



GCP/RAS/171/JPN  
Field Document No. 3

IMPROVEMENT OF AGRICULTURAL STATISTICS  
IN ASIA AND PACIFIC COUNTRIES  
(GCP/RAS/171/JPN)

**Proceedings of  
the Workshop on Improvement  
of Fishery Statistics  
in Asia and Pacific Countries**

Bangkok, Thailand, 6-10 August 2001

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
BANGKOK, 2001**

This publication is produced by

**The FAO Regional Project  
For the Improvement of Agricultural Statistics in Asia and Pacific Countries  
GCP/RAS/171/JPN**

The designations employed in the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The opinions expressed in each paper are those of the author or authors alone and do not engage the responsibility of FAO in any way.

All rights reserved.

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means – electronic, mechanical or otherwise – without the prior written permission of the copyright owner. Applications for such permission, with a statement of the purpose and extent of the reproduction, should be addressed to the Food and Agriculture Organization of the United Nations, Regional Office for Asia and the Pacific, Maliwan Mansion, 39 Phra Athit Rd, Bangkok 10200, Thailand.  
© FAO 2001

**For copies, write to:**

Regional Project for the Improvement  
of Agricultural Statistics in Asia and Pacific Countries  
c/o FAO Regional Office for Asia and the Pacific  
Maliwan Mansion  
39 Phra Athit Road  
Bangkok 10200, Thailand

**Contact address:**

Ryuki Ikeda  
Agricultural Statistics Expert  
GCP/RAS/171/JPN  
Tel: 66-2-2817844 Ext. 354  
Fax: 66-2-6292144  
Email: <Ryuki.Ikeda@fao.org>

## TABLE OF CONTENTS

	Page
<b>Executive Summary</b>	
Introduction	1
Workshop sessions	2
Recommendations	5
<b>Appendixes</b>	
A. List of Participants	7
B. Provisional Programme	11
C. Opening Statement by Dr. R. B. Singh, FAO Assistant Director General and Regional Representative for Asia and the Pacific	15
D. Presentation on Artfish	19
E. Data and results worked out by participants	33

# Executive Summary

## Introduction

1. The Workshop on Improvement of Fishery Statistics in Asia and Pacific Countries was held during the period 6-10 August 2001 at the FAO Regional Office for Asia and the Pacific in Bangkok, Thailand. It was organized under the auspices of the Japan/FAO Cooperative Project for the Improvement of Agricultural Statistics in Asia and Pacific Countries (GCP/RAS/171/JPN). Sixteen (16) representatives from fifteen (15) countries participated in the workshop. The representatives were senior officials expected to influence the direction of development of fishery statistics systems in their respective countries. The list of the persons that have attended the workshop is given in Appendix A and the Workshop Programme in Appendix B.

2. During the opening session, Dr. R. B. Singh, FAO Assistant Director-General and Regional Representative for Asia and the Pacific, welcomed the participants and expressed his satisfaction with the results achieved by the project. He further underlined the fact that the approved second phase of the project was an indication of its success, and he thanked the Government of Japan for its generous assistance and support given to the project.

3. Dr. Singh noted that in the Asia-Pacific region, the agricultural sector had been contributing significantly to the social and economic development of the countries and to the improvement of living standards and quality of life of the people. He also stressed the fact that agriculture was not confined only to utilization and exploitation of land-based resources but it encompassed a wide variety of other food production activities, such as capture fisheries and aquaculture.

4. It has always been recognized that fisheries was a significant sector in the Asia Pacific region and that it continues to grow at a fast pace. Further growth in world fish production, especially from aquaculture, was expected to come mainly from this region. The need to produce more fish to address increasing demand had caused heavy pressure on the fishery resources and their environment. Dr. Singh noted that this trend ought to be arrested in order to ensure sustainability of fisheries contribution to livelihood and food security. Countries could contribute to achieving a balance between environment and development by observing the code of conduct for responsible fishing as developed by FAO.

5. Given the nutritional role of fish in the diet of several millions of people, countries must enhance their capacity to evolve policies and development plans, especially for the fishery sector. Such plans must be based on timely, accurate and reliable statistics. Dr. Singh added that statistics ought to be viewed not as mere figures but as meaningful and useful knowledge upon which sound policy making and planning will be based. In concluding his statement, Dr. Singh emphasized that FAO had always placed high priority on fishery information and statistics and expressed his confidence that the Workshop would be successful. The full text of the ADG's Opening Statement is given in Appendix C.

6. Dr. Constantine Stamatopoulos, Senior Fishery Data Officer from FAO Headquarters in Rome, expressed his appreciation for the initiative taken by the regional Project to organize the Regional Workshop. He thanked Dr. Singh and his staff at RAPA for the excellent workshop preparations and his colleagues in Rome for their support. He explained that the purpose of the Workshop was to present practical approaches to address familiar problems in fishery data generation. He said that this was consistent with FAO's role in developing standardized and harmonized methodologies that were sustainable and cost-effective. At the end of the Workshop, he expected the participants to come up with an assessment of the applicability of the approaches in their respective countries.

7. Mr. Ryuki Ikeda, Agricultural Statistics Expert, GCP/RAS/171/JPN, introduced the Regional Project to the participants. He recounted that the Project was born from a recommendation made during the 16th Session of the Asia-Pacific Commission on Agricultural Statistics held in Tokyo in 1996. Its main objectives were (i) to contribute to national statistical development through studies of national systems and organization of national seminars and workshops, and (ii) to formulate a plan for the establishment of a regional data exchange system on food and agriculture statistics in Asia and Pacific countries, based on the country studies. He informed the Workshop that the Project was implemented in 16 countries through focal points who facilitated their countries' participation in Project activities.

## **Workshop sessions**

8. The participants introduced themselves and presented brief descriptions of the state of fishery statistics in their countries, with focus on the constraints in the development of sustainable national fishery statistical systems. They reported that fisheries played a key role in the food security programmes and socio-economic development of their countries. In this connection, all participants

recognized the need for improved fishery statistics in the formulation of policies and the design of programmes for the fisheries sector.

9. Countries generated fishery statistics primarily to address their own data needs. This was done by various means and to different extents. Most commonly collected information includes numbers of fishing units, volume of catch or production, prices, and foreign trade. In most cases, fishery statistics were generated by offices responsible for the management of fishery development programmes, notwithstanding the existence of national statistical offices that were responsible for general-purpose statistics. Several countries had been using sampling techniques to produce statistics. Others relied on complete coverage of fishery units either through enumeration, administrative reporting or registration systems. Others used a combination of these two general approaches.

10. It was generally felt that despite progress being made in the implementation of national fishery statistical programmes in the region, there was still much room for methodological and operational improvements. Several participants stressed the fact that fisheries statistics operated under serious constraints in human and financial resources which in turn created negative impact in the production of accurate, reliable, timely and comprehensive fishery statistics. Statistical systems development is constrained by a number of factors. Among these factors the most important were: (i) shortage of skilled manpower to design and implement statistical activities; (ii) inadequacy of resources to support statistical operations; (iii) absence of suitable methodologies; and (iv) lack of support and appreciation of the value of statistics from general public as well as from key decision makers.

