Preliminary Results of the Multilateral Catch Monitoring Programme on fresh-tuna longliners operating from ports in Indonesia

DGCF[1]-RCCF[2]-IOTC[3]/OFCF[4]-CSIRO[5]/ACIAR[6]/DAFF[7]

Summary

Indonesia, with catches of tuna and tuna-like species exceeding the 150,000 t in recent years, is among the most important fishing countries in the Indian Ocean. The rapid evolution of its longline tuna fishery, especially during the last decade made it a priority for Indonesia to strengthen the monitoring activities. This strengthening was achieved through the implementation of a Multilateral Catch Monitoring Program in June 2002, involving domestic and foreign institutions. The present document presents the results of the first two years monitoring. The new catches estimated, at around 45,000 t, are thought much more precise than previous catches estimates. The quality of the size data and other key biological information now available for this fishery is, by far, the best existing in the Indian Ocean for a longline fishery.

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[1] Directorate General of Capture Fisheries, Indonesia

[2] Research Centre for Capture Fisheries, Indonesia

[3] Indian Ocean Tuna Commission, Seychelles

[4] Overseas Fisheries Cooperation Foundation, IOTC/OFCF Project, Seychelles

[5] Commonwealth Scientific and Industrial Research Organization, Australia

[6] Australian Centre for International Agricultural Research

[7] Department of Agriculture, Fisheries and Forestry, Australia

Introduction

Indonesia is among the most important fishing countries in the Indian Ocean, with tuna catches exceeding 150,000 t in recent years.

The rapid expansion of the fresh-tuna longline fishery in Indonesia, especially the dramatic increase in the catches of tunas and/or tuna-like species unloaded in Jakarta and Benoa since the early 1990's, made it a priority to strengthen the monitoring activities. The data collection systems formerly in place in Indonesia were unable to provide complete estimates of catches of tuna and tuna-like species for the fresh-tuna longline fleet due to:

- Tuna and billfish were not being identified to species but all aggregated as Tuna

- The existing catch monitoring activities being limited to Benoa and concentrated mainly in the collection of information on southern bluefin tuna.

Indonesia, aware of the importance of obtaining precise catch estimates for the assessment and management of tuna stocks and desire to fulfil its obligations relating to the requirements of the Regional Fishery Bodies responsible for the management of these resources, decided to expand the existing activities. The new monitoring scheme was agreed in a meeting in Jakarta (2000) involving the participation of domestic and foreign institutions. During this meeting it was agreed to expand the existing Benoa monitoring to Jakarta and Cilacap and to modify the existing design to fit the new data requirements. The new catch monitoring activities were implemented in June 2002 and to date have been covered through ACIAR/DAFF and OFCF funds. Several staff from the CSIRO, IOTC and OFCF has been providing training, technical advice and database support to Indonesian scientists, enumerators and data entry and administration staff since the beginning of the activities.

The results of the first two years of catch monitoring are presented in this document. The first section (page 3) provides an overview on the tuna longline fishery in Indonesia, the fleets involved, ports of operation, fishing techniques, main areas exploited and catch and fleet trends. Details on the two data collection systems that were in place in Indonesia before the implementation of the Multilateral Catch Monitoring are given in the second section (page 6). The fundamentals of the new sampling strategy implemented in Jakarta, Benoa and Cilacap, institutions and personnel involved and the major constraints relating to the implementation are covered in the third and fourth sections of the document (pages 9 and 12, respectively). The new catches and size frequency data estimated by using the data collected as well as the way in which estimates were made for each port are provided in the following section (page 16). The achievements made since the implementation of the program are identified in the last section (page 39). The remaining problem areas identified for the programme and possible future actions to manage them are also covered in that section.

History of fresh-tuna longline fishery in Indonesia

1. Development of industrial longline industry and key landing ports

Indonesia's first commercial tuna longline operation began in 1965 with one company, B.P.U. Perikanan, that had two vessels (modified pole and line vessels of 167 and 185 GT). These vessels were gifts from the Japanese Government (Simorangkir 1993). With further financial assistance from the Japanese Government the state-owned fishing company PT. Perikanan Samudera Besar (PT. PSB) commenced operations in 1972 and its fleet quickly expanded to 18 vessels by 1975 with bases at Benoa in south Bali and Sabang in Banda Aceh.(Simorangkir 1993). Largely because of its remoteness, the port of Sabang did not develop to be an important base for large-scale commercial long-lining operations and Benoa became the primary base for longline operations (Ishida et al. 1994). The PT. PSB vessels fished in Indian Ocean waters, but also in areas to the east - Timor and Arafura Seas, and north-east - Flores and Banda Seas.

In recognising the increasing importance of the tuna fishing industry and commercial fishing operations in general the Indonesian Government, in collaboration with the Overseas Economic Corporation Foundation (OECF) of Japan, developed a second major landing centre. After almost 10 years of planning and development, Jakarta Fishing Port at Muara Baru was officially opened in 1984. In 1985 the Japanese sashimi market opened to fresh tuna imports from Indonesia and in the years that followed Indonesia's commercial tuna longline fishery underwent dramatic expansion (Figure 1, Table 1) both at Benoa and at Muara Baru. From 36 vessels (34 Indonesian) in 1986, the number of longline vessels based in Indonesia and operating in the Indian Ocean waters had increased by year 1991 to 536 (158 Indonesian) (Herrera 2000). The majority of foreign vessels were Taiwanese, but there were also vessels from Japan, Korea, Honduras, and Philippines. In 1998 the Indonesian government introduced regulations requiring all fishing vessels based in Indonesian ports to be Indonesian flagged, and by 2000 all vessels were officially classed as Indonesian-owned vessels.

Benoa and Muara Baru are not the only commercial ports for Indian Ocean tuna fishing activities in Indonesia, but are by far the largest. A third ocean class ("Class A") fishing port servicing commercial longline vessels is located at Cilacap on the south coast of Central Java. Since its official opening in 1995, the number of tuna longline vessels at Cilacap has continued to increase (Table 2), although in recent years the port has been plagued by problems of siltation, restricting berthing by larger vessels. During recent years the port of Pelabuhanratu at the western end of Java has shown an increasing level of tuna longline activity. Much of the fresh tuna from Cilacap and Pelabuhanratu is transported by truck to Muara Baru for processing.

2. Vessel numbers

Establishing a figure for the number of active Indonesian longline vessels operating in the Indian Ocean has historically been difficult due to inconsistencies and limitations of government and port authority vessel registries (as described in Herrera 2000 and Proctor et. al 2003).. ??? longliners are currently registered at Port of Benoa, ??? at Muara Baru, and ??? at Cilacap. IOTC currently estimates around 1800 Indonesian flagged longliners currently operate in the Indian Ocean (Herrera, pers. Comm.) Local supervisors to seek update on numbers of vessels from Port Authority for 2004/2005.

The size of industrial Indonesian tuna longliners operating from the three main landing ports varies considerably (Table 3), as do the proportions of wooden, fibreglass, and steel hulls.

Local supervisors to seek update on size and type of vessels from Port Authority for 2004/2005.

3. Gears used, fishing techniques

Gears and fishing techniques - Pak Gede

4. Fishing grounds

The main fishing areas in the Indian Ocean for the longline fleets operating from Benoa, Muara Baru and Cilacap are regions to the west an south of Java, eastwards, from Bali to south of West Timor, and off west coast of Sumatra (Appendix 2, page 44). However, information provided by industry during the past two years suggests that as catches of the primary target species (yellowfin and bigeye tunas) on these 'traditional' grounds have declined, some vessels are fishing in other areas further from their home ports. Correspondingly these vessels are spending much longer periods at sea – up to 4 to 5 months, compared to 1 – 2 months for closer fishing grounds. There has been a corresponding increase in use of carrier vessels and fishing vessels acting as carrier vessels, landing their own catch but also catch transhipped at sea from 'sister vessels' of their company. Such activities have been necessary to overcome the absence of freezer facilities on the majority of the longline vessels.

5. Historical catches

Data collection and processing before the implementation of the Multilateral Catch Monitoring

1. National Fisheries Data Collection System

Indonesia has had a National Fisheries Data Collection System for marine fisheries since 1978 – a system that emerged from a collaborative program between the Government of Indonesia, the United Nations Development Programme, and FAO. The design, development and implementation of a standard set of surveys and reporting methods across all of Indonesia's provinces was done by Dr Tadashi Yamamoto, a fisheries statistician employed by FAO, in collaboration with Directorate General of Fisheries (now Directorate General of Capture Fisheries).

Figure 2 Generalised procedure of the national system of fisheries statistics
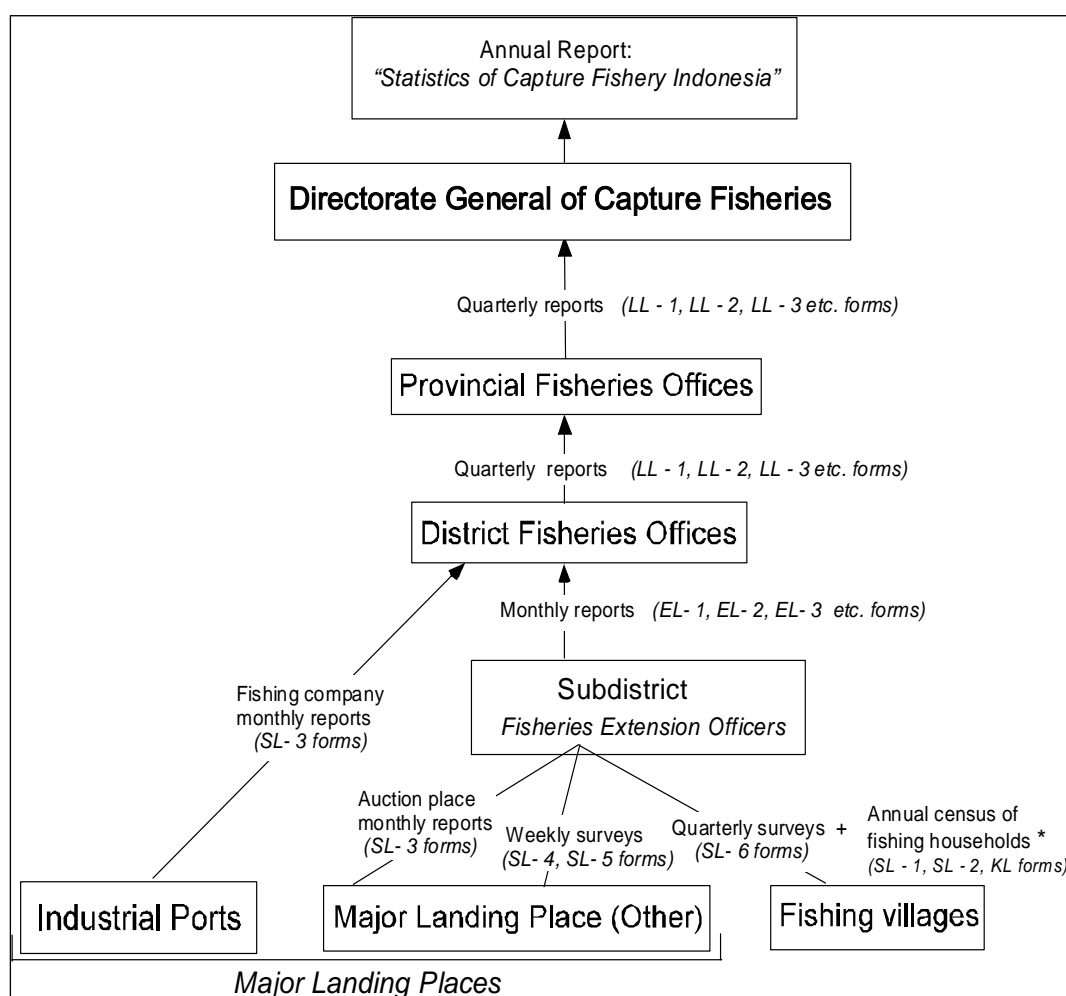
With respect to marine fisheries, the system was designed to have two primary outcomes: 1) Nation-wide statistics on annual production for all species groups fished, both at the industrial and artisanal levels of fishing activity, and 2) Nation-wide annual inventories of the number of fishing units (households, companies, operators) and number, size, and gear-type of fishing vessels involved in the fishing activities at both levels in all provinces. These statistics have been and continue to be published by the Directorate General of Fisheries (now DGCF) as the annual report "Statistik Perikanan Tangkap Indonesia" (= Statistics of Capture Fisheries of Indonesia) These reports also include similar statistics for inland "openwater" fisheries. The surveys and

censuses were, and still are, coordinated at a national government level by DGCF (in collaboration with the Central Board of Statistics), but involve data collection and reporting by provincial, district, and subdistrict government offices. The fundamental design and procedure of the national system are summarised below in Figure 2 but for a more detailed description, see Yamamoto (1980).

Up until 2002 the National Fisheries Data Collection System did not meet the data requirements for scientific stock assessments relating to tunas and tuna-like species because of several limitations and shortcomings[8]:

- The system of fisheries statistics was designed for providing production figures and census statistics for assessment of importance of fisheries to the nation's economy rather than for science-based stock assessments for fisheries management.

- Production data for tunas (yellowfin, bigeye, southern bluefin, albacore) and tuna-like (marlin, swordfish, sailfish) species, in reports at provincial and national level were aggregated and reported as a single category "tuna".

- The national production statistics, and production data in contributory reports, often showed a high level of variability across years but little explanation provided to explain the inconsistencies.

- Validation/cross-checking procedures followed at higher levels (e.g. between National and Provincial levels but limited validation/cross-checking procedures at lower levels of data collection and data processing (e.g. at data collection points such as fishing companies, auction rooms, District fisheries offices).

- Non-standardisation of data collection procedures (e.g. differences in data collection techniques between different regencies within a province, port authorities collecting data by varied means).

- Accuracy of the data from some sources compromised due to collected data being used for determining local government taxes i.e. ever present incentive for some fishing companies/vessel owners to under-report catch.

- Shortages of resources (staff, computers, transport) impacting on efficiencies of data collection, processing and reporting.

In 2002 DGCF embarked on a program of modifications to the National System to address some of the above shortcomings, with the objective of achieving a system of fisheries data collection that will provide data useable in scientific stock assessments while still meeting Indonesia's requirements for production statistics.

2. RCCF/CSIRO monitoring program at Benoa prior to IOTC sampling

A collaborative research program between the CSIRO Division of Marine Research and the Research Institute of Marine Fisheries of Indonesia (RIMF) was set up in August 1992 to monitor the catch of southern bluefin tuna (SBF) caught by longline fisheries operating out of Indonesia. SBF spawn in the north-east Indian Ocean, and are caught by Indonesian-based longline boats targeting yellowfin and bigeye tuna south of Java and the Lesser Sunda Islands. These boats were based at the Port of Benoa.

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[8] A more detailed discussion of the National System of Fisheries Data Collection and recommendations for addressing its limitations can be found in Proctor *et al.* (2003).

Monitoring was first established at P.T. Perikanan Samodra Besar (PSB) at Benoa in October 1992. The company was situated on the Eastern side of the port in the general port area. Two PSB staff were employed part-time to provide landings data from tuna processed at PSB. Many of the non-PSB companies moved to new processors as they were formed on the Western side of the port which was developed for fishing boats. In response, a fulltime enumerator was employed to monitor the landings at one of the processing rooms at the P.T. Sari Segara Utama (SSU) site in 1994. In 1996, an additional enumerator was employed to monitor landings as many new processing companies formed. However, the additional monitoring did not effectively match the increase in processing rooms. This was exacerbated by restricted access to processing rooms by companies. In 1999 it was decided that a new approach was required, rather than stop-gap measures to marginally improve monitoring coverage. Following the March 2000 Meeting in Bali on Indonesia Australia Cooperation on shark and tuna, a new monitoring program was agreed which was started in 2002 with support from ACIAR, AFFA and IOTC (through OFCF). This enabled the IOTC model of monitoring to be introduced in August 2002.

Prior to IOTC monitoring the information on the composition of the tuna catch was obtained by the enumerator from buyers at the processing room when the tuna were processed. Enumerators would aggregate the data on individual fish provided by the buyer by species and export status, recording subtotals of weight and number of pieces. These data were aggregated by month and the sampled data raised to the estimated catch using export permit data from Dinas of Fisheries for Province of Bali, Laboratorium Pembinaan dan Pengujian Mutu Hasil Perikanan (Laboratory of Quality Control for Fisheries Products). It was assumed that the fresh and frozen whole tuna categories aggregated by Dinas, corresponded to the export category of tunas recorded at the processing rooms by the enumerators.

Data from this Benoa monitoring program (and subsequent IOTC sampling program described below) have, for the past decade, provided the necessary information for reporting of Indonesia's SBT catch to the annual Scientific Meetings of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT).

New Multilateral Catch Monitoring: Sampling strategy

1. Estimator

The basic estimator is the product of,

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the number of unloadings (or landings), as a measure of activity of the fleet during the period (month) and the average catch unloaded per landing estimated.

2. Sampling Design

   a. Sampling unit

The *vessel unloading* (or *landing*) is the sampling unit. A random coverage of the landings occurs in each of the three ports to obtain the most accurate estimate of the statistic population (i.e. total catches unloaded per port for a given period).

   b. Stratification

The following strata are considered:

• **Port:** The activities of fresh-tuna longliners calling in to Muara Baru (**Jakarta**), Denpasar (**Benoa**) and **Cilacap** are monitored.

• **Month**

Port and month are the only strata considered in Cilacap. The following strata apply, in addition, to Benoa and Jakarta.

• **Fish destination**: catches unloaded through processing plants (**export-reject**) or to fish markets or auction halls (**by-catch**).

The catches of fresh-tuna longliners are usually unloaded separately depending on the species involved or catch quality:

   a. Catches unloaded through processing plants: yellowfin tuna, bigeye tuna and southern bluefin tuna, preserved iced or in refrigerated seawater, are usually unloaded through processing plants, where the specimens are graded and classified depending on the quality of the flesh:

   i. **Export**: Those specimens whose flesh is graded sashimi-quality are labelled and packed and air-freighted to Japan or other markets.

   ii. **Reject:** Those specimens whose flesh does not comply sashimi-quality standards are labelled and sold locally. The higher quality 'Reject' fish are processed into loin, steak, toro, fillet etc. and some of this is exported to Japan and other overseas markets, both as fresh and frozen product.

