species proportions established by the CPUE survey.

Experience has shown that sample CPUEs are rather robust magnitudes if formulated by means of few but well-selected representative landing sites, and that most of the difficulties and problems in sampling surveys for artisanal fisheries are associated with the estimation of total fishing effort. Furthermore, it has also been observed that sample CPUEs require the availability of few but well-trained and experienced staff, especially in what concerns species identification, quick and effective assessment of the weight of landings, and unambiguous indication of the fishing effort exerted by each boat/gear type involved in the sampling exercise. On the other hand, due to higher variation, samples on boat/gear activity would require the involvement of more numerous and even less qualified staff, in order to cover as many landing sites and as many sampling days, as possible.

3. STATISTICAL MONITORING OF ARTISANAL FISHERIES

Major aspects: Government expenditure. Design phase. Implementation of a prototype system. Evaluation/revision. Progressive expansion of a survey programme. Decentralization of office operations. Basic infrastructure.

Government expenditure

Any agency would require some government expenditure for its administration and to carry out the relevant research and information-gathering functions. Thus, for example, if it is appropriate for overall fishery administration expenditures not to exceed a certain proportion of the annual value for a fully developed fishery, then the expenditure of one function, data collection for example, should be a fraction of this figure. No attempt will be made here to generalize on the appropriate level of expenditure for a fishery statistical programme but, in view of the rather general situation of shortages in staff and financial resources, it would seem that the current policy of national fishery administrations is to seek cost-effective data collection approaches that would fit into their staff and financial capacity and which do not require major upgrades of the existing infrastructure. Recognizing, however, that the results would be as accurate as the effort expended to develop and maintain a national fishery statistical programme. Thus, the first thing to do is to identify on one hand, the types of data needed as well as the priorities and procedures for the collection of the spectrum of characteristics required, and on the other hand, determine the budget and manpower available for the design and implementation of the data collection system.

Design phase

Frame Survey

A complete census of the main units (landing sites, boats, gear, fishermen, access routes), is essential for establishing the operational and methodological framework of a sample-based data collection scheme. The result of a frame survey is a set of tables indicating:

- a) Existing landing sites;
- b) Number of fishing units and information on their components, such as fishermen, and number and type of fishing craft and gear;
- c) Fishing and landing patterns; and
- d) Access routes to landing sites.

For the collection of the above information, the most common approach is by road or water, and if possible supplemented by low-cost remote sensing techniques (such as aerial surveys). The pattern of rotation of a frame survey, i.e. how often the survey should be conducted, is a function of temporal changes in the size, distribution, and operational patterns of the target fishing population. For artisanal fisheries, it is usually necessary to carry out a frame survey once every one or two years. From the staff requirement viewpoint, frame surveys may mobilize part-time data recorders who need not be regular fishery staff.

Experience has shown that data from frame surveys are, at times, one of the weakest elements in a sampling program, since they are used as extrapolating factors in order to derive general conclusions about the total fishing effort (and at much larger scale) from a rather limited number of sample-based fishing effort parameters. This problem stems from the following two main factors:

- a) Even when the frame survey data are fully updated and accurate, sampling fishing effort from a limited number of landing sites may not be representative of the overall fishing patterns (such as frequency and duration of trips, number of gear used during fishing, etc.), thus introducing positive or negative bias in the estimation process for total fishing effort;
- b) Frame survey data are "static", that is they are only a snapshot of the operating fishing units during a limited period of time. This situation is assumed to remain more or less constant while the sampling surveys for effort are conducted, and this assumption may lead to inaccurate results if significant changes have occurred to the number and location of the artisanal fishing units. However, under certain conditions related to the scheduling of sample-based effort surveys, the validity of frame survey data depends on the relative rather than actual numbers of fishing units which means that they are still adequate if increases or decreases to the number of fishing craft and gear have occurred in a more or less proportional fashion.

Survey standards and classifications

The results of the frame survey, supplemented by species identification guidelines and a species list, should be organized into a set of tables containing the following information:

- a) A table of major strata for reporting purposes;
- b) For each major stratum a table of associated minor strata. All sampling schemes and estimation procedures will each apply within the context of a minor stratum;
- c) For each minor stratum a table of landing sites that may be used as primary sampling points, including also the number of fishing craft and gear by boat/gear type;
- d) A table of species that will be used for species composition during the CPUE sampling survey;
- e) A table of all boat and gear types; and
- f) For each minor stratum a table indicating all boat/gear types in the stratum and preliminary estimates as to the expected active days. This table will be due to changes at the end of each survey month in order to include information not known in advance (such as periods of no fishing because of bad weather).

Tables (a) and (f) constitute the statistical standards that are assumed to remain in force during the reference period of a survey (usually a calendar month).

The design of a survey programme takes into consideration methodological, operational and logistical aspects. From the methodological viewpoint, a data collection scheme utilizes the standard approach of conducting three parallel sample-based surveys (CPUE survey, boat/gear activity survey, active days survey), supplemented with a census (frame survey). The computational procedures for formulating sample magnitudes and calculating total estimates should be independent of the specific sampling scenarios used during the survey operations. They also incorporate a full set of statistical indicators related to sample sizes, variation in space and time and confidence limits for all produced estimates, so as to facilitate the identification of problem areas and provide guidance for revisions and improvement.

Survey operations are scheduled by determining the primary sampling units (landing sites) as the target locations to be visited by the data recorders for data on CPUEs and boat/gear activities. The sampling days during which data collection will be carried out, are also pre-selected. This process should take into consideration the number of recorders available as well as the space and time constraints for their movements (such as distances, accessibility, and time and duration of visits). Logistical aspects involve arrangements for the transport of data collectors and supervisors, equipment to be used in the field by the recorders, cash for fuel, meals and lodging, and in general, planning and supporting of the field operations.

Implementation of a prototype system

Experience has shown that during the survey design phase some types of methodological, operational and logistical shortcomings cannot be fully anticipated and they become evident only after a survey programme has entered into its operation. Given the usually large-scale space and time framework of a fully operational statistical system, the number of staff involved, the substantial investment in training and equipment, and the regular operational and logistical costs, it is considered a good practice to first field-test a survey within a limited geographical area, comprising perhaps of one or two minor strata, and for a test period for one to two months. This prototype system will allow early revision of the system components presenting problems and help the staff involved to acquire the necessary experience in the field and office operations.

Evaluation/revision

The results of the prototype system must be critically analyzed and evaluated. Likely problem areas that may arise are:

- a) **Frame survey:** Lack of guidelines for boat/gear identification. Poorly designed data collection forms. Insufficient number of recorders. Insufficient training of staff. Inadequate approach in interviewing fishermen. Inappropriate period for conducting the census.

- b) CPUE survey: Lack of guidelines for species and boat/gear identification. Poorly designed landings forms. Insufficient training of staff. Inadequate approach in interviewing fishermen. Non-representative landing sites (systematic gaps in the recording of certain boat/gear types). High variation in CPUE due to inappropriate grouping of boats/gear. Wrong timing of visits (most of boats not landed or landed and mostly no longer attended).
- c) Boat/gear activity survey: Lack of guidelines for boat/gear identification. Poorly designed boat/gear activity forms. Insufficient training of staff. Gross inconsistencies between expected numbers of boats/gear (from frame survey) and those observed by the data collectors. Non-representative landing sites (systematic gaps in the recording of certain boat/gear types). High variation in boat/gear activities due to inappropriate grouping of boats/gear.
- d) Active days survey: No differentiation between different types of boats/gear. Non representative active days. Omission of some key events that have caused no fishing.
- e) Computerization: There should be no software problems if the computer procedures are part of a standard application adaptable to most types of sample-based surveys. Problems may be associated with operational aspects, as for instance bottlenecks in the inputting of primary data or insufficient training of computer operators for handling the various functions of the computer system.

Computerization will assist in the quick analysis of sample sizes and variations in space and time. The combination of these indicators may lead to same tactical decisions related to:

- a) More sampling in space and less in time (or the reverse);
- b) Reduction of sample size (thus saving on costs) if an expected level of accuracy can be obtained with fewer samples (the computer could be used to simulate a less intensive data collection scheme using existing data); and
- c) Impact in accuracy by grouping together certain boat/gear types in order to simplify data collection and computation of estimates.

Lessons learned during the prototype phase will greatly assist in the implementation of the survey program on a larger scale. That is, when the system will be expanded in a progressive manner to cover other geographical areas.

Progressive expansion of a survey program

Expansion of a prototype survey program is not merely a matter of increasing its geographical and time reference scope. It mainly involves an in-depth study of the population characteristics of the new areas to be statistically monitored and, almost invariably, leads to sampling schemes and data collection scenarios that are not essentially the same as those in force for other areas.

For instance, for certain minor strata, it may be feasible to collect effort data by means of a census in space and sampling in time, an approach that could not be applicable in other strata. Or, it may be essential for certain strata to use different species and boat/gear classifications that have little in common with other sectors of the artisanal fisheries. In general, however, different classification schemes and tactical changes to the data collection approach should not have any impact on the standard methodology used in the estimation process, nor should they affect the general-purpose computer systems used throughout the entire geographical area.

Decentralization of office operations

Experience has shown that computer operations with primary data (inputting, editing, error-checking), as well as estimating the total catch and effort at minor stratum level, are more effective if performed closest to the minor strata where field operations are taking place. Such decentralized office operations require some higher investment in computing units and computer training, but offer the following advantages:

- a) Inputting effort is more evenly distributed, thus avoiding bottlenecks in the computer operations;
- b) Error-checking and data revisions are performed in a more timely manner and are more effective, since they involve staff with local knowledge and experience in the artisanal fisheries sector under their responsibility;
- c) Basic reports on estimated catch and effort are directly available to local users for their own regional needs; and
- d) Headquarters need only obtain pre-processed computer files with estimated catch and effort, which can be easily integrated at various aggregation levels, thus speeding up the process of preparing reports and documents at national level.

Basic Infrastructure

The design and implementation of a statistical monitoring system with integrated data collection and computer procedures, requires some extent of re-organization of the human resources available in order to better handle a wide variety of field and office operations. A general-scheme of such an infrastructure is given below:

Regional Focal Points (RFPs)

Responsible for data collection and basic computer operations within an administrative region, comprising several major and minor strata, the staff of RFPs consist of data collectors, supervisors, computer operators and a fishery officer whose overall responsibility is this survey component. RFPs use statistical standards and stratification schemes determined by the HQ offices and which are used within the same methodological and operational context throughout the entire survey program.

Primary data are stored locally in computer files. Files with estimates are regularly submitted to the HQ offices for integration with similar data sets produced by the other regions.

Headquarters (HQs)

Usually, the staff of the HQs are also the RFPs responsible for a specific survey component. In addition, the HQ Offices are responsible for:

- a) Distributing computer software to RFPs;
- b) Setting-up statistical standards and stratification schemes;
- c) Organizing training courses and workshops for participants from the various regions;
- d) Coordinating the exchange of data between RFPs and HQ;
- e) Provide advice and assistance to RFPs in aspects concerning statistical methodology, field operations, and computer techniques;
- f) Integrating regional data with catch and effort estimates into the national databases; and
- g) Preparing reports and statistical bulletins and performing statistical analyses.

HQ staff consists of data collectors, supervisors, computer operators and a fishery officer whose overall responsibility is the entire survey program.

4. CONCLUSIONS

From the discussion above, the following major points may be taken into consideration in the process of setting-up a statistical monitoring system for artisanal fisheries:

- a) For operational and logistical reasons the census approach is in general, not applicable in the statistical monitoring of artisanal fisheries. Well-defined sampling schemes should be used for the estimation of total catch, fishing effort and species composition. The effectiveness and accuracy of a sample-based programme is in reverse proportion to the number of assumptions as regards the homogeneity of the population and the representatives of the samples. Any reduction in the number of such assumptions (i.e. reducing the statistical risk of obtaining inaccurate results), will automatically imply higher operational and logistical costs;

- b) Standard statistical methodology, well-planned operational approaches and application of standard computer software are essential components in the design and implementation of sample-based survey programs. A typical approach is the implementation of three sampling surveys and a census (frame survey), and combining the information obtained for the derivation of estimated totals for catch and fishing effort;
- c) Need for sufficient budget to cover operational and logistical expenditures in the design and implementation of a prototype system and its progressive expansion at national level;
- d) Medium/large-scale survey programs operate more effectively if the field operations, as well as computerization of primary data, are performed in a decentralized fashion, with the HQ office being responsible for coordinating and supporting the entire statistical monitoring system; and
- e) Sample-based survey programs should be dynamic and flexible so as to easily adapt to changes in the artisanal fishery without methodological and software implications. The accumulated knowledge resulting from regular field operations should, over time, be interpreted into new and improved stratification and classification schemes, thus also increasing the effectiveness of the sampling and estimation approaches.

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**EXPERIENCES AND CASE STUDIES IN THE
IMPLEMENTATION OF DATA COLLECTION METHODS
FOR ARTISANAL FISHERIES**

by

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1. INTRODUCTION

This note is based on the experience gained during the design and implementation of data collection methods for artisanal fisheries in a number of countries under the FAO Technical Cooperation Programme, and other national and regional projects supported by UNDP and Government Cooperation Agencies. Its purpose is to illustrate some general approaches that have been introduced in a number of FAO member countries, and to highlight major constraints and problems that are found to be common in the design and implementation of statistical development activities. Specifically, the note is based on FAO field activities that, since 1994, have taken place in Asia (Cambodia, Myanmar), Africa (Gabon, Mozambique, Sao Tome and Principe, Sierra Leone, Tunisia), and Latin America (Guyana, Suriname, Venezuela).

In most of these countries the degree of exploitation of the fish resources by the artisanal sector was generally, not known to an acceptable level of accuracy. For instance, in some cases, and based on empirical data from the artisanal sector, there was reason to believe that the level of exploitation of some important resources had indicated the need for more accurate and timely statistical information, the lack of which was invariably attributed to the absence of a regularly operated, nationally sustained, appropriately focused, and cost effective data collection program. It was thus in this context that FIDI participated in the formulation and technical backstopping of field activities related to the development of data collection methods and computer-assisted systems for the statistical monitoring of artisanal fisheries.

**2. MAJOR CONSTRAINTS IN THE STATISTICAL MONITORING OF
ARTISANAL FISHERIES**

Size of target statistical areas

In most cases, one of the major constraints for the statistical monitoring of artisanal fisheries is the size of the target statistical area which comprises long maritime coastlines, shorelines of main lakes, and several other important water systems of rivers and fresh-/brackishwater bodies. Thus, artisanal fisheries are often characterized by a great diversity as they extend over several morphological (or even climatic) zones, types of water bodies, types of resources, and exploitation practices. One of the early conclusions regarding data collection schemes and sampling scenarios was that the diversity of artisanal fisheries required the implementation of different methodological and operational approaches, each of which take into consideration specific conditions and each focusing on specific data requirements but, at the same time, each operating within an overall methodological and operational framework.

Fragmentary sampling schemes

During the recent years most national institutions have initiated a number of data collection activities with the view of increasing the knowledge of the artisanal fishery sector and also preparing the ground for an overall fishery statistical program operating on a regular basis. These activities included censuses at regional level as well as some limited sample-based data collection schemes for catch and fishing effort. Based on the experience gained from these activities, it has been generally accepted that it would not be feasible to record catch and effort from all landing sites and on a daily basis, and that in most parts of the country sample-based approaches in space and time (supported by one-time censuses), should be introduced. These ought to be well-defined so as to reduce the risks of bias, operationally simple in order to be sustainable and methodologically robust for adapting to local conditions and needs. A common constraint in all these data collection activities has been their fragmentary and piecemeal character, combined with a lack of statistical and computerization standards.

Need for increased computing power and skills

From the computerization viewpoint, most of the national agencies responsible for operating fishery statistical systems have placed particular emphasis in introducing computers in the early stages of data collection and statistical analysis. Although the degree of computer skills is rather uneven among user groups, the average level of computer literacy is promising and expected to increase in the short and medium term. However, there is evidence that future statistical systems will operate on a much larger scale and will thus call for a more powerful and effective computing configuration and an in-parallel upgrading of staff skills.

3. IMPLEMENTING STATISTICAL AND COMPUTERIZATION STANDARDS

National workshops have proved very useful during the initial development stages of large-scale data collection programs. Usually these are organized to take place within a week and are attended by national fishery experts responsible for statistical activities in national administrative areas such as regions and provinces. Experience has shown that these workshops are more effective when delivered in three phases. The first phase involves presentation of basic concepts and approaches commonly used in the statistical monitoring of artisanal fisheries. The participants are presented with a series of slides illustrating the use of sampling techniques in the formulation of CPUEs, boat/gear activity coefficients, and the derivation of total estimates for catch, fishing effort, prices and values. From the methodological viewpoint, emphasis is placed on the need for a sampling program to handle four different types of survey data related to sample landings, sample boat/gear activities, active fishing days, and extrapolating factors (total number of boats/gear) provided by frame surveys. The presentation also deals with operational and infrastructural aspects such as cost effectiveness of survey programs, means for increasing mobility of recorders and/or mobilization of field staff, and effective ways in distributing data collection effort and computer operations.

The second phase of the workshop deals with case studies and exercises which are worked out by the participants. During this phase, the participants operate a simulated artisanal fishery within a geographically limited area with a small number of operating fishing craft and gear. This set of data is used as a basis for the application of several sampling scenarios and the evaluation of the derived estimates. The third part of the workshop includes presentation of the standard FAO-FIDI software ARTFISH/ARTSER and hands-on exercises using the numerical data worked out during the second phase.

The meetings are usually concluded with technical discussions related to the applicability of the general statistical and computer concepts presented during the workshop on specific cases occurring in the national fisheries. During these discussions, suggestions may arise indicating that the presented approaches should first be implemented on a small-scale bases, that is developing and field-testing a prototype system in a geographically limited but representative district or region in the country.

4. COORDINATING A DATA COLLECTION PROGRAM

The diversity of artisanal fisheries requires a statistical monitoring program to be implemented in successive phases and be continually guided and supported by a representative managing group of users and developers. A first consideration concerns the minimum infrastructure required for performing a number of statistically-related management tasks including:

- a) Planning of the system design and its initial implementation;
- b) Enforcement of harmonized statistical and computer concepts throughout the target statistical area;
- c) Preparation of planning and budgeting proposals for in-office and field activities;
- d) Diagnostics on and critical evaluation of the performance of the statistical system;
- e) Deciding on corrective actions of and when required; and
- f) Coordinating linkages with higher-level fishery information systems at national and international level

At this stage it would seem appropriate to suggest that if several national agencies are to benefit from the introduction of a data collection program, then they should join forces with the view of complementing each other in the design and implementation of the central component of an overall statistical system. There is clear indication that basic statistical data such as catch, fishing effort, prices and values, are often of common utility to more than one institutions and should thus be the result of joint effort as regards data collection, storage, and basic analysis/reporting. Specific data collection activities of biological or socio-economic scope would continue to be the subject of activities focusing on specific institutional needs. These should be made fully compatible with the commonly operated central component of basic data, so as to allow for estimated or primary statistics to be drawn from a single data depository and thus reduce undesirable effects caused by incompatible, duplicating or conflicting information.

A second consideration concerns the type of statistical approach to be used in situations with specific data collection requirements. In this respect it should be underlined that application of different types of statistical approaches according to local needs, is a well-accepted practice in most national statistical programs, and it should present no significant difficulties if the overall methodological and operational framework is flexible enough to accommodate different data collection schemes and estimating methods. However, an important aspect is the compatibility between different approaches and the need to avoid fragmentary and uncoordinated application of concepts and standards in different statistical areas.

This means that although variations in methodology and operations are, in fact, a desirable feature of a decentralized and flexible statistical program, it should also be stressed that all of its sub-systems should be perfectly harmonized in terms of statistical and computer standards (such as species, boat/gears, geographical and time stratification, database structures, etc.) and be capable of exchanging information and become integrated into an overall statistical program. Thus, the application of statistical standards and approaches could be effectively coordinated by a statistical committee or working group constituted of users and developers representing all parties involved in the operation and support of a large-scale statistical program.

Thirdly, an important aspect is computerization. Use of a single general-purpose software throughout the target statistical area should minimize development, testing, documenting and implementation costs, and at the same time, facilitate decentralization of computer operations. However, should there be a need for different computer systems operating concurrently in different places, these should be geared to produce fully compatible outputs permitting their interchange and eventual integration into an overall system. Again, identification and selection of appropriate software tools and enforcement of computerization standards should be more effective if it is part of the coordinating functions of the statistical committee or working group described above.

5. APPLICABILITY OF STANDARD SOFTWARE IN DATA COLLECTION SYSTEMS

In most cases, development of fishery statistical applications by national institutions is already underway, and with appropriate guidance and coordination, should greatly assist in addressing specific data integration, analysis and reporting needs. However, future systems development may be hampered by a combination of conditions. These range from a lack of satisfactory computer hardware, software, documentation, and adequately trained information technology professionals. FAO-FIDI's past experience with systems development of statistical data collection systems that were country-specific, indicated that a major investment of time and materials is required to produce a successful system. A fully operational system that has to undergo design/development, field testing and be supported by an effective kit of tutorial and operations guide, requires an investment of 1.5 - 2.0 years of a full-time professional systems developer, particularly if it is to be used in the Windows environment. If existing general-purpose systems are available and the necessary operational considerations are reasonably negligible, it is often more advantageous to utilize these rather than risk the costs with custom development.

The present ARTFISH/ARTSER MS DOS version 2.0, developed by FIDI in 1994, is a general-purpose system designed to handle sample-based surveys operating with varying sampling scenarios and estimation approaches. Its data management component (ARTFISH) caters for stratification in space and time, organization of collected data into databases of primary statistics according to the data collection schemes in use, and the derivation of total estimates for catch, fishing effort, prices and values. Its reporting component (ARTSER) operates with estimated data and provides users with consolidated tabulations, graphical presentations and interfaces with commonly used applications software.

FIDI has in its plans the implementation of a fully integrated ARTFISH/ARTSER Windows version which will be ready for distribution by the end of 1997. Functionally, the Windows version is expected to offer the known advantages of better screen handling, more flexible selection of system configuration and options, easy integration with other software applications, etc. Moreover, the Windows version is expected to offer users a complete suite of statistical services including:

1. **ARTPLAN:** A survey planner that will assist in the design of a sample survey

This software component will operate on parameters supplied by users and generate a simulated fishery which will then be used for testing and evaluating alternative sampling scenarios. This technique can be effectively used in order to anticipate commonly occurring shortcomings related to accessibility to landing sites, time schedule of sampling, frequency sample size, mobility and cost-benefit tradeoffs.

2. **ARTFISH/ARTSER for Windows**

Functionally this component will follow the same methodological approach used by its MS DOS equivalent. However, it will provide enhanced system functions, more transparent handling of data inter-relations, and much improved reporting features and integration with internationally utilized computer standards (MS Access, MS Excel, MS Word, MS Powerpoint, etc.)

3. **ARTHELP:** Help and Tutorial enhancements

The above two components will be fully described and supported by a comprehensive set of documents, slides, and graphics which will be interactive and provide users with tutorial and help functions to the depth of knowledge they are willing and able to obtain.

4. **ARTBIEC:** Bio-economic component

This will consist a number of supplementary modules, each focusing on a specific applications sector. It is envisaged that special procedures should be developed for linking the ARTFISH estimates with samples of length-frequency and other important biological data, whereas other modules will provide linkages to socio-economic information.

The above plan envisages the collaboration of FIDI with other fishery institutions that may show interest and willingness in participating in the system development. The multi-lingual requirements of the software, the amount of work required for the fourth component (ARTBIEC), and the obvious advantages of a jointly issued product (dissemination, installation, training, technical advice, troubleshooting), have already been taken into consideration and potential partners (such as ORSTOM, DANIDA) will shortly be contacted in this respect.

6. SUMMARY OF FINDINGS

- Statistically-related management tasks are performed more effectively if designated to a national fishery statistical committee or work group with responsibilities and *modus operandi* as regards system design, development, implementation maintenance, and support;
- Prior to implementing a large-scale system at national level it would be advantageous to develop a prototype system in a geographically limited but representative area. Based on experiences gained from the prototype system, stepwise expansion of the system in other areas may be necessary, by first considering new methodological requirements and operational/logistical constraints;
- Enforcing harmonization of statistical and computer standards (statistical classifications, database structures) throughout the target statistical area; and
- Selection of a single general-purpose applications software to handle the basic primary data (catch, fishing effort, prices and values). Consideration be given to new computer requirements resulting from the implementation of large-scale data collection operations.