11. Participants further reported a number of technical or operational problems encountered in their work. These included: (i) difficulty in handling subsistence capture fishery; (ii) lack of standard methodology for aquaculture statistics; (iii) lack of appropriate sampling frames; (iv) difficulty in monitoring illegal fishing activities; (v) uncooperative respondents; (vi) insufficiently trained and/or motivated field staff; (vii) lack of guidelines and technical reference material in the design and implementation of fishery statistical programmes.

12. Participants suggested some measures to improve the fishery statistical system in the region. A few participants identified external technical assistance, either in the technological aspects of fishery or in statistical methodologies, as an urgent need. Human resource development in the form of training had also been identified as very useful. In this respect, participants expected to gain new knowledge and improve their skills from this regional workshop. However, they

expressed the need for training at national level as a requisite to effectively strengthen the technical capacity of staff in their countries.

13. The concepts of sustainability and cost-effectiveness were defined. It was said that on the basis of data requirements, survey planners might choose from among several statistical schemes to address these requirements. If a scheme was workable within the limits of available resources, then it was sustainable. Among the sustainable schemes, the one that was cheapest and at the same time satisfied data requirements, was referred to as cost-effective.

14. Dr. Stamatopoulos introduced *Artfish* to the participants. *Artfish* was the acronym for Approaches, Rules, and Techniques for Fisheries Statistics. The system was a family of statistical approaches, technical documents and computer software that was used to streamline survey operations and process/analyze data collected from the field. While countries might consider developing their individual systems to meet their own requirements, *Artfish* was developed by FAO as a generic system intended to be as widely applicable as possible. Work on *Artfish* was meant to spare countries the high cost of software development in terms of time, effort and money. It was first developed in MS DOS in 1996 but had recently been converted to run under Windows. A copy of the presentation is given in Appendix D.

15. Participants were presented with basic terms and concepts used in *Artfish* such as: (i) Definitions of catch, effort and CPUE for statistical purposes; (ii) a generic expression for estimating catch and types of surveys involved; (iii) types and criteria for geographical stratification schemes; (iv) criteria and methods used for setting-up survey standards such as species and boat/gear tables; (v) *Artfish* data flows and system architecture; and (vi) concepts in data organization and formulation of estimation contexts.

16. To demonstrate the functions and capabilities of *Artfish*, participants were invited to prepare datasets of data on landings and fishing effort and emulate field activities of data reporters responsible for data collection. Data were entered into the system and related diagnostics resulting during data processing and statistical analysis were described and explained. Output tables showing various dimensions of the final estimates were produced and analyzed. Sample output tables are given in Appendix E.

17. It was concluded that *Artfish* was specially suited for the statistical monitoring of small-scale inland and marine fisheries but would not be appropriate for surveys on aquaculture and large-scale industrial fishing operations. Further, the participants concluded that *Artfish* was a promising approach with potentially beneficial applications in the countries of the Asia-

Pacific region. In this connection, participants strongly felt the need for FAO to actively seek and support modalities which would institutionalize Artfish in countries that needed systems for the statistical monitoring of fisheries sectors that were at present not covered, and in countries that were not in a position to invest on systems development. However, institutionalization of Artfish in countries would involve a certain extent of technical assistance in installing the system and training statistical personnel on its use.

18. On the statistical issues related to aquaculture monitoring, the Workshop concluded that a separate regional activity, in the form of expert consultation, be organized specifically for the purpose of articulating these issues and proposing measures to address them. Participating experts would be asked to prepare alternative methodological and operational data collection and analysis schemes for presentation and discussion.

19. The List of Participants and the Workshop Programme are given as Appendix A and Appendix B, respectively. The full text of Dr. Singh's Opening Statement is presented as Appendix C. A copy of the presentation on Artfish is attached as Appendix D while tables and reports worked out by participants are in Appendix E.

## **Recommendations**

20. On the basis of the discussions, observations and conclusions, the workshop participants made the following recommendations:

- (a) A regional workshop or expert consultation, to address statistics on aquaculture and subsistence fishery, to be organized in the near future.
- (b) FAO to seek ways and means for providing technical assistance, such as training and national workshops, for the introduction and use of Artfish in countries where the system is both applicable and needed.
- (c) Countries in the region to increase support to fisheries statistics and facilitate operations for data collection and processing.
- (d) FAO to plan periodic organization of regional workshops such as the present to provide a forum to exchange views and observations on fishery statistical development.
- (e) Basic statistical data such as those being collected at present, may serve a wide variety of applications. Senior Fishery Statistical Officials ought to increase the current utility of their statistical outputs through enhanced and more comprehensive statistical analyses and reporting, combined with upgraded data exchange procedures.



**FAO Regional Project  
Improvement of Agricultural Statistics in Asia and Pacific Countries  
(GCP/RAS/171/JPN)**

---

**Workshop on Improvement of Fishery Statistics  
in Asia and Pacific Countries  
Bangkok, Thailand, 6-10 August 2001**

**List of Participants**

**BANGLADESH**

Mr. Abu Bakar SIDDIQUE  
Director  
Agriculture Wing,  
Bangladesh Bureau of Statistics  
Ministry of Planning  
Block-2, 3<sup>rd</sup> Floor  
E 27/A, Agargoan  
Dhaka 1207  
Tel. 8130466 (Office), 7214174 (Res)  
Fax.  
Email: bakar34@hotmail.com

**BHUTAN**

Mr. T.N. ACHARYA  
Head, Information Management Section  
Department of Agriculture and Livestock Support  
Services  
Ministry of Agriculture  
P.O. Box 113  
Thimphu  
Tel. 975-2-322418  
Fax. 975-2-322094  
Email: tn\_acharya@moa.gov.bt

**CAMBODIA**

Mr. Vannak TUOR  
Statistician  
Agricultural Statistics  
Statistics Office  
Department of Planning, Statistics and  
International Cooperation  
Ministry of Agriculture, Forestry and Fisheries  
#200 Phnom Penh  
Tel : (855-23) 720527  
Fax : (855-23) 720527  
E-mail : Tuor-Vannak@hotmail.com

**CHINA**

Mr. Gang ZHAO  
Principle Staff Member  
International Cooperation Division  
Bureau of Fisheries  
Ministry of Agriculture  
No. 11, Nongzhanguan Nanli  
Beijing 100026  
Tel. 86-10-64192928  
Fax. 86-10-64192951  
Email: inter-coop@agri.gov.cn

**FIJI**

Mr. Subodh Prasad SHARMA  
Fisheries Officer (Statistics)  
Fisheries Department  
Ministry of Agriculture, Fisheries & Forestry  
P.O. Box 3165  
Lami, Suva  
Tel. 679-361122  
Fax. 679 361184  
Email. ssharma001@fisheries.gov.fj

