FIELD MANUAL

for

STATISTICS AND SAMPLING OF ATLANTIC TUNAS AND TUNA-LIKE FISHES

by

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THIRD EDITION

INTERNATIONAL COMMISSION
FOR THE CONSERVATION OF
ATLANTIC TUNAS

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Foreword

It is our pleasure to offer this Field Manual to all people engaged in collecting and compiling statistics and biological samples of tunas and tuna-like fishes in the Atlantic Ocean. The objectives of ICCAT (International Commission for the Conservation of Atlantic Tunas) are the conservation and maximum utilization of tunas and tuna-like fishes. With such objectives in mind, ICCAT is endeavoring to evaluate the present condition of populations of tunas and tuna-like fishes. Fishery statistics and biological information on them are essential in order to carry out such studies. However, obtaining such data is a rather difficult task because of the many varieties of fishing gears, fishing areas, species, seasons, operational pattern and many other factors differ from one country to another. Also, the quality and quantity of trained technicians differ widely in the various fisheries involved.

Considering all these factors, the Standing Committee on Research and Statistics of ICCAT set up guidelines for sampling and collecting statistics. Following the guidelines thus agreed upon, this volume has been prepared to help scientists, statistical officers, field technicians, fishermen and industry.

Since the original edition was issued in 1972, the Manual has fulfilled its objectives satisfactorily. However, as research has been progressing, there have been some changes in the requirements, criteria, etc., in collecting statistics and sampling. Also, as biostatistical studies have advanced, more appropriate advice has become available for sampling schemes at each port.

Accordingly, revisions of the Field Manual are essential for the Commission. The first revision was made and the Second Edition was published in 1977. This present volume corresponds to the Third Edition and contains some additional revisions which became necessary since 1977. Therefore, any changes made in this edition supersede those contained in the previous editions.

The Manual is published in the three official languages of the Commission, English, French and Spanish. Copies are obtainable by writing to the Secretariat.

O. Rodríguez Martín
Executive Secretary

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FIELD MANUAL FOR STATISTICS AND SAMPLING

ATLANTIC TUNAS AND TUNA-LIKE FISHES

Chapter 1. INTRODUCTION

1.1 Foreword

This is the Third Edition of the "Field Manual for Statistics and Sampling Atlantic Tunas and Tuna-like Fishes". The original edition was issued in 1972, and the Second Edition was published in 1978 and included some later studies on the sampling of tunas. The purpose of the Manual is to provide guidelines for the collection of fishery statistics and for biological sampling of Atlantic tunas and tuna-like species. It has been useful for biologists and field technicians who are working on tunas and tuna-like species research, and in collecting statistics and designing and carrying out biological sampling.

Our knowledge and experience on Atlantic tunas and tuna-like species has improved and grown in the last decade. The Standing Committee on Research and Statistics recommended revising this Manual, updating all the techniques and requirements, based on the latest theories, knowledge and experience.

The author of the Field Manual was asked by the Indo-Pacific Tuna Development and Management Programme (IPTP), in 1986, to develop a similar manual for the Indian Ocean and that version was published by IPTP in May, 1987, co-authored with Mr. T. Sakurai, IPTP Programme Leader. As the catch by artisanal fisheries is very important in that area, an entire chapter was devoted to that fishery. The Atlantic Ocean Manual has now been totally revised, including the multi-purpose sampling theory and special guidelines for artisanal fisheries.

For the national officials who are responsible for data collection and reporting to ICCAT, this Manual describes:

1. Objectives for collecting fishery statistics and carrying out biological sampling.
2. Data requirements set by ICCAT.
3. Design and method of establishing a system of data collection and of biological sampling.
4. Actual techniques and methods of data collection and of biological sampling.
5. Instructions for filling out reporting forms.
6. Keys to identification of tunas and tuna-like species (Chapter 4).
7. Short descriptions of species concerned, including some biological features (Chapter 4).

8. Standard, scientific and common names of tunas and tuna-like species (Chapter 5).
9. Instructions for recovered tags (Chapter 6).
10. ICCAT codes to be used (Appendices 2 and 5).
11. Definitions of some of the technical terms used in this Manual (Appendix 7).

1.2 Objectives for collection of fishery statistics and biological sampling

Various fishery management plans may be based on different principles, e.g., maintaining the maximum biological yield, producing maximum economic yield, etc. However, unless we know the biological status of a certain fish population of interest, none of these objectives can be achieved. Therefore, population studies are essential for establishing a fishery management plan, no matter the objective of the management.

The basic concept of a population study includes:

i) Estimating the present size and age structure of a stock. Here a stock means a biologically independent unit of fish population subject to management.

ii) Predicting how the stock would react to a given amount of fishing effort (which is also age specific).

iii) Estimating the optimum size of the stock (in terms of age) which can support the maximum yield in the long run, and the optimal effort needed to make that maximum yield.

The information essential for carrying out such a study is as follows:

a) Total amount of fish removed from a stock

In order to study the impact of a fishery on a stock, one has to know the total amount of fish removed from a stock, which comprises the catch, discards, and the amount of fish which escape from the gear but are killed.

b) Estimation of abundance indices

A series of catch-per-unit-of-fishing effort (CPUE) data is generally used as an index for fish abundance. Consequently, in addition to the catch data, we need effective fishing effort statistics. Since fishing efficiency increases as more modern equipment is developed and new fishing techniques are introduced, some associated information on the gear and fishing efficiency should be collected together with fishing effort data.

c) Estimation of growth of fish and age composition of stock

The age composition of the fish stock is generally estimated from the age composition of catches. Unfortunately for tunas and tuna-like species, direct methods of determining age (such as otolith reading, etc.) are either costly and time consuming or not yet verified. Therefore, the most cost-effective and practical way to estimate age composition is to convert the size of fish into age using a growth curve which is also estimated from the size of fish.

In order to achieve these objectives, we have to establish a proper system through which data are adequately collected, stored and used.

1.3 Data requirements set by ICCAT

The responsibility for collecting data for the ICCAT data base lies with national governments and scientists. However, in order to achieve an Atlantic-wide data base, collected data are to be harmonized with standard concepts and definitions, so that the statistics collected will be consistent and can be compiled in an integrated data base. They are kept strictly confidential but summaries are very useful for scientists, administrators and industries.

Tuna statistics to be collected from the countries in the ICCAT Convention area by national offices can be divided into three categories:

TASK I (Nominal annual catch)
Annual nominal catch by species and gear type, and the number of fishing crafts operated by gear type (Chapters 2 and 3)

TASK II (Catch and effort)
Catch and fishing effort by gears and time-area strata (Chapter 4)

TASK II (Size)
Size frequency data by gears and time-area strata (Chapter 5)

Chapter 2. ANNUAL NOMINAL CATCH DATA (TASK I)

2.1 Objectives

To estimate the total removal of fish from the stock, we have to know the annual amount of fish caught by each fishery. The total catch indicates the magnitude of removal and later, together with other information such as the size of the fish, the effect of the fishery on a stock can be analyzed.

2.2 Data requirements

The Commission requests that the total catch (in live round weight) of tuna and tuna-like species be reported by the fishing vessels which made the catch, by flag, species, major areas, and major fishing gears for the entire Atlantic Ocean (including the Mediterranean Sea).

The preliminary estimate of the previous year's catch should be submitted by March 15, as an interim report, and final estimates should be reported by April 30, as the regular report. ICCAT Form 1-1 (Appendix 1) should be used for both occasions.

Task I data received at ICCAT are validated and entered into its data base. They are reported in the "ICCAT Statistical Bulletin."

2.3 Instructions for reporting annual nominal catch (Task I) using ICCAT Form 1-1

Catch

Record the estimated total annual nominal catches of tunas and tuna-like specie in the Atlantic Ocean. The catch data should include all quantities caught by units of the domestic fleet of the reporting country, and eventually either discarded at sea, transshipped or landed not only in domestic harbors of the reporting country, but also in foreign harbors. The data should exclude or separate quantities caught by foreign fishing craft and landed in domestic harbors of the reporting countries (see sections "Country" and Flag country").

If any particular branch or sector of the national tuna fishing industry cannot be covered by the data provided (e.g., landings by the national flag boats at foreign ports or by the artisanal fishery), mention such exclusions in the footnotes accompanying the completed forms and, wherever possible, give an indication of the estimated or recorded magnitudes of the quantities not reported.

The fish may have been processed on board (e.g., head removed, etc.), then the landing quantities should be adjusted to the live round weight using the conversion factors in Appendix 6. If this cannot be done for some reason and the weight given on the reporting form is other than round live weight, it should be footnoted.

Country

Write the name of the country for which statistics are prepared and reported.

All catch statistics should be prepared by the flag country, in principle, even though its fishing craft may be separated under a fishing license of a foreign country and land their catch in foreign harbors under a joint-venture agreement.

In most cases, therefore, the reporting country is the flag country. There is an exception when the statistics are collected only by the licensing country or by a country which chartered the foreign boats and fish with its own crew and capital. In such cases, the country which chartered the boat is encouraged to report the catches but the catches should not be mixed with those made by the national flag boats. This is very important in order to avoid double reporting of the same catches by charterer and the flag country.

Flag country

Flag country means the country in which a boat is legally registered. The flag country may be different from the country which issues the fishing license.

Person in charge, Address of agency

Fill in the name and address of the person who can be contacted later if clarification of the data is needed.

Unit of effort

Indicate in what unit the effort is given (see 4.2.2.)

Year

Insert the last two digits of the calendar year (January 1 - December 31) during which catches are made and statistics are collected. Note that there may be some discrepancies between year of catch and year of landing. The catch should be

reported according to the year in which the actual catch was made rather than when the fish were landed. If for any reason the year is not the calendar year or the year of the catch, footnote on explanation.

Catch or landing

Check whether the data are for catch or landing. See detailed discussion in Section 2.4.2. Catch data are much preferred to landing data.

Weight or number of fish

Check whether the reported catches are in weight (and in what unit) or in number of fish. Weight is requested, however, in Task I statistics. If weight is reported but estimated from the number of fish caught, indicate what conversion factor (or average weight of fish) was used for the estimation.

Round weight or other measure

Note if the weight of catch reported is in round live weight or in dressed weight (gilled and gutted, head removed, etc.). If it is not round weight, indicate the condition of the fish when the weight was taken and if the conversion to the round weight is known, fill in the appropriate column.

Region

The catch should be reported by major regions in the Atlantic. Appendix 5 shows the regions and codes for which the catch of each species must be reported.

Gear

See Appendix 2 for gear definition and codes.

In case it is not possible to separate catch statistics by gear, list all gears which were used to make the corresponding catches and footnote the estimated proportion of catches (percent) made by each type of gear.

Effort

If the fishing effort corresponding to the catch is known, it should be reported (see Section 4.2.2.)

Catch by species

Insert catch by species, (by type of fishing gear). The species covered by this form as well as other forms include tunas and tuna-like fishes. Chapters 8 and 9 of this Manual will help in identifying species and lists all the species which should be included. For the three alpha identifiers and species codes, refer to Appendix 2, although it is not required to report the catches with species codes. Only major species are listed on the form. If there are species other than those listed, they should be reported in the blank column.

Reporting in vernacular names often causes problems in mixing up the species (e.g., bonito for skipjack). Unless reported by ICCAT standard names, it is recommended that scientific names be added to the vernacular names.

If the catch is recorded for mixed species and cannot be separated, footnote the species included and the proportion of each species.

On this form, the catch should cover all areas fished by a country and all types of fishing units catching tunas and tuna-like species. If national statistics cover only part of the area or fishing units, an estimation should be made of the total.

2.4 System to collect annual nominal catch statistics (Task I)

In principle, there are two data collection methods, i.e., complete enumeration and sampling. A frame survey or fishery census is generally conducted by complete enumeration. For estimating the total annual catch, complete enumeration is highly recommended; but for a coastal artisanal fishery, this may require much funding and time. For such cases, establishing a proper sampling system is the next best solution.

2.4.1 Total catch estimation through a logbook system

If an adequate logbook system is established for a fishery, it would produce catch and effort data by small time-area strata (see Chapter 4). By merely summing up all the catches in each time-area stratum, the total annual catches can be estimated.

In estimating the total nominal catches from logbook data, however, the following two elements must be considered: the rate of data coverage and the accuracy of estimates. Logbook coverage is generally not 100 percent and the catch data have to be raised to 100 percent using the known coverage rate (detailed information on estimating the coverage rate is given in Chapter 4 for catch and effort by time-area strata). For example, if the logbook coverage rate is 80 percent and if the sum of the

catches reported in the logbook is 100 MT, then the total estimated catch would be 100/.8 = 125 MT.

A second source of error is the fact that the catches reported in the logbook are those estimated by the captains, and these estimates are usually not very accurate. In order to make an accurate estimate of the total catch, the landing data often supplement the logbook information. They will serve to cross-check as well as to make adjustments to captains' estimates with the more accurate landing weight (weighed on a scale). (Detailed information is provided in Chapter 4.)

2.4.2 *Estimating total catch from landing data*

When logbook data are not available, or the coverage of the logbook is low or not known, the landing quantity is frequently used to estimate the total amount of catches. In many fisheries, the amount of fish landed is available in the form of market records, landing records at the ports, sales slips, transshipment records, export custom records, etc.

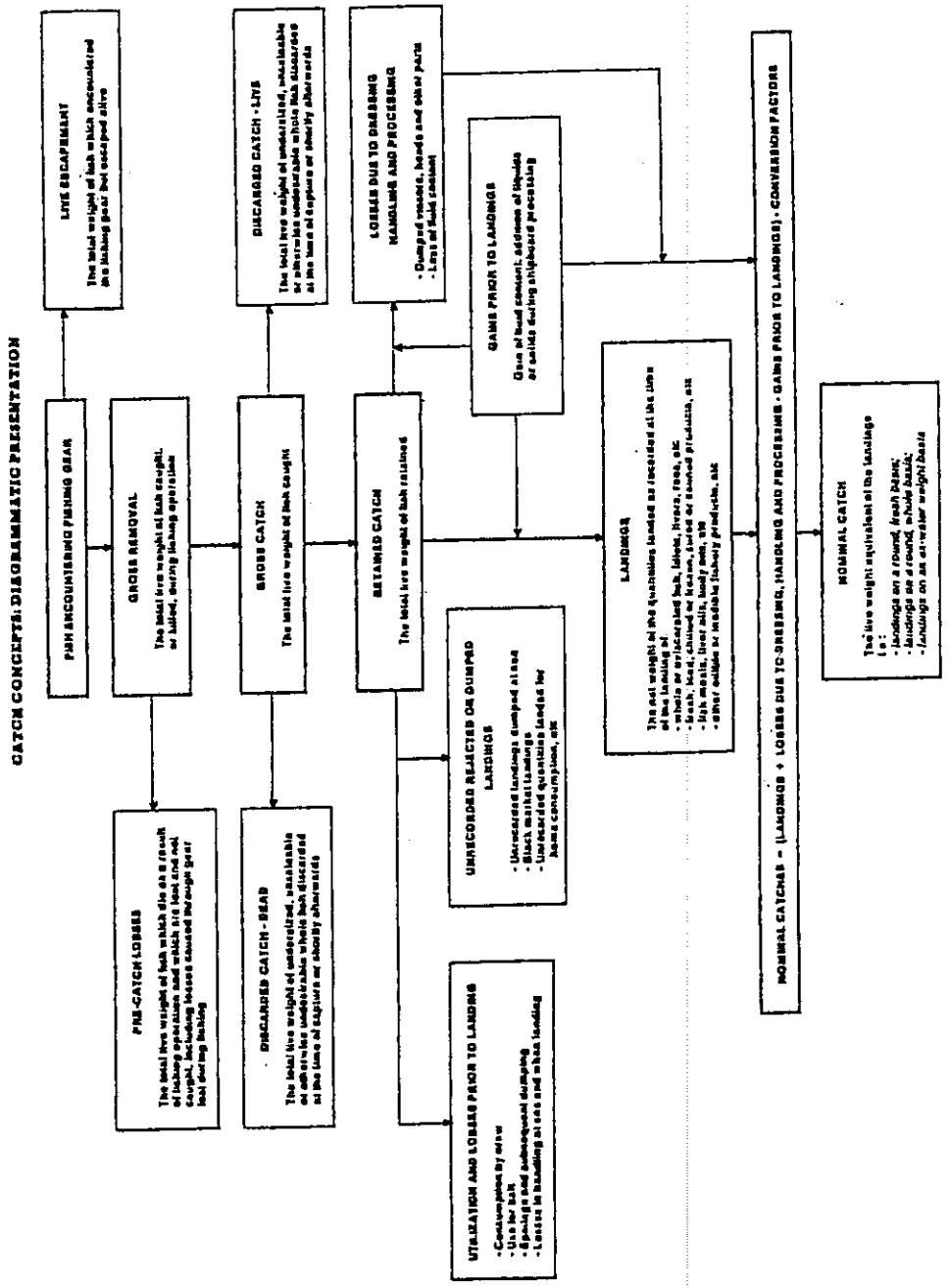
Landings, however, are not necessarily equal to the catch. Catch means fish removed from the water by a fishing gear, while landing means the fish unloaded by a boat. Table 1 explains the concepts of catches and landings. The difference between catch and landing is generally accounted for by the following:

Fish caught are generally kept until the end of the trip and may be unloaded at a port far from where the catch was made (particularly in the case of industrialized fisheries). In this case, the area and time of landing may be quite different from those of the catch (e.g., some catches made in the Atlantic Ocean can be unloaded in the Pacific or Indian Ocean ports the year following the year of the catches.)

Fish may be processed to some extent on board the vessels (i.e., dressed, filleted, gilled-and-gutted, frozen or even canned).

Fish may be eaten at sea by the crew or discarded at sea for various reasons.

Therefore, caution should be taken on various items if landing data are used for the total catch estimates. In which unit are the records kept? Are they in weight (kg, lbs, short tons, metric tons) or in number of fish? Are they in round live weight or gilled-and-gutted weight? If they are not in round weight, they should be converted to round weight. If they are in pounds or short tons, they should be converted to the metric system. Conversion factors which may be useful in tuna statistics are given in Appendix 6.



Again, the coverage rate of data always has to be taken into consideration, because even though sales slips were used which supposedly cover all the fish, there may be some fish caught but not sold in the market. There could be some minor ports or markets which might not have reported the sales. The portions not covered by the survey have to be investigated, and a coverage rate should be estimated on which the landing data must be extrapolated to the total.

2.4.3 Total catch estimation through sampling

When adequate logbook records or landing data are not available, a sampling system has to be designed to estimate the total amount of the catch. Sampling is a technique to obtain information on only a part of the catch and to estimate the total based on that partial data.

Since sampling for the size of fish has to be carried out, these two objectives can be combined in actual sampling. Specially designed multi-purpose sampling theories and techniques are discussed in Chapter 6.

2.5 Potential problems in total annual catch statistics

Some possible problems are discussed in Table 2. The major problems are discussed below.

2.5.1 Statistical system

As can be noted, many of the difficulties relate to the fact that the country has no proper statistical system. Since establishing a good logbook system or landing statistics system requires time and is costly, particularly for artisanal fisheries where an enormous number of boats are involved, the quick and effective solution is to establish a multi-purpose sampling system at major fish landing sites as discussed in Chapter 6.

2.5.2 Statistical office vs. scientists' estimates

For ICCAT Task I statistics, if there are any discrepancies between scientists' best estimates of catches and the official statistics reported by national statistical offices, the former is used.

Such discrepancies are not limited to countries which have inadequate statistical systems but also include those with adequate systems. It is mostly due to the persons in charge in the regional statistical offices and/or in the central office being statisticians and/or administrators who are not necessarily familiar with fisheries or fish biology. As a result, statistics are collected rather mechanically without understanding the nature and limitations of the data. One solution to these problems is the inclusion of biologists on the statistical team, or that the statisticians seek advice from biologists actually engaged in studies of these fisheries.

Table 1. Problems relating to collection of Task I statistics

Problems	*Examples*	*Solutions*
I) SPECIES BREAKDOWN		
1. Species reported together. —The same prices per unit of weight paid.	—Portuguese Islands fisheries. —Eastern Atlantic tropical surface fisheries (FIS,* Japan, Korea, U.S., etc.) bigeye vs. yellowfin. —U.S.S.R. longline fishery (all big tunas are combined).	—Encourage, educate, instruct and/or oblige fishermen to report catch by species. —Carry out sampling and examine sample species composition in order to estimate catch species composition.
2. Misidentification or unidentifiable species. —Lack of easy, clear identification key.	—Young yellowfin vs. bigeye tuna.	—Find easy key and inform fishermen. —Carry out sampling to estimate total species composition.
3. Confusion in local vernacular names.	—Spanish names for albacore (bonito), yellowfin (atún). —Japanese, Korean and Chinese names for marlins (black marlin locally called white marlin, blue marlin called black marlin). —Portuguese names for tunas (albacore, bigeye classified by size but not by species).	—Biologists become involved in central statistical office so that persons responsible for statistics realize problems and correctly identify species reported by local names. —Train local statistical staff and fishermen to report using correct names.
4. Groups of species reported together. —No column provided on the reporting forms to report a certain species.	—Many countries where tuna fisheries are of minor importance or where one species of tuna is minor to the other.	—Add a column on reporting form to report species in question.
II) INADEQUATE COVERAGE		
1. Landings at some ports are missing. —Survey system does not cover them.	—Many countries.	—Expand survey system. —Make occasional visits to those ports for landing estimates.
2. Certain fleets (most likely very localized) are missing.	—Many countries.	—Raise catches to 100 % coverage, using ratio of no. of boats covered to those not covered.

* FIS = French + Ivorian + Senegalese fleet.

Problems	Examples	Solutions
3. Landings at foreign ports are not covered.	—Panamanian fleets.	—Oblige captains of boats to report catches by law.
4. Catch was used for family consumption or not sold through markets.	—Almost all countries.	—Make sample survey to estimate such amount.
5. Catch is sold on the black market.		—Make survey by team of non-governmental personnel to make estimates.
6. Catch is classified and reported mixed with non-tuna species.	—Many countries, in the Mediterranean, Africa, South America, and Caribbean Sea.	—Establish system (and format) to report tuna. —Sample mixed species.
7. Catch is transshipped at sea from a fishing vessel to another fishing or cargo vessel of the same or different flag.	—U.S., Spain, Japan, U.S.S.R. (?), etc.	—Oblige captains to report catches regardless of landing or transshipping. —Check landing ports (e.g. Puerto Rico) for cargo and foreign transshipments.
8. Catch is landed at a customs zone and from there exported to a foreign country (often after canning).	—Many African ports. —Foreign flag vessels unloading at Canary Islands.	—Check landings at custom zones (do not use through-custom statistics).
9. Catch is processed on the motherboat and is landed as canned product.	—Japan, U.S.S.R.	—Oblige captain to report catches instead of using landing statistics.
III) FLAGS		
1. Double reporting by flag country, country which licenses the boats, importer of catch and/or country where fish are transshipped.	—Fleets of Korea, Panama, Japan, Ghana, etc., landing at Africa ports.	—People involved should realize the problem. —Each country involved should report catches by flag. —Secretariat monitors the flow of fish and fleets.
2. No reporting for boats where different nationalities of owners, operators, crew, investors, licensers, registration, etc., are involved.	—Panamanian flag vessels.	—Government of operators of boats could encourage or request reporting of catch of such foreign flag boats (catch should be reported separately by flag to avoid confusion).

2.5.3 *Uncertainty in species identification*

Even if the total catches are accurate, often it is found that species are mixed up or incorrectly reported. There are several reasons for such misreporting.

a) Vernacular names are confusing. Vernacular names may be different or the same vernacular names refer to different species in different countries or even between regions of the same country. This causes confusion in reporting catches by species. Accompanying vernacular names with scientific names is highly recommended.

b) Problems arise with the reporting forms. Often reporting forms used at the national level require only major species for that country. As there is no column for certain individual species, they are combined with others when the form is filled out, even though the original data were available by each individual species.

c) When species identification is difficult between two or more species, they are reported together under one species. In such cases, proper sampling for species composition is essential (see Chapters 5 and 6).

d) When the same value is paid for more than one species, fishermen do not have to separate them by species and they are reported as one species. Again proper sampling for species composition is essential (see Chapters 5 and 6).

e) When fishery regulations are implemented, deliberate misreporting may take place.

2.6 Summary

The total catch in round live weight must be reported, by species, gear, flag of fishing vessel, and by major ocean area. ICCAT Form 1-1 may be used. The year and area should be those of the catch but not necessarily those of landing.

Chapter 3. FISHING CRAFT STATISTICS (TASK I)

3.1 Objective and method of collecting fishing craft statistics

As explained in previous sections, effort data are very important in studying current fisheries as well as the status of stocks and in forecasting future stock trends. However, if adequate effort data are not available, fishing craft statistics will give at least some indication of overall trends in fishing power, and are essential in predicting future effort trends for industrial planning.

These data are summarized and published in the ICCAT Statistical Bulletin.

3.2 Data requirements

ICCAT Form 1-2 (Appendix 1) requires reporting the total number of fishing craft which are actually engaged in tuna and tuna-like fisheries in the Atlantic Ocean during the respective year, by class categories (size) and by the type of fishery.

The deadline for reporting fishing craft statistics is April 30 of the following year.

3.3 Instructions for reporting fishing craft statistics (Task I) using ICCAT Form 1-2

Reporting country/Flag country/Year

See instructions for Form 1-1. (Also see Section 2.3).

Type

Fill in all types of gears (see Appendix 2 for classification and codings) under which the fishing boats are classified. If a boat is used in two different types of fishing in the same year, e.g., longline (January-July) and pole and line (baitboat) (August-December), the boat should be doubly counted; once for longline and once for pole and line. (Also see Section 3.4 for definition of fishing craft).

Type and size class of boat

The number of fishing boats are also to be counted by type of gear and type and size class of boat. The form has the class criteria adopted by the ICCAT.

Boats which are only partially engaged in tuna fishing should also be included. Such boats are: those engaged in the tuna fisheries only for a part of the year for various reasons (e.g., fishery is seasonal or the boat sank, etc.); and the boats which catch tuna as a by-catch while fishing for something else. In some fisheries, assistant boats are used, such as baitboats to attract fish while a purse seiner is setting a net. These baitboats may not take the fish in but they should be included in the statistics.

Boats which work together with other fishing boats or fishing units for the purpose of carrying the fish caught by these other boats or fishing units should be considered to be fishing craft, even though they are not directly engaged in taking fish. Fish-carrying boats in a two-boat type seining operation, mother-ships for longliners, and carriers for trap fisheries belong to this category. However, a transshipper which comes occasionally only to pick up catches from the fishing vessels should not be included in the fishing craft category.

3.4 Method of collecting fishing craft statistics

In most countries, registration of all boats is required by law, and in most cases, fishing boats are so identified in the registration. From such registration, specifications of boats (size and often fishing gears) can be found. It might be difficult, however, to identify which boats are actually engaging in tunas and tuna-like fisheries; they should be cross-checked by the following methods.

In a country where a fishing licensing system is established, the license statistics can be used for collecting fishing craft statistics. Also, if the landings statistics (and, of course, logbooks) are collected together with boat names, they can be used for the purpose of knowing which boats fish tunas and tuna-like species.

The biggest problem in collecting fishing craft statistics is the artisanal fleets (such as dugout canoes) and sport fishing boats. A sampling survey is essential in such cases. Rough sampling might be made by the "length of coast line" multiplied by the "number of boats found per unit of length of coast line surveyed." In the same way, the number of boats per coastal capita, number of boats per coastal village, number of boats per landing site, number of boats per market can be used as the basis for estimation. If the amount of fish landed is known, and the catch per boat per year is surveyed, the number of boats engaged in the fishery can also be estimated. ICCAT can provide consultation for designing a sampling system for such a survey.

3.5 Summary

The number of fishing vessels engaged in tuna fishing in the Atlantic must be reported by gear type, size classes and by flag. ICCAT Form 1-2 can be used.

Chapter 4. CATCH AND EFFORT DATA BY SMALL TIME-AREA STRATA (TASK II)

4.1 Objective of collecting catch and effort data

As explained in previous sections, catch and effort data are essential for calculating catch-per-unit-of-effort (CPUE), which is used as an index of fish abundance. Also, catch and effort data by small time-area strata have to be used for studying stock structure, fish migration, gear interactions, and many other important biological studies. When estimating catch by age, information on catch by time-area strata is essential, as the total catch has to be subdivided into the strata to which the size data are matched and raised (see Chapter 5).

4.2 Data requirements

4.2.1 Strata in which the catch and effort should be reported

For longline fishery: Catch (in number of fish and/or in weight of fish) and effort (in number of hooks) should be reported by month and by 5°x5° area.

For surface fishery: Catch (in weight) and effort (number of fishing days) should be reported by month and at least by 5°x5° area and preferably by 1°x1° area.

The coding system for 1°x1° or 5°x5° areas is explained in Figure 1.

The data should be combined by fishery (type of gear), species, and flag countries, and should cover all national fisheries.

Since the purpose of collecting these data is to estimate the total catch and effort in a given time-area stratum, the data coverage should be reasonably good, but not necessarily 100 percent, as the data can be raised to the total catch (i.e., if the total catch is known by another survey).

4.2.2 Data submission

The deadline for submitting the data is July 31 of the following year. The data can be reported on Form 2 (Appendix 1), or as a computer printout, on computer diskettes or on magnetic tapes. If the latter methods are used the following specifications should be observed:

The code for area is made up of seven digits.

X	X	X X	X X X
Size	Quadrant	Latitude	Longitude

Digit	*Representing*	*Code*
1	Size of rectangle	
	1° × 1°	5
	5° × 5°	6
	5° × 10°	1
	10° × 20°	2
	10° × 10°	3
	20° × 20°	4
	No square available	0
2	Quadrant	
	NE	1
	SE	2
	SW	3
	NW	4
3-4	Latitude[1] (expressed in 2 digits)	
5-7	Longitude (expressed in 3 digits)	

[1] Each rectangular area should be represented by the latitude and longitude of the corner of the square closest to 0° latitude and 0° longitude

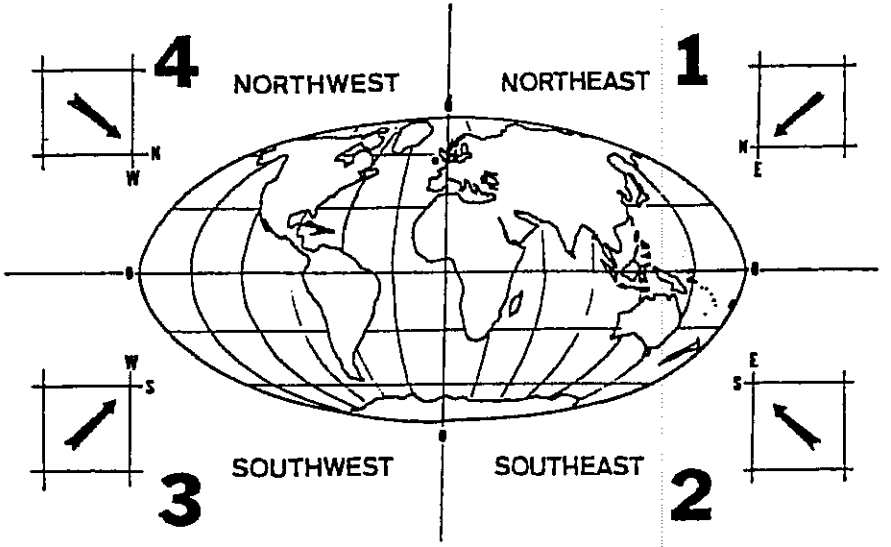


FIG. 1. — System for identifying statistical rectangles.

a) Magnetic tape

The data should be copied onto the tape in the form of a file of records, rather than in the form of a table. The tape should be prepared as:

- 9 track, odd parity
- Density 1600 bpi
- EBCDIC or ASCII
- Formatted files with fixed-length records containing unpacked fields
- Unlabeled

The tape specification and format in which the data are prepared, as well as a description of the codes used (especially for non-ICCAT codes), should accompany the tape. Bytes/record, records/block or bytes/block and number of records/file should also be indicated. The maximum acceptable block size is 65532 bytes and the maximum acceptable record size is 9995 bytes.

b) Diskette (floppy disk)

Records must be in files rather than in tables. Specifications are:

- 5 1/4 inches
- CPM or MS-DOS
- Single-sided or double-sided
- Double-density or high density
- ASCII

Diskette specifications, as well as a description of the records format and codes used, should accompany the diskette. A diskette file entered in word processing software (e.g., Wordstar) cannot be accepted. If non-ICCAT codes are used, they should be explained fully.

The data received at ICCAT are entered into the data base. The data catalogue and summaries are published periodically in the ICCAT Data Record and the entire or a part of the data base can be copied and provided to the scientists of the member countries, as long as the data are not confidential, and if the request is made through proper national channels.

4.3 Instructions for reporting Task II catch and effort statistics (ICCAT Form 2)

(Reporting) Country

See the section on catch statistics (2.3).

Flag country

See the section on catch statistics (2.3).

Gear

See Appendix 2 for classification and codings.

Unit of effort

Describe the unit in which the effort data are reported (see Effort).

Coverage (%)

Insert the coverage rate of the data reported on this form (not the coverage rate in the original survey). Data recorded on this form will supposedly come from logbooks or surveys at landing centers: 100 percent coverage of catches in the survey is not generally expected. If the data recorded have already been raised to 100 percent coverage of catches, enter 100. If not raised, fill in the estimated coverage rate of the survey. If the data coverage rate is unknown but not 100 percent, enter XXX in the percent column.

Year

See the section on catch statistics (2.3).

Catch or landing

See the section on catch statistics (2.3).

Unit of catch

Report the unit in which catches are recorded, i.e., metric tons, 100 kgs., number of fish, etc. (See the section on catch statistics (7.1)).

Month

Fill in the month during which catches were taken, using the corresponding numerals (i.e., January is 01, February is 02, ... December is 12).

Area

Area where fish are caught is to be classified preferably into 1° latitude by 1° longitude areas for the surface fishery and at least into 5° latitude by 5° longitude areas for the longline fisheries (See Section 4.2.1 and Figure 1 for coding).

Effort

Report the number of units of effort employed in the corresponding time and area. Even though no catch is made, if effort is employed, it should be reported.

Effort data must to be reported in number of hooks for longline and in fishing days for surface fisheries. However, if this is not practical, the unit of effort should be chosen to reflect the effort directly made to harvest the corresponding catch. Recommended units of effort are listed below in descending order of preference for each type of fishing gear.

Longline

1. Total number of effective hooks used (excluding hooks which were not effective in fishing)
2. Total number of hooks used
3. Total number of sets of longlines
4. Total number of boat-days fishing
5. Total number of boat-days at sea (out of port)
6. Total number of trips (cruises) made
7. Total number of boats actually engaged in fishing

Pole and line (baitboat)

1. Total number of boat-days fishing (including searching days, whether or not fish were actually caught). The number of boat-days spent baiting should be excluded, but can be recorded separately for use in assessing bait stocks
2. Total number of boat-days at sea
3. Total number of fishing poles used; that is, the number of crew engaged in fishing with a pole

4. Total number of trips (cruises) made
5. Total number of boats actually engaged in fishing

Purse seine, ring net, lift net (bag net), seine net, gill net, trawl

1. Total number of boat-days fishing (including searching days, whether or not fish were actually caught)
2. Total number of boat-days at sea
3. Total number of trips (cruises) made
4. Total number of boats actually engaged in fishing

Trolling, handline

1. Total number of hook- (or line-) days fishing
2. Total number of boat-days fishing
3. Total number of boat-days at sea
4. Total number of trips (cruises) made
5. Total number of boats actually engaged in fishing

Traps

1. Total number of trap-days (trap units multiplied by days at sea)
2. Number of trap units in operation

Catch by species

Record catches in the unit specified above.