**EXAMPLE OF
FISHING LOG BOOK***

The schematic flow of catch and effort statistics on the Japanese Squid DRIFT NET Fishery:

Fishing Log Book	Skipper's Report	Data Check	Computerize Analysis
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FISHING LOG BOOK SHEET

Description of Vessel, Gear, etc.	Duration	Name of Respondent
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Operation (Deploy Net)

<u>Date</u>	<u>Location of Set Net</u>	<u>Tan Used</u>	<u>Catch (kg)</u>	
	<u>Lat.</u> <u>Long.</u>		<u>Squid</u>	<u>Others</u>

Fishing Effort

Catch (Processed weight)

Name of Vessel (License No.)	Flying squid
Size of vessel	Other squids
Horsepower	Albacore
Crew	Pacific Pomfret
Mesh Size	Sharks (multiple)
Tan Length	Skipjack
No. of Operations	Tuna
Deployed Tans, etc.	Yellowtail, Billfishes, etc.

* Hayase, S. 1994. Catch and Effort Statistics for the Japanese Squid Drift Net Fishery. In: Status of Fishery Information and Statistics in Asia. Volume II. Proceedings of the Regional Workshop on Fishery Information and Statistics in Asia, Bangkok, Thailand, 18-22 January 1994. SEAFDEC, Bangkok, Thailand, June 1994.

TUNA FISHERY STATISTICS

Until 1996, collection of tuna fishery statistics was a responsibility of the Indo-Pacific Tuna Management and Development Programme (IPTP). The coverage of IPTP's activity was the compilation and dissemination of statistics on tuna and tuna-like fish catches from the Indian Ocean (FAO Areas 51 and 57) and the Western Central Pacific off Southeast Asia (FAO Area 71).

In June 1996, the responsibility of collecting tuna fishery statistics from the Southeast Asian region was transferred from IPTP to SEAFDEC through its Department in Malaysia. While maintaining the IPTP databases on catch, fishing crafts, catch and effort, length-frequency, and tuna transshipment, SEAFDEC added three types of data. These are landing statistics by gear type and species, type and number of boats, and catch and effort statistics.

Three major groups of tuna and tuna-like species are included in the collection activity, namely, tunas and bonitos, seerfishes and billfishes. At present, seven countries are involved in the activity: Brunei Darussalam, Indonesia, Malaysia, the Philippines, Thailand, Singapore, and Vietnam.

Tuna catch statistics are compiled from flag nations reporting through the liaison officers designated by each country. The questionnaires sent to the liaison officers include information on the manner in which the tuna statistics are generated. Data are also collected by non-flag nations and these are used for confirmation purposes.

The data required are expressed as nominal catch in weights corrected for losses, i.e. fish which die due to fishing activities but are not caught, discards which are unwanted by-catch species, damaged or undersize fish which are used for food or bait by the crew, and increased in weights due to water absorption or ice accretion.

**DEVELOPMENT ON COLLATION OF
TUNA FISHERY STATISTICS FOR THE
SOUTHEAST ASIAN REGION**

by

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1. INTRODUCTION

The collation of tuna fishery statistics in the region has been undertaken by Indo-Pacific Tuna Development and Management Programme (IPTP) based in Sri Lanka since 1982. Historical and current tuna statistics were collected, processed and disseminated for use in the development and management of tuna fisheries in the region. However, with the establishment of the Indian Ocean Tuna Commission (IOTC) in March 1996, IPTP transferred its activities on tuna in the Western Central Pacific to SEAFDEC.

A Memorandum of Understanding between FAO and SEAFDEC was signed on 17 June 1996, regarding the transfer of responsibility from FAO to SEAFDEC for the collation of tuna fishery statistics in the Southeast Asian region. With the effect of this agreement, the Marine Fishery Resource Development and Management Department (MFRDMD) of SEAFDEC, in particular has requested countries fishing for tuna in the region to provide statistical data that are previously entrusted to FAO, to MFRDMD for collation. MFRDMD will also maintain appropriate databases and publish the data or disseminate it upon request. MFRDMD has also developed a computer program known as the Fishery Resources Information and Management System (FRIMS), to facilitate information transfer to and from Member Countries.

SEAFDEC through MFRDMD will report on the status of the database and plans for its future maintenance, including the updating of statistics for non-SEAFDEC member countries. Under the agreement established between FAO and SEAFDEC, SEAFDEC is responsible for the collation of tuna statistics in FAO area 71. However, for this specific task, SEAFDEC will only concentrate its activities in the Southeast Asian region as indicated in Map 1. With such understanding SEAFDEC will avoid overlapping with the activities of the other established regional body operating in the area, i.e., the South Pacific Commission (SPC).

The list of species covered under this program is tabulated in the Table 1. In general, three major groups of tuna and tuna like species were included, i.e., tunas and bonitos, seerfishes and billfishes. Coding for each species followed the FAO species code as published in IPTP Data Summary No. 12.

2. DEVELOPMENT AND PROGRESS

SEAFDEC has received eight designations as the liaison officers from Member Countries who are responsible for the collation of tuna fishery statistics in their respective countries. The names and addresses of those nominated liaison officers are indicated in the Appendix. SEAFDEC will organize a two-day technical meeting at MFRDMD in Kuala Terengganu, tentatively in December 1997. The official announcement and invitation will be released to all designated liaison officers not later than September 1997. The objectives of the meeting are to formalize procedures for data collection data format; and to draw up the expected outputs of the data collection for dissemination.

Three types of data are requested by SEAFDEC from Member Countries annually. These will include landing statistics by gear type and species, type and number of boats catching for tuna and catch and effort statistics. Member Countries are asked to use special forms provided by SEAFDEC when providing the needed statistics. Samples of the data format are given as MFRDMD FORMS 1, 2 and 3.

3. FUTURE ACTIVITIES

Provided with a good and adequate data, SEAFDEC plans to produce charts and maps on tuna landings by area and gear types for the whole Southeast Asian region. This information is useful for management of the tuna resources in this area. With the advantages of information technologies, SEAFDEC plans to provide facilities for data transfer and receiving using computers in the Member Countries of SEAFDEC.

4. PROBLEMS ENCOUNTERED

Several problems were encountered in the collation of tuna fishery statistics provided by Member Countries. These include:

- a) Member Countries consider it time consuming to respond to SEAFDEC's requirement for tuna statistics;
- b) Tuna landings reported in many cases are not according to species level;
- c) Some liaison offices do not come from statistical division;
- d) Lack of awareness among different sections in collecting tuna statistics;
- e) Problems of species identification for early stages of tuna species, especially yellowfin and bigeye; and
- f) Tuna landings are scattered and difficult to centralize.

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FAO, (1992) Indian Ocean and Southeast Asian Tuna fisheries Data Summary For 1990. IPTP Data Summary No. 12, May 1992

**NAMES AND ADDRESSES OF
LIAISON OFFICERS DESIGNATED TO COLLATE
TUNA FISHERY STATISTICS**

Name	Official Address
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Dr. Naozumi Miyabe (Japan)	Head of Tropical Tuna Section Pelagic Fish Resources Division National Research Institute of Far Seas Fisheries (NRIFSF) 5-7-1 Orido, Shimizu City Shizuoka-ken, 424 Japan
Mr. Lee Yuen Tong (Singapore)	Chief Fisheries Officer Primary Production Department Ministry of National Development 5 Maxwell Road #03-00 National Development Building Singapore 0106
Mr. Pirochana Saikliang (Thailand)	Marine Fishery Biologist Bangkok Marine Fishery Development Centre 89/1 Soi Saphan Pra, Yannawa Bangkok 10120
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MAP 1: Southeast Asian Region

Table 1. List of species under SEAFDEC interest

Scientific Name	FAO English Name	Code
Tuna and Bonito		
<i>Thunnus albacares</i> <i>Thunnus obesus</i> <i>Thunnus alalunga</i> <i>Thunnus tonggol</i> <i>Thunnus maccoyii</i> <i>Euthynnus affinis</i> <i>Auxis thazard</i> <i>Auxis rochie</i> <i>Sarda orientalis</i> Scombridae	Yellowfin tuna Bigeye tuna Albacore Longtail tuna Southern bluefin tuna Eastern little tuna Frigate tuna Bullet tuna Indo-Pacific Bonito Tunas NEI	YFT BET ALB LOT SBF KAW FRI BLT BIP TUN
Seerfishes		
<i>Scomberomorus commerson</i> <i>S. guttatus</i> <i>S. lineolatus</i> <i>Acanthocybium solandri</i> <i>Scomberomorus</i> spp	Narrow-bared Spanish mackerel Indo-Pacific King Mackerel Streaked seerfish Wahoo Seerfishes NEI	COM GUT STS WAH KGX
Billfishes		
<i>Makaira mazara</i> <i>M. indica</i> <i>Tetrapturus audax</i> <i>Istiophorus platypterus</i> <i>Xiphias gladius</i> Istiophoridae	Indo-Pacific blue marlin Black marlin Striped marlin Indo-Pacific sailfish Swordfish Billfishes NEI	BLZ BLM MLS SFA SWO BIL

**TUNA STATISTICS IN SOUTHEAST ASIAN REGIONS
LANDINGS STATISTICS**

REPORTING COUNTRY: _____

FLAG COUNTRY: _____

YEAR: _____

WEIGHT UNITS: _____

BOAT SIZE UNITS: _____

DATA TYPE: SUBSAMPLE DATA SOURCE: LOGBOOK RAISED DATA: YES
 TOTAL ENUMERATION LANDINGS NO

LANDINGS BY SPECIES

AREA	GEAR	TYPE OF BOAT	BOAT SIZE RANGE	LOCAL/DISTANT OPRN.	FISH CONDITIONING	TOTAL VALUE	TOTAL LANDINGS	TUN	KGX	BILL										
TOTAL YEARLY LANDINGS																				
TOTAL YEARLY VALUE																				

**TUNA STATISTICS IN SOUTHEAST ASIAN REGIONS
FISHING CRAFT STATISTICS**

REPORTING COUNTRY:

ACTUALLY OPERATED:

FLAG COUNTRY:

REGISTERED:

YEAR:

BOAT SIZE UNITS:

TYPE OF BOAT	BOAT SIZE RANGE	MECHANISATION	FISH PRESERVATION	LOCAL/DISTANT OPRTN.	GEAR	NUMBER OF BOAT CATCHING TUNA		
						MULTI-PURPOSE	TUNA ONLY	TOTAL

**TUNA STATISTICS IN SOUTHEAST ASIAN REGIONS
FISHING CRAFT STATISTICS**

REPORTING COUNTRY: M _____

FLAG COUNTRY: _____

YEAR: _____

RAISED DATA: <input type="checkbox"/>
UNRAISED DATA: <input type="checkbox"/>

COVERAGE RATE: _____

TYPE OF GEAR: _____

TYPE OF BOAT: _____

BOAT SIZE RANGE: _____

LOCAL/DISTAN OPERATED: _____

BOAT SIZE RANGE: _____

LOCAL/DISTANT OPERATED: _____

UNIT OF EFFORT: _____

UNIT OF EFFORT: _____

UNIT OF CATCH: _____

MONTH	SIZE	QUADRANT	LAT.	LONG.	EFFORT	TOTAL CATCH	CATCH BY SPECIES			
							TUN	KGX	BILL	

TOTAL

AQUACULTURE STATISTICS

Many countries in Asia have exerted much efforts in improving their collection and processing of aquaculture information in addition to the compilation of capture fishery statistics. The countries can now make use of two FAO databases, one for marine and inland capture fisheries, and the other for aquaculture, which was not the case earlier when the countries implemented the database FISHSTAT NS1 (National Summary). From the data which FAO received from participating countries, the total fishery statistics are disaggregated into capture fishery and aquaculture components. It is hoped that the quality of the data are likely to improve because of the implementation of two separate questionnaires for capture fisheries and aquaculture.

In the process of disaggregating capture fisheries from aquaculture, the need to harmonize terminology and to classify fishery production as "aquaculture" or "capture fisheries" was recognized. Thus, in order to have a complete delineation of activities that could be categorized as capture fisheries or aquaculture, FAO has continuously modified the definition of aquaculture for statistical purposes. The latest revised definition, included in FAO's paper in this section of the Proceedings, encompasses three components which must be fulfilled in order that an activity can be classified as aquaculture. These are: the cultured organism, the activity involved, and ownership of the reared organism.

In another development, since aquaculture is closely related with other farming activities and in order that collection of production data from aquaculture could be improved, FAO considered the inclusion of aquacultural activities in the World Census of Agriculture Programme for 2000 (WCA 2000). Thus, the Supplement on Aquaculture for the WCA 2000 which is being finalized by FAO, will be ready for distribution before the end of 1997.

RECENT DEVELOPMENTS IN AQUACULTURE STATISTICS

by

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1. INTRODUCTION

The Fisheries Information, Data and Statistics Unit (FIDI) of the Food and Agricultural Organization of the United Nations (FAO) has been systematically collecting and disseminating global aquaculture production by weight and value (US\$) since 1984. During this period the capacity of many countries, particularly in Asia to collect and process aquaculture information has, greatly improved. The mechanisms for collecting data and the coverage and quality of data on production from aquaculture provided by countries to FAO have been constantly under review with the aim of improving their quality and relevance to future national and global needs. The aim of this paper is to identify these future needs and to discuss how some of these are being currently addressed.

2. COVERAGE OF AQUACULTURE STATISTICS

Based on national priorities, FAO Fisheries Department has adopted three principal interrelated initiatives geared towards promoting:

- a) at global, regional and national levels, the responsible fisheries management;
- b) the outcome of the Kyoto Conference to reduce waste and increase fish production; and
- c) the enhanced global monitoring and strategic analysis.

For aquaculture, the implementation, verification and evolution of practices of the first two initiatives are underpinned by the third. At the national and global levels, such monitoring is increasingly required for developing policies, managing natural resources and monitoring the efficiency of aquatic production and utilization of resources. The FAO database on aquaculture is a key vehicle for monitoring global, regional and national developments in aquaculture.

Unlike the monitoring of capture fisheries, the monitoring of aquaculture needs to encompass the various facets of culture from seed production to harvest. Even though some structural information on culture systems and production from hatcheries is collected at present, FAO has so far disseminated end-product weight and value of cultured aquatic organisms. The need to broaden the coverage for collecting and disseminating information on aquaculture for management and strategic planning purposes, is acknowledged within the structure and activities of the Fisheries Department of FAO

This requires that FIDI ensures the collection of “quantitative data required for developing and managing fisheries and on preserving the aquatic environment” (FAO, 1992). Such expansion, however, should consider the country’s capacity to routinely provide such information and this is probably best done on two phases: firstly, to consider indicators on aquaculture currently collected by countries but not requested by FAO, or reported to FAO but not utilized; and secondly, to develop with countries, the capacity to widen the coverage in order to meet their future needs.

In addition to coverage, other issues which are likely to impede monitoring, need to be re-addressed. These include:

- a) harmonization of terminology, there is the difficulty of national authorities to classify fishery production as “aquaculture” or “capture fisheries”;
- b) aggregated reporting of unclassified or incompletely identified aquatic organisms; and
- c) inappropriate methodologies for collecting information on aquaculture and institutional limitations.

Progress on initiatives to address some of these issues on aquaculture are considered below. Irrespective of the range of constraints, however, the quality of national statistical and non-statistical information on aquaculture is unlikely to improve if its development is conceived in isolation of national technical developments in aquaculture, and if the need for national monitoring is not given due priority.

3. AQUACULTURE AS AN ECONOMIC ACTIVITY

Unlike many other economic activities, aquaculture is currently not recognized or defined under the International Standard Industrial Classification of All Economic Activities (ISIC) as a separate economic activity. Instead, elements of aquaculture are categorized under “Fishing” (division 05, 005) which covers “fishing, operations of fish hatcheries and farming, and service activities incidental to fishing”. Moreover, this category specifically excludes activities such as frog culture, and is clearly unsuitable for defining aquaculture practices. In order to rectify this omission, FIDI is examining the possibility of including aquaculture in ISIC as an economic activity in its own right.

4. DEFINITION OF AQUACULTURE

Based on the definition developed by the Southeast Asian Fisheries Development Center (SEAFDEC) in the early 1970s, FAO has formulated its own working definition of aquaculture for statistical purposes. This definition is itself undergoing modification to accommodate recent changes in the culture practices within fisheries. At present, the FAO definition read as follows:

Aquaculture is the farming of aquatic organisms including fish, mollusc, crustaceans and aquatic plants. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated.

For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture while aquatic organisms which are exploitable by the public as a common property resource, with or without appropriate licenses, are harvest fisheries.

Despite widespread discussion and acceptance of the above definition by international fora and organizations such as the Coordinating Working Party on Fishery Statistics (CWP), the European Union (EU), International Council on the Exploration of the Seas (ICES) and SEAFDEC, limitations of the above definition are increasingly apparent (Beveridge, 1990, etc., Floyd et al. 1991, New & Crispoldi-Hotta 1992, Csavas & New 1994, Kara 1994, SEAFDEC 1994, CWP 1995a, 1995b, FIRI 1995, Garibaldi 1995).

In recent years it has been realized that, for capture fisheries in inland waters, the exploitable fish biomass and consequent catches can be increased through varying forms of intervention such as stocking of fingerlings, fertilization, environmental engineering, etc. (Welcomme, 1996). Therefore, under the current FAO definition of aquaculture, capture fisheries in which restocking is practiced and in some situations, recreational fisheries can, with only minimal inputs be considered as aquaculture (Welcomme, 1996). The current FAO definition of aquaculture has therefore raised questions on what form and degree of intervention in aquatic production constitutes "aquaculture" and which practices and products should be regarded as aquaculture. It also leaves the difficult question of the implications of ownership of the cultured aquatic organism open to interpretation. To accommodate these changes FAO is continuing to refine and standardize the definition of aquaculture. Recent changes proposed include that the definition should limit aquaculture to "rearing for most of the life-cycle" (Welcomme, 1996), is still unsatisfactory as it excludes aquatic seed production as an aquacultural activity.

To overcome these ambiguities, a revised and hopefully clearer working definition for aquaculture is proposed as follows:

"Aquaculture is the farming of aquatic organisms including crocodiles, alligators, amphibians, finfish, molluscs, crustaceans and plants where farming refers to their rearing up to their juvenile and/or adult phase under captive conditions. Aquaculture also encompasses individual, corporate or state ownership of the organism being reared and harvested in contrast to capture fisheries in which aquatic organisms are exploited as a common property source, irrespective of whether harvest is undertaken with or without exploitation rights."

The above definition encompasses three components which must be fulfilled for an activity to be classified as aquaculture. These are: **the cultured organisms, the activity, and ownership of the reared organism.**

To assist in the designation of production to aquaculture and culture-based capture fisheries, the following working definition has been proposed for the latter and included in the FAO Technical Guidelines for Responsible Fisheries:

"Activities aimed at supplementing or sustaining the recruitment of one or more aquatic species and raising the total production or the production of selected elements of a fishery beyond a level which is sustainable through natural processes. In this sense culture-based fisheries include enhancement measures which may take the form of introduction of new species; stocking natural and artificial water bodies;

fertilisation; environmental engineering including habitat improvements and modification of water bodies; altering species composition including elimination of undesirable species, or constituting an artificial fauna of selected species; genetic modification of introduced species."

A proposed classification of various fishery practices is given in Table 1.

5. UNIDENTIFIED AQUATIC ORGANISMS

In both capture fisheries and aquaculture, aquatic organisms which are not identified to the species level may be aggregated and reported as "miscellaneous freshwater fishes" or reported to the family or genus level. This aggregation is potentially a serious constraint for monitoring changes in fish assemblages and the legally binding Convention on Biodiversity. The chronological changes in reporting incompletely identified aquatic organisms from inland and marine waters are considered elsewhere. This paper considers only the reporting of unidentified aquatic organisms from inland waters.

Although an increase in both the number and volume of unidentified aquatic species reported to FAO is evident in aquaculture and capture fisheries, over 68% of the total volume from inland waters in Asia originates from inland capture fisheries. On the other hand, for inland capture fisheries the greatest problem for improving the resolution of unidentified aquatic species reported to FAO is the high tonnage of "freshwater fishes *nei*". By 1995, this group totaled 2.6 million mt and accounted for 69% of the total volume of unidentified aquatic species from inland capture (Figure 1).

Identifying the various species items originating from aquaculture and inland capture may help to focus assistance for species identification. Inland capture fisheries accounts for 68% of the "freshwater fishes *nei*" and almost all of freshwater crustaceans and mussel *nei* groupings. For cyprinid *nei*, however, aquaculture accounts for 78% of the total (Figure 2).

Although the quantities of reported unidentified aquatic organisms have increased, the ranking of major countries reporting unidentified species as freshwater fishes *nei* has remained the same in the last five years. In 1995, China reported around 734,000 and 895,000 mt as freshwater fishes *nei* from aquaculture and inland capture fisheries, respectively, followed by Bangladesh with 287,00 and 437,500 mt and India with 0 and 471,000 mt, respectively (Figure 3). In the case of India, it reported that most of its unidentified finfish as cyprinid *nei*. In 1995, India accounted for 87% of this group (Figures 2 and 4). Thus, overall attention to species identification should focus on the freshwater fishes, molluscs and crustaceans and cyprinid *nei* as in China, Bangladesh, India, Viet Nam, Indonesia and Myanmar.

6. PROPOSED CHANGES FOR REPORTING GLOBAL PRODUCTION FROM FISHERIES

The aquaculture questionnaire (FISHSTAT AQ) was introduced in 1984 and the data are published in Aquaculture Production Statistics (FAO Fisheries Circular No. 815). At present, nominal catches for marine and inland capture fisheries are inferred by subtracting the country returns from FISHSTAT AQ from the national summary (FISHSTAT NS1).

This procedure for estimating catches is currently under review and FIDI intends to develop two separate databases, one on capture fisheries to include marine and inland capture fisheries and the other on aquaculture. The separation process is planned in two phases: establishment of these databases at FAO (already complete for 1984-1995), and the reporting by countries of separate statistics for both these databases from 1998.

At present, FIDI, is estimating national production from aquaculture for the period 1950-1984. The completion of this exercise will facilitate the total separation of the FAO aquaculture and capture fisheries databases. Whilst these changes will ease access to marine and inland capture fisheries data in the *Catches and Landings* Yearbook, it does not change the current procedure used by FAO for estimating production for inland and marine capture and aquaculture or influence the quality and detail of the data. The quality of these data are likely to improve with the implementation of separate questionnaires for aquaculture and capture.

7. QUANTITATIVE STRUCTURAL INFORMATION ON AQUACULTURE

Despite the significant contribution of cultured fish to national security, particularly in rural areas, structural information on aquaculture is virtually non-existent. This is being increasingly recognized by policy makers, aquaculturists and agriculturists. Following continued requests to agricultural statisticians at a national level, and given the close association of aquaculture with other farming activities, the Fifteenth Session of the Asia and Pacific Commission on Agricultural Statistics (APCAS), recommended that "FAO should give consideration to include aquacultural activities in the World Census of Agriculture Programme (WCA 2000) either in the global program or as a regional addendum for the Asia and Pacific Region" in order to take advantage of the large scale agricultural census in the collection of more and useful data on aquaculture.

To meet the repeated requests, various options were explored by FIDI in collaboration with other relevant FAO divisions such as the Statistical Development Service (ESS) and the Inland Water Resources and Aquaculture Service (FIRI). Countries may choose to conduct an independent aquaculture census, or as in the case of some countries, include it with their fisheries census. Alternatively, countries may wish to collect such information as part of their agricultural census program. In this initial consideration, the feasibility of the third option was explored by FIDI and ESS at two regional consultations. The option that countries eventually choose may depend on the national priority given to this sector, the state of national aquaculture development, and the coverage expected from such an exercise.

Expert Consultations

To consider this option, draft guidelines for the collection of quantitative structural data on aquaculture (hereafter referred to as the Supplement) were prepared by FIDI/FAO in collaboration with ESS/FAO, from a working document prepared by Mrs. Virgilia T. Sulit (SEAFDEC Aquaculture Department, Iloilo, Philippines). The purpose of the Supplement is to provide guidelines for countries who would like to expand the scope and coverage of their Census of Agriculture to include the collection of structural information on aquaculture.

Such guidelines would also provide harmonized definitions and methodologies for countries which already collect such information as part of their fisheries census and form the basis for improved and appropriate sampling frames and methodologies for use during inter-census aquaculture surveys. These outputs should eventually result in improved national and FAO statistics. These guidelines were reviewed in two recent consultations organized by FAO at the Regional Office for Asia and the Pacific (RAP), namely the:

- a) Round Table Discussion on Aquaculture Statistics, November 1996 (predominately with aquaculturists to provide feedback on the items covered in the proposed Supplement, and establish the suitability of the scope and coverage of the Supplement to meet country needs), and
- b) Technical Evaluation of the Supplement, April 1997 (predominately with agricultural statisticians to establish the need, implication and logistics of including aquaculture in the agricultural census).