**INDIA**

Mr. Surinder Kumar GUPTA  
Director  
Department of Animal Husbandry & Dairying  
Ministry of Agriculture  
Krishi Bhawan  
New Delhi 110001  
Tel.: (91-11) 3386318(Office), 5933634 (Res)  
Fax: (91-11) 3384030  
E-mail : skg@aphind.deihi.nic.in  
skg52@hotmail.com,

**INDONESIA**

Mr. Djoko SANTOSO  
Chief  
Production Statistics Field  
BPS East Java Prov.  
JL. Raya Kendangsari Industri  
43-44 Surabaya 60292  
Tel. 62-31-8438611  
Fax. 62-31-8494007  
Email: djokosan@telkom.net

**IRAN**

Alireza HATAMI SADABAD  
Deputy Director General  
Bureau Statistics and Information Division  
Ministry of Jihad-e-Agriculture  
Tehran  
Tel : 98- 21- 8963025  
Fax: 98 - 21- 8960377  
Email. a.hatami@jahad.net

**LAO PDR**

Mr. Somphanh CHANPHENGXAY  
Director of Division  
Statistics and Planning Division  
Department of Livestock and Fisheries  
Ministry of Agriculture and Forestry  
P.O. Box 811  
Vientiane  
Tel : (856-21) 416932  
Fax : (856-21) 415674  
E-mail : eulaodlf@laotel.com

**MYANMAR**

Ms. Aye Aye MYAING  
Director  
Directorate of Livestock and Fisheries  
Ministry of Livestock and Fisheries  
460 Merchant Street, Konthe Road  
Botataung Township  
Yangon  
Tel : 095-1-295365  
Fax : 095-1-290083  
E-mail:

**NEPAL**

Mr. Ramesh Chandra DAS  
Deputy Director  
Section Chief  
Fisheries, Livestock and Horticulture  
Central Bureau of Statistics  
Thapathali, Ram Shah Path  
Katmandu  
Tel. 977-1-229406, 245946-47  
Fax. 977-1-227720  
Email: Env@stat.wlink.com.np

**PAKISTAN**

Cdre. Qamar Raza SYED  
Director General  
Marine Fisheries Department  
Ministry of Food Agriculture and Livestock  
Fish Harbour, West Wharf  
Islamabad  
Tel. 92-21-2312923  
Fax. 92-21-2316539  
Email:

**SRI LANKA**

Mr. A.D.B. JAYASOORIYA  
Statistician  
Ministry of Fisheries and Aquatic Resource  
Development  
Department of Census and Statistics  
Colombo 10  
Tel : (94-1) 381367  
Fax : (94-1) 329440  
E-mail: dsensus@lanka.ccom.lk

**THAILAND**

Mr. Kasem PRAPHABKUL  
Senior Statistician  
Center for Agriculture Information  
Office of Agricultural Economics  
Ministry of Agriculture and Cooperatives  
Bangkhen, Bangkok 10900  
Tel : (662) 5790617  
Fax : (662) 5790625  
E-mail :

Ms. Marina WAIYASILP  
Senior Statistician  
Fisheries Statistics & Informational  
Technology Subdivision  
Department of Fisheries  
Ministry of Agriculture and Cooperatives  
Tel : (662) 9406151  
Fax : (662) 9406560  
Email : marinaw@fisheries.go.th

#### **VIETNAM**

Mr. Ngyen Hoa BINH  
Senior Statistician  
Department of Agriculture  
General Statistical Office  
Dept. for Agriculture, Forestry and  
Fishery  
No 2 Hoang Van Thu  
Hanoi  
Tel : (846) 8463497, 8463492  
Fax : (844) 8464345  
Email:

#### **FAO HQ**

Mr. Constantine STAMATOPOULOS  
Senior Fishery Data Officer  
FIDI, Fishery Department  
FAO Rome  
ITALY  
C-436, ext. 52923  
Tel : (39) 06 5705 6477  
Fax : (39) 06 5705 5615  
Email: Constantine.Stamatopoulos@fao.org

#### **FAO RAP**

Mr. Generoso DE GUZMAN  
Consultant  
FAO Regional Office for Asia and the Pacific  
39 Phra Atit Rd.  
Bangkok 10200, THAILAND  
Tel : (662) 281-7844 ext. 250  
Fax : (662) 280-0445  
Email: Generoso.deGuzman@fao.org

Mr. Romeo RECIDE  
Consultant  
FAO Regional Office for Asia and the Pacific  
39 Phra Atit Rd.  
Bangkok 10200, THAILAND  
Tel : (662) 281 - 7844  
Fax : (662) 629 - 2144  
Email: rsrecide@mozcom.com

#### **FAO Secretariat**

Mr. Ryuki IKEDA  
Agricultural Statistics Expert  
GCP/RAS/171/JPN  
FAO Regional Office for Asia and the Pacific  
39 Phra Atit Rd.  
Bangkok 10200, THAILAND  
Tel : (662) 281 - 7844 ext. 354  
Fax : (662) 629 - 2144  
Email: Ryuki.Ikeda@fao.org

Ms. Luisa KOSAISAEVEE  
Secretary  
GCP/RAS/171/JPN  
FAO Regional Office for Asia and the Pacific  
39 Phra Atit Rd.  
Bangkok 10200, THAILAND  
Tel : (662) 281 - 7844 ext. 354  
Fax : (662) 629 - 2144  
Email: Luisa.Kosaisaevee@fao.org



**FAO Regional Project  
Improvement of Agricultural Statistics in Asia and Pacific Countries  
(GCP/RAS/171/JPN)**

---

**Workshop on Improvement of Fishery Statistics  
in Asia and Pacific Countries  
Bangkok, Thailand, 6-10 August 2001**

**Provisional Programme**

**Monday, 6 August 2001**

- 13:30-14:00 Registration.
- 14:00-14:30 Opening of the Workshop.
- 14:30-15:00 Photo-Session and Tea break.
- 15:00-15:30 Introduction of participants and lecturer; organization of the workshop.
- 15:30-16:10 (Session 1)  
General discussion on national and regional needs of fishery statistics.
- 16:10-16:50 (Session 2)  
Expected outputs and objectives of the workshop.
- 18:30 - Reception (Welcome Dinner)

**Tuesday, 7 August 2001**

- 08:30-09:20 (Session 3)  
Basic statistical concepts and terminology with focus on sample-based fishery surveys.
- 09:20-10:10 (Session 4)  
A generic approach for estimating basic parameters of catch and fishing effort.
- 10:10-10:30 Tea break
- 10:30-11:20 (Session 5)  
Numerical examples involving survey parameters.
- 11:20-12:00 (Session 6)

Description of "Artfish" concepts and terminology.

- 12:00-13:30 Lunch break
- 13:30-14:10 (Session 7)  
Discussion on sample-based approaches used in fishery surveys.
- 14:10-14:50 (Session 8)  
Safe sample size for estimating fishing effort.
- 14:50-15:10 Tea break
- 15:10-15:50 (Session 9)  
Safe sample size for estimating Catch-Per-Unit-Effort (CPUE).
- 15:50-16:30 (Session 10)  
About the concept of estimation contexts.