   In some cases, specimens of swordfish, marlins and some species of sharks are also unloaded through processing plants. This component of the catch is referred to as export-reject.

   b. Catches unloaded through local fish markets or auction halls: Albacore, billfish, sharks, small tuna species, undersized or spoiled tunas and other non-tuna species, preserved

iced or frozen, are usually unloaded through the harbour and sold locally. This component of the catch is called **by-catch**.

- *Processing Plant:* The catches of fresh-tuna longliners (export-reject) are unloaded through 15 to 20 processing plants operated in Benoa and in Jakarta. The landings of by-catch are also classified according to the plant through which the catches of export-reject from the sampled vessel were unloaded.

c. Collection of vessel activity and catch data

- Collection of **vessel activity data** (effort): The samplers in each port record the vessels' names, dates of unloading and processing plants through which the catches are unloaded of all longliners putting in.

- **Sampling coverage:** Initially**,** the samplers in each port shall monitor at least the 30% of the landings per fish destination, month and plant.

- **Selection of the unit/s to sample:** An even coverage is sought per strata. The samplers do not usually know in advance the landings scheduled for the next day and therefore a random selection of the units to sample is not possible. An even coverage of the landings is achieved as follows:

    a. First day of the month (or first sampling day): The sampling teams visit the plants sequentially until they identify a longliner whose catches are to be unloaded, monitoring all fish unloaded from the vessel. They repeat this process until the end of the working day. Therefore, there is not prior selection of landings.

    b. Second day to last day of the month: The total number of landings recorded and the number sampled during the previous day per stratum are compared in each port. The different strata are sorted according to the proportion of landings monitored in each case. The samplers will first visit the plants for which the proportion of landings monitored is lowest and so on in ascending order. This process is repeated at the end of each day and until the end of the month.

- **Taking the sample:** All specimens unloaded from the selected vessel shall be monitored (total enumeration). The weight and/or length of each specimen unloaded are recorded. In the case that two or more specimens cannot be monitored individually the samplers shall record the number of fish, species or closest species group and weight of the aggregate. Length measurements shall be taken for at least one every tenth fish weighed.

The sampling strategy followed in each port is summarized in the table 5:

Table 5: Sampling strategy in Benoa, Jakarta and Cilacap

	Benoa-Jakarta	Cilacap
Sampling unit	Vessel unloading	Vessel unloading
Strata	Month, Fish Destination, Plant	Month
Collection of effort data	The samplers record all landings from longliners during the month (total enumeration)	The samplers record all landings from longliners during the month (total enumeration)
Sampling Coverage	At least the 30% of the vessel unloadings per stratum shall be sampled	At least the 30% of the vessel unloadings per month shall be sampled
Selection of Landings	Landings are selected to assure an even coverage of vessel unloadings per month, fish	Landings are selected to assure an even coverage of vessel unloadings per month

Table 5: Sampling strategy in Benoa, Jakarta and Cilacap

	Benoa-Jakarta	Cilacap
	destination and plant	
Frequency of sampling	The samplers work from Saturday to Thursday every week (vessel unloadings are not recorded on Fridays[9])	The samplers work from Friday to Wednesday every week (vessel unloadings are not recorded on Thursdays[10])
Size of the sample	The total enumeration of the selected landings of export-reject or by-catch is required	The total enumeration of the selected landings is required
Type of measurement recorded	Mainly fish weights Fish length for one every tenth fish weighed Lengths are also taken on by-catch specimens that are not individually weighed Straight length-round length-weight samples of tuna and billfish specimens are taken as a complement of the routine sampling in order to obtain the data needed to convert recorded lengths into standard lengths for each species.	Mainly fish length Fish weights are recorded for some species Straight length-round length -weight samples of tuna and billfish specimens are taken as a complement of the routine sampling in order to obtain the data needed to convert recorded lengths into standard lengths for each species.
Measuring tool	The use of calipers is recommended Tape measures can be used alternatively	The use of calipers is recommended Tape measures can be used alternatively
Measurement type	Tuna and billfish species are usually gilled and gutted or tailed, respectively. The lengths and weights recorded depend on the processing underwent (e.g. gilled and gutted weight and fork length for most tunas)	Tuna and billfish species are usually gilled and gutted or tailed, respectively. The lengths and weights recorded depend on the processing underwent (e.g. gilled and gutted weight and fork length for most tunas)

3. Data handling and processing

All data recorded by samplers are input by using the software FINSS. The software, developed at the IOTC Secretariat, was adapted to the needs of the current monitoring and is being used in the three ports to record all data generated regarding vessel record, vessel activity and sampling.

Several data verification routines and reports are also available with FINSS or through Microsoft access and Microsoft excel.

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[9] The Japanese sashimi market is not active on Saturdays

[10] All export-reject fish from Cilacap is sent by road to Jakarta and air-freighted to Japan or other overseas markets subsequently

Implementation of sampling and main constraints to monitoring

1. <u>Institutional arrangements: human resources and main tasks assigned</u>

The Directorate General of Capture Fisheries (DGCF) records details on vessel identification, vessel size, port/s of operation of fresh-tuna longliners based in Indonesia whose GRT is 30 or above. The information on longliners under 30 GRT is obtained directly from port sampling. The DGCF keeps also a record on the catches and number of landings of fresh-tuna longliners per port. The responsibility for the reporting of catch data on tuna and tuna-like species in Indonesia lies with the DGCF. This involves not only longline but also a number of artisanal fisheries.

The Port Authority offices in Jakarta and Cilacap and Waski office in Benoa collect additional information on vessel identification and vessel dimensions, keeping also a record of the longliners putting in to port as well as general details on its fishing activities.

The Research Centre for Capture Fisheries (RCCF) is responsible for the collection of effort and catch data through port sampling in the major ports of operation of this fleet, Jakarta, Benoa and Cilacap. The current RCCF activities are financed through OFCF and ACIAR funds. The RCCF carries also other research programmes related to tuna, sharks or other species.

The main functions and responsibilities of staff working under the programme are summarized in Table 6 (the names and posts of all staff involved is provided in Annex 1).

Table 6: Human resources and main tasks assigned

Post-Institution	Port	No.	Main Functions
Head of Statistics DGCF	Jakarta	1	Compiling catch estimates and reporting of catch, effort, size and vessel record data to the IOTC
Project Coordinator RCCF	Jakarta	1	Allocates IOTC/OFCF budget Coordinates the sampling activities through overall supervisor, local supervisors and database administrator Coordinates the submission of data collected through the Project to DGCF Statistics and the submission of Progress Reports and Financial Reports to the IOTC Secretary
Head Port Authority	Jakarta	1	Coordinates the collection of vessel activity and catch data through Port Authority officers
Head Port Authority	Cilacap	1	Coordinates the collection of vessel activity and catch data through Port Authority officers
Head WASKI	Benoa	1	Coordinates the collection of vessel activity, catch and fishing data through WASKI officers
Database Administrator RCCF	Jakarta	1	Monitors the computerization of sampling and vessel activity data Compiles of all Project databases and runs validation and verification routines Trains Data Entry Staff Monitors the transmission of database backups and reports of progress concerning the administration of RCCF project databases Produces standard tables and charts to feed template reports to the Industry and other interested parties
Overall Supervisor RCCF	Jakarta	1	Liaises with the Project coordinator on all sampling related matters Supervises the activities of enumerators through the local supervisors
Local Supervisors RCCF (RIMF/RIM)	Jakarta Benoa Cilacap	1 1 1	Liaise with the overall supervisor on all sampling related matters Supervise the activities of enumerators
Enumerators[11] RCCF	Jakarta Cilacap Benoa	7 3 8	Liaise with the local supervisor on all sampling related matters Collect effort data (record of vessel unloadings) Select the units (vessel unloadings) to sample Collect sampling data Collect other biological data (length-length-eight)
Data input staff			Liaise with the database administrator on all data input related matters

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[11] Most of the enumerators working for the program are university graduates

Table 6: Human resources and main tasks assigned

Post–Institution	Port	No.	Main Functions
RCCF	Jakarta	1	Entry all vessel activity and sampling data from Cilacap and Jakarta
	Benoa	1	Entry all vessel activity and sampling data from Benoa

Several IOTC/OFCF and CSIRO staff travel frequently to Indonesia providing training, technical advice and database support or other support whenever it is required.

The original design had to be adjusted at different times in response to various events and changes occurring in the field. The following sections refer to changes to the design or problems faced in each port.

2. Collection of vessel activity (effort) data

The samplers in Jakarta and Benoa record every day the names of the longliners unloading catches and the processing plant/s through which the catches unloaded go.

The vessel unloadings in Cilacap occur in three different sites: Cilacap, Batere and Seleko. All fish go directly through the harbour and are loaded onto trucks for transport to Jakarta or sold locally.

The following issues relate to the collection of vessel activity data:

a. Carrier vessels: Up to 50% of the landings of longliners recorded in Benoa and as much as the 80%-90% of the landings in Jakarta and Cilacap are from carrier vessels. These vessels are, in most cases, fishing vessels that collect the catches from other vessels operating in the same area, usually owned by the same company. This transfer of catch usually refers to specimens preserved fresh (export-reject), seldom to those preserved frozen (by-catch). Each specimen on board can be identified according to the transhipping vessel (through a plastic ribbon tied up around its tail). The samplers collecting this information are not always aware of which landings are from carriers and which from non-carriers. The names of the vessel/s whose catches were transhipped to the carrier are not always available. According to the present design, no difference is made between the landings of carrier and non-carrier vessels. The estimation procedure remains valid irrespective of whether the landing is from a longliner that carries catch from other longliners (transhipped at sea) or only its own.

b. Vessel size: Although the existing information is still insufficient, the data collected on vessel size (mainly GRT and length overall) indicates that a much broader than expected size range of vessels are operating in Indonesia. Longliners from 10 GRT to up to 300 GRT operate currently in Indonesia. It is, therefore, likely that the catch rates, areas of operation and amounts unloaded per landing are related to the vessel size. The longliners of large size would be more likely to operate as carriers, collecting the catches from other fishing vessels. The stratification of vessels according to size may, for this reason, be considered in the future, once that the data are more complete.

c. Number of landings: According to the information collected by enumerators in Jakarta and Benoa the number of vessel unloadings per month is different for export-reject and by-catch fish. While most of the longliners putting in to Jakarta or Benoa unload export-reject, only 30%-50% of them unload by-catch. It is important to note that this information comes from interviews to vessels' skippers in Jakarta and Benoa.

The information on the number of landings of <u>export-reject</u> is likely to be accurate because all fish unloaded go through plants (plants are active during only several hours at daytime - and coincide with the samplers' working hours). Therefore, the number of landings from the enumerators' record was used for export-reject.

However, the number of landings of <u>by-catch</u> from the enumerators' record is not used. The information from the skippers' interviews is considered to be unreliable because the majority of the vessels unloading catches are fishing vessels and therefore are likely to carry both export-reject and by-catch species on board. In addition, by-catch landings may occur during daytime or at night. Samplers might, therefore, overlook landings that occur outside working hours. Furthermore, the number of landings of by-catch monitored is, for some strata, higher than the total number of landings recorded by enumerators. This would confirm that the information collected through interviews is incomplete. It is, therefore likely that all vessels that unload export-reject are also, at some point in time, unloading by-catch. The same number of landings was, therefore, used for export-reject and by-catch.

d. <u>Landings to two or more plants</u>: The catches from carrier vessels are in some cases unloaded through two or more processing plants. Thus, individual landings would, in some cases refer to different processing plants. The catches from individual vessels unloaded to several processing plants are fully assigned to the plant of operation of the carrier vessel. This applies also to the information collected through sampling.

3. <u>Sampling</u>

• **Sampling coverage:** The amount of vessel unloadings sampled have been so far 30% or above in all ports. The coverage rates are, however, consistently low for some strata, mainly because the owners of some plants restrict the access of samplers.

• **Enumeration of fish unloaded:** The samplers in Jakarta can not monitor all fish unloaded from carrier vessels. This occurs mainly because the catches are unloaded through several plants and the samplers are unable to monitor all plants at the same time.

The catches stored on carrier vessels are identified according to the catcher vessel. Thus, the catches from the carrier itself and each individual transhipping vessel are identified through plastic ribbons of different colours, that are attached to the tail of each fish. It is also known that the totality of catches of each individual transhipping vessel (or the carrier itself) go through a same plant.

The samplers in Jakarta and Benoa record in the forms the total number of catcher vessels and the number of catcher vessels monitored. Each fish unloaded is also identified through a number matching the number assigned to its catcher vessel (depending on the colour of the plastic ribbon attached to its tail). These numbers are used to distinguish between landings totally and partially enumerated.

All fish unloaded from the longliners selected for sampling in Benoa and Cilacap have been monitored so far.

• **Collection of size data:** The samplers in Jakarta and Benoa monitor all <u>export-reject</u> fish individually. All measurements are recorded in weight due to the limited access that the enumerators have to *sashimi* quality fish in the plants.

<u>By-catch</u> fish are, by contrast, not always weighed or not weighed individually. Although the samplers do their best to measure the length of the specimens whose weight is not available,

this is not always possible. Thus, the total number of specimens and total weight of the aggregate are recorded in the form.

- **Collection of length-weight data:** Data on length and weight of individual specimens are used to convert fish weights into fork length. The coverage rates, established at 10% for the main tuna and billfish species, have been achieved only for yellowfin tuna and bigeye tuna in Benoa and Jakarta (this information is shown in Table 25, page 37).

- **Species identification:** Most of the tunas, the swordfish and some sharks are usually identified to the species level. The identification of marlins and sharks is in some cases difficult, especially when the fish are frozen and/or processed. Thus, the three species of marlins are usually tailed and only shark carcasses or shark fins are unloaded. These fish are, therefore, recorded using the closest aggregate possible (e.g. MARL for marlins, SSSP for Sailfish and short-bill spearfish, SKH for unspecified sharks, etc.).

- **Type of measurement and measuring tools:** All fish weights are taken to the lowest kilogram. Although the balances used in the different plants have not been calibrated, it is not likely that a significant difference exist among the measurements taken in each plant as most of the fish weighed go to the *sashimi* market and there is a strong commercial incentive to have accurate weights.

All fish lengths are taken to the lowest centimetre. The use of callipers, originally intended for the three ports, proved impossible in Jakarta and Cilacap. The samplers in Cilacap and Jakarta are using metallic tapes to measure length. Information on the relationships between tuna and billfish lengths measured by callipers and tapes is is currently under way. This will enable all lengths recorded in Cilacap and Jakarta to be provided as straight length.

Results of Catch Monitoring

1. Estimation of Catches

Catches per port, species, month and processing plant are estimated as:

$$\hat{C} = L_w \overline{C}_l$$

It is a simple product of: 1) the number of vessel unloadings (or landings), as a measure of activity of the fleet during the period, and 2) an estimate of the average catch unloaded per landing.

Total catches per species and year are obtained by summing up catches estimated per strata.

a. Jakarta

Catches unloaded through processing plants (Export-Reject)

Sampling strategy: The samplers in Jakarta were unable to follow the sampling protocols that underpin the total enumeration of specimens unloaded from the selected vessels. In spite of the different estimation procedures that were used to estimate the total catches unloaded from non-totally enumerated vessel unloadings the results obtained are considered imprecise. Therefore, the samples that referred to vessel unloadings not totally enumerated were not considered to estimate catches in Jakarta.

Figure 3: Proportion of YFT and BET (expressed as percentage) obtained from sampling of the catches unloaded through processing plants in Jakarta, per month (1-12 above) and processing plant (numbers on the left) during 2003 (left) and 2004 (right)
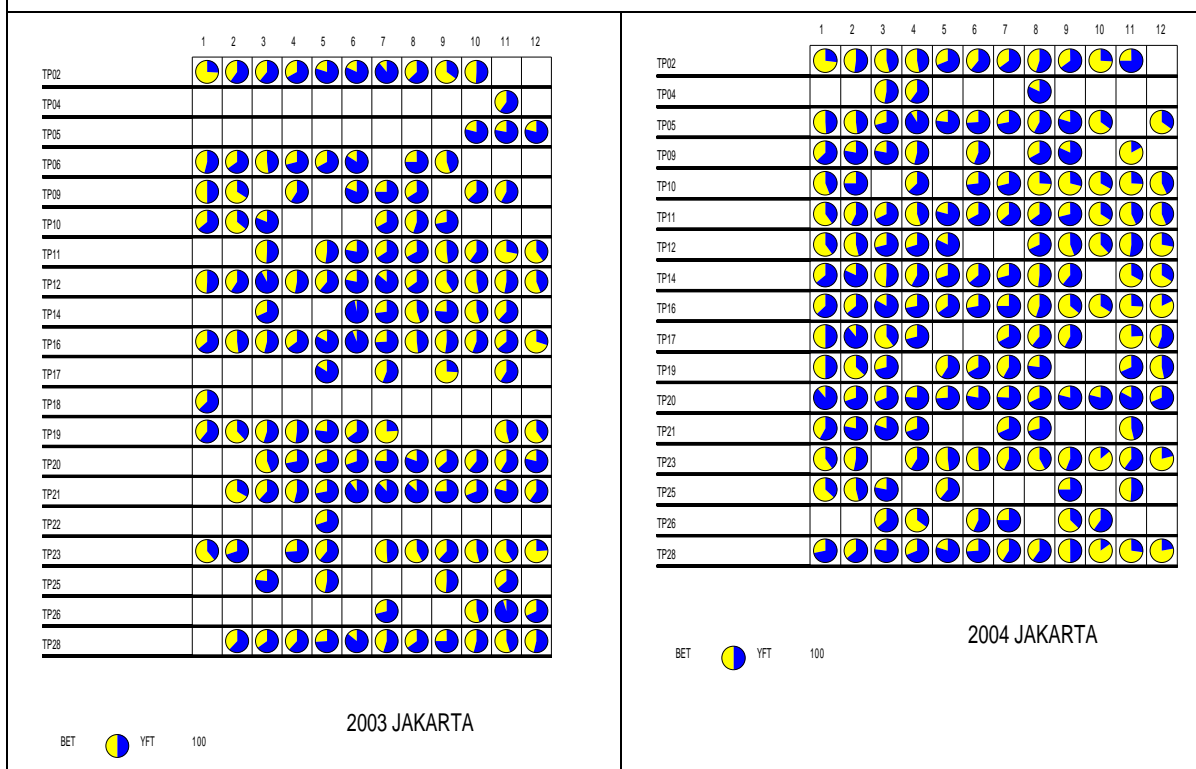
Strata: Catches per species were estimated per year, month and type of vessel. The processing plants were not considered due to the fact that no substantial difference in average catches per

vessel or species composition was identified among the different plants (Figure 3). Changes in average catch and/or species composition seem to be more related to the type of vessel or the fishing season (e.g. the higher proportion of bigeye tuna recorded in most of the plants during the last quarter of the year).