Participation of Countries and Regional Organizations

The above mentioned meetings were attended by 40 participants representing eight countries, and eight regional and global institutions which are closely associated with the monitoring and development of the aquaculture sector. The meetings were attended by participants from Cambodia, China, India, Indonesia, Japan, Philippines, Thailand, and Vietnam as well as representatives from the Asian Institute of Technology (AIT), the Bay of Bengal Programme (BOBP), the International Center for Living Aquatic Resources Management (ICLARM), the Mekong River Commission (MRC), the Network of Aquaculture Centres in Asia-Pacific (NACA), SEAFDEC, Stirling Aquaculture - Asia, and FAO.

Outcome of meetings

The need to collect structural information on aquaculture was reinforced by the participants in both consultations. For the consultations, the Supplement was divided into three major parts: (a) Introduction and methodological considerations, (b) Proposed census items, and (c) Tabulation program. The detailed deliberations of the participants on possible mechanisms for the collection of structural information on aquaculture will be published in the final reports of the meetings. Overall, three major aspects were discussed: the coverage of aquaculture within the WCA 2000 Programme, the range of items to be covered, and implementation of the Supplement.

The coverage of aquaculture within the agricultural census program was the key consideration of both consultations. In this context, the participants at both consultations noted that the value of the census will be limited due to the current definition of the agriculture holding, which restricts the scope of the census to those agricultural holdings on which aquafarming is practiced. Participants concluded that, to increase the probability of implementing the census on aquaculture, FAO should emphasize cost/benefit considerations of including aquaculture in the agricultural census program and provide flexible guidelines to enable countries to include the collection of structural statistics either as part of their agricultural, livestock or fisheries censuses or through an independent aquaculture census. Following the recommendations of both consultations, holdings of two types which conduct aquacultural activity, will be defined in the guidelines. These are:

a) Agri-aqua holding

An agri-aqua holding will be defined as an agricultural holding engaged in agriculture as well as aquaculture provided that the means of production (labor, equipment, buildings) on the holding is the same. Aquaculture can be conducted alongside and integrated with agriculture or on a separate site as long as both activities belong to the same economic unit. Examples are combined fish and rice, plants or livestock and fish culture.

b) Aquaculture holding

An aquaculture holding will be defined as an economic unit which is predominately or solely engaged in aquafarming. For an economic unit to be considered an aquaculture holding, the means of production (labor, equipment, buildings) on the holding must be the same. Such holdings may also be "landless": for example houseboats, in which cages are suspended from below the floor boards, may be an integral part of the dwelling, and aquaculture on water bodies such as sea, estuaries, lagoons, lakes, reservoirs, rivers, etc.

The participants in both consultations acknowledged that, given the possible financial and human resource and institutional constraints, the collection of information on all the desired items may not be feasible and therefore recommended that a reasonable limit (say 10) be placed on the number of questions asked. Nevertheless, the number of items and their definitions provided by FAO in their guidelines will be sufficiently broad so that even though countries may limit the number of questions or items based on their national priority, the definitions of selected items will be harmonized between countries to permit international comparison. It was also recommended that items should be prioritized as "essential" and "recommended", based on the comments by agricultural statisticians and should provide examples of tabulation tables.

Given the current debate on the aquaculture sector as a net user of natural resources and on the possible impact of aquaculture on the environment, participants discussed the merits of classifying farms as extensive, semi-intensive and intensive. The participants acknowledged that such demarcations were arbitrary and subjective and, as such, difficult to define. The participants concluded that the level of intensification of culture systems can best be addressed by ensuring that the key features of intensification (capital energy, feed and fertilizer inputs, and stocking density) are included in the questionnaire.

In view of recent concerns on the possible negative impact of aquaculture on the environment, the regional experts supported the importance of collecting key environmental indicators in the WCA 2000 Programme. For aquaculture, participants mentioned that they would like to see more emphasis on the indicators of sustainable development. They suggested that the section on aquaculture, production facilities be regrouped according to environments, e.g. land-based facilities, lakes, marine etc. They were informed on the sensitivity of such grouping and of the willingness of respondents to answer such questions, particularly if they felt that by doing so their future activities will be compromised. It was therefore suggested that a preferable approach would be to augment the questionnaire with additional information on culture practices, such as water treatment plants, use of special feeds, etc. It is envisaged that the Aquaculture Supplement to the WCA 2000 Programme will be published at the end of 1997.

8. CURRENT STATUS AND CONSTRAINTS OF COLLECTING AQUACULTURE STATISTICS

Current procedures used to collate aquaculture statistics and status of current aquaculture listing and other sampling frames in selected countries, were considered at the Round Table Discussion. A preliminary effort was made to:

- a) establish current practices and constraints of collecting aquaculture statistics in selected countries,
- b) ascertain the potential role of regional bodies in data collection; and
- c) inform participants on fisheries census conducted to date.

This process was initiated for Malaysia through direct contact with the Department of Fisheries and through several country papers presented at this discussion. Representatives from China, India, Japan, Cambodia, Vietnam and Philippines and representatives from ICLARM, NACA, SEAFDEC, MRC, and BOBP presented papers giving carrying levels of detail on the above three aspects.

The participants noted that among the main objectives of a census program is the development of appropriate sample frames. Given that sample frames are likely to form the basis for annual inter-census surveys, participants emphasized the need for, and FAO, assistance in, developing and/or improving sample frames and listings to foster international comparability.

The common constraints faced by most countries were shortage of manpower, limited funding and inadequate equipment. Despite these constraints many countries collect and report national aquaculture statistics to FAO. The sampling methodology, quantity, and quality of aquaculture data collected, however, are still not considered suitable. Inadequately qualified staff for data collection, coupled with staff turnover and minimal motivation and understanding the methods and purposes of collecting data, often reduce the accuracy of collected data. In Malaysia for example, aquaculture data are collected by extension officers who have 11 years of school education. The range of items covered major aquaculture producing countries, such as the Philippines, were not considered to be adequate. Whilst countries collect information on the output of aquaculture products for final consumption and processing information on operational hatcheries and seed production by species are however lacking. The assistance of FAO and other agencies to evaluate and improve the current practices of data collection was requested.

9. SUGGESTED ACTION

The participants of the Workshop were invited to comment upon the developments of norms and standards (e.g. definition of aquaculture and culture-based capture fisheries) reported in this paper, and the proposed inclusion of aquaculture in the WCA 2000 Programme as well as how aquaculture statistics in particular species identification, can be improved.

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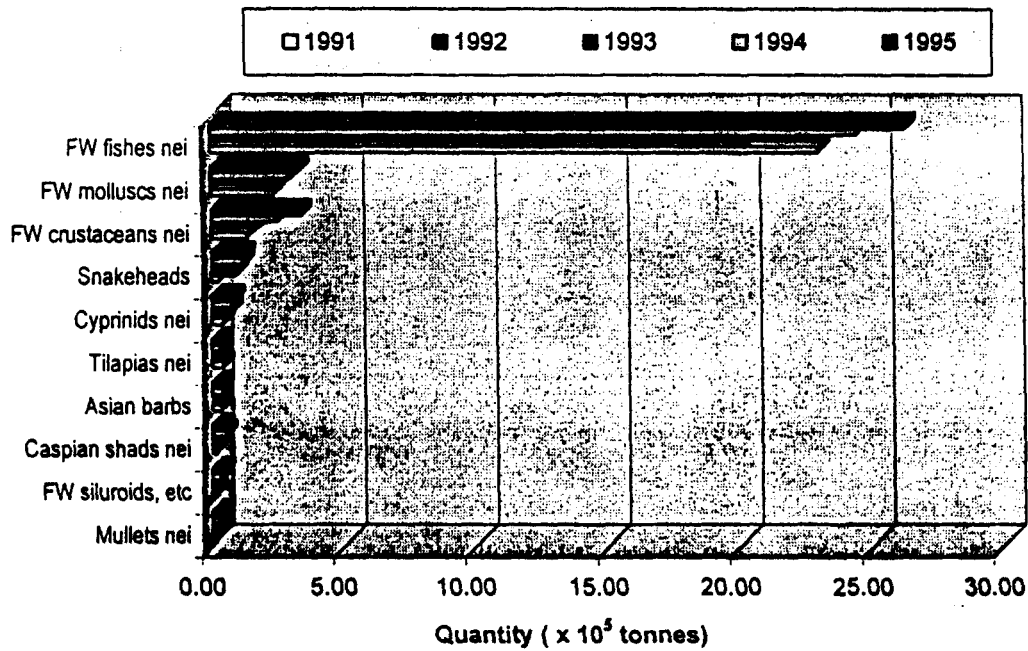


Figure 1. Tonnage of Unidentified Species Items Reported for Inland Capture Fisheries in Asia for 1995 (top 10 reports)

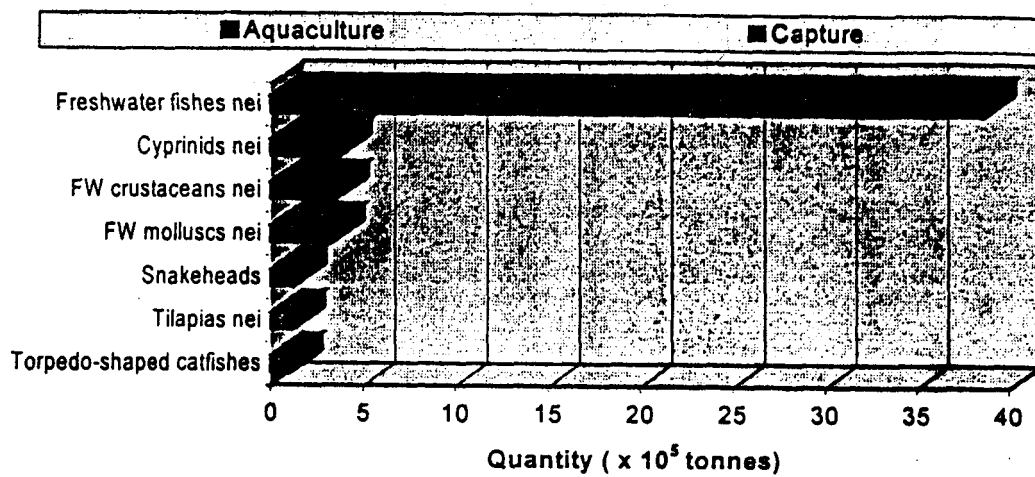


Figure 2. Contribution of Major Species Items to Inland Water Production in 1995. Note: Species items included are those with a production above 100,000 tonnes.

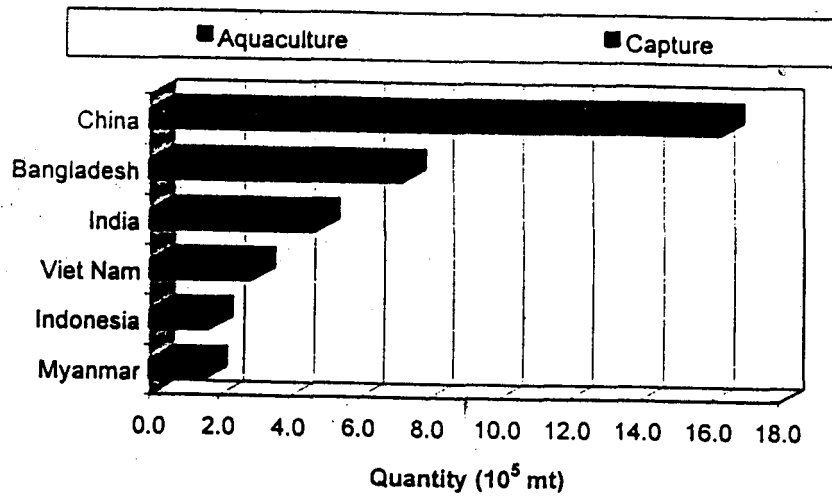


Figure 3. Contribution of Major Countries to Freshwater net grouping in Asia for 1995.

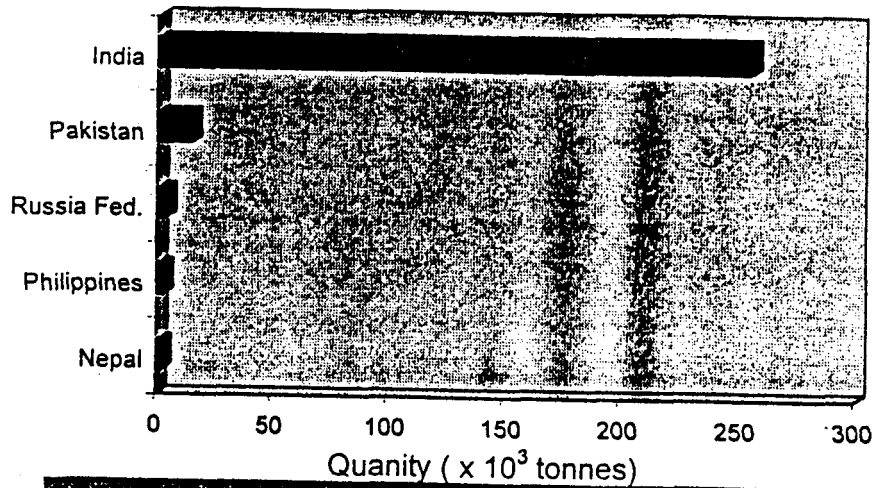


Figure 4. Aquaculture Production of Finfish reported by Countries as Cyprinid net.

Table 1. Classification proposed for various aquaculture and capture fisheries practices. (Modified from CWP1992)

PRODUCTION FROM	DESIGNATION		
	AQUACULTURE	CAPTURE FISHERIES	
		Enhanced	Traditional
Hatcheries	*		
Ponds	*		
Tanks	*		
Raceways	*		
Cages	*		
Pens	*		
Barrages	*		
Integrated vallicoltura production	*		
Private, tidal ponds (tambaks)	*		
Stocked lakes, reservoirs and rivers			
- with other enhancement (predator control and/or fertilisation)			
- modification with "exploitation rights"		*	
- no other intervention without "exploitation rights"			*
Unstocked lakes and reservoirs			
- with enhancement (fertilisation and/or predator control habitat modification), with "exploitation rights"		*	
Rice-fish culture:			
- from stocked rice-paddy	*		
- from unstocked rice-paddy			*
Finfish and other animals harvested from brush parks:			
- managed over time and with other enhancement rights		*	
- harvested on an install and harvest basis			*
Fish and other animals harvested from:			
- fish aggregating devices			*
Molluscs			
- from managed grow-out site (e.g. poles, ropes, net bags)	*		
- subject to open fisheries			*
Aquatic plants			
- harvest of planted and suspended seaweed	*		
- harvest of natural seaweed beds			*
Enhanced marine fisheries		*	
Aquatic organisms caught in open waters			*
Privately owned recreational fisheries			*
Ranching		*	
Fish and other animals harvested from artificial reefs		*	

PROPOSED CONTENTS

SUPPLEMENT ON AQUACULTURE*

FOREWORD

CHAPTER 1. INTRODUCTION

The Need for A Supplement on Aquaculture for the World Census of Agriculture 2000 Programme (WCA 2000)

- 1.1 Background
- 1.2 Extending the Coverage of the WCA 2000 Programme to Include Aquaculture
- 1.3 Types of Aquaculture Activity Under Consideration for the Supplement
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Identification of Aquacultural Activity and Scope

- 2.1 Identification of Agricultural Holdings Conducting Aquaculture Activities
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- 2.4 Census Scope
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- A1 International Standard Industrial Classification of all Economic Activities (Explanatory note on fisheries and aquaculture activities)
- A2 List of cultured species, with scientific and English Names
- A3 List of culture systems being practiced
- A4 List of equipment used in aquaculture
- A5 List of fertilizers commonly used in aquaculture
- A6 List of pesticides commonly used in aquaculture

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* For the World Census of Agriculture Programme 2000 (WCA 2000)

SOCIO-ECONOMIC STATISTICS

A rational fishery management should be concerned not only with catch information but also with economic and social information, specifically on how the catchers of fish or fisherfolk make use of the fishery resources in order to produce the fish. Economic and social information could include a wide variety of data, such as, number and type of fishermen, the returns associated with the different types of fishing activity and types of gear used, markets supplied by the fishermen with their catch, and the characteristics of fish supply and demand, etc. Such information are necessary for the assessment of the success of fishery management programs in order to achieve sustainability of the fishery industry.

The need for renewed attention on the compilation and analysis of socio-economic data on the fisheries sector was recognized, in view of the fact that the development of economic and social statistics in the area of fisheries lags behind the other sectors of the industry. It cannot be denied that there is a great wealth of socio-economic information existing in the Asia and Pacific region. However, the systematic collection and compilation of such information have not been pursued by many countries in the region. The advantages and benefits that could be derived by intensifying the analysis of socio-economic data are emphasized in the papers presented during the Workshop.

Moreover, the need for national governments to review their statistical programs was also raised, in order that countries in the region will be able to keep abreast of the changing requirements and conditions of fishery development and management in the region. Specifically, there is now an initiative to facilitate and promote the inclusion of the fishery sector in national accounts in order to provide policy-makers with reliable measures of the contribution of the fishery industry to the national economy.

SOCIO-ECONOMIC INFORMATION FOR FISHERY MANAGEMENT AND DEVELOPMENT

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1. INTRODUCTION

A wide array of socio-economic data is needed for effective fishery management and development planning. The increasing number of fish stocks fully exploited or approaching the level of non-sustainability requires the introduction of more sophisticated management techniques which in turn demand more specific data. Planning processes including goals of achieving sustainability of development, and growth with equity have increased demands for comprehensive fishery statistics. A growing scarcity of marine resources and their increasing value, accompanied by often inadequate management measures contribute to the increasing conflicts between various resource users. The conflicts are particularly notable between small-scale and large-scale fisheries, when economically beneficial development is blocked by the absence of an efficient system to allocate resources, capital and labor with the risk that many fisheries are subject to overcapitalization, depletion and economic waste. Understanding the socio-economic impact that different management techniques have on the communities that depend on fisheries for their livelihood also requires access to timely and reliable social and economic information.

However, the development of economic and social statistics in the area of fishery lags somewhat behind that of biological data. Renewed attention is required from national administrations as well as from regional and international agencies responsible for the collection and gathering of fishery statistics, to encourage improved regional availability and analysis of socio-economic data of the fishery sector.

2. SOCIO-ECONOMIC DATA FOR MANAGEMENT AND DECISION MAKING

The most salient features for which fisheries differ from agriculture are the common property characteristic of fishery resources. This implies that management responsibilities reside with an institution rather than with individual owners as is the most frequent case in agriculture, and the uncertainty of the output of fishery operations which has important implications in the development planning process. The recognition of the importance of information for fishery management interventions has emerged in response to a tendency to depletion or over-exploitation of many fish stock, due to excessive levels of capital and labor in many fisheries around the world.

The types of information needed for fishery management and development planning are many and vary not only with the policy objectives and the kinds of decisions that need to be made, but also with different stages of fishery development. Biological, technical, economic, social, and institutional information and data are required for sound management.

How much information and routine, long-term data are essential and how reliable the data should be, has to be determined on a case by case basis. The type of data collected, their frequency, and the method of data acquisition vary greatly among countries with the varying importance of the fishery sector in the national economy. Under limited financial resources, gains in precision and reliability may be obtained at the expense of obtaining other information.

Not all data series identified as desirable components of the fishery information system, should be collected for all types of fisheries and with the same frequency. The information required for commercial harvesters (bonafide fishermen) is generally more diverse, due to the different capability of production that commercial activities have, compared to subsistence and recreational fisheries. All sectors should be monitored from the cost and benefits perspective, and some basic characteristic (descriptive data) of the technology used for fishing should also be known. In the acquisition of information and data, small-scale fisheries, as opposed to industrial pose an additional constraint, due to the scattered and frequently isolated location of fishing communities and the seasonality of the operations often associated to fishermen's seasonal migration.

Data and information on the natural and biological aspects of fisheries provide the basic guidelines for management decisions, as they are essential to indicate the limitations and constraints of the resources and would determine the level of fishing pressure that can be applied without threatening the sustainability. Fishery administrations generally have well-established systems to capture and analyze this type of information. The provision of data for stock assessment, resource management (including allocation among fishing units and licensing) and enforcement are generally the primary functions of national fishery statistical systems. Environmental and physical data can be derived from the national statistical systems and also from research. Biological data are gathered through experimental fishing, fish resource surveys and catch records.

Fishery data needed for economic research are those for which statistics have been lagging somewhat behind in the development within many national systems. The fishery economic component is essential to understand the overall functioning, in so far as it relates the benefits generated to their distribution within the fishery sector.

Economic statistics are necessary for estimating the net benefits that a nation derives from its aquatic resources, for measuring the impact of management decisions and monitoring the economic evolution of such decisions over time, as well as the influence of external factors on fisheries. As an example, FAO/SEAFDEC/97/Inf.5 presented at this Workshop, contains a case study on the use of national economic accounting to estimate the contribution of fisheries to the national economy of Norway, a major fishing nation. Essential types of data needed for such an exercise include cost of harvesting, trends in fish prices of catch, income of fishermen, returns to capital and changes in return in relation to fishing effort, price and income elasticities of demand for fish and substitute products. Information on fixed and variable costs is basic, the former including costs associated with vessel and gear maintenance and depreciation, of acquiring fishing licenses and permits, while the other cost for insurance, taxation and professional expenses for the administrative part of fishing. Variable costs would include cost of fuel per trip, crew wages and remuneration system, etc.

Most of such data are dynamic in character and are influenced by both internal and external forces. To acquire them, a diversity of approaches is required. The major sources of information are markets, fishermen and fishing communities, traders and middlemen, but also periodic official statistics assembled for more general purposes.

Social information includes the number of fishermen, according to occupational status, trends in numbers of fishermen and their occupational mobility, functioning of formal and informal fishermen's organizations, traditional concepts of property rights to access fishing grounds, and conflicts among different fishermen groups in resource exploitation. The adequate consideration of human and social aspects is important in determining the success or failure of management policies.

Fishery management decisions affect not only a fishery, but the economy as a whole. These may include:

- a) decisions concerning whether and how limited entry should be imposed for domestic fisheries, whether foreign fleets should be provided access to the country's exclusive economic zone (EEZ) and how much they should be charged for access, which management technique should be adopted in allocating resources exploitation; and
- b) how to reduce conflicts between artisanal and commercial fishermen. The consequences of these decisions must also be considered beforehand, and afterwards.

3. REQUIREMENTS AND PROBLEMS IN DATA COLLECTION

The data required for rational management are complex and they evolve in response to changes in the way fisheries are exploited, to the structure of the industry, national and international laws, and resource management practices. A comprehensive fishery information system requires description of its basic components, of the structures of the activities in the fishery process, the flow of products, services and other factors. From an economic and social points of view, the system should identify linkages among its basic components, such as:

- a) social (e.g., fishing community) and productive units (fishermen, processing plants);
- b) resource units (stocks, fishing areas); and
- c) market units (e.g., wholesaler, retailer).

The flow can be followed quantitatively or financially, to capture the profits and rents from fisheries. Fish abundance and distribution, fishing power and labor skill, domestic and foreign market demand are factors influencing production. Information is costly to collect, the costs being higher initially when the benefits are lower. The acquisition of all desirable information is very costly especially where tropical conditions prevail. That is, the existence of widely scattered multispecies fisheries as they prevail in the region.

The identification of data needs is a long process based on consultation among all parties concerned, taking into account the costs of collection. It is imperative to identify the information which is of prime importance for a wide range of management decisions and also to require such information in a cost-effective manner. Data and information on the activities (fishing, landing, processing, marketing and distribution, domestic consumption, trade) usually give more emphasis to the structure rather than to the evolution over time.

The relationship linking various elements, activities, and components may be expressed by coefficients, parameters, rates, and performance indicators. Examples are elasticities, production coefficients, prices, rates of unemployment, exchange rates, and coefficient of income distribution.

4. REGIONAL PERSPECTIVE

Fisheries in the Asia and Pacific region are contributing substantially to satisfying nutritional requirements of people, generating employment and earnings, through exports and granting access rights to foreign fleets. Fisheries and aquaculture have by and large kept pace with increasing demands of large and growing populations. However, there are many signs of economic dislocations and changes that have brought excessive pressure on coastal areas, including over-exploitation of coastal resources. Also in many countries (notably Thailand, the Philippines and Indonesia) traditional collective systems of resource management have been rapidly changing under the pressures of monetary forces, and as a result of increasingly scarce resources, without being replaced by entirely satisfactory alternative systems.