### **Wednesday, 8 August 2001**

- 08:30-10:00 (Session 11)  
Working in groups and define an "Artfish" structure to serve as a theoretical example by participants.
- 10:00-10:30 Tea break `
- 10:30-12:00 (Session 12)  
Construction of "Artfish" geographical stratifications, boat/gear lists and species classification.
- 12:00-13:30 Lunch break
- 13:30-14:50 (Session 13)  
Preparation of samples of landings and boat/gear activities to be used in "Artfish" by participants
- 14:50-15:10 Tea break
- 15:10-16:30 (Session 13, continuation)

### **Thursday, 9 August 2001**

- 08:30-10:00 (Session 13, continuation)

- 10:00-10:30            Tea break
- 10:30-12:00    (Session 13, continuation and conclusion)
- 12:00-13:30            Lunch break
- 13:30-14:50    (Session 14)  
                         Production of "Artfish" estimates and statistical diagnostics.
- 14:50-15:10            Tea break
- 15:10-16:30    (Session 15)  
                         Analysis of results and discussion.

**Friday, 10 August 2001**

- 08:30-09:30    (Session 16)  
                         General discussion on "Artfish" (adaptability, computer requirements, decentralization schemes).
- 09:30-10:00            Tea break
- 10:00-11:00    (Session 17)  
                         Presentation and discussion on the workshop report.
- 11:00-11:30    Closing of the workshop.



**FAO Regional Project  
Improvement of Agricultural Statistics in Asia and Pacific Countries  
(GCP/RAS/171/JPN)**

---

**Workshop on Improvement of Fishery Statistics  
in Asia and Pacific Countries**

Bangkok, Thailand, 6-10 August 2001

**Opening statement**

By

**Dr. R. B. Singh**

FAO Assistant Director-General and  
Regional Representative for Asia and the Pacific

Distinguished Participants,  
FAO Colleagues,  
Ladies and Gentlemen,

It is my great pleasure to extend to you a warm welcome to this five-day Workshop on Improvement of Fishery Statistics in Asia and Pacific Countries.

As you know, this Workshop is organized by the FAO Regional Project "Improvement of Agricultural Statistics in Asia and Pacific Countries" (GCP/RAS/171/JPN), a project which was initiated in 1998 and funded by the Government of Japan. The project's main objectives are

- Contribution of national statistical development on food and agriculture through study of national systems and organization of national/regional meetings.
- Formulation of a plan for the establishment of a regional data exchange system on food and agriculture statistics in Asia and Pacific countries, based on the country studies.

To achieve these objectives, the project has conducted country studies on national systems of food and agricultural statistics in a number of participating countries. It has also organized national seminars on production and use of agricultural statistics, and regional workshops on specific areas of food and agricultural statistics.

Why statistics on food and agriculture?

As we all know, in this region the combined agricultural and fishery sector accounts for a significant proportion in the GDP and employs over 60 percent of the huge population. Accordingly, we recognize the significance of the sector's contribution to the social and economic development of countries in the region and the improvement of living standards and quality of life of its people.

When we talk of the agriculture sector, we are not confining our interests in looking only at the use and exploitation of land-based resources. The sector includes: livestock and poultry, forestry, and of course, fisheries, including the various stakeholders deriving benefits from these activities. While we have achieved significant strides in the development of statistics on crop production, fishery statistics remain to be one of the weak sectors in our agricultural information system. We do not, for example, have strong figures on the number of people dependent on fisheries. In countries comprising the ASEAN, it was estimated that some 12.2 million people are employed in the sector. However, this may not really be entirely true. We know that many farm households, one way or another, are able to supplement their daily diet with fish coming from irrigation waters. But since this activity is, in general, not monetized, there is a strong likelihood that they are not also counted as being engaged in fishery activities.

Figures from FAO FISHSTAT show that Asia-Pacific accounted for over 60% of world fish production in 1998. China alone contributed about 32% of total production in that year. These statistics show that fisheries in the region is indeed a significant economic activity. In addition, statistics would also show that the sector is growing at a fast pace. From 1990 to 1998, fish production in Southeast Asia for example, increased from 10.8 million metric tons to 14.1 million metric tons - a hefty 30% growth during the period, benefiting largely from a robust aquaculture industry.

Fish production in the world has ranged between 112 and 125 million tons during 1994 - 1999. Marine capture has stagnated around 84 million tons, but inland capture has steadily, though slowly, increased by 1.5 million tons during 1994 - 1999. During the same period, aquaculture production (both marine and inland) increased by more than 50 percent, from 20.8 million tons in 1994 to 32.9 million tons in 1999. Developing countries have a net fish export of US \$ 16-17 billion per year - a major source of foreign currency exchange.

It is estimated that in the long term global capture fish production will stabilize at around 100 million tons. The increasing demand for fish products will thus have to be met from aquaculture reaching about 50 million tons in the next 20 years or so, and bulk of this will materialize in the Asia-Pacific Region. The aquaculture industry in our region supplies 91% of the world's aquaculture product. Moreover, 52% of the capture fisheries products are coming from our region. However, we are now getting alarming signals that may adversely affect fisheries production in the region. Fish supplies from capture fisheries are severely threatened due to overexploitation of the existing stocks across all of Asia. In future, most stocks will not produce as much as they do today. Governments and people must work to find urgent and effective solutions to the ineffective management regimes that have led to the current state of stock degradation. Over fishing and degradation of marine, estuarine and freshwater fisheries habitats have all contributed to the current state. The rapid growth of aquaculture in South, Southeast and East Asia is fraught with environment degradation. These trends must be arrested and even reversed in order to further enhance and sustain the contribution of fisheries to livelihood security. All countries must observe the code of conduct for responsible fishing as developed by FAO.

Ladies and Gentlemen:

It was in the World Food Summit organized by FAO in Rome in 1996 when food security was defined as "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life." Countries committed to reduce the number of malnourished people in the world by half by the year 2015.

Fisheries and aquaculture contribute significantly to food security in the Asia-Pacific region. Fish make up more than 50% of animal protein in most countries of the region. Fish provide high protein food with additional benefits such as calcium, vitamin A, omega-3 fatty acids and iodine, deficiencies in which are detrimental to the physical and mental development of all people, especially children. Greater recognition must be given to the nutritional role of fish for the poor, especially those living on and near the coast and other water bodies. Fish and other aquatic resources, even when eaten in small quantities, often have a defining role in nutritional security and it is this security that is most threatened as the natural supplies disappear. Fish should be added adequately in FAO and other world food models and outlook to obtain fuller picture of food availability and nutritional adequacy.

While fishery production may indeed be high, some studies in consumption and projections of demand reveal that an imbalance between food fish supply and demand can occur in the future. This could come as a result of insufficient production volumes being unable to meet increasing demand. To ensure that this imbalance does not occur is the challenge that confronts fishery resource managers, fishery program planners and administrators.