Only major species are indicated on the form because species are so varied according to the type of gear and the country. Please specify any additional names of species using the blank columns, according to the statistics obtained. See Appendix 2 for the species codes.

Reporting in vernacular names often cause problems in species mix-up (e.g., bonito for skipjack). Unless reported by ICCAT standard names, it is recommended that scientific names be added to the vernacular names.

If a catch is recorded for mixed species and cannot be separated, a footnote should be added to explain the name of species included and the portion of each species, etc.

4.4 Data collection systems

There are two basic methods of collecting information on catch and effort statistics:

4.4.1 Sampling survey

A sampling survey consists of interviewing fishermen, and examining landings to obtain information on when, where, how much of the fish of what species were caught by what gear and how much effort was used, etc. Since it depends mostly on the captain's memory, this procedure would be effective for small-scale fisheries or for fisheries which operate near their home base for short trips. A variation of this method would be to ask fishermen to report the above information by mail, using a self-addressed postcard, instead of using a personal interview. This method is often used for sport fishing boats. A sample of the form recommended by ICCAT for use in sampling is shown in Appendix 3 and a full explanation is given in Chapter 6.

4.4.2 Establishment of a logbook system

For any large-scale fishery, particularly if the boats stay at sea for an extended period of time, establishing a logbook system is essential in obtaining catch-effort information by time and area.

Generally, the captains of large-sized boats keeps their own navigation and fishing logs. Therefore, if the design of a logbook is proper, the captains welcome such a form and use it for their own records. In many countries, it is mandatory for national fishing boats as well as foreign fishing boats licensed to fish in jurisdictional waters, to submit a copy of fishing logs to the government (it is even a condition for obtaining a fishing license); or otherwise, an interviewer at the port goes to the boats to abstract data from the captain's fishing log.

4.5 Logbook format and system

The logbook format can vary according to the fishery, local conditions and many other factors. However, some essential information must be reported no matter what forms are used. This essential information includes:

General Information

Name of the boat, captain's name, registration number, owners and addresses
Flag of the boat

Capacity, gross tons, horse power of engines, boat length
Number of crew
Trip information (Date and port of departure/arrival, number of days at sea)
Type and units of fishing gears used

Daily Records (regardless of whether or not a catch was made) or *Each Set Records*

Date, time
Noon position, position of fishing
Activities
Catch by species (either in weight and/or number of fish)
Amount of fishing effort employed

At the End of Trip

Total catches by species unloaded (not the sums of the daily catches but the weight of total fish recorded by a commercial scale at the time of unloading).

Examples of such logbooks are shown in Appendix 4. In the form, special care should be taken that there is enough space to report all the necessary information. For example, if the species are already listed on the form, all the species taken by the fishermen in the waters concerned should be included. It is unlikely that fishermen add a species to a report. If they do not find the correct species listed, they will either ignore the catch or report it combined with other species.

Important. The days in which a boat was searching for fish but unable to catch any must be considered as fishing days. It is often misunderstood that fishing days mean only the days which yielded catches. Scouting for fish is one type of fishing activity. Therefore, the logbook should be designed and instructions should be added to report ACTIVITIES, i.e., what the fishing boats were doing on days when no catches were made. Whether the boat was floating due to bad weather or gear breakdown, was moving from one fishing ground to another or was looking for a school makes a difference in counting fishing days.

4.6 Adjustments to be made to logbook records

4.6.1 Adjustments to the estimated catch weight and species composition

When catch and effort data are collected through a logbook system, and even if all the trips are completely covered, there is still a need for adjusting the data. Generally, the logbook gives daily catches, estimated by the captain. These catches are

unloaded at the end of the trip and weighed on a commercial scale. When the sum of the daily catch estimates is compared to the accurately scaled (weighed) landings, there often are differences of up to 10 percent of the total. All the logbook records of daily catches should be adjusted proportionally to the total landing weight so that the sum of the catches matches the landing, if all the fish caught are unloaded.

Another adjustment which could be made is the species composition. At sea, captains tend to record some of the species together (e.g., yellowfin and bigeye together as tunas). Upon landing, those species are often sorted and their weights are recorded separately. While adjusting catch estimates by landing weight data, these mixed catches could also be separated by species proportionally to the total landings by species.

4.6.2 Adjustment for coverages

If logbook records cover only part of a fishery, the catch and effort data collected through the logbook system should be raised to the total catch, applying an estimated logbook coverage rate. The rate can be estimated by using one of the following three methods:

$$(1)\ \text{Coverage rate} = \frac{\text{Sum of catches of one major species recorded}}{\text{Total catch of the species}}$$

$$(2)\ \text{Coverage rate} = \frac{\text{Number of trips covered by the logbook}}{\text{Total estimated number of trips made by entire fleet}}$$

$$(3)\ \text{Coverage rate} = \frac{\text{Sum of catches of all species recorded in logbook}}{\text{Total catches of all species made by that fishery}}$$

For the fishery where fewer species are involved (e.g., albacore trolling fishery), or where one major species dominates the catches (e.g., swordfish longline fishery), equation (1) might be applicable; but for multi-species fisheries, equation (2) or (3) is more realistic. Equation (1) gives different coverage rates for each species involved, and the rate to be applied for the effort is debatable and not yet conclusive. This involves the problem of evaluating effort in mixed-species fisheries. Equations (2) and (3) give one common rate for all species and gears.

When raising catch and/or effort data by such coverage rates, it is important to check for bias in the coverage. Let us assume that at one port of landing better coverage is achieved, while at another port the coverage is low. If the fleets from these two ports go to the same fishing ground and fish similarly, there would be no problem. However, if the fleet based at one port operates at a different ground (or season) from the fleet operating out of the other port, we cannot combine the two

sets of data from the two ports, applying one coverage rate. Coverage rates should be estimated by port.

If the fishery is rather homogeneous, relatively low coverage (40 to 50 percent) would be satisfactory. If the fishery is heterogeneous (e.g., the longline fisheries), high coverage (60 to 80 percent) is required, unless a separate rate can be calculated for each homogeneous segment of the fleet.

In reporting to ICCAT, already-extrapolated data are preferred but if the sum of the raw logbooks is reported, the coverage rate should accompany the data. The coverage rate could be reported for the entire data or for each strata.

4.7 Problems in logbook data

In collecting catch and effort data, the same types of problems may be experienced as in collecting annual catch statistics. The major problems concerning "species", "coverage" and "flag" are discussed in detail in Chapter 2. However, the following problems concerning the inaccuracy of location and time should be mentioned for catch and/or effort data.

i) Fishermen tend to keep confidential the location where, and the time when a good catch was made, thereby resulting in no reports being made or in false reporting. This problem is very difficult to solve. Sometimes, guaranteeing secrecy leads to some success. Also, feedback information to the fishermen who provide a good set of data may eventually convince fishermen to report correctly.

ii) When a fishing regulation is set (closed area, etc.), deliberate misreporting of species, location, etc., is done so that illegal operations do not appear in the reports. If the administration tries to use the logbooks for the purposes of implementing the regulations, the accuracy of data will be greatly reduced. If it is guaranteed that the logbook is used only for scientific purposes and not for regulatory purposes, there could be some positive results.

iii) Confusion in N-S latitudes and/or E-W longitudes are frequently observed in the data, particularly in the Gulf of Guinea where 0° latitude and 0° longitude exist and four quadrants meet. Whatever the cause, it is essential to verify the catch and effort data by time-area strata to eliminate inaccurate reporting. It is best that this be done by the scientists who are familiar with the fisheries. Also, proper designing of the logbook itself might reduce such errors.

iv) Fishermen often report the location or time very roughly, or in terms of time-area strata larger than that required. A skilled interviewer might be able to narrow down when and where actual fishing took place.

4.8 Summary

Catch and effort data should be gathered and reported by 1°x1° area and by month (5°x5° area and by quarter for longline). The data should be reported together with a coverage rate or already extrapolated to the total catches. Effort should include searching time, regardless of success of fishing. ICCAT Form 2 may be used in reporting.

Chapter 5. BIOLOGICAL SAMPLING AND SIZE COMPOSITION OF CATCH (TASK II)

5.1 Objective of collecting size data

In order to forecast how a stock would react to a fishery and what the future potential yield of a stock would be, the age (and size) structure of the stock as well as the catch has to be known. The growth rate of the fish also has to be known. Since there is no technique established for easy age reading, we have to depend on the size of the fish to estimate growth and age.

In most cases, all fish caught cannot be measured. Therefore, it is necessary to sample part of the catch. Since the catch is not homogeneous in terms of species and size of fish (different gears take different species and different sizes of fish, or the different sizes of fish are caught in different areas and times) a proper sampling design is essential for estimating the size composition of the entire catches.

In this Chapter, size sampling is discussed. This sampling is, however, very often carried out in combination with sampling for catch and effort data. In such cases, the sampling design and technique may be altered to meet the extra requirements. It is recommended, therefore, that after reading this Chapter, you refer to Chapter 6 for detailed sampling designs for general purposes. Biological sampling, other than size (e.g., gonads, hard parts, etc.) are not discussed in this Manual.

5.2 Data requirements

5.2.1 Data characteristics

For the purposes mentioned above, size frequency data should be collected for each species and each gear type in minimum; but practical, units of time-area strata. Size frequency data should be compiled and reported on two different levels:

Level 1: Actual size frequency -- size frequencies of fish measured in the field in a time-area resolution.

Level 2: Size composition of the catch -- a calculated frequency based on actual size frequencies of fish raised to the catches made in the corresponding time-area strata.

The data requirements for Levels 1 and 2 are as follows:

	Categories	Area	Time
LEVEL 1	Flag, major species, gear, (and sex for billfish)	Smallest area available	Month (Quarter acceptable for longline)
LEVEL 2	Flag, major species, gear, (and sex for billfish)	ICCAT Sampling Areas (see Appendix 5)	Month (Quarter acceptable for for longline)

5.2.2 *Data submission*

The data on Level 1 and Level 2 should be reported on ICCAT Forms 3-4 and 3-5, respectively. These can also be submitted on computer printout or magnetic tape, as long as the format contains all the elements required.

The deadline for submitting the data is July 31 of the following year. The data can be reported on Form 2 (Appendix 1), computer printout, computer diskettes or magnetic tapes.

If data are reported on diskettes or magnetic tapes, Section 4.2.3 should be referred to for specifications.

The deadline for submitting these biological data is July 31 of the following year. All the data received at ICCAT are entered in the data base. The data catalogue and summary are published in the ICCAT Data Record. Authorized users may request a copy of any part of the data as a hard copy or on magnetic tape, as long as the data are not confidential.

5.3 Instructions for reporting Task II size data using ICCAT Form 3-3 and 3-4

Country, Flag country, Year, and Gear

See instructions for Form 1 (2.3).

Species

Fill in the name of species for which the data were collected. Reporting in vernacular names often causes problems in species mix-up (e.g., bonito for skipjack). Unless reported by ICCAT standard names, it is recommended that scientific names be added to the vernacular names.

Port (fish landing sites)

In the case of port sampling, fill in the name of the port where sampling is done.

Sampling location

Check the appropriate location(s) where sampling is done.

Type of size measurement

Check and specify the measurement which was actually applied.

Area

As in ICCAT Form 2, the area may be expressed by a seven-digit code (see Figure 1 and Section 2.2). Area signifies the location of the catch from which the sample is taken and does not signify the location where the sampling is conducted (Section 2.2.2). In general, it is desirable to compile size frequency data by small geographic areas to facilitate subsequent compilation for any appropriate region.

In the case of port (landing sites) sampling, it is hoped that the actual location of the catch can be estimated from the location of the port in the rectangular seven-digit area. If there are more than two rectangular areas, the area representing the largest catch should be chosen.

If for some reason, size samples cannot be divided into such rectangles (or if a catch-by-size file is created for the entire fishery and reported), ICCAT sampling areas (see Appendix 5) could be used.

Month

Fill in the month (or quarter, if only this is available) which should be recorded as follows:

Month: 01, 02, 03, ... 11, or 12
Quarter: 13, 14, 15, 16 (for 1st, 2nd, 3rd and 4th quarters)

Total number of specimens (Number of fish measured)

The total number of fish measured in each time-area stratum. Sums of frequencies will give this information in actual size frequencies but the information is also essential for raised data.

Number of samples

The number of groups of fish measured (samples) in each time-area stratum (Level 1 and Level 2).

Total Weight of samples (fish measured)

The weight can either be obtained from the sum of actual weight of sampled fish, or the calculated weight based on the length frequencies, using the length-weight relationship (see instructions in Chapter 5).

Total amount of catch from which samples were taken

This is the weight (or number) of the total catch recorded in each area-time stratum from which samples were taken.

Weighting (Raising) factor

This is a factor used to raise Level 1 size frequency data to the size composition of catch, Level 2. The data are obtained by dividing the "total amount of catch from which sample taken" by the "weight of fish measured" (see instructions in Chapter 5).

Size classes

The size class is generally expressed in 1 cm intervals of fork length for fish smaller than 60 cm and in 2 cm intervals for fish equal to or larger than 60 cm.

For instance, for large fish 2 cm intervals are: 90.0 cm - 91.9 cm, 92.0 cm - 93.9 cm, ... 128.0 cm - 129.9 cm, 130.0 cm - 131.9 cm, etc. All sets of length intervals should start from zero. On the forms, the intervals can be expressed by omitting the upper limit, i.e., 40.0-, 42.0-, ... 128.0-, 130.0-, etc.

Size frequencies

Size frequency data must be in number of fish. Percentage is not acceptable.

5.4 Methods of collecting size data (biological sampling)

5.4.1 Sampling location

i) *At sea*

The ideal location for measuring fish is at sea, aboard a fishing boat. If such sampling can be achieved at the time of the catch, all associated information such as location, date, whether or not the sample is from a single school, etc., can be recorded with accuracy.

Sampling at sea can be conducted either by a biologist, or by a trained technician aboard, or on some occasions by well instructed fishermen. The latter might be a particularly useful method with longliners operating far from the base ports. Generally, a longliner trip lasts several months. The boat travels a long distance and daily catches are few. Consequently, when the boat returns to the port for unloading, most of the fish in the hold have lost their identity in terms of time, date and place where the fish were caught. Since the daily catch is rather small, it is easier to request fishermen to measure some of these fish.

ii) *At the time of unloading at ports*

The most popular method of measuring fish is as they are being unloaded from the fishing boats. If this method is adopted, it is essential that the samplers have access to the fishing and/or engine log of the boat, so that the proper origin of fish from which a sample is taken can be identified. (In the case of a coastal artisanal fishery, this may not be needed since most of the catches are made on the same day in an area very close to the landing site.)

For longline catches, such identification is difficult, as explained in the above paragraph, although this method is suitable for the industrialized surface catch. Surface fishing boats (e.g., purse seiners and baitboats) catch fish from large schools. Therefore, fish kept in a hold are from a single school or from a few schools captured within a short period in the same area. These fish can easily be identified by logbooks and accordingly the samples can be traced to their origin.

The actual site of sampling can be as follows:

- In the fish hold of a fishing boat
- On the deck of a fishing boat
- On the pier (or on the beach) when the fish are brought up
- On the vehicles (or carts) which transport the fish
- In the market when fish are laid out for auction or sale

Sampling at the time of unloading is generally the most economical, since one person stationed at a port can cover all the boats entering the port. Also, it provides a site for measuring fish safely and easy access to accurate auxiliary information on the location, date, gear, etc., of the catch.

iii) *When transshipping from a fishing boat to a freighter*

In order to cut down handling costs, a growing number of fishing boats unload fish directly to a freighter instead of to cold storage. If such transshipment is done at sea, only methods i) or v) described here are valid. However, if transshipping to another vessel is done at a port, a sampling method such as ii) can be applied. Transshipments should be carefully monitored as they are not necessarily done at a pier, but in the off-shore port area. A sampler might have to use a small launch to get to the freighter.

iv) *At cold storage or canning plant*

If, for some reason, sampling methods i) and ii) are not practical, this method can be substituted, assuming that the origin of the fish can still be traced.

v) *At port when freighters (transshippers) unload*

This is the least desirable method, since the origin of sampled fish can be traced only as far back as the fishing vessels which caught the fish. There is also a risk that the fish were sorted by size at a transshipping port and only part of the catch (of a certain size-class) was sent by freighter to the port where the sampling is done.

On the other hand, if no sampling was ever made on a certain fishery, even sampling from a freighter can give some information on the overall catch composition of that particular fishery.

5.4.2 Selecting fish

Fish should be sampled at random, disregarding the size. If sampling is done during fishing operations, all the fish (for example, in the case of a longline operation) of a certain species, or one fish out of every 5 or 10 (or whatever frequency is most suitable) can be selected for measurement. The other way to achieve random sampling is to select the first 10, 20, 30 or 50 fish of each species brought aboard, unless it is known that there is some difference in the size between the beginning and the end of fishing.

At a port, if the fish are delivered by moving line (e.g., by a conveyer) one from every certain number of fish can be selected for measurement. If the condition of the fish selected is not suitable for measurement, the next fish can be measured, or that

turn can be skipped. When more than one species is mixed in a catch, first sample one species, then the other.

If circumstances do not permit the above procedure and one has to select from a pile of fish, it is probably best to separate some fish from the top and the bottom of the pile, and measure them. Exercise caution because sometimes large fish are selectively placed at the bottom of the pile or vice versa. In this way, if only the fish at the top of the pile are measured, the sample is biased.

If the fish are already pre-sorted by size and/or species, special attention should be paid at the time of sampling. If this is the case, each pre-sorted section of the catch should be sampled independently and then raised to the catch of that size category. Raising procedures are explained in Sections 5.5 and 6.4.3.

5.4.3 Number of fish to be measured for each time-area stratum (Number of samples and sample size)

Unplanned sampling tends to produce an excessively large amount of data from target species or the area and time where and when the fisheries are at a peak, while it tends to produce a very poor sample from another incidental species and/or the area and time where and when fishing is relatively inactive. In order to compensate for this, one has to keep track of sampling and adjust the measuring activity so that a more even amount of measurements can be obtained from all species, areas and time periods fished. In other words, measurements should not be made proportional to the size of catch in the sense of species (unless the sampling is specifically designed to obtain species composition at the same time), area and time.

If the sampling is multi-purpose to obtain species composition as well as size, the sampling will be at random, disregarding species. Therefore, minor species would be undersampled in terms of biological information. Supplemental sampling on these under-represented species only might be necessary. However, those supplementally sampled fish should not be included in the estimation of species composition.

The information needed on the size frequency at the required level of accuracy can usually be obtained (for tunas above 15 kg) by measuring about 500 fish of each species for each sampling area, each sampling period and each country and gear category. When variances between sample boats and within a single boat are small, 200 fish may provide adequate data. However, for smaller-sized tuna, the number should be increased.

The following is an explanation of two different fisheries:

i) *Longline fishery (large-scale)*

Since longliners catch non-schooling fish at a great depth, and since a set extends as far as 120 km to catch a few relatively large fish, the variance of fish size between

samples from different boats is no larger than the variance of fish size within a sample taken from one boat.

For the target species (bluefin, yellowfin, albacore and bigeye tunas, depending on the fishery), from 10 boats, probably 50 fish each can be sampled to get 500 fish for each time-area stratum. For small coastal longliners, it may be better to take from 25 boats (5 days x 5 boats) 20 fish each.

For species which are incidental to catches (billfishes, swordfish, sometimes even some major tuna species, depending on the fishery), it is unlikely that 500 fish could be secured for each stratum. In such cases, it is recommended that as many fish as available be measured.

ii) *Surface fishery (purse seine, pole and line, trolling etc.)*

Generally, these gears catch relatively small schooling fish near the surface. Their catches per day are much larger than those of the longliners and even more so in terms of number of fish as the average size of fish is smaller. In order to get the same coverage rate as for the longline fishery, which catches a lesser number of much heavier fish, the sample size must be increased. One fish per one metric ton of catch would provide sufficient sampling coverage and can be used as a guideline for establishing the sampling level.

On the other hand, similarly sized fish tend to form schools near the surface. Therefore, a sample taken from a school has little within-sample variance of fish size. However, the between-sample variance of fish size taken from different schools is large, meaning that if the same total number of fish are to be measured, increasing the number of samples while reducing the sample size would give better estimates.

Considering all of the above, the following recommendations are made for surface gears:

- A sample should be taken from a catch of a single school as often as possible.
- In stratified sampling (single species), each sample should consist of 50 (if fish are large) to 100 (if they are small) fish.
- In multi-purpose sampling (with mixed species) and when fish sizes are relatively large (over 15 kg), 100 fish should be sampled. If fish sizes are small, 200 fish are recommended.
- Large industrialized seiners should be sampled twice to three times from different wells known to contain catches from different schools.
- About ten boats (in the case of industrialized large boats) should be sampled for each time-area stratum.
- For small coastal fisheries, from 25 boats (5 days x 5 boats) 40-50 fish each can be sampled to get 500 fish for each time-area stratum.

These guidelines are only general rules. The samplers or their supervisors should monitor the sampling procedure and adjust the sampling scheme as appropriate.

5.4.4 Equipment used for measurement

i) *Calipers*

Calipers may be the most convenient tool for measuring (Figure 2), particularly for tunas. They are easily made of wood, brass, aluminum and/or plastic.

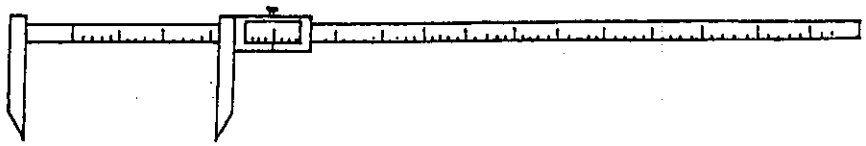


Figure 2. An example of calipers.

ii) *Measuring board*

A measuring board may also be used (Figure 3). Such a board is particularly suitable for measuring small fish.

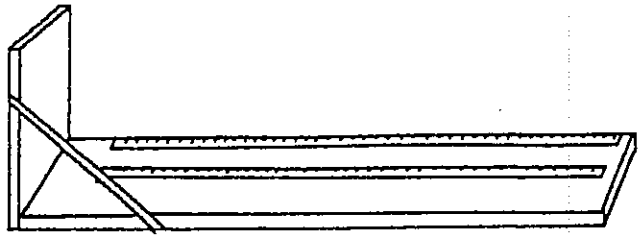


Figure 3. An example of a measuring board.

iii) *Tape*

A steel or fiber glass measuring tape can also be used, if there is no alternative methods. In this case, an attempt must be made to keep the tape straight. The best

would be to place a tape on the floor and place the fish on top of the tape, or to place the tape on the floor to the side of the fish being measured.

An exception is made for measuring the lower-jaw fork length of billfish, in which case the tape measurement should be over body contour of the fish (i.e., curved body length). See Section 5.4.5.ii) for details.

iv) *Photographic techniques*

In some countries, fishermen refuse to allow a sampler to touch the fish. In such a case, photographic techniques might be applied to estimate size composition. The basic principle is to take photographs of fish lying alongside a scale. Later, the fish length can be calibrated relative to the scale in the picture. Particular care should be taken so that the camera's line of sight is perpendicular to the plane of the fish.

This method is much more costly than measuring directly and provides less accurate data.

5.4.5 Measurements to be taken

The fish should be placed on a flat surface in a horizontal position while being measured. Fish with a broken snout (if snout-fork length is being taken) or tail, or frozen fish not in a straight position should be rejected.

i) *Tunas*

All species except billfishes must be reported to the ICCAT in fork length, that is, a projected straight distance from the tip of the upper jaw to the posterior tip of the shortest caudal ray (fork) (see Figure 4).

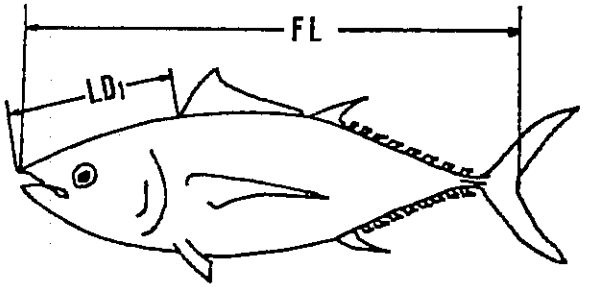


Figure 4. Measurements of tunas - Upper jaw-fork length (FL) and Upper-jaw 1st dorsal (LD1).

It is best to measure fish in fork length. In particular, if smaller sized fish are abundantly found in the catch (e.g., skipjack, surface albacore), fork length measurements are recommended, although this is sometimes difficult to achieve. For example, the fish may be too large for the equipment (calipers) in use; there is not enough room to handle the long calipers (e.g., aboard small commercial fishing vessels); the fish tails have been chopped; or most of the fish are not lying straight. In these cases, the next best measurement is the pre-dorsal length (LD1), which is the straight distance from the tip of the upper jaw to the insertion of the first dorsal spine. However, do not mix two measurements in one sample.

If it is decided to measure the predorsal length, those data have to be converted to fork length prior to reporting to ICCAT. The relationship between the predorsal length and fork length must be established for each species and area, based on adequate samples, as they are quite variable. Unless the data have been converted to the fork length or are received with an adequate conversion equation, the predorsal length cannot be accepted for the ICCAT data base.

ii) *Billfishes*

Standard Measurements (Fig. 5)

An important major difference in sampling billfish is that the fish should be sampled for length as well as for sex, as far as possible. It is very well known that male and female billfishes have significantly different growth rates. However, it is sometimes impossible to identify the sex and in such cases, only length measurements have to be taken.

The preferred and most reliable measure of body length for billfish is the lower jaw-fork length (LJFL). For small fish, calipers are practical and provide an accurate straight line measurement. However, field use of calipers for large billfishes, which have a maximum length of over four meters, is impractical.

For purposes of standardization, it is preferred that all length measurements of large fish be taken with a tape (fiber glass or steel if possible) over the body contour of the fish (that is, curved body length). However, straight measurements by placing fish over a board which has length scales are also acceptable.

As there is difference in the value between straight and curved measurements, what measurements are made and what equipment is used should be clearly recorded on the sampling sheets and reported to ICCAT along with the data.

Alternative Measurements (Fig. 5)

Sampling from commercial billfish catches sometimes poses serious problems, since the fish are generally dressed on board, prior to freezing. This may cause some difficulties in species identification of carcasses (see Chapter 8), and/or affect the measurements.

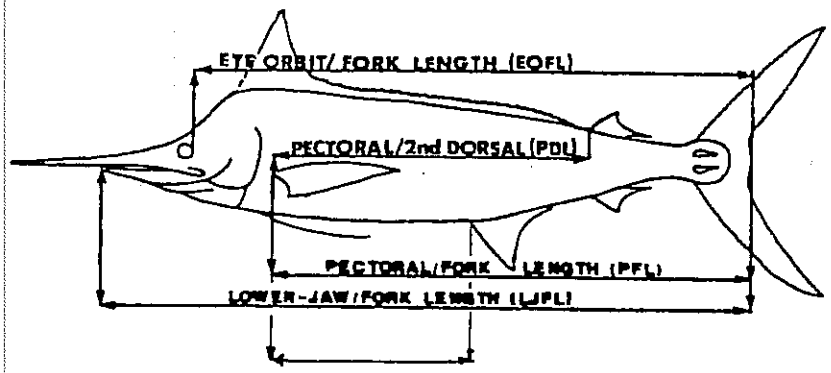


Figure 5. Alternative measurements of billfishes.

Alternative measurements are:

Eye-fork length	Projected straight or curved-body distance between posterior edge of the eye orbit to the fork of the tail.
Pectoral-fork length	Projected straight or curved-body distance between the most anterior insertion of the pectoral fin to the fork of the tail.
Pectoral-dorsal length	Projected straight or curved-body distance between the most anterior insertion of the pectoral fin to the most anterior insertion of the second dorsal fin.
Pectoral-anal length	Projected straight or curved-body distance between the most anterior insertion of the pectoral fin to the most posterior rim of the anal sphincter.

Dressed weight	Weight of individual carcass. In this case an accurate description of how the fish is dressed is essential.

Measurements should be made in the vicinity of the lateral line. For example, when taking Pectoral Second Dorsal Length (PDL), the distance to the anterior part of the second dorsal fin should be read along the lateral line, NOT up on the dorsal ridge of the back (regardless of whether a tape or calipers are used).

The measurements of length that can be taken on any individual carcass will depend on how it is dressed. The following measurements of length should be taken for the categories of dressed fish as follows:

i) Whole (round) carcasses – Lower jaw-fork length.
ii) Bills, gills and fins off, gutted – Lower jaw-fork or Eye-fork length.
iii) Dressed carcasses with heads and fins off and caudal peduncles present – Pectoral fork length.
iv) Dressed carcasses with heads, fins, and caudal peduncles off – Pectoral second dorsal length and Pectoral anal length.

Conversions between Measurements

As in the case of LD1 measurements for tuna, if any measurement other than lower jaw-fork length (LJFL) is taken, it is recommended that the relation between this measurement and the standard (LJFL) be studied so that the measurements can be converted to the standard. In order to develop a conversion equation for past length measurements, as well as for new measurements from dressed fish where LJFL is not available, an adequate sample should be measured at all five elements described above, together with the LJFL. Since the fish carcasses are landed dressed at many sampling sites, it would be impossible to take all the measurements. Until the conversion equations are well established, it is recommended that the samplers try to measure by as many elements as possible, particularly where whole fish are available for sampling. All the known conversion factors and equations used by ICCAT are given in Appendix 6.

Sex Determination

Sex determination of billfishes can only be done by examining internal organs. Thus, information on sex can only be obtained from carcasses which have not been eviscerated. The gonads can be found in the ventral part of the body cavity (Figure 6) and in sexually mature fish, both male and female gonads are often over 30 cm long. Distinguishing between male and female billfish is relatively easy. Male gonads have a relatively uneven appearance and irregular shape, with many nodules present

on the external surface. Cross sections of male gonads have a characteristic rectangular shape and when sexually ripe, milt is easily seen. This can be contrasted with females, which generally have a smooth external appearance and in cross section, the gonad is oval in shape and occasionally has a hole (or lumen) in the middle.

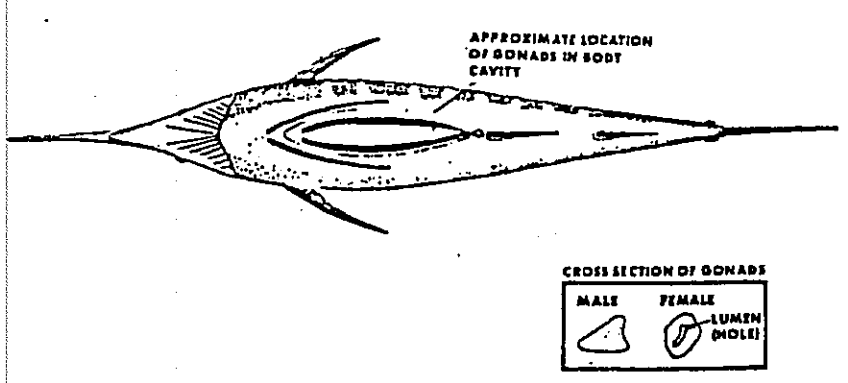


Figure 6. Diagram showing sex identification of billfishes.

The weight of the fish is another factor in determining the sex of individual fish, since the males of most billfish species are considerably smaller (on the average) compared to females. This is particularly true for Atlantic blue marlin, where males rarely grow over 100 kg (220 pounds) and females can grow to over 400 kg (880 pounds) and are common over 125 kg (275 pounds). In other words, if you determine that a blue marlin over 125 kg dressed weight is a male, you may have made a mistake. This trend generally holds true for the majority of billfishes, with the possible exception of spearfish. However, so few spearfish are available for examination that sexually different maximum sizes for this species have not been reported.

5.4.6 Size-class intervals

Most of the measurements discussed above should be made by 1 cm size-class intervals. However, if necessary, fish over 60 cm in fork length could be measured in 2 cm intervals. If the fish is being measured by predorsal length (LD1), the measurements require more accuracy, as 1 cm of the predorsal length is equivalent to 2 to 4 cm in fork length, particularly in larger fish. For fish less than 35 cm in fork length (although it is much more feasible to measure fork length rather than predorsal

ength for such a small fish), LD1 can be measured to the centimeter. However, for any fish over 60 cm, LD1 should be taken in at least 5 mm intervals.

Record the length to the nearest lower centimeter (less than a centimeter should be truncated) or 5 mm, as in the following example:

13.0 - 13.9 cm = 13 cm
14.0 - 14.9 cm = 14 cm
94.0 - 95.9 cm = 94 cm

24.0 - 24.49cm = 24.0 cm
24.5 - 24.99cm = 24.5 cm

If for any reason, your measurements are made to the nearest centimeter, rather than truncated, this should be specifically mentioned when they are reported to ICCAT. Otherwise, the data will be assumed to be measured in the standard way.

5.4.7 Survey method and recording data

Systems for recording measurements should be developed individually. Waterproof recording paper, if available, will be useful. A tape recorder would be very handy, if one sampler has to do all the work. However, in this case, caution should be exercised to make sure that the recorder is in working order and is operating properly while measuring fish.

There are two distinct methods of recording. One is to record all the individual measurements directly as they appear (available at the Secretariat as ICCAT Form 3-1, see Appendix 1); the second is to mark the appropriate size class, so that frequencies are recorded (ICCAT Form 3-2, Appendix 1).

The recording sheet should have columns for dates, locations of catches, sampling and other related data such as boat names, catch unloaded at the time of sampling, well numbers which are sampled, weight of fish from that well, equipment used, type of length measurement made, sampling frequency applied, etc.

If sampling is multi-purpose and on mixed species, more information on catch and effort, as well as on species, etc., would be required. In such cases, ICCAT Form 3-1 recording individual measurements would be more convenient as one sheet could be used for mixed species. On the other hand, if the sample is by species but species composition sampling is carried out at the same time, Form 3-2 may be used. If species composition sampling is not required, the column provided for it on the same form is not to be used.

5.5 Processing raw data

Figure 7 presents a flow chart illustrating the steps to be followed. Our final goal is to estimate the catches with proper species breakdown and size. For this we have to estimate them by segments (strata) and add them. Catch by strata and size data (and/or species composition, which would not be repeated hereafter but should be understood) are essential to achieve this.

i) The raw data obtained from sampling have to be combined into the strata adopted (Level 1 data). During this process, raw size data could simply be combined. If a sub-sample of pre-sorted catches are taken or if the samples are taken from different wells of the same boat and the catches are known by well, they could be partially extrapolated to the catch from which sample is taken, prior to being combined (Section 5.5.1).

ii) Then the Level 1 size data have to be matched to the catch reported for the corresponding stratum. If any size data are missing for a catch, the size composition of that missing stratum should be assumed to be similar to some other size frequency (*data substitution*). Then using the size data, catch by size in each stratum has to be estimated (*raising* the size to the catch) (Section 5.5.2).

iii) This section explains procedural techniques. If the sampling is multi-purpose (size and species composition), the substitution and raising should be made in the same way for size and species all together, or first catches should be estimated by species in each time-area stratum and then by size. In either case the technique of substitution and raising is identical as explained here for size data (Section 5.5.3).