A wealth of socio-economic information exists regionally both for capture and culture fisheries. National and regional studies and research available deal with: a) problems of fishermen's income and of fishing community living standards; b) policy oriented overviews of management and development options; c) analyses of fishing regulatory proposals with socio-economic perspectives; d) studies of traditional common property resource systems and community-based management system; e) descriptive and analytical studies of labor markets including gender roles in fisheries; f) economic analyses on cost; and g) earning and marketing. Many data are generated by surveys conducted on fishing communities.

Systematic collection and availability of socio-economic fishery data are not equally pursued by countries in the region. Economic statistics are already collected in countries where an established fishery licensing system exists which requires the estimation of the cost of fishing and the assessment of economic performance of different gear types. Cost and earning surveys are systematically conducted only in some countries, mainly by means of periodic interviews of a sample of fishermen. In Japan the method applied (the book-keeping system) covers aspects related to the fishery household income and expenditures.

Fish producer price surveys are conducted only in a few countries, through the recording of fish market transactions. The lack of systematic information on the value by species at point of landing has far-reaching implications on the ability of the administration to apply an interdisciplinary approach to fishery management. The collection of landed catches data by species and by gear in both quantities and values should be regarded as the absolute minimum requirement. In most countries, fish prices are available at the wholesale and retail levels, frequently being collected at regular intervals by systemic visits to fish markets. Such prices may be used for assessing seasonal price variations only.

In selected countries in the region, censuses are used to collect fishery statistics, particularly structural data (Japan, Taiwan Province of China, Thailand, Korea, Indonesia). In developing countries these have been conducted to the extent possible in conjunction with agricultural censuses to optimize resource use. Although a census is an efficient and reliable method to collect structural data, they are infrequent and they may not capture enough information on small units. The information collected is often not analyzed to the extent that data purport, or are not presented in a form that allows establishing benchmarks. Also the results of censuses are often delayed and the dissemination of the information to users takes place some years later, thus detracting substantially from the potential value of data to users and risking to take wrong decisions based on facts that may have evolved differently since the data were collected.

Sampling has the advantage of reduced implementation cost, and lower probability of error in data collection and handling. It may be best suited and effective to capture information in small scale fishing communities where seasonality of fishing obliges harvesters to diversify their sources of income.

5. REMARKS AND CONCLUSIONS

Many fisheries have sharply declined in recent years, as a consequence of overfishing. In coastal and shelf areas, where species survival is also threatened by pollution and other environmental damages, the problem is more acute. Increased concern regarding the sustainable contribution of fisheries to national economic, social and nutritional goals echoed in international fora, have resulted in greater responsibilities for fishery administrations in assessing, regulating and monitoring fisheries.

However, it is apparent that most fishery administrations in the past have tended to concentrate on data for which they have exclusive responsibility, that is catch, effort and stock assessment data. Since socio-economic data collection is a responsibility frequently shared with other institutions, it has been regarded as an area of low priority in most countries.

National governments should periodically review their fishery statistical programs to:

- a) determine what changes to the on-going system are necessary to meet a rising need; and
- b) re-organizations and improvements that may be necessary.

This process requires close participation of data users, the research workers in economics and government officials requiring data in the fishery program administration. Given the constraints in planning and implementing new inquiries, benefits would be derived in the short term by intensifying analysis of socio-economic data becoming available from surveys originating outside the fishery sector (e.g., population surveys, labor surveys). Conversely the intensified and closer participation of fishery administrations to national statistical programs would maximize the benefits to be derived from these surveys and ensure a correct understanding of the complexity of fisheries.

6. CASE STUDY OF THE PREPARATION OF NATIONAL ECONOMIC ACCOUNTS: NORWAY

The results of the survey is given as Appendix to this paper.

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**CASE STUDY OF THE PREPARATION OF
NATIONAL ECONOMIC ACCOUNTS: NORWAY¹**

by
Ann Lisbet Brathaug

1. NATIONAL ACCOUNTS AND ECONOMIC PLANNING

National account statistics give an overall view of the economy in a country. It gives a systematic, consistent and statistical description of the economy as a whole and the inter-relationship between the different economic sectors and between the total economy and the rest-of-the-world.

Within the national accounts the society is separated into activities and sector accounts which are all parts of the overall national accounting system, thus giving information on each economic sector as well as the linkage between the different economic sectors. The accounts themselves present in a condensed way, a great mass of detailed information, organized according to economic principles and perceptions about the working of an economy.

The national accounts system provides a set of concepts, definitions and classifications within a broad accounting framework, and is designed for purposes of economic analysis and policy-making. The national accounts, therefore, serve as an essential basis for economic policy in a country. In many countries, the national accounts have performed a dual function. First, the accounts serve to monitor the performance of economic policy. Secondly, the data and the underlying framework are fed into econometric models that are used for national budgeting, macro-economic planning, forecasts and various economic analyses. Integrating supply and use of tables on an annual basis in the national accounts, and arranging the basic economic statistics in order to fit in with the purposes of the national accounts, provide for a useful empirical basis for constructing such econometric models.

In the national accounts, valuation is restricted to market values. The accounts do not take into account biological resources. The use of the natural environment for economic purposes is not taken into account in the calculation of costs in the national accounts and therefore not reflected in gross domestic product (GDP). There can be examples where the national accounts show an increase in the value produced by fishing and the company's own financial statement show a profit, where there are in reality losses and a reduction in the value produced if one takes into account the cost that accompanies over-exploitation of biological resources. This is a cost that compared with the conventional methods after some years, will manifest itself in reduced production value and losses (Nordic Natural Resource and Environmental Accounting, Nordisk Ministerrad 1996).

¹ Draft of possible guidelines on fisheries for the FAO System of Economic Accounts for Food and Agriculture
Appendix to Socio-Economic Information for Fishery Management and Development

2. SUPPLY AND USE TABLES

The 1993 UN System of National Accounts (SNA) includes an integrated set of supply and use tables. They provide a detailed analysis of the process of production and the use of goods and services and the income generated in that production. The concepts and definitions of the supply and use tables of the SNA are the same as in the rest of the System. Its role is primarily related to the goods and services accounts and to the shortened sequence of accounts for industries.

In complement to the full sequence of accounts for institutional sectors, which covers all kinds of accounts in the System, the supply and use tables serve to provide a more detailed basis for analyzing industries and products in the System through a breakdown of the production accounts, the generation of income accounts, and the goods and services accounts.

The supply and use tables serve both statistical and analytical purposes. They contain information which show inter-relationship between producer and user, thus providing a framework for checking the consistency of statistics on flows of goods and services obtained from different kinds of statistical sources. The supply and use tables are also appropriate for calculating much of the economic data in the national accounts and for detecting weaknesses. This is particularly important for decomposition of values of flows of goods and services into prices and volumes for the calculation of an integrated set of price and volume measures.

The supply and use tables are data-oriented in nature, while the symmetric input-output-tables are constructed from having made certain analytical assumptions, usually from the supply and use tables. The symmetric input-output tables serve as a tool for various analytical purposes related to production, thus the input-output data are conveniently integrated into macro-economic models in order to analyze the link between final demand and industrial output levels, or the link between industrial input and output levels etc.

The goods and services accounts play a fundamental and important role in the national accounting system. The supply and use balances are derived on this basis. They show for the economy as a whole and for groups of products, the total resources in terms of output and imports, and the use of goods and services in terms of intermediate consumption, final consumption, gross capital formation, and exports. By incorporating the production and generation of income accounts, an overall framework is obtained for depicting the production sphere.

3. ACCOUNTS ON FISHERIES

According to the System of Economic Accounts for Food and Agriculture (SEAFSA) 1996 (Annex 2.8), a proper system of accounts should provide policy-makers with reliable measure of the contribution of the fishery industry to the national well-being. For the fisheries sector, SEAFSA may be regarded as a framework for analyzing the mutual relationship between production activity, income originating from production, and the use of income for consumption and capital accumulation.

Capture fisheries are essentially different from farming in that much of the output of the individual farming households may still be considered as one productive unit, whereas this is not generally true fishing. The household can be important in some types of fishing in certain countries, but generally some members of fishing households have other occupations than fishing, and members of a fishing units do not have to belong to one household. A characteristic fishing unit may catch several species of fish, but does not catch anything other than fish. Hence, in this sector, the characteristic fishing household will be almost impossible to investigate.

Since there is no characteristic institutional unit to investigate, the economic accounts should be compiled for the fishery industry. Establishments are units which are identified only for the purposes of measuring production. An establishment is intended to be a unit whose production is as homogenous as possible and ideally it should be engaged in only one single type of production activity. However, the total output from establishments will in practice, tend to include some output from secondary activities. Establishments are conceptually distinct from institutional units. If an institutional unit contains only a single establishment, the production account for the establishment will be the same as for the institutional unit. It is the institutional unit <<that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities>> (1993 SNA paragraph 4.2).

The only accounts that can be compiled for establishments are production and generation of income accounts. The production account will give the total output from fisheries, distributed on different fish species, the value of intermediate consumption, and the value added from fisheries. The generation of income account will show how value added from the fishing activity is distributed between compensation of employees, taxes and subsidies on production and mixed income or operating surplus (gross).

Although production and generation of income accounts only can be compiled for establishments, it is possible to collect additional data for the establishments. In line with the recommendations of the 1993 SNA, data for gross fixed capital formation for the fishery industry should be collected, broken down by type of asset. Numbers of persons engaged in fishery, split as self-employed (owners and unpaid family workers) and employees, should also be collected, and estimation on hours worked should be made. However, hours worked in fisheries is not a well-defined variable and may be very difficult to estimate.

Included in the accounts of SEAFSA, are also goods and services accounts. These should be compiled for individual fish species or a designated set of fish species. The goods and services accounts show on the one hand, the fish species produced and imported during the year, and on the other hand, the uses of the fish species. The total supplies is by definition equal to the total uses. In general, output from domestic establishments plus imports equals intermediate consumption plus final consumption expenditures plus exports plus gross capital formation. The output from domestic producers include, in addition to output from fisheries, trade and transport margins on the product. On the resources side, value added tax is also included and if output is recorded at basic prices, other taxes/subsidies on products also have to be included. The goods and services accounts will give the inter-relationship between the output from the fishing activity and the other economic industries/sectors. The production and goods and services accounts should be compiled both in current and constant prices, while the generation of income account is compiled in current prices only.

4. SOURCES OF DATA AND METHODS OF ESTIMATION

According to the recommendations of the 1993 SNA, the industry classification of the national accounts should be based on ISIC Rev. 3 (UN Statistical Papers, Series M No. 4, Rev. 3). Fishing is classified as ISIC-class 050 group 0500, and includes fishing on a commercial basis in ocean, coastal or inland waters. It also includes fish farming, breeding, rearing, cultivation of oysters for pearls or food and service activities related to marine and freshwater fisheries and to operators of fish hatcheries or fish farms. Excluded is processing of fish on vessels or in factories abroad, which is classified as manufacturing (ISIC-class 1512 processing and preserving of fish and fish products).

Fishing in ocean, coastal or inland waters differs from the production in fish farms. For both industries the product is fish, but the production processed is very different. In ocean fishing, vessels will be the important capital asset, and hence, fuel expenditures and repairs and maintenance of the fishing boat and gear will be important intermediate consumption items. In aquaculture, the production machinery and equipment will be different from what is used in ocean and coastal fishing. Intermediate consumption in aquaculture will mainly consist of fingerlings and animal feed (the fry or fingerlings will be produced and used in the same industry). The work-in-progress will be important in aquaculture. Since the production process in fisheries and aquaculture is so different, for analytical purposes it will be advisable to establish separate production accounts for the two industries.

Any definition of the fishery sector is fragmented in many ways. Fish go through many processes before being consumed and to place the boundary of this industry at the point of any transaction is difficult. It is statistically most convenient to adopt the industry definition when drawing the borderliness between what is fisheries and other industries. For policy purposes it is not satisfying to analyze only the fishing activity. The activity of the processing and preserving industry is also important. For instance, the country's revenues from exporting fish consist both of the revenues from exporting fish directly, as well as exporting fish indirectly as processed products. It is important to design the accounts for fisheries according to the particular economic features of the industry, while being compatible with the national accounts.

To reduce the statistical problems of recording the accounts, the production boundary for fisheries should cover all the fishing activity on a commercial basis in ocean, coastal or inland water. The household's fishing for own final consumption fall within the production boundaries in the SNA, and should be taken into account in the SEAFA. The fishing for own final consumption should be calculated either in the production account for market production (the commercial fisheries), or in a production account for non-market production (non-commercial fisheries).

The sources of data for the compilation of SEAFA include fishery censuses, surveys on economic results for fishing vessels, catch statistics, manufacturing statistics, external trade statistics, surveys of fishermen, register of fishermen, register of fishing vessels, license register, household budget surveys and government accounts. When compiling the accounts, it is often necessary to use several of the available sources. Some of the sources consist of data with complete coverage of the fisheries, while others consist of data with incomplete coverage.

Generally, fishery censuses will be used as benchmark information, while current calculations will be based on different surveys and information from registers. Manufacturing statistics, external trade statistics and household budget surveys will contain data to be utilized in the goods and services accounts when compiling intermediate consumption and final use figures. In Norway, all boats which are used in commercial fishing are registered in the Vessel Register by the Directorate of Fisheries. The boat owner is obliged to report his boat to the register, and to report sale or condemnation of the boat if the boat for any reason is removed from fishing activity. Information from the register of fishing vessels is important for determining the population of fishing boats, and for estimating gross fixed capital formation. The Norwegian municipal register of fishermen comprises persons engaged in sea fisheries, whaling or sealing. Crew onboard the boats are included in the register whether they directly take part in fishing or not. To be registered in the municipal register, the fishermen have to exceed a certain minimum time about their participation in fisheries and income from fisheries. The register gives information to be used for the compilation of employment in fisheries. In some fisheries, participation is conditioned by license from the Norwegian authorities. The Directorate of Fisheries records such licenses.

Market output

According to SNA 1993, goods and services produced for sale on the market, may be valued either at basic prices or at producer's prices. The preferred method of valuation is at basic prices. The basic price is <<the amount receivable by the producer from the purchaser for a unit of good or service produced as output minus any tax payable, and plus any subsidy receivable, on that unit as a consequence of its production or sale>> (1993 SNA paragraph 6.205).

The market output from fisheries can be compiled by using either economic results for fishing vessels or using information from catch statistics. In Norway, the Directorate of Fisheries compiles catch statistics. Most of the information comes from the sales associations which have statutory protection for first-hand sales of fish. The information from the sales associations also comprises Norwegian catches landed abroad. In some fisheries the boat owners are obliged to keep catch journals. This concerns trawling of cod fish and catch of small whales. The catch statistics from the Directorate of Fisheries are detailed, showing the catches and landing of all fish species both in quantity and value. Sealing, seaweed, oysters and mussels are not covered by the catch statistics, neither are unregistered sale of fish or fishing for own final consumption.

Another source for compiling the market output from fisheries is the data from surveys of the economic results for fishing vessels. In Norway, a survey is conducted only for vessels defined as <<whole year operated vessels>>. The results of this survey are published by the Norwegian Budget Commission of Fishery every year. It gives information on the income from fishing and the income from other sources (e.g. transportation of goods). Income from sources outside fishing is of minor importance in Norway.

In Norway, the catch statistics are considered as most reliable, thus giving the value of landed fish in the production account. In the catch statistics, the value is based on producer's price (VAT excluded). A certain product tax is levied on the first-hand value of landed fish and by correcting for this tax, the basic price is obtained. The production value is distributed on specific products as cod, herring and capelin, mackerel etc. (Table 1).

The catch statistics do not include unregistered catches, which comprise fish sold directly to the consumers by the fishermen. Imputations for unregistered catches are made, even though by nature it is difficult to estimate. In Norway, studies show that unregistered catches are now of minor importance. In countries where there are no sales associations with statutory protection for first-hand sales of fish, unregistered sales can be important. A fishery census can give a benchmark estimate on the value of unregistered sales, and this estimate can be extrapolated to other years as a fixed proportion of registered sales.

Production for own final use

The value of fixed assets being produced on own account, is supposed to be included in the production account. Data for own account production of fixed assets is difficult to obtain without any census or sample survey. If data are available from a census, this can be used as a benchmark estimate and extrapolated to other years on the basis of estimates on man-week/hours and hourly wages for similar economic activities. Benchmark estimates can also be extrapolated in proportion with gross fixed capital formation. Fixed assets produced for own gross fixed capital formation are valued at their estimated basic prices or alternatively by their cost of production (1993 SNA paragraph 6.48).

In Norway, the households own account production is compiled in a separate production account. The figures are based on quantity data from the fishery census and extrapolated to subsequent years by assuming a small decrease in quantity every year. The quantity is converted to value by using the same prices as for comparable registered landed fish after correcting for product taxes (and subsidies). According to SNA 1993 (paragraph 6.219) <<output produced for own final use should be valued at the average basic prices of the same goods or services sold on the market, provided they are sold in sufficient quantities to enable reliable estimates to be made of those average prices>>. The production account in Table 1 includes both households own account production and market production.

Intermediate consumption

Intermediate consumption consists of the value of the goods and services consumed as inputs in the production process. It should be valued at purchasers' prices, where deductible value added tax is excluded.

Various items may be classified as intermediate consumption. The composition of the intermediate consumption depends on the technical level of the production process, on whether the fishing is inshore or in distant water. In Norway, where the mechanization degree is high, items such as repair and maintenance costs and fuel consumption are the most important sub-categories included in intermediate consumption. The distinction between maintenance and repairs and gross fixed capital formation is however, not clear-cut. According to 1993 SNA (paragraph 6.161), ordinary maintenance and repairs are distinguished by whether:

- a) they are activities or current costs that cannot be avoided if the fixed assets are to continue to be used; and
- b) they do not change the fixed assets or its performance, but simply maintain it in good working order or restore it to its previous condition in the event of a breakdown.

In Norway, repair and maintenance costs contribute to over 40 % of total intermediate consumption, and fuel is about 30 % (Table 1). Data for estimating the value of the different intermediate consumption items can be available either from sample surveys of the costs in fisheries or from surveys of the economic result in fisheries. Benchmark estimates can be based on figures in fishery census and extrapolated to other years by the sample surveys. Purchased repair services related to fishing vessel and gear, can alternatively be extrapolated on the basis of manufacturing statistics. In Norway, manufacturing statistics will contain output data on <<repair work on fishing vessels>>. The supply of repair services will consist of output from domestic industries and imports of repair services. Since there should be no changes in inventories for repair services, the supply and use have to balance, and hence, intermediate consumption of repairs is made equal to total supply.

In Statistics Norway, natural resource accounts are worked out regularly for energy. These are material accounts that show the use of the energy resources by industry. The resource accounting framework is based on existing economic standards and industry classification, thus ensuring general consistency in the sectoral classification of economic and resource related data statistics. As the national accounts use the same industrial classification, data from the resource accounts are utilized to extrapolate the quantity of fuel. The price basis is direct statements from the oil companies as well as price regulations for mineral oil products. The estimates of fuel expenditures made in this way are compared with the estimates based on the survey of economic results in the fisheries. If the estimates differ, corrections can be made. Due to different rebate-agreements, the price information will be a work point and may therefore be adjusted.

Certain goods and services used by enterprises or establishments do not enter directly into the production process but are consumed by employees working on that process. In such cases it is necessary to decide whether the goods and services are intermediate consumption, or remuneration in kind to employees. <<In general, when the goods and services are used by employees in their own time and at their own discretion, for the direct satisfaction of their needs and wants, they constitute remuneration in kind>> (SNA 1993 paragraph 6.153). If the employees are obliged to use the goods or services in order to enable them to carry out their work, they constitute intermediate consumption. This means that clothing and footwear of a kind which ordinary consumers do not choose to purchase or wear, and which are worn mainly at work, should be treated as intermediate consumption. The same are special meals or drinks provided to fishermen on active duty. From the employer's viewpoint it is immaterial whether such expenses are treated as remuneration in kind or as intermediate consumption. However, reclassifying such items from remuneration in kind to intermediate consumption, changes the value added and hence the GDP as a whole.

Consumption of fixed capital

According to SNA 1993, it is recommended that consumption of fixed capital is compiled in conjunction with estimates of the capital stock. These can be built up from data on gross fixed capital formation in the past combined with estimates of the rates at which the efficiency of fixed assets decline over their expected service life. The method is called the perpetual inventory method, or PIM. A description of this method is given in <<A System of Economic Accounts for Food and Agriculture>>, FAO Statistical Development Series 8, page 88.

Compensation of employees

Compensation of employees is recorded under uses in the generation of income account and is defined as the total remuneration, in cash or in kind, payable to an employee in return for work done by the latter during the accounting period. No compensation of employees is payable for the work done by members of a household within an unincorporated enterprise owned by the same household (1993 SNA paragraph 7.21). Unpaid family workers are treated as self-employed. It is not self-evident whether a worker is an employee or self-employed. Some workers paid by results may be employees while others may be self-employed. It is necessary, therefore, to clarify the nature of the employment relationships in order to fix the boundary between compensation of employees and other kinds of receipts.

In Norway, the municipal register of fishermen comprises all persons who are engaged in sea fisheries, whaling or sealing. Crew on fishing boats are included even if they do not take part in fishing directly. Normally the fishermen on boats, including the crew, are paid by result, and neither the owner of the vessel nor the employee, pay social contributions on the same basis as other employers or employees. Instead there is a product tax levied on the first-hand value of landed fish. In Norway, it was decided to treat fishermen and crew on fishing vessels as employees, and the owners of the unincorporated enterprises in which they work, as self-employed persons. Self-employed persons receive mixed income and not compensation of employees. The tax mentioned is in the national accounts treated as a product tax and not as part of compensation of employees. Compensation of employees has two main components, namely:

- a) wages and salaries in cash and kind; and
- b) social contributions payable by employers to Social Security Schemes or to private funded social security schemes.

Data for compensation of employees can be obtained from surveys of the economic result in fisheries. Alternatively, the register of fishermen can provide data about the number of fishermen. Labor force data, if available, can also give information about the number of employees and hours worked. Combined with average wage rates in fisheries, estimates of wage and salaries can be compiled. Estimates for social contributions can be compiled using information from government statements or law regulations.

Taxes on production

Taxes on production are unrequited payments made by enterprises to government units. They are taxes on products payable on products when they are produced or sold. These are usually proportionate to the quantity or value of products sold. Other taxes on production consist mainly of taxes on the ownership or use of land, buildings or other assets used in production or on the labor employed (SNA 1993 paragraph 7.49).

When production is valued at basic prices, all taxes (subsidies) on products payable (receivable) on the goods produced are deducted from (added to) the value of that output at a producer's prices. In this case, the taxes (subsidies) on products are not to be recorded under uses in the generation of income account.

However, if output is valued at producer's prices, the taxes (subsidies) on products have to be recorded under the generation of income account for an industry. Invoiced VAT is never included in the value of the output, and will therefore, never be recorded under the generation of income account for an industry or institutional unit. Tax data are generally available from the government offices collecting taxes, but it can be difficult to allocate the sum of taxes to local kind of activity units. Estimates of taxes on production paid by the fishery industry may be compiled on the basis of suitable indicators.

Subsidies

Subsidies are current unrequited payments that government units make to enterprises on the basis of their production activity or the quantity or values of the goods which they produce or sell. Subsidies are equivalent to negative taxes on production. The data source for estimating subsidies are government income and expenditure statements. More detailed data can be available from the Ministry responsible for the implementation of subsidies schemes, if such schemes exist for the fishery sector. If production is valued at basic prices, only other subsidies on production, not subsidies on products, shall be compiled in the generation of income account.

Mixed income and operating surplus

Operating surplus or mixed income is the balancing item in the generation of income account and defined as:

value added (net),
less (-) compensation of employees,
less (-) other taxes on production (included taxes on products if output is valued at producer's prices)
plus (+) subsidies receivable (included subsidies on products if output is valued at producer's prices)

Value added should be valued net, after deducting consumption of the fixed capital. If consumption of fixed capital is difficult to measure, value added may be valued gross in the generation of income account. The operating surplus, or mixed income, will then be valued gross.

Mixed income is the term reserved for un-incorporated enterprises owned by members of household, in which the owner or other members of the household, may work without receiving wages or salary. For the fishery industry, the balancing item of the generation of income account will consist mainly of mixed income. If fishing vessels are owned by other institutional units than households, the balancing item will be the operating surplus.

According to SNA 1993 paragraph 10.33, gross fixed capital formation is measured by the total value of a producer's acquisitions, less disposals of fixed assets. New fixed assets acquired by purchase are valued at purchaser's prices. The purchaser's prices include all transport and installation charges, and costs incurred in the transfer of ownership.