This brings us to the issue on strengthening of national capacities to evolve policies and development plans, specifically for the fishery sector. However, policies and plans cannot be formulated out of thin air. In particular, useful information on fisheries derived from good-quality statistical methods are necessary for assessing the state of fishery resources and their exploitation which are essential for sound policy analysis and advice; for planning of development programmes; for analysing the impact of such policies and programmes; for evaluating sector performance; for monitoring of food security and poverty monitoring; and in the calculation of national accounts.

In addition, to ensure that information is useful, the statistics on which it is based must be timely, accurate and reliable. The need for strengthening national fishery statistics systems in terms of collection, analysis and dissemination is therefore recognized.

This fact seems evident enough. And yet, despite the urgent and serious need for a well-developed fishery statistical system, the progress of improvement steps ahead slowly in many countries in recent years. Our experience in the region has shown that, among the main obstacles to sustainable fishery statistics development, there are inadequate funding, insufficiency of qualified manpower, and poor facilities for data processing and dissemination.

This has been one of the major findings in the country studies that were conducted

under the project.

To help address these concerns, this Workshop on Improvement of Fishery Statistics was conceptualised as the Project's contribution to the continuing process of assisting governments to improve the quality and timeliness of their official fishery statistics. As a start, it shall explore sound methodologies for collecting, processing, analysing and disseminating fishery statistics. In the process, it is hoped that we would have contributed to building of capabilities of the manpower that run the fishery statistics systems in the region.

To be sure, the fishery statistical systems of countries represented here today are at various stages of development and therefore, participants stand to gain and learn a lot from each other. We hope that the workshop will become a venue for frank, open and free exchange of views - in the interest of improving the fishery statistical systems of countries in the Asia and Pacific regions.

Ladies and Gentlemen:

I have always advocated that statistics are not mere figures. They must have a form, a life. Statisticians have to face the challenge to humanize statistics, including fisheries statistics. Fisheries statistics are not confined only to production, distribution, consumption. Fisheries statistics should also include providing pictures on the impact of the industry to the stakeholders - the fisherfolks, the wife, the children; the community where they belong; the environment where they live; the future that they face; the changes in the overall quality of their lives; these and much more.

The figures statisticians provide should not only focus on the good side of the industry. Of specific concern is the seemingly high returns derived from aquaculture. This has become very attractive that some countries are now contemplating of converting the already dwindling arable lands into aquaculture farms for marine fish species such as the tiger prawn. This will require bringing in sea water into our farmlands with possible irreversible adverse effects on the salinity and fertility of the soil for crop production. These types of quick fix approaches could be avoided by having available the right facts and figures.

FAO has always regarded priority concern for fisheries information. For this reason, we at RAP have requested Rome to provide for a post of a regional fishery statistician. I am pleased to let you know that Rome has recently approved our request and we hope that by early next year the RAP fishery statistician will be appointed to support on-going efforts in the development of fisheries statistics in the region.

Let me assure you that all concerned staff of the FAO Regional Office for Asia and the Pacific will do their best to ensure a successful Workshop. We enjoin you to do the same.

In closing, allow me to extend my best wishes for all participants - not only for a fruitful meeting but also for an enjoyable stay in this beautiful City of Bangkok.

Thank you very much.

## Presentation on Artfish

### Section 1

Derivation of a generic expression for the estimation of total catch

#### 1.1 Definition of TOTAL CATCH, FISHING EFFORT and CPUE for statistical purposes

Data: N boats (in general fishing units), have been fishing during a month.

Each boat made fishing trips of  $E_1, E_2, \dots, E_N$  days, catching  $C_1, C_2, \dots, C_N$  kg of fish.

TOTAL FISHING EFFORT is  $E = E_1 + E_2 + \dots + E_N$  boat-days.

TOTAL CATCH is  $C = C_1 + C_2 + \dots + C_N$  kg

CATCH-PER-UNIT-EFFORT (CPUE) =  $\frac{C}{E}$  kg per boat-day

#### 1.2 Observation

Total catch C can be expressed as:

$$C = C \quad \text{or}$$

$$C = \frac{C}{E} \times E \quad \text{or}$$

$$C = \text{CPUE} \times E$$

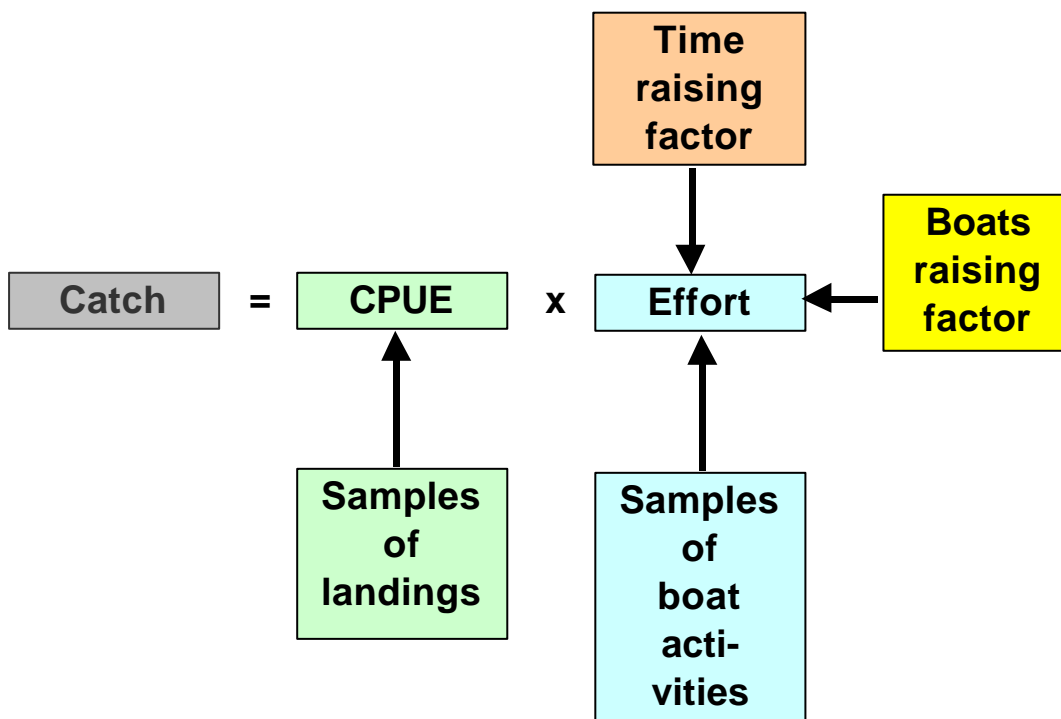
### 1.3 Conclusion

It can be concluded that the two variables in the catch expression are:

**CPUE**  
**FISHING EFFORT (E)**

For the estimation of CPUE and fishing effort E a maximum of four surveys are required.