By contrast, the average catches recorded per vessel differ substantially depending on the type of vessel. Thus, landings from vessels acting as carriers (i.e. carrying on board catches from several longliners, including their own in most cases) are substantially higher than those from non-carrier vessels (Figure 4). Catches were, therefore, estimated per, year, month and type of vessel.

Note the landings from non-carriers are always totally enumerated compared with the landings from carriers (Figure 4) which are not totally enumerated in all cases. As expected, the average catches obtained from the landings of carrier vessels that were not totally enumerated are lower than those from the landings of carrier vessels whose catches were totally enumerated.
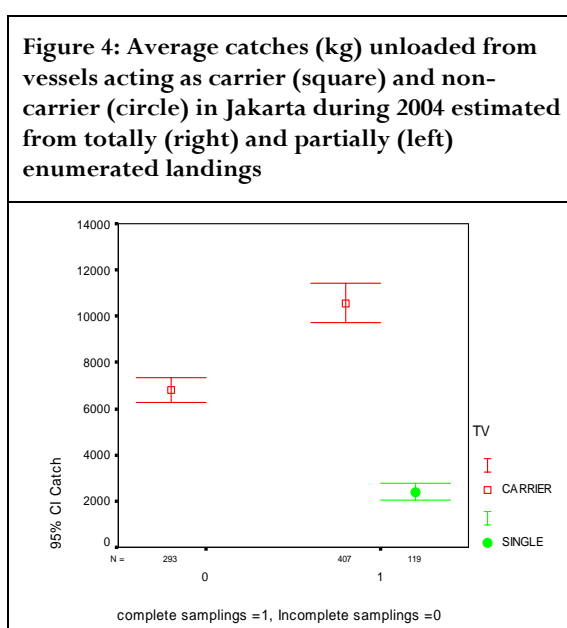
Figure 4: Average catches (kg) unloaded from vessels acting as carrier (square) and non-carrier (circle) in Jakarta during 2004 estimated from totally (right) and partially (left) enumerated landings

Input data

- Information on vessel activity: The number of landings of longliners recorded in Jakarta per year and month and the number of landings of export-reject sampled that were used to estimate catches in this port is shown in Table 7. Samples of carriers and non-carriers are shown separately. Coverage rates are also shown in each case.

Table 7: Total number of unloadings of fresh-tuna longline vessels through processing plants and number of vessel unloadings sampled per year and month in Jakarta from August 2002 to December 2004.

Year	M	Total no. Samp.	No. Samp. Single	No. Samp. Carrier	Samp. Carrier Comp.	Samp. Carrier Incom.	Total No. Land.	No. Land. Single	No. Land Carrier	Cov. Single ER	Cov. Carrier ER
2002	8	9	4	5	0	5					0
2002	9	45	17	28	0	28					0
2002	10	56	16	40	0	40	125	36	89	45	0
2002	11	50	14	36	0	36	102	29	73	49	0
2002	12	30	7	23	0	23	64	15	49	47	0
2003	1	49	20	29	0	29	131	53	78	37	0
2003	2	47	9	38	12	26	156	30	126	30	10

Table 7: Total number of unloadings of fresh-tuna longline vessels through processing plants and number of vessel unloadings sampled per year and month in Jakarta from August 2002 to December 2004.

Year	M	Total no. Samp.	No. Samp. Single	No. Samp. Carrier	Samp. Carrier Comp.	Samp. Carrier Incom.	Total No. Land.	No. Land. Single	No. Land Carrier	Cov. Single ER	Cov. Carrier ER
2003	3	57	7	50	28	22	164	20	144	35	19
2003	4	65	5	60	31	29	134	10	124	49	25
2003	5	63	9	54	30	24	165	24	141	38	21
2003	6	69	9	60	30	30	211	28	183	33	16
2003	7	61	7	54	30	24	127	15	112	48	27
2003	8	62	7	55	36	19	95	11	84	65	43
2003	9	65	7	58	19	39	109	12	97	60	20
2003	10	81	19	62	29	33	121	28	93	67	31
2003	11	55	17	38	21	17	101	31	70	54	30
2003	12	57	2	55	27	28	111	4	107	51	25
2004	1	80	6	74	40	34	136	10	126	59	32
2004	2	74	8	66	39	27	112	12	100	66	39
2004	3	80	14	66	31	35	134	23	111	60	28
2004	4	69	9	60	29	31	122	16	106	57	27
2004	5	67	8	59	29	30	107	13	94	63	31
2004	6	73	4	69	41	28	133	7	126	55	33
2004	7	78	14	64	37	27	123	22	101	63	37
2004	8	73	18	55	34	21	144	36	108	51	31
2004	9	53	15	38	30	8	110	31	79	48	38
2004	10	64	7	57	34	23	104	11	93	62	37
2004	11	46	11	35	24	11	99	24	75	46	32
2004	12	63	5	58	39	19	102	8	94	62	42

M	Month
Total no. Samp.	Total number of vessel unloadings sampled
No. Samp. Single	Number of samples from longliners not acting as carriers
No. Samp. Carrier	Number of samples from longliners acting as carriers
Samp. Carrier Comp.	Number of landings from longliners acting as carriers totally enumerated
Samp. Carrier Incom.	Number of landings from longliners acting as carriers partially enumerated
Total No. Land.	Total number of vessel unloadings recorded
No. Land. Single	Number of vessel unloadings of non-carriers estimated
No. Land. Carrier	Number of vessel unloadings of carriers estimated
Cov. Single ER	Percentage of landings of non-carriers sampled
Cov. Carrier ER	Percentage of landings of carriers sampled (totally enumerated)

The total number of landings of carrier (No. Land. Carrier) and non-carrier (No. Land. Single) vessels in the above table are estimated as the proportion of samples taken on carriers and non-carriers each month (accounting for both totally and partially enumerated vessel unloadings):

No. Land. Carrier(Single) = Total No. Land. * No. Samp. Carrier(Single) / Total no. Samp.

Coverage rates for carrier and non-carrier vessels are estimated as the percentage of vessel unloadings sampled totally enumerated:

Cov. Carrier ER = Samp. Carrier Comp. *100 / No. Land. Carrier

Cov. Single ER = No. Samp. Single * 100 / No. Land. Single

- Information on catches: Total catches sampled per year, month and type of vessel per species are obtained by summing up the catches from the individual samples. Only totally enumerated landings are used.

Average catches per stratum per vessel unloading are estimated by dividing the total catches obtained from sampling for each stratum by the number of vessel unloadings sampled within the stratum.

Catch estimation

The total catches for a stratum are estimated by multiplying the average catches per vessel unloading from above by the number of landings estimated for the stratum.

- Strata substitution: The catches of carriers in January 2003 were estimated as the number of landings recorded multiplied by the average catches per species obtained for February 2003. This was the only case in which strata substitution was required.

Catches not unloaded through processing plants (By-catch)

Sampling strategy: All by-catch fish unloaded from the selected vessels was monitored by samplers (total enumeration).

Strata: The catches are estimated per species, year and month.

Input data

- Information on vessel activity: The number of landings of longliners recorded in Jakarta per year and month and the number of landings of by-catch sampled is shown in Table 8. Coverage rates per stratum are also shown.

Table 8: Total number of unloadings of bycatch from fresh-tuna longline vessels and number of vessel unloadings sampled per year and month in Jakarta from August 2002 to December 2004.

Year	Month	No. Samp. ByC	Total No. Land	Cov. ByC
2002	8	1		
2002	9	3		
2002	10	3	125	2
2002	11	0	102	0
2002	12	2	64	3
2003	1	6	131	5
2003	2	4	156	3
2003	3	4	164	2
2003	4	0	134	0
2003	5	16	165	10
2003	6	50	211	24
2003	7	58	127	46
2003	8	38	95	40
2003	9	49	109	45
2003	10	59	121	49

Year	Month	No. Samp. ByC	Total No. Land	Cov. ByC
2003	11	28	101	28
2003	12	28	111	25
2004	1	43	136	32
2004	2	36	112	32
2004	3	47	134	35
2004	4	39	122	32
2004	5	31	107	29
2004	6	32	133	24
2004	7	21	123	17
2004	8	25	144	17
2004	9	23	110	21
2004	10	21	104	20
2004	11	16	99	16
2004	12	8	102	8

No. Samp. ByC	Total number of vessel unloadings sampled
Total No. Land.	Total number of vessel unloadings recorded
Cov. ByC	Percentage of landings sampled

Information on catches: Total catches sampled per year and month are obtained by
summing up the catches from the individual samples.

Average catches per stratum per vessel unloading are estimated by dividing the total catches
obtained from sampling for each stratum by the number of vessel unloadings sampled within the
stratum.

Catch estimation

Total catches for a stratum are estimated by multiplying the average catches per landing from
above by the number of vessel unloadings estimated for the stratum.

Strata substitution: The catches in April 2003 were estimated as the number of landings
recorded multiplied by the average catches per species obtained for May 2003. This was the
only case in which strata substitution was required.

The number of by-catch samples available for some strata, mainly during the first months of
2003 is considered low. Catches estimated are probably less accurate than for other strata.

New Catch Estimates

The amounts of export-reject and by-catch estimated in Jakarta for 2003 and 2004 are shown in
table 9 (see also annex 3, page 45).

Table 9: Total number of specimens caught, total catches (tons) and catches per species estimated per year, month and type of vessel unloading in Jakarta from January 2003 to December 2004

Year	M	Dest	Number	Catch (t)	YFT	BET	SKJ	ALB	SBF	SWO	MARL	OBIL	SKH	OTHR
2003	1	E-R	20,420	868	480	388	0	0	0	0	0	0	0	0
2003	1	ByC	59,016	756	4	15	40	57	0	143	139	125	83	150
2003	2	E-R	31,504	1,356	738	618	0	0	0	0	0	0	0	0
2003	2	ByC	44,382	595	18	21	20	79	0	121	121	78	36	101
2003	3	E-R	33,155	1,402	880	523	0	0	0	0	0	0	0	0
2003	3	ByC	104,960	1,706	232	28	159	192	0	158	335	243	230	128
2003	4	E-R	50,760	2,132	1,392	740	0	0	0	0	0	0	1	0
2003	4	ByC	45,887	764	117	5	14	69	0	48	111	102	198	99
2003	5	E-R	52,983	1,936	1,368	567	0	0	0	0	0	0	0	1
2003	5	ByC	56,502	941	144	6	17	86	0	59	138	125	244	122
2003	6	E-R	74,111	2,783	2,205	578	0	0	0	0	0	0	0	0
2003	6	ByC	133,225	2,314	276	36	121	213	0	259	395	314	457	244
2003	7	E-R	35,028	1,262	840	422	0	0	0	0	0	0	0	0
2003	7	ByC	54,220	947	94	10	29	88	0	112	158	118	212	126
2003	8	E-R	23,554	822	604	218	0	0	0	0	0	0	0	0
2003	8	ByC	30,035	530	65	5	20	52	0	76	71	64	92	84
2003	9	E-R	26,278	1,000	674	325	0	0	1	0	0	0	0	0
2003	9	ByC	39,892	633	36	10	18	115	0	81	81	71	99	122
2003	10	E-R	31,175	1,207	740	467	0	0	0	0	0	0	0	0
2003	10	ByC	57,282	864	54	16	30	140	0	140	130	70	115	171
2003	11	E-R	24,059	971	588	382	0	0	0	0	0	0	0	0
2003	11	ByC	39,401	579	25	13	25	67	0	94	114	37	88	117
2003	12	E-R	25,736	1,118	669	448	0	0	0	0	0	0	0	0
2003	12	ByC	48,951	759	20	13	30	93	0	84	137	83	171	128
2004	1	E-R	30,416	1,301	784	518	0	0	0	0	0	0	0	0
2004	1	ByC	56,418	874	36	8	34	163	0	74	152	91	143	174

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Table 9: Total number of specimens caught, total catches (tons) and catches per species estimated per year, month and type of vessel unloading in Jakarta from January 2003 to December 2004

Year	M	Dest	Number	Catch (t)	YFT	BET	SKJ	ALB	SBF	SWO	MARL	OBIL	SKH	OTHR
2004	2	E-R	28,780	1,316	837	479	0	0	0	0	0	0	0	0
2004	2	ByC	48,726	885	44	9	31	108	0	122	179	113	165	113
2004	3	E-R	22,127	995	683	312	0	0	0	0	0	0	0	0
2004	3	ByC	55,339	977	69	11	36	149	0	114	156	106	190	146
2004	4	E-R	37,289	1,559	1,107	452	0	0	0	0	0	0	0	0
2004	4	ByC	61,619	1,151	84	8	27	262	0	82	104	118	327	139
2004	5	E-R	31,899	1,191	833	358	0	0	0	0	0	0	0	0
2004	5	ByC	57,770	1,030	91	7	37	213	0	81	107	141	236	117
2004	6	E-R	34,089	1,318	947	370	0	0	0	0	0	0	0	0
2004	6	ByC	61,641	1,074	102	15	49	178	0	105	193	147	178	107
2004	7	E-R	32,569	1,228	845	382	0	0	0	0	0	0	0	0
2004	7	ByC	41,920	792	60	7	23	183	0	105	92	101	129	92
2004	8	E-R	27,276	1,028	597	432	0	0	0	0	0	0	0	0
2004	8	ByC	50,319	791	62	6	28	200	0	73	119	67	113	123
2004	9	E-R	21,323	822	565	257	0	0	0	0	0	0	0	0
2004	9	ByC	49,620	774	70	10	24	182	0	95	80	74	130	110
2004	10	E-R	24,781	984	548	436	0	0	0	0	0	0	0	0
2004	10	ByC	41,164	608	16	9	12	162	0	63	73	66	64	142
2004	11	E-R	14,993	569	290	280	0	0	0	0	0	0	0	0
2004	11	ByC	47,328	679	51	2	39	103	0	69	46	63	177	129
2004	12	E-R	23,163	1,013	523	490	0	0	0	0	0	0	0	0
2004	12	ByC	38,327	525	41	6	34	65	0	62	71	63	86	97

M	Month
Dest	Type of fish unloaded, fish going through processing plants (E-R for Export-Reject) or not (ByC for By-Catch)
Number	Total number of specimens unloaded estimated
Catch (t)	Total catch estimated (in metric tons)
Catches of yellowfin tuna (**YFT**), bigeye tuna (**BET**), skipjack tuna (**SKJ**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**), marlins (**MARL**), other billfish (**OBIL**), sharks (**SKH**) or other non IOTC species (**OTHR**) in metric tons	

The proportion of the catch (in weight) sampled in Jakarta for the major export-reject and by-catch species unloaded is indicated in Table 10 (export-reject) and Table 11 (by-catch).

Table 10: Proportion of the export-reject of yellowfin tuna and bigeye tuna (in weight) sampled in Jakarta per year and month between January 2003 and December 2004

Year	M	YFT			BET		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	1	868	20	2.30	388	17	4.38
2003	2	738	86	11.62	618	76	12.33
2003	3	880	174	19.78	523	105	19.99
2003	4	1,392	355	25.53	740	186	25.16
2003	5	1,368	297	21.68	567	124	21.80
2003	6	2,205	379	17.19	578	100	17.26
2003	7	840	228	27.16	422	114	27.10
2003	8	604	262	43.43	218	95	43.81
2003	9	674	135	19.99	325	67	20.72
2003	10	740	242	32.64	467	154	33.05

Table 10: Proportion of the export-reject of yellowfin tuna and bigeye tuna (in weight) sampled in Jakarta per year and month between January 2003 and December 2004

Year	M	YFT			BET		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	11	588	182	30.93	382	120	31.28
2003	12	669	171	25.63	448	114	25.36
2004	1	784	252	32.08	518	170	32.72
2004	2	837	330	39.38	479	189	39.56
2004	3	683	200	29.35	312	93	29.78
2004	4	1,107	306	27.68	452	127	28.16
2004	5	833	264	31.73	358	114	31.74
2004	6	947	312	32.94	370	122	32.93
2004	7	845	324	38.29	382	146	38.10
2004	8	597	203	33.97	432	144	33.37
2004	9	565	220	38.93	257	100	38.87
2004	10	548	203	36.97	436	162	37.23
2004	11	290	95	32.90	280	92	32.98
2004	12	523	217	41.57	490	204	41.68

M	Month
Yellowfin tuna (**YFT**) and bigeye tuna (**BET**)	
Tcatch (t)	Total catches estimated
Scatch (t)	Catches monitored
Cov. (%)	Proportion of the catch (in weight) covered (expressed in percentage)

The coverage rates in weight for export-reject fish are very similar between yellowfin tuna and bigeye tuna, agreeing also with the coverage rates estimated from the number of landings total and sampled, as it would be expected. The same applies to the coverage rates obtained for by-catch species (Table 11).