Purchases of existing fixed assets are also valued including transport, installation and other costs incurred by the purchaser, while sales of existing fixed assets are valued after deducting any cost of ownership transfer incurred by the seller. Fixed assets produced for own gross fixed capital are valued at basic prices or alternatively by cost of production.

In the fishery industry, gross fixed capital formation by type of assets include:

- a) fishing vessels,
- b) machinery and equipment (fishing gear),
- c) computer software, and
- d) boat houses.

Fishing vessels and fishing gear will be the most important assets. The main source for estimating gross fixed capital formation in fisheries are data collected through fishery census or sample surveys. The censuses will give the benchmark estimates by type of assets, while the sample surveys can be used to extrapolate gross fixed capital formation to other years. Alternatively, purchases of fishing vessels can be estimated by using data from supply and use tables in the overall national accounting system. Manufacturing statistics provide data for domestic supply of new fishing boats, while external trade statistics provide data for imports of new and old fishing boats. The exports of fishing boats, new and old, will also be available from the external trade statistics. Assuming that existing fishing boats sold domestically always are sold or purchased within the fishery industry, the acquisitions less disposals of fishing boats can be compiled as domestic production of fishing boats plus imports less exports (commodity flow method). In Norway, the Vessel Register by the Directorate of Fisheries can also be used to estimate of new boats and sales or purchases of existing boats.

Major renovations of existing boats which increase the productive capacity of the boats or significantly extend their previously expected service life, shall be treated as gross fixed capital formation. Major renovations of boats can be estimated in the same way as purchases of boats, as total domestic production plus imports less exports. Alternatively, benchmark estimates can be extrapolated by using data from sample surveys, if such exist.

If no data for gross fixed capital formation of machinery and equipment (fishing gear) are available, the benchmark estimate can be extrapolated by using the growth of purchases of fishing boats (in fixed prices) as indicator. Gross fixed capital formation in current prices is obtained by inflating the estimate in fixed prices with a price index for machinery and equipment.

The number of goods and services in the national accounting system will differ from country to country. The SNA 1993 recommends that the product classification should be based upon the Central Product Classification (CPC). At the 3-digit level there is only one product, while at the 5-digit level there are four products related to fisheries (fish, crustaceans, other aquatic products, and pearls). In Norway, seven fish species are specified as follows.

- a) salmon and trout (not important in fishery industry, but important in aquaculture),
- b) herring and capelin,
- c) cod,
- d) mackerel,
- e) other fish species,
- f) shrimps and shellfish, and
- g) other ocean products.

In addition, there is one item containing all fish species produced in own account fishing. In Norway, Classification of Products by Activity (CPA) is used for classifying the products. The breakdown of product is, however, also made taking into account which fish species are important for the Norwegian economy and at the same time trying to make the products as homogenous as possible.

Use of goods and services, both intermediate consumption and final uses, shall be recorded at purchaser's prices. The components of the purchaser's prices can be recognized as (SNA 1993 paragraph 15.26):

Basic price of the product as output,
 Plus (+) taxes on the product,
 Less (-) subsidies on the products,
 Plus (+) trade and transport margin inn delivering the product to the purchaser (valued at basic prices).

The taxes/subsidies on products include both taxes/subsidies payable/receivable by the producer and the wholesalers and retailers. The product taxes also include non-deductible value added tax (VAT).

The domestic output given in the goods and services accounts should be fully consistent with the supply in the production accounts. The preferred method of valuation is at basic prices. The output of wholesale and retail trade is measured by the value of the trade and transport margins realized on the goods they sell. The margins are also valued at basic prices and should be done for each product. The compilation of the goods and services accounts is shown by the numerical example given in Appendix.

Changes over time in the values of flows of goods and services can be factors into one component reflecting changes in the price of the goods and services concerned and one component reflecting changes in their volume. One method to be used is to deflate every product flows in the goods and services accounts. In this way value added can be measured at constant prices by subtracting intermediate consumption at constant prices from output at constant prices. This is called the <<double deflation method>> (SNA 1993, chapter XVI).

5. ENVIRONMENTAL ACCOUNTING

The World Commission for Environment and Development has recommended that accounts of natural resources and state of the environment are developed and presented in addition to traditional national accounts. The UN Conference on Environment and Development in Rio de Janeiro in June 1992 emphasized natural resource and environmental accounting as important tools to obtain a sustainable development. The fifth environmental program of EU, which was adopted in 1992, also emphasizes the necessity of developing environmental accounts, and the goal is that environmental accounts shall be established in the Member States before the year 2000.

UNStat is developing a satellite system to the SNA, called System of Integrated Environmental and Economic Accounts (SEEA). A preliminary version of such a handbook was published in 1993, *Integrated Environmental and Economic Accounting*. SEEA consists of several different parts, with both physical and monetary accounts. The first step is to link environmental data expressed in physical units with the national accounts system. The second step will be the monetary accounts which are based on the physical accounts to evaluate the impact in economic terms.

SEEA comprises four sections which all have parts that can be combined with the traditional national accounts (see *Integrated Environmental and Economic Accounting 1993* chapter C3), these are:

- a) Disaggregation of the traditional national accounts so as to better illustrate environmental aspects (monetary accounts only) (part A);
- b) Description of the interrelationship between the environment and the economy in physical units (part B);
- c) Estimate of costs for use of natural assets (monetary accounts) (part C); and
- d) Extending SEEA further with, for example, the effects of using environmental services and the activities carried out by the households (part D).

Environmental accounts for fisheries should concentrate on part A and B. Part A provides the basic framework for the SEEA. It contains a description of the production and consumption activities (supply and use tables) and the accounts of non-financial assets. The assets accounts comprise opening stocks, net capital formation, other volume changes, revaluation due to market price changes and closing stocks. Part B comprises physical accounts shown as natural resource accounts and material/energy balances. Natural resource accounts show how nature is utilized or affected by the economy and also show the changes in natural resources, e.g. through economic influence. Apart from the flows into and inside the economy, the material flow consist of the flows of residuals leaving the economy and in turn the impact on the natural environment.

The Norwegian Ministry of Environment was established in 1972, and a search for suitable management tools for natural resources was initiated. Natural Resource Accounts (NRA) were seen as an important part of the necessary tool kit and from 1978 Statistics Norway was given the task of developing such accounts for Norway. The purpose of these accounts was to provide better and more long term planning of the exploitation of natural resources, and emphasis was put on the resource aspect.

The first NRA established for energy, minerals, forest, fish and land use in the early 1980s. Today there is less interest for natural resource accounts in Norway, and in their original form accounts are only worked out regularly for energy. The stock part of the accounts for fish and forest (woods) are also updated regularly (Sæbø 1994).

The Norwegian resource accounts are mainly material accounts. They comprise accounts for reserves in nature and for the material flow of resources from extraction until their use. Figure 1 shows the structure of the Norwegian material resource accounts (Alfsen 1996). Reserves of biotic resources are usually called stocks. In the Norwegian case, the stock accounts show how the stocks change due to recruitment and growth, revaluation (because of better knowledge) natural death, and extraction.

Some points which are worth noting with regard to the structure in Figure 1:

- a) The account consists of more than the reserves accounts (not for fish at the moment). This is essential when it comes to using the accounts for management purposes. It is important to know how they are going to be affected by a change of policy. The end use accounts are essential for this kind of analysis. The end use accounts should be consistent with the use side of the goods and services accounts (in the traditional national accounts), except that the former is in physical terms while the latter is in monetary terms. However, year to year changes for the different uses should be the same irrespective of whether the analysis is done according to the NRA or according to the goods and services account in constant prices.
- b) Although the accounts are kept in physical units, they are complemented with price information whenever market prices are available, allowing tables in monetary terms to be constructed. These should be consistent with the figures in the goods and services account in the traditional national accounts.
- c) The industrial classification of the extraction, conversion and trade accounts and end use accounts follow the SNA classification, thus facilitating a linkage between the resource accounts and the national accounts.
- d) A biotic resource like fish requires a relatively detailed reserve account with the specification of age structure and the localization of different fish stocks. The end use account is, however quite simple, since relatively few industries utilize fish as input for their production.

The Norwegian experience is that by using the same framework for analysis of both economic and environmental policies, consistency in behavioral and other key assumptions are secured. Furthermore, linking physical resource accounts and environmental statistics to economy-wide models provide for better and more comprehensive information on the value of natural resources and environmental services than through more partial studies. Recognizing this, it is important that the natural resource accounts are organized according to the classification standards (industry and product classifications) used in the national accounts. Another experience is that the end use of the resources should also be accounted for. This is important in order to be able to say something about who is going to be affected by a change in resource policy, how they may react to a change in policy and how this will in turn affect the resource depletion.

Valuation of the fish resources is problematic, since the value of the resources to society will depend on expectations about the future technological development as well as the development in process and extracted volumes. According to Alfsen (1996), these expectations will fluctuate very much and he recommends that the accounts are kept in physical units, and that additional valuation exercises are carried out as analytical projects when the need arises.

Country situations vary both regarding the endowment of natural resources and stage of economic development and regarding the political system and institutional set-up. For this reason, it can be difficult to set up a natural resource accounting system entirely according to international standards or other country schemes. It can be wise to think through which problem one is facing and whether a suitable natural resource account is likely to be useful for formulating a rational resource policy. <<International comparability is of course enhanced by following standards in natural resource accounting, but this is seldom a major concern within the context of natural resource and environmental management>> (Alfsen 1996, page 21).

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GOODS AND SERVICES ACCOUNT

An example

1. The supply side:

- From the production accounts the output of fish, at basic prices alternatively at producer's prices, are known both for market and own account producers.
- Imports are given in the external trade statistics, valued at c.i.f.-prices.
- In the example there are no import duties, but these can normally be estimated using information from the customs office.
- Taxes less subsidies on products are generally available from the government offices collecting the taxes and responsible for implementing the subsidies schemes. Normally, it will be known whether the taxes/subsidies should be allocated to one or several products. A tax which is levied on first-hand value of landed fish, can be allocated to the different fish species in proportions with the first-hand values. Normally, it will be known whether the product taxes are paid by the producer or by the wholesaler/retailer.
- Value added tax by product have to be estimated. The compilation will be done at the use side of the goods and services account.
- Trade and transport margins by products will normally have to be estimated on the use side of the account.

2. The use side:

- From manufacturing statistics intermediate consumption of fish will be known or can be estimated. If the surveys are carried out periodically, the benchmark estimates can be extrapolated to other years on the basis of output manufacturing establishments assuming a fixed input-output ratio. Intermediate consumption will be valued at purchaser's prices excluding deductible VAT. The value of intermediate consumption of fish should be consistent with intermediate consumption in the production account for processing and preserving of fish, etc.
- Intermediate consumption in industries such as hotels and restaurants can be difficult to allocate by products. Normally, total input costs only will be available. To estimate the breakdown by specific products it can be necessary to carry out periodically sample surveys of the costs in the hotels, restaurants etc. The benchmark estimates can be extrapolated to other years by using the industries' total intermediate expenditures. Intermediate consumption of fish in hotels, restaurants, hospitals etc. is probable of minor importance in the goods and services account.

- Household final consumption expenditure can be estimated from the household budget surveys.
- Exports of fish will be available from the external trade statistics.
- An alternative method of obtaining data on the use of fish is to carry out periodic surveys within the sales associations. The surveys should be designed to cover all users, both in manufacturing and other industries, for households and for exports.
- Changes in inventories can be difficult to estimate on the basis of surveys. If it is possible to establish information on all the various kinds of uses, reconciliation of both the supply and use side of the goods and services account is necessary. Changes in inventory may be considered one of the weakest estimates, and if one chooses to make a less sophisticated balancing method, changes in inventories may be derived residually. However, even if the changes in inventories are derived residually, it will be necessary to analyze the data and perhaps compromise on one of the other flows.

3. The allocation of the purchaser price:

a) *Value added tax*

The VAT rate is known from the tax regulations. VAT on products can be compiled by the following formulas:

- i) $VAT(i) = X_i (1 - 1/(1 + a_i))$
- ii) $VAT(j) = \sum VAT(i)$

where X_i is the purchaser value for user i , a_i is the VAT rate for user i (= zero if deductible VAT) and $VAT(j)$ is total VAT on product j .

In the numerical example in Table 4, VAT rate is 15%. Exports are exempted from VAT. For manufacturing and restaurants the purchaser value is exclusive deductible VAT, and VAT on immediate consumption for these industries will therefore be zero. In Norway, hospitals are not in a position to deduct VAT on intermediate consumption. In the example, one fourth of the aggregate intermediate consumption in hotels, restaurants, hospitals etc. is assumed to be input in hospitals. The households' purchases from market producers are 450 and own account production (consumption) is 50. VAT are not levied on households and production for own final consumption and this should be taken into account when compiling VAT on households consumption expenditures. TOTAL VAT on fish is estimated to be 62 in the numerical example.

b) *Trade and transport margins*

Data on trade and transport margins by product (or product groups) and user will normally have to be obtained from sample surveys. In the example in Table 4, margin rate for fish delivered to manufacturing is zero, for deliveries to other industries the margin rate is 0.25, for fish delivered to households the rate is 40% of the first-hand value of landed fish, for exports the margin rate is 10%. The margins for each product flow can be estimated by:

- i) $M(i) = [X_i/(1+a_i)] (1-1/(1+m_i))$
- ii) $M(j) = \text{sum } M(i)$

where M_i is the margin for user i , X_i is the purchaser value for user i , m_i is the margin rate for user i , and $M(j)$ is the total margin on product j .

There will be no trade margins on fish catches for own consumption. This will have to be taken into account when compiling the trade margins on households consumption expenditures.

c) *Product taxes and subsidies*

In the example, there is a general tax levied on the first-hand value of landed fish, irrespective of whether the fish is landed in Norway or abroad. No tax is levied in fisheries for own final use. The tax is allocated to all users, except changes in inventories, in proportion with their purchaser value less VAT and trade margin (will be consistent with the first-hand value on each flow).

d) *Basic prices*

On the use side of the account, values at basic prices are derived as a residual (purchaser value less VAT less trade and transport margin less taxes plus subsidies on products).

Balancing the goods and services accounts

The supply at basic prices is known from different sources, so are the uses at purchaser's prices (except changes in inventories) and the total product tax (except VAT). VAT and trade and transport margins are compiled on the use side of the account. What balances the account is the item of changes in inventories, compiled as total supply at basic prices (including trade and transport margins) plus taxes less subsidies on products (including VAT) less all the uses at purchaser's prices.

Table 1. Production account for the fisheries industry* - Norway 1993
(Million Kroner)

USES		RESOURCES	
Intermediate consumption (valued at purchaser's prices):		Market output (valued at basic prices):	
Fuel and oils	679	Salmon and trout	16
Repairs of fishing vessels	675	Herring and capelin	829
Repairs of machinery and equipment	345	Cod	1990
Food	141	Mackerel	517
(provided to fishermen on the boat			
Salt, bait, package, etc.	137	Other fish species	1733
Different equipment	148	Shrimps and shellfish	613
Different services	234	Other ocean products	384
		Income from other sources	21
		Output for own final use:	
		Fixed assets produced for own use	14
		Fish for own final consumption	159
Total intermediate consumption	2359	Total market and non-market output	6276
Value added, gross	3917		
- Consumption of fixed capital (not available in Norway at the moment)			
= Value added, net (not available in Norway at the moment)			

* Includes both market production and households production for own final consumption (non-market)

Table 2. Generation of income account for the fishery industry - Norway 1993
(Million Kroner)

USES		RESOURCES	
Compensation of employees	1478	Value added, gross	3917
Taxes on production	239		
Subsidies on production	-342		
Mixed income and operating surplus, gross	2542		

**Table 3. Gross fixed capital formation for the fisheries industry - Norway 1993
(Million Kroner)**

Acquisitions of:	
Vessels	
Machinery and equipment	370
Fixed assets produced for own use	166
	14
Sales of existing vessels	-271
Gross fixed capital formation	279

Figure 1. Structure of the Norwegian material resource accounts

I. Reserve accounts	
Start of period	Resource base Reserves (developed and non-developed) Total gross extraction during the period Adjustments of resource base (new discoveries, reappraisals) Adjustments of reserves (new technologies, cost of extraction, transport, etc., resource prices)
End of period	Resource base Reserves (developed and non-developed)
II. Extraction, conversion, and trade accounts (by industry)	Extraction net + Imports - Exports + Changes in stocks = For domestic use
III. End use accounts	End use by economic sectors (industry, households and exports)

Table 4. Account for fish (e.g. cod) at current prices

RESOURCES

	Basic prices	Taxes less subsidies on products (payable by the producer)	Trade and transport margin (basic value)	Taxes less subsidies on products (payable by the wholesaler/retailer)	Value added tax	Purchaser prices
Output from fisheries (market)	2300					2300
Output for own use	50					50
Imports	200		267			200
Trade and transport margins						267
Value added tax		60			62	62
Product taxes less subsidies		(57)				60
Total	2550	60	267	0	62	2939

USES

	Basic prices	Taxes less subsidies on products (payable by the producer)	Trade and transport margin (basic value)	Taxes less subsidies on products (payable by the wholesaler/retailer)	Value added tax	Purchaser prices
ISIC 1512 Processing and preserving of fish and fish products	684	16				700
ISIC 1514 Manufacturing of vegetable and animal oils and fats	195	5				200
Intermediate consumption in industries such as hotels and restaurants, hospitals, etc.	76	2	19		3	100
Households final consumption expenditure	323	6	112		59	500
Exports	1333	31	136			1500
Changes in inventories	-61					-61
Total	2550	60	267	0	62	2939

DRAMATIC CHANGE IN SHRIMP CULTURE IN THAILAND

by

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1. INTRODUCTION

Thailand conducted its first marine fishery census in 1967 and its second census in 1985. Owing to the rapid expansion of shrimp farming and aquaculture, the National Statistical Office (NSO) and the Department of Fisheries (DOF) deemed it necessary to conduct the third census in 1995.

With the expanded world market, the export of farmed shrimp has played a major role in the Thai economy. The rapid increase of shrimp export made this new commodity outrank, in value, rice and rubber, the traditional export commodities of Thailand. The values of annual shrimp export for 1993, 1994 and 1995 amounted to 38,622; 49,847 and 51,246 million Baht, respectively, whereas those of rice came to 32,959, 39,187 and 48,627 million Baht, respectively. Anticipating the interest of planners and entrepreneurs, this document of the National Statistical Office is devoted exclusively to shrimp culture statistics.

The 1995 marine fishery census set out the following two distinctive objectives:

- a) to collect data on basic economic structure of marine capture fishery, coastal aquaculture and socio-economic characteristics of fishery households, fishery employees' households, fishermen and aquaculture workers; and
- b) to provide data as a sampling frame of other related surveys.

The census dealt mainly with marine capture fishery and coastal shrimp culture. The census covered all households and establishments conducting these activities, the households of their employees within and outside the municipal areas of the 24 coastal provinces of Thailand. The households of foreign employees were excluded from the census. For the purpose of the census, the coastal provinces were divided into five coastal zones:

Coastal Zone 1 (Eastern part of the Gulf of Thailand) consisting of three provinces: Trat, Chanthaburi and Rayong;

Coastal Zone 2 (Inner part of the Gulf of Thailand) consisting of seven provinces: Chon Buri, Chachoengsuo, Samut Prakan, Bangkok Metropolis, Samut Sakhon, Samut Songkhram, and Phetchaburi;

Coastal Zone 3 (Central part of the Gulf of Thailand) consisting of five provinces: Prachaup Khiri Khan, Chumphon, and Surat Thani;

Coastal Zone 4 (Southern part of the Gulf of Thailand) consisting of five provinces: Nakhon Si Thammarat, Phatthalung, Songkhla, Pattani, and Narathiwat;

Coastal Zone 5 (Andaman Sea) consisting of six provinces: Ranong, Phangnga, Phuket, Krabi, Trang, and Satun

The data collected from coastal shrimp culture households and establishments were:

- a) **Number of coastal shrimp establishments (called households and establishment together) and the acreage under the shrimp culture;**
- b) **The types of land tenure for the area under shrimp cultivation;**
- c) **The shrimp farming practices, i.e., cultured species, and culture method, source of seeds, etc.;**
- d) **Number of workers and source of workers;**
- e) **Type of shrimp buyers; and**
- f) **Debt and source of loan.**

The method of complete enumeration was used. The total of 920 enumerators, the NSO and DOF staff, temporary employees, and some local teachers, prepared the list of all establishments under the area of coverage. Subsequently, each establishment was interviewed for detailed information. All enumerators were fielded simultaneously from April 16 to May 20, 1995. They covered all 3,500 Enumeration Districts (EDs) in all coastal provinces. The post enumeration survey was conducted a month later to verify the data collected in the first survey. The area under 120 EDs came under the data verification.

Inspection of all enumeration sheets by the field officers for completion and consistency was carried out before these are sent to the central office in Bangkok. The data were then transferred to magnetic tapes. Computer editing was performed for the final review and correction, and subsequently for tabulation. The time reference used was as follows:

- a) **Census Date.** Referred to as April 1, 1995, the date was used as the time reference for the data on:
 - Type of management;
 - Acreage under shrimp culture;
 - Types of land tenure; and
 - Source of debt and loan.
- b) **The last 12 months.** This period was from 1 April 1994 to 31 March 1995. It was used as the time reference for all data except those mentioned in (1).

The unit of measurement used is rai, and 1 rai = 0.16 hectares = 0.4 acres. In the data a hyphen (-) denotes a Nil.

2. DEFINITIONS AND CLASSIFICATION

Marine Shrimp Culture is defined as an economic activity, carried out in a coastal area, to rear juvenile shrimp to a commercial size, excluding those activities carried out in the hatchery.

Marine Shrimp Culture Establishment is an economic unit engaged in coastal shrimp culture during the last 12 months. The subsets of such establishments are:

- a) Operator's household is a household engaged in coastal shrimp culture on its own account;
- b) Joint management is an economic unit engaging in coastal shrimp culture under a joint investment of two or more households or by their own joint principal production means such as loan and equipment; and
- c) Company limited or Juristic partnership is an economic unit engaged in coastal shrimp culture under the management of a company or juristic partnership.

Area Under Culture refers to the surface area of water used for the purpose of shrimp culture, e.g., grow-out ponds, water reservoirs, including the area occupied by dikes surrounding these water areas.

Land Tenure for Shrimp Culture refers to the land-holding rights or the arrangement made by the establishment to use the land. An establishment may come under one or more tenure forms defined below:

- a) **Owner:** An establishment under this category must be
 - i) An establishment, according to law, holding a full right of the land, i.e., having in possession a form of land-holding certificate, e.g., Title Deeds, N.S. 3, SK. 1, issued by a Land Authority Office, other land-holding certificates such as those under the Land Reform Act which give the right for land use;
 - ii) An establishment openly occupying and cultivating the land without a documentary evidence, e.g., inheritance cultivators or land-owner whose land-holding certificate is under processing; or
 - iii) An establishment occupying and cultivating the land, without interruption and any opposition from a lawful owner for a period no less than 10 years.
- b) **Renter:** A person who rents the land from another person for the purpose of shrimp culture.
- c) **Others:** This type of land tenure refers all remaining types of tenure, such as those cultivators who encroached mangrove forest, those who rented a piece of land without pay, etc.

Aquaculture Workers is the person engaged in some forms of activity relating to the shrimp culture, e.g., repair of the pond, water supply, feeding, etc. However, those engaged exclusively in the management, planning and accounting do not fall into this category.

Coastal Shrimp Culture Methods can be divided into three following categories:

- a) **Extensive culture** acquires the shrimp seeds that occur in nature through pumping seawater into the pond. It provides neither additional stocking with nursery-bred or nursery-reared shrimp seeds nor feeding of any kind. Under a normal circumstance, shrimp seeds take 45 to 90 days to reach marketable size.
- b) **Intensive culture** refers to a method of shrimp culture in the following conditions:
 - Stocking with no less than 24,000 pieces of shrimp seed in a rai of water;
 - Feeding 3-5 times a day;
 - Using at least one paddle wheel for the purpose of aerating a water area of 1 to 2 rais;
 - Extending the cultivation period over 4 to 5 months.
- c) **Semi-intensive** refers to the culture method under the following conditions:
 - Stocking with no more than 24,000 pieces of shrimp seed in a rai of water;
 - Feeding as one or no paddle wheel for aerating the water;
 - Extending the cultivation period over 4 to 5 months.

3. SUMMARY FINDINGS

The census results showed that there was a total of 25,210 coastal shrimp culture establishments in the 24 coastal provinces of Thailand. These establishments operated a total water area of 421,282 rais for the purpose; with the average water area per establishment of 16.7 rais.