### 1.4 Generic survey scheme



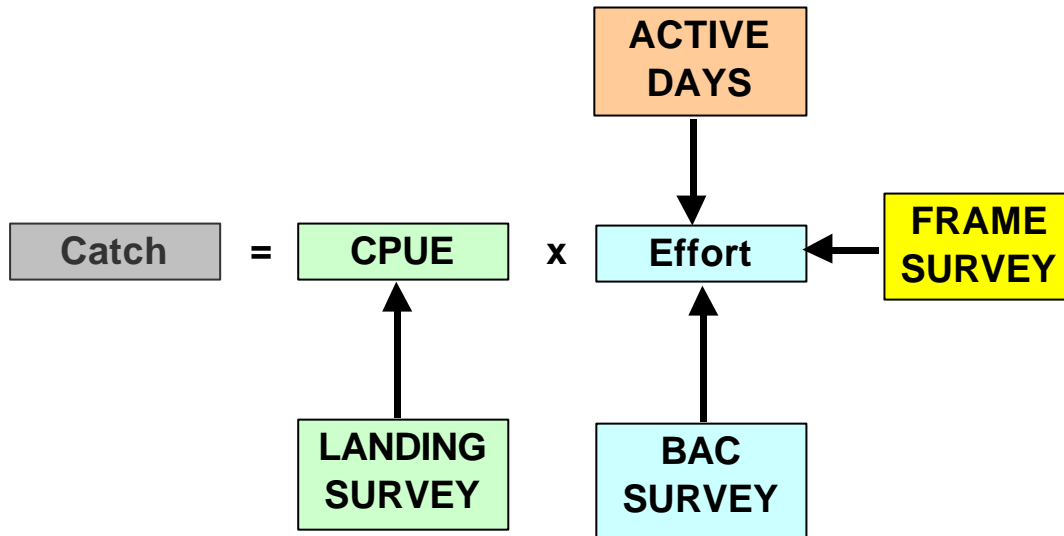
## **1.5 Observations on the generic survey scheme**

- a) There cannot be more than four surveys**
- b) Landings survey is based on samples**
- c) Samples of boat activities are used to determine the Boat Activity Coefficient (BAC)**

**BAC is the probability that ANY boat is ACTIVE on ANY day**

- d) The Boats Raising Factor is taken from census-based surveys known as FRAME or BASELINE surveys**
- e) The Time Raising Factor is determined by the survey period (normally a calendar month) and the total number of applicable fishing or active days assumed during this period**
- f) The generic estimation formula always applies within an ESTIMATION CONTEXT of:**
  - A statistical period (i.e. a month)**
  - A limited geographical area (or stratum)**
  - A specific boat/gear category**

## 1.6 Summarized survey scheme



**Section 2**

**A theoretical example of a small fishery  
involving 5 gillnetters A,B,C,D and E**

**CONTEXT OF A CENSUS (complete recording)**

**April 2000  
Stratum VI of Lake Artfish  
Gillnet fishing**

**Fishing trips are shown in yellow  
Total catch of each trip is known at landing time**

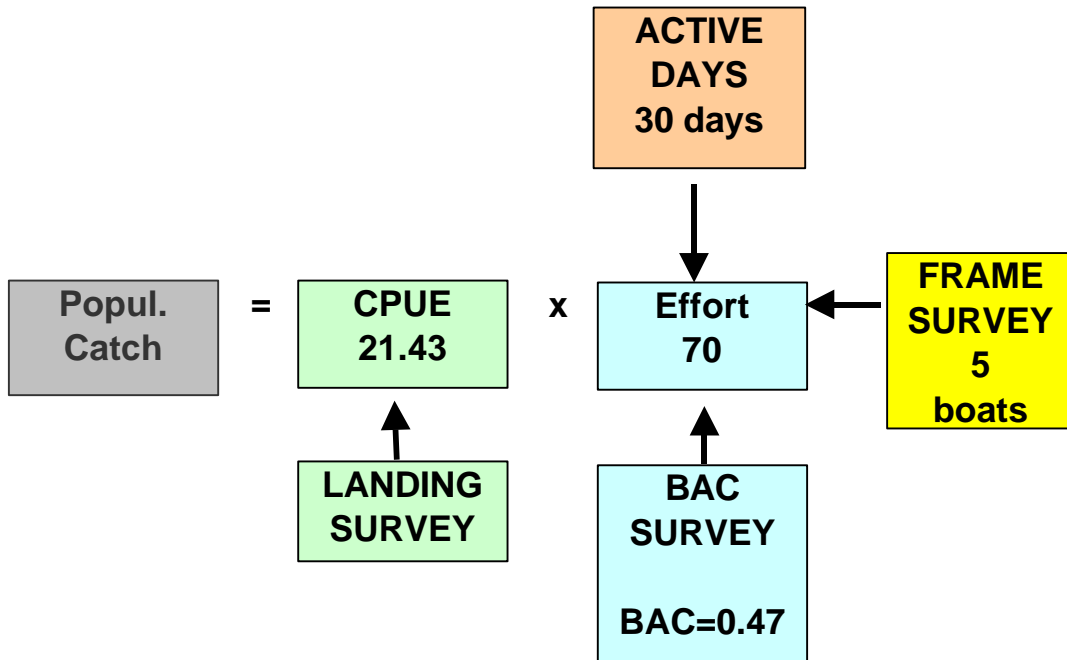
DAY	Boats					Active boats	Landings Kg	Total boats
	A	B	C	D	E			
1						0		5
2		20				3	20	5
3			15		10	4	25	5
4				40		3	40	5
5	100				5	3	105	5
6		50	8			2	58	5
7						1		5
8			20			3	20	5
9					10	4	10	5
10	80			60		4	140	5
11			30			2	30	5
12					8	2	8	5
13		200				2	200	5
14				5		2	5	5
15			50		12	3	62	5
16						1		5
17		10			2	4	12	5
18			15			3	15	5
19					20	3	20	5
20	300			50		3	350	5
21					14	2	14	5
22						1		5
23			150		6	3	156	5
24	25					3	25	5
25				30	10	3	40	5
26		70				1	70	5
27			20		5	3	25	5
28	40			10		2	50	5
29						0		5
30						0		5

**Total effort      Total catch      Sum of total no.**

**70                      1500                      150**  
boat-days                      kg

**Population CPUE**      **21.4286** kg/boat-day

**Population BAC**      **0.46667** "Total effort divided by 5 boats x 30 days "  
(Probability that any boat is active on any day)



**VERIFICATION OF RESULTS FOR POPULATION**

**Effort = BAC x No. Boats x Active days = 0.47 x 5 x 30 = 70 boat-days.**

**Catch = CPUE x Effort = 21.43 kg/boat-day x 70 boat-days = 1500 kg.**

Section 3

SAMPLING SCHEME - ESTIMATION CONTEXT

April 2000  
Stratum VI of Lake Artfish  
Gillnet fishing

Days of sampling: 2, 6, 13, 14, 15, 20, 21, 25

Sample DAY	Boats					Sample catch	Sample Effort	Active boats	Out of
	A	B	C	D	E				
1									
2		20				20	1	3	5
3			?		?				
4				?					
5	?				5				
6		?	8			8	1	2	5
7									
8			20						
9					10				
10	80			60					
11			30						
12					8				
13		200				200	5	2	5
14				5		5	1	2	5
15			50		12	50	3	3	5
16									
17		10			2				
18			15						
19					20				
20	300			50		50	4	3	5
21					14	14	1	2	5
22									
23			150		6				
24	25								
25				30	10	30	2	3	5
26		70							
27			20		5				
28	40			10					
29									
30									