Table 11: Proportion of the by-catch of yellowfin tuna, bigeye tuna, albacore and swordfish (in weight) sampled in Jakarta per year and month between January 2003 and December 2004

Year	M	YFT			BET			ALB			SWO		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	1	4	0	4.20	15	1	4.61	57	3	4.56	143	7	4.59
2003	2	18	0	2.55	21	1	2.54	79	2	2.56	121	3	2.56
2003	3	232	6	2.44	28	1	2.48	192	5	2.44	158	4	2.44
2003	4	117	14	11.90	5	1	12.48	69	8	12.02	48	6	11.99
2003	5	144	14	9.67	6	1	10.40	86	8	9.64	59	6	9.75
2003	6	276	65	23.66	36	9	23.69	213	50	23.69	259	61	23.69
2003	7	94	43	45.64	10	4	44.49	88	40	45.92	112	51	45.51
2003	8	65	26	39.79	5	2	40.98	52	21	40.35	76	31	40.24
2003	9	36	16	44.48	10	5	46.20	115	52	44.98	81	36	44.75
2003	10	54	26	48.45	16	8	50.20	140	68	48.61	140	68	48.66
2003	11	25	7	27.23	13	4	27.00	67	18	27.60	94	26	27.68
2003	12	20	5	25.23	13	3	24.77	93	24	25.34	84	21	25.31
2004	1	36	11	31.70	8	2	30.58	163	52	31.63	74	23	31.53
2004	2	44	14	31.83	9	3	31.69	108	35	32.17	122	39	32.09
2004	3	69	24	35.30	11	4	34.75	149	52	35.02	114	40	34.93

Table 11: Proportion of the by-catch of yellowfin tuna, bigeye tuna, albacore and swordfish (in weight) sampled in Jakarta per year and month between January 2003 and December 2004

Year	M	YFT			BET			ALB			SWO		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2004	4	84	27	32.00	8	3	32.12	262	84	31.99	82	26	31.86
2004	5	91	26	28.84	7	2	28.70	213	62	29.04	81	23	28.87
2004	6	102	25	24.09	15	4	23.40	178	43	24.02	105	25	24.05
2004	7	60	10	16.99	7	1	17.53	183	31	17.08	105	18	17.10
2004	8	62	11	17.26	6	1	16.77	200	35	17.32	73	13	17.41
2004	9	70	15	20.83	10	2	21.74	182	38	20.87	95	20	20.81
2004	10	16	3	20.76	9	2	19.44	162	33	20.18	63	13	20.32
2004	11	51	8	16.02	2	0	12.32	103	17	16.19	69	11	16.21
2004	12	41	3	7.93	6	0	8.23	65	5	7.82	62	5	7.80

M	Month
Yellowfin tuna (**YFT**), bigeye tuna (**BET**), albacore (**ALB**) and swordfish (**SWO**)	
Tcatch (t)	Total catches estimated
Scatch (t)	Catches monitored
Cov. (%)	Proportion of the catch (in weight) covered (expressed in percentage)

b. Benoa

Catches unloaded through processing plants (Export-Reject)

Sampling strategy: All fish unloaded through processing plants from the selected vessels was monitored by samplers (total enumeration).

Figure 5: Proportion of YFT, BET and SBF (expressed as percentage) obtained from sampling of catches unloaded through processing plants in Benoa, per month (1-12 above) and processing plant (numbers on the left) during 2003 (left) and 2004 (right)
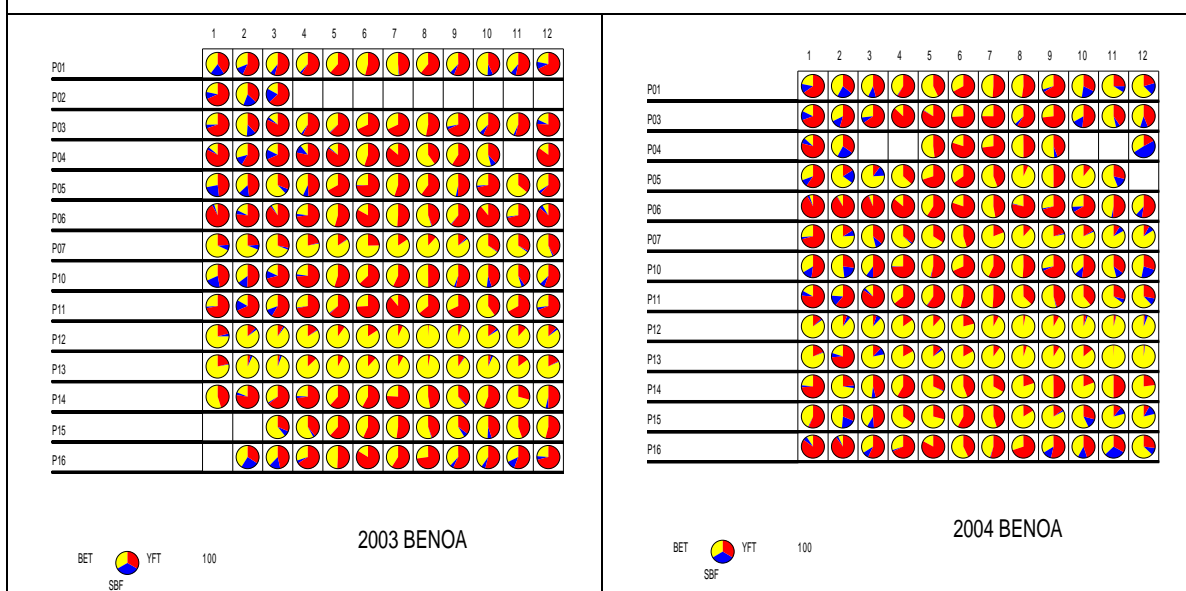
Strata: The catches are estimated per species, year, month and processing plant, as scheduled. The proportions between yellowfin tuna, bigeye tuna and Southern bluefin tuna per year, month and plant for 2003 and 2004 are represented in figure 5. The species composition varies

greatly, with plants handling a greater proportion of bigeye tuna and almost no southern bluefin tuna. Therefore, the stratification per plant is justified.

> *Input data*

• Information on vessel activity: The number of landings of longliners recorded in Benoa per year and month and the number of landings of export-reject sampled in this port is shown in Table 12. Coverage rates per stratum are also shown.

Table 12: Total number of unloadings of export-reject and bycatch from fresh-tuna longline vessels and number of vessel unloadings sampled per year and month in Benoa from July 2002 to December 2004.

Year	Month	No. Samp ER	Samp ER Carrier	Samp ER Single	No. Samp BY	No. Land	Cov. ER	Cov. BY
2002	7	119	3	116	36	353	34	10
2002	8	120		120	54	331	36	16
2002	9	144	81	63	77	348	41	22
2002	10	146	90	56	95	381	38	25
2002	11	138	72	62	65	336	41	19
2002	12	110	82	38	32	290	38	11
2003	1	149	102	47	60	325	46	18
2003	2	127	71	56	73	310	41	24
2003	3	114	65	49	78	265	43	29
2003	4	110	74	36	63	296	37	21
2003	5	107	63	44	67	265	40	25
2003	6	138	72	66	88	323	43	27
2003	7	133	71	62	109	292	46	37
2003	8	126	72	54	85	279	45	30
2003	9	123	69	54	90	286	43	31
2003	10	119	58	61	71	291	41	24
2003	11	150	65	85	75	305	49	25
2003	12	112	53	59	38	268	42	14
2004	1	135	52	83	54	310	44	17
2004	2	92	29	63	38	199	46	19
2004	3	119	44	75	65	250	48	26
2004	4	94	47	47	58	226	42	26
2004	5	93	42	51	65	220	42	30
2004	6	111	42	69	68	253	44	27
2004	7	100	55	45	74	234	43	32
2004	8	88	49	39	67	233	38	29
2004	9	100	48	52	66	236	42	28
2004	10	92	54	38	50	209	44	24
2004	11	149	49	100	58	231	65	25
2004	12	106	65	41	45	223	48	20

noSampER	Total number of vessel unloadings sampled (export-reject)
Samp ER Carrier	Number of unloadings of export-reject sampled from carrier vessels
Samp ER Single	Number of unloadings of export-reject sampled from non-carrier vessels
noSampBY	Total number of vessel unloadings sampled (bycatch)
noLand	Total number of vessel unloadings recorded
CovER	Percentage of landings sampled (export-reject)
CovBY	Percentage of landings sampled (by-catch)

The number of carrier vessels operating in Benoa is lower than that in Jakarta and Cilacap. The proportion of longliners of small size (less than 30 GRT) operating in Benoa is higher than in

the other two ports according to the results. These vessels would not operate as carriers due to their small size.

- Information on catches: Total catches sampled per year, month and processing plant are obtained by summing up the catches from the individual samples.

Average catches per stratum per vessel unloading are estimated by dividing the total catches obtained from sampling for each stratum by the number of vessel unloadings sampled within the stratum.

Catch estimation

Total catches for a stratum are estimated by multiplying the average catches per vessel unloading from above by the number of vessel unloadings estimated for the stratum.

- Strata substitution: Strata substitution was only required in eight cases. The coverage rates recorded per stratum are shown in table 13. The strata not covered through sampling are highlighted.

Catches for non-sampled strata were estimated as the number of landings recorded for the stratum multiplied by the average catches per species obtained from sampled strata for the month.

The number of export-reject samples available for some strata is considered low (less than 10%). Catches estimated are probably less accurate than for other strata.

Table 13: Proportion of landings sampled per processing plant, year and month in Benoa from July 2002 to December 2004.

Year	M	PP01	PP02	PP03	PP04	PP05	PP06	PP07	PP08	PP09	PP10	PP11	PP12	PP13	PP14	PP15	PP16
2002	7	0.4	0.5	0.4	0.1	0.3	0.4		0.5	0.4	0.1	0.4	0.4	0.4			
	8	0.3	0.3	0.4	0.1	0.4	0.5		0.5	0.3	0.4	0.4	0.3	0.4			
	9	0.4	0.3	0.3	0.2	0.4	0.4		0.3	0.4	0.4	0.3	0.4	0.3			
	10	0.4	0.3	0.4	0.1	0.3	0.3		0.5	0.3	0.4	0.3	0.3	0.5			
	11	0.4	0.3	0.4	0.2	0.4	0.4	0.1	0.3		0.4	0.3	0.4	0.4	0.2		
	12	0.4	0.3	0.3	0.0	0.4	0.4	0.3	0.3		0.3	0.4	0.4	0.5	0.4		
2003	1	0.4	0.5	0.4	0.4	0.5	0.4	0.4			0.4	0.3	0.5	0.4	0.6	**0.0**	
	2	0.6	0.6	0.4	0.2	0.4	0.4	0.3			0.4	0.4	0.4	0.4	0.7	**0.0**	0.7
	3	0.3	0.8	0.4	0.4	0.4	0.4	0.5			0.3	0.3	0.4	1.0	0.7	0.6	0.7
	4	0.3		0.4	0.3	0.4	0.3	0.3			0.4	0.3	0.4	1.0	0.5	0.5	0.5
	5	0.5		0.4	0.2	0.4	0.4	0.4			0.4	0.5	0.4	0.6	0.4	0.5	0.4
	6	0.5		0.4	0.4	0.4	0.5	0.4			0.5	0.3	0.4	0.4	0.5	0.4	0.5
	7	0.4		0.5	0.1	0.6	0.5	0.5			0.5	0.5	0.4	0.4	0.4	0.5	0.5
	8	0.5		0.5	0.2	0.4	0.4	0.4			0.5	0.5	0.4	0.6	0.4	0.5	0.7
	9	0.5		0.4	0.1	0.6	0.5	0.5			0.5	0.4	0.4	0.6	0.6	0.5	0.4
	10	0.4		0.4	0.3	0.4	0.5	0.5			0.3	0.5	0.3	0.5	0.5	0.4	0.4
	11	0.4		0.6	**0.0**	0.4	0.5	0.3			0.6	0.4	0.7	1.0	0.4	0.6	0.5
	12	0.6		0.4	0.1	0.5	0.5	0.5			0.4	0.4	0.4	0.5	0.5	0.4	0.4
2004	1	0.5		0.4	0.2	0.4	0.5	0.5			0.5	0.4	0.5	0.7	0.4	0.4	0.4
	2	0.8		0.5	0.2	0.2	0.2	0.9			0.5	0.4	0.4	0.4	0.4	0.4	0.5
	3	0.5		0.4	**0.0**	0.3	0.4	0.7			0.4	0.5	0.3	0.8	0.7	0.5	0.4
	4	0.6		0.5	**0.0**	0.5	0.5	0.3			0.4	0.4	0.4	0.5	0.6	0.4	0.5
	5	0.4		0.4	0.2	0.3	0.3	0.5			0.4	0.4	0.4	0.6	0.4	0.5	0.5
	6	0.4		0.4	0.1	0.4	0.5	0.7			0.5	0.5	0.5	0.4	0.4	0.4	0.4
	7	0.5		0.4	0.2	0.5	0.5	0.4			0.5	0.4	0.4	0.6	0.5	0.4	0.4
	8	0.3		0.3	0.3	0.3	0.4	0.4			0.4	0.5	0.4	0.6	0.4	0.3	0.6
	9	0.5		0.3	0.1	0.7	0.4	0.5			0.6	0.6	0.4	0.4	0.4	0.4	0.3

Table 13: Proportion of landings sampled per processing plant, year and month in Benoa from July 2002 to December 2004.

Year	M	PP01	PP02	PP03	PP04	PP05	PP06	PP07	PP08	PP09	PP10	PP11	PP12	PP13	PP14	PP15	PP16
	10	0.5		0.4	**0.0**	0.4	0.4	0.5			0.5	0.5	0.5	0.4	0.4	0.5	0.5
	11	0.7		0.8	**0.0**	0.7	0.6	0.7			0.8	0.5	0.4	0.6	0.6	0.7	0.7
	12	0.4		0.4	0.1	**0.0**	0.5	0.7			0.6	0.4	0.5	0.7	0.6	0.6	0.3

M	Month
PP01 to PP016	Proportion of vessel unloadings sampled per year and month for each plant

Catches not unloaded through processing plants (By-catch)

Sampling strategy: All by-catch fish unloaded from the selected vessels was monitored by samplers (total enumeration).

Strata: Catches per species were estimated per year, month and processing plant (i.e. according to the plant through which the export-reject fish was unloaded).

Input data

- Information on vessel activity: The number of landings of longliners recorded in Benoa per year and month and the number of landings of by-catch sampled is shown in Table 12 (page 24). Coverage rates per stratum are also shown.

- Information on catches: Total catches sampled per year and month are obtained by summing up the catches from the individual samples.

Average catches per stratum per vessel unloading are estimated by dividing the total catches obtained from sampling for each stratum by the number of vessel unloadings sampled within the stratum.

Catch estimation

Total catches for a stratum are estimated by multiplying the average catches per vessel unloading from above by the number of vessel unloadings estimated for the stratum.

- Strata substitution: Strata substitution was required in several cases. The coverage rates recorded per stratum are shown in table 14. The strata not covered through sampling are highlighted.

The catches of non-sampled strata were estimated as the number of landings recorded for the stratum multiplied by the average catches per species obtained from sampled strata for the month.

The number of export-reject samples available for some strata is considered low (less than 10%). The catches estimated are probably less accurate than for other strata.

Table 14: Proportion of landings of by-catch sampled per year and month according to the processing plant to which the catches of export-reject were unloading in Benoa from July 2002 to December 2004.

Year	M	PP01	PP02	PP03	PP04	PP05	PP06	PP07	PP08	PP09	PP10	PP11	PP12	PP13	PP14	PP15	PP16
2002	7	0.4	0.1	0.0	0.1	0.2	0.1		**0.0**	0.3	0.1	0.2	0.0	0.3			
	8	0.2	**0.0**	0.2	0.1	0.3	0.2		**0.0**	0.2	0.4	0.1	0.1	0.3			
	9	0.4	0.1	0.2	0.1	0.2	0.2		0.3	0.0	0.2	0.1	0.3	0.3			
	10	0.4	0.3	0.3	0.1	0.3	0.2		0.3	0.1	0.4	0.2	0.2	0.5			
	11	0.4	0.2	0.2	0.1	0.3	0.1	0.1	0.3		0.3	0.2	0.2	0.4	0.2		
	12	0.1	0.1	0.1	0.1	0.3	0.1	0.2	0.1		**0.0**	0.2	**0.0**	0.1	**0.0**		
2003	1	0.3	0.3	0.1	0.4	0.4	0.1	0.2			0.3	0.0	0.2	0.4	0.1	**0.0**	

Table 14: Proportion of landings of by-catch sampled per year and month according to the processing plant to which the catches of export-reject were unloading in Benoa from July 2002 to December 2004.

Year	M	PP01	PP02	PP03	PP04	PP05	PP06	PP07	PP08	PP09	PP10	PP11	PP12	PP13	PP14	PP15	PP16
	2	0.4	0.0	0.2	0.2	0.2	0.3	0.2			0.3	0.3	0.3	0.3	0.1	0.0	0.1
	3	0.3	0.3	0.3	0.4	0.2	0.2	0.5			0.2	0.2	0.4	0.5	0.0	0.2	0.2
	4	0.3		0.1	0.2	0.3	0.2	0.3			0.1	0.1	0.3	0.9	0.0	0.2	0.1
	5	0.5		0.2	0.2	0.3	0.2	0.4			0.2	0.1	0.4	0.3	0.0	0.2	0.0
	6	0.2		0.2	0.3	0.2	0.4	0.3			0.3	0.2	0.4	0.3	0.2	0.2	0.2
	7	0.4		0.3	0.1	0.4	0.4	0.5			0.5	0.3	0.3	0.4	0.2	0.4	0.3
	8	0.5		0.3	0.1	0.3	0.3	0.4			0.3	0.3	0.3	0.4	0.1	0.2	0.5
	9	0.5		0.4	0.0	0.4	0.3	0.5			0.3	0.1	0.3	0.5	0.0	0.3	0.2
	10	0.4		0.1	0.3	0.4	0.2	0.5			0.2	0.0	0.2	0.3	0.0	0.3	0.0
	11	0.3		0.3	0.0	0.4	0.2	0.3			0.2	0.0	0.6	0.7	0.0	0.1	0.1
	12	0.2		0.1	0.1	0.1	0.0	0.4			0.1	0.0	0.3	0.1	0.0	0.1	0.0
2004	1	0.3		0.1	0.2	0.4	0.1	0.4			0.1	0.0	0.4	0.3	0.0	0.1	0.0
	2	0.2		0.0	0.2	0.4	0.2	0.6			0.2	0.0	0.2	0.1	0.0	0.1	0.0
	3	0.4		0.1	0.0	0.7	0.0	0.6			0.2	0.0	0.2	0.6	0.0	0.2	0.0
	4	0.6		0.1	0.0	0.3	0.3	0.4			0.3	0.0	0.4	0.5	0.0	0.2	0.3
	5	0.4		0.2	0.2	0.5	0.1	0.5			0.4	0.1	0.3	0.3	0.0	0.3	0.3
	6	0.4		0.2	0.1	0.5	0.2	0.6			0.3	0.1	0.2	0.1	0.0	0.3	0.1
	7	0.5		0.2	0.2	0.5	0.4	0.4			0.4	0.0	0.3	0.3	0.0	0.3	0.4
	8	0.4		0.2	0.3	0.8	0.2	0.3			0.3	0.1	0.4	0.6	0.0	0.2	0.1
	9	0.5		0.1	0.1	1.3	0.2	0.4			0.4	0.0	0.3	0.3	0.0	0.3	0.3
	10	0.4		0.1	0.0	0.4	0.0	0.5			0.3	0.2	0.3	0.1	0.0	0.2	0.0
	11	0.4		0.3	0.1	0.7	0.1	0.6			0.4	0.0	0.0	0.0	0.0	0.3	0.1
	12	0.3		0.1	0.1	0.8	0.0	0.4			0.4	0.0	0.3	0.0	0.0	0.2	0.0

M	Month
PP01 to PP016	Proportion of vessel unloadings sampled per year and month for each plant

New Catch Estimates

The amounts of export-reject and by-catch estimated in Benoa for 2003 and 2004 are shown in table 15 (see also annex 3, page 48).

Table 15: Total number of specimens caught, total catches (tons) and catches per species estimated per year, month and type of vessel unloading in Benoa from January 2003 to December 2004

Year	M	Dest	Number	Catch (t)	YFT	BET	SKJ	ALB	SBF	SWO	MARL	OBIL	SKH	OTHR
2003	1	E-R	34,485	1,483	819	493	0	1	129	18	18	0	0	3
2003	1	ByC	14,871	389	5	1	3	34	0	122	150	28	13	34
2003	2	E-R	27,661	1,185	551	471	0	0	134	15	15	0	0	0
2003	2	ByC	18,171	367	9	1	2	115	0	53	109	12	16	51
2003	3	E-R	24,818	1,014	567	334	0	0	71	14	22	2	3	1
2003	3	ByC	19,400	378	2	1	2	142	0	48	90	24	16	52
2003	4	E-R	33,546	1,295	731	505	0	1	43	10	5	0	0	0
2003	4	ByC	30,750	568	13	0	2	255	0	48	154	16	3	78
2003	5	E-R	26,228	927	499	396	0	1	5	22	5	0	0	0
2003	5	ByC	26,258	611	3	2	6	237	0	84	100	10	117	54
2003	6	E-R	36,236	1,220	669	520	0	1	2	24	4	0	0	0
2003	6	ByC	37,203	790	1	0	6	515	0	119	69	9	16	55
2003	7	E-R	36,811	1,127	644	446	0	0	0	32	5	0	0	0

Table 15: Total number of specimens caught, total catches (tons) and catches per species estimated per year, month and type of vessel unloading in Benoa from January 2003 to December 2004

Year	M	Dest	Number	Catch (t)	YFT	BET	SKJ	ALB	SBF	SWO	MARL	OBIL	SKH	OTHR
2003	7	ByC	31,527	582	7	1	5	384	0	47	62	6	14	56
2003	8	E-R	24,613	780	314	425	0	5	1	28	7	0	0	0
2003	8	ByC	47,820	1,101	5	4	16	605	0	152	73	11	184	52
2003	9	E-R	23,998	922	454	412	0	0	23	27	5	0	0	0
2003	9	ByC	48,619	958	1	8	0	778	0	76	51	4	1	38
2003	10	E-R	23,547	1,084	471	532	0	1	48	24	8	0	0	0
2003	10	ByC	26,076	536	1	1	2	348	0	34	80	4	14	52
2003	11	E-R	26,718	1,272	587	597	0	2	43	26	17	0	0	0
2003	11	ByC	8,150	247	0	0	1	77	0	47	102	1	3	15
2003	12	E-R	33,847	1,571	1,001	448	0	0	56	29	37	0	0	0
2003	12	ByC	13,269	263	48	0	3	7	0	35	127	13	8	22
2004	1	E-R	28,334	1,341	889	315	0	0	102	25	10	0	0	0
2004	1	ByC	16,843	499	3	0	1	121	0	61	215	16	47	36
2004	2	E-R	11,094	517	203	238	0	0	63	6	7	0	0	0
2004	2	ByC	9,857	306	0	0	1	41	32	99	74	4	14	41
2004	3	E-R	17,975	768	389	284	0	0	60	16	19	0	0	0
2004	3	ByC	8,248	244	1	1	0	69	6	51	80	2	6	29
2004	4	E-R	17,147	713	426	266	0	0	5	7	8	0	0	0
2004	4	ByC	5,944	160	0	0	0	49	0	27	47	2	19	17
2004	5	E-R	16,023	580	274	292	0	0	4	7	3	0	0	0
2004	5	ByC	16,342	437	0	0	1	133	0	138	73	6	40	45
2004	6	E-R	25,294	1,020	587	401	0	0	0	31	1	0	0	0
2004	6	ByC	32,637	718	30	31	4	287	10	143	100	4	18	91
2004	7	E-R	25,655	897	430	442	0	1	1	15	9	0	0	0
2004	7	ByC	19,584	352	0	1	7	161	0	41	55	6	17	62
2004	8	E-R	17,847	623	222	355	0	9	4	27	6	0	0	0
2004	8	ByC	20,568	522	19	4	1	241	0	125	69	3	13	46
2004	9	E-R	16,624	649	293	303	0	5	16	23	8	0	0	0
2004	9	ByC	28,757	759	22	28	2	342	0	72	55	7	184	46
2004	10	E-R	15,596	712	233	335	0	4	70	46	22	0	0	0
2004	10	ByC	12,736	290	1	1	0	162	0	33	59	0	3	31
2004	11	E-R	12,305	577	144	360	0	1	39	17	16	0	0	0
2004	11	ByC	18,136	515	52	7	5	180	11	151	80	1	5	23
2004	12	E-R	21,076	1,094	263	588	0	0	217	10	16	0	0	0
2004	12	ByC	22,311	467	3	4	0	203	1	76	111	3	12	55

M	Month
Dest	Type of fish unloaded, fish going through processing plants (E-R for Export-Reject) or not (ByC for By-Catch)
Number	Total number of specimens unloaded estimated
Catch (t)	Total catch estimated (in metric tons)

Catches of yellowfin tuna (**YFT**), bigeye tuna (**BET**), skipjack tuna (**SKJ**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**), marlins (**MARL**), other billfish (**OBIL**), sharks (**SKH**) or other non IOTC species (**OTHR**) in metric tons

The proportion of the catch (in weight) sampled in Benoa for the major export-reject and by-catch species unloaded is indicated in Table 16 (export-reject) and Table 17 (by-catch).

Table 16: Proportion of the export-reject of yellowfin tuna, bigeye tuna, Southern bluefin tuna and swordfish (in weight) sampled in Benoa per year and month between January 2003 and December 2004

Year	M	YFT			BET			SBF			SWO		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	1	889	311		493	199	40.28	129	52	40.35	18	7	40.35
2003	2	551	220	39.90	471	184	39.01	134	56	42.07	15	6	37.25
2003	3	567	223	39.41	334	140	41.92	71	28	38.95	14	6	40.12
2003	4	731	255	34.88	505	185	36.57	43	14	33.72	10	4	35.96
2003	5	499	192	38.44	396	166	41.97	5	2	34.09	22	9	40.96
2003	6	669	274	40.96	520	216	41.63	2	1	32.78	24	9	37.03
2003	7	644	253	39.24	446	202	45.20	0	0		32	14	43.97
2003	8	314	145	46.09	425	191	45.04	1	0	31.74	28	13	46.59
2003	9	454	181	39.88	412	176	42.81	23	11	46.70	27	12	44.31
2003	10	471	196	41.60	532	216	40.64	48	18	37.39	24	10	41.83
2003	11	587	270	45.98	597	286	47.82	43	20	46.80	26	12	47.21
2003	12	1,001	348	34.72	448	181	40.50	56	26	46.67	29	13	45.65
2004	1	889	336	37.77	315	137	43.38	102	40	38.93	25	10	40.04
2004	2	203	79	38.91	238	97	40.69	63	25	39.99	6	3	43.27
2004	3	389	177	45.37	284	130	45.86	60	27	45.59	16	8	47.87
2004	4	426	188	44.03	266	116	43.43	5	2	42.02	7	3	43.57
2004	5	274	99	36.21	292	107	36.69	4	1	36.83	7	3	42.10
2004	6	587	217	37.00	401	170	42.35	0			31	15	47.83
2004	7	430	164	38.05	442	189	42.78	1	0	32.66	15	7	43.52
2004	8	222	81	36.42	355	139	39.03	4	1	35.85	27	10	38.78
2004	9	293	111	37.91	303	119	39.35	16	5	33.07	23	9	40.16
2004	10	233	101	43.46	335	150	44.90	70	31	44.50	46	20	42.73
2004	11	144	92	63.71	360	218	60.55	39	26	67.93	17	12	68.39
2004	12	263	108	40.88	588	250	42.53	217	61	28.19	10	5	46.52

M	Month
Yellowfin tuna (**YFT**), bigeye tuna (**BET**), Southern bluefin tuna (**SBF**) and swordfish (**SWO**)	
Tcatch (t)	Total catches estimated
Scatch (t)	Catches monitored
Cov. (%)	Proportion of the catch (in weight) covered (expressed in percentage)

The coverage rates in weight for export-reject fish are very similar for the different species, agreeing also with the coverage rates estimated from the number of landings total and sampled, as it would be expected. The coverage rates obtained for by-catch species are more uneven (Table 17).

Table 17: Proportion of the by-catch of yellowfin tuna, bigeye tuna, albacore and swordfish (in weight) sampled in Benoa per year and month between January 2003 and December 2004

Year	M	YFT			BET			ALB			SWO		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	1	5	1	19.55	1	0	18.60	34	6	16.34	122	13	11.01
2003	2	9	2	19.99	1	0	29.88	115	23	20.43	53	13	23.97
2003	3	2	0	22.85	1	0	25.70	142	40	27.91	48	12	24.77
2003	4	13	2	17.39	0			255	50	19.78	48	9	17.84
2003	5	3	1	19.80	2	0	15.45	237	51	21.47	84	16	18.49
2003	6	1	0	31.30	0	0		515	128	24.80	119	29	24.09

Table 17: Proportion of the by-catch of yellowfin tuna, bigeye tuna, albacore and swordfish (in weight) sampled in Benoa per year and month between January 2003 and December 2004

Year	M	YFT			BET			ALB			SWO		
		Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)	Tcatch (t)	Scatch (t)	Cov. (%)
2003	7	7	1	19.00	1	0	27.10	384	121	31.54	47	14	30.54
2003	8	5	1	29.90	4	1	27.80	605	133	22.06	152	38	25.26
2003	9	1	0	33.08	8	1	8.04	778	91	11.68	76	15	20.33
2003	10	1	0	29.37	1	0	19.10	348	89	25.46	34	10	28.05
2003	11	0	0		0			77	18	23.18	47	10	21.41
2003	12	48	2	4.15	0			7	1	16.60	35	4	11.17
2004	1	3	1	19.17	0			121	24	20.16	61	9	14.47
2004	2	0			0			41	3	6.53	99	21	20.95
2004	3	1	0	45.20	1	0	37.48	69	28	39.99	51	17	34.01
2004	4	0	0		0			49	14	27.58	27	7	24.31
2004	5	0	0		0			133	35	26.07	138	16	11.94
2004	6	30	7	24.42	31	3	11.28	287	77	26.67	143	26	18.13
2004	7	0	0		1	0	30.39	161	42	26.34	41	12	30.34
2004	8	19	13	68.87	4	2	37.78	241	107	44.35	125	35	27.93
2004	9	22	10	46.55	28	3	11.08	342	108	31.48	72	22	30.63
2004	10	1	0	40.00	1	0	42.70	162	36	22.53	33	8	24.79
2004	11	52	5	10.16	7	1	9.00	180	31	16.98	151	30	19.62
2004	12	3	1	48.37	4	2	55.42	203	45	22.10	76	20	26.18

M	Month
Yellowfin tuna (**YFT**), bigeye tuna (**BET**), albacore (**ALB**) and swordfish (**SWO**)	
Tcatch (t)	Total catches estimated
Scatch (t)	Catches monitored
Cov. (%)	Proportion of the catch (in weight) covered (expressed in percentage)

c. Cilacap

All export-reject and bycatch specimens from longliners putting in to in Cilacap are unloaded to the harbour.

Sampling strategy: All fish unloaded from the selected vessels was monitored by samplers (total enumeration).

Strata: Catches per species were estimated per year and month, as scheduled.

Input data

Information on vessel activity: The number of landings of longliners recorded in Cilacap per year and month and the number of landings sampled is shown in Table 18. Coverage rates per stratum are also shown.

Table 18: Total number of unloadings from fresh-tuna longline vessels and number of vessel unloadings sampled per year and month in Cilacap from July 2002 to December 2004.

Year	Month	No. Samp.	Samp Carrier	Samp Single	Total No. Land	Cov.
2002	8	2			2	100
2002	9	50			50	100

Table 18: Total number of unloadings from fresh-tuna longline vessels and number of vessel unloadings sampled per year and month in Cilacap from July 2002 to December 2004.

Year	Month	No. Samp.	Samp Carrier	Samp Single	Total No. Land	Cov.
2002	10	56			56	100
2002	11	31			31	100
2002	12	6			6	100
2003	1	31			31	100
2003	2	31	26	5	31	100
2003	3	62	56	6	62	100
2003	4	46	41	5	46	100
2003	5	61	47	14	61	100
2003	6	39	38	1	39	100
2003	7	29	26	3	29	100
2003	8	19	17	2	19	100
2003	9	11	9	2	11	100
2003	10	9	8	1	9	100
2003	11	16	12	4	16	100
2003	12	22	22		22	100
2004	1	37	34	3	48	77
2004	2	40	34	6	52	77
2004	3	49	46	3	64	77
2004	4	37	35	2	48	77
2004	5	42	36	6	71	59
2004	6	17	13	4	50	34
2004	7	6	6		62	10
2004	8	2	2		79	3
2004	9	1	1		158	1
2004	10	5	3	2	27	19
2004	11	6	4	2	19	32
2004	12	14	14		39	36

No. Samp.	Total number of vessel unloadings sampled
Samp Carrier	Number of unloadings sampled from carrier vessels
Samp Single	Number of unloadings sampled from non-carrier vessels
Total No. Land.	Total number of vessel unloadings recorded
Cov.	Percentage of landings sampled

- Information on catches: Total catches sampled per year and month are obtained by summing up the catches from the individual samples.

Average catches per stratum per vessel unloading are estimated by dividing the total catches obtained from sampling for each stratum by the number of vessel unloadings sampled within the stratum.

Catch estimation

Total catches for a stratum are estimated by multiplying the average catches per vessel unloading from above by the number of vessel unloadings estimated for the stratum.

• Strata substitution: No strata substitution was required in Cilacap. The number of samples available for some strata is considered low (less than 10%). Catches estimated are probably less accurate than for other months.

New Catch Estimates

The amounts of export-reject and by-catch estimated in Benoa for 2003 and 2004 are shown in table 19 (see also annex 3, page 46).

Table 19: Total number of specimens caught, total catches (tons) and catches per species estimated per year and month in Cilacap from January 2003 to December 2004

Year	M	Dest	Number	Catch(t)	YFT	BET	SKJ	ALB	SBF	SWO	MARL	OBIL	SKH	OTHR
2003	1	n/a	3,469	150	93	39	0	6	1	7	2	1	0	0
2003	2	n/a	3,172	128	87	21	0	2	4	3	4	3	1	2
2003	3	n/a	7,019	238	157	32	0	21	1	5	12	6	1	2
2003	4	n/a	6,282	204	104	43	0	31	0	8	11	4	1	2
2003	5	n/a	6,981	241	122	55	0	27	0	9	15	5	5	2
2003	6	n/a	4,696	160	95	28	0	13	0	10	7	1	3	2
2003	7	n/a	3,876	136	37	39	0	30	0	10	6	1	12	2
2003	8	n/a	2,740	99	14	40	0	27	0	5	4	0	5	3
2003	9	n/a	917	38	7	22	0	5	0	1	1	0	2	0
2003	10	n/a	994	42	8	24	0	3	0	2	2	0	3	1
2003	11	n/a	1,378	59	27	22	0	2	0	1	3	0	3	1
2003	12	n/a	2,789	133	92	28	0	1	0	2	5	1	3	2
2004	1	n/a	5,472	242	113	76	0	4	14	5	15	5	3	6
2004	2	n/a	4,228	174	95	34	0	1	7	4	14	7	4	7
2004	3	n/a	5,982	261	148	74	0	7	3	7	10	5	3	4
2004	4	n/a	9,317	309	167	102	0	17	0	9	6	3	1	4
2004	5	n/a	6,262	251	94	87	0	26	0	18	13	2	4	7
2004	6	n/a	6,271	281	149	76	0	7	0	19	13	1	8	6
2004	7	n/a	7,977	340	180	118	0	5	0	14	14	3	0	5
2004	8	n/a	4,819	270	38	227	0	0	0	5	0	0	0	0
2004	9	n/a	6,162	186	0	95	0	91	0	0	0	0	0	0
2004	10	n/a	1,507	58	6	37	0	13	0	1	0	0	0	0
2004	11	n/a	1,254	47	7	33	0	0	0	4	0	0	1	2
2004	12	n/a	4,772	241	54	158	0	1	0	7	7	1	3	10

M	Month
Dest	Not applicable (n/a)
Number	Total number of specimens unloaded estimated
Catch (t)	Total catch estimated (in metric tons)

Catches of yellowfin tuna (**YFT**), bigeye tuna (**BET**), skipjack tuna (**SKJ**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**), marlins (**MARL**), other billfish (**OBIL**), sharks (**SKH**) or other non IOTC species (**OTHR**) in metric tons

d. Other Ports

The catches unloaded in ports other than Benoa, Cilacap and Jakarta are not monitored through this program.

Catch data are, however, available through the Directorate General of Capture Fisheries of Indonesia as total catches unloaded per port and year. The total catches recorded are, in most cases, lower than those estimated through monitoring and no information on the species composition is available.

The catches in these ports were estimated as the proportion that they make out of the catches recorded for Jakarta, according to DGCF figures. This information is provided in table 20 for the period 1992-2003.

Table 20: Proportion of the catches of fresh tuna longliners (Rawai Tuna) unloaded in Jakarta, Benoa, Cilacap or other ports according to data from the DGCF of Indonesia

Year	Bali	Cilacap	Jakarta	Other
1992	0.463	0.003	0.328	0.206
1993	0.551	0.015	0.391	0.044
1994	0.365	0.001	0.587	0.047
1995	0.398	0.012	0.562	0.029
1996	0.402	0.000	0.598	0.000
1997	0.315	0.000	0.674	0.011
1998	0.486	0.048	0.418	0.048
1999	0.428	0.045	0.460	0.067
2000	0.654	0.110	0.203	0.033
2001	0.632	0.102	0.209	0.058
2002	0.643	0.098	0.215	0.044
2003	0.516	0.044	**0.412**	**0.028**

The catches estimated per port and total catches per year and species are shown in Table 21.

Table 21: Total catches (tons) and catches per species estimated per year in Benoa, Cilacap, Jakarta and other ports for 2003-04

Year	Species	Benoa	Cilacap	Jakarta	Oports	Total
2003	YFT	7,405	842	12,261	836	**21,344**
	BET	5,598	394	5,855	399	**12,246**
	SKJ	49	0	523	36	**608**
	ALB	3,508	168	1,252	85	**5,013**
	SBF	555	7	1	0	**563**
	SWO	1,133	64	1,375	94	**2,666**
	MARL	1,313	73	1,931	132	**3,448**
	OBIL	139	21	1,431	98	**1,689**
	SKH	409	39	2,025	138	**2,611**
	OTHR	561	20	1,594	109	**2,283**
	TOTAL	**20,670**	**1,628**	**28,248**	**1,927**	**52,473**
2004	YFT	4,486	1,052	9,285	633	**15,456**
	BET	4,258	1,118	4,861	332	**10,569**
	SKJ	23	0	374	26	**423**
	ALB	2,011	174	1,967	134	**4,287**
	SBF	641	24	0		**665**
	SWO	1,245	93	1,044	71	**2,452**
	MARL	1,142	94	1,371	94	**2,701**
	OBIL	54	26	1,150	78	**1,308**
	SKH	380	28	1,940	132	**2,480**
	OTHR	522	51	1,488	102	**2,163**
	TOTAL	**14,761**	**2,660**	**23,481**	**1,601**	**42,504**

Catches of yellowfin tuna (**YFT**), bigeye tuna (**BET**), skipjack tuna (**SKJ**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**), marlins (**MARL**), other

> billfish (**OBIL**), sharks (**SKH**) or other non IOTC species (**OTHR**) in metric tons

Thus, the catches in ports other than Benoa, Cilacap and Jakarta (OPorts) were estimated as:

$$\textbf{Catch}_{\textbf{OPorts}}=\textbf{Catch}_{\textbf{Jakarta}}\textbf{* 0.028 / 0.412}$$

The same factor was used to estimate 2003 and 2004 catches (data for 2004 is not yet available from the DGCF)

2. Precision of current catch estimates

The precision of the catch values obtained for the three ports has not been estimated yet.

3. Estimation of Catch-at-Size tables

Catch-at-Size tables were created for yellowfin tuna, bigeye tuna, albacore, Southern bluefin tuna and swordfish.

Input data

Size Data: The number of individual specimens measured per size class (round weight) was extracted from the database according to the following strata:

>   *Jakarta*: Year, Month, Type of vessel, Destination

>   *Benoa*: Year, Month, Destination, Processing Plant

>   *Cilacap*: Year, Month

Measurements in length were not used due to the different measuring tools or measurement types used in each port.

Sample size: the total number of specimens and catches sampled per species per strata were obtained from the above data.

Catch per strata: the catches estimated for each species per stratum were used.

Data processing

The total number of specimens per size class was estimated as the product of the number of specimens sampled for that class by the factor obtained by dividing the total weight of the species by the weight sampled in the strata.

Strata substitution: Size samples were not available or sample sizes very low for some of the strata considered. The size frequencies of empty or insufficiently covered strata were estimated according to the following rules:

All strata for which the catch sampled represented less than 10% of the total catch estimated or for which the number of specimens measured was below 100 were treated as empty strata.

The size frequency of empty strata was estimated according to the following **substitution scheme** (Table 22).

Table 22: Strata used to estimate size frequency data on non-sampled or poorly sampled strata

Step	Alternate strata used
1A	SAME PORT, FLEET, YEAR AND MONTH (i.e. all plants or all types of vessels)
1B	SAME PORT, FLEET, YEAR AND QUARTER (i.e. all plants or all types of vessels; previous and/or following month/s)
2A	SAME FLEET, YEAR, MONTH (Applying only to ports not covered through catch monitoring for which size frequency

Table 22: Strata used to estimate size frequency data on non-sampled or poorly sampled strata

Step	Alternate strata used
	data are estimated by using available data from Cilacap)
2B	SAME FLEET, YEAR, QUARTER (Applying only to ports not covered through catch monitoring for which size frequency data are estimated by using available data from Cilacap)
3A	SAME PORT, FLEET, BIENIUM, MONTH
3B	SAME PORT, FLEET, BIENIUM, QUARTER
3C	SAME PORT, FLEET, TRIENIUM, MONTH
3D	SAME PORT, FLEET, TRIENIUM, QUARTER
4A	SAME PORT, FLEET, YEAR
4B	SAME FLEET, YEAR

The amount of catch for which size data were available and that for which strata substitution was required is shown in Table 23. The proportion of catch for which sample data was used (OS) and for which substitution was needed is also shown in percentage (refer to the above substitution scheme for details).

Table 23: Amount of catch for which size data are available and amount for which catches-at-size had to be estimated by using data from other strata. These amounts are also shown as the percentage of the catch for which size data was available and those for which size data from other strata had to be used, according to the substitution scheme specified in Table 22

Species	Port	Year	Catch (t)	Cov (t)	Ncov (t)	OS	% 1A	% 1B	% 2A	% 2B	% 3A	% 3B	% 3C	% 3D	% 4A	% 4B
ALB	BENO	2002	2,350	471	1,879	20	62	18								
		2003	3,508	1,179	2,329	34	66									
		2004	2,011	700	1,311	35	65									
	CILA	2002	88	88		100										
		2003	168	57	110	34		29						3	34	
		2004	174	12	162	7		1			29		60	3		
	JAKA	2003	1,252	609	643	49		25				26				
		2004	1,967		1,967			55			37	9				
	OTHR	2003	85		85				62	5						34
		2004	134		134				8	4						88
BET	BENO	2002	3,493	3,410	83	98	2	0								
		2003	5,598	5,438	159	97	3	0								
		2004	4,258	4,111	148	97	3									
	CILA	2002	152	152		100										
		2003	394	394		100										
		2004	1,118	795	322	71		29								
	JAKA	2003	5,855	5,398	457	97		1				1			1	
		2004	4,861	4,765	97	98		1			1	0				
	OTHR	2003	380		380				100							
		2004	332		332				71	29						
SBF	BENO	2002	367	367		100										
		2003	555	544	11	98	2									
		2004	641	615	26	96	4									
	CILA	2002	0	0		100										
		2003	7	7		100										
		2004	24	24		100										
	JAKA	2003	1	1		100										
	OTHR	2003	0		0				100							

Table 23: Amount of catch for which size data are available and amount for which catches-at-size had to be estimated by using data from other strata. These amounts are also shown as the percentage of the catch for which size data was available and those for which size data from other strata had to be used, according to the substitution scheme specified in Table 22

Species	Port	Year	Catch (t)	Cov (t)	Ncov (t)	OS	% 1A	% 1B	% 2A	% 2B	% 3A	% 3B	% 3C	% 3D	% 4A	% 4B
SWO	BENO	2002	985	829	156	84	16									
		2003	1,133	953	180	84	16									
		2004	1,245	891	355	72	28									
	CILA	2002	20	20		100										
		2003	64	64		100										
		2004	93	73	19	79		21								
	JAKA	2003	1,375	989	386	72		28								
		2004	1,044	1,044		100										
	OTHR	2003	94		94				100							
		2004	71		71				95	5						
YFT	BENO	2002	3,427	3,342	85	98	2									
		2003	7,405	7,270	135	98	1					1				
		2004	4,486	4,365	121	97	3	0								
	CILA	2002	93	93		100										
		2003	842	842		100										
		2004	1,052	1,014	38	96		4								
	JAKA	2003	12,261	11,319	942	95		3		2						
		2004	9,285	8,895	390	96		3			0	1				
	OTHR	2003	812		812				100							
		2004	633		633				96	4						

Species	Yellowfin tuna (**YFT**), bigeye tuna (**BET**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**)
Port	Benoa (**BENO**), Jakarta (**JAKA**), Cilacap (**CILA**), other ports (**OTHR**)
Catch (t)	Total catch estimated (in metric tons)
Cov (t)	Amount of catch for which size data are available
NCov (t)	Amount of catch for which size data are not available
Proportion of the catch (expressed as percentage) for which size data are available (OS) and proportion of the catch for which size data from other strata had to be used to estimate catch-at-size (see table 22 for details)	

The resulting size frequency data per species are shown in annex 4 (page 49).

The proportion of yellowfin tuna, bigeye tuna, albacore, Southern bluefin tuna and swordfish (t) for which individual measurements exist is indicated in Table 24. While coverage rates are high for export-reject they are low for most by-catch species. By-catch fish are seldom weighed individually and the enumerators cannot always measure individually every fish in the aggregate. Thus, the amount of individual measurements for by-catch fish is much lower than for export-reject, usually handled individually in the plants. The amount of size data available is, however, considered sufficient as it is shown in Table 23 (strata substitution was only needed in some cases).

Table 24: Amount of yellowfin tuna, bigeye tuna, albacore, Southern bluefin tuna and swordfish (tons) for which individual measurements are recorded per year and totals for 2003-04

Species	Dest	Year	JAKARTA			BENOA			CILACAP			TOTAL		
			CSI	TC	%	CSI	TC	%	CSI	TC	%	CSI	TC	%
YFT	**Ex-Re**	**2003**	2,564	11,178	23	2,867	7,308	39	776	842	92	6,206	19,329	32
		2004	2,926	8,559	34	1,751	4,353	40	507	1,052	48	5,184	13,964	37
	ByC	**2003**	19	1,082	2	9	96	10				28	1,178	2

Table 24: Amount of yellowfin tuna, bigeye tuna, albacore, Southern bluefin tuna and swordfish (tons) for which individual measurements are recorded per year and totals for 2003-04

Species	Dest	Year	JAKARTA			BENOA			CILACAP			TOTAL		
			CSI	TC	%	CSI	TC	%	CSI	TC	%	CSI	TC	%
		2004	21	725	3	39	133	29				60	859	7
		TOTAL	5,530	21,545	26	4,667	11,891	39	1,283	1,894	68	11,479	35,330	32
BET	Ex-Re	2003	1,325	5,676	23	2,342	5,578	42	383	394	97	4,050	11,648	35
		2004	1,663	4,765	35	1,822	4,180	44	360	1,118	32	3,845	10,062	38
	ByC	2003	5	179	3	3	20	15				8	199	4
		2004	3	97	4	12	79	15				15	175	9
		TOTAL	2,996	10,716	28	4,178	9,856	42	743	1,511	49	7,918	22,084	36
SBF	Ex-Re	2003	0	1	20	228	554	41	7	7	97	235	562	42
		2004		0		222	582	38	18	24	76	240	606	40
		TOTAL	0	1	20	450	1,136	40	25	31	81	475	1,168	41
ALB	ByC	2003	24	1,252	2	179	3,496	5	19	168	11	223	4,916	5
		2004	11	1,967	1	109	1,989	6	2	174	1	123	4,130	3
		TOTAL	35	3,219	1	289	5,485	5	21	342	6	345	9,046	4
SWO	ByC	2003	249	1,375	18	179	866	21	63	64	99	491	2,305	21
		2004	191	1,044	18	221	1,016	22	41	93	45	454	2,153	21
		TOTAL	439	2,419	18	400	1,882	21	104	156	67	944	4,457	21

Species	Yellowfin tuna (**YFT**), bigeye tuna (**BET**), albacore (**ALB**), Southern bluefin tuna (**SBF**), swordfish (**SWO**)
Dest	Type of fish unloaded, fish going through processing plants (E-R for Export-Reject) or not (ByC for By-Catch)
CSI	Total weight (t) of the specimens whose size is individually recorded
TC	Total catches estimated (t)
(%)	Proportion of the catch (in weight) for which individual measurements are available (expressed in percentage)

4. Collection of biological data

The amounts of fish for which length-weight data are available for yellowfin tuna, bigeye tuna, albacore and swordfish are indicated in Table 25. These data will enable the conversions of individual weights into standard lengths per species.

The samplers in the three ports are currently taking length-length-weight measurements of tuna and billfish species, intended to complete the above and build the formulas required to convert from round (tape measure) to straight (calliper) measurements.

Table 25: Number of specimens of yellowfin tuna, bigeye tuna, albacore and swordfish for which length-weight data are available FROM Jakarta and Benoa sampling

Year	Month	YFT		BET		ALB		SWO	
		JAK	BEN	JAK	BEN	JAK	BEN	JAK	BEN
2002	6		575		219		18		33
2002	7		1,155		1,182		61		118
2002	8	426	486	474	963		25		70
2002	9	1,621	788	1,359	960		38		95
2002	10	2,285	586	1,965	679		40		32
2002	11	1,365	396	1,423	425				13
2002	12	1,061	27	1,005	15				
2003	1	1,513	257	1,262	274				
2003	2	2,128	555	1,560	431		11		
2003	3	3,739	1,047	2,201	502		12		25

Table 25: Number of specimens of yellowfin tuna, bigeye tuna, albacore and swordfish for which length–weight data are available FROM Jakarta and Benoa sampling

Year	Month	YFT		BET		ALB		SWO	
		JAK	BEN	JAK	BEN	JAK	BEN	JAK	BEN
2003	4	4,789	872	2,609	622		40		23
2003	5	3,865	997	1,349	910		25		54
2003	6	3,922	1,387	1,139	1,039	13	91	130	33
2003	7	2,848	820	2,281	493		23	20	24
2003	8	3,068	720	1,211	833		76		20
2003	9	2,960	595	1,475	504				
2003	10	3,285	515	1,687	380				
2003	11	1,786	352	1,135	164				
2003	12	2,355	835	1,855	403				
2004	1	2,523	778	1,673	329				
2004	2	2,811	338	1,654	187				
2004	3	2,084	515	789	233				
2004	4	1,632	622	569	400				
2004	5	1,605	233	616	250				
2004	6	838	410	317	432		12		
2004	7	572	329	283	582				
2004	8	338	234	473	645				
2004	9	533	289	326	578				
2004	10	274	245	387	394				
2004	11	150	99	45	280				
2004	12	500	213	399	507				
	TOTAL	YFT	74,146	BET	49,336	ALB	485	SWO	690

Species	Yellowfin tuna (**YFT**), bigeye tuna (**BET**), albacore (**ALB**), swordfish (**SWO**)
Port	Benoa (**BENO**), Jakarta (**JAKA**)

Conclusion

A great deal of progress has been achieved since the implementation of the Multilateral Catch Monitoring Program in Indonesia. The main areas of progress are summarized below:

- Improved vessel record: The information collected through enumerators, Port Authorities (Jakarta, Cilacap) and the Waski office in Benoa on vessel names, identification and vessel dimensions has improved the records of longline vessels operating in Indonesia, especially regarding the longliners whose GRT is below 30 (not in the DGCF record). The number of longliners operating in Indonesia is, consequently, better known.

- The information that the enumerators collect daily from fresh-tuna longliners in Jakarta, Benoa and Cilacap has greatly improved the records of longliner unloadings.

- Increased knowledge of the fishery: The regular visits of enumerators to the harbour and interviews to plants and vessels owners has greatly improved understanding on the operation of fresh-tuna longliners, areas exploited and seasonality. This information also led to changes in the sampling design in several occasions.

- More precise catch estimates: The new sampling involves both components of the catch i.e. export-reject and by-catch. The previous data collection system was obtained only estimates of the catches unloaded through processing plants i.e. the remaining catches disregarded in most cases. The new estimates are considered to be much more reliable.

- More precise information on the catches of individual species: In the past the species composition of the landings was only available from the RCCF/CSIRO monitoring in Benoa. The species breakdown from the Benoa sampling was, therefore, used to break the catches unloaded in other ports per species, on the assumption that all Indonesian longliners were exploiting the same areas, harvesting the same amounts per species. The results from the new monitoring have proved that the latter assumption was incorrect due to the different composition of the catch obtained per species in each port. The new data collected will, therefore, also help to revise the catches estimated before the implementation of the new strategy.

- Size frequency data are now available for the major tuna and billfish species: The amount of size data collected in Indonesia during the last two years, with coverage rates ranging between 10% and 40% depending on the species, has allowed that catches-at-size be estimated for the first time for this fishery. The current levels of coverage are, by far, the best existing in the Indian Ocean for a longline fishery.

- Collection of biological data (length-length-weight) on major tuna and billfish species: The ongoing collection of biological data on key tuna and billfish species in Indonesia will allow size data from the Indonesian longline fleet to be converted from weight to length, and *vice versa*, in a more accurate manner.

The implementation of the new Multilateral Catch Monitoring has not, however, come without difficulty. There have been and still are several issues that will require close attention and may lead to further changes in the sampling design, estimation procedure or estimated catches. The following problem areas have been identified:

- Imprecise information on effort: The amount of unloadings of by-catch fish collected through port interviews by enumerators is consistently, markedly lower than the amount of unloadings of export-reject. Although this information is thought to be unreliable due to the reasons explained in a previous section, the assumption that the same number of unloadings of

export-reject applies also to by-catch needs to be verified. The estimated catches may change if the above assumption is proved inaccurate, resulting in lower estimates of by-catches unloaded.

• Incomplete information on vessel dimensions: The information available on vessel GRT and length overall (LOA) was used to compare the average catches unloaded by vessels of different sizes. The results obtained indicated that the amounts unloaded by longliners of different sizes vary significantly. This may lead to the incorporation of different vessel size classes to the existing strata once that the vessel record is complete. This change is, however, not likely to affect substantially the current catch estimates due to the high coverage rates attained.

• Different vessel operation: The above applies also to longliners acting as carrier vessels or only as fishing vessels, for which the average catches estimated per landing proved to be significantly different. It is, however, likely that the amount of information available on the type of vessel operation in each port would be insufficient or unreliable.

In spite of the above problems, the current monitoring has proved to be successful in many areas. Indonesia is currently in a position to report catch and size frequency data according to the requirements of the IOTC and CCSBT. The close cooperation between the RCCF and the DGCF and its successful coordination of all program activities will also assure that the transfer of responsibilities from the IOTC/OFCF and CSIRO/ACIAR/DAFF to the Indonesian institutions occur in a smooth way.

References

To be added later

Annexes

1. <u>Staff Involved with the Multilateral Catch Monitoring Program</u> (April 2004 to date)

Name	Institution	Post
Mr. Parlin Tambunan	DGCF[12]	Director of Fisheries Resources
Dr. Subhat Nurhakim	RCCF[13]	Director Project Coordinator
Mrs. Dyah Retnowati	DGCF	Chief of Data & Statistics Sub Directorate Liaison Officer IOTC
Mr. Lasma Tambunan	DGCF	Former Directorate of Capture Fisheries Facility
Mr.Banbang Sutejo	DGCF	Head Port Authority Muara Baru (Jakarta)
Mr. Silaen	DGCF	Head Port Authority Cilacap
Mr. Nengah Nesa	WASKI	Head WASKI office Benoa
Mr. Budi Iskandar	RCCF	Systems' Manager Database Manager
Dr. Gede Sedana Merta	RIMF[14]	Senior Tuna Scientist Overall Supervisor
Dr. Wudianto	RIMF	Director of RIMF Local Supervisor Cilacap
Mrs. Retno Andamary	RIM[15]	Research officer Local Supervisor Benoa
Mr. Mahisuwara	RIMF	Program & Collaboration Research Local Supervisor Muara Baru
Mr. Enjah Rahmat	RIMF	Data entry person Muara Baru/Cilacap
Mr. Arief Gunawan	RIMF	Data entry person Muara Baru/Cilacap
Mr. B. Teguh Trihandoyo	RIM	Data entry person Benoa
Lucky Aditya Nugraba	RIMF	Enumerator Muara Baru (resigned)
Budi Abdilah	RIMF	Enumerator Muara Baru (resigned)
Suleiman Karimi	RIMF	Enumerator Muara Baru
Andri	RIMF	Enumerator Muara Baru
M. Furqon	RIMF	Enumerator Muara Baru
Nadia Nurhaliati	RIMF	Enumerator Muara Baru
Edi Nurcholis	RIMF	Enumerator Muara Baru
Asep Sofian	RIMF	Enumerator Muara Baru
Eko Febnanto	RIMF	Enumerator Muara Baru
Alif Priyambodo	RIMF	Enumerator Cilacap
Dian Novianto	RIMF	Enumerator Cilacap
Joko Rianto	DGCF[16]	Enumerator Port Authority Cilacap
Rachmat	RIMF	Enumerator Benoa (Quitted)
Aziz	RIMF	Enumerator Benoa (Quitted)
Dyah	RIMF	Enumerator Benoa (Quitted)
Iffah	RIMF	Enumerator Benoa (Quitted)
Awarawantining Tias	RIMF	Enumerator Benoa (Quitted)
Jumariadi	RIMF	Enumerator Benoa
Ririk	RIMF	Enumerator Benoa
Nalin	RIMF	Enumerator Benoa
Farida Aisha	RIMF	Enumerator Benoa
Noor Mohmud	RIMF	Enumerator Benoa
Paulos Yuda Irawar	RIMF	Enumerator Benoa

Training technical advice and support:

Name	Institution	Post
Tim Davis	CSIRO[17]	Senior Research Scientist
Craig Proctor	CSIRO	Research Scientist
Koichi Sakonjyu	OFCF[18]	Administration IOTC/OFCF Project
Shunji Fujiwara	OFCF	Senior Scientist IOTC/OFCF Project

[12] Directorate General of Capture Fisheries, Indonesia (Jakarta)

[13] Research Institute for Capture Fisheries, Indonesia (Jakarta)

[14] Research Institute for Marine Fisheries, Indonesia (Jakarta)

[15] Research Institute for Mariculture, Indonesia (Gondol, Bali)

[16] Port Authority Cilacap, Indonesia

[17] Commonwealth Scientific and Industrial Research Organization, Australia (Hobart, Tasmania)

[18] Overseas Fisheries Cooperation Foundation, Japan

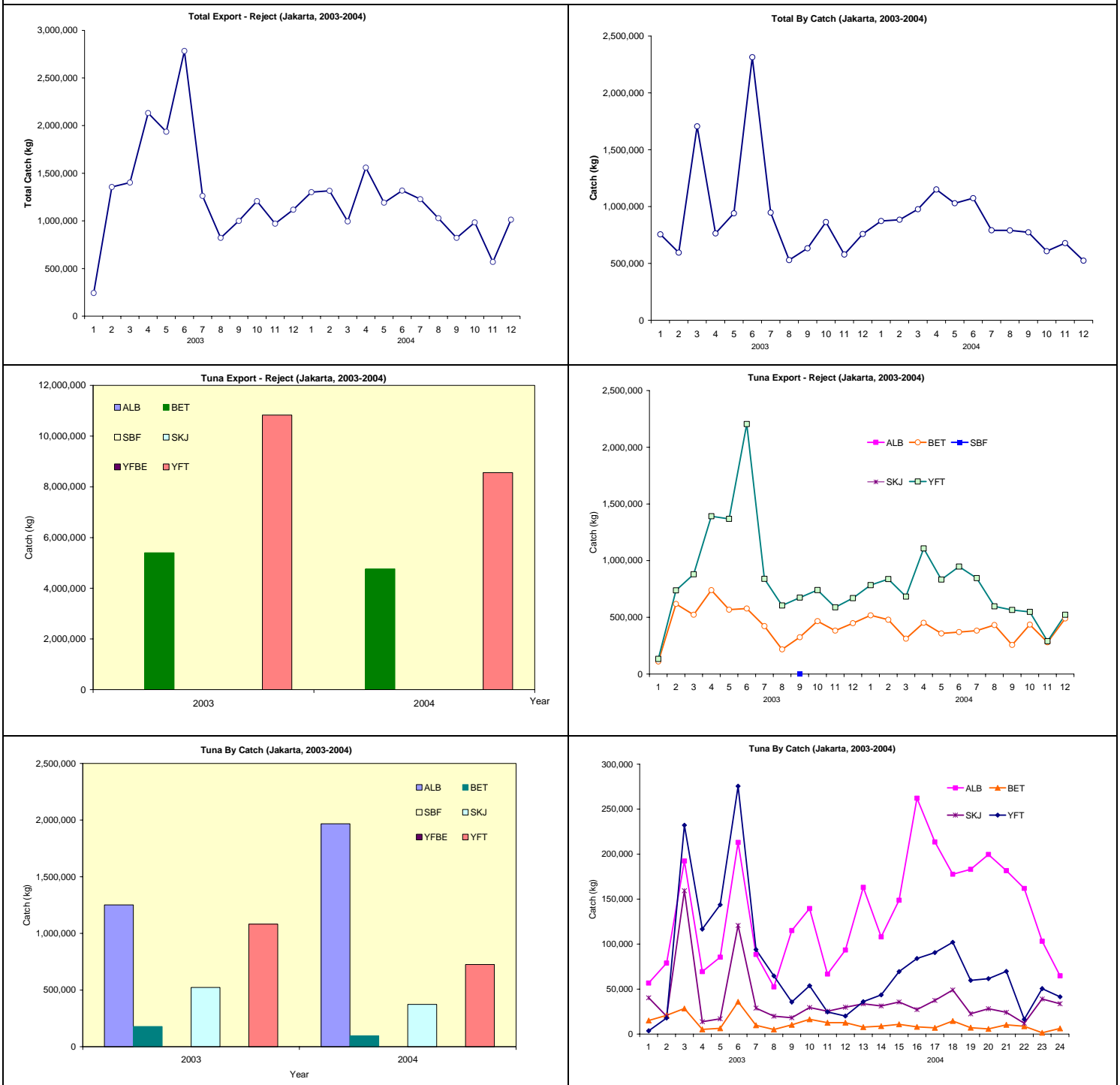| Name	Institution	Post
Miguel Herrera	IOTC[19]	Data Coordinator
Francois Poison	IOTC	Field Data Manager

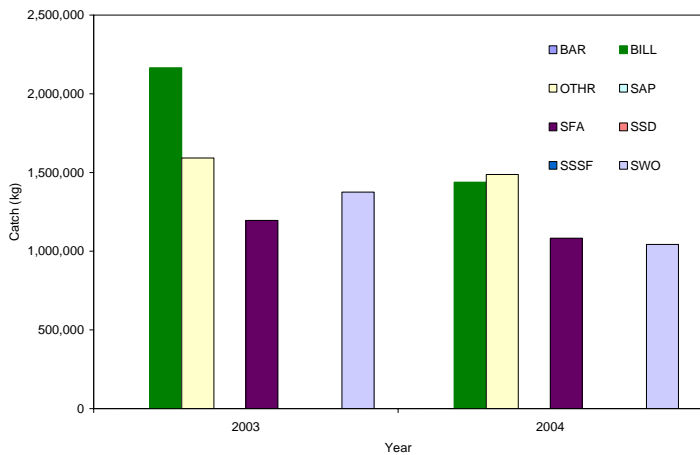[19] Indian Ocean Tuna Commission, Seychelles (Victoria)
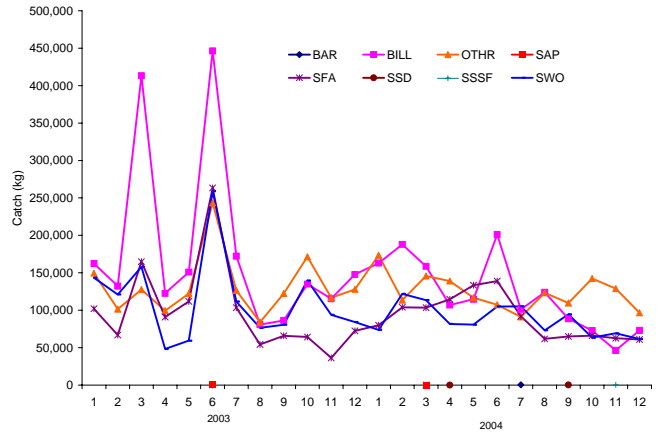
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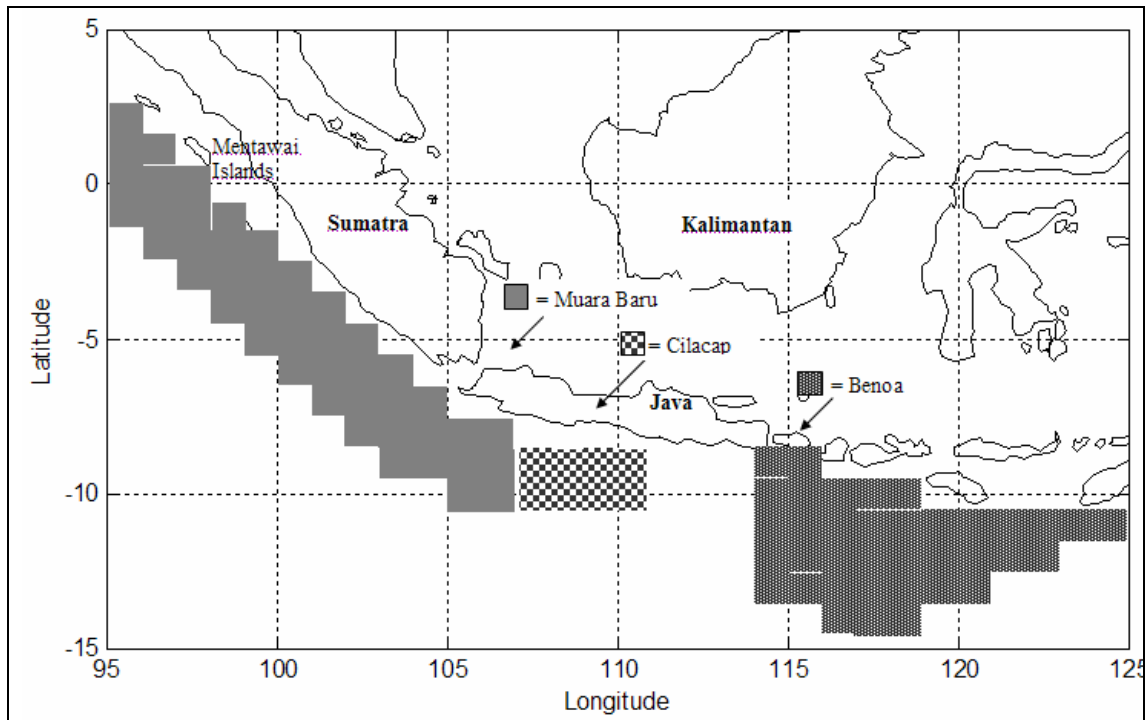
3. Catch estimates Charts

JAKARTA

Total Export - Reject (Jakarta, 2003-2004)

Total By Catch (Jakarta, 2003-2004)

Tuna Export - Reject (Jakarta, 2003-2004)

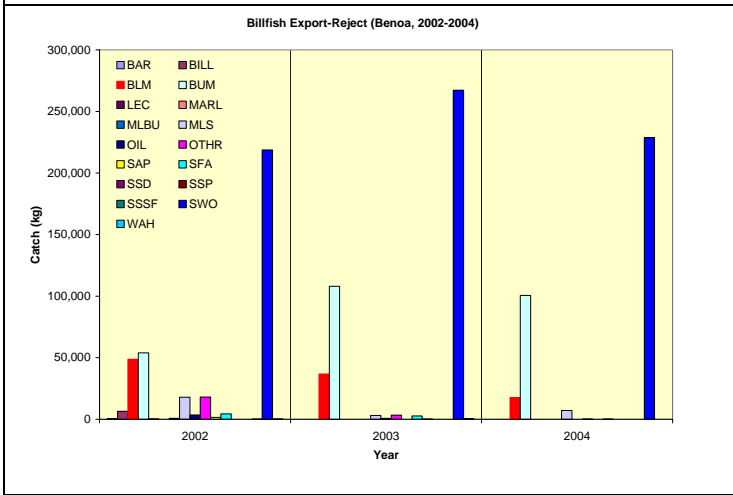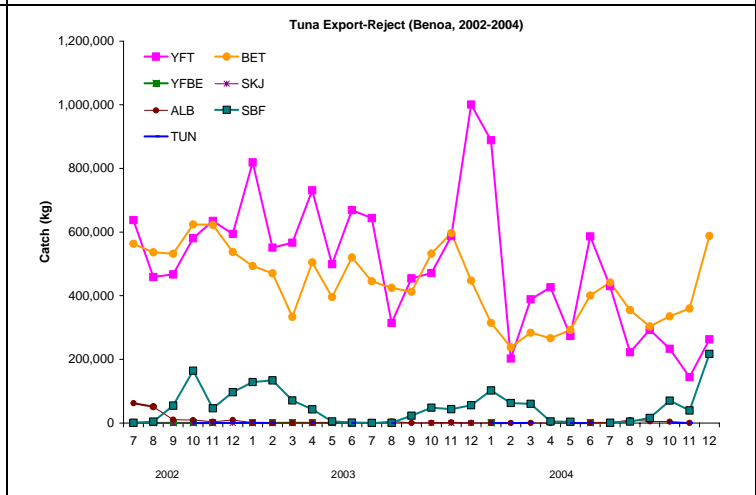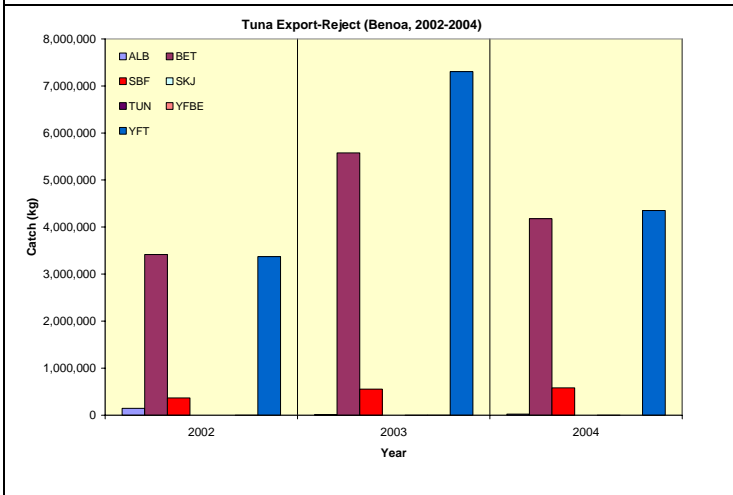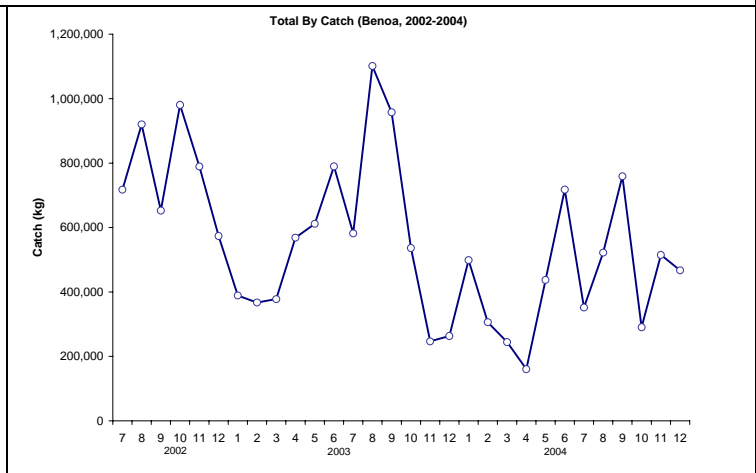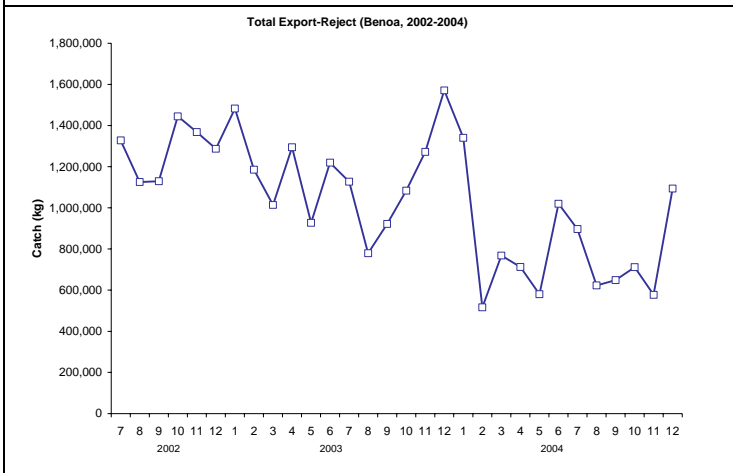Tuna Export - Reject (Jakarta, 2003-2004)

Tuna By Catch (Jakarta, 2003-2004)

Tuna By Catch (Jakarta, 2003-2004)

JAKARTA

Billfish By Catch (Jakarta, 2003-2004)

Billfish By Catch (Jakarta, 2003-2004)

Shark By Catch (Jakarta, 2003-2004)
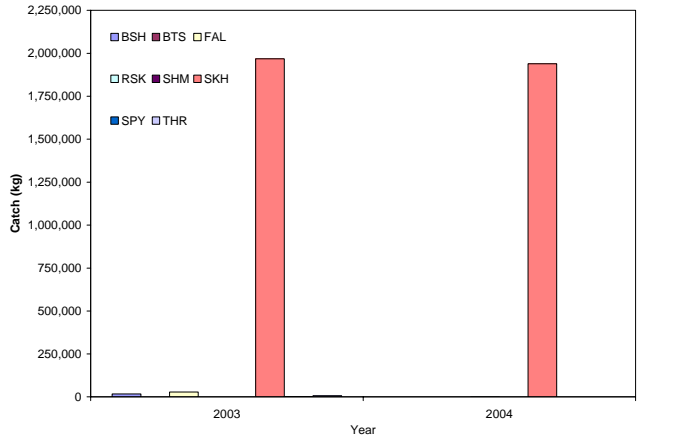
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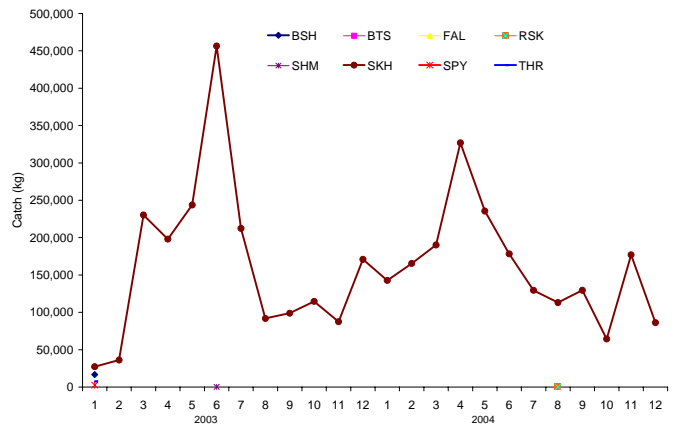
CILACAP

Total Export - Reject (Cilacap, 2002-2004)

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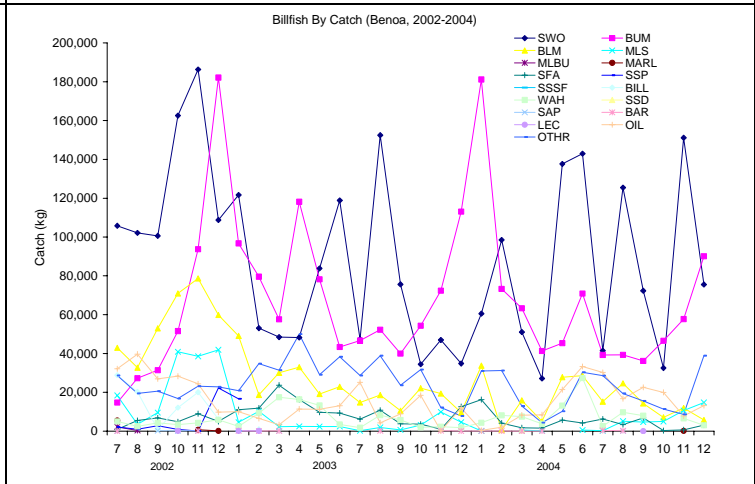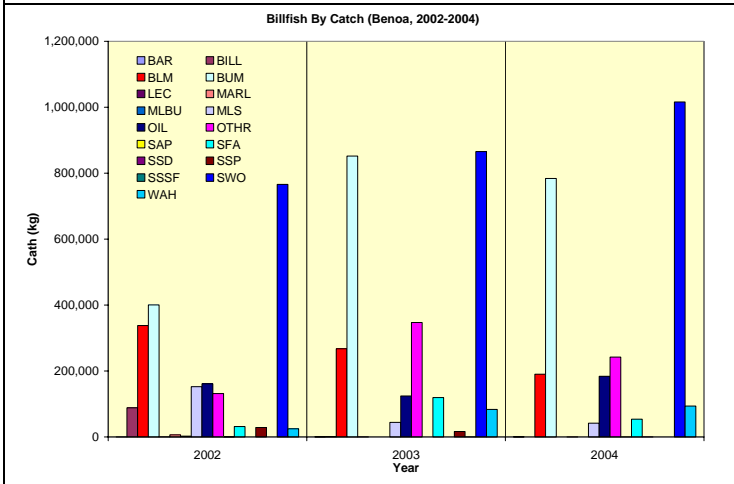
BENOA

BENOA

Tuna By Catch (Benoa, 2002-2004)

Tuna By Catch (Benoa, 2002-2004)

Billfish By Catch (Benoa, 2002-2004)

Billfish By Catch (Benoa, 2002-2004)

Shark By Catch (Benoa, 2002-2004)

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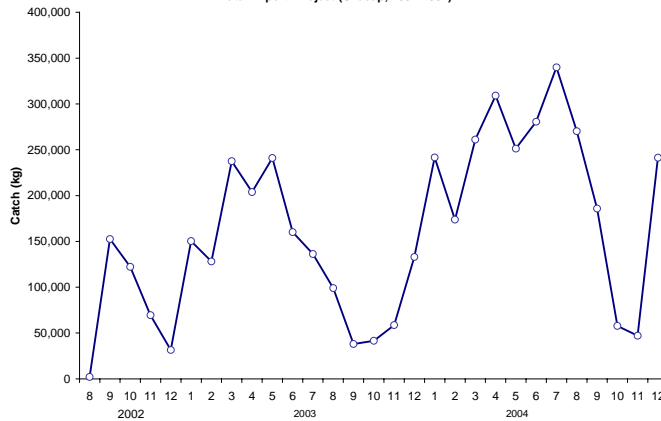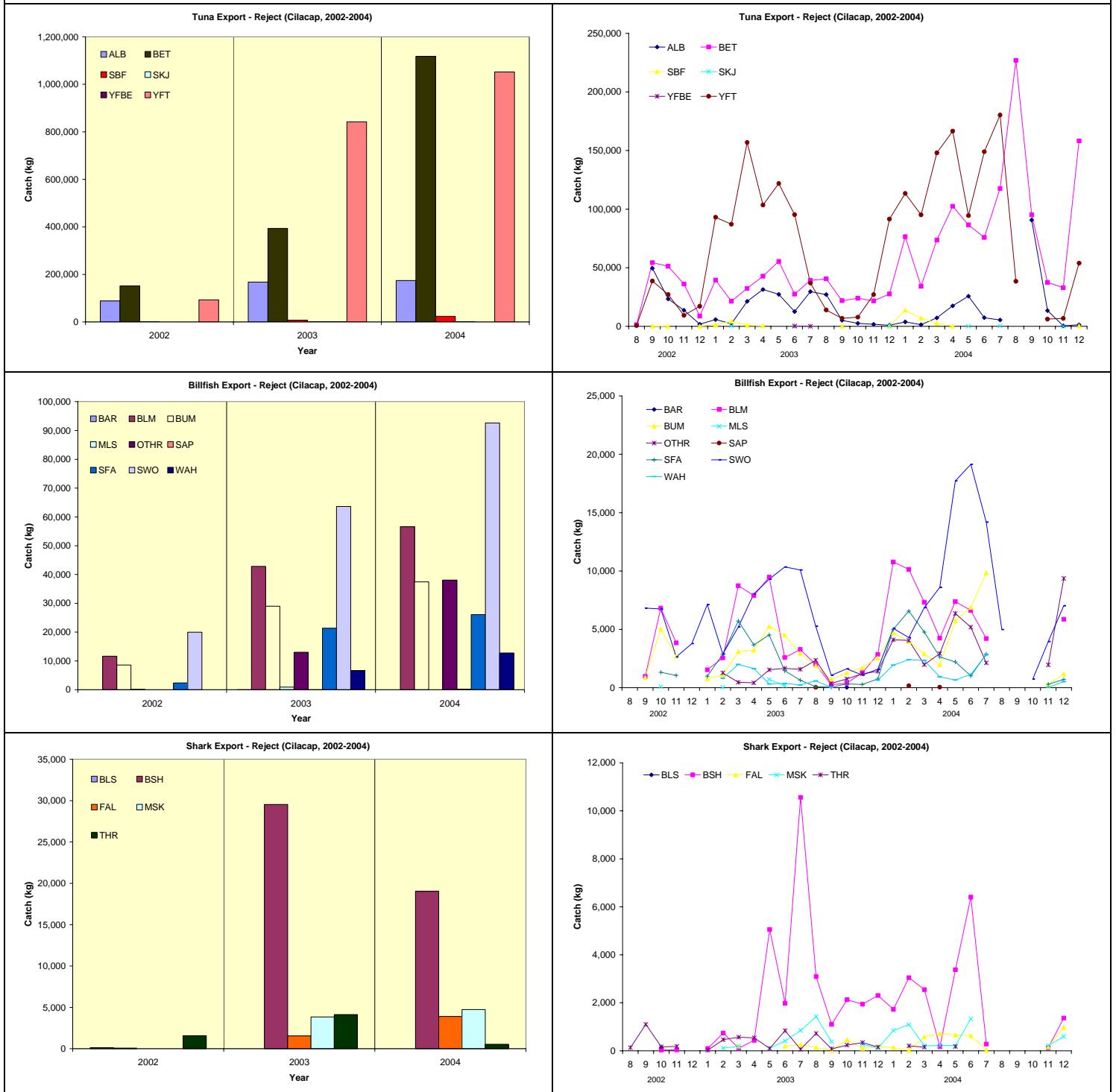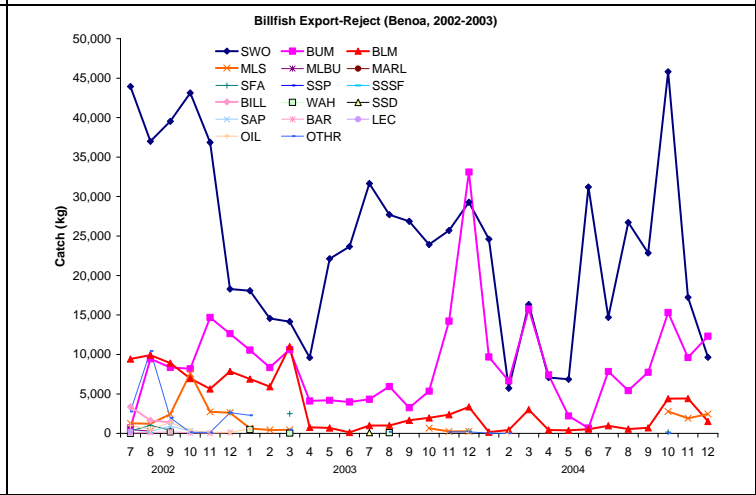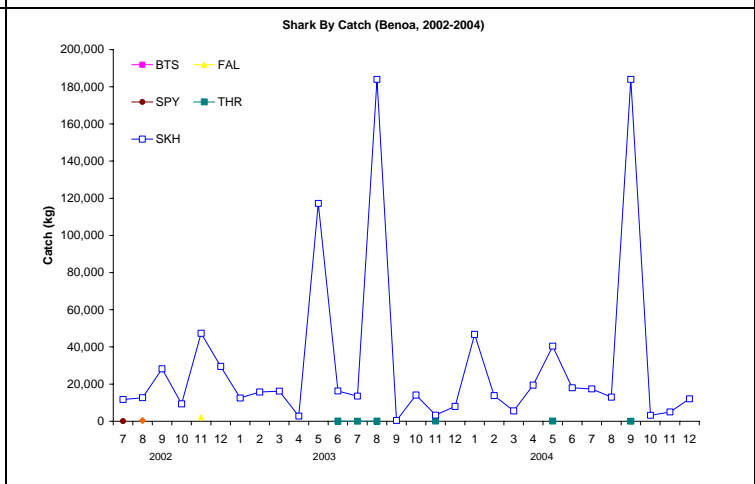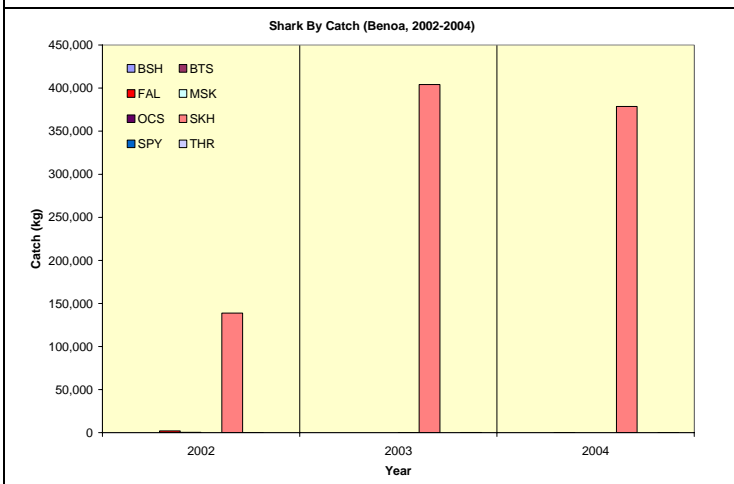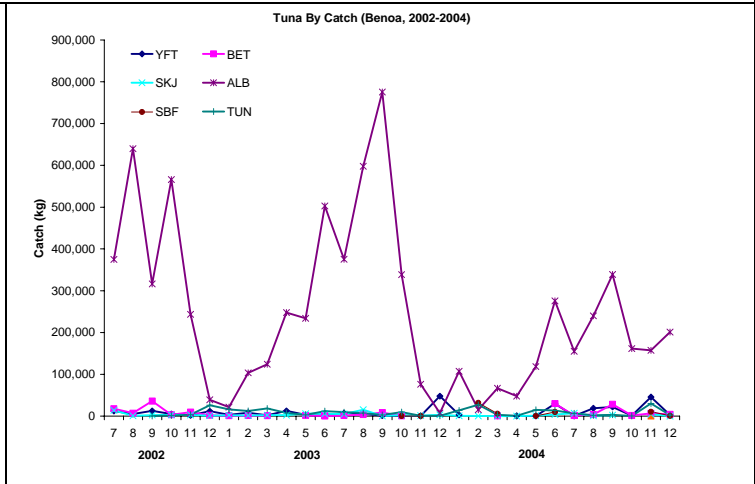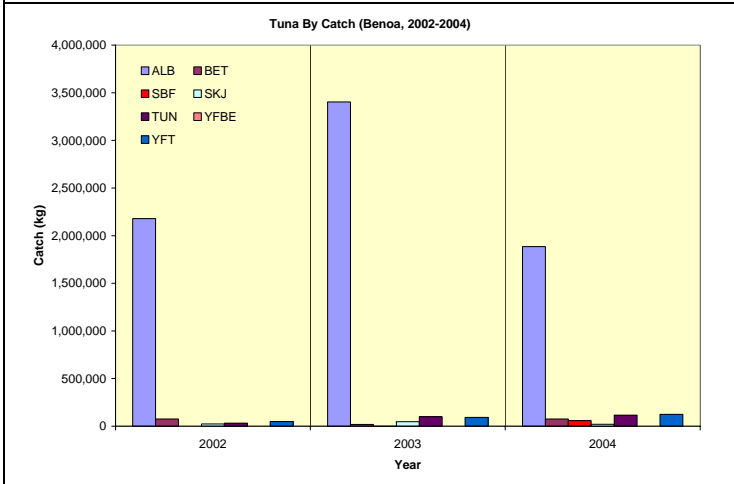
4.   Length Frequency (Catch-At-Size)

2002: Bigeye tuna (BET)	2002: Yellowfin tuna (YFT)

2003: Yellowfin tuna (YFT)	2004: Yellowfin tuna (YFT)