The Zone-wise congregation of the shrimp culture establishments showed the highest percentage at 36.0% in Zone 4 (Southern part of the Gulf of Thailand) and the lowest percentage at 10.0% in Zone 3 (Central part of the Gulf of Thailand). The average water area per establishment in Zone 4 was 9.0 rais; while that of Zone 3 was 19.0 rais (Table 1).

As shown in Figure 1, majority of shrimp culture establishments (33.2%) were operated by operator households, followed by 11.4% under joint management. Only 0.4% came under the company operation. On the other hand, Table 2 shows the dramatic increase of shrimp culture establishments from 4,544 in 1985 to 15,060 in 1990. This trend continued up to 1995 which had 25,210 establishments, 4.5 times over that of 1985 contributing to an annual increment of 44% in operation (Figure 2).

The land area under marine shrimp culture was also expanded rapidly from 216,990 rais in 1985 to 317,841 rais in 1990 and further to 421,282 rais in 1995. The average land area under shrimp cultivation per establishment continued to shrink from 47.8 rais in 1985 to 21.1 rai in 1990 and 16.7 rai in 1995. The shrinkage of the average land area per establishment may be attributed to the fact that the method of shrimp culture had shifted all these years, from extensive to intensive shrimp cultivation.

Table 3 shows that majority of the 64.9% shrimp establishments operated a cultivation area of less than 10 rais. The next largest group (21.3%) cultivated an average land area from 10 to 29.9 rais; and the least group (13.8%) operated land area of 30 rais and larger.

The largest number of the less-than-10 rais shrimp establishments (80.4%) were found in Zone 4; while that of 10-29.9 rais group (34.5%) were in Zone 2 and of 30-rai-and-above (15.5%) in Zone 3 (Table 3).

The change in the method of shrimp culture from extensive to semi-intensive was apparent starting in 1985. As the change continued, more and more shrimp farmers adopted the intensive cultivation method which requires smaller pond area for effective rearing and management. As shown in Figure 3, the percentage of establishments cultivating <10-rai of land rose from 5.7% in 1985 to 53.1% in 1990, and further to 64.9% in 1995.

Conversely, the percentage of larger shrimp culture establishments continued to decrease during the 1990s. Figure 3 also shows that the establishment, operating 10-29.9 rai of land reduced from 31.8% in 1995 to 25.2% in 1990, and further to 21.3% in 1995. The similar pattern is also true for the establishments cultivating land area of 30 rai and larger.

The shrimp culture establishments acquired land from different sources, i.e., owned and/or rented from the private or public sectors. As presented in Table 4, the great majority (72.5%) owned the farmland. Some 23.9% of the establishments either rented the land or held the tenure of the land in some other forms. The last group, comprising 4.6%, was made up of mangrove forest encroachers and those who operated on someone else's land but not paying any rent.

Coastal Zone-wise analysis, the proportion of the number of establishments holding the other forms of land tenure in Coastal Zone 1 was at 32.0%. These proportions were considerably high. The proportion of the number of establishments operating on their own farmland and that of establishments renting land from the government did not show marked difference in the Coastal Zones.

The extensive shrimp culture method which depended entirely on the wild shrimp seeds that enter the ponds with the tide, was widely used in Thailand until 1985. From 1985 to 1990, the percentage of shrimp culture establishments practicing extensive method was reduced from 94.9% in 1985 to 14.2% in 1990. Until 1995, however, some 13.6% of shrimp culture establishments still practiced the traditional method.

Conversely, more and more shrimp farms switched from wild shrimp seeds to hatchery-raised fry. From only 5.1% of shrimp culture establishments in 1985 using hatchery shrimp seeds, exclusively the black tiger shrimp, the percentage increased to 85.8 in 1990. For the next five-year period until 1995, the percentage of hatchery-shrimp seed users, increased slightly to 86.4% (Figure 4).

The results of the 1995 marine fishery census also showed that as much as 79.2% of the marine shrimp culture establishments in Thailand cultivated exclusively the black tiger shrimp using the intensive method; leaving only 7.1% of the establishments practicing the semi-intensive method. The remaining 14.6% was found to practice the extensive method which produced mainly the banana shrimp, which is found preponderant in the wild. This type of culture method was found in Coastal Zone 1 on the western part of the Gulf of Thailand (Table 5).

Marine shrimp farming requires workers employed on a permanent basis, who assume the regular duties, e.g., feeding, maintaining water levels, repairing of ponds, monitoring of water quality, etc. Most of the shrimp culture establishments (61.6%) engaged family members in performing the works. The remaining establishments resorted to hired labor.

Of the 38.4% establishments hiring workers on farms, almost all (30.2%) depended on the people in the same or nearby locality. Only 5.1% of the establishments engaged employees who came from afar, while 3.1% had both types of employees.

Almost all employees (92.8%) in Coastal Zone 2 (the Inner part of the Gulf) were members of the family, while only 37.0% of shrimp farms used intensive cultivation. This was in contrast to the hiring pattern in Coastal Zone 5 on the Andaman Sea where 64.7% of the establishments hired workers, although some 45.0% depended on the local people (Table 6).

The total number of permanent workers in shrimp culture establishments in 1995 was 72,074 comprising 41,510 family members (57.6%) and 30,564 employees (42.4%) respectively. Of the total workers, 69.9% were from the same and nearby locality. The remaining percentage comprised 15.6% of workers from Northeastern Thailand and 9.4% came from the other regions.

Zone-wise, it was noted that as much as 88.1% of the workers employed by the shrimp culture establishments in Coastal Zone 4 (the southern part of the Gulf) came from the same or nearby locality; while in Coastal Zone 1 (the eastern part of the Gulf) the situation was remarkably different. As much as 44.0% of workers in Coastal Zone 1 came from the northeastern provinces compared to 40.5% who came from the same or nearby locality. Regarding the employment of overseas workers, it was noted that as much as 14.9% of the workers in Coastal Zone 5 were overseas workers (Table 7).

All shrimp culture establishments were on commercial scale based on their produce. However, it was found that 1.9% of the establishments could not bring their operation to the commercial stage. Some may still be beginners who had never produced any crop during the year of the survey, or their crops were totally lost. Majority of the shrimp culture establishments which could offer their produces for sale did not have direct contact with the consumers. Some 89.7% dealt with middlemen, 4.3% with cold storage and 2.6% with retailers.

The Zone-wise comparison (Table 8) showed that as much as 4.7% of the shrimp culture establishment in Zone 5 (on the Andaman Sea) could not offer their farm produce for sale. The proportion of establishments in the Zones were less than 2% of the number in each Zone.

Cold storage attracted as much as 11.7% of shrimp culture establishments in Zone 1; although the figures from cold storage in the other Zones remained below 5%. Retailers had brisk business with the establishment in Zone 2, where 47.4% of the shrimp farms made use of extensive cultivation method and could not offer the merchandise in bulk to middlemen or cold storage. However, retailers could only strike a deal with no better than 2.3% of establishments in the other Zones.

4. DEBT AND SOURCES OF LOAN

Shrimp culture establishments need a high cash liquidity, particularly to facilitate the regular purchase of feed. It was found that as many as 16,808 establishments (66.7% of the total) resorted to taking loans and still showed outstanding debts. Of these, 44.6% took loans from banks: The Bank of Agriculture and Agricultural Cooperatives (BAAC which is government controlled gave loans to 28.1%, while private commercial banks extended loans to 27.3% of the establishments.

With the exception of Coastal Zone 5, the BAAC succeeded in extending its loans to 40% or more shrimp culture establishments. On the other hand, private commercial banks extended loans to as much as 46.4% of the shrimp culture establishments in Zone 5. It was also remarkable to find that other sources of loan, which include shrimp feed dealers, accounted for as much as 31.7% of the establishments in Zone 5 (Table 9).

Table 1. Number of marine shrimp culture establishments and area under culture by coastal zone

Coastal Zone	Establishment		Area under culture		Average area under culture (Rai)
	Number	%	Area (Rai)	%	
Whole country	25,210	100.0	421,282	100.0	16.7
Coastal Zone 1	4,428	17.6	121,994	29.0	27.6
Coastal Zone 2	5,331	21.2	123,581	29.3	23.2
Coastal Zone 3	2,531	10.0	47,677	11.3	18.8
Coastal Zone 4	9,083	36.0	85,248	20.2	9.4
Coastal Zone 5	3,837	15.2	42,782	10.2	11.1

Table 2. Number of marine shrimp culture establishments and area under culture: 1985, 1990 and 1995

Year	No. of Establishments	Area under culture (Rai)	Average area under culture (Rai)
Census year 1985	4,544	216,990	47.8
Survey year 1990	15,060	317,841	21.1
Census year 1995	25,210	421,282	16.7
Percentage change 1990/85	231.4	46.5	-55.8
Percentage change 1995/90	67.4	32.5	-20.8
Percentage change 1995/85	454.8	94.1	-65.0

Table 3. Percentage of marine shrimp culture establishments by size of area under culture and by coastal zone, 1995.

Coastal Zone	Size of area under cultivation (rai)				
	Total	less than 10	10-29.9	30-49.9	50 and over
Whole country	100.00	64.9	21.3	6.1	7.7
Coastal Zone 1	100.00	61.8	17.7	5.0	15.5
Coastal Zone 2	100.00	38.8	34.5	14.1	12.6
Coastal Zone 3	100.00	59.1	26.8	7.1	7.0
Coastal Zone 4	100.00	80.4	13.8	2.9	2.9
Coastal Zone 5	100.00	72.2	21.0	3.1	3.7

Table 4. Percentage of marine shrimp culture establishments by land tenure and by coastal zone

Coastal Zone	Owned	Rented		
		From private sector	From government	From others
Whole country	72.5	23.9	0.8	4.6
Coastal Zone 1	70.6	15.3	0.4	15.3
Coastal Zone 2	69.6	27.6	2.0	2.6
Coastal Zone 3	75.7	22.2	0.8	2.3
Coastal Zone 4	76.3	23.1	0.4	2.3
Coastal Zone 5	67.5	32.0	0.2	1.6

Note: An establishment may report more than one form of land tenure.

Table 5. Percentage of marine shrimp culture establishments by method of culture and by coastal zone

Coastal Zone	Method of culture		
	Intensive	Semi-intensive	Extensive
Whole country	79.2	7.1	14.6
Coastal Zone 1	85.6	5.6	12.8
Coastal Zone 2	37.0	46.0	47.4
Coastal Zone 3	85.1	4.9	10.8
Coastal Zone 4	92.8	4.2	3.4
Coastal Zone 5	94.5	5.1	0.4

Note: An establishment may report more than one method of culture.

Table 6. Number of marine shrimp culture establishments by type of employment and by coastal zone.

Coastal Zone	Total	Without employment	Employing			
			Sub-total	Local people	Non-local people	Both local and non-local
Whole country	100.0	61.6	38.4	30.2	5.1	3.1
Coastal Zone 1	100.0	69.4	30.6	17.8	8.7	4.1
Coastal Zone 2	100.0	92.8	7.2	5.0	1.9	0.3
Coastal Zone 3	100.0	53.7	46.3	35.8	6.5	4.0
Coastal Zone 4	100.0	52.7	47.3	43.3	2.4	1.6
Coastal Zone 5	100.0	35.3	64.7	45.0	10.7	9.0

Table 7. Percentage of marine shrimp culture employees by source of employees and by coastal zone

Coastal Zone	Total %	Source of Employee			
		Local employee	Non-local employee from		
			NE region	Non-NE regions	Overseas
Whole country	100.0	69.6	15.6	9.4	5.4
Coastal Zone 1	100.0	44.0	40.5	11.6	3.9
Coastal Zone 2	100.0	60.1	22.4	17.3	0.2
Coastal Zone 3	100.0	69.1	22.5	6.9	1.5
Coastal Zone 4	100.0	88.1	5.9	5.8	0.2
Coastal Zone 5	100.0	62.2	10.6	12.6	14.6

Table 8. Zone-wise percentage of shrimp establishments selling their farm produces to different types of customer.

Coastal Zone	Total	Without sale	With sale				
			Sub-total	Retailer	Middlemen	Cold storage	Others
Whole country	100.0	1.9	98.1	2.6	89.7	4.3	1.5
Coastal Zone 1	100.0	1.7	98.3	1.3	84.1	11.7	1.2
Coastal Zone 2	100.0	1.1	98.9	7.0	86.7	3.3	1.9
Coastal Zone 3	100.0	1.3	98.7	2.3	90.4	3.1	2.9
Coastal Zone 4	100.0	1.4	98.6	1.6	94.8	1.3	0.9
Coastal Zone 5	100.0	4.7	95.3	0.6	88.0	4.9	1.8

Table 9. Percentage of loans and their sources extended to marine shrimp culture establishments in different coastal zones, 1995.

Coastal Zone	Source of loan						
	Government agencies	BAAC	Private commercial bank	Middle man	Money lender	Relative and friend	Others ^{1/}
Whole country	3.8	44.6	28.1	5.0	13.4	27.3	10.2
Coastal Zone 1	7.4	41.7	23.0	7.2	14.3	32.9	4.5
Coastal Zone 2	2.3	57.4	14.1	3.2	19.3	31.9	2.3
Coastal Zone 3	6.2	53.5	25.8	11.6	10.0	29.6	4.1
Coastal Zone 4	2.9	40.8	29.8	4.2	12.2	27.3	7.5
Coastal Zone 5	2.3	37.7	46.4	2.5	12.0	16.5	31.7

Note: An establishment may report more than one source of loan.

^{1/} Others included loan from feed dealers

Figure 1. Percentage of shrimp culture establishment in Thailand, 1995.



Figure 2. Number of shrimp culture establishments and area under culture : 1967, 1985, 1990 and 1995

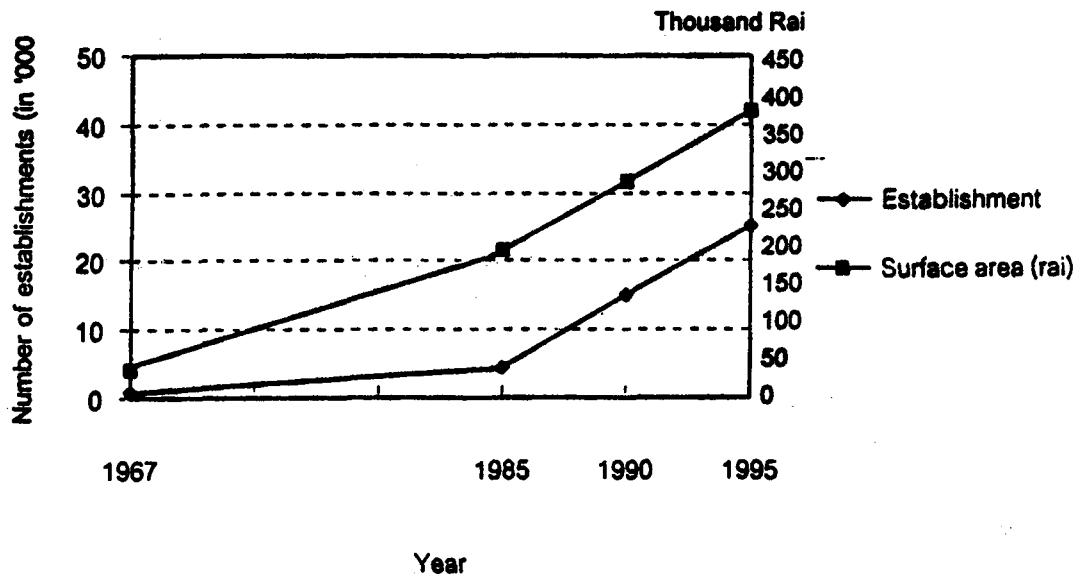


Figure 3. Percentage of marine shrimp culture establishments by size of area under culture : 1985, 1990 and 1995

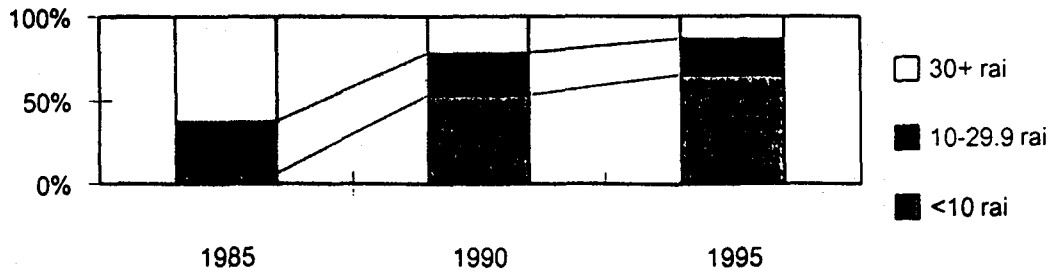
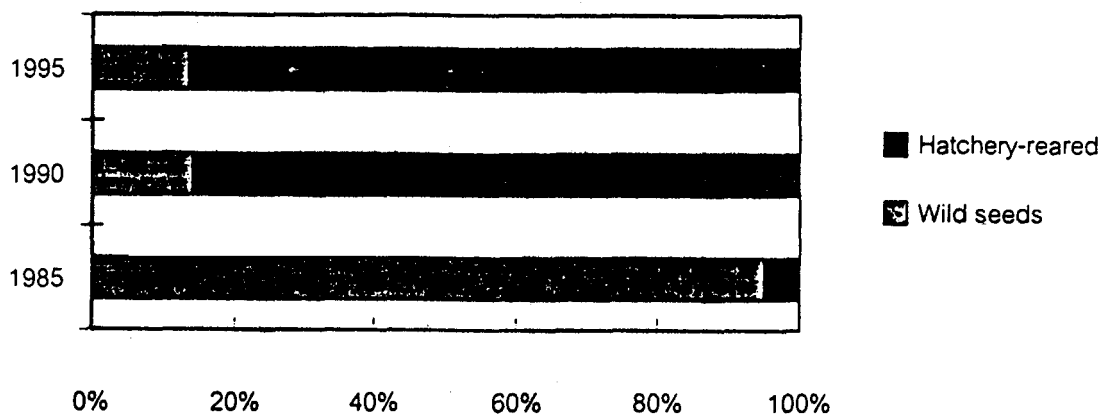


Figure 4. Percentage of marine shrimp culture establishments by source of seeds : 1985, 1990 and 1995



INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING IN FISHERIES

A Joint Initiative of the
Fisheries Department and Statistics Division of the
Food and Agriculture Organization of the United Nations (FAO/FI/ESS),
Institute of Advanced Studies of the United Nations University (UNU/IAS)
and
United Nations Statistics Division (UNSD)

Prospectus

1. BACKGROUND

The resources provided by nature are central to the economic performance of the fishery sector and the well-being of the fishing communities and other people who make directly or indirectly a living from it. They comprise manifold fish species, coral reefs, sea grass beds, mangroves and other estuarine vegetation, nutrients received from rivers and land run-off, fresh water itself, and many other resources which ensure the growth, reproduction and health of the fish stocks. These varied components of natural capital in combination with human-made physical capital (i.e., machinery, fishing vessels and gear, etc.), human capital (skills, knowledge) and human work (labor) sustain the capacity of the sector to contribute to food production and food security. While the fishery sector's contribution to Gross Domestic Product (GDP) is small for most countries, its contribution to animal protein intake is globally in order of 17 percent, and much higher in many countries, especially those with low incomes and large populations (e.g. China, Bangladesh, the Philippines and others).

At present, only some countries maintain separate economic accounts for the fishery sector, and very few of them publish estimates of the fishery sector GDP. Those countries which prepare separate accounts, usually treat fisheries in the same manner as any other industry. Many fisheries, however, have characteristics which distinguish them from typical industries such as car manufacturing or the production of textiles. An important feature of the fishery sector is its high reliance on the functions and services of environmental assets including fish stocks, ocean currents, fresh water resources, coral reefs, mangroves and other types of forests, etc. Globally, these functions and services are becoming increasingly scarce due to the aggregate effects of excessive fishing, use of destructive fishing techniques, unsustainable culture practices (e.g. mangrove destruction through, *inter alia*, coastal shrimp culture) and habitat degradation by mostly other sectors of the economy. The economic consequences of such unsustainable developments are presently only inadequately, or not at all, reflected in national accounts. The costs associated with overfishing and habitat degradation are generally not systematically accounted for and thus policy-decisions are taken based on incomplete, or even erroneous information.

Another special characteristic of the fishery sector is the difficulty of precisely defining the production, asset and consumption boundaries. This difficulty relates to, for example, geographical and institutional boundary definitions because of the shared nature of many environmental resources including fish stocks and because of often ambiguous property rights conditions.

2. OBJECTIVES

The primary objective of this initiative is to produce guidelines for integrated environmental and economic accounting of capture fisheries and aquaculture in order to facilitate and promote the more wide-spread inclusion of the fishery sector in national accounts. This will allow for a better appreciation of the interrelationship between the production of fish, for primarily direct human consumption, the creation of income and employment, and the physical flow and quality of environmental goods and services. The guidelines will take as their basic framework the UN System of National Accounts (SNA) and the interim version of the UN System of Integrated Environmental and Economic Accounting (SEEA).

A secondary objective is to contribute to the methodological discussion on integrated environmental and economic accounting. The expected contribution comes about indirectly through, on one hand, the special characteristics of fisheries and their implications for accounting concepts and methods, and on the other hand, the participation in this methodological discussion by fishery scientists, biologists, oceanographers, fisheries economists, and others, whose views otherwise would hardly flow into this debate.

The three collaborating institutions have ongoing and prior activities related to national accounting. UNSD is the lead unit in the UN System on this subject and has been closely involved in the development of SNA and SEEA. UNU/IAS has organized jointly with the Economic Planning Agency of the Government of Japan an International Symposium on Integrated Environmental and Economic Accounting Theory and Practice in Tokyo in March 1996. FAO has published a manual on agricultural accounts in 196 entitled: *A System of Economic Accounts for Food and Agriculture* and the envisaged guidelines will complement it for the fishery sector.

3. PROCEDURE

The steps envisaged for producing these guidelines are as follows:

- a) Launching of a three-month electronic workshop starting August 1997, the objective which is to obtain inputs and advice from a wide cross-section of experts in various disciplines including natural sciences (especially fishery biology), social sciences (especially fishery and ecological economics) and statistics (especially fishery statistics, national economic accounting and resources/environmental accounting) in various countries and regions.
- b) After the workshop, authors will be contracted to prepare the first draft methodological guidelines. The draft will be peer reviewed by experts and will be made available on the Internet for comments.
- c) Prior to publication, and if agreeable, the final draft guidelines may also be reviewed by international working groups dealing with national accounting methodology, e.g., the Inter-Secretariat Working Group on National Accounts (ISWGNA), and the London and Nairobi groups, respectively.

The guidelines are expected to be published in the summer of 1998. The application of the guidelines to case studies is subsequently foreseen.

REGIONAL COOPERATION IN STRENGTHENING THE APPLICATION OF FISHERY STATISTICS

One very important recommendation of the 1992 UN Convention on the Law of the Sea (UNCLOS III) and the various regional and international initiatives as offshoot of UNCLOS III, was the need for strong cooperation among agencies in the region. Such cooperation could serve as a vehicle to assist the coastal nations in reinstating the almost demolished fishery resource base in Southeast Asia; facilitate sustainable development of fisheries in the region; and as a tool in achieving a systematic collection, compilation, and processing of fishery and aquaculture statistics for the rational management of fishery and aquatic resources.

For the aforecited reasons, FAO, SEAFDEC, and APFIC facilitate the compilation and utilization of fishery statistics in the region through their regional fishery statistics program. FAO has enhanced the improvement of the collection of fishery and aquaculture statistics in the region through the formulation and application of databases that it had developed. SEAFDEC on the other hand, publishes the annual Fishery Statistical Bulletin for the South China Sea Area, continues the compilation and publication of tuna fishery statistics in the Southeast Asian region as well as the catch and effort statistics of the region; and together with APFIC, continues to improve the compilation and processing of fishery and aquaculture statistics in the region.

FAO, SEAFDEC, and APFIC also collaborate with other organizations and agencies in the region in the implementation of their respective fishery statistical programs. These programs are aimed at addressing statistical issues and needs common among the nations. While facilitating cooperation in the compilation and appreciation of fishery statistics, these regional organizations also noted the increasing concern about timeliness, reliability, and compatibility and comparability of the data collected by the national agencies which could also be tackled as a collaborative effort among the agencies concerned.