Sample Catch	Sample Effort	Active	Out of
377	18	20	40

**Estimated CPUE = 377 kg / 18 boat-days = 20.94 kg/boat-day**

**Estimated BAC = 20 / 40 = 0.5**

**Estimated Effort = BAC x No. Boats x No. Active days =**  
**= 0.5 x 5 x 30 = 75 boat-days.**

**Estimated Catch = Est. CPUE x Est. Effort = 20.94 x 75 = 1571 kg**

### **COMPARISONS**

-----

	<b>Population</b>	<b>From sampling</b>
<b>CPUE</b>	<b>21.43</b>	<b>20.94</b>
<b>BAC</b>	<b>0.47</b>	<b>0.50</b>
<b>Effort</b>	<b>70</b>	<b>75</b>
<b>Catch</b>	<b>1500</b>	<b>1571</b>

## **Section 4**

### **Preparatory steps for using ARTFISH**

#### **THE NINE TYPES OF ARTFISH TABLES**

##### **Geographical stratification**

- 4.1 Major strata (for reporting purposes)**
- 4.2 Minor strata (estimates produced at this level)**
- 4.3 Linking minor strata to major strata**
- 4.4 Sites (all locations at which boats are potentially operational)**
- 4.5 Linking sites to minor strata**

##### **Classifications**

- 4.6 Boat/gear categories**
- 4.7 Frame survey information**

**A complete list of sites combined with boat/gear categories will contain number of boats for each table entry**

- 4.8 Species list**
- 4.9 Units (weight and currency)**

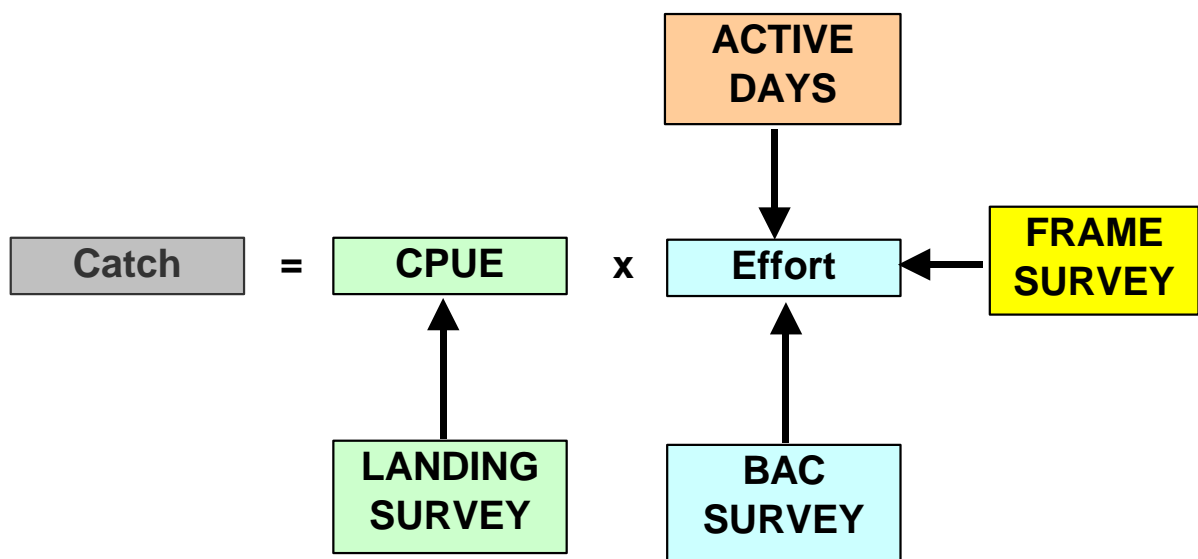
## **1.5 Observations on the generic survey scheme**

- a) There cannot be more than four surveys**
- b) Landings survey is based on samples**
- c) Samples of boat activities are used to determine the Boat Activity Coefficient (BAC)**

**BAC is the probability that ANY boat is ACTIVE on ANY day**

- d) The Boats Raising Factor is taken from census-based surveys known as FRAME or BASELINE surveys**
- e) The Time Raising Factor is determined by the survey period (normally a calendar month) and the total number of applicable fishing or active days assumed during this period**
- f) The generic estimation formula always applies within an ESTIMATION CONTEXT of:**
  - A statistical period (i.e. a month)**
  - A limited geographical area (or stratum)**
  - A specific boat/gear category**

## 1.6 Summarized survey scheme



## Section 5

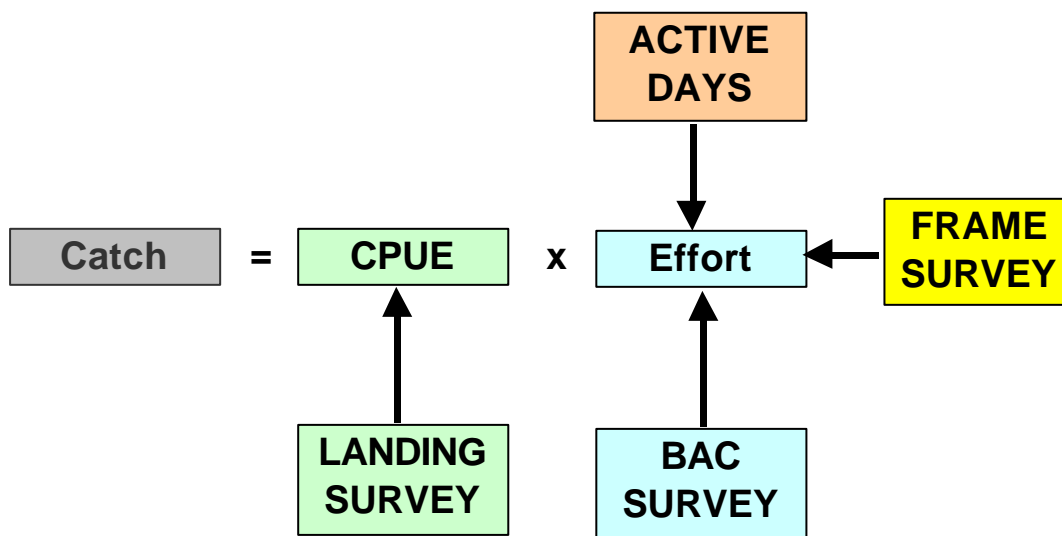
### Inputting of samples into ARTFISH

#### THE THREE TYPES OF ARTFISH INPUTTING PHASES

Artfish inputs correspond to the generic catch expression and are linked to an estimation context of a MONTH, MINOR STRATUM and a specific BOAT/GEAR category.