5.5.1 Obtaining Level 1 data

The size data obtained from sampling have to be processed into the form required as Level 1 data and then eventually into the form of Level 2.

If the size data are, for some reason, recorded in a unit other than standard (fork length or lower jaw-fork length) such as LD1, etc., they should be converted into the standard (see Section 5.4.7). If all the measurements are in the same unit, such conversions could be made after all the data are combined and raised. However, if various measurements are mixed, the conversion has to be made prior to combining all the samples.

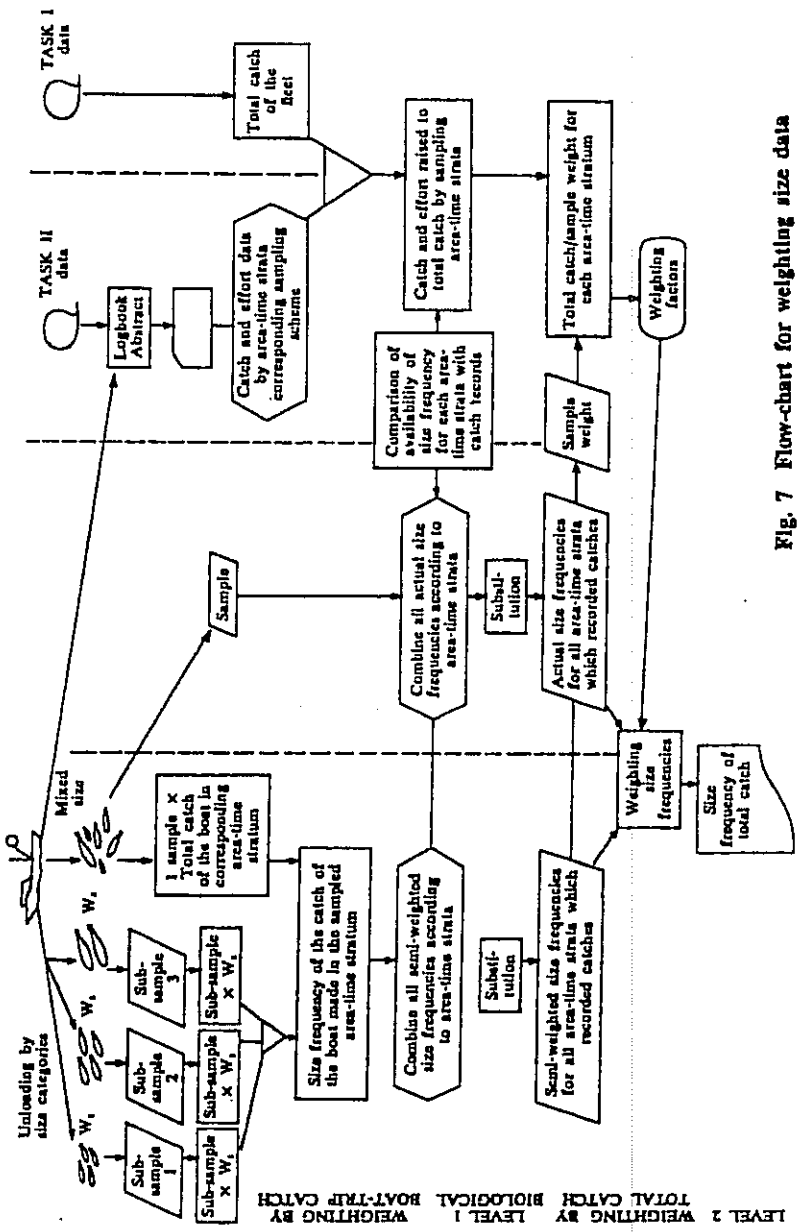


Fig. 7 Flow-chart for weighting size data

If the catches were pre-sorted by size, etc., prior to sampling and consequently sub-samples were taken or the sampling can be identified by wells of boats and associated information (such as catch by wells) is available, the (sub-)samples should first be raised to the catch of the pre-sorted categories or sampled wells, using the techniques described in the next section.

Then these (sub-)samples raised to the catches from which the samples are made, should be accumulated to the desired minimum stratum (e.g., 1°x1° and by 10-day periods, or 5°x5° and by month).

If such intermediate raising is not possible (e.g., longline size data) a size frequency has to be generated by combining the size data recorded on daily sampling sheets for each unit of stratum. This can be done manually but more easily with any computer. ICCAT can provide programming assistance, if needed. (As described previously, the results of these Level 1 statistics should be reported to ICCAT on ICCAT Reporting Form 3-4). Instructions for filling out this Form can be found in Chapter 7.)

5.5.2 Obtaining Level 2 data

a) *Data substitution*

The size data (Level 1) combined for each stratum have to be checked for their availability against the catch data compiled by the same time-area strata.

If a catch is recorded for any strata but no size data are available, a substitution of data has to be made. There are several ways to do this.

i) Use size frequencies observed by the same type of fishery of another country in the same time-area stratum.
ii) Use size frequencies observed by the same fishery in neighboring areas during the same time period.
iii) Use size frequencies from the same time-area strata but from previous years.
iv) Use size frequencies observed in the same area but during the time periods preceding or following the period from which data are missing.
v) Use size frequencies for last several years combined for the same time area stratum, by the same fishery.

The best substitution varies according to the fishery, season, area, etc. In the surface fisheries i) might be the best solution. In the longline fishery, ii) or iii) would be better than i). If the results are to be used in virtual population analyses where catch at age for each year plays an important role, iii) should be avoided as much as

possible. In using iv), one can even adjust the size by applying a growth curve. When data are very scarce, v) is often used.

At any rate, data substitution is very tricky. The resulting catch by size could be completely different depending on how the substitution was made and may even lead to a different conclusion in the population analyses. It is important that all the substitution procedures adopted be well documented together with data.

b) *Raising to the total catch*

When the substitution is completed, the size frequencies can be raised to the total catch. Raising should be done for each time-area stratum.

i) Size frequency expressed in terms of number of fish should be converted to weight using length-weight relationships. (This is not necessary if the catch is known in number of fish rather than weight. The total number of fish in the catch divided by the total number of sampled fish equals the raising factor.) Now the fish in each length class is expressed in weight. The sum of those weights will give the estimated sample weight.

Example: Yellowfin tuna

Size classes	Frequencies (No. of fish)	Avg. weight of fish	Weight of fish in size classes
52 cm - 53.9 cm	10	2.87 kg	28.70 kg
54 cm - 55.9 cm	12	3.11 kg	37.32 kg
56 cm - 57.9 cm	15	3.47 kg	52.05 kg
.	.	.	.
.	.	.	.
.	.	.	.
Total	250		1050.24 kg*

*Sample weight

If all the fish measured have also been weighed, the above procedure would be unnecessary as the sum of weights can be used as sample weight.

ii) Total catches (in weight) recorded for each time-area stratum can then be divided by the sample weight. This will give the raising factors. For example: if the catch of yellowfin tuna in corresponding time-area strata is 1,520 MT,

while the sample weight is 1,050.24 kg, the raising factor is 1,520 MT divided by 1.05024 MT, or 1,447.2882.

iii) Actual size frequency should be multiplied by the raising factors in order to obtain catch by size.

Example: Yellowfin tuna Raising factor = 1447.2882

Size classes	Actual frequencies	Raised frequencies (No. of fish caught)
52 cm - 53.9 cm	10	14473 (= 10 x 1447.2882)
54 cm - 55.9 cm	12	17367 (= 12 x 1447.2882)
56 cm - 57.9 cm	15	21709 (= 15 x 1447.2882)
.	.	.
.	.	.
.	.	.
Total	250	361822 (= 250 x 1447.2882)

Chapter 6. SAMPLING THEORY AND TECHNIQUES (MULTI-PURPOSE SAMPLING)

6.1 Objectives of sampling

Sampling means that a part of the population is selected and examined, from which characteristics of the population will be estimated.

In this Chapter, tuna sampling designed not only to produce size data but also other information, such as species breakdown of the catches, time and area of catches, quantities of catches and/or sex, is presented. In other words, this sampling's multi-purpose is to produce information on size, species composition, sex ratios, catch and effort and/or even total catches.

6.2 Stratified sampling or sampling proportional to catch

There are two distinct concepts for tuna sampling: stratified sampling and sampling proportional to the catch. Stratified sampling is a well accepted technique, in which the population is stratified (e.g., by species, fishing gear, time and area) and each stratum is properly sampled. The sample size and number of samples needed from each stratum are functions of population, variance, etc., but can be defined. Later, the population of the corresponding strata are estimated from the respective samples and the total population is further estimated by adding all the strata.

Well designed stratified sampling will minimize the sample size and give a very reliable estimate of the population. Stratified sampling is the most effective and economical (see Chapter 5).

Stratified sampling should be designed to cover evenly as many time and area strata as possible where any catch was made (see Section 6.3).

However, sampling is often multi-purpose, as described here. Also, we often do not have enough information to make a proper stratification. In such cases, sampling proportional to catch is unavoidable. In other words, a certain number of fish will be sampled per metric tons of catch, or 1 fish out of so many fish, regardless the strata. This system is simple and easy since it can be carried out with a very simple criterion, and since the sampling coverage rate is easy to estimate, the estimation of total catches, etc., could be easier than when using stratified sampling.

In proportional sampling, sampling will be biased to the major fishing grounds and area. It also requires a larger sample size and effort than stratified sampling.

6.3 Instructions for survey design and method of sampling

6.3.1. Total catches are known

In many fisheries, the total catches by a certain fishery is known through logbooks or through landing surveys, although problems in the species breakdown of catches may exist. For example, in the tropical juvenile tuna fisheries, yellowfin and bigeye tunas are often confused and reported as yellowfin. They are even confused with skipjack. The species identification between yellowfin and bigeye is not easy when they are small (see Chapter 8). As the same price is paid to the fishermen for both species, there is no reason for the fishermen to distinguish between these two species. Since yellowfin is a major species, the mixed catch is often reported as yellowfin or just as tuna.

The solution for such a fishery is to sample for species composition while carrying out biological sampling. Since the total catches as well as the distribution of catches by time-area strata are already known through the logbook system, the only motivation for sampling would be to determine length frequencies and species composition. There are two distinct ways to achieve such sampling.

a) *Independent stratified samplings for size and species*

One method is to make stratified sampling for size, as described in Chapter 5, measuring a certain number of fish of a known species from each stratum, and sample independently for species identification. For example, measure 50 fish of each species and after the measurements, sample 200 fish of the catches of mixed species only for species composition.

Detailed sampling methods and number of fish required are discussed in Chapter 5. ICCAT Sampling Form 3-2 would be more convenient to use. The advantage of this system would be that fewer fish could be measured and yet minor species are well covered. On the other hand, the sampling design is more complicated, and two distinct samplings have to be made on the same occasion (size and species). Also, since the sampling is better stratified, the treatment of data (raising to catch) is somewhat more complicated.

This system is practiced by the Inter-American Tropical Tuna Commission (IATTC) in the Pacific, in U.S. Puerto Rican sampling for transshipment, and others.

b) *Mixed-species sampling*

If proportional sampling (i.e., one fish from each metric ton of tuna caught) is done, regardless the species from the mixed catches, the same sample could be used for estimating size frequencies as well as species composition. For example, if 200 fish

are sampled from mixed catches and size and species are recorded together, the sample will provide us with both species composition as well as size frequencies.

Detailed sampling methods and number of fish required are discussed in Chapter 5. ICCAT Sampling Form 3-1 would be more convenient to use. The advantage of this system is that both types of information could be secured in one sampling and data processing might be less complicated with known raising factors. On the other hand, the major species could be oversampled, which is not a serious defect but minor species could be undersampled since the number of fish in the sample is proportional to the catches. If the species are pre-sorted before sampling, this system is not valid.

This system is practiced widely in the Atlantic tropical surface fisheries.

c) *Pre-sorted catches*

If the catches are pre-sorted by species and/or size prior to the sampling, special care has to be taken. If the pre-sorting by species is accurate and there is no mixing of species in any sorted categories, stratified sampling for each species is quite satisfactory. However, if the category of small fish still has some mixed species, while the large fish category has single species, stratified sampling for size could be made from the single-species categories but species composition sampling (a) or proportional sampling (b) would be required from the mixed-species categories.

The data obtained must be individually treated (raised) to the different pre-sorted categories (see Chapter 5 and 6.3.2.f).

6.3.2 Total catches not known

a) *Objectives*

For some fisheries, only very poor or no estimations of catch statistics are available. The coastal artisanal fisheries or recreational fisheries involve many landing sites and small fishing crafts and the estimates of catches by accurate species by such fisheries are very difficult.

A sampling system for these fisheries should not be aimed only at size measurements but also at improving general statistics. Some guidelines for such multi-purpose sampling planning is given in this section.

For the artisanal fishery, the question is which part of the population should be selected and on what basis: part of the fleet, part of the landing sites, part of the period, part of the coast lines, etc. The most common is a combination of these. A few major landing sites, certain days (e.g., every five days), and, if necessary, additional boats (e.g., every five boats coming to the port) are selected.

b) *Criteria for strata*

Sampling should cover all gears, boat categories, and flags but should distinguish between them. A sampling design such as sample size, selection of sampling units and sampling sites should be established for each type of gear. See Chapter 2 and Appendix 2 for details.

c) *Sampling sites*

Sampling sites have to be chosen depending on the purpose of sampling and the local situation (see Section 5.3.1). For sampling from the artisanal fisheries, the best choice would be the major landings sites. As many landing sites as possible should be selected to cover major species in the catch and major gears employed. A preliminary study on the geographical distribution of catch and tuna fishing units would help in the selection of landing sites.

d) *Frequency of sampling and sample size*

Section 5.4.3 describes general guidelines for the level of sampling. For the artisanal fisheries, a large number of small-scale fishing boats land their catches almost every day. If this is the case, it is not necessary to sample the catch and effort every day, because the variance of catch per boat between days would be small. The following criteria can be considered as standard procedure:

Ten days per month (every third day will be the sampling day) including holidays and non-fishing days (or non-fish-landing days), except during the off-fishing season.

Ten boats per day be sampled.

The above guidelines are, however, a general standard and they should be adjusted to the local situation. Sampling days can be every two to five days depending on the number and catch of fishing boats coming in to the landing site as well as on the sampler available. During the off season, sampling can be suspended.

The standard of ten boats per day can be reduced to five boats if the between-boats variance is low, but if it is high, twenty boats should be sampled.

Sample boats should be selected with a fixed interval. For instance, in the case of ten sample boats to be selected for each type of gear:

–less than 10 boats, sample all boats
–20 boats, sample every second boat

–50 boats, sample every fifth boat
–100 boats, sample every tenth boat

If the number of boats coming into the port is not previously known, some flexibility should be practiced, (e.g., every other boat is sampled until the desired number of boats is sampled).

For size sampling, the selection of fish is discussed in Section 5.3.

e) *Sampling items*

From all the fishing crafts arriving at port (landing site)

An example of sampling sheets for the artisanal fishing is found in Appendix 3 (upper part of Form A-1). On a sample day, for each type of fishing gear, record:

–the total number of boats arriving at the landing site, by type and size class of boats (including the boats which were out fishing for tuna and tuna-like species but made no catches);

–their effort and catch by species (in kg).

For species classification, see Chapter 8. In the case where tuna and tuna-like species are by-catches for the gear, the target species should be included with tuna and tuna-like species.

The information of all the above can probably be obtained from a market authority or someone else responsible for landings. If not, the sampler should estimate the total catch and effort himself using the following formula:

"Total number of boats arrived" (1) multiplied by
"average effort and catch by species per boat" (2).

Where (1) has to be counted by the sampler himself during the course of sampling with the help of the market authority or someone else and (2) is obtained as a result of sampling described in the following sections.

From boats subjected to sampling

From each sampled boat, the following information should be recorded (See example given in Appendix 3, lower part of Form A-1).

–name and registration number of boats
–type and size class
–fishing effort
–catch by species (kg)
–locations of catches
–size (see Chapter 5)

f) *Sampling method*

Tuna and tuna-like species may be landed either in containers or by individual pieces. If all the catch records broken down by species are available for each boat, the sampling procedure will be very simple. Only a size sample should be taken. However, if the catch is not known, sampling should be conducted for estimating the total catch by species as well as for measuring size.

Mixed landing by pieces

When species and sizes are mixed in the landing, fish should be randomly selected according to the criteria (e.g., one out of five fish). Species and length should be recorded on the selected fish (ICCAT Form 3-1 may be used). The total weight of fish sampled (by species) is essential information in order to estimate catches by species of sampled boat. This can be taken by weighing individual fish as being sampled, or piling up all the sampled fish by species which are weighed together at the end of sampling. If length-weight relationships are established for each species, the length data can be used for estimating the weight of the fish sampled.

At the end of sampling, the total weight of fish sampled by species can be multiplied by the sampling rate (i.e., if one fish out of five is sampled, multiply by five), to obtain estimated total landing by species by sampled boat.

Pre-sorted landing

If the catch is pre-sorted by species and/or size, each pre-sorted section should be sampled independently (although the technique of sampling should be the same as described above). Catches by species have to be estimated separately for each section. The total catch by species of that boat is estimated by summing the catch of each pre-sorted section.

Size sampling will be a bit more complicated in this case. The size sample should be taken in the same way as described for mixed landings. If pre-sorting is done only by species, these samples can be added for each species and used as size data. However, if the catch is pre-sorted by size of fish, the size sample of each pre-sorted section has to be raised for weight or number of fish included in each pre-sorted section and then they are added to give the size frequencies of the total catch of the boat. The procedures used are the same as raising the size data by time-area strata as shown in Section 5.5.

Chapter 7. SPECIES IDENTIFICATION

Chapter 7 is prepared to aid in the correct identification of tunas and tuna-like fishes. Since there is still a great deal of discussion among taxonomists regarding classification and taxonomy of fish in the Scombriformes, this paper is not expected to precipitate scientific arguments on taxonomy.

The species with which our Commission is concerned are the Scombriformes, with the exception of families Trichiuridae and Gempylidea, and the genus Scomber. The families and genera in which we are interested are as follows:

SCOMBRIDAE

Thunnus
Gymnosarda
Euthynnus
Sarda
Katsuwonus
Auxis
Acanthocybium
Scomberomorus
Orcynopsis
Allothunnus
Gasterochisma
Rastrelliger

XIPHIIDAE

Xiphias

ISTIOPHORIDAE

Istiophorus
Tetrapturus
Makaira

7 -1 includes keys for identification of genera and species. The key for Scombridae is based on Richard (unpublished) and Collette (1970), with some modification by Gibbs and Collette (1967), Fraser-Brunner (1950), and Iwai *et al.* (1965); for billfishes it is based on Nakamura *et al.* (1968). Those species with which we are not directly concerned are listed in parenthesis; they are species either not existing in the Atlantic Ocean or not covered by the Convention.

7 -2 includes a short description of each important species of tuna and billfishes. The description consists of scientific and vernacular names, distinctive

characters and diagnosis, color, distinction from similar species occurring in the area, size, geographical distribution and behavior, present fishing grounds, catches, main fishing gear, principal forms of utilization of fish, etc., plus illustrations of the fish. This has been prepared by ICCAT in conjunction with the Worldwide FAO Program on Species Identification Sheets for Commercial Aquatic Organisms, following the outline agreed on by FAO.

The following species, although of interest for the work of the Commission, have not been included in Section 7 -2 at this time. These species are of relatively minor commercial importance and hence available knowledge is somewhat limited. They will be included as soon as it is possible to prepare the sheets.

Gasterochisma melampus
Rastrelliger kanagurta
Acanthocybium solanderi
Scomberomorus cavalla
S. regalis
S. tritor
S. maculatus
Allothunnus fallai
Orcynopsis unicolor

7 -1. KEYS FOR IDENTIFICATION

7 -1-1. Keys to the Genera and species of Scombridae know to exist in the Atlantic Ocean

1a. Long deep groove present along abdomen from pelvic base to anus into which the large pelvic fins fit, scales large (about 50 along lateral line). Interpelvic processes minute, separate . . . *Gasterochisma melampus*

1b. No long abdominal groove. Scales, if present, minute and difficult to discern, at least on posterior portion of body 2

2a. First and second dorsal fins separated by a distance equal to or greater than snout length (caution: posterior part of first dorsal hidden in the dorsal groove) 3

2b. First and second dorsal fins separated by a distance no more than the diameter of the eye 6

3a. Entire body covered with moderately large scales; gill rakers very long, longer than gill filaments; plainly visible through open mouth . . . . . *Rastrelliger kanagurta*

3b. Scales, if present, minute and difficult to discern, at least on posterior portion of body; gill rakers not as long as gill filaments, hardly or not at all visible through open mouth 4

4a. (Body completely covered with small scales; interpelvic process very small, much shorter than the shortest pelvic ray; adipose eyelids cov-

ering front and rear of eye; only two small keels present on each side of caudal fin base; dorsal and anal finlets 5 . . . . *Scomber*)

4b. Body covered with scales anteriorly, mostly naked posteriorly; interpelvic process single, about as long as pelvic fins; no adipose eyelids; in addition to two small keels, a large mid-lateral keel present on each side of caudal peduncle; dorsal finlets 8, anal finlets 7 . . *Auxis* 5

5a. Narrow corselet of scales along lateral line — 1-5 scales wide under second dorsal fin; dark wavy lines in dorsal scaleless area usually oblique to nearly horizontal; pectoral fin extending posterior to anterior margin of dorsal scaleless area . . . . . *Auxis thazard*

5b. Wide corselet of scales — more than 6 scales wide under second dorsal fin; dark bars in the dorsal scaleless area usually nearly vertical; pectoral fin not reaching anterior margin of dorsal scaleless area . . . . . *Auxis rochei*

6a. No anterior corselet present, body entirely covered with scales of rather uniform size 7

6b. An anterior corselet present, consisting of an anterior thickened area of larger, modified scales, the posterior scales smaller or absent . . 11

7a. Dorsal spines 21-27; snout as long as rest of head, gill rakers absent . . . . . *Acanthocybium solanderi*

7b. Dorsal spines 14-17, snout much shorter than rest of head; gill rakers present (although sometimes reduced to 1 plus 2) . *Scomberomorus* 8

8a. Lateral line forming an even or wavy curve from head to tail, not abruptly bent downward in region below end of second dorsal fin, vertebrae 46-53 9

8b. Lateral line abruptly bent downward below end of second dorsal fin. Gill rakers 1 to 2 + 6 to 9 = 8 to 10, vertebrae 42-43 . . . . . *Scomberomorus cavalla*

9a. Yellow spots on sides separate and not run together as streaks . . 10

9b. Yellow spots on sides run together to form lateral stripes, gill rakers 3 to 4 + 10 to 13 = 13 to 18 . . . *Scomberomorus regalis*

10a. Eastern Atlantic, vertebrae 46 . . . *Scomberomorus tritor*

10b. Western Atlantic, vertebrae 52-53 . *Scomberomorus maculatus*

11a. Tongue with a pair of dorsally-projecting longitudinal cartilaginous ridges 14

11b. Tongue without dorsally-projecting ridges 12

12a. Jaw teeth very small; gill rakers 71-77 on first arch . . . . . *Allothunnus fallai*

12b. Jaw teeth large and prominent; 11-24 gill rakers on first arch . . 13

13a. Five to eleven narrow, dark longitudinal stripes on upper part of body; no teeth on tongue; dorsal spines 20-23; gill rakers 16-24 on first arch . . . . . *Sarda sarda*

13b. Body without stripes, dorsal spines 11-14 (spots on back of young) two patches of teeth on tongue . . . . *Orcynopsis unicolor*

14a. Several prominent dark longitudinal stripes on lower flank; leading edge of first dorsal fin white; gill rakers 52-63 on first arch; dorsal spines 15-16 . . . . . *Katsuwonus pelamis*

14b. No dark longitudinal stripes on lower part of body; gill rakers 19-43 on first arch; dorsal spines 11-14; teeth present on palatines and vomer 15

15a. Body naked except for corselet and lateral line; several black spots usually present between pectoral and pelvic fins; pectoral rays 24-27 . . . . . *Euthynnus alletteratus*

15b. Body covered with small scales behind corselet; no black spots present between pectoral and pelvic fins, pectoral rays 30-36 . . . . . *Thunnus* 16

16a. Caudal fin with a narrow white posterior margin; body deepest posterior to mid-length, at or slightly before level of second dorsal fin; pectoral fin very long, reaching well past end of second dorsal fin base (similar in smaller *T. obesus*); liver striated on ventral surface; gill rakers on first arch 25-31 . . . *Thunnus alalunga*

16b. Caudal fin without white posterior margin; body deepest at about mid-length, near middle of first dorsal fin; pectoral fin short to moderately long, not reaching end of second dorsal base (except on smaller *T. obesus*) 17

17a. Reported only from Western Atlantic; total gill rakers on first arch 19-25, prominent gold lateral band on body, finlets gray or dusky yellow (not bright lemon yellow); liver without striations on ventral surface; small size (15 kg maximum) . . . . . *Thunnus atlanticus*

17b. Total gill rakers on first arch 25 or more, fish attain large size . 18

18a. Pectoral fin long, greater than 80 percent of head length; gill rakers on first arch 23-34; all finlets bright lemon yellow . . 19

18b. Pectoral fin short, less than 80 percent of head length; liver striated on ventral surface; gill rakers on first arch 31-43 . . 20

19a. Body obese, its depth more than 1/4 fork length; liver striated on ventral surface; second dorsal and anal fins not elongated, equal to 20 percent of fork length or less at all sizes; no prominent gold lateral band; gill rakers on first arch 25-31 . . . . . *Thunnus obesus*

19b. Body somewhat slender, its depth less than 1/4 fork length; liver without striations on ventral surface; second dorsal and anal fins of larger specimens elongated, greater than 20 percent of fork length; prominent gold lateral band on body; gill rakers on first arch 26-35 . . . . *Thunnus albacares*

20a. Keel on caudal peduncle yellow, standard length 4.4-4.6 times length of pectoral fin; gill rakers on first arch usually less than 36 (31-40) . . . . . *Thunnus maccoyii*

20b. Keel on caudal peduncle black (semitransparent in juveniles), standard length 4.6-6.0 times length of pectoral fin; gill rakers on first arch usually more than 36 (34-43) . . . . . *Thunnus thynnus thynnus*

7-1-2. Key to the Families, Genera and Species of Xiphiicae (billfishes) known to exist in the Atlantic Ocean (Fig. 5)

1a. No ventral fin. One pair of caudal keels. Long bill. Cross section of the bill depressed. No scales. No teeth. Short base of first dorsal fin. Second dorsal fin separated considerably from the first . . . Xiphiidae *Xiphias gladius*

1b. Ventral fin present. Two pairs of caudal keels. Relatively short bill. Round cross section. Body covered with long hard scales. Small teeth. Long base of first dorsal fin close to second dorsal fin . . Istiophoridae 2

2a. High first dorsal fin forms sail shape. Long ventral fin rays. Ventral fin membrane well developed . . . . . *Istiophorus* 3

2b. Height of first dorsal fin is more or less equal to body depth. Ventral fin rays not long. Ventral fin membrane not well developed 4

3a. (Relatively short pectoral and caudal fin (at body length 90 cm): Indo-Pacific species . . . . . *Istiophorus platypterus*)

3b. Relatively long pectoral and caudal fin (at body length 90 cm): Atlantic species . . . . . *Istiophorus albicans*

4a. Height of anterior part of first dorsal fin equal to or greater than body depth. Body compressed remarkably. Front of head does not rise sharply . . . . . *Tetrapturus* 5

4b. Height of anterior part of first dorsal fin less than body depth. Body compressed moderately. Front of head rises sharply . . . *Makaira* 9

5a. All fin rays of first dorsal are equal in height except first few which are longer. Anus located relatively ahead of base of first anal fin. Second anal fin is located anterior to second dorsal fin 6

5b. Height of anterior part of first dorsal fin equal to or slightly greater than body depth. First dorsal fin decreases in height posteriorly. Anus is located right in front of the anal fin base. Second dorsal fin and second anal fin located symmetrically 8

6a. Pectoral fin narrow and short 7

6b. Pectoral fin wide and long . . . . *Tetrapturus pfluegeri*

7a. (Very short bill, Indo-Pacific species . *Tetrapturus angustirostris*)

7b. Relatively long bill . . . . . *Tetrapturus belone*

8a. Pectoral fin wide, round end. Round tips of first dorsal and first anal fins . . . . . *Tetrapturus albidus*

8b. (Pectoral fin narrow, sharp end. Sharp pointed tips of first dorsal and first anal fins, Indo-Pacific species . . . . . *Tetrapturus audax*)

9a. Pectoral fin can touch body surface. More than one complicated lateral line 10

9b. Pectoral fin projects rigidly at right angle to body surface, cannot touch body surface. One unclear lateral line . . . *Makaira indica*

10a. (Relatively simple loopshaped lateral line — Indo-Pacific species . *Makaira mazara*)

10b. Lateral lines form a netlike pattern . . . *Makaira nigricans*

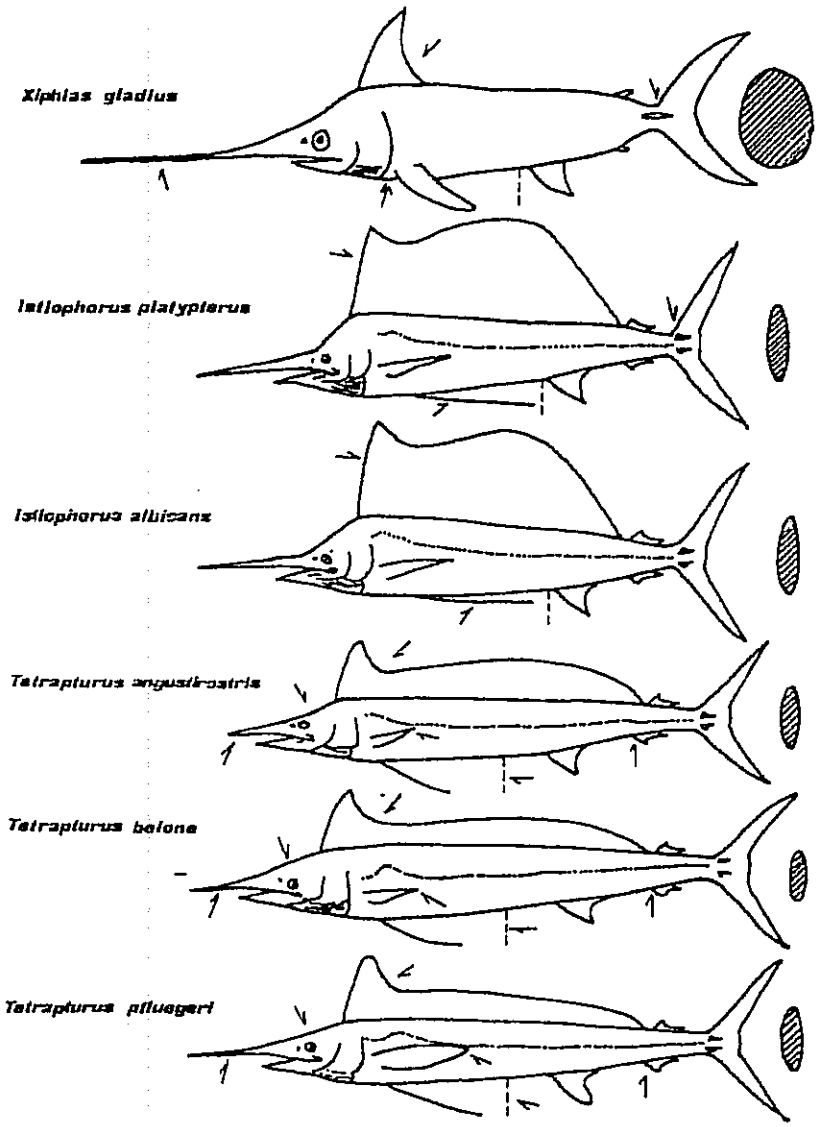


FIG. 5. — External morphometric comparison among species of billfishes.

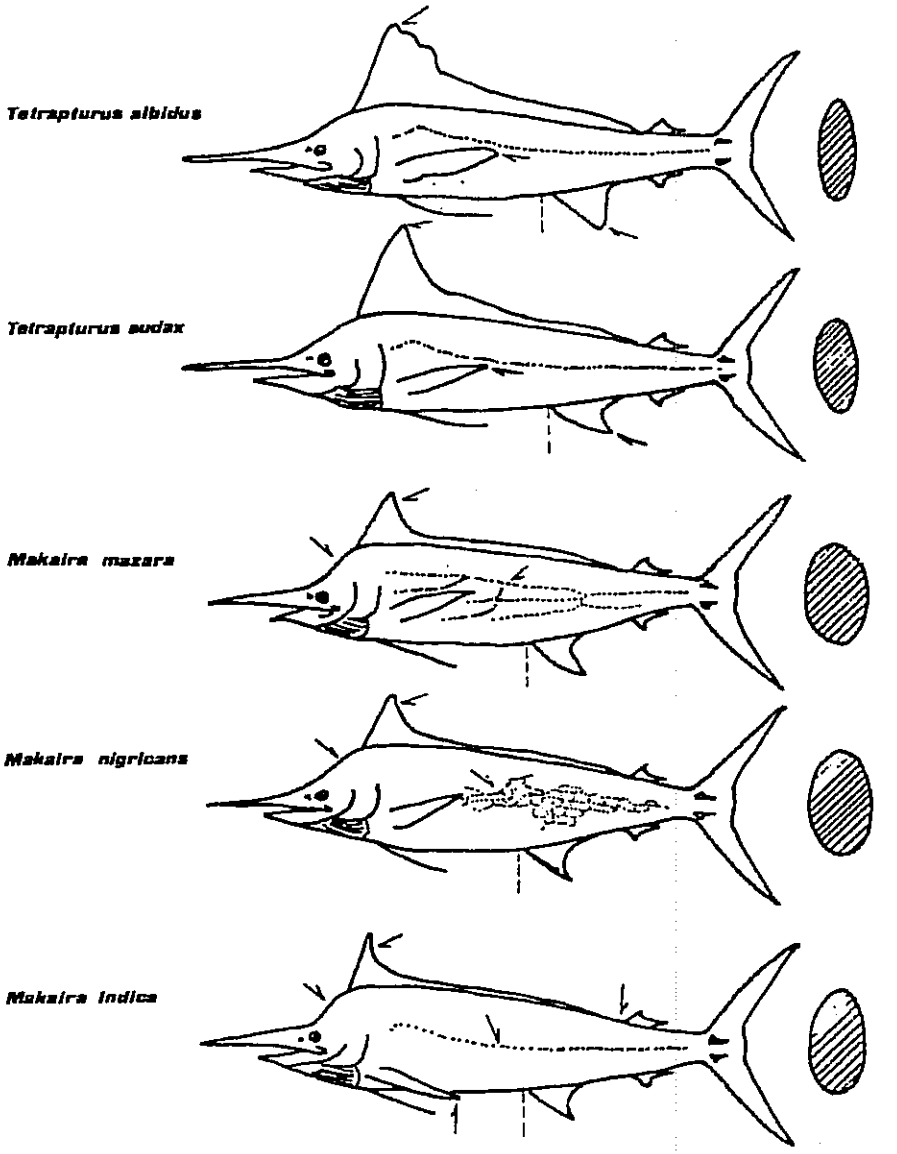


FIG. 5. — Continued

7 ·2. — Species identification sheets

COUNTRY CODE USED IN THESE SHEETS

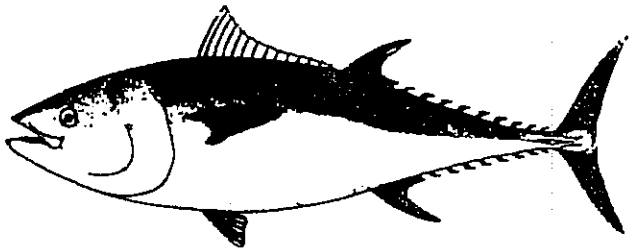
BERM:	Bermuda
BRAZ:	Brazil
CAND:	Canada
DENM:	Denmark
FINL:	Finland
FRAN:	France
GERM:	Germany
ICEL:	Iceland
JAPN:	Japan
KORE:	Korea
MORC:	Morocco
NETH:	Netherlands
NORW:	Norway
POLN:	Poland
PORT:	Portugal
S. AFR:	South Africa
SPAN:	Spain
SWED:	Sweden
TAIW:	Taiwan
USA:	United States of America
USSR:	Union of Soviet Socialist Republics

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Scombridae (Thunnidae)

Sheet No. 1
1972

SCIENTIFIC NAME: *Thunnus thynnus thynnus* (Linnaeus)
SYNONYMS STILL IN USE: *Thunnus thynnus*



10 cm

VERNACULAR NAMES:

	ICCAT	FAO
En:	Bluefin tuna	Bluefin tuna Northern Atlantic
Fr:	Thon rouge	Thon rouge Atlantique Nord
Sp:	Atún	Atún Atlántico Norte

NATIONAL. —

BRAZ:	Atúm	NETH:	Tonijn
CAND:	Bluefin tuna Thon rouge	NORW:	Makrellstørje
		POLN:	Turíczyk
DENM:	Tunfisk	PORT:	Atúm
FINL:	Tonnikala	S. AFR:	Bluefin tunny Blouvin tuna
FRAN:	Thon rouge		
GERM:	Thunfisch	SPAN:	Atún
ICEL:	Túnfiskur	SWED:	Tonfisk
JAPN:	Kuromaguro	TAIW:	Hay we
KORE:	Cham-da-raeng-i	USA:	Bluefin tuna
MORC:	Thon rouge	USSR:	Tunets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Fusiform body compressed and very robust in front. Short pectoral fin scarcely reaching origin of 2nd dorsal fin. Height of 2nd dorsal longer than that of 1st dorsal. Caudal keel black at adult stage. Semi-transparent when immature. Liver striated on ventral surface. Gill rakers 34-43.

Dorsal skin dark blue or black. Ventral skin silvery gray with colorless transverse lines and rows of colorless dots in alteration. These run vertically in young and gradually bend backwards toward median ventral line as fish grows. Fins: 1st dorsal obscure yellow —2nd dorsal and anal grayish yellow. Finlets: grayish yellow edged with black.

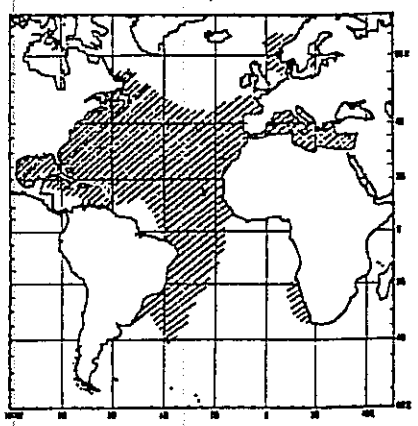
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Thunnus thynnus thynnus has caudal keels black in adult and semi-transparent in young while *T. maccoyii* (southern bluefin) has yellow caudal keel. Fork length is 4.6 to 6.0 times length of pectoral fin in bluefin, 4.4 to 4.6 in southern bluefin tuna.

SIZE:

Maximum: over 300 cm Common: 40 to 200 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Widely distributed throughout the Atlantic. Distribution in east Atlantic extends as far north as northern coast of USSR, Norway, Lofoten Is. and Iceland, and as far south as off northern West Africa. Found in western Atlantic along Labrador and Newfoundland (Canada), southward to Tobago, Trinidad, Venezuela and the Brazilian coast. Also in existence in Mediterranean and Black Seas.

Immatures found mainly in warm waters. Adults distribute towards cold water during feeding stage, but more to the Carribean Sea and adjacent waters, and southern Europe during spawning stage. Transoceanic migration. In general young form schools, sometimes with other species.

PRESENT FISHING GROUNDS:

Norwegian coast, off Bay of Biscay, off Iberian Peninsula and Mediterranean coasts, off North American coast between Nova Scotia through Carribean Sea and off Brazil.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Catches have fluctuated between 25 and 45 thousand tons annually in recent years.

Caught mainly by surface fisheries, including traps, live-bait, trolling, purse seine. Scarce in longline catches. Locally gillnets, trammel nets, harpoons, etc. are used on a minor scale.

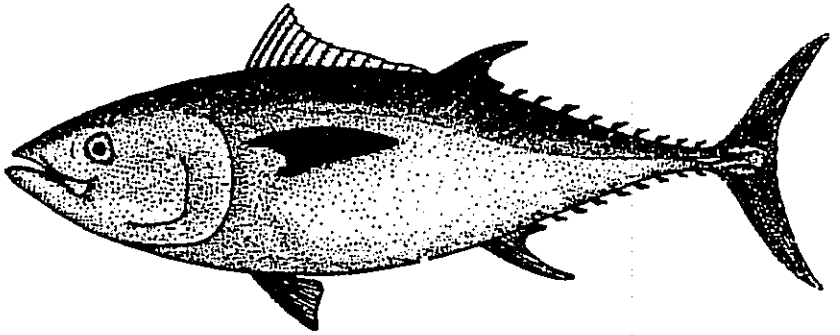
Most of catches are utilized as canned product. Some fresh frozen fish is also sold on market.

ICCAT CODE:	BFT – 1

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 2
FAMILY: Scombridae (Thunnidae) 1972

SCIENTIFIC NAME: *Thunnus maccoyii* (Castelnau)
SYNONYMS STILL IN USE: *Thunnus thynnus maccoyii*



10 cm

VERNACULAR NAMES:

	ICCAT	FAO
En:	Southern bluefin tuna	Southern bluefin tuna
Fr:	Thon rouge du sud	Thon rouge du sud
Sp:	Atún del sur	Atún del sur

NATIONAL.—

CAND:	Southern bluefin tuna	SPAN:	Atún del sur
FRAN:	Thon rouge du sud	TAIW:	Nan fang hay we
JAPN:	Minamimaguro	USA:	Southern bluefin tuna
KORE:	In-do-da-raeng-i		
S. AFR:	Bluefin tunny		
	Blouvin tuna		

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Fusiform body compressed and very robust in front. Short pectoral fin scarcely reaching origin of second dorsal fin. Height of second dorsal longer than that of first dorsal. Caudal keel yellow. Liver striated on ventral surface. Gill rakers 31-40.

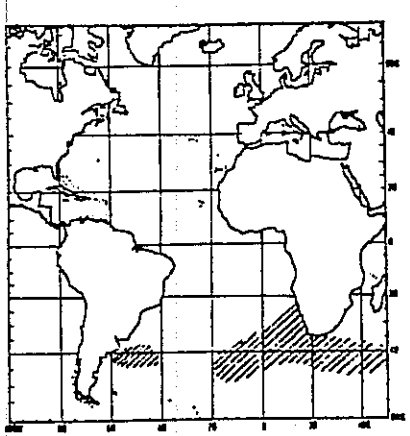
Dorsal skin dark blue. Ventral silvery gray. Young have 10 or more pale stripes on side. Fins: 1st and 2nd D. F. and A. F. yellow. Finlets: yellow edged with black.

DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Pectoral fins of southern bluefin *(Thunnus maccoyii)* slightly longer than those of bluefin *(T. thynnus thynnus)*. Fork length 4.4 to 4.6 times length of pectoral fin in southern bluefin — 4.6 to 6.0 in bluefin. Caudal keel stays yellow in southern bluefin. In bluefin, black at adult and semitransparent at immature stage.

SIZE:

Maximum: 230 cm Common: 110 to 160 cm.



GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Known only in southern hemisphere. Habitat in Atlantic limited to the West Wind Drift.

Immatures and adults appear in West Wind Drift throughout the year except during spawning season when adults gather in northwestern waters of Australia. Immatures gather in waters close to continent.

PRESENT FISHING GROUNDS:

South of South Africa. Some minor catches made off Argentina.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Catch in the Atlantic is rather minor. In most statistics catches are combined with those of (northern) bluefin tuna.

In Atlantic Ocean caught only by longline.

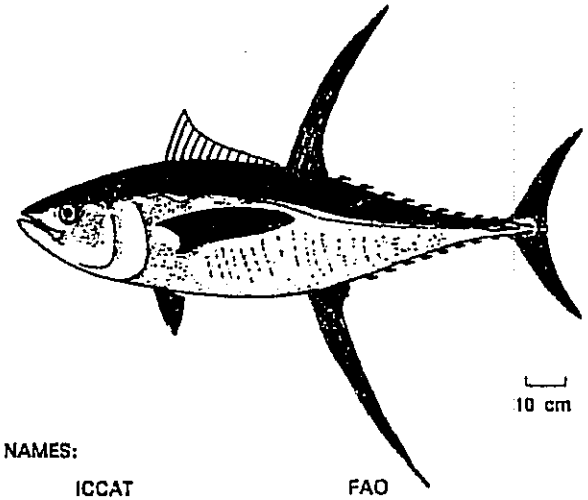
Fish generally frozen on board, taken to Japan and sold in fresh fish market for «sashimi» (sliced raw fish) consumption.

ICCAT CODE:	SBF – 2

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 3
FAMILY: Scombridae (Thunnidae) 1972

SCIENTIFIC NAME: *Thunnus albacares* (Bonnaterre)
SYNONYMS STILL IN USE: *Neothunnus macropterus*



VERNACULAR NAMES:

	ICCAT	FAO
En:	Yellowfin tuna	Yellowfin tuna
Fr:	Albacore	Albacore
Sp:	Rabil	Rabil

NATIONAL.—				
	BRAZ:	Albacora de lage	PORT:	Albacora
	CAND:	Yellowfin tuna Albacore à nageoires noire	S. AFR:	Yellowfin tunny Geelvin tuna
	FRAN:	Albacore	SPAN:	Rabil
	JAPN:	Kihada	TAIW:	Huang chi wa
	KORE:	Huang-da-raeng-i	USA:	Yellowfin tuna
	MORC:	Albacore	USSR:	Zheltoperyi tunets

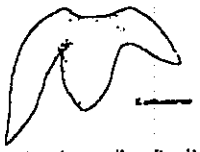
DISTINCTIVE CHARACTERS AND DIAGNOSIS:

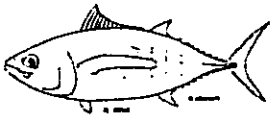
Slender fusiform body — body depth less than 25 % of fork length. Small eyes and head, longer second dorsal and anal rays than other tunas. These traits vary with size of fish and area of catch. Liver without striations on ventral surface. Gill rakers 26-35.

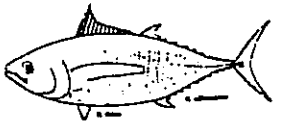
Dorsal skin dark blue —ventral silvery gray— side golden. Young (less than 120-130 cm) have chains of white spots. Fins: 1st D. F. lemon yellow — 2nd D. F. and A. F. yellow. Finlets: yellow with black edges.

DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Bigeye *(Thunnus obesus)* is often caught together with yellowfin *(T. albacares)* by surface gear. Young fish resemble each other and are often confused. White stripes on side of the body usually curve backwards toward ventral side in yellowfin, while in bigeye they normally run straight down. Stripes appear alternatively in an unbroken line and in a chain of dots in yellowfin, but, appear only as un unbroken line in bigeye. Yellowfin has more than 10 stripes, bigeye less than 8.

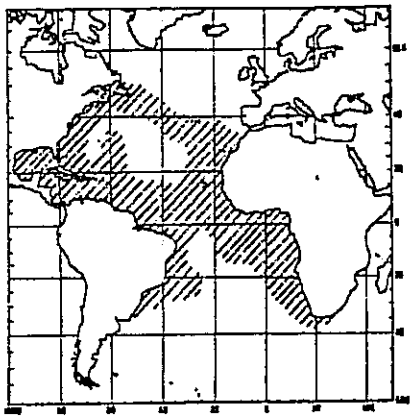






In the yellowfin liver, right lobe is longer than central lobe, and all lobes are rather pointed, while in bigeye the central lobe is the longest, with all lobes being less pointed. Liver striated in bigeye but not in yellowfin.

For 85-95 % of yellowfin specimenes, a parasite (Tristoma), 12-14 mm in diameter, pearl colored and disc type, is found in the nasal cavity. These are not found in bigeye.



SIZE:

Maximum: 190 cm.
Common: 40 to 170 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Warm water species. Abundant in tropical waters throughout Atlantic Ocean.

Young known to form large schools near surface. Often mixed with other species (skipjack or bigeye). Adults, as well as living near surface, inhabit fairly deep waters. This is the most tropical species of tunas.

PRESENT FISHING GROUNDS:

Longline catches in tropical waters across the Atlantic. Surface fisheries catch the species off Central West Africa. Also some local fisheries off Venezuela, Brazil and in the Caribbean Sea.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Catches of yellowfin in recent years range from 70 to almost 100 thousand tons per year.

Longline, purse seine and baitboat methods are the most important. Hand lines, gillnets, set nets, trolling, etc., used locally in minor quantity.

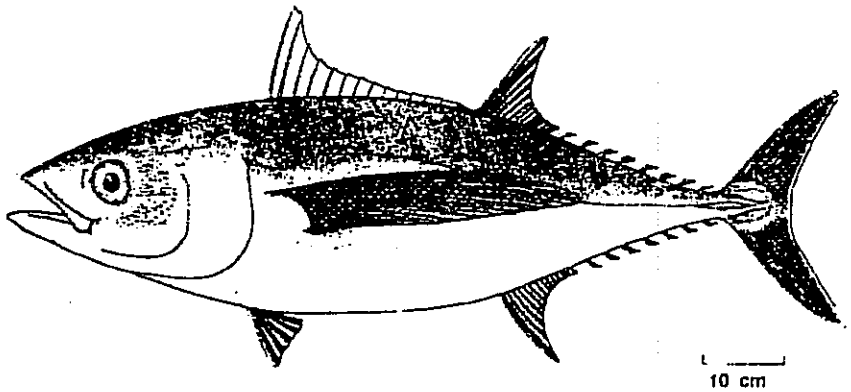
Yellowfin used mostly for making canned products.

ICCAT CODE:	YFT -- 3

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes — Sheet No. 4
FAMILY: Scombridae (Thunnidae) — 1972

SCIENTIFIC NAME: *Thunnus alalunga* (Bonnaterre)
SYNONYMS STILL IN USE: *Germo alalunga*



VERNACULAR NAMES:

	ICCAT	FAO
En:	Albacore	Albacore (Longfin white tuna)
Fr:	Germon	Germon
Sp:	Atún blanco	Atún blanco

NATIONAL.—

BRAZ:	Albacora-branca		PORT:	Voador
CAND:	Albacore		S. AFR:	Longfin tunny
	Germon atlantique			Langvin tuna
FRAN:	Germon		SPAN:	Atún blanco
GERM:	Weisser Thun			Albacora
JAPN:	Bin-naga		TAIW:	Chang chi we
KORE:	Nai-gae-da-raeng-i		USA:	Albacore
MORC:	Germon		USSR:	Dlinnokrylyi tunets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Elongated fusiform body. Caudal peduncle slender — keel on each side. Long pectoral fins reaching 2nd dorsal finlets. Caudal fin has white posterior margin in immatures and adults. Liver striated on ventral surface. Gill rakers 25-31 (in Atlantic).

Dorsal side metallic dark blue. Ventral silvery white. Fins: 1st D. F. yellow — 2nd D. F. and A. F. light yellow. Finlets: light yellow edged with black. Posterior margin of caudal fin is white.

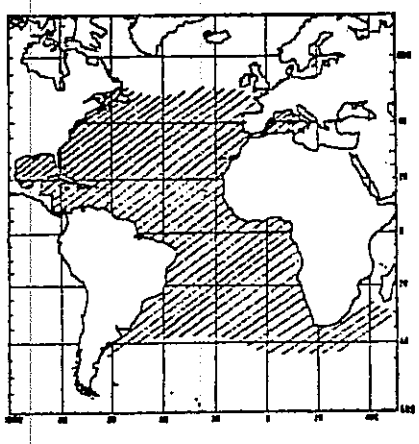
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Young (less than 30 cm) have shorter pectoral fins than similar sized yellowfin and bigeye. However albacore can be identified by lack of white vertical stripes on ventral side. Adult can be identified by its uniquely long pectoral fin.

SIZE:

Maximum: 120 cm Common: 40 to 110 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Adults (over 90 cm) appear mainly in sub-tropical or tropical waters, while immatures are found in temperate waters. They are distributed throughout the Atlantic, in the west from mid-Atlantic states of the United States to northern Argentina, and in the east from the Bay of Biscay to South Africa, continuing into the Indian Ocean.

Young are often found forming large surface schools.

PRESENT FISHING GROUNDS:

Longline catches of albacore in wide ranges around 40° N and 40° S. Surface fisheries in Bay of Biscay, off Iberian Peninsula and near the Azores. Some minor local fisheries off South Africa.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Recent annual catches about 70 to 90 thousand tons.

Longline, baitboat and trolling are most important.

Mainly used for canning in oil or brine. Also some local consumption in fresh fish markets.

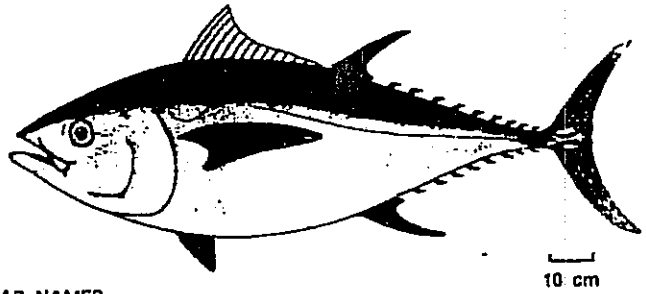
ICCAT CODE:	ALB – 4

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Scombridae (Thunnidae)

Sheet No. 5
1972

SCIENTIFIC NAME: *Thunnus obesus* (Lowe)
SYNONYMS STILL IN USE: *Parathunnus obesus*
Parathunnus sibi



VERNACULAR NAMES:

	ICCAT	FAO
En:	Bigeye tuna	Bigeye tuna
Fr:	Thon obèse	Thon obèse
Sp:	Patudo	Patudo

NATIONAL.—	BRAZ:	Albacora-bandolin	PORT:	Patudo
	CAND:	Bigeye tuna	S. AFR:	Bigeye tunny
		Thon ventru		Grootoog tuna
	FRAN:	Thon obèse	SPAN:	Patudo
	JAPN:	Mebachi	TAIW:	Tha mu we
	KORE:	Nun-da-raeng-i	USA:	Bigeye tuna
	MORC:	Thon obèse	USSR:	Bol'sheglazyi tunets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

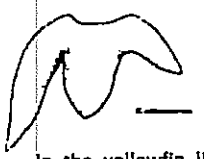
Stocky body and big eyes characterize the species. Pectoral fin in adult extends beneath second dorsal fin but not beneath second dorsal finlet. Large head. Body depth exceeds 25 % of standard fork length. Second dorsal and anal rays are relatively short. Liver striated on ventral surface. Gill rakers 25-31 (in Atlantic).

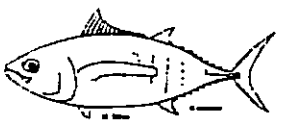
Dorsal side metallic dark blue. Ventral silvery white. Side yellowish purple. Young have greyish white spots on ventral side. Fins: 1st dorsal greyish yellow — 2nd dorsal and anal light yellow. Finlets: light yellow edged with black.

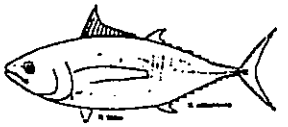
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Immature yellowfin *(Thunnus albacares)*, albacore *(T. alalunga)* and blackfin *(T. atlanticus)* have eyes of size comparable to young bigeye. *(T. obesus)*, and pectoral fins of young bigeye are as long as those of albacore of comparable size.

Also, bigeye is often caught together with yellowfin by surface gear. Young fish resemble each other and are often confused. White stripes on side of the body usually curve backwards toward the ventral side in yellowfin, while in bigeye they normally run straight down. Stripes appear alternately in an unbroken line and in a chain of dots in yellowfin, but appear only as an unbroken line in bigeye. Yellowfin has more than 10 stripes, bigeye less than 8.

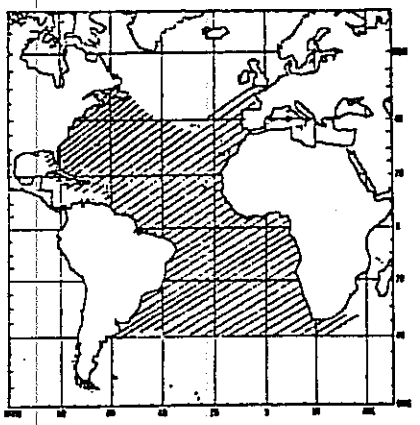






In the yellowfin liver, right lobe is longer than central lobe, and all lobes are rather pointed, while in bigeye the central lobe is the longest, with all lobes being less pointed. Liver striated in bigeye but not in yellowfin.

In nasal cavity, no parasites are found. However, the lack of parasites does not necessarily indicate bigeye.



SIZE:

Maximum: 190 cm.
Common: 40 to 170 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Widely distributed in Atlantic. This is a warm water species, often caught together with yellowfin and adult albacore in equatorial and temperate waters.

Immatures and feeding adults found in cold waters, with immature albacore. Young are taken by surface gear together with yellowfin and skipjack.

Offshore species. Sometimes young form schools, occasionally together with yellowfin and skipjack. Adults are known to be found in deep waters.

PRESENT FISHING GROUNDS:

Caught by longline across the Atlantic, from 40° N to 40° S, and by surface fisheries off northwestern coast of Africa.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Recent annual catches vary between 10 and 20 thousand tons.

Most catches are made with longline. Some minor catches are made by baitboats and purse seiners.

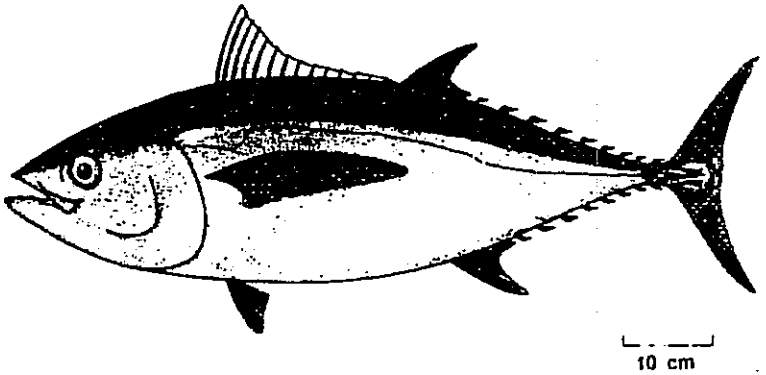
Longline catches are frozen aboard and usually taken to Japan to be sold in the fresh fish market. Some are used for making canned products.

ICCAT CODE:	BET -- 5

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes — Sheet No. 6
FAMILY: Scombridae (Thunnidae) — 1972

SCIENTIFIC NAME: *Thunnus atlanticus* (Lesson)
SYNONYMS STILL IN USE: None



VERNACULAR NAMES:

	ICCAT	FAO
En:	Blackfin tuna	None
Fr:	None	None
Sp:	None	None

NATIONAL —	BRAZ:	Albacorinha
	CAND:	Blackfin tuna
	JAPN:	Taiseiyomaguro
	KORE:	Dae-seo-yang-da-raeng-i
	S. AFR:	Blackfin tunny
		Swartvin tuna
	TAIW:	Hay chi we
	USA:	Blackfin tuna

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Fusiform body. Three keels on each side of caudal peduncles, all short. Body completely covered with small scales. Liver without striations on ventral surface.

Finlets: black to dusky yellow. Dorsal bluish-black. Ventral silvery white. Some have light stripes on side. Fin: 2nd dorsal yellow. Dorsal finlets dark bronze color — anal finlets dark gray.

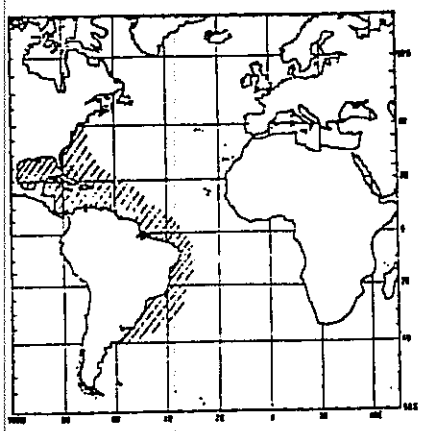
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Intermediate of bigeye *(Thunnus obesus)* and yellowfin *(T. albacares)* in body shape, but differs from these two in number of gill rakers. Gill raker count on first gill arch ranges from 19 to 25 in blackfin, while there are 25 to 31 in bigeye and 26 to 35 in yellowfin.

SIZE:

Maximum: 90 cm Common: 70 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Limited to coastal and warm waters of western Atlantic from southern Brazil northward to Bermuda, Caribbean, Gulf of Mexico and Cape Cod.

PRESENT FISHING GROUNDS:

Local fishing in the Caribbean Sea and along Brazilian coast.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Cuban fishery uses live-bait with pole-and-line. Small catches made by trolling and longline.

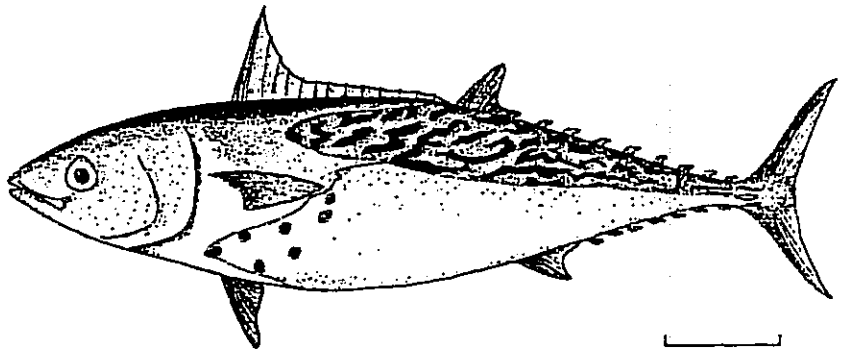
ICCAT CODE: BLF -- 6

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Scombridae

Sheet No. 7
1972

SCIENTIFIC NAME: *Euthynnus alletteratus* Rafinesque
SYNONYMS STILL IN USE: None



10 cm

VERNACULAR NAMES:

	ICCAT	FAO
En:	Atlantic little tuna	Atlantic little tuna
Fr:	Thonine	Thonine de l'Atlantique
Sp:	Bacoreta	Bacoreta del Atlántico

NATIONAL.— (BERM: Mackerel)
BRAZ: Bonito pintado
CAND: Little tunny
FRAN: Thonine (de l'Atlantique)
JAPN: Yaito
MORC: Bacorette
PORT: Merma
S. AFR: Little tunny
SPAN: Bacoreta
USA: Little tunny
USSR: Platnistyi tunets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Body naked behind anterior corselet. Pectoral fin rays 26-27.

Dark blue on dorsal part with complicated striped pattern. Silvery gray on ventral side. Several dark spots between pelvic and pectoral fins characterize the species. Gill rakers 37-43 (in skipjack 53-63).

SIZE:

Maximum: about 100 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Found in warm and tropical waters of Atlantic Ocean and Mediterranean Sea. Sporadic occurrence in the Black Sea. In the eastern Atlantic they are reported as far north as Skaggerak and as far south as South Africa. In the western Atlantic they are known to be between Cape Cod and Brazil.

Not as migratory as skipjack or other species of tunas. Usually found in coastal waters with swift currents, near shoals and isolated islands, etc.

PRESENT FISHING GROUNDS:

Near coast of southeastern United States, in the Gulf of Mexico, Caribbean S a, Mediterranean and Black Seas.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Annual catches amount to 4 to 8 thousand tons in recent years.

Fisheries are more or less coastal, using trap nets, beach seines, surrounding gillnets, small purse seines, trolling and pole-and-line.

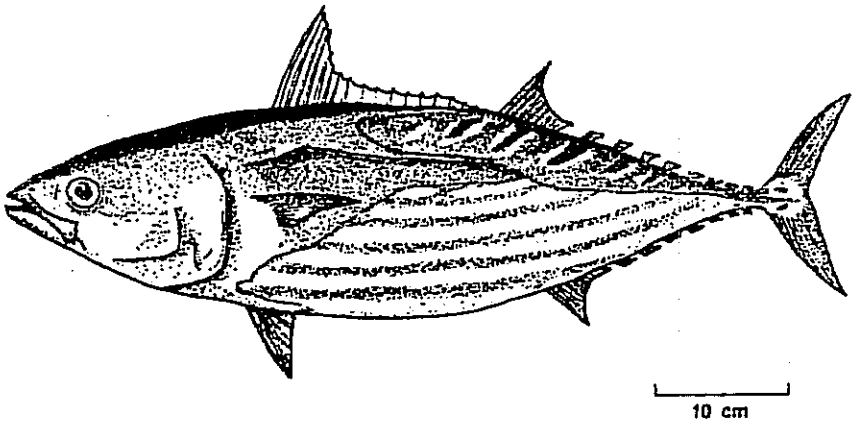
ICCAT CODE:	LTA — 7

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Scombridae

Sheet No. 8
1972

SCIENTIFIC NAME: *Katsuwonus pelamis* (Linnaeus)
SYNONYMS STILL IN USE: *Euthynnus pelamis*



VERNACULAR NAMES:

	ICCAT	FAO
En:	Skipjack	Skipjack tuna
Fr:	Bonite à ventre rayé	Bonite à ventre rayé
Sp:	Listado	Listado

NATIONAL. —				
	BRAZ:	Bonito de barriga listada	PORT:	Galado
	CAND:	Skipjack	S. AFR:	Skipjack
		Thonine à ventre rayé	SPAN:	Listado
	FRAN:	Bonite à ventre rayé	TAIW:	Theng chien
	JAPN:	Katsuo	USA:	Skipjack tuna
	KORE:	Ga-da-raeng-i	USSR:	Okeanskii bonito
	MORC:	Listao		

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

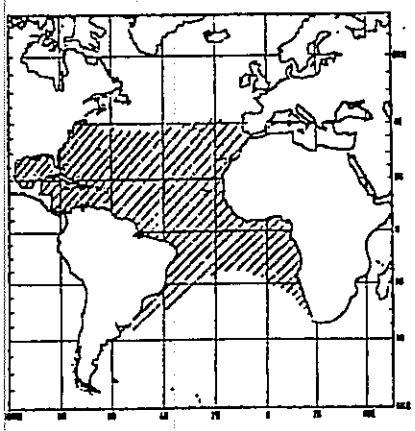
Three to five prominent dark longitudinal stripes on lower part of body. Gill rakers 53-63 on first arch. No teeth on palatines, vomer or tongue. First dorsal spines 15-16.

Dark purplish blue on dorsal side and silvery on ventral. Several dark stripes run along the body in ventral part. When dead, these appear as horizontally continuous lines, but while alive they are not continuous and do not form horizontal nor vertical lines.

SIZE:

Maximum: Occasionally exceed 90 cm Common: 40 to 70 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Found in Atlantic, in western Mediterranean, but is absent in the Black Sea.

Cosmopolitan in tropical and subtropical regions. Typical migratory species. Makes big surface schools and is oceanic.

PRESENT FISHING GROUNDS:

Caribbean Sea, off Brazil, off central western Africa from Angola to Canary Is. Sporadic catches all over the tropical and subtropical Atlantic Ocean by longliners.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Annual catches reach 80 thousand tons.

Most important gears are live-bait and purse seines operating off African coast. Some local fisheries use gillnets and hand lines.

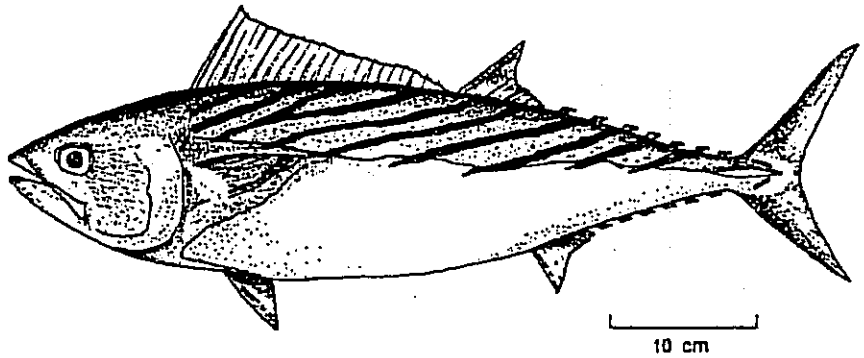
Catches are mostly used for making canned products. However, some minor quantities go to the fresh fish market.

ICCAT CODE:	SKJ – 8

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 9
FAMILY: Scombridae 1972

SCIENTIFIC NAME: *Sarda sarda* (Bloch)
SYNONYMS STILL IN USE: None



VERNACULAR NAMES:

	ICCAT	FAO
En:	Atlantic bonito	Atlantic bonito (Belted pelamid)
Fr:	Bonite à dos rayé	Bonite à dos rayé
Sp:	Bonito	Bonito

NATIONAL.—				
	BRAZ:	Sarda	MORC:	Bonite
	CAND:	Atlantic bonido	PORT:	Bonito
		Bonite à dos rayé	S. AFR:	Bonito
	FRAN:	Bonite à dos rayé		Katonke
	GERM:	Pelamide	SPAN:	Bonito
	JAPN:	Hagatsuo	USA:	Atlantic bonito
	KORE:	Dae-seo-yang-chul-sam-chi	USSR:	Pelamida

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Five to eleven longitudinal dark oblique stripes on upper part of body. First dorsal spines 20-23. Gill rakers 16-24 on first arch. No teeth on tongue. Teeth are sometimes present on vomer. Body covered with tiny scales. Caudal peduncle very slender, with well developed keel on each side at base of caudal fin. First dorsal long, nearly reaches second dorsal.

Steel-blue above, silvery below. Back and sides in adults have several dark stripes running obliquely downward and forward. Dorsal and caudals dusky. Pectoral pale. Other fins more or less silvery.

SIZE:

Maximum: 85 cm Common:

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Widely distributed in tropical and subtropical waters of Atlantic, Mediterranean and Black Seas.

Not as coastal as *Euthynnus alletteratus*, but more apt to be found in inshore than in offshore waters.

PRESENT FISHING GROUNDS:

Most important areas are Black, Marmara and Mediterranean Seas, including Aegean and Adriatic, and on both sides of Atlantic, between about 25° N and 45° S.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Annual catches reach 30-70 thousand tons.

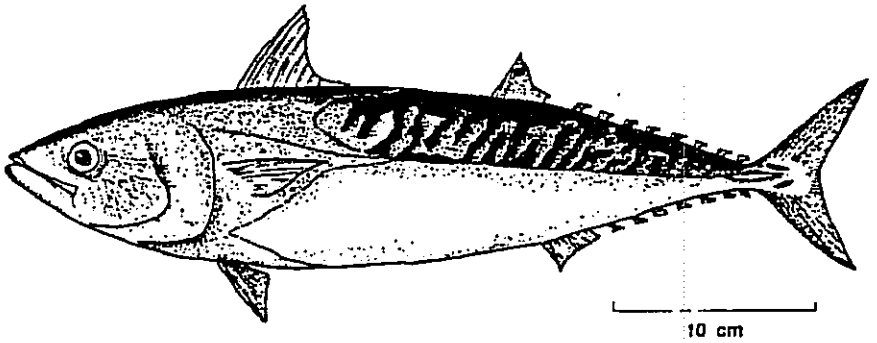
Trap nets, purse seines, ring nets, beach seines, gillnets, trammel nets and fishing lines are principal gears.

ICCAT CODE:	BON -- 9

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 10
FAMILY: Scombridae 1972

SCIENTIFIC NAME: *Auxis thazard* (Lacépède)
SYNONYMS STILL IN USE: *(Auxis rochei)*



VERNACULAR NAMES:

	ICCAT	FAO
En:	Frigate tuna	Frigate tuna
Fr:	Auxide	Auxide
Sp:	Melva	Melva

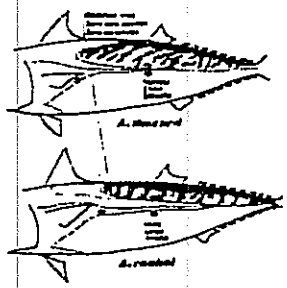
NATIONAL.—				
	BRAZ:	Bonito cachorro	PORT:	Judeu
	CAND:	Frigate tuna; Thazard	S. AFR.	Frigate tuna
	FRAN:	Auxide	SPAN:	Melva
	JAPN:	Hirasoda	TAIW:	Chien yu
	KORE:	Mul-chi-da-rae	USA:	Frigate tuna
	MORC:	Melva	USSR:	Auksida

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

First and second dorsal fins separated by a distance equal to or greater than snout length. Interpelvic process single and very large, equal to length of pelvic fins; no adipose eyelids; body scaly anteriorly, naked posteriorly; dorsal finlets 8; anal finlets 7. Corselet no more than about five scales wide under second dorsal fin origin. Pectoral fin extending posterior to beginning scaleless area above corselet.

Bluish above, very deep purple, almost black, on upper part of head; oblique dark bars and stripes on dorsal; silvery white below; several large, regular dark blotches, not sharply circumtrunk anteriorly; fins — pectoral and ventral purple, black on inner side, on outer side pectoral is paler, ventral white.

DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:



Many scientists believe that *Auxis thazard* is the same species as *Auxis rochei*. *A. thazard* is identified by its narrow corselet (no more than about five scales wide under second dorsal fin origin) compared to *A. rochei* which has wider corselet (6-20 scales). Pectoral fin of *A. thazard* extends posteriorly to beginning of scaleless area above corselet while in *A. rochei* pectoral fin does not reach beginning of scaleless area. Dark wavy line in the dorsal scaleless area usually oblique to nearly horizontal in *A. thazard* while in *A. rochei* nearly vertical. Gill rakers on lower limb of 1st arch count 31 to 36 in *A. rochei* compared to 29 to 32 in *A. thazard*.

SIZE:

Maximum: Common: 40 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Cosmopolitan species throughout tropical and sub-tropical waters of Atlantic and in Mediterranean and Black Seas. In west Atlantic, however, occurrence is reportedly more variable each year. Occurs from New England to Brazil including Caribbean Sea, Bahamas and Gulf of Mexico.

Highly migratory species with strong tendency toward schooling. Often found making schools together with other small size tunas or tuna-like species. There are contradictory observations that fish stay near surface and that they stay in mid-waters.

PRESENT FISHING GROUNDS:

Some catches are made by surface fishery off central western Africa. Local fishing along coasts of Mediterranean and Black Seas, along Iberian Peninsula, west African coast and in the Caribbean Sea.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Annual catches of this species (together with *Auxis rochei*) from entire Atlantic vary from 7 to 20 thousand tons, of which 2 to 4 thousand are taken in Mediterranean and Black Seas. Catches in western Atlantic are minor.

Bait fishing is most important, followed by purse seine fishing.

ICCAT CODE:	FRI – 10

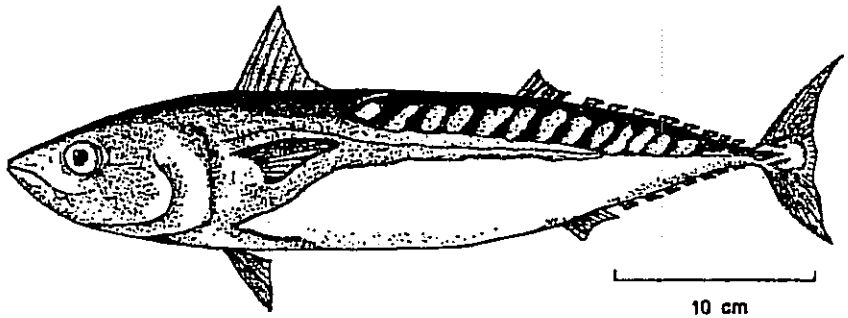
INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes — Sheet No. 11

FAMILY: Scombridae — 1972

SCIENTIFIC NAME: *Auxis rochei* (Risso)

SYNONYMS STILL IN USE: *Auxis thynnoides*
A. tapeinosoma
(A. thazard)



VERNACULAR NAMES:

	ICCAT	FAO
En:	Bullet tuna	Bullet tuna

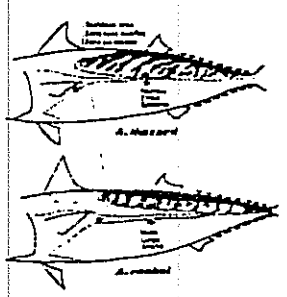
NATIONAL. — JAPN: Marusoda
USA: Bullet tuna
USSR: Skumbrievyi tunets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Round fusiform body. Caudal portion very short. Teeth on both jaws only. First and second dorsal fins separated by a distance equal to or greater than snout length. Interpelvic process single and very large, equal to length of pelvic fins; body scaly anteriorly, naked posteriorly; dorsal finlets 8; anal finlets 7. Wide corselet of scales (6-20 scales) under second dorsal fin origin.

Fresh specimen has overall bluish iridescence. Wavy bars on side above and behind corselet. Black patch at postero-ventral border of eye. Anal fins and finlets almost colorless, with white patch around base.

DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:



Many scientists believe that *Auxis rochei* is the same species as *A. thazard*. *A. thazard* is identified by its narrow corselet of scales (no more than about five scales wide under second dorsal fin origin) compared to *A. rochei* which has wider corselet (6-20 scales). Pectoral fin of *A. thazard* extends posteriorly to beginning of scaleless area above corselet while in *A. rochei* pectoral fin does not reach beginning of scaleless area. Dark wavy line in the dorsal scaleless area usually oblique to nearly horizontal in *A. thazard* while in *A. rochei* nearly vertical.

Gill rakers on lower limb of 1st arch count 31 to 36 in *A. rochei* compared to 29 to 32 in *A. thazard*.

SIZE:

Maximum: Common:

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:

Found in tropical and sub-tropical waters in Atlantic, including Mediterranean Sea.

This species makes large schools and is migratory. Often mixes with *A. thazard* in one school.

PRESENT FISHING GROUNDS:

Caught together with *A. thazard*, off central western Africa, Mediterranean and Caribbean Seas.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

In the Atlantic, *A. rochei* and *A. thazard* are caught together, and no distinction is made between them. Thus, in the total catch of frigate tuna which varies from 7 to 20 thousand tons per year, the proportion of each of the two species caught is not known.

Bait fishing and purse seining are most important.

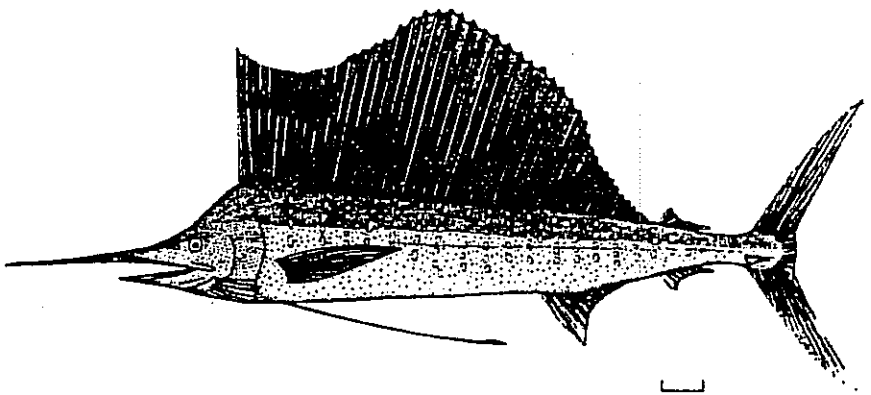
ICCAT CODE:	BLT – 30

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Istiophoridae

Sheet No. 12
1972

SCIENTIFIC NAME: *Istiophorus albicans* (Latreille)
SYNONYMS STILL IN USE: *Istiophorus americanus*
Istiophorus platypterus



10 cm

VERNACULAR NAMES:

	ICCAT	FAO
En:	Atlantic sailfish	Atlantic (American) sailfish
Fr:	Voilier	Voilier de l'Atlantique
Sp:	Pez vela	Pez vela

NATIONAL.—

BRAZ:	Agulhão vela	PORT:	Veleiro do Atlantico
CAND:	Sailfish	S. AFR:	Sailfish
FRAN:	Voilier de l'Atlantique		Seilvis
JAPN:	Nishibasho kajiki	SPAN:	Pez vela
KORE:	Dot-sae-chi	USA:	Sailfish
MORC:	Espadon	USSR:	Ryba-parusnik

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Long sail-like first dorsal fin. Compressed body and long ventral rays.
Dorsal side dark blue, body side brownish blue, ventral side silver-white. On body side more than ten rows of dots (light to cobalt blue). First dorsal fin dark blue to bluish-black, scattered with small black dots. Other fins brownish-black.

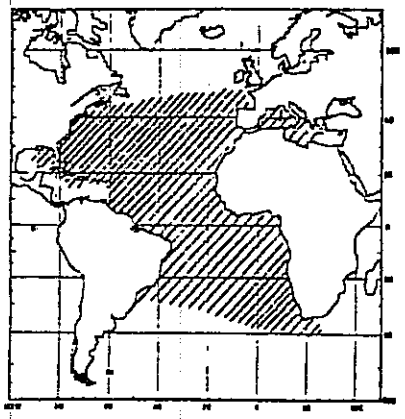
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Resembles *Istiophorus platypterus* (the species in the Indian and Pacific Oceans) in shape at adult stage. Pectoral and caudal fins of immatures (90 cm) are longer in Atlantic species. This species resembles spearfish *(Tetrapturus)*, both being of relatively small size and having compressed body, but sailfish can be identified by its high and sail-like 1st dorsal fin.

SIZE:

Maximum: 250 cm Common: 120-170 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Widely distributed throughout tropical and temperate Atlantic Ocean. More abundant in Gulf of Mexico, Caribbean Sea. Recorded from New England states. Few reports from Mediterranean.

Tagging results indicate relatively little migration. Larvae are collected in Gulf Stream region.

PRESENT FISHING GROUNDS:

Caught by longline fisheries. More abundant in the eastern Atlantic.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

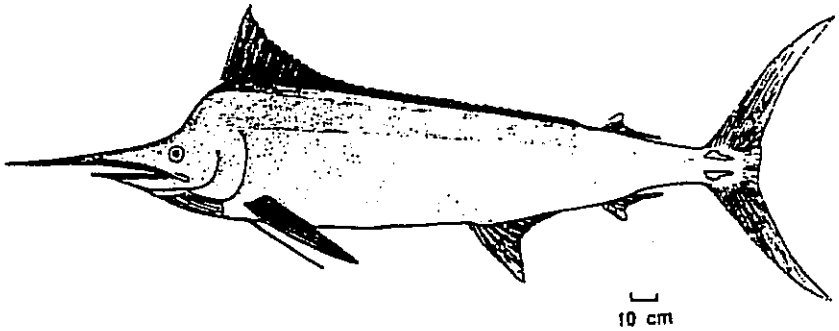
Annual catches are aproximately 1,000 tons.
Only incidental catches reported by longline fisheries.
Sold in fresh fish market and also used for making fish sausage.

ICCAT CODE:	SAI -- 15

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 13
FAMILY: Istiophoridae 1972

SCIENTIFIC NAME: *Makaira indica* (Cuvier)
SYNONYMS STILL IN USE: None



VERNACULAR NAMES:

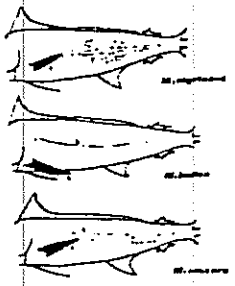
	ICCAT	FAO
En:	Black marlin	Black marlin
Fr:	Makaire noir	Makaire noir
Sp:	Aguja negra	Aguja negra

NATIONAL —				
	CAND:	Black marlin	SPAN:	Aguja negra
	FRAN:	Makaire noir	USA:	Black marlin
	JAPN:	Shirokajiki	USSR:	Sere bristyi marlin
	PORT:	Espadim negro		
	S. AFR:	Black marlin Swart marlyn		

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Most outstanding feature of this species is that pectoral fins are rigid and do not fail on lateral part of body. Ventral fins shorter than pectoral fins. Single unclear lateral line.

Dorsal side blackish-blue, ventral side silvery white. After death body turns grayish white. First dorsal fin dark blue. Others blackish-brown.



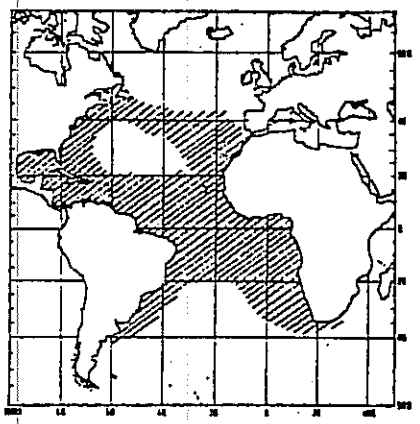
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Black marlin resembles two species of blue marlins, *Makaira nigricans* (Atlantic species) and *Makaira mazara* (Indo-Pacific species), but is easily distinguished from both by its rigid pectoral fin and its unclear single lateral line.

SIZE:

Maximum: 460 cm Common:

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



This species is rarely found in the Atlantic Ocean. If so, seems to be an occasional migrant from the Indian Ocean.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Catches are very minor.

Sporadic catches made by longliners in high seas of the Atlantic.

Sold in fresh fish market and also used for making fish sausage.

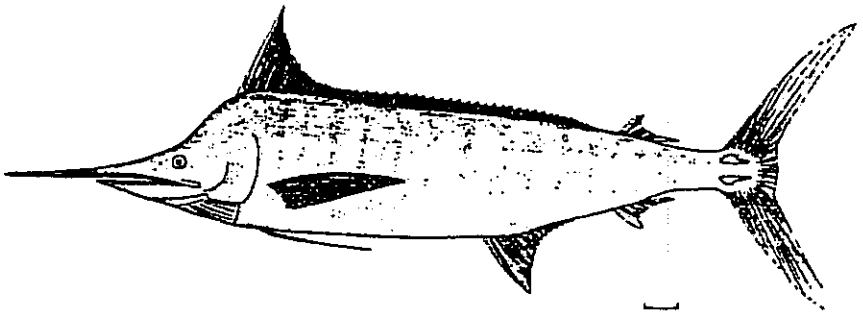
ICCAT CODE	BLM -- 161

INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Istiophoridae

Sheet No. 14
1972

SCIENTIFIC NAME: *Makaira nigricans* Lacépède
SYNONYMS STILL IN USE: None



10 cm

VERNACULAR NAMES:

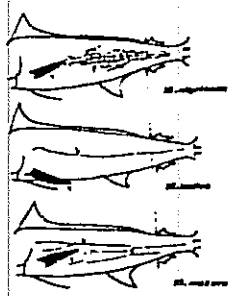
	ICCAT	FAO
En:	Atlantic blue marlin	Atlantic blue marlin
Fr:	Makaire bleu	Makaire bleu
Sp:	Aguja azul	Aguja azul

NATIONAL.—	BRAZ:	Agulhão preto	PORT:	Espadim azul do Atlantico
	CAND:	Blue marlin Makaire bleu	S. AFR:	Blue marlin Blou marlyn
	FRAN:	Makaire bleu	SPAN:	Aguja azul
	JAPN:	Nishikurokajiki	USA:	Blue marlin
	KORE:	Nog-sae-chi	USSR:	Chernyi marlin
	MORC:	Espadon		

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Lateral lines form net-like pattern. First dorsal fin low, height less than body depth. Steep front. Pectoral fin can touch body surface.

Dorsal side dark blue, ventral side silvery white. Many specimens have more than 10 rows of cobalt blue dots on side of body. First dorsal fin dark blue. Other fins blackish-brown to dark blue.



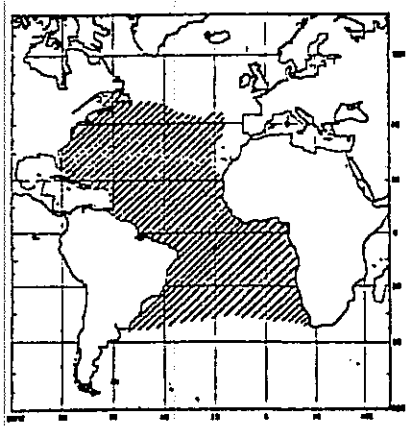
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Makaira is distinguished from other genera of *Istiophoridae* by low first dorsal fin and less compressed body. This species, its Indo-Pacific counterpart *(M. mazara)* and *M. indica* (black marlin) resemble each other. *M. nigricans* has most complicated net-like lateral lines among these three species. Also, in *M. nigricans*, as well as *M. mazara*, pectoral fin can touch body surface, while it cannot in *M. indica*.

SIZE:

Maximum: 390 cm Common: 120 to 300 cm

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Widely distributed in the Atlantic Ocean from 45° N to 35° S.

Particularly abundant in tropical waters.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Annual catches of this species, including minor quantities of *Makaira indica* in recent years, have amounted to 3 to 8 thousand tons.

Caught by longliners throughout the Atlantic Ocean.

Fish are generally frozen, sold in fresh fish market and also used for making fish sausage.

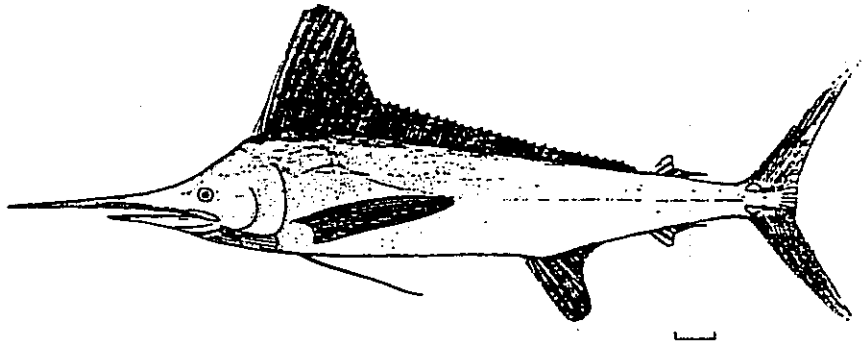
ICCAT CODE:	BUM – 17

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Istiophoridae

Sheet No. 15
1972

SCIENTIFIC NAME: *Tetrapturus albidus* Poey
SYNONYMS STILL IN USE: *Makaira albida*



VERNACULAR NAMES:

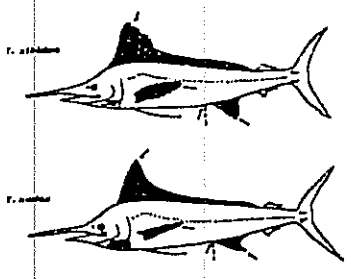
	ICCAT	FAO
En:	Atlantic white marlin	Atlantic white marlin
Fr:	Makaire blanc	Makaire blanc
Sp:	Aguja blanca	Aguja blanca

NATIONAL.—	BRAZ:	Agulhão	PORT:	Espadim branco do Atlantico
	CAND:	White marlin Makaire blanc	S. AFR:	White marlin Wit marlyn
	FRAN:	Makaire blanc	SPAN:	Aguja blanca
	JAPN:	Nishimakajiki	USA:	White marlin
	KORE:	Baeg-sae-chi	USSR:	Belyi marlin
	MORC:	Espadon		

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Body moderately compressed. First dorsal fin high anteriorly, being equal to or slightly exceeding body depth, but decreases rapidly toward posterior end. Anus located slightly anterior to first anal fin. Second anal fin just below second dorsal fin.

Dorsal side blackish-blue, body side slightly brownish silvery-white, ventral side silvery white. First dorsal fin dark blue, scattered with black dots. Other fins dark blue to dark brown.



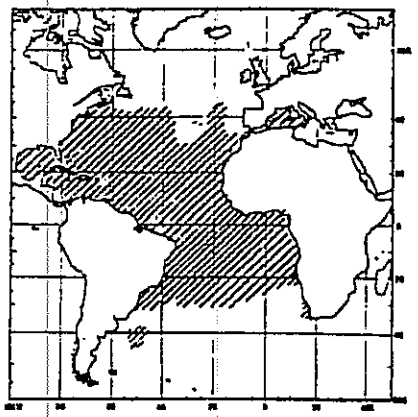
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

This species and its Indo-Pacific counterpart, *Tetrapturus audax*, differ in position of anus and in shape of first dorsal, second anal and pectoral fins. Fins are round in *T. albidus* and sharply pointed in *T. audax*.

SIZE:

Maximum: 260 cm Common: 120 to 170 cm

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Widely distributed across the Atlantic Ocean from about 45° N to 40° S.

Also found in the Mediterranean Sea.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

One to five thousand tons are caught annually.

Longliners catch this species widely across the Atlantic.

Sold in fresh fish market and also used for making fish sausage.

ICCAT CODE:	WHM – 18

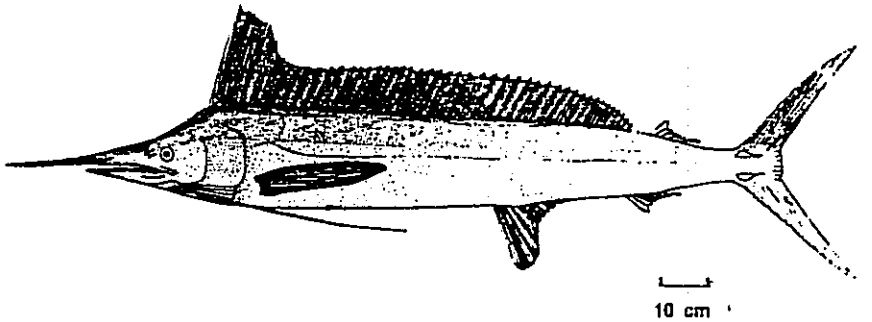
INTERNATIONAL COMMISSION FOR THE CONSERVATION OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 16

FAMILY: Istiophoridae 1972

SCIENTIFIC NAME: *Tetrapturus pfluegeri* Robins and De Sylva

SYNONYMS STILL IN USE: None



VERNACULAR NAMES:

	ICCAT	FAO
En:	Longbill spearfish	None

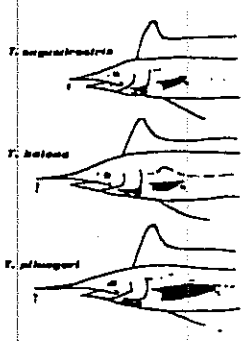
NATIONAL — JAPN: Kuchinagafurai

USA: Longbill spearfish

USSR: Malyi kop'enosets

DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Body remarkably compressed. First dorsal fin high anteriorly, being equal to or exceeding body depth. Height, although decreasing over pectoral fins, remains fairly high



over whole length of fish. Anus located fairly anterior to first anal fin. Second anal fin located anterior to second dorsal fin. Wide and long pectoral fins.

Dorsal side blackish-blue, body side slightly brownish silvery-white, ventral side silvery-white. First and second dorsal fins dark blue without dots, pectoral fin blackish-brown. First anal fin dark blue with grayish-white at base. Second anal fin blackish-brown with silvery-white at base. Tail blackish brown. Ventral fin blackish-blue.

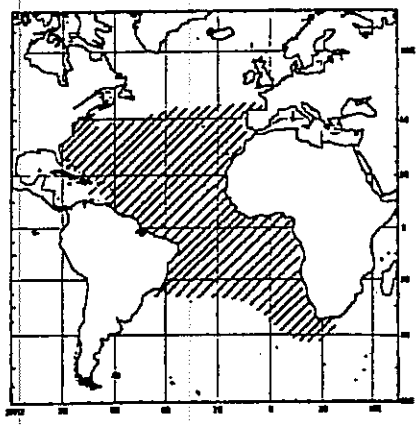
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Similar to *Tetrapturus belone* (Mediterranean spearfish) and *Tetrapturus angustirostris* (Indo-Pacific spearfish), but these two have smaller pectoral fins.

SIZE:

Maximum: 184 cm Common: 110 to 170 cm.

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Distributed widely throughout Atlantic in all tropical and subtropical waters.

This is a relatively offshore species.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Catch is minor.

Longliners catch the species from various parts of the Atlantic Ocean.

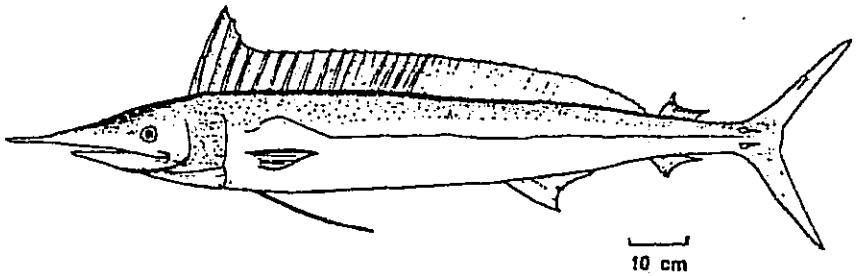
Sold in fresh fish market and also used for making fish sausage.

ICCAT CODE:	SPF -- 20

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes Sheet No. 17
FAMILY: Istiophoridae 1972

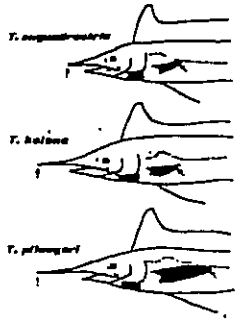
SCIENTIFIC NAME: *Tetrapturus belone* Rafinesque
SYNONYMS STILL IN USE: None



VERNACULAR NAME:

	ICCAT	FAO
En:	Mediterranean spearfish	None

NATIONAL.—JAPN: Chichukaifural
PORT: Espadim agula
USA: Mediterranean spearfish
USSR: Kop'anosets



DISTINCTIVE CHARACTERS AND DIAGNOSIS:

Body remarkably compressed. Adults have medium height dorsal fin slightly exceeding body depth.

Dorsal side bluish-gray, ventral white to gray (preserved specimens).

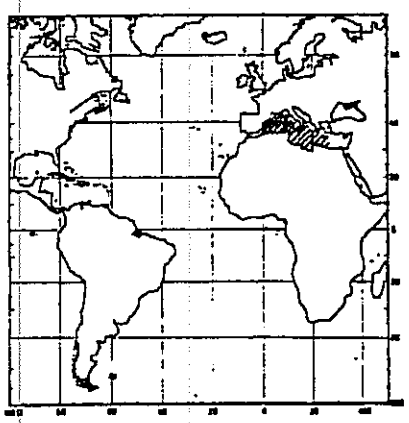
DISTINCTION FROM MOST SIMILAR SPECIES OCCURRING IN THE AREA:

Mediterranean spearfish distinguished from Atlantic spearfish by smaller pectoral fins, 10-13 % of fork length. Bill is longer than in Indo-Pacific species (*Tetrapturus angustirostris*).

SIZE:

Maximum: 188 cm Common:

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Reported only in Mediterranean Sea. Abundant in Messina Strait. No report from the Black or Aegean Seas.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Sporadic catches are recorded, but no commercial fisheries exist.

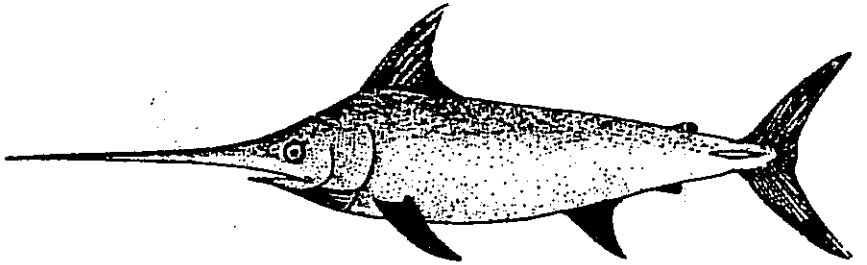
ICCAT CODE:	MSP – 32

INTERNATIONAL COMMISSION
FOR THE CONSERVATION
OF ATLANTIC TUNAS

ORDER: Scombriformes
FAMILY: Xiphiidae

Sheet No. 18
1972

SCIENTIFIC NAME: *Xiphias gladius* Linnaeus
SYNONYMS STILL IN USE: None

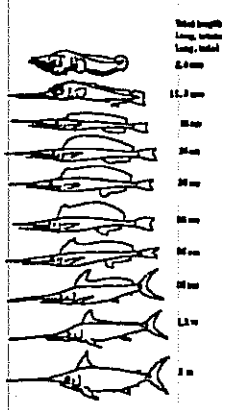


10 cm

VERNACULAR NAMES:

	ICCAT	FAO
En:	Broadbill swordfish	Broadbill swordfish
Fr:	Espadon	Espadon
Sp:	Pez espada	Pez espada

NATIONAL. —				
	BRAZ:	Espadarte	PORT:	Espadarte
	CAND:	Swordfish	S. AFR:	Swordfish
		Espadon		Swaardvis
	FRAN:	Espadon	SPAN:	Pez espada
	JAPN:	Mekajiki	TAIW:	Chien chi yu
	KORE:	Hwang-sae-chi	USA:	Swordfish
	MORC:	Espadon	USSR:	Mechenos



DISTINCTIVE CHARACTERS AND DIAGNOSIS:

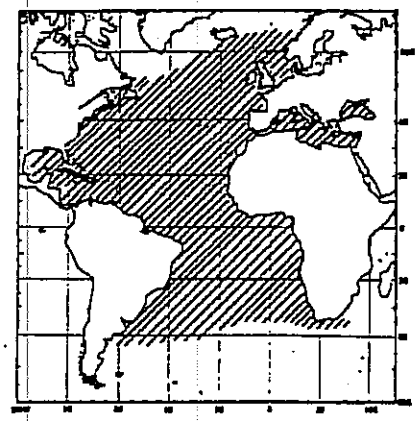
In adults, round body, flat and long bill, single caudal keel, small and separated dorsal fins, absence of teeth, scales and ventral fins. At younger stage (in specimens of about 1 m fork-length) teeth and scales may exist and shape of dorsal fins may vary with body size. See figure on morphological changes by growth.

Dorsal side brownish-black. Ventral side light brown. Fins: first dorsal dark brown — others from brown to dark brown.

SIZE:

Maximum: 450 cm Common: 100 to 220 cm

GEOGRAPHICAL DISTRIBUTION AND BEHAVIOR:



Widely distributed throughout the Atlantic from Iceland and North Sea to 45°S. Also found in Mediterranean and Black Seas and Sea of Marmara.

Found in coastal waters as well as offshore. Very aggressive nature.

PRESENT FISHING GROUNDS:

This species is fished all over the Atlantic. Longline fishing exists in high seas as well as along the east coast of North America (this has been terminated in recent years), off Central America and Brazil and in the Mediterranean Sea. Spear fishing as well as trolling is conducted off northern Europe and off the coasts of the Americas.

CATCHES, MAIN FISHING GEAR AND PRINCIPAL FORMS OF UTILIZATION:

Ten to fifteen thousand tons are caught annually, including in the Mediterranean Sea.

Most important gear is longline (horizontal and vertical lines). Spears are commonly used. Sport fishermen use fishing tackles for trolling.

Fish are generally sold as swordfish steak (fresh or frozen).

ICCAT CODE:	SWO – 19

7.3 Species identification of billfish carcasses

Port samplers often have great difficulties in identifying billfish species because in most cases they are by-catches to the fisheries. Therefore, the billfish species are often mixed and most of them are dressed in a way that keys to identifying the fish are lost. Another difficulty is that many coastal researchers and technicians are not very familiar with billfish as tuna.

7.3.1 Whole fish or dressed carcasses with fins on

Most billfish landed with recreational gear will be whole. In addition, some of the billfish landed by small longline operations will be landed dressed but with fins and spines on.

Figure 5 gives some of the major external characteristics that can be used to identify billfish that are landed whole or dressed carcasses that still have all fins intact, as follows:

i) Swordfish (*Xiphias gladius*) – The only billfish with one caudal keel (all the rest have two keels), rigid dorsal fin extends only a short length down the body, and no pelvic fins (family Xiphiidae);

ii) Sailfish (*Istiophorus platypterus*) – All of dorsal fin high, with many spots, the only billfish with long pelvic fins that extend at least 2/3 to 3/4 the length of the body toward the anal opening, single lateral line, long slender body, (family Istiophoridae);

iii) Blue marlin (*Makaira nigricans*) – Dorsal, pectoral, and anal fins all have pointed lobes, short pelvic fin extends no longer than length of pectoral fin, reticulated (chain-like) lateral line extends over entire body surface, the heaviest bodied of the billfishes, (family Istiophoridae);

iv) White marlin (*Tetrapturus albidus*) – Dorsal, pectoral, and anal fins all have rounded lobes, dorsal fin with small dark spots, short pelvic fin extends no longer than length of pectoral fin, single lateral line, long slender body (family Istiophoridae);

v) Spearfish (*Tetrapturus spp.*) – Most of dorsal moderately high over its entire length with no spots and dorsal lobe slightly pointed and truncated, pelvic fin extends slightly past length of pectoral fin, pectoral fins generally wide and long, slender body, anus far in front of anal fin origin, smallest maximum size of the billfishes, (family Istiophoridae).

Spearfish are the rarest of all the billfishes. However, the most common spearfish in the Atlantic Ocean is *Tetrapturus pfluegeri*–the longbill spearfish. In addition, the Mediterranean spearfish (*Tetrapturus belone*) may be found in some transshipment ports of the eastern Atlantic Ocean, although these were probably caught in the Mediterranean Sea.

The occurrence of black marlin (*Makaira indica*) in the Atlantic Ocean seems to be very rare and is generally restricted to the extreme southeastern section off southwest Africa. This makes landings of black marlin in the Atlantic negligible. The pectoral fins of black marlin are rigid and this characteristic can be used to distinguish it from blue marlin.

7.3.2 Dressed Billfish with Fins, Spines, and Heads Removed

Most of the billfish caught on the larger longline vessels (100 MT or greater) equipped air blast freezers, are dressed at sea and off-loaded frozen without heads and intestines and all fins and spines removed. Billfish dressed and held in this manner make identification of species particularly difficult for port samplers. The ability to identify different species of longline-caught billfish will depend on the dressing method used and the extent to which the fins and spines critical to identification (presented in previous section) are removed. The following criteria can be used as temporary characteristics to identify dressed billfish carcasses (i.e., headless, gutless, and finless):

i) Swordfish –Dressed weight can exceed 70 kg, dorsal fin scar does not extend past mid-body, only one caudal keel, no pelvic fin scar or ventral groove for pelvic fin, single lateral line not easily seen on frozen carcasses;

ii) Blue marlin –Dressed weight can exceed 70 kg, has two caudal keels, a pelvic fin scar and ventral groove. Lateral line is highly reticulated (chain-like) and not easily seen on frozen carcasses but will show up as surface thaws or frosts;

iii) White marlin –Maximum size is less than 70 kg dressed weight, has two caudal keels, a pelvic scar and ventral groove. Single lateral line is easily seen on frozen carcasses, and connective tissue on belly thinner compared to sailfish so sharp scales can be felt easily and the general texture of the skin is rough when running finger from anus up towards head;

iv) Sailfish –Maximum size is less than 60 kg dressed weight, has two caudal keels, a pelvic fin scar and ventral groove. Single lateral line is easily seen on frozen carcasses, and connective tissue on belly thicker compared to white marlin so sharp scales cannot be felt easily and texture of skin comparatively smooth when running finger from anus up towards head;

v) Spearfish – Maximum size is less than 30 kg dressed weight, has two caudal keels, a pelvic scar and ventral groove, and anal opening far in front of anal fin. Single lateral line is easily seen on frozen carcasses, body shape very slender compared to rest of billfishes.

Carcass weight can also be used as one element for the identification.

Single caudal keel ..... Swordfish

Double caudal keels:

Over 70 kg. ..... Blue marlin

60 and 70 kg. ..... Blue or White marlin

Below 60 kg:

Highly reticulated lateral line that covers the entire body. (This might be identified by pouring a little water in the area of the lateral line of a frozen carcass and then removing the scales in this area ..... Blue marlin

Connective tissue on belly thicker compared to white marlin. (If for some reason the pelvic fins are left intact, they reach almost to the anus ..... Sailfish

Connective tissue on belly thinner compared to sailfish (If pelvic fin left, short) ..... White marlin

Smaller and very thin and whip-like body..... Spearfish

Chapter 8. LIST OF STANDARD AND COMMON NAMES OF TUNAS AND TUNA-LIKE SPECIES.

8.1 ICCAT Species codes, scientific names and standard names.

The ICCAT species codes, scientific names and standard names in three official languages are given in the following table. In the second table, also given are those used by FAO.

ICCAT

		ICCAT STANDARD NAMES CODE SCIENTIFIC NAMES		
		ENGLISH	FRENCH	SPANISH
BFT	Thunnus thynnus thynnus	Bluefin tuna	Thon rouge	Atún
SBF	Thunnus maccoyii	Southern bluefin tuna	Thon rouge du sud	Atún del sur
YFT	Thunnus albacares	Yellowfin tuna	Albacore	Rabil
ALB	Thunnus alalunga	Albacore	Germon	Atún blanco
BET	Thunnus obesus	Bigeye tuna	Thon obèse	Patudo
BLF	Thunnus atlanticus	Blackfin tuna	Thon à nageoires noires	Atún aleta negra
LTA	Euthynnus alletteratus	Atlantic black skipjack*	Thonine	Bacoreta
SKJ	Katsuwonus pelamis	(Oceanic) Skipjack	Listao	Listado
BON	Sarda sarda	Atlantic bonito	Bonite à dos rayé	Bonito
FRI	Auxis thazard	Frigate tuna	Auxide	Melva
BLT	Auxis rochei	Bullet tuna	Auxide	Melva
BOP	Orcynopsis unicolor	Plain bonito	Palometta	Tasarte
WAH	Acanthocybium solandri	Wahoo	Thazard bâtard	Peto
SSM	Scomberomorus maculatus	Spotted Spanish mackerel	Maquereau espagnol	Carita
KGM	Scomberomorus cavalla	King mackerel	Thazard	Carita lucio
MAW	Scomberomorus tritor	West African Spanish mackerel	Thazard blanc	Carita oeste africano
BRS	Scomberomorus brasiliensis	Serra Spanish mackerel	Thazard serra	Serra
CKR	Scomberomorus regalis	Cero	Thazard franc	Carita chinigua
SAI	Istiophorus albicans	Atlantic sailfish	Voilier	Pez vela
BLM	Makaira indica	Black marlin	Makaire noir	Aguja negra
BUM	Makaira nigricans	Atlantic blue marlin	Makaire bleu	Aguja azul
WHM	Tetrapturus albidus	Atlantic white marlin	Makaire blanc	Aguja blanca
SWO	Xiphias gladius	Broadbill swordfish	Espadon	Pez espada
SPF	Tetrapturus pfluegeri	Spearfish		

* Previously called "Atlantic little tuna".

FAO

		FAO STANDARD NAMES		
CODE	SCIENTIFIC NAMES	ENGLISH	FRENCH	SPANISH
BFT	Thunnus thynnus thynnus	Northern bluefin tuna	Thon rouge du nord	Atún
SBF	Thunnus maccoyii	Southern bluefin tuna	Thon rouge du sud	Atún del sur
YFT	Thunnus albacares	Yellowfin tuna	Albacore	Rabil
ALB	Thunnus alalunga	Albacore	Germon	Atún blanco
BET	Thunnus obesus	Bigeye tuna	Thon obèse	Patudo
BLF	Thunnus atlanticus	Blackfin tuna	Thon à nageoires noires	Atún al negra
LTA	Euthynnus alletteratus	Atlantic black skipjack*	Thonine commune	Bacoreta
SKJ	Katsuwonus pelamis	Skipjack tuna	Listao	Listado
BON	Sarda sarda	Atlantic bonito	Bonite à dos rayé	Bonito atlántico
FRI	Auxis thazard	Frigate tuna	Auxide	Melva
BLT	Auxis rochei	Bullet tuna	Bonitou	Melvera
BOP	Orcynopsis unicolor	Plain bonito	Palometta	Tasarte
WAH	Acanthocybium solandri	Wahoo	Thazard bâtard	Peto
SSM	Scomberomorus maculatus	Atlantic Spanish mackerel	Thazard atlantique	Carita atlántico
KGM	Scomberomorus cavalla	King mackerel	Thazard barré	Carita lucio
MAW	Scomberomorus tritor	West African Spanish mackerel	Thazard blanc	Carita Ibeitánico
BRS	Scomberomorus brasiliensis	Serra Spanish mackerel	Thazard serra	Serra
CKR	Scomberomorus regalis	Cero	Thazard franc	Carita chinigua
SAI	Istiophorus albicans	Atlantic sailfish	Voilier de l'Atlantique	Pez vela del Atlántico
BLM	Makaira indica	Black marlin	Makaire noir	Aguja negra
BUM	Makaira nigricans	Atlantic blue marlin	Makaire bleu de l'Atlantique	Aguja azul del Atlántico
WHM	Tetrapturus albidus	Atlantic white marlin	Makaire blanc de l'Atlantique	Aguja blanca del Atlántico
SWO	Xiphias gladius	Swordfish	Espadon	Pez espada
SPF	Tetrapturus pfluegeri	Longbill spearfish	Makaire bécune	Aguja picuda

* Previously called "little tunny".

8.2 Vernacular names by various countries

The ICCAT conducted surveys of vernacular names of tuna and tuna-like fish used by various countries. These vernacular names for the countries which responded to our surveys are listed by countries. The list is not exhaustive, as many countries have not responded to the survey (including ICCAT member countries), or there may be many more local names which are not included by the reporters. The left column shows ICCAT species codes (see 8.1 for scienitific names) and the right column lists the vernacular names. Those with (*) are national standard names.

BARBADOS

YFT	Albacore
BET	Albacore
BLF	Bonita
SKJ	Bonita
FRI	Bonita
WAH	Kingfish
KGM	Kingfish
SAI	Billfish
BUM	Billfish
WHM	Billfish

BENIN (Popo)

BFT	Kpokú, Kpokúkpokú, Guégou
YFT	Gégú*, Guégou
ALB	Gégú*, Guégou
BET	Gégú*, Guégou
LTA	Kpokúkpokú, Kpokou
SKJ	Kpokú-xwinò*, Kpokúhuinon, Kpokou-Houinon
BON	Kpokúkpokú
FRI	Gégú
BLT	Gégú
BOP	Zadù*, Zadou, Gbammadoui
WAH	Togbògbanmadwi*, Togbogbammadoui, Togbo-Zadou
SSM	Gbanmad-wí, Zadou, Gbammadoui
KGM	Gbanmad-wí
MAW	Gbanmad-wí*, Zadù
BRS	Gbanmad-wí
CER	Gbanmad-wí
SAI	Ajètè-àbádanò*, Ajètè-abadanon
BUM	Ajètè, Adjètè
WHM	Ajètè, Adjètè
SWO	Ajètè, Adjètè
SPF	Ajètè, Adjètè

BRAZIL

BFT	Atum*, Albacora azul, Atum azul
YFT	Albacora de lage*, Atum, Albacora
ALB	Albacore branca*, Atum, Albacora
BET	Albacora bandolim*, Atum, Albacora
BLF	Albacorinha
LTA	Bonito Pintado*, Bonito
SKJ	Bonito de barriga listada*, Bonito rajado, Gaiado
BON	Sarda*, Serra, Serrinha, Bonito
FRI	Bonito cachorro, Bonito banana
WAH	Cavala empige
KGM	Cavala verdad eira, Cavala sardinheira, Cavala
BRS	Serra*, Sororoca, Serra pima
SAI	Agulhao-vela
BUM	Agulhao-negro
WHM	Agulhao-branco, Agulhao prata
SWO	Espadarte*, Meca
SPF	Agulhao-estilete

CANADA

BFT	Bluefin tuna*, Bluefin, Albacore (large fish only), Horse mackerel (large fish only), Tunny, Tuna, Blackfish, Thon rouge*
SBF	Southern bluefin tuna
YFT	Yellowfin tuna*, Yellowfin, Allison's tuna, Yellowfin albacore, Albacore à nageoires jaunes*, Autumn albacore
ALB	Albacore*, Atlantic albacore, Longfin tuna, Longfinned albacore, Longfin, Germon atlantique*
BET	Bigeye tuna*, Bigeye, Thon ventru*
BLF	Blackfin tuna*, Bermuda tuna, Bigeye tuna, Atlantic blackfin tuna
LTA	Little tunny*, Little tuna, False albacore
SKJ	Skipjack*, Skipjack tuna, Oceanic bonito, Striped bonito, Thonine à ventre rayé*
BON	Atlantic bonito*, Bonito, Common bonito, Skipjack, Bonite à dos rayé*
FRI	Frigate tuna*, Frigate mackerel, Thazard*
WAH	Wahoo
SSM	Spanish mackerel
KGM	King mackerel, Cavalla
CER	Cero
SAI	Sailfish

BLM	Black marlin
BUM	Blue marlin, Makaire bleu
WHM	White marlin, Makaire blanc
SWO	Swordfish*, Broadbill, Broadbill swordfish, Espadon*

CAPE VERDE

YFT	Albacore*, Rabo seco, Chefarote (small fish)
BET	Patudo, Cala*, Chefarote (small fish)
LTA	Merma
SKJ	Gaiado
FRI	Judeu
WAH	Ilher, Serra*

COTE D'IVOIRE

YFT	Albacore
ALB	Germon
BET	Patudo
LTA	Rabil
SKJ	Listao
FRI	Ravil
BLT	Ravil
WAH	Thon brochet
SSM	Maquereau bonite
KGM	Maquereau bonite
MAW	Maquereau bonite
SAI	Voilier
BUM	Espadon
WHM	Espadon
SWO	Espadon

CUBA

BFT	Magró
YFT	Atún aleta amarilla
ALB	Albacora
BET	Atún ojo grande

BLF	Albacora*, Falsa albacora
LTA	Comeviveres
SKJ	Bonito listado
BON	Bonito
FRI	Melva
BLT	Melva
BOP	Bonito
WAH	Peto
SSM	Serrucho
KGM	Sierra
BRS	Serrucho
CER	Pintada
SAI	Aguja
BLM	Aguja negra
BUM	Castero
WHM	Aguja blanca
SWO	Emperador
SPF	Aguja

DENMARK

BFT	Tunfisk

ESPAÑA

BFT	Atún*, Atún rojo, Cimarrón, Zurdo, Atuarro, Cachorreta, Atunillo, Toyina
SBF	Atún del sur
YFT	Rabil*, Janco, Atún, Yellowfin, Atún aleta amarilla
ALB	Atún blanco*, Albacora, Ojón, Bonito (del norte), Barrilete
BET	Patudo*, Zapatero, Atún, Ojo grande, Monja, Bonita, Ojón
LTA	Bacoreta*, Sarda, Albacoreta
SKJ	Listado*, Skipjack, Atún de altura, Alistado
BON	Bonito*, Bonito del sur
FRI	Melva*, Canutero
BLT	Melva*, Canutero
BOP	Tasarte
WAH	Peto
SSM	Carita*, Caballa moruna
KGM	Carita*, Caballa moruna

CER Carita*, Caballa moruna
SAI Pez vela
BLM Aguja negra
BUM Aguja azul
WHM Aguja blanca*, Saltón
SWO Pez espada*, Aguja pala, Emperador
SPF Saltón

ESPAÑA (CANARIAS)

BFT Patudo
YFT Rabil
ALB Barrilote
BET Tuna
SKJ Listado
WAH Peto
SWO Picudo, Aguja paladar

FINLAND

BFT Tonnikala

FRANCE

BFT Thon rouge
SBF Thon rouge du sud
YFT Albacore*, Thon à nageoires jaunes
ALB Germon*, Thon blanc
BET Thon obèse*, Patudo
BLF Thon à nageoires noires
LTA Thonine*, Thonine de l'Atantique, Ravil
SKJ Bonite à ventre rayé*, Listao
BON Bonite à dos rayé*, Bonite, Pelamide
FRI Auxide*, Auxis, Melva
BLT Bonitou*, Auxide
BOP Palomette
WAH Thazard*, Thazard bâtard
SSM Thazard atlantique, Thazard tacheté
KGM Thazard, Thazard serra, Thazard barré

MAW Thazard blanc
BRS Thazard tacheté du sud
CER Thazard*, Thazard franc
SAI Voilier*, Voilier de l'Atlantique
BLM Makaire noir, Marlin noir
BUM Makaire bleu, Marlin bleu
WHM Makaire blanc
SWO Espadon, Poisson épée
SPF Makaire bécune

GERMANY

BFT Thunfisch*, Roter Thun
SBF Thunfisch*, Sudliche Roter Thun
YFT Thunfisch*, Gelbflossenthun
ALB Thunfisch*, Weisser Thun
BET Thunfisch*, GroBaugenthun
BLF Thunfisch*, Schwarzflossenthun
LTA Falscher bonito, Thonine
SKJ Echter Bonito .
BON Pelamide
FRI Fregattmakrele
BLT Fregattmakrele
BOP Ungestreifter Pelamide
WAH Peto, Wahoo
SSM Atlantische Konigsmakrele
KGM Echte Konigsmakrele
MAW Westafrikanische Konigsmakrele
BRS Serra, Brasilianische Konigsmakrele
CER Cero, Karibische Konigsmakrele
SAI Segelfisch, Facherfisch
BLM Schwarzer Marlin
BUM Blauer Marlin
WHM Weisser Marlin
SWO Schwertfisch
SPF Speerfisch, Langschnabliger

GREECE

BFT	Tónnos, Orkinos
ALB	Tónnos macry'pteros, Tounnaki
LTA	Karvoúni, Tounnida, Lentiki
SKJ	Lacérda, Palamída
BON	Palamída, Riki
FRI	Kopáni, Kopanáki
BOP	Kopáni
SWO	Xiphias, Xiphíos

GRENADA

BFT	Guégou
YFT	Guégou
BET	Guégou
LTA	Pkokou, Kpokou-Kpokou
SKJ	Kpokou-Houinon
BON	Kpopou-Kpokou
FRI	Kpopou-Kpokou
BOP	Zadou, Gbammadoui
WAH	Togbo-Zadou
SSM	Zadou, Gbammadoui
MAW	Zadou, Gbammadoui
SAI	Adjètè-Abadanon
BUM	Adjètè
SWO	Adjètè

ICELAND

BFT	Túnfiskur

ITALY

BFT	Tonno*, tonno rosso
ALB	Tonno*, Alalunga
LTA	Tonnetto*, Alletterato
BON	Tonnetto*, Palamita
FRI	Biso*, Tombarello
BLT	Biso*, tombarello
WHM	Aguglia imperiale
SWO	Pesce spada

JAPAN

BFT	クロマグロ (Kuromaguro)*, マグロ (Maguro), ホンマグロ (Honmaguro), Young- メジ (Meji), ヨコワ (Yokowa)
SBF	ミナミマグロ (Minamimaguro)
YFT	キハダ (Kihada)*, キワダ (Kiwada), Young- キメジ (Kimeji)
ALB	ビンナガ (Bin-naga)*, ビンチョウ (Binchô), トンボ (Tonbo)
BET	メバチ (Mebachi)*, バチ (Bachi); Young- ダルマ (Daruma)
BLF	タイセイヨウマグロ (Taiseiyômaguro)*, ミニマグロ (Minimaguro)
LTA	ヤイト (Yaito)
SKJ	カツオ (Katsuo)*, ホンガツオ (Hongatsuo)
BON	ハガツオ (Hagatsuo)*, キツネガツオ (Kitsunegatsuo)
FRI	ヒラソーダ (Hirasôda)*, ソーダガツオ (Sôdagatsuo)
BLT	マルソーダ (Marusôda)*, メジカ (Mejika)
WAH	カマスサワラ (Kamasusawara)
SAI	ニシバショウカジキ (Nishibashôkajiki)*, バショウ (Bashô)
BLM	シロカジキ (Shirokajiki)*, シロカワ (Shirokawa)
BUM	ニシクロカジキ (Nishikurokajiki)*, クロカワ (Kurokawa)
WHM	ニシマカジキ (Nishimakajiki)*, マカジキ (Makajiki)
SWO	メカジキ (Mekajiki)*, メカ (Meka)
SPF	クチナガフウライ (Kuchinagafurai),
MSP	チチュウカイフウライ (Chichukaifurai)

KOREA

BFT	참다랭이 (Cham-da-raeng-i),* 다랭이 (Da-raeng-i)
	다랑어 (Da-rang-eo), 참치 (Cham-chi)
SBF	인도다랭이 (In-do-da-raeng-i) *
YFT	황다랭이 (Huang-da-raeng-i) *
ALB	날개다랭이 (Nal-gae-da-raeng-i) **
BET	눈다랭이 (Nun-da-raeng-i) **
BLF	대서양다랭이 (Dae-seo-yang-da-raeng-i) **
SKJ	가다랭이 (Ga-da-raeng-i) * 가다리 (Ga-da-ri) 어다랭이 (Yeo-da-raeng-i)
	강고등어 (Gang-go-deung-so) 소룡치 (So-young-chi)
	목만중이 (Mog-maen-dung-i) 다랭이 (Da-raeng-i)
BON	대서양줄삼치 (Dae-seo-yang-chul-sam-chi)
FRI	물치다래 (Mul-chi-da-rae) * 물치 (Mul-chi)
	무대다랭이 (Mu-tae-da-raeng-i) 목만중이 (Mog-man-dung-i)
WAH	꼬치삼치 (Ggo-chi-xam-chi)
SAI	돗새치 (Dot-sae-chi)
BUM	녹새치 (Nog-sae-chi)
WHM	백새치 (Baeg-sae-chi)
SWO	황새치 (Hwang-sae-chi)

MAROC

BFT	Thon rouge
YFT	Albacore*, Thon à nageoires jaunes, Thon tropical
ALB	Germon
BET	Patudo*, Thon obèse, Gros yeux
LTA	Bacorette*, Thonine de l'Atlantique, Bonite
SKJ	Listao
BON	Bonite*, Sarda, Bonite sarda (sarda)
FRI	Melva
BOP	Palomette
SAI	Espadon
BUM	Espadon
WHM	Espadon
SWO	Espadon

NETHERLANDS

BFT	Tonijin

NETHERLAND ANTILLES (PAPIAMENTO)

BFT	Buni fluitdo
YFT	Buni halfash
ALB	Buni habrikos
BET	Buni wowo di baka, Buni fluitdo
BLF	Buni pretu
LTA	Buni
SKJ	Buni karèt, Buni porko
FRI	Buni masbangu
BLT	Buni masbangu
WAH	Mula
SSM	Pishishé
KGM	Pishishé, Konévis (koningsvis)
BRS	Pishishé
CER	Pishishé
SAI	Balau wairu, Balau di bandera
BUM	Balau blanku
WHM	Balau salmou, Balau kòrá
SWO	Balau tonini
SPF	Balau blanku

NORWAY

BFT	Makrellstrje
SBF	Sydlig stØrje
YFT	Gulfinnet stØrje
ALB	Albakor
BET	StorØyet stØrje
BLF	Svartfinnet stØrje
LTA	Tunnin
SKJ	Bukstripet bonitt
BON	Stripet pelamide
FRI	Auxid
BLT	Auxid
BOP	Ustripet pelamide
WAH	Wahoo
SSM	Flekket kongemakrell

KGM Kongemakrell
MAW Vestafrikansk kongemakrell
BRS Serra
CER Cero
SAI Atlantisk seilfisk
BLM Svart marlin
BUM Bla marlin
WHM Hvit spydfisk
SWO Sverdfisk
SPF Spydfisk

POLAND

BFT Tûnczyk

PORTUGAL

BFT Atúm*, Rabilho, Rabilo, Atúm verdadeiro, Atúm vermelho, Atúm do-Algarve, Atúm vulgar
YFT Albacora*, Atúm amarelo, Atúm de barbatana amarela, Atúm de galha à ré, Peixinho da ilha
ALB Voador*, Atúm branco, Atúm voador, Atúm de barbatana comprida, Ilhéu
LTA Merma, Barrilete, Bonito, Cachorreta
SKJ Gaiado, Bonito de ventre raiado, Bonito, Listado
BON Bonito*, Sarrajao, Bonito de dorso raiado
FRI Judeu, Cachorra, Bonito
BOP Palometa, Bonito, Palombeta
WAH Cavala da India, Ilhéu, Peixe serra, Serra
SSM Serra Espanhola, Cavala bonita, Moira, Peixe serra
MAW Gavala serra, Bicuda, Peixe serra, Serra tigre
SAI Veleiro do Atlantico, Bicuda, Espadarte veleiro, Peixe de vela
BLM Espadim negro, Agulhão negro, Marlim, Espadim
BUM Espadim azul do Atlantico, Espadim azul, Peixe agulha
WHM Espadim branco do Atlantico, Espadim branco, Agulha, Espadim pequeño
SWO Espadarte, Agulha, Espada, Peixe espada
SPF Espadim Aguia, Aguia, Espadim do Mediterráneo

PORTUGAL (Azores)

BFT Rabilo*, Rabão

YFT Galha-à-ré*, Albacora de galha-à-ré, Galha amarela
ALB Voador*
BET Patudo*, Albacora, Atum
SKJ Bonito*, Gaiado
BON Serra*
SAI Veleiro*
BLM Espadim negro*
BUM Espadim azul*
WHM Espadim branco*
SWO Espadarte*, Agulhão

SOUTH AFRICA

BFT Bluefin tunny*, Bluefin tuna, Blouvin-tuna (Afrikaans)
SBF Bluefin tunny*, Southern Bluefin tuna, Blouvin-tuna (Afrikaans)
YFT Yellowfin tunny*, Yellowfin tuna, Geelvin-tuna (Afrikaans)
ALB Longfin tunny*, Albacore, Longfin tuna, Langvin-tuna (Afrikaans)
BET Bigeye tunny*, Bigeye tuna, Grootoog-tuna (Afrikaans)
BLF Blackfin tunny*, Swartvin-tuna (Afrikaans)
LTA Little tunny*, Atlantic little tuna, Little tuna, Mackerel tuna
SKJ Skipjack*, Skipjack tuna, Oceanic bonito, Penastreep-tuna (Afrikaans)
BON Bonito*, Atlantic bonito, Bluefin bonito, Short-finned tuna, Katonkel (Afrikaans), Atlantiese bonito (Afrikaans)
FRI Frigate tuna*, Frigate mackerel, Fregat-makriel (Afrikaans)
BLT Bullet mackerel, Koeelmakriel (Afrikaans)
WAH Wahoo
SSM Spanish mackerel, Spaanse makriel (Afrikaans)
SAI Sailfish*, Seilvis (Afrikaans)
BLM Black marlin*, Swart marlyn (Afrikaans)
BUM Blue marlin*, Blou marlyn (Afrikaans)
WHM White marlin*, Wit marlyn (Afrikaans)
SWO Swordfish*, Broadbill swordfish, Swaardvis (Afrikaans)
SPF Spearfish*, Longbill Spearfish, Langbekspeervis (Afrikaans)

SWEDEN

BFT Tonfisk

TAIWAN

BFT 黑鮪 (Hay we)
SBF 南方黑鮪 (Nan fang hay we)
YFT 黃鰭鮪 (Huang chi we)
ALB 長鰭鮪 (Chang chi we)
BET 大目鮪 (Tha mu we)*, 大眼鮪 (Tha yen we)
BLF 大西洋黑鮪 (Tha hsi yang hay we)*, 黑鰭鮪 (Hay chi we)
LTA 巴鰱 (Pa chien)
SKJ 正鰹 (Theng chien)* 鰹鰹 (Toh khun)
BON 鰹 (Hu chien)*, 遠仔虎 (Yan tsai hu)
FRI 平花鰹 (Ping hua chien)
BLT 圓花鰹 (Yuan hua chien)
BOP 鯖鯖 (Lo tsun)
WAH 鰆鯖 (Chi chuen*, 土托 (Tu to)
SSM 斑馬加 (Ban ma chia)
KGM 大西洋馬加 (Tha hsi yang ma chia)
MAW 西非馬加 (Hsi fe ma chia)
BRS 羅齒鯖 (Chu chih chuen)
CER 拉鯖 (La chuen)
SAI 芭蕉旗魚 (Ba chiao chi yu)*, 雨傘旗魚 (Yu san chi yu)
BLM 白皮旗魚 (Pai pi chi yu)
BUM 黑皮旗魚 (Hay pi chi yu)
WHM 紅肉旗魚 (Hung jou chi yu)
SWO 劍旗魚 (Chien chi yu)
SPF 長吻旗魚 (Chang wen chi yu)

TRINIDAD & TOBAGO

BFT Bluefin tuna, Bluefin, Tunny, Tuna
YFT Yellowfin tuna, Albacore, Bonito
ALB Albacore, Bonito
BLF Blackfin tuna, Tuna
LTA Little tunny, tunny
SKJ Skipjack
BON Bonito
FRI Mackero
WAH Wahoo
SSM Carite
KGM Kingfish, Thazard, Tassard
BRS Carite
CER Carite, Mackeral (Tobago)

SAI Sailfish, Ocean gar
BUM Blue marlin
WHM White marlin
SWO Swordfish
SPF Longbill spearfish

TURKEY

BFT Orkinos
SBF Guney kiyi orkinosu
ALB Yazili orkinos
BET Kocagoz orkinos
LTA Akdeniz orkinozu
BON Palamut
FRI Boyali istavrit
BLT Gobene baligi
BOP Duz uskumru
SSM Kolyoz
SWO Kiliç baligi

U.S.A.

BFT Bluefin tuna*, Horse mackerel, Tunny, Tuna, School tuna (small), Albacore (medium size), Giant tuna (large)
SBF Southern bluefin tuna*, Southern bluefin
YFT Yellowfin tuna*, Yellowfin, Allison tuna
ALB Albacore*, Longfin tuna
BET Bigeye tuna*, Bigeye
BLF Blackfin tuna*, Blackfin
LTA Little tunny*, Little tuna, Flase albacore, Bonito, Albacore
SKJ Skipjack tuna*, Skipjack, Striped bonito, Oceanic bonito, Striped tuna, Arctic bonito, Mushmouth
BON Atlantic bonito*, Bonito, Skipjack, Horse mackerel
FRI Frigate tuna*, Frigate mackerel
BLT Bullet mackerel
BOP Plain bonito
WAH Wahoo*, Queenfish
SSM Spanish mackerel*, Mackerel
KGM King mackerel*, Cero, Kingfish, King
MAW West African Spanish mackerel

CER	Cero*, Cero mackerel, King mackerel, Kingfish, Mackerel
SAI	Sailfish*, Sail
BLM	Black marlin
BUM	Blue marlin
WHM	White marlin*, Skilligalee (New England)
SWO	Swordfish*, Broadbill swordfish, Broadbill
SPF	Longbill spearfish*, including Mediterranean spearfish

U.S.S.R.

BFT	СИНЕПЕРЫЙ ТУНЕЦ (Sineperyi Tunets)*, ОБЫКНОВЕННЫЙ ТУНЕЦ (Obyknovenny tunets)
SBF	ЮЖНЫЙ ГОЛУБОЙ ТУНЕЦ (Juzhnyi goluboi tunets)
YFT	ЖЕЛТОПЕРЫЙ ТУНЕЦ (Zheltoperyi tunets)
ALB	ДЛИННОПЕРЫЙ ТУНЕЦ (Dlinnoperyi tunets)*, АЛЬБАКОР (Al'bakor)
BET	БОЛЬШЕГЛАЗЫЙ ТУНЕЦ (Bol'sheglazyi tunets)
BLF	ЧЁРНОПЕРЫЙ ТУНЕЦ (Chernoperyi tunets)*, ЧЁРНЫЙ ТУНЕЦ (Chernyi tunets)
LTA	ПЯТНИСТЫЙ ТУНЕЦ (Pyatnistyi tunets)
SKJ	ПОЛОСАТЫЙ ТУНЕЦ (Polosatyi tunets)*, СКИПДЖЕК (Skipdzhek)
BON	ПЕЛАМИДА (Pelamida)
FRI	МАКРЕЛЕВЫЙ ТУНЕЦ (Makrelevyi tunets)
BLT	СКУМБРИЕВИДНЫЙ ТУНЕЦ (Skumbrievidnyi tunets)
BOP	ОДНОЦВЕТНЫЙ БОНИТО (Odnotsvetnyi bonito)
WAH	ВАХУ (Vakhu)
SSM	ПЯТНИСТАЯ КОРОЛЕВСКАЯ МАКРЕЛЬ (Piatnistaia korolevskaia makrel')
KGM	КАВАЛЛА (Kavalla)*, КОРОЛЕВСКАЯ МАКРЕЛЬ (Korolevskaia makrel)*
MAW	АФРИКАНСКАЯ КОРОЛЕВСКАЯ МАКРЕЛЬ (Afrikanskaia korolevskaia makrel')*
CER	ЗАПАДНОАТЛАНТИЧЕСКАЯ КОРОЛЕВСКАЯ МАКРЕЛЬ (Zapadnoatlanticheskaia korolevskaia makrel')
SAI	ПАРУСНИК (Parusnik)*
BLM	ЧЁРНЫЙ МАРЛИН (Chornyi marlin)
BUM	СИНИЙ МАРЛИН (Sinii marlin)
WHM	БЕЛЫЙ МАРЛИН (belyi marlin)
SWO	МЕЧ-РЫБА (Mech-ryba)
SPF	МАЛЫЙ КОПЬЕНОСЕЦ (Malyi kopienosets)

VENEZUELA

BFT	Atún azul
YFT	Atún aleta amarilla
ALB	Albacora*, barrilote (Pacífico), atún blanco
BET	Ojo gordo*, ojona
BLF	Atún aleta negra
LTA	Carachana pintada
SKJ	Listado*, Bonito oceánico, Barrilete (Pacific)
BON	Cabaña de diente*, Cabaña cariba, Cabaña con dientes
FRI	Cabaña negra*, Carachana
BLT	Cabaña negra
WAH	Peto*, Sierra
SSM	Carite pintado
KGM	Carite lucio
CER	Carite chinigua*, Carite rey
SAI	Pez vela
BUM	Aguja azul
WHM	Aguja blanca
SWO	Pez espada*, Palagar
SPF	Aguja,

NAFO

BFT	Northern bluefin tuna
YFT	Yellowfin tuna
ALB	Albacore tuna
BET	Bigeye tuna
LTA	Little tunny
BON	Atlantic bonito
FRI	Frigate tuna
BUM	Blue marlin
WHM	White marlin
SWO	Swordfish

Chapter 9. RECOVERING TAGGED FISH

9.1 Objectives of tagging

ICCAT has developed an international cooperative tagging program in the Atlantic Ocean and its adjacent seas. A number of member countries are now participating in the program and releasing many tagged tunas, billfishes and tuna-like fishes. To make this program successful, it is essential to secure the cooperation of both fishermen and industry in recovering these tags.

The results of these tagging experiments will eventually reveal to us patterns of fish migration in the ocean, intermingling of the various species, population structure, influence of fishing activities on fish stocks, mortality, growth rate, etc.

9.2 Tags

Each tag is a plastic tube or capsule attached to a small plastic or metal dart (Figure 9); this is inserted into the dorsal flesh of the fish near the base of the second dorsal fin on tunas, and in the hump behind the head or near the base of the first dorsal on billfishes (Figure 10). Once the tag has been inserted, only the tube or capsule is visible. Letters and serial numbers are printed on each tag to identify the agency conducting the experiment.

Identification of fish that already have tags in them is not always as easy as it appears. Various forms of marine growth, which often attach to exposed portions of tags (after a period of time), tend to disguise the tag and make it difficult to recognize. Billfish anglers should carefully examine each billfish brought to the boat before tagging and releasing the fish.

Some fish carry more than one tag; thus, a tagged fish must be checked to insure that all have been recovered.

9.3 Rewards

ICCAT will pay US$4 or the equivalent in local currency for each tag recovered (or some other reward such as a T-shirt, depending on the port and project). Thus, if two tags are recovered from one fish, the reward will be $8. In some cases, the agency conducting the tagging experiment will pay additional money.

In addition to this reward paid for each recovered tag, ICCAT holds annual lotteries, awarding US$500 each. The general prizes are one ($500) for tropical species and one for temperate species. However, often additional prizes are given to specific species (e.g., skipjack, yellowfin, billfishes, etc.) when a special tagging program is

going on. All tag numbers reported during a calendar year and submitted to ICCAT directly or through agencies conducting cooperative tagging will be eligible to participate in this annual lottery.

Additional rewards will also be offered to fishermen who recapture fish carrying red tags (indicating tetracycline-injected fish) or tagged billfish and return the fish together with tags (see 9.5 for procedures).

9.4 Arrangements for paying rewards

The reward for each tag reported directly to the ICCAT Secretariat by the recoverer will be sent immediately. For recoverd tags reported to local fisheries officers, etc., the Secretariat would appreciate their paying the reward on the spot in the appropriate currency. This, we hope, will encourage expeditious reporting of recovered tags. The ICCAT Secretariat will, of course, reimburse the fishery officers as soon as recovery information and tags are received.

9.5 Recovery information

9.5.1 Tags recovered

Commercial and recreational fishermen as well as people working in unloading fish or even cannery workers can be significant contributors to this program by returning tag-recapture information to ICCAT. Each person who recoveres a tagged fish will receive a $4.00 reward. They will later be informed of the release information on the fish they recoved. Recapture information will also be sent to fishermen who tagged the fish.

Even though in recreational fisheries, fishermen wish to release fish after capture, the fish should be killed if it is carrying a tag.

When a tagged fish is recovered

i) If you can bring back the fish in a short period

a) Leave the tag(s) in the fish (not attempt to remove). Only record the exact location, and time of recapture of fish into your log.
b) Keep the fish with tag(s) separate from the rest of the catches, in a place easily identified.
c) If possible, contact the nearest fishery or oceanographic laboratory or contact the ICCAT Secretariat by telephone or cable, and let them know where and when the boat is arriving, so that a technician can meet the boat to examine the recovered fish.

d) Even if contact can not be made beforehand, contact the laboratories or bring the fish to the laboratory or fisheries administration mentioned below when you reach a port.

ii) *If you can bring the fish back after a long period,* take all the information mentioned below iii) and separate the tagged fish from the rest in the freezer. Then follow the instructions of i) c) - d).

iii) *If circumstances do not permit bringing the fish back,* the following information should be recorded. Then the tag should be recorded. The tag can then be removed from the fish and kept together with the recovery information.

a) Letters and numbers on tag(s)
b) Species of fish
c) Date and location of tag recovery. If tags are recovered during unloading or in canneries, report from which fishing vessels or which transshipment loads the tag came. The local officers or researcher may try to pinpoint the actual date and location in which the fish was caught based on such information. If this is not possible, indicate the general area and period of capture. This procedure also applies when tags are found detached from the fish, e.g., at the bottom of the fish well. It could be possible to report where and when the fish in that particular well were captured.

d) Fishing gear used
e) Size of fish (upper jaw-fork length for tunas and lower jaw-fork length for billfishes.) (See Chapter 5). Include what equipment was used for measurement.
f) Weight of fish, if possible, and in what condition (gutted, round, etc.) the fish was weighed and what equipment was used.
g) Sex of fish larger than 120 cm (see Chapter 5)
h) Name, nationality and address of recoverer and the person who collected the recovery information

The recovered tags should be attached to the information sheet and forwarded to one of the following:

i) Local fishery officers or fishery laboratories. These collectors are further requested to send them to either "b" or "c" below. If the aforementioned agencies can pay the reward on the spot, they should obtain the corresponding receipt and send it with recovery information for immediate reimbursement.
ii) Address shown on tag (conducting agency).

iii) ICCAT Secretariat
Príncipe de Vergara, 17
28001 Madrid, Spain

Telephone: Spain (34)-1-431-0329
Cable code: CICATUNA
Telex: 46330 ICCATE
Faximil: Spain (34)-1-576-1968

9.5.2 Returning fish with tags

Additional rewards ($25 - $100) will also be offered to fishermen who recapture red tags or tagged billfish and return the fish, as well as the tag, to ICCAT. The tagged fish should be saved by refrigeration or freezing, and the ICCAT Secretariat must be contacted immeditely (by phone, telex, fax).

The inner ear bones in the head and the dorsal spines of these fish are used for age and growth studies. This is a particularly important part of the program, since the age and growth data obtained from tagged-recaptured fish provide a rare opportunity to validate the accuracy of methods used in aging these fish.

In such cases, a recaptured tagged fish should be submitted to the closest laboratory together with recovery information listed above. If there is no laboratory near by, tags should be detached from the fish and sent to the ICCAT Headquarters. The fish can be frozen until the scientists contact you.

9.6 Publicity

The ICCAT Secretariat has prepared posters to publicize the tagging project and its rewards. These posters have been printed in the following languages: Arabic, Chinese, English, French, Japanese, Korean, Portuguese and Spanish. They are posted in prominent places at waterfronts, canneries, offices of fisheries unions, government offices, etc. Posters may be obtained free of charge from the ICCAT Secretariat.

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Appendix 1

SAMPLES OF ICCAT FORMS FOR REPORTING TUNA STATISTICS

Forms 1-1 Reporting Task I Catch statistics (Nominal annual catch)

1-2 Reporting Task I Effort statistics (Fishing power)

2 Reporting Task II Catch and Effort statistics by area, month and species

3-1 Field recording form for fish measured — 1

3-2 Field recording form for fish measured — 2

3-3 Form for compiling sub-samples of measurements

3-4 Reporting Task II Biological statistics (or actual size frequencies of tunas)

3-5 Reporting Catch by size (weighted size frequencies)

ICCAT FORM 1-1
Rev. 1

CATCH AND EFFORT STATISTICS FOR ATLANTIC TUNAS (TASK 1)

DATA: Quick estimate ☐
Estimate ☐
Preliminary ☐
Final ☒

Year 19 77

Catch ☒ or landing ☐

Weight ☒ unit MT or number of fish ☐ Conversion factor

Round weight ☒ or in what condition

Conversion factor BF · 1.18 Converted from Gilled & Gutted

Country France

Flag France

Person in charge Pierre Lapeire

Address of agency A.N.D.T. 170 Rue Bergère, Paris

Unit of effort Days at sea

REGION	GEAR	(EFFORT)	CATCH BY SPECIES: Total	Bluefin	Yellowfin	Albacore	Bigeye	Skipjack	Swordfish	Bonito	Others (specify) Flying Fish			
				T.thynnus	T.albacares	T.alalunga	T.obesus	K.pelamis	X.gladius	S.sarda				
E.Trop. + NE.	PS	4.803	12.472		7.345		715	4.392		120				
NE	BB	2.709	6.952		2.831			3.874			247			
	TROL	3036	9.200	1.421		7.779								
	BB	1.024	2.300	400		1.900								
	TOTAL	11.572	30.924	1.821	10.976	9.679	715	8.266		120	247			

SAMPLE

ICCAT FORM 1-2
Rev. 1

NUMBER OF ATLANTIC TUNA FISHING BOATS (TASK 1)

FLAG COUNTRY SPAIN YEAR 1976

REMARKS

TYPE	CLASS	MULTI-PURPOSE	TUNA ONLY
LONGLINERS Decktonded-type mother boat LL	201-500 GT		
	501-1000		
	1001-		
Self operating mother boat LL	51-200 GT		
	201-500		
	501-800		
	1001-		
Homeland-based L.L.	- 50 GT		
	51-200	20	
	201-500		
	501-1000		
	1001-		
Foreign-based L.L.	- 50 GT		
	51-200		
	201-500		
	501-1000		
	1001-		
PURSE SEINERS Double-boat type ps	- 50 GT		
	51-150		
	151-		

SAMPLE

TYPE	CLASS	MULTI-PURPOSE	TUNA ONLY
Single-boat type ps	CAP. MT - 50		
	51-100		
	101-200	12	
	201-300		20
	301-400		5
	401-500		
	501-800		9
	801-1000		4
	1001-		
BAIT BOATS Ice-well bb	- 50 GT	115	
	51-150		20
	151-		
Freezer bb	CAP. MT - 50		
	51-150		12
	151-		
No cooling bb			
TROLLERS	- 50 GT	105	
	51-150	105	
	151-		
OTHERS			
SPORT BOATS			

ATLANTIC TUNA CATCH AND EFFORT STATISTICS BY AREA, MONTH, AND SPECIES (TASK 2)

Country: Korea
Flag: Korea
Gear: Longline (Foreign base)
Unit of effort: Number of hooks used
DATA: Sampled 100% coverage ☒ Coverage rate 17.42

DATA: Quick-estimate ☐ Estimate Preliminary ☒ Final ☐
Year 19 75
Catch or landing ☒
Weight ☒ unit MT or number of fish ☐ Conversion factor
Round weight ☒ or in what condition YF: 1.30
Conversion factor other: 1.13 Converted from other species

Month	Area	Lat	Long	Effort	TOTAL	Bluefin T. thynnus	Yellowfin T. albacares	Albacore T. alalunga	Bigeye T. obesus	Skipjack K. pelamis	Swordfish X. gladius	Bonito S. sarda	Other species (specify) Sailfish	Wahoo A.
01	61	00	00	2498	3.5	--	2.5	0.5	0.2	--	--	--	0.3	--
	61	05	00	7800	9.2	--	2.3	0.7	0.3	--	0.2	--	0.6	0.4
	64	05	00	10200	7.4	0.5	1.4	4.2	1.3	--	--	--	--	--
	64	05	45	7200	4.5	--	0.5	2.0	--	--	--	--	0.8	--
	63	15	35	8000	4.2	--	--	4.0	--	0.1	--	--	--	--
	54	15	45	25678	23.7	0.5	6.7	17.4	1.8	0.1	0.3	--	2.7	0.4
02	61	05	05	7198	2.8	0.1	0.7	1.0	0.3	--	0.5	--	--	--
	61	05	10	13200	9.4	0.3	3.5	2.0	1.3	--	0.8	--	0.5	--

SAMPLE

FORM 3-1

FIELD RECORDING FORM 1 FOR FISH MEASUREMENTS

DATA FOR CATCHES

Species: Yellowfin
Location of catch: 01°S 007°W
Date of catch: July 21, '71
Name of boat: Fake
Fish well number: 2
Gear used: Purse seine (1-boat)
REMARKS: Fish is well 2 come from a single set. Mix catch with skipjack.

DATA FOR SAMPLING

Date of measurement: Sept. 1, '71
Location of measurement: Star-camp, Puerto Rico
boat ☐ market ☐ dock ☐ cannery ☒ others
Person measuring: Bill Fisher
Measuring equipment: Measuring board
Part of fish measured: Upper jaw to fork
Number of fish: 50
Frequency of fish sampled: Every 5 fish

79	75
82	62
47	73
56	59
62	70
63	62
69	60
65	68
65	65
71	71
68	49
67	82
73	73
59	67
74	82
69	58
70	62
77	73
72	64
59	67
61	58
65	61
69	70
67	64
68	68

SAMPLE

ICCAT FORM 3-2

FIELD RECORDING FORM 2 FOR FISH MEASUREMENTS

DATA FOR CATCHES

Species: Yellowfin

Location of catch: 100 miles off Cape Verde

Date of catch: April 1, 1971

Name of boat: Fool

Fish well number: ____

Gear used: Longline

DATA FOR SAMPLING

Date of measurement: Apr. 1, 1971

Location of measurement: Fishing ground — boat [X] market [ ] dock [ ] cannery [ ] others ____

Person measuring: Jack Skipper

Measuring equipment: calipers

Fish measured from upper jaw to fork

Number of fish measured: 50

Frequency of fish sampled: First 50 fish caught.

REMARKS

70 –		100 –	/	0 –	
1 –		1 –		1 –	
2 –		2 –	//	2 –	
3 –		3 –	///	3 –	
4 –		4 –	//	4 –	
5 –		5 –		5 –	
6 –		6 –	/	6 –	
7 –		7 –	/	7 –	
8 –	/	8 –		8 –	
9 –	//	9 –	/	9 –	
80 –	//	110 –	//	0 –	
1 –	|||||	1 –		1 –	
2 –	///	2 –	/	2 –	
3 –		3 –		3 –	
4 –	/	4 –	/	4 –	
5 –		5 –	//	5 –	
6 –		6 –		6 –	
7 –	///	7 –	/	7 –	
8 –	//	8 –		8 –	
9 –	/	9 –	/	9 –	
90 –		0 –		0 –	
1 –	/	1 –		1 –	
2 –		2 –		2 –	
3 –	/	3 –		3 –	
4 –	/	4 –		4 –	
5 –	//	5 –		5 –	
6 –	///	6 –		6 –	
7 –	//	7 –		7 –	
8 –		8 –		8 –	
9 –	/	9 –		9 –	

SAMPLE

ICCAT FORM 3-3

FORM FOR COMPILING SUBSAMPLES OF MEASUREMENTS

COUNTRY: Japan SPECIES: Albacore AREA: 1-3-10030

FLAG: Japan YEAR: 1970 MONTH: Jan.-March

NUMBER OF SUBSAMPLES: 15 GEAR: Long line TOTAL NO. OF FISH SAMPLED: 7 2 1

REMARKS

		FREQUENCY			FREQUENCY
0 –			50 –	//	2
1 –			1 –	卌	5
2 –			2 –	卌 卌 ///	13
3 –			3 –	卌 卌 ////	14
4 –			4 –	卌 卌 卌 卌 卌 /	26
5 –			5 –	卌 卌 卌 ////	18
6 –			6 –	卌 卌 卌 //	17
7 –			7 –	卌 卌 ///	13
8 –			8 –	卌 卌 卌 /	16
9 –			9 –	卌 卌 卌 卌	20
0 –			60 –	卌 卌 卌 卌 卌 卌 卌 卌 //	42
1 –			2 –	卌 卌 卌 卌 卌 卌 卌 卌 卌 /	46
2 –			4 –	卌 卌 卌 卌 卌 卌 卌 ////	39
3 –			6 –		
4 –			8 –		
5 –					
6 –			70 –		
7 –			2 –		
8 –			4 –		
9 –			6 –		
			8 –		
40 –					
1 –			80 –		
2 –			2 –		
3 –			4 –		
4 –			6 –		
5 –	/	1	8 –		
6 –					
7 –	//	2	90 –		
8 –	卌	5	2 –		
9 –	卌 //	7	4 –		
			6 –		
			8 –		

SAMPLE

ICCAT FORM 3-4
Rev. 1

ACTUAL SIZE FREQUENCY OF TUNAS

REPORTING COUNTRY Senegal

YEAR 19 76

FLAG COUNTRY Senegal

GEAR Purse seine

SPECIES Skipjack

SIZE: ☒ FORK LENGTH (cm) –FL
☐ PREDORSAL LENGTH (cm) –LD_1
☐ WEIGHT (unit : _____) – WI

PORT Dakar

SAMPLING LOCATION: ☐ At sea ☐ While unloading ☒ Cold storage ☐ Freighter ☐ Cannery
Others (specify) _____

ICCAT sampling areas or lat.–long. areas			5100003	5103012	5105012	5500026	- -	- - - -	- - -	- - - -	- -
Month(s)			4	4	4	5	-	-	-	-	-
Total no. of specimens			514	674	327						
No. of samples			10	14	7						
Total weight of samples			1822 kg	1543	716						
Total amount of catch from which samples taken	no.										
	wt.		720 MT	540 MT	24 MT						
Weighting factor			4050.93	309.97	33.52						
Size classes											
1 cm interval	2 cm interval	others									
0–.9	40–.9	–									
10–19	20–39	–			1						
20–29	40–59	–	2	1							
30–39	60–79	–	5								
40–49	80–99	–	21		1						
5–	50–	–	7		1						
6–	2–	–	5		3						
7–	4–	–	0	2	4						
8–	6–	–	3	4	24						
9–	8–	–	9	9	58						
0–	60–	–	48	21	127						
1–	2–	–	35	156	49						
2–	4–	–	27	132	32						
3–	6–	–	19	129	14						
4–	8–	–	24	47	2						
5–	70–	–	36	28							
6–	2–	–	31	16	1						
7–	4–	–	15	35	1						
8–	6–	–	27	29	4						
9–	8–	–	38	18	2						

SAMPLE

ICCAT FORMS 3-4 and 3-5 (2nd page)
Rev. 1

Size classes											
1 cm interval	2 cm interval	others									
0–.9	80–.9	–	44	5	1						
10–19	20–39	–	23	2							
20–29	40–59	–	31	3	1						
30–39	60–79	–	18		1						
40–49	80–99	–	30	1							
5–	90–	–	11								
6–	2–	–	7								
7–	4–	–	1								
8–	6–	–	3								
9–	8–	–									
0–	100–	–	1								
1–	2–	–									
2–	4–	–									
3–	6–	–									
4–	8–	–									
5–	0–	–									
6–	2–	–									
7–	4–	–									
8–	6–	–									
9–	8–	–									
0–	0–	–									
1–	2–	–									
2–	4–	–									
3–	6–	–									
4–	8–	–									
5–	0–	–									
6–	2–	–									
7–	4–	–									
8–	6–	–									
9–	8–	–									
0–	0–	–									
1–	2–	–									
2–	4–	–									
3–	6–	–									
4–	8–	–									
5–	0–	–									
6–	2–	–									
7–	4–	–									
8–	6–	–									
9–	8–	–									

ICCAT FORM 3-5
Rev. 1

CATCH BY SIZE (WEIGHTED SIZE FREQUENCIES)

REPORTING COUNTRY Ghana

YEAR 19 77

FLAG COUNTRY Panama

GEAR- Baitboat

SPECIES Bigeye

SIZE: ☒ FORK LENGTH (cm) -FL
☐ PREDORSAL LENGTH (cm)-LD_1
☐ WEIGHT (unit : _____)-Wt
☐ FL CONVERTED FROM LD_1

PORT Tema

SAMPLING LOCATION: ☐ At sea ☒ While unloading ☐ Cold storage ☐ Freighter ☐ Cannery
Others (specify) _____

ICCAT sampling areas or lat.-long. areas			SBE2	SBE2	SBE3	SBE1	SBE2	SBE3			
Month (s)			1-3	4-6	4-6	7-9	7-9	7-9			
Total no. of specimens			276	950	700	634	503	548			
No. of samples			8	19	14	14	10	11			
Total weight of samples			4.35 MT	2.4 MT	1.45 MT	1.67 MT	1.32 MT	1.75 MT			
Total amount of catch from which samples taken		no.	22706	6925							
		wgt.	524 MT	128 MT	760 MT	400 MT	2450 MT	41 MT			
Weighting factor			123.29	53.11	517.24	237.52	1856.06	30.37			
Size classes											
1 cm intervals	2 cm intervals	others									
.0-.8	40-49	-	82	47							
10-19	20-29	-	0	0							
20-29	40-49	-	0	141							
30-39	60-79	-	0	727							
40-49	80-99	-	246	0							
5-	50-	-	329	660							
6-	2-	-	0	613							
7-	4-	-	411	94							
8-	6-	-	0	281							
9-	8-	-	329	948							
0-	60-	-	493	282							
1-	2-	-	576	940							
2-	4-	-	329	613							
3-	6-	-	987	282							
4-	8-	-	1374	282							
5-	70-	-	1316	330							
6-	2-	-	2057	47							
7-	4-	-	2964	0							
8-	6-	-	2140	0							
9-	8-	-	3045	47							

SAMPLE

ICCAT FORMS 3-4 and 3-5 (2nd page)
Rev. 1

Size classes											
1 cm intervals	2 cm intervals	others									
.0-.8	40-49	-	1563	47							
10-19	20-29	-	1563	"							
20-29	40-59	-	1152	"							
30-39	60-79	-	246	"							
40-49	80-99	-	329	"							
5-	90-	-	82	"							
6-	2-	-	"	"							
7-	4-	-	82	"							
8-	6-	-									
9-	8-	-									
0-	0-	-									
1-	2-	-									
2-	4-	-									
3-	6-	-									
4-	8-	-									
5-	0-	-									
6-	2-	-									
7-	4-	-									
8-	6-	-									
9-	8-	-									
0-	0-	-									
1-	2-	-									
2-	4-	-									
3-	6-	-									
4-	8-	-									
5-	0-	-									
6-	2-	-									
7-	4-	-									
8-	6-	-									
9-	8-	-									

Appendix 2 DESCRIPTION AND CODINGS OF FISHERIES (GEARS)

Gear codes		Fishing	Descriptions
BB	17	Baitboat	Pole-and-line fishing while chumming live bait to attract tuna schools.
BBI	15	Baitboat ice-well	Relatively small size baitboat carrying catches in the fish well together with ice (see BB).
BBF	16	Baitboat-freezer	Relatively large size baitboat equipped with freezer.
GILL	24	Gill-net	A set of nets (either drifting or fixed to the bottom of the sea) used for gilling or entangling fish.
HAND	19	Hand-line	Lines held by hand with or without chumming live bait.
HARP	18	Harpoon	Fish are caught by throwing a harpoon or spear by hand or by an auxiliary mechanism.
HS	29	Haul seine	Beach seine. Fish are caught by seine hauled at beach.
LL	1	Longliner	A set of lines to which branch lines with hooks are attached.
LLD	33	Longliner (Discarded fish)	Special code used for fish caught by longliners but not retained (discarded to the sea).
LLFB	3	Foreign-based longliner	Longliner (see LL) operating from a port outside her flag country.
LLHB	4	Home-based longliner	Longliner (see LL) operating from a port of her flag country.
LLMB	2	Deckloaded-type mother-boat longliner	A relatively large boat with one or more smaller boats carried aboard: these can be dispatched to the fishing ground to participate in longline fishing.

Gear codes		Fishing	Descriptions
MWT	23	Mid-water trawl	A net which is immersed in the water and then dragged for a certain period, in mid-water (i.e. the opening of the net does not touch the sea bottom).
MWTD	34	Double boat mid-water trawl	A mid-water trawl which is dragged by a pair of fishing boats.
PS	6	Purse seiner	Relatively large size seine with pursing mechanism at the bottom to close the net after fish schools are encircled in the seine. The boat may carry a skiff as an auxiliary method of operation.
PSFB	25	Purse seiner (Big fish)	A special code to distinguish purse seiners (see PS) fishing large fish.
PSFS	26	Purse seiner (Small fish)	A special code to distinguish purse seiners (see PS) fishing small fish.
PSG	5	Large size purse seiner	A purse seiner (see PS), having a fish holding capacity greater than 400 MT.
PSM	20	Medium size purse seiner	A purse seiner (see PS), having a fish holding capacity between 150 and 400 MT.
PSS	7	Small size purse seiner	A purse seiner (see PS), having a fish holding capacity less than 150 MT.
PSD	8	Double-boat purse seiners	Two boats operating as a pair, fishing with a purse seine (see PS). The two boats contribute equally to the operation. Catches may be bailed to a third boat.
PSLB	21	Purse seiner with live bait	A purse seiner (see PS), using bait to hold schools of tunas. Bait may be used from the seiner or another boat specializing in chumming bait.
RR	22	Rod-and-reel	A rod and line fishing, while the line is operated with a reel attached to the rod (sport fishing type gear).

Gear codes		Fishing	Descriptions
RRFB	27	Rod-and-reel (Big fish)	A rod-and-reel (see RR) catching mostly large fish.
RRFS	28	Rod-and-reel (Small fish)	A rod-and-reel (see RR) catching small fish only.
SPHL	31	Sport handline	Hand-line fishing (see HAND) by recreational fishermen.
SPOR	12	Sport fisheries unclassified	All unspecified fishing methods not carried out as a commercial activity, i.e. not with the intention of selling the catches for profit.
SURF	13	Surface fisheries unclassified	Any gear which catches tunas at surface or near surface area.
TRAP	10	Trap	Fixed gear anchored to the seabed. Generally composed of a guide net that leads tunas into an enclosure.
TRAW	14	Trawl	A net which is immersed in the water and then dragged for a certain period along the bottom of the sea.
TROL	9	Troller	A boat equipped with a line or lines, each having one or more hooks. Lines are trolled from the running boat either directly or held by a pole or poles.
UNCL	13	Unspecified methods	Any other fishing gears or methods not described above or gears which are unknown.

Appendix 3

SAMPLES OF PORT SURVEY FORMS

A. ICCAT port sampling form for Asian longliners transshipping in the Atlantic ports.

B. Port sampling forms for the Spanish fleet:

1. For the collection of landing statistics.
2. For the collection of catch and effort statistics.
3. Biological sampling form.

C. ICCAT for for recording landings.

D. Port sampling forms developed for Venezuelan fisheries.

1. For recording landings and biological sampling of tunas.
2. For biological sampling of billfishes.

A

Date: _____ Sampler: _____

NAME OF THE BOAT	
선 명	
船名	

FLAG COUNTRY	
船籍国	
농국국적	
国籍	

TOTAL LANDING (MT) — 総水揚量 — 총어획량 — 總捕獲量 (公噸)

YELLOWFIN	BIGEYE	ALBACORE	BLUEFIN	OTHERS	TOTAL
キハダ	メバチ	ビンナガ	クロマグロ	その他	計
옐로핀 (황다랑어)	빅아이(눈다랑어)	알바코(날개다랑어)	블루핀	다른	총계
黄鰭鮪	大目鮪	長鰭鮪	黒鮪	其他	総計

NO. HOOKS/BASKET	NO. BASKET USED
一籠当り鉤数	使用籠数
산 갈고리 수/광주리	사용 광주리 수
一籠当鉤数	使用籠数

International Commission for the Conservation of Atlantic Tunas

LAST UNLOAD PORT	DATE OF DEP.	TRANS. LANDING PORT	DATE OF ARR.	DAYS AT SEA	NO. FISH TRANS.
出港港	出港日	入港港	入港日	航海日数	移送日数
출항지	출항일	입항지	입항일	항해일수	사영일수
出発港	出発日	入港港	入港日	航海日数	移送日数

		CATCHES — 漁獲量 — 어획량 (尾数)					
FISHING GROUNDS	TERM	YELLOWFIN	BIGEYE	ALBACORE	BLUEFIN	OTHERS	TOTAL
漁場	期間	キハダ	メバチ	ビンナガ	クロマグロ	その他	計
어장	기간	옐로핀	빅아이	알바코	블루핀	다른	총계
漁場	期間	黄鰭鮪	大目鮪	長鰭鮪	黒鮪	其他	総計

Boat Names _____ Date _____

Species								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Página ____ de ____ Páginas

Entrevistador

Total desembarcado en el puerto (Kg) ※

Atún blanco "Bonito"	
Atún	
Atún blanco y Atún (auxiliado)	
Otros	
T o t a l	

Puerto de Desembarco

Fecha de Desembarco

Mes | Día | Año

ATUNEROS ("BONITEROS")

Nombre del barco	Características: Número de tolto	Características: Bodalidad de pesca CV, L, CV y L	Características: Tonelaje	Características: Número de líneas	Características: Tripulación	Datos de la Barca: Fecha partida	Datos de la Barca: Puerto partida	Datos de la Barca: Nº días buscando cabo	Datos de la Barca: Nº días pescando	CAPTURAS: Atún blanco ("Bonito")	CAPTURAS: Atún	CAPTURAS: Atún blanco ("Bonito") y Atún (mezclados)	CAPTURAS: Otros funidos	CAPTURAS: Total

Si es necesario, continuar sobre otra hoja reproduciendo los datos del encabezamiento

※ CV = Cebo Vivo L = Línea (Curricán o pluma)

※ Fuente de estos Datos: _____

B2

11(a) - ENCUESTA - CAPTURAS Y ZONAS DE PESCA

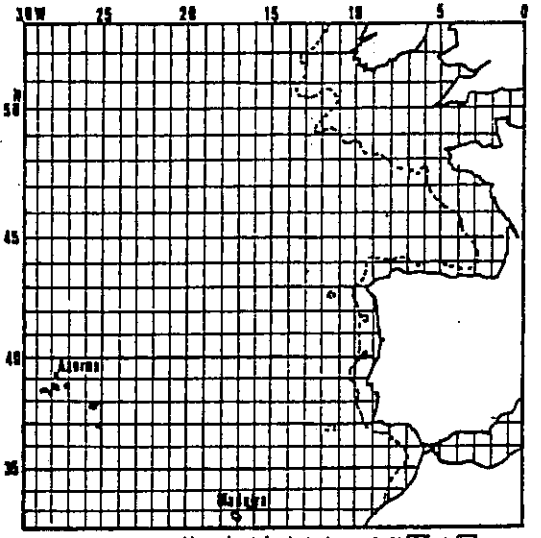
Páginas ____ de ____ Páginas .

Entrevistador _____ Puerto _____ Fecha ___ Día ___ Mes

Nombre del atunero ("Bonitero") _____ Folio _____

	Día	Mes
Fecha partida		
Puerto partida		
Nº días buscando cabo		
Fecha comienzo pesca		
Fecha fin pesca		
Cantidades reales desembarcadas (Número de Peces): Atún blanco		
Cantidades reales desembarcadas (Número de Peces): Atún		
Cantidades reales desembarcadas (Número de Peces): Atún blanco y Atún		
Cantidades reales desembarcadas (Número de Peces): Otros		
Cantidades reales desembarcadas (Número de Peces): Total		

Modalidad de Pesca _____ Tonelaje _____ Nº de líneas _____ Tripulación _____



COMENTARIOS MAPA:

-Indicar CV en la posición donde se pescó el cebo.

-Señalar las zonas de pesca inscribiendo I, II, III, etc...

Zonas de pesca frecuentadas

Lleva el patrón diario de pesca? SI ☐ No ☐

Zona		Atún blanco ("bonito") nº	Atún blanco ("bonito") peso	Atún nº	Atún peso	Otros peso	Fechas aproxim. de	Fechas aproxim. hasta	Modalidad de pesca CV, L, y CV	Días pescados ※	Horas ※	Observaciones sobre bollos y barcas
	P											
	G											
	P											
	G											
	P											
	G											
	P											
	G											
	P											
	G											
Total												

※ No incluir los días en que no hubo pesca ni búsqueda (aún encontrándose en las caladeros), o por cualquier razón.

※ Se tomará esta información siempre que haya posibilidad.

B3

III - ENCUESTA - MUESTREO

Página _____ de _____ Páginas
Información tomada del Impreso II

Localización de las capturas	
Fecha de las capturas	
Arte utilizado	

	Desembarco total en el puerto el día del muestreo	Desembarco total del barco en esta Marea
Atún blanco(*Bonito)		
A t ú n		
Atún blanco y Atún		
Otros		
T o t a l		

Puerto

Fecha ____ ____ 19__
Día Mes Año

Nombre del barco

Folio

Lugar del muestreo:
barco ☐ lonja ☐
fábrica ☐ comprador ☐

peso de la muestra (Kg)

Instrumento utilizado para medir

Persona que ha efectuado las mediciones

| Frecuencia de la muestra | | |

D1

HOJA DE MUESTREO ICCAT

ARTE DE PESCA		MUESTREADOR			
Nombre del barco		Código		Banderas	

Puerto de salida	Fecha de salida	Puerto de llegada	Fecha de llegada	Fecha de muestreo	Lugar de muestreo

ESPECIES	TOTAL DESEMBARQUE		Peso de capturas en bodega muestreada	ESPECIES MUESTREADAS		
	Kg	No.peces*				
BONITO SKIPJACK						
ALETA AMARILLA						
ALBACORA						
ATUNES VARIOS						
OJO GRANDE						

Especies			
Fecha**			
Zona**			

* Sólo cuando se disponga de información.

** Fecha y zona de las capturas (no del muestreo)

D2

BILLFISHES

FORM B

FONAIAP-ICCAT
BILLFISH PROGRAM

PORT SAMPLING – LONGLINER

Name of boat _____

Date ___ ___ 19 ___ ___
MONTH DAY YEAR

Equipment used: Calliper ☐ Tape ☐

BILLFISH SAMPLING

SPECIES	MEASUREMENTS (cm)			WEIGHT (kg)	SEX (M/F/I)	IDENTIFICATION NUMBER
	LJFL	PFL	DFL			

NAME OF PORT:

Appendix 4

SAMPLES OF FORMS FOR LOGBOOK AND OBSERVERS ABOARD

A. ICCAT logbook form for the longline fishery.

B. ICCAT logbook form for the Tema-based baitboat fishery.

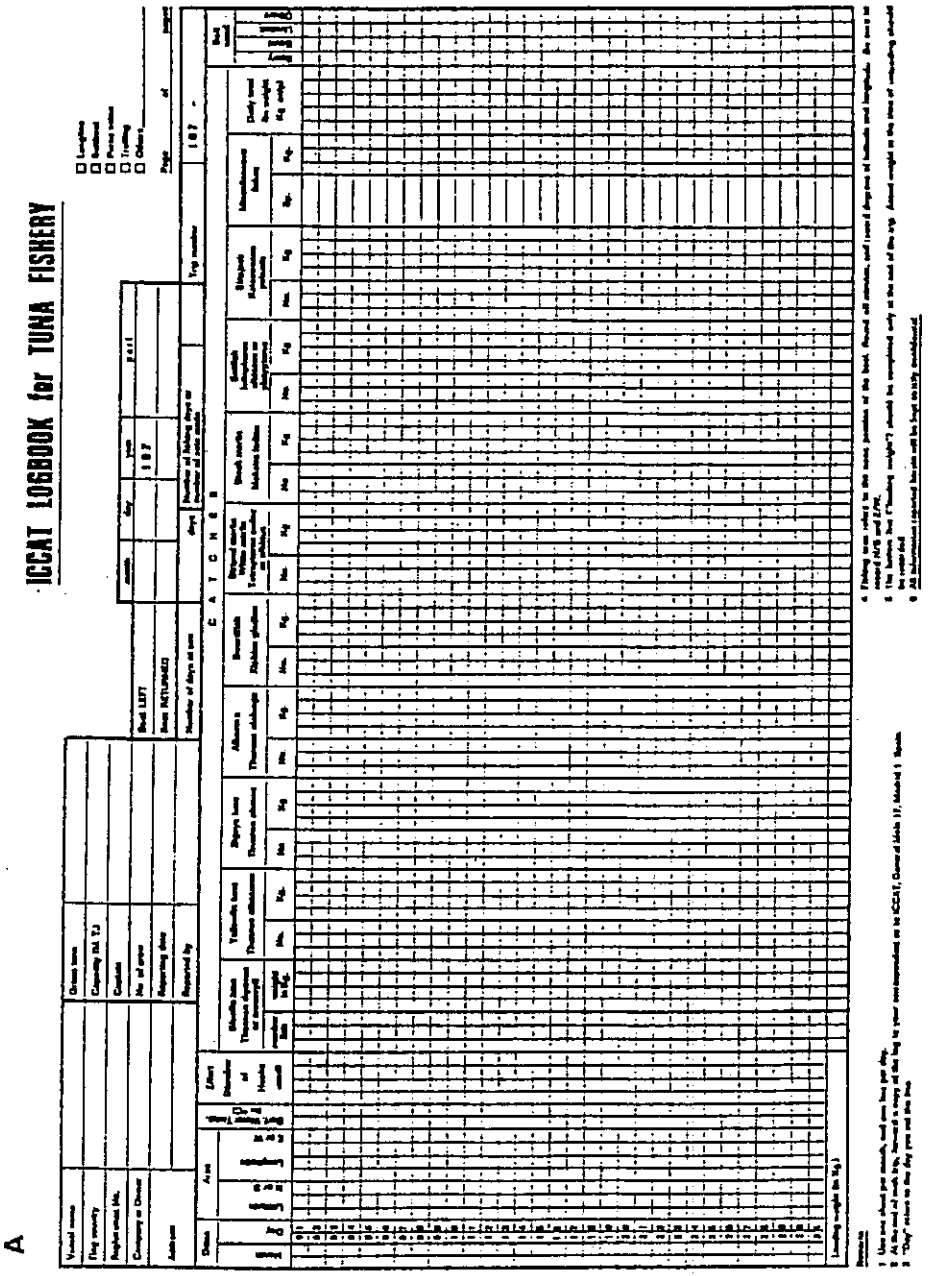
1. Daily catch records.
2. Landing records.

C. ICCAT logbook form for the purse seine fishery.

D. ICCAT observers form for the small scale longline fishery.

1. Daily fishing records.
2. Biological sampling form.

A



B1

DAILY CATCH RECORDS 日別漁獲記録 일일어획량 기록

Month 月 월	Day 日 일	LOCATION 位置 위치	Unit 単位 단위	YELLOWFIN キハダ 황다랭이				SKIPJACK カツオ 가다랭이				BIGEYE メバチ 눈다랭이	OTHERS その他 기 타	TOTAL 計 계	WELL NO. 魚倉番号 어창번호
				GG (1.3.5)	R1 (3.4)	R2	R3	Jumbo (2.4)	R1 (1.8)	R2	R3 (1.4KG)				
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		
		°_ ' N S °_ ' E W	No. Kg.										★		

★Fill in major species. その他の魚種のうち主要魚種名を記入する。 혼획량에는 중요어종을 표시

B2

LANDING RECORDS 水揚記録 양육량 기록

BOAT NAME 漁船名 선 명		OWNER 所属会社 소유자		FLAG 船籍国 국기명		NO. OF CREW 乗組員数 승무원수	

PORT OF DEPARTURE 出港地 출항지	DATE OF DEPARTURE 出港月日 출항일자	DATE ARRIVAL-ABIDJAN アビジャン入港月日 아비잔 입항일자	DATE ARRIVAL-TEMA テマ入港月日 테마 입항일자	NO. DAYS AT SEA 航海日数 항해일수	NO. DAYS AT BAITING 餌場滞在日数 어로어장 체류일수	NO. DAYS TUNA FISHING マグロ漁撈日数 다랭이 어획일수

TOTAL LANDING (IN METRIC TONS) 総水揚量量(MT) 총양육량(톤)

LANDING PORTS 水揚港 양육항	YELLOWFIN キハダ 황다랭이		BIGEYE メバチ 눈다랭이		SKIPJACK カツオ 가다랭이		OTHERS その他 기 타 Major Species 主要魚種 중요어종	Weight 重量 중량
ABIDJAN アビジャン 아비잔	GG-1.16		GG		Jumbo >2.4			
	R1 1.16-3.4		R1		R1 3.4-1.8			
	R2 3.4-1.8		R2		R2 1.8-1.4			
	R3 <1.8		R3		R3 <1.4			
	Total		Total		Total		Total	
TEMA テマ 테 마	GG		GG		Jumbo			
	R1		R1		R1			
	R2		R2		R2			
	R3		R3		R3			
	Total		Total		Total		Total	
OTHERS その他 기 타	GG		GG		Jumbo			
	R1		R1		R1			
	R2		R2		R2			
	R3		R3		R3			
	Total		Total		Total		Total	

C

VESSEL BATEAU ..... FROM DE ..... TOWARD VERS ..... DATE .....

TUNA FISHING ..... RECORD OF SETS MADE ..... PECHE DE THONIDES ..... REGISTRE DES LANCERS EFFECTUES

LOCATION SITUATION	TYPE OF SCHOOL TYPE DE BANC	Time set made / Heure de lancer	Time set ended / Heure de lancer	CATCH (Tons) CAPTURES (tonnes)							REMARKS OBSERVATIONS
				Skipjack Listao	Yellowfin Albacore	Bigeye Patudo	Bluefin Th. rouge		Others Autres		

D2 BILLFISHES

FONAIAP-ICCAT
BILLFISH PROGRAM

OBSERVERS – LONGLINERS

Name of boat _____

Date 19 __ __
Month Day Year

Equipment used: Calliper ☐ Tape ☐

SPECIES	Dead	Live	Landing Time		MEASUREMENTS (cm) LIFL	PFL	DFL	Estimated Weight (Kg)	Sex (M/F/J)	Identification Number

Appendix 5

ICCAT SAMPLING AREAS AND CODES

A. Sampling areas and data base codes used.

B. Maps illustrating ICCAT sampling areas.

A. Sampling areas and data base codes used.

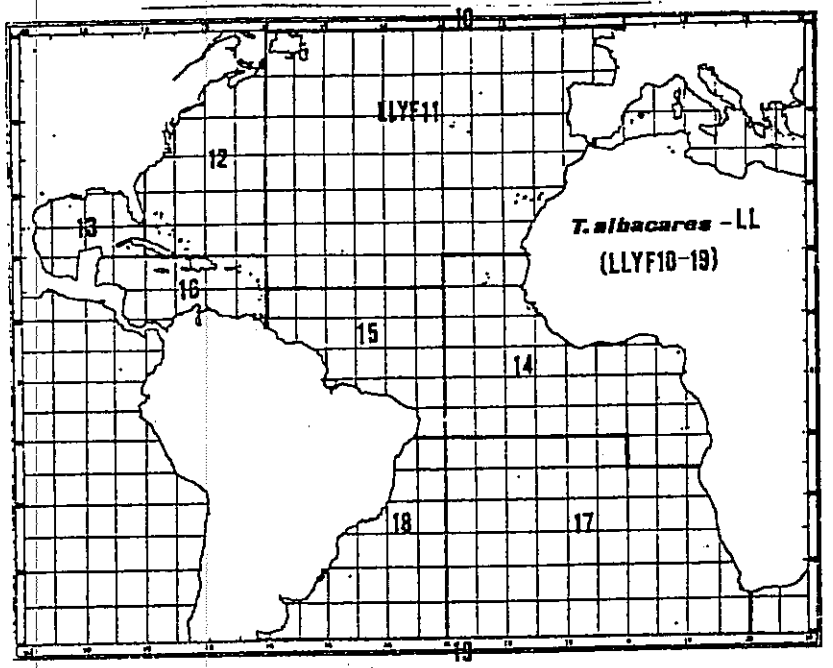
Species	Fisheries	Sampling areas (see maps)	Catch & effort data base codes*	Size data base codes*
Yellowfin & Bigeye	Surface	SBY 1	1	1
Yellowfin & Bigeye	Surface	SBY 2	2	2
Yellowfin & Bigeye	Surface	SBY 3	3	3
Yellowfin & Bigeye	Surface.	SBY 4	4	4
Yellowfin & Bigeye	Surface	SBY 5	5	5
Yellowfin & Bigeye	Surface	SBY 21	21	6
Yellowfin & Bigeye	Surface	SBY 22	22	7
Yellowfin & Bigeye	Surface	SBY 23	23	8
Yellowfin & Bigeye	Surface	SBY 24	24	9
Yellowfin & Bigeye	Surface	SBY 25	25	10
Yellowfin & Bigeye	Surface	SBY 26	26	11
Yellowfin	Longline	LLYF10	10	1
Yellowfin	Longline	LLYF11	11	2
Yellowfin	Longline	LLYF12	12	3
Yellowfin	Longline	LLYF13	13	4
Yellowfin	Longline	LLYF14	14	5
Yellowfin	Longline	LLYF15	15	6
Yellowfin	Longline	LLYF16	16	7
Yellowfin	Longline	LLYF17	17	8
Yellowfin	Longline	LLYF18	18	9
Yellowfin	Longline	LLYF19	19	10
Albacore	All gears	AL 31	31	1
Albacore	All gears	AL 32	32	2
Albacore	All gears	AL 33	33	3
Albacore	All gears	AL 34	34	4
Albacore	All gears	AL 35	35	5
Bigeye	Longline	LLBE40	40	1
Bigeye	Longline	LLBE41	41	2
Bigeye	Longline	LLBE42	42	3
Bigeye	Longline	LLBE43	43	4
Bigeye	Longline	LLBE44	44	5
Bigeye	Longline	LLBE45	45	6
Bigeye	Longline	LLBE46	46	7
Bigeye	Longline	LLBE47	47	8
Bigeye	Longline	LLBE48	48	9
Bigeye	Longline	LLBE49	49	10
Bigeye	Longline	LLBE50	50	11

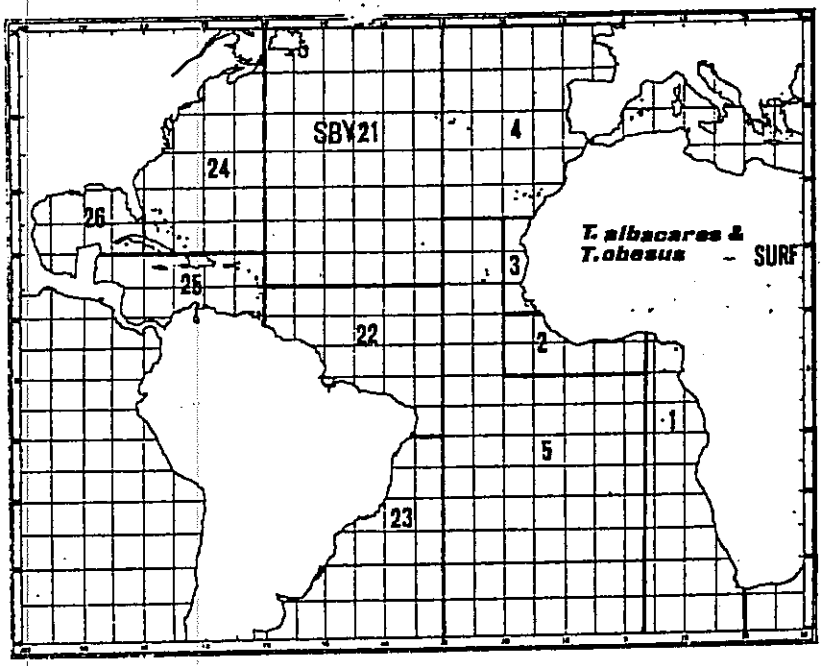
Species	Fisheries	Sampling area	C&E base codes*	Size base codes*
Bluefin	All gears	BF 51	51	1
Bluefin	All gears	BF 52	52	2
Bluefin	All gears	BF 53	53	3
Bluefin	All gears	BF 54	54	4
Bluefin	All gears	BF 55	55	5
Bluefin	All gears	BF 56	56	6
Bluefin	All gears	BF 57	57	7
Bluefin	All gears	BF 58	58	8
Bluefin	All gears	BF 59	59	9
Bluefin	All gears	BF 60	60	10
Bluefin	All gears	BF 61	61	11
Bluefin	All gears	BF 62	62	12
Bluefin	All gears	BF 63	63	13
Bluefin	All gears	BF 64	64	14
Bluefin	All gears	BF 65	65	15
Bluefin	All gears	BF 66	66	16
Bluefin	All gears	BF 67	67	17
Skipjack	All gears	SJ 71	71	1
Skipjack	All gears	SJ 72	72	2
Skipjack	All gears	SJ 73	73	3
Skipjack	All gears	SJ 74	74	4
Skipjack	All gears	SJ 75	75	5
Skipjack	All gears	SJ 76	76	6
Skipjack	All gears	SJ 77	77	7
Skipjack	All gears	SJ 78	78	8
Skipjack	All gears	SJ 79	79	9
Skipjack	All gears	SJ 80	80	10
Skipjack	All gears	SJ 81	81	11
Skipjack	All gears	SJ 82	82	12
Skipjack	All gears	SJ 83	83	13
Skipjack	All gears	SJ 84	84	14
Billfish & Others	All gears	BIL 91	91	1
Billfish & Others	All gears	BIL 92	92	2
Billfish & Others	All gears	BIL 93	93	3
Billfish & Others	All gears	BIL 94	94	4
Billfish & Others	All gears	BIL 94A**	94-1	14**
Billfish & Others	All gears	BIL 94B**	94-2	24**
Billfish & Others	All gears	BIL 95	95	5
Billfish & Others	All gears	BIL 96	96	6
Billfish & Others	All gears	BIL 97	97	7

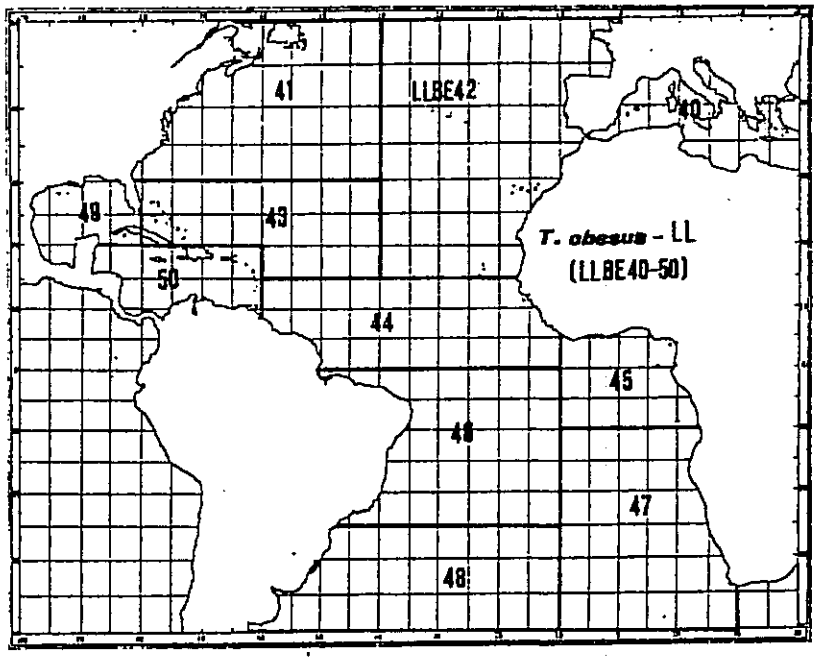
* The Area should be in latitude and longitude. However, in case that such information is not available, sampling area code may be used.

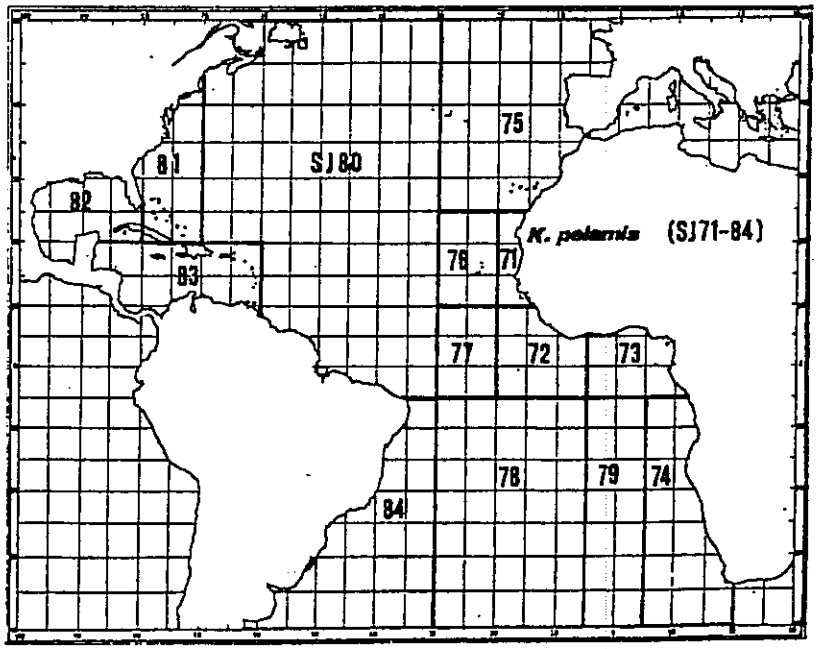
** Used only for Swordfish and other species.

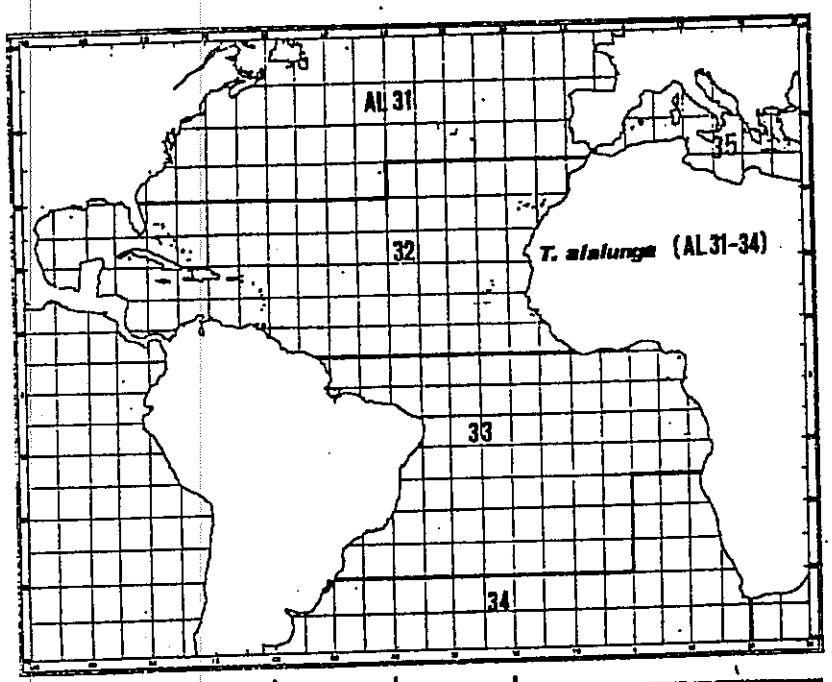
B. MAPS ILLUSTRATING ICCAT SAMPLING AREAS

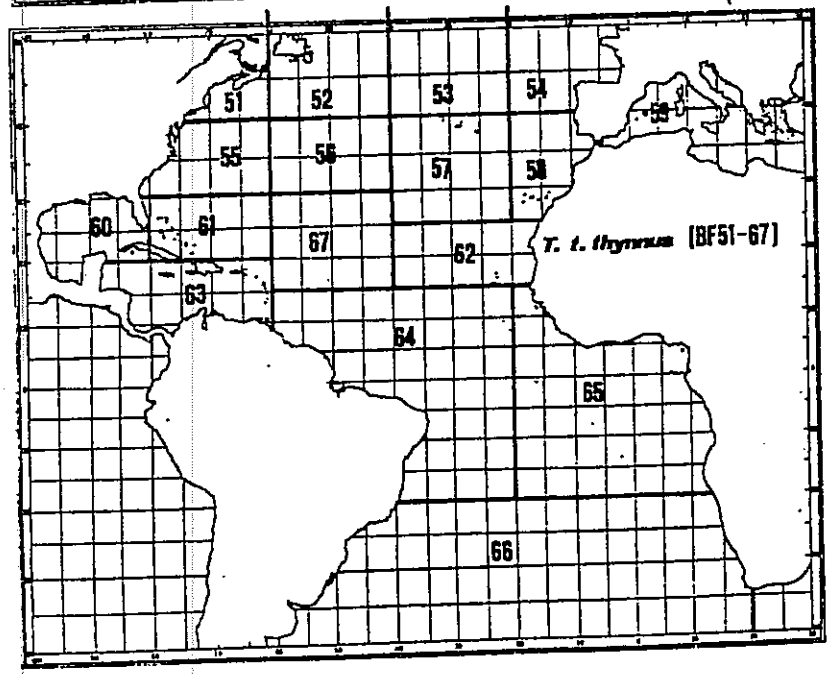









AL 31
32
33
34
35
T. alalunga (AL31-34)


51
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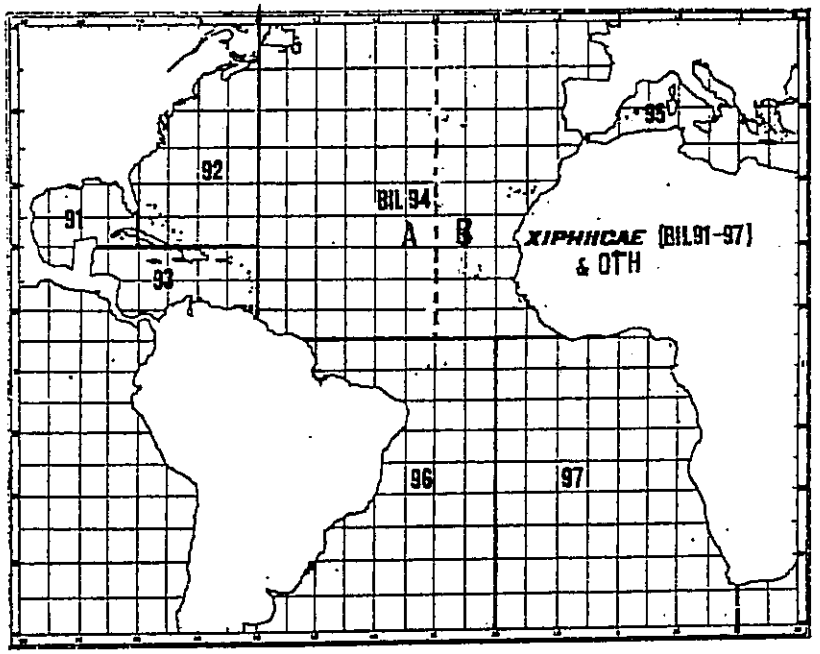
67
T. t. thynnus (BF51-67)


91
92
93
BIL 94
A
B
95
96
97
XIPHIIDAE (BIL91-97)
& OTH

Appendix 6 Various conversion factors useful in tuna statistics

Weight conversions

1 lb = 0.4536 kg
1 kg = 2.2046 lbs
1 short ton = 2000 lbs = 0.9072 metric tons

Gilled and Gutted Weight (GWT) to Round Weight (RWT):

Yellowfin, Bigeye.....GWT x 1.13 = RWT
Bluefin.....GWT x 1.16 = RWT

Dressed Weight (DWT) or Gilled and Gutted Weight (GWT) vs. Round Weight (RWT):

Billfishes.....DWT x 1.20 = RWT
Swordfish Northwest Atlantic*.....DWT x 1.3333 = RWT (Turner, 1987)
Central-East Atlantic..DWT x 1.3158 = RWT (Mejuto et al., 1988)
Southwest Atlantic.....GWT = 0.8009 x $RWT^{1.013}$ (Amorim et al., 1979)
Southeast Atlantic .....GWT x 1.140 = RWT (Mejuto et al, 1988)

* Presently used also for the Mediterranean swordfish

Length-weight conversions

The following length-weight relationships are suggested for calculating mean weights:

YFT $RWT = 2.153 \times 10^{-5} \times FL^{2.976}$ (Caverivière, 1976)

SKJ $RWT = 7.480 \times 10^{-6} \times FL^{3.2526}$ (Cayré & Laloe, 1986)

BET $RWT = 2.396 \times 10^{-5} \times FL^{2.9774}$ (Parks, et al., 1981)

ALB $RWT = 6.303 \times 10^{-6} \times FL^{3.2825}$ (Beardsley, 1971)

BFT East Atlantic $RWT = 2.95 \times 10^{-5} \times FL^{2.898958}$ (Rey and Cort, Unpbl.)
West Atlantic* $RWT = 2.861 \times 10^{-5} \times FL^{2.929}$ (Parrack & Phares, 1979)
Mediterranean $RWT = 1.9607 \times 10^{-5} \times FL^{3.0092}$ (Arena, Unpbl.)

BLF $RWT = 1.810 \times 10\text{-}5 \times FL^{3.02838}$ (Beardsley & Richards, 1970)

FRI $RWT = 1.66 \times 10^{-6} \times FL^{3.44257}$ (Ramos et al., 1986)

BON $RWT = 7.24 \times 10^{-3} \times FL^{3.16446}$ (Rey et al., 1984)

SWO NW Atlantic $DWT = 4.592 \times 10^{-6} \times LJ\text{-}F^{3.1370}$ (Turner, 1987)
Centr. North Atl. $RWT = 4.203 \times 10^{-6} \times LJ\text{-}F^{3.2134}$ (Mejuto et al., 1988)
NE Atlantic $RWT = 3.4333 \times 10^{-6} \times LJ\text{-}F^{3.2625}$ (Mejuto et al., 1988)
Mediterranean $DWT = 5.701 \times 10^{-6} \times LJ\text{-}F^{3.16}$ (De Metrio, 1987)
SW Atlantic $GWT = 1.24 \times 10^{-5} \times E\text{-}F^{3.04}$ (Amorim et al, 1979)
SE Atlantic $GWT = 4.3491 \times 10^{-6} \times LJ\text{-}F^{3.188}$ (Mejuto et al., 1988)

RWT = Round weight
DWT = Dressed weight (Gilled, gutted, part of head off, fins off)
GWT = Gilled and gutted weight
FL = Fork length
LJ-F = Lower jaw - fork length
E-F = Eye - fork length

* For monthly relationship (west Atlantic bluefin), the following table should be used where $W = A \times 10^{-5} \times FL^{B}$

Month	A	B=
January	2.861	2.9290
February	2.861	2.9290
March	2.861	2.9290
April	6.043	2.7794
May	6.043	2.7794
June	4.044	2.8370
July	3.733	2.8683
August	2.227	2.9704
September	1.520	3.0531
October	0.3871	3.3172
November	0.3871	3.3172
December	2.861	2.9290

Relationship between pre-dorsal length (LD_1) and Fork length (FL)

The following tables show the relationships between pre-dorsal length and fork length for various tuna species. They should not, however, be applied to areas other than those described here.

Yellowfin (for the eastern tropical Atlantic)

LD_1	FL (LF)		LD_1	FL (LF)	
	Mean	*Class*		*Mean*	*Class*
10 - 10.9	33.7	32 - 33.9	30 -	105.6	104 -
11 - 11.9	35.7	34 - 35.9	31 -	109.5	108 -
12 - 12.9	38.5	38 - 39.9	32 -	112.7	112 -
13 -	40.4	40 -	33 -	118.4	118 -
14 -	44.5	44 -	34 -	121.6	120 -
15 -	47.4	46 -	35 -	126.4	126 -
16 -	50.8	50 -	36 -	133.1	132 -
17 -	54.2	54 -	37 -	135.9	134 -
18 -	57.2	56 -	38 -	139.9	138 -
19 -	60.2	60 -	39 -	144.7	144 -
20 - 20.9	63.8	62 -	40 -	149.1	148 -
21 -	67.7	66 -	41 -	152.0	152 -
22 -	71.6	70 -	42 -	156.8	156 -
23 -	76.1	76 -	43 -	160.7	160 -
24 -	80.7	80 -	44 -	166.6	166 -
25 -	85.5	84 -	45 -	168.9	168 -
26 -	88.8	88 -	46 -	171.9	170 -
27 -	93.1	92 -	47 -	175.0	174 -
28 -	97.2	96 -	48 -	176.5	176 -
29 -	101.4	100 -	49 -	178.0	178 -

NOTE: — In case $LD_1 \geqslant 50$ cm
$FL = 81.3 + 1.98\ (LD_1 + 0.5)$

Albacore (for the northeastern Atlantic)

F.L. = 3.09 x LD1 - 21.1

Bigeye (for the eastern tropical Atlantic)

LD_1	FL (LF)		LD_1	FL (LF)	
	Mean	*Class*		*Mean*	*Class*
13 - 13.9	42.4	42 - 43.9	31 -	99.5	98 -
14 - 14.9	45.1	44 - 45.9	32 -	103.0	102 -
15 - 15.9	47.0	46 - 47.9	33 -	106.5	106 -
16 - 16.9	49.8	48 -	34 -	110.6	110 -
17 -	52.6	52 -	35 -	114.4	114 -
18 -	55.3	54 -	36 -	118.3	118 -
19 -	58.2	58 -	37 -	121.6	120 -
20 -	61.3	60 -	38 -	124.9	124 -
21 -	64.6	64 -	39 -	128.5	128 -
22 -	67.4	66 -	40 -	133.7	132 -
23 -	71.0	70 -	41 -	138.4	138 -
24 -	74.6	74 -	42 -	139.6	138 -
25 -	78.2	78 -	43 -	143.	142 -
26 -	81.4	80 -	44 -	148.4	148 -
27 -	85.1	84 -	45 -		150 -
28 -	88.5	88 -	46 -	154.5	154 -
29 -	91.5	90 -	47 -	160.0	160 -
30 -	96.0	96 -	48 -	169.0	168 -

NOTE: — In case $LD_1 \geqslant 49$ cm

$$FL = \left(\frac{LD_1 + 0.5 + 21.45108}{5.28756}\right)^2$$

Relationship between various measurements.

Swordfish LJ-F = 7.821534 + 1.0897 x E-F (Rey & Garces, 1979)

Billfishes (except swordfish)

The following table gives relationships between:

Lower jaw-fork length (LJFL = LJ-F);
Eye-fork length (EOFL = EF);
Pectoral-fork length (PFL);
Second dorsal-fork length (DFL); and
Pectoral-dorsal length (PDL)
(Prince, 1989).

Species	Sex	Dependent variable	Regression equation	R^2
Blue marlin	female	EOFL	LJFL = 10.52 + 1.09(EOFL)	0.97
		PFL	LJFL = 19.23 + 1.20(PFL)	0.97
		DFL	LJFL = 10.02 + 1.20(DFL)	0.96
		PDL	LJFL = 33.29 + 1.61(PDL)	0.90
	male	EOFL	LJFL = 7.15 + 1.10(EOFL)	0.97
		PFL	LJFL = 9.34 + 1.24(PFL)	0.95
		DFL	LJFL = 9.08 + 1.20(DFL)	0.95
		PDL	LJFL = 50.15 + 1.33(PDL)	0.75
White marlin	female	EOFL	LJFL = 17.75 + 1.04(EOFL)	0.90
		PFL	LJFL = 36.91 + 1.05(PFL)	0.83
		DFL	LJFL = 35.14 + 1.00(DFL)	0.78
		PDL	LJFL = 72.07 + 1.02(PDL)	0.64
	male	EOFL	LJFL = 6.89 + 1.11(EOFL)	0.92
		PFL	LJFL = 27.19 + 1.12(PFL)	0.94
		DFL	LJFL = 17.48 + 1.13(DFL)	0.95
		PDL	LJFL = 53.03 + 1.19(PDL)	0.80
Sailfish	female	EOFL	LJFL = 9.14 + 1.08(EOFL)	0.98
		PFL	LJFL = 10.02 + 1.23(PFL)	0.98
		DFL	LJFL = 11.75 + 1.14(DFL)	0.96
		PDL	LJFL = 18.79 + 1.55(PDL)	0.93
	male	EOFL	LJFL = 8.01 + 1.10(EOFL)	0.98
		PFL	LJFL = 5.06 + 1.27(PFL)	0.97
		DFL	LJFL = -0.18 + 1.23(DFL)	0.96
		PDL	LJFL = 9.83 + 1.64(PDL)	0.92

Appendix 7 Definition of technical terms used

Abundance index

A type of statistics which represent the abundance of fish stock in a given area and time. Catch per unit of effort is the typical index to measure abundance. However, in general only relative abundance (density) of a fish stock can be measured instead of the total population size.

Catch (also called Nominal Catch or Yield)

The total weight or number of fish removed from the sea as a quantitative result of all kinds of commercial, industrial, subsistence and sport fishing operations and activities, undertaken by all types and classes of fishing units in or on the water.

Catch by size

A table showing the number of fish caught, grouped into various size classes. It is the same as the catch frequencies raised to the total catch.

Catch per unit of effort (CPUE)

The catch of fish, in number or in weight, taken by a defined unit of fishing effort.

Data base

A collection of information organized in a way that facilitates access, analysis, and reporting.

Effective fishing effort

Fishing effort adjusted, when necessary, so that each increase in the adjusted unit causes a proportional increase in the instantaneous rate of fishing.

Fishery management

Control of fishing activities so that the fish stocks are kept at a level best for human interests (which could be biological, economic or any other interests). The term is used not only in the negative sense but also in the positive sense such as for the development of a fishery on underexploited fish stocks.

Fishing days (Boat-days fishing)

Unit of effort frequently used for most of the surface gears. One fishing day represents a full day in which a boat is engaged in fishing activities (including searching for fish).

Fishing effort

The total fishing gear in use for a specified period of time. When two or more kinds of gear are used, they must be adjusted to some standard type.

Fishing mortality

Death of fish caused by man's fishing activities.

Fishing mortality (instantaneous)

The instantaneous mortality rate, multiplied by the ratio rate of fishing deaths to all deaths, i.e., the natural logarithm (with sign change) of the survival rate through fishing activities. The ratio of the number of deaths by fishing activities per unit of time to population abundance during that time.

Flag (which a vessel flies)

The country where the boat is formally registered. It can be different from the nationality of owners, operators, and/or country giving fishing licenses for that vessel.

Growth curve

A curve representing the growth of fish in a time series. The time series is on the X-axis and fork length on the Y-axis and in most cases the curve is S-shaped. The relationship is generally expressed by the Bertalanffy equation:

$$l_t = l_\infty \left(1^{-e^{-k(t-t_0)}}\right)$$

Landing

The amount of fish (either in number or weight) unloaded at a certain site on land either from fishing vessels or from transshippers.

Maximum (sustainable biological yield) – See "Maximum sustainable yield".

Maximum sustainable economic yield

The largest average economic profit which can continuously be made by fishing a stock under current environmental conditions. Economic profit can be defined narrowly as the total landing value less cost or widely as including all the profits made by subsequent marketing, canning and even by boat builders and gear manufacturers.

Maximum sustainable (equilibrium) yield (MSY)

The largest average catch which can continuously be taken from a stock under current environmental conditions.

Natural mortality

Deaths from all causes except man's fishing, including senility, epidemics, pollution, etc.

Optimum stock size

Stock size which would give maximum sustainable yield at its equilibrium state with a proper effort level.

Parameter

A constant or numerical description of some property of a population.

Population

A genetic group of fish of one species which has common ecological and genetic features.

Raising (weighting)

A procedure to estimate population from a sample by multiplying all the fractions of a sample (e.g., number of fish in each size class) by a value (raising factor) which is a reciprocal of the portion of the population represented by the sample.

Recruitment

Addition of new fish to the vulnerable population by growth from among smaller size categories.

Statistics

Estimates of parameters which are obtained by observation, and which in general are subject to sampling error.

Stock

A biological unit of fish of one species forming a group of similar ecological characteristics and as a unit is the subject of fishery management.

Surface fishery

Any fishery which uses a gear to catch fish in the near-surface water (0 – 100 m. for tunas and tuna-like species) (e.g., purse seine, pole-and-line, handline, gill net, and trap fisheries).

Tuna and Tuna-like species (fishes)

All the fish of Scombriformes with the exception of the families Trichiuridae and Gempylidae and the genus Scomber.

Year-class

The fish spawned or hatched in a given year.

Appendix 8 Summaries of ICCAT data base codes

(as of September 1, 1990)

Country codes (in alphabetical order)

ALGERIE	1	GHALMD	89	S.AFRICA	20
ANGOLA	34	GREECE	10	SPAIN	21
ARGENTIN	2	GRENADA	30	SPAIN-CANARY I	45
ARUBA	90	GUADELOU	36	S.HELENA	61
BARBADOS	63	G.BISSAU	94	ST.LUCIA	77
BENIN	67	HONDURAS	71	SWEDEN	22
BERMUDA	83	IRELAND	66	SYRIA	64
BRASIL	3	ISRAEL	38	TOGO	72
BRAS.CAY	80	ITALY	11	TRINIDAD	41
BRAS.JPN	57	IT.TY-LI	91	TUNISIE	23
BRAS.KOR	56	JAPAN	12	TUN.MON.	92
BRAS.ESP	75	JPN.ICAT	55	TURKEY	24
BULGARIA	47	JP-CA-OB	86	URUGUAY	42
CAMEROON	84	JP-SH-OB	97	USA	25
CANADA	4	JP-US-OB	87	US P.R. TR	58
CAN.JPN.	95	JPN REF	93	US VIR.I	43
CAP VERT	65	KOREA	13	USSR	35
CAYMAN I	74	KOR+PAN	46	VENEZUEL	29
CHI.TAIW	5	LEBANON	39	VEN-POR	85
CHI.ICAT	54	LIBERIA	51	YUGOSLAV	26
COLOMBIA	62	LIBYA	14		
CONGO	69	MALTA	15		
C.IVOIRE	50	MARTINIQ	33		
CUBA	6	MAURITAN	82		
CUB.ICAT	