**REGIONAL COOPERATION
FOR FISHERY STATISTICS PROGRAM**

by

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1. INTRODUCTION

Fishery statistics have been successfully used to highlight increasing fishery production and contribution of fisheries to national economy. Importantly, it is widely recognized that fishery statistics is an essential input to do formulation of the sector management policies and plans. In recent years, the need for timely and reliable data for the sector management has been highlighted, as the necessity to manage fishery resources intensifies due to increasing competition/conflict among many sectors for access to resource bases, i.e., land and water, and intense exploitation and declining abundance of natural fish stock. Meanwhile, there is also a growing awareness that the statistics are not adequately utilized, particularly for sustainable fishery production, conservation of living aquatic resources and improvement of livelihood fishing and fishfarming communities. For example, the need to facilitate and promote utilization of fishery information and statistics through regional cooperation and collaboration were advocated at the 1994 Regional Workshop on Fishery Information Statistics in Asia (FAO/SEAFDEC/SIFR, 1994). A recent study reported that development and management of aquaculture sector in fourteen Asian countries are seriously affected by ineffective utilization of data and information, and lack of usable data and information for management (FAO/NACA, 1997).

Recognizing the need to strengthen regional capacity to compile and utilize fishery statistics for the sector management and development, ensuring sustainable exploitation of fish stocks, particularly migratory and straddling fish stocks, and development of the fishery industries, at its 25th Session held in 1996, the Asia-Pacific Fishery Commission (APFIC) identified collection, dissemination and exchange of fishery information and statistics as among the priority actions of the Commission (APFIC, 1996).

2. FUNCTIONS OF REGIONAL FISHERY STATISTICS PROGRAM

Fishery statistics are generally collected and compiled into national and regional yearbooks to demonstrate changes in fishery production from the previous year, or over a given period of time. Annual fishery statistics generally refer to catch statistics, but in recent years it also includes aquaculture and fishery socio-economic data. Fishery census was carried out in several countries in the region, e.g., marine fishery census in Thailand in 1995 and in Sri Lanka in 1995/6 which provide more detailed information on fishing and fishfarming populations.

The integral nature of fishery data and information program in the sector management can be illustrated by the following working definition of fishery management, used in the FAO Technical Guidelines for Responsible Fisheries (FAO, 1997):

“Fishery management is the integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and accomplishment of other fisheries objectives.”

This working definition also indicates that collection and compilation of fishery statistics are not an end in itself. Fishery statistics must be analyzed and applied to the management of fishery resources and accomplishment of objectives of the sector.

The SEAFDEC Fishery Statistical Bulletin for the South China Sea Area aims at providing reliable and comparable fishery statistics with standardized definition and classifications to facilitate the exchange of information for the management of fishery resources and planning of various fishery development programs for countries bordering the South China Sea (SEAFDEC, 1997). Thus, the basic function of regional fishery statistics program can be defined as “to facilitate cooperation and coordination in compilation, processing, analysis, packaging and utilization of fishery statistics for development and management fisheries resources and sector in the region” (Figure 1).

To carry out its functions, the regional program undertakes tasks designed to address issues and needs common among participating national programs, while facilitating regional cooperation in compilation and application of fishery statistics. Accordingly, the regional program concentrates mainly on such activities as:

- a) assessment of regional needs and data requirement;
- b) development of common and compatible data handling methodologies and tools, including standard definitions, classifications and codes;
- c) exchange and sharing of data, resources and skills;
- d) establishment and strengthening of data exchange networks and linkages among responsible agencies/bodies;
- e) analysis and synthesis of data and information for management of aquatic resources that are exploited by more than one country; and
- f) regional capacity building through training activities.

Traditionally, it was assumed that a central database is essential to a regional fishery statistics program, equating a central regional database to a regional program. However, with the development of information and communication technologies, functional decentralization, and efficient and effective coordination and cooperation, are essential to the effective regional program. The main role of a regional program is to facilitate and promote collaboration and coordination of activities aimed to accomplish the objectives of the program. A regional program for fishery statistics, therefore, can consist of several closely linked components that serve the needs of target users in the subsectors (Figure 2).

3. ISSUES AND CONSTRAINTS IN THE COMPILATION AND UTILIZATION OF FISHERY STATISTICS

Regional and international organizations, particularly FAO and SEAFDEC in collaboration with other organizations, have been active in facilitating the compilation and utilization of fishery statistics and information in the region. However, there is increasing concerns about timeliness, reliability and compatibility/comparability of data and data gaps.

For example, the papers presented at the 1994 Regional Workshop on Fishery Information and Statistics in Asia (FAO/SEAFDEC/SIFR, 1994), pointed out that usefulness of fishery statistics has diminished due to time-lag (i.e., delay in compilation), data gaps, unavailability of comparable and reliable data. The main difficulties and constraints in regional exchange and utilization of fishery statistics highlighted at the 1994 Workshop are:

- a) Delays in compiling fishery statistics, mainly due to delay caused by the national programs;
- b) Incomplete and incorrect or unreliable data;
- c) Inconsistencies in national data sets as typified by the changes in the manner in which catches were categorized by species and by gear;
- d) Non-correction for nominal catch, non-calendar year reporting time frames and non-localization of catches and non-reporting;
- e) Need to review the classification of type of fishing gear and of species in view of the changes in the fishing methods or catch fish resources as previously designated;
- f) Incompatibility of data; and
- g) Burden imposed on national programs, e.g., national programs often have to re-process data to cater requirements of international or regional agencies.

At the national level, many national programs reported lack of skilled personnel to collect and compile fishery statistics; poor systems of data collection, validation and maintenance; and the need to computerize fishery statistical system. National fishery programs are concerned primarily with publication of fishery statistical yearbook, which are often two or three years old by the time they are published. The manual systems do not facilitate timely accessibility, availability, analysis and synthesis of data.

Furthermore, many of key issues and constraints in availability and accessibility of fishery data and information in the region noted in an APFIC study (APFIC Secretariat, 1996) apply to fishery statistics program. Issues particularly relevant to fishery statistics programs raised included:

- a) Lack of political will and commitment;
- b) Poor understanding of requirements of users;
- c) Poor accessibility;
- d) Lack of relevant and usable information;
- e) Lacked of skilled manpower;
- f) Insufficient channeling of data and information to target user groups; and
- g) Inadequate resources and sustainability

Fishery information and statistics programs in the region tend to be preoccupied with "collection" and "organization" of data and information, and keeping up with rapidly advancing information technologies. Little attention and resources have been devoted to improving understanding of user needs and/or improving utility of data and information collected (APFIC, 1996). The constraints noted above underscore the need for the fishery statistics programs to give more attention to the needs of their target user groups, particularly the sector management, and compile, analyze and package statistics in a form that users can readily use; and improve accessibility and availability of data, including efficient flow of data and information among related agencies at all levels.

Naturally, all actions required to alleviate difficulties confronting the fishery statistics programs are indicated in Table 1. Formulation and implementation of remedial actions is basically a national effort through coordination, organization and implementation of activities that address common concerns of national programs, while promoting availability of comparable data in the region. Regional collaboration and cooperation would help not only to share expertise and resources, but also to stimulate regional commitment and political will.

The remedial actions listed above suggest that regional responses are particularly desirable in the areas of:

- a) identification of user needs and determination of minimum data requirements;
- b) establishment and adoption of standardized or compatible data compilation methodologies and tools;
- c) strengthening coordination and linkage mechanisms;
- d) analysis of data and production of information packages for regional fishery management, and
- e) skill development.

4. STRENGTHENING REGIONAL COMPILATION AND UTILIZATION OF FISHERY STATISTICS

It has been shown that the basic functions of fishery statistics programs are to provide data and information services for the sector management. Thus, regional cooperation in fishery statistics programs must begin with identification of the sector management needs and determination of data requirements to address the needs identified.

The issues and constraints noted above include:

- a) critical factors affecting exchange and utilization of fishery statistics in national capacities to systematically compile data;
- b) establishment and application of common and compatible data handling methodologies and tools; and
- c) analysis and utilization of data in the context of fishery management needs. Obviously, fundamental to effective and efficient utilization of fishery statistics is the willingness and ability of national programs to address issues relating to:
 - Methodological and operational principles in compilation, processing, analysis and utilization of fishery data;
 - Tools for compilation and processing basic or core fishery data/statistics; and
 - Availability of critical mass of skilled personnel at various functional levels, from data collection, processing and integration, analysis and synthesis, and dissemination.

The region has made considerable progresses in developing and establishing common data handling methodologies and tools. The existing regional standards include standard definitions and classifications of fish species, fishing gears and fish products used for compilation of statistics for South China Sea Areas and FAO.

A computer software designed to record artisanal fishery statistics, i.e., ARTFISH/ARTSER, also exist. This software has been successfully tested and implemented in Cambodia. Given the complex processes and resources required in improving the fishery statistics programs, the region needs to adopt a modular approach based on common priority management needs. In view of the urgency to take measures for management and conservation of fishery resources, the region could begin with strengthening statistics to support regional fisheries management framework recommended by APFIC/COMAF.

Many of the required data are already being collected, but reliability, comparability and completeness need to be improved, and some additional data, particularly in the area of fishery efforts, may need to be compiled. While it is necessary for the national programs to determine and agree on minimum data requirements and compilation methodologies, including standard definitions, classifications and units, and implement the agreement, regional coordination and cooperation would help to ensure benefits of shared expertise and resources, and availability of compatibility and comparability of the data (Table 2).

Additionally, a regional action could be taken to develop a software for the compilation and processing of aquaculture statistics. In spite of the fact that eight of ten major aquaculture producing countries are in Asia, the sector lacks common tools that facilitate compilation of reliable and compatible aquaculture statistics. The sector also needs to redefine/clarify the existing definitions and some of the classifications taking into account data requirements for management. Again, actions at the national and regional levels, are needed to expedite progress for the benefit of the region.

There is also a pressing need to streamline the processes of data compilation and processing at all levels, taking advantage of common or established methodologies and information technologies. In effect, this initiative augments the two initiatives noted above. It would be useful to identify applicable methodologies and tools (e.g., ARTFISH/ARTSER) in the context of the sector management needs and explore ways to facilitate systematic application of common methodologies and tools, particularly strengthening data compilation and processing capacity at data collection level. Capacity building and adoption/application of established methodologies and tools at primary data collection level help to improve minimize re-handling data, e.g., re-inputting/recording and re-processing, reduce error rate, improve consistency, make data easily available to local fishery managers, and facilitate data exchange/linkages among agencies responsible for fishery statistics at all levels. More importantly, this leads to electronic access to databases and allow the sector management to benefit from timely data and information services. The region has several established regional mechanisms such as SEAFDEC and APFIC/FAO, that facilitate and provide leadership in fishery statistics programs.

These organizations, in collaboration with other relevant bodies such as AIT, INFOFISH, MRC and NACA, can effectively facilitate regional consultation and cooperation, and play an active role in formulating and implementing regional actions.

5. CONCLUSION

A number of previous regional fora and studies recognized that:

- a) reliable, relevant and timely data and information are essential inputs to the formulation of policies and action plans for environmentally sound and socially responsible fisheries, and

- b) regional collaboration on fishery information and statistics must be strengthened to support the sector management.

Although attempts were made to establish an information network among Southeast Asian countries, the region is without effective and efficient fishery information and statistics program(s) to support management of the sector. The pressing need to ensure availability and accessibility of reliable and timely statistics for formulation of fishery policies and management plans and actions has been pointed out repeatedly. Formulation and implementation of appropriate responses based on the nature of fisheries and specific needs, are basically national responsibilities.

Nonetheless, regional cooperation and collaboration ensure benefits of shared expertise and resources, and availability of comparable data for management and development of regional fisheries resources and industries. Hence, opportunities for regional cooperation are presented in this paper in order to facilitate the Workshop discussion and formulation of action plan.

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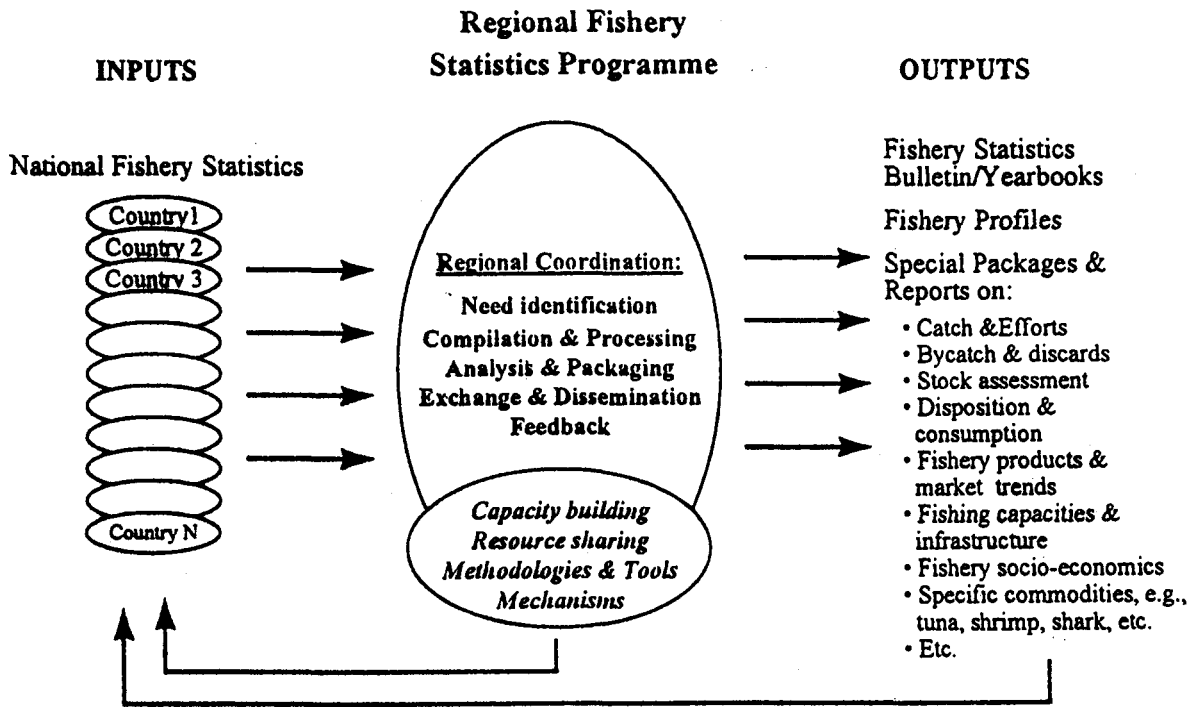


Figure 1. Functions of Regional Fishery Statistics Programme

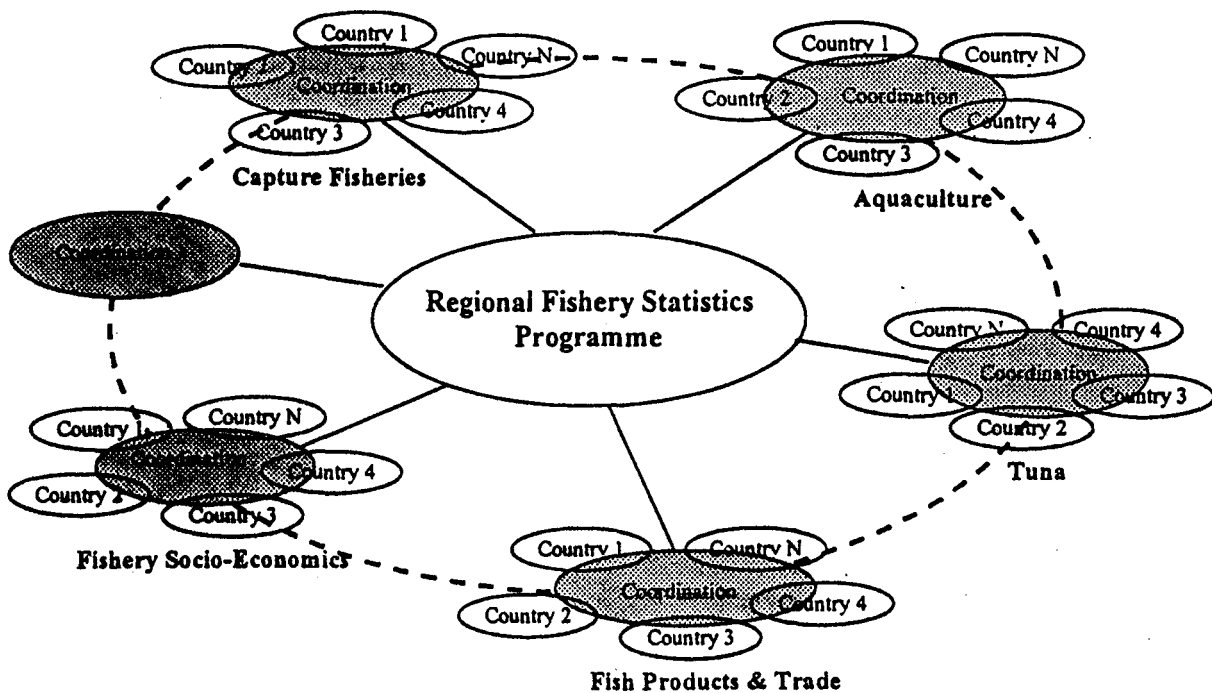


Figure 2. Components of Regional Fishery Statistics Programme

Table 1. Issues and constraints in fishery statistics programs

Issues and Constraints	Illustrative Remedial Actions
<ul style="list-style-type: none"> • Delays in compiling and submitting fishery statistics • Burden on national programs, e.g., data have to be re-input or re-process data in order to meet requirements of international or regional bodies 	<ul style="list-style-type: none"> • Determine the data needs and minimum data requirements • Streamline the processes • Establish and adopt standardized/compatible data collection and compilation methodologies and tools • Strengthen coordination and collaboration mechanisms • Skill development
<ul style="list-style-type: none"> • Incomplete and incorrect or unreliable data • Non-correction for nominal catch, non-calendar year reporting time frames and non-localization of catches, and non-reporting • Inconsistencies in national data sets as typified by the changes in the manner in which catches were categorized by species and by gear 	<ul style="list-style-type: none"> • Establish and adopt standardized/compatible data collection and compilation methodologies and tools • Skill development • Improve and/or strengthen system of data collection and verification
<ul style="list-style-type: none"> • Need to review the classification of type of fishing gear and of species in view of the changes in the fishing methods or catch fish resources as previously designated 	<ul style="list-style-type: none"> • Determine data needs and minimum data requirements • Periodic review, ensuring data collected meet needs of target users
<ul style="list-style-type: none"> • Incompatibility of data 	<ul style="list-style-type: none"> • Determine data needs and minimum data requirements • Establish and adopt standardized/compatible data collection and compilation methodologies and tools
<ul style="list-style-type: none"> • Poor accessibility 	<ul style="list-style-type: none"> • Strengthen functional linkage, and data & information flow • Improve data and information dissemination and exchange mechanisms • Improve capacities for information management and service
<ul style="list-style-type: none"> • Poor understanding of user needs 	<ul style="list-style-type: none"> • Improve understanding of user needs • Establish/strengthen feedback mechanisms
<ul style="list-style-type: none"> • Lack of relevant and usable information 	<ul style="list-style-type: none"> • Improve understanding of user needs & determine minimum data requirements • Improve timeliness, reliability, accuracy, compatibility, relevancy and completeness of data (see above other related actions necessary to achieve this) • Improve analysis and packaging
<ul style="list-style-type: none"> • Lack of skilled manpower 	<ul style="list-style-type: none"> • Develop and make available critical mass of skilled manpower at functional level
<ul style="list-style-type: none"> • Insufficient channeling of information to target user groups 	<ul style="list-style-type: none"> • Improve understanding of user needs • Improve data & information dissemination and exchange mechanisms • Analyze and package data & information according to user needs • Improve dissemination and delivery methods
<ul style="list-style-type: none"> • Lack of political will and commitment • Inadequate resources and sustainability 	<ul style="list-style-type: none"> • Increase awareness that timely and reliable data and information are essential input to management • Strengthen leadership and need-oriented fishery statistical programme • Mobilize commitment and will

Table 2. Opportunities for regional cooperation

Opportunities	Key Indicative Actions	Responsible Body
<ul style="list-style-type: none"> Statistics for fishery management framework recommended by APFIC/COMAF 	<ul style="list-style-type: none"> Determination of needs and minimum data requirements Establishment of common methodologies Preparation & distribution of manual Training of (national) trainers Training of national personnel Implementation, i.e., data compilation & exchange Analysis and packaging of data/statistics in the context of user needs 	<ul style="list-style-type: none"> NP; RP-coordination NP; RP-coordination RP RP NP; RP-tech. backup NP NP; RP
<ul style="list-style-type: none"> Software for aquaculture statistics 	<ul style="list-style-type: none"> Determination of needs and minimum data requirements Establishment of common methodologies Development of software & testing Development & distribution of user guide/manual Training of (national) trainers Training of national personnel Implementation, i.e. data compilation & exchange Analysis and packaging of data/statistics in the context of user needs 	<ul style="list-style-type: none"> NP; RP-coordination NP; RP-coordination RP RP RP NP; RP-tech. backup NP NP; RP
<ul style="list-style-type: none"> Adoption of common methodologies and tools 	<ul style="list-style-type: none"> Determination of needs and minimum data requirements Identification of appropriate tools and methodologies Development & distribution of user guide/manual, if required Training of (national) trainers Training of national personnel Adoption & utilization of methodologies and tools Analysis and packaging of data/statistics in the context of user needs 	<ul style="list-style-type: none"> NP; RP-coordination NP; RP-coordination RP RP NP; RP-tech. backup NP NP; RP

Note: NP-National Programmes; RP-Regional Programme; tech. - technical

**STRENGTHENING OF INLAND FISHERIES INFORMATION SYSTEMS
IN THE LOWER MEKONG BASIN (BASINWIDE)**

by

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Thailand

PROJECT SUMMARY

1. INTRODUCTION

The inland fisheries of the Mekong River basin represent a vital resource with significant economic value. Current production of fish from the region is estimated at possibly one million tons annually with a national monetary value of around US \$750,000,000. Of this total, only about 10% arises from aquaculture, the remainder is produced by an extremely diverse and complex capture fishery operating in one of the world's most productive aquatic ecosystems. In order to sustain these production levels, better informed policy decisions are required. The need to have data and information on various aspects of the capture fishery and aquaculture in the region is being recognized. Improved fishery statistics and information systems will monitor the trends in the fishery and promote improved management of the resource.

The present inland fishery statistical systems for the riparian countries of the lower Mekong River basin are extremely poor, except for Thailand, and has not been useful for the sound management of the resources either on a national or regional (basin-wide) basis. The purpose of the current project is to rectify this situation. A basin-wide fishery statistics and information system will be developed based on the concept of capacity strengthening in each riparian country. National statistical systems will be fortified, primarily through training programmes and the inputs of improved methodologies, appropriate computer software programmes and necessary computer hardware. The data collection and storage systems developed will be enhanced by training in data analysis and the presentation of results to, and consideration by, appropriate decision makers. The objective is to make each country self-sufficient in these respects and the priority will be sustainability of the system. Regional management programmes will be strengthened by improved regional statistics and information systems.

The lack of reliable statistical data for the inland fisheries of the Lower Mekong Basin was raised during the Review of the Fisheries Sector in the Lower Mekong Basin in 1991-92. The review concluded that "Improvement of the basic data must therefore have a high priority for all agents interested in the development of the sector". This review was endorsed during the 1994 Regional Workshop on Fishery Information and Statistics in Asia, partly in response to the issues raised in Agenda 21 of The United Nations Conference on Environment and Development (UNCED) and The Study of International Fisheries Research (World Bank et al).

The project benefits from considerable inputs into the area of data collection and analysis, training and infrastructure development, undertaken by previous and on-going programmes, in particular those associated with the Mekong River Commission Fisheries Management and Development Co-operation Programme.

The current project will draw upon the experiences, methods and progress of these other initiatives and will concentrate on how to develop a sustainable statistics and information system after these other projects have been completed. To a large extent, this project forms a climax of achievement under the regional fisheries programme, the objective of which is to promote "sustainable use of the economic and nutritional potential of the inland aquatic resources of the lower Mekong basin".

External inputs shall be about US \$2,384,120 over a three-year period. Major inputs include technical assistance, short-term consultancies, computer software and hardware. The project has a very heavy institutional capacity strengthening commitment through training. The considerable degree of prior inputs into this technical area will significantly enhance the prospects of success of the project.

2. REQUIREMENTS

Needs for statistical data

- a) managing appropriate revenue generating activities
- b) monitoring trends in the fishery
- c) monitoring the state of the environment
- d) developing and implementing appropriate management policies
- e) basin-wide management considerations

Basic requirements for data analysis and information systems

- a) appropriate data collection,
- b) safe and effective data storage systems,
- c) effective and efficient analyses of the data that relate to the goals and functions of the statistical data system
- d) dissemination of the results and/or implications of these results to the necessary users of the information so generated
- e) feedback mechanisms from the end users to the collectors, compilers and analyzers of the data
- f) detailed records of fish production included

Fishery data required

- a) records of fish production in the required detail
- b) export and import data for fishery products both by region (Province etc.) and nationally

Basic approaches to data collection

A necessary data collection system will normally involve three basic activities:

- a) a large scale and intensive survey of the fishery to establish the characteristics of the fishery and the importance of the fishery including its status in the national economy.
- b) current (monitoring) programmes for selected aspects of the fishery, useful for indicating trends and other features of the fishery,
- c) less frequent follow-up surveys or census activities

3. PROJECT OBJECTIVES

The Development Objective of the project is identical to the immediate objective of the Mekong Fisheries Programme:

Sustainable use of the economic and nutritional potential of the inland aquatic resources of the lower Mekong basin.

The project will contribute to the fulfillment of the Development Objective through the Immediate Project Objective, which is:

Improved and basin-wide compatible inland fisheries data for the lower Mekong basin available for the riparian Governments and the MRC, for fisheries management, planning and policy formulation purposes.

4. OUTPUTS

In order to achieve the Immediate Objective, the following outputs are required:

- (1) *A database on national Mekong basin capture and culture fisheries established and maintained in each of the riparian countries.*
- (2) *A regional database on Lower Mekong basin capture and culture fisheries established and maintained.*
- (3) *National institutions responsible for inland capture and culture fisheries data collection, storage, processing, analysis interpretation and dissemination strengthened.*

5. STRATEGY

The project should begin in a timely fashion that will allow maximization of the benefits on the experiences from previous MRC Fisheries Projects (particularly the Management of the Freshwater Capture Fisheries of Cambodia, and the Assessment of Mekong Fisheries - Fish Migration and Spawning and Impact of Water Management). Such a strategy will help both maximize the efficiency of technical assistance inputs of the recommended project and help increase the benefits of these other initiatives.

Taking into account the financial situation of the various riparian countries, the shortage of skilled manpower, and the difficulties encountered in mobilization, the project will balance the need for statistical information against the costs and operational constraints encountered. Therefore, the aim will be the design and establishment of a sustainable set-up at the lowest operational cost possible. It is essential that the riparian countries can sustain the programme from their own resources at the end of the project, the single most important factor. The statistical systems developed will have to be compatible with statistical systems in operation, or being developed, for other sectors of fisheries, particularly in Thailand and Vietnam where production from the Mekong basin represents only a minority of total national production. The system will also, as far as possible, be compatible between the four riparian countries, thus enhancing the ability to analyse data on a basin-wide approach. The systems should also be compatible with international fishery statistics. The project will cooperate actively with existing projects or new initiatives covering these areas including those dealing with associated statistical and information systems (e.g., for agriculture) in each riparian country and on a basin-wide basis.

Training is the main component, and will include routine data collection, sampling surveys, and data processing, analyses and interpretation and the dissemination of information to the appropriate quarters. This will be backed-up with the supply of modest amounts of computer hardware and appropriate software programmes.

The project, which is planned for a period of 36 months, forms an integral part of the MRC Programme for Fisheries Management and Development Co-operation, which was recommended by the representatives of the riparian line agencies for fisheries at the Second Regional Seminar on Fisheries Management and Development Co-operation in the Lower Mekong basin in Bangkok, 15-16 August 1996. As part of the Programme it is coordinated with a number of MRC fisheries research and management projects. It is planned, under the Programme Component for Strengthening of Fisheries Institutions, which has the long-term Objective of "National fisheries institutions meeting the needs for fisheries sector planning, research and management, and supporting a sustainable development of the fisheries sector also through a basin-wide co-operation".

The project has further been included under the SIFR Strategy for establishment of fisheries information systems in Asia (SIFR 1995). It falls well within the mandate of the Mekong River Commission as a basin-wide project contributing to the coordinated development of the shared natural resources of the Mekong basin.

PROJECT IDENTIFICATION

Project Title : Strengthening inland Information Systems in the Mekong Basin (basin-wide)

Country or Region : Cambodia, Lao PDR, Thailand and Viet Nam

Sector : Fisheries

Duration : 36 months

Starting Date : End of 1998 (tentatively)

Project Main Office : Thailand

National Inputs : USD 219,000 (in kind)

External Contribution : USD2,348,120

Status : Project Document Appraised; seeking funding

Project Description : The Project aims on establishing a common system for collection, processing, analysis and application of fisheries data adopted and in use in the four countries of the lower Mekong basin. The outputs include compatible and sustainable fisheries statistics and information systems in each riparian country enabling a basin-wide management approach. Information systems components, including system design, sampling procedures, computer hardware and software systems and capacity for data analyses and information dissemination will be strengthened. The inputs comprise technical assistance: Long-term: 36 m-m; short-term: 30 m-m; riparian support staff: 120 m-m. Computer hardware and software, office equipment, training, surveys, transportation.

**REGIONAL TECHNICAL ASSISTANCE TOWARD STRATEGIES
AND ACTION PLANS FOR SUSTAINABLE UTILIZATION OF
COASTAL FISH STOCKS IN TROPICAL ASIA**

**by
International Center for living Aquatic Resources Management
(ICLARM)**

PROJECT SUMMARY

1. COLLABORATING INSTITUTIONS

Various developing Member Countries (DMCs)

Bangladesh - Department of Fisheries, Fisheries Research Institute

Indonesia - Directorate General of Fisheries, Central Research Institute of Fisheries

Malaysia - Department of Fisheries, Fisheries Research Institute

Philippines - Bureau of Fisheries and Aquatic Resources, University of the Philippines in the Visayas

Sri Lanka - Ministry of Fisheries and Aquatic Resources Development, National Aquatic Resources Agency

Thailand - Department of Fisheries, Southern Marine Fisheries Development Center

Vietnam - Ministry of Fisheries, Research Institute of Marine Products

2. DONOR

Asian Development Bank (ADB)

3. DURATION

3 years (1997-2000)

4. OBJECTIVES

The main objective of the Regional Technical Assistance (RETA) is to assist selected DMCs, in a catalytic mode, in improving the management and sustainable utilization of their coastal fisheries. Specifically, the RETA aims to:

- a) develop resource databases and enhance management information in order to meet the resource management needs of selected DMCs;
- b) develop appropriate strategies and action plans to assist selected DMCs in rehabilitating their coastal stocks and sustaining the resulting improved benefits; and
- c) strengthen the capabilities of selected DMC institutions in coastal fisheries assessment and management.

5. BACKGROUND AND JUSTIFICATION

The results of ADB RETA No. 5651 (Sustainable Exploitation of Tropical Coastal Fish Stocks in Asia) acknowledged that the multiplicity of issues impacting coastal fisheries in the region requires action on a broad front. Success in reversing or mitigating these issues will be highly premised on institutional capabilities and resources mobilization in the DMCs, which face considerable technical, manpower and financial constraints in responding to the host of issues. In this regard, RETA No. 5651 has successfully identified key elements for an expected regional collaboration. The consensus achieved is that these elements (duly incorporated and for implementation in this project) can catalytically assist the DMCs in identifying, prioritizing and orchestrating the interventions to many of the issues at hand. This RETA supports the objectives of ICLARM and ADB as it would address environmental and natural resources management. The regional cooperation is cost-effective in addressing common issues in the management of coastal fish stocks in the participating DMCs. The Project will have an impact on the management and protection of fishery resources in South and Southeast Asia. It will contribute to scientific advancement in stock assessment and development of fishery resource databases which could be applied extensively developing countries for improved management and sustainable utilization of coastal fisheries resources.

6. PROJECT COMPONENTS AND EXPECTED OUTPUTS

Target outputs for the proposed RETA will be generated via the implementation of two interrelated components, namely:

- a) Research, Information and Training; and
- b) Management Policy and Planning.

The Research, Information and Training Component consists of three main tasks, namely, database development (Task 1), the conduct of regional and national training for DMC scientists in the required fields of expertise for successful RETA implementation (Task 2), and analyses of the compiled data and related information at the national and regional level (Task 3). The Management Policy Planning Component consists of three main tasks:

- a) for the conduct of national and regional workshops (Task 4),
- b) elaboration of national strategies and action plans for participating DMCs (Task 5), and
- c) the development of strategies and action plans at the regional level (Task 6).

The main outputs of the RETA activities are:

- a) TRAWLBASE - a consolidated regional resource database and related documentation;
- b) a regional training/workshop proceedings detailing the results of the data analyses and reviews conducted at the national and regional levels (including resource/management trends and opportunities;
- c) reports detailing the national strategies and action plans for each of the participating DMCs; and
- d) a report detailing regional strategies and action plans for rehabilitation of coastal stocks/fisheries.

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LIST OF DOCUMENTS**A. Working Documents**

FAO/SEAFDEC/97/1	Annotated Agenda and Timetable
FAO/SEAFDEC/97/2	Follow-up by FAO to Recommendations from the 1994 Regional Workshop on Fishery Information and Statistics in Asia
FAO/SEAFDEC/97/3	Recent international initiatives with implications for fishery statistics
FAO/SEAFDEC/97/4	Current FAO fishery statistics programme
FAO/SEAFDEC/97/5	Fishery Statistics Bulletin for the South China Sea Area
FAO/SEAFDEC/97/6	Quality of capture fishery and aquaculture production statistics for Asia and the Pacific
FAO/SEAFDEC/97/6. Suppl.	Naitonality of catch
FAO/SEAFDEC/97/7	Review and the present status on the catch-effort statistics for the South China Sea Area
FAO/SEAFDEC/97/8	Guidelines for the collection of fishery data for artisanal fisheries
FAO/SEAFDEC/97/9	Experiences and case studies in the implementation of data collection methods for artisanal fisheries
FAO/SEAFDEC/97/10	Development on collation of tuna fishery statistics for the Southeast Asian region
FAO/SEAFDEC/97/11	Recent development on aquaculture statistics
FAO/SEAFDEC/97/12	Socio-economic information for fishery management and development
FAO/SEAFDEC/97/12, Suppl.	Dramatic change in shrimp culture in Thailand
FAO/SEAFDEC/97/13	Regional cooperation for fishery statistics programmes

B. Country Reports

FAO/SEAFDEC/97/CR1	Fisheries Statistics in Brunei Darussalam
FAO/SEAFDEC/97/CR2	Fisheries and fishery statistical system in Bangladesh
FAO/SEAFDEC/97/CR5	Country Report of Indonesia
FAO/SEAFDEC/97/CR6	Outline of Fishery Statistics: Japan
FAO/SEAFDEC/97/CR7 A	Status and prospect of Korean fisheries
FAO/SEAFDEC/97/CR7 B	Korean fishery statistical system
FAO/SEAFDEC/97/CR8	Country Report: Malaysia I. Current status of fishery statistical systems in Malaysia II. Current and future economic aspect of fisheries in Malaysia
FAO/SEAFDEC/97/CR9	Fishery statistics in the Philippines
FAO/SEAFDEC/97/CR10	Fishery statistics of Taiwan
FAO/SEAFDEC/97/CR11	Country Paper: Thailand I. Thailand fishery and its statistics II. General trends in the fishery sector
FAO/SEAFDEC/97/CR12	Statistical data on Vietnamese fisheries
FAO/SEAFDEC/97/CR13	Present status of fishery statistics in Myanmar

C. Information Documents

FAO/SEAFDEC//Inf. 1, Rev. 4	Provisional List of Documents
FAO/SEAFDEC/Inf. 2	Provisional List of Participants
FAO/SEAFDEC/Inf. 3	Proceedings of the Regional Workshop on Fishery Information and Statistics in Asia, Bangkok, Thailand, 18-22 January 1994, Vol. I
FAO/SEAFDEC/Inf. 4	Recent FAO activities related to by-catch and discard issues

FAO/SEAFDEC/Inf. 5	Case study of the preparation of national economic accounts: Norway
FAO/SEAFDEC/Inf. 6	Integrated environmental and economic accounting in fisheries
FAO/SEAFDEC/Inf. 7	Strengthening of Inland Fisheries Information Systems in the Lower Mekong Basin (Basinwide) Project Summary. Mekong River Commission Secretariat
FAO/SEAFDEC/Inf. 8	Regional Technical Assistance Towards Strategies and Action Plans for the Sustainable Utilization of Coastal Fish Stocks in Tropical Asia: Project Summary. ICLARM

D. Reference Documents

FAO/SEAFDEC/Ref. 1	Fishery Statistical Bulletin for the South China Sea, 1994. SEAFDEC. SEC/ST/30 (January 1977)
FAO/SEAFDEC/Ref. 2	The Catch-Effort Statistics for the South China Sea Area, 1992. SEAFDEC, MFRDMD/ST/1 (August 1997)
FAO/SEAFDEC/Ref. 3	Indian Ocean Tuna Fisheries Data Summary for 1985-1995. IPTP Data Summary No. 17 (1997)
FAO/SEAFDEC/Ref. 4	FAO Yearbook of Fishery Statistics Vol. 80: Catches and Landings, 1995. FAO Fisheries Series No. 48 (1997)
FAO/SEAFDEC/Ref. 5	FAO Yearbook of Fishery Statistics Vol. 81 Commodities, 1995. FAO Fisheries Series No. 45 (1997)
FAO/SEAFDEC/Ref. 6	1995 Marine Fishery Indicators of Thailand. National Statistical office, Office of the Prime Minister, Thailand (1997)

AGENDA

1. **Opening of the Session**
2. **Adoption of the Agenda and Arrangements for the Session**
3. **Current status of fishery and aquaculture statistics**
 - a. **National fishery and aquaculture statistics**
 - b. **FAO fishery statistics programmes**
 - c. **SEAFDEC Fishery Statistical Bulletin**
 - d. **Catch and effort statistics**
 - e. **Tuna fishery statistics**
 - f. **Aquaculture statistics**
 - g. **Socio-economic statistics**
4. **Improvement on the collection, compilation, and dissemination of fishery and aquaculture statistics**
5. **Regional cooperation in strengthening the application of fishery and aquaculture statistics**
6. **Conclusion and recommendations**
7. **Closing ceremonies**

ARRANGEMENTS OF THE MEETING

19-21 August 1997

Royal Princess Hotel, Bangkok, Thailand

Tuesday, 19 August 1997

- 0900 - 1000 Agenda 1.0 Opening of the Session
 Procedural
 Welcome Address by *Mr. Udom Bhatiyasevi*
 Opening Remarks by *Dr. Soetatwo Hadiwigeno*
- Agenda 2.0 Adoption of the Agenda and Arrangements for the Session
- Chair:** Udom Bhatiyasevi
 Rapporteur: V. Sulit
- 1045 - 1200 Agenda 3.1 Current status of national fishery and aquaculture statistics: Country papers
 Chair: R. Grainger
 Presentors: Abdul Halidi Salleh, Rakhal Kangsa Banik, Lui Quian-fei, Bambang Wahyudi, Norimuchi Suzuki, Doo-Hae An
 Working Documents: FAO/SEAFDEC/97/CR 1-6
- 1330 - 1530 Agenda 3.1 Continuation
 Chair: R. Grainger
 Presentors: Thalathiah Bt. Haji Saidin, Ma Ma Lay, Tran Thi Mieng, Romeo Recide, Chaur-Lian Horng, Marina Waiyasilp
 Working Documents: FAO/SEAFDEC/97/CR 7-12
 FAO/SEAFDEC/97 Inf. 3
- Rapporteur:** V. Sulit
- 1545 - 1700 Agenda 3.2 FAO Fishery Statistics Programme
 Chair: Hiek Som
 Presentors: T. Visser, R. Grainger
 Working Documents: FAO/SEAFDEC/97/2-4
- Agenda 3.3 SEAFDEC Fishery Statistical Bulletin
 Chair: Hiek Som
 Presenter: Pouchamarn Wongsanga
 Working Document: FAO/SEAFDEC/97/5
- Rapporteur:** V. Sulit
- 1800 - 2200 Reception hosted by SEAFDEC Secretary-General

Wednesday, 20 August 1997

- 0900 - 1030 Agenda 3.4 Catch and effort statistics
Chair: Veravat Hongskul
Presentors: Ibrahim bin Johari, R. Grainger, T. Visser
Working Documents: FAO/SEAFDEC/97/6-9, 6 Suppl.
Rapporteur: V. Sulit
- 1045 - 1200 Agenda 3.5 Tuna fishery statistics
Chair: K.P. Nambiar
Presenter: Raja Bidin bin Raja Hassan
Working Document: FAO/SEAFDEC/97/10
Rapporteur: V. Sulit/Yong-Ja Cho
- 1330 - 1530 Agenda 3.6 Aquaculture statistics
Chair: R. Recide
Presenter: T. Visser
Working Document: FAO/SEAFDEC/97/11
Rapporteur: V. Sulit
- 1545 - 1700 Agenda 3.7 Socio-economic statistics
Chair: Damrong Silpachai
Presenter: R. Grainger
Working Documents: FAO/SEAFDEC/97/12-12 Suppl.
Rapporteur: Yong-Ja Cho
- 1700 - 1800 ARTFISH demonstration by *T. Visser*

Thursday, 21 August 1997

- 0900 - 1030 Agenda 4.0 Improvement of the collection, compilation and dissemination of fishery and aquaculture statistics
Chair: R. Grainger
Rapporteur: V. Sulit/Yong-Ja Cho
- 1045 - 1200 Agenda 5.0 Regional cooperation in strengthening the application of fishery and aquaculture statistics
Chair: M. Shimomura
Presenter: Yong-Ja Cho
Working Document: FAO/SEAFDEC/97/13
Rapporteur: V. Sulit
- 1300 - 1530 Drafting of Workshop Recommendations
- 1530 - 1700 Agenda 6.0 Adoption of the recommendations
Chair: Udom Bhatiyasevi
- Agenda 7.0 Closing ceremonies
Chair: Udom Bhatiyasevi
 Richard Grainger
- Rapporteur:** V. Sulit

WELCOME ADDRESS

by

Mr. Udom Bhatiyasevi

Secretary-General

Southeast Asian Fisheries Development Center

I would like to take this opportunity to welcome all of you to Bangkok, and particularly to the Royal Princess Hotel which used to house SEAFDEC's Office of Secretary-General in its early years. Many SEAFDEC old timers will be glad that we are organizing this Workshop on the premises of our old home. This really gives us the feeling, in a traditional sense, that we are really your "host".

Allow me also to welcome you to the Regional Workshop on Fishery Statistics. As many of you are aware, this is a sequel to a series of fishery statistics workshops, the latest of which was the 1994 FAO/SEAFDEC Regional Workshop on Fishery Information and Statistics in Asia. The 1994 Workshop made several recommendations which included the need for improved statistics processing systems particularly for improved data validation and exchange using advanced technology. This time, we need to review the progress in these areas as well as discuss regional efforts in strengthening the application of statistics.

The prevailing situation facing all fishery resource managers is a grim picture painted by the continuous deterioration of physical and living marine resources. We all know that the reckless extraction or destruction of minerals, marine fishes and corals have led to the present state of concern. It is true that the seas and oceans have been so well endowed with the myriad resources, but they have to endure the consequences of greedy and selfish acts of harvesters who set high hope and expectation particularly for the outrageous amount of profit. The symptom of the "Tragedy of the Commons" has been well-known to the vast sheet of marine water, which makes it extremely difficult for anyone to exercise effective control given the extension of EEZ by most coastal nations.

When many people of various interest who have in their hands the highly destructible technology and in their heads an enormous greed, set their aims at the seas, the marine resources would inevitably come under the great plunder of all times. This grim situation is bad enough, but the worst is yet to come if effective preventive measures cannot be put in place. A few instances of crime can be said as "bad"; their endless recurrences cannot be termed anything but "worse".

Fishery statistics, like all other statistics, is an important tool for most resource managers. It is not necessarily meant for providing an exact number of an indisputable fact, but as a meaningful yardstick. Statistics can tell us how better or worse we are performing. The trend of things and its probable attributes are what planners and resource managers need to know, so that they can chart their future courses of action. The most reliable source of information could be the trend in the recent past. How can one possibly prepare coping with tomorrow if he only knows what it was like in the very immediate past?

Responsible fishing is what all coastal nations have been told and agreed upon to practice. The advocating agencies do realize the many shortcomings of fishery statistics, that is why they also promote the concept of "precautionary measures" or be on the safe side, they would say, if you don't really know the facts. If I ask all of you here: Is it really impossible to get the facts? I earnestly hope you would say "No", as FAO and SEAFDEC strongly believe that providing facts to fishery resource managers is quite possible. This is the reason why we jointly organize this Workshop.

As a planner, I do appreciate your past contribution knowing that it is very difficult to collect and analyze fishery statistics especially the empirical data. Fishery statistics is indeed complex since it has to cope with thousands of fish species, caught by some obscure methods in hardly defined geographical areas of the sea. Although the shortage of manpower and funds can be cited as reasons for not being able to achieve something, it is certainly not about statistics. It is exactly for these reasons why statistics come into being. When you cannot count something, statistics can tell you a rough but meaningful number.

For the past many years, SEAFDEC and FAO have been promoting fishery statistics in the South China Sea Area, and our efforts have been very much appreciated. Now that we are all benefiting from the advancement of information technology, we should hope to do it even better. One thing we cannot replace and will never replace, is the active involvement of the national statistics offices. I am indeed very happy that you are all here to discuss things of your own expertise. I hope you will be able to resolve the persistent hurdles and come up with practical agreement that we can work together effectively.

I would like to thank FAO, particularly the Assistant Director-General, Dr. Soetatwo Hadiwigeno; The FAO/RAP Regional Fisheries Officer, Dr. Veravat Hongskul, and other officers present here, for their hard work and warm partnership. I am confident that when FAO and SEAFDEC work together, many tangible and useful things can be done.

I hope you will spend the next few days in a fruitful discussion, so that in the end, you will produce results that would benefit all of us. With additional effort from APFIC, which organizes the next two days Meeting of the Working Party on Fishery Statistics and Economics, we can pin our hope on a better and timely statistical information for Southeast Asian fishery resource planners in the years to come.

Good day to one and all!

OPENING REMARKS
by
Dr. Soetatwo Hadiwigeno
Regional Representative and Assistant Director-General
Regional Office for Asia and the Pacific of FAO

The Secretary-General of SEAFDEC, distinguished participants, ladies and gentlemen, good morning!

It is my privilege and pleasure to be with you this morning for the opening ceremony of the FAO/SEAFDEC Regional Workshop on Fishery Statistics as well as the First Session of the APFIC Joint Working Party on Fishery Statistics and Economics which are held together for the interest of economy and greater participation. The continued cooperation between FAO and SEAFDEC should be commended as we are both working closely for the development and management of fisheries in this region.

Being an economist myself, the need for accurate and timely statistics is well recognized. Assessment of performance in all sectors of agriculture requires reliable data in order to gain in-sight of the current status and future prospect. In using available data for fishery management, one should be well aware of the present and future trends. The era of limitless exploitation is now gone while the golden years of increasing production has passed. What we are confronted now is no longer how to further develop our fisheries but rather how to properly conserve and manage all fishery and aquatic resources to ensure future supply of fish for food security.

At the World Food Summit held in Rome in 1996, the issues on fisheries and food security were discussed. It was noted that 44 percent of stocks that have been assessed were exploited at their maximum or close to it while 25 percent are depleted. On the other hand, projections of demand for fish for food in the year 2010 are in the range of 110-120 million tons a year. Projections of supply however are less precise but the most optimistic projections fall within the range of the above demand. Disparities between supply and demand are worsened by wasteful methods of catching and processing fish. As much as 27 million tons of fish may be discarded each year. This is a painful fact for all of us concerned.

In order to guide fishery planners and policy-makers in developing a better strategy for sound management and sustainable use of aquatic resources, timely and accurate statistics are required. The compilation and dissemination of fishery statistical data related to catches, aquaculture production, trade and production of fishery commodities, fish consumption and fishing fleets are essential for policy analysis. In addition, growing statistical demands are to be met concerning high sea fisheries and fleets, fish consumption trends and the role of fish in nutrition.

I am pleased to see close collaboration between FAO and SEAFDEC in organizing this Regional Workshop to address the current status of fishery statistics in the region as well as ways and means to improve the existing statistical systems to meet the new demands for better statistics for management purposes. As FAO will continue to be the global focal point for the compilation and dissemination of fishery statistics, actions taken at national and regional levels would undoubtedly strengthen this role for mutual benefit of all concerned. I therefore wish the Regional Workshop success in its deliberation.

With these words, I wish you a very fruitful session and a pleasant stay in this "amazing" City of Bangkok.