To be noted that:

- (a) Frame surveys have already been included in the TABLES
- (b) Landing samples are used to estimate CPUE, species composition, sample prices and sample fish size
- (c) BAC samples, together with the indication of ACTIVE DAYS and NO.BOATS from frame surveys are used to estimate fishing effort



## **Section 6**

### **ARTFISH ESTIMATION PHASE**

**Artfish always estimates CATCH, FISHING EFFORT, SAMPLE PRICES, VALUES and AVERAGE FISH SIZE within the estimation context of a MONTH, MINOR STRATUM and a specific BOAT/GEAR category.**

**Artfish reports also provide diagnostics relating to:**

- (a) Reliability of estimates based on sample size**
- (b) Variability of estimates (total, in space, and in time)**
- (c) Results can be grouped according to the stratification criteria in use**
- (d) All reports are automatically exported in Excel format for further processing**



FAO Regional Project  
Improvement of Agricultural Statistics in Asia and Pacific Countries  
(GCP/RAS/171/JPN)

---

**Workshop on Improvement of Fishery Statistics  
in Asia and Pacific Countries**  
Bangkok, Thailand, 6-10 August 2001

Data and results worked out by participants

**A.1 Major and minor strata, sites and associations**

Major stratum

0001 BANGKOK WORKSHOP AUGUST 2001

Minor strata

0001 INLAND WATERS  
0002 MARINE WATERS

Minor strata and "sites" (participants)

0001 INLAND WATERS

0002 RAM (INL)  
0003 SK (INL)  
0005 SOM (INL)  
0001 TN (INL)  
0004 ZGANG (INL)

0002 MARINE WATERS

0008 ALI (MAR)  
0009 AYE (MAR)  
0014 BIN (MAR)  
0007 DS (MAR)  
0011 JAYA (MAR)  
0013 KA (MAR)  
0012 MW (MAR)  
0015 SAB (MAR)  
0006 SPS (MAR)  
0010 SQ (MAR)  
0016 TVK (MAR)

## A.2 Boat/gear types

0001 GILLNETS (INL)  
0002 LONGLINE (MAR)  
0003 GILLNETS (MAR)

## A.3 Species

0002 CARP  
0004 CATFISH  
0005 OTHER (INL)  
0010 OTHER (MAR)  
0006 SHARK  
0008 SHRIMP  
0009 THREADFIN  
0003 TILAPIA  
0001 TROUT  
0007 TUNA

## A.4 Active days

Description		# days
INLAND WATERS	GILLNETS (INL)	27.00
MARINE WATERS	LONGLINE (MAR)	24.00
MARINE WATERS	GILLNETS (MAR)	24.00

## A.5 Frame survey

Description		# Units
RAM (INL)	GILLNETS (INL)	60.00
SK (INL)	GILLNETS (INL)	200.00
SOM (INL)	GILLNETS (INL)	50.00
TN (INL)	GILLNETS (INL)	80.00
ZGANG (INL)	GILLNETS (INL)	140.00
ALI (MAR)	LONGLINE (MAR)	1000.00
ALI (MAR)	GILLNETS (MAR)	500.00
AYE (MAR)	GILLNETS (MAR)	20.00
BIN (MAR)	LONGLINE (MAR)	80.00
BIN (MAR)	GILLNETS (MAR)	65.00
DS (MAR)	LONGLINE (MAR)	50.00
DS (MAR)	GILLNETS (MAR)	130.00
JAYA (MAR)	GILLNETS (MAR)	640.00
KA (MAR)	LONGLINE (MAR)	100.00
MW (MAR)	LONGLINE (MAR)	80.00
MW (MAR)	GILLNETS (MAR)	100.00
SAB (MAR)	LONGLINE (MAR)	90.00
SPS (MAR)	LONGLINE (MAR)	70.00
SPS (MAR)	GILLNETS (MAR)	1000.00
SQ (MAR)	LONGLINE (MAR)	250.00
SQ (MAR)	GILLNETS (MAR)	1500.00
TVK (MAR)	LONGLINE (MAR)	200.00
TVK (MAR)	GILLNETS (MAR)	50.00

## A.6 Example of an estimation process – Inland Waters

ARTBASIC: August 2001 - Reports ( Estimation )

Minor stratum : INLAND WATERS  
 Order : By boat/gear and species

=====

UNITS IN USE

Catch in: Kg  
 Effort in: Fishing days  
 CPUE in: Kg/Fishing days  
 Prices in: US\$/Kg  
 Values in: US\$  
 Average weight of fish in: Kg/# of fish

INLAND WATERS : GILLNETS (INL)

=====

Estimation of effort

BAC - Boat Activity Coefficient..... 69.126 %  
 Accuracy level..... 98.603 %  
 Units sampled..... 3 660  
 Active..... 2 530

# sites..... 5  
 # days..... 26  
 BAC variability..... 5.204 %  
 BAC var component (space)..... 0.000 %  
 BAC var component (time)..... 5.204 %  
 BAC lower limit at 95%..... 62.076 %  
 BAC upper limit at 95%..... 76.176 %

Units in frame survey..... 530  
 Active days..... 27.000  
 Estimated effort (days)..... 9 892  
 Effort lower limit at 95%..... 8 883  
 Effort upper limit at 95%..... 10 901

Estimation of catch

CPUE..... 155.000  
 Accuracy level..... 59.992 % Not acceptable ( < 90%)  
 Smp. size required for accuracy 90%.... 31  
 Landings sampled..... 2  
 Sample catch..... 310  
 Sample effort..... 2.000

# sites..... 1  
 # days..... 2  
 CPUE variability..... 41.935 %  
 CPUE var component (space)..... Not computed  
 CPUE var component (time)..... Not computed  
 CPUE lower limit at 95%..... 27.600  
 CPUE upper limit at 95%..... 282.400

Estimated catch (Kg) ..... 1 533 242  
 Catch variability..... 42.257 %  
 Catch lower limit at 95% (Kg) ..... 263 351  
 Catch upper limit at 95% (Kg) ..... 2 803 133

Total value (US\$) ..... 2 324 593  
 Average price (US\$/Kg) ..... 1.516

Catch by species	Quant. Effort	CPUE Aver.W	Value Price
CARP	494 594 ( 32.3%) 9 892	50.000 0.303	563 837 ( 24.3%) 1.140
CATFISH	197 838 ( 12.9%) 9 892	20.000 0.976	296 757 ( 12.8%) 1.500
OTHER (INL)	148 378 ( 9.7%) 9 892	15.000 0.200	148 378 ( 6.4%) 1.000
TILAPIA	395 675 ( 25.8%) 9 892	40.000 0.286	425 351 ( 18.3%) 1.075
TROUT	296 757 ( 19.4%) 9 892	30.000 0.375	890 270 ( 38.3%) 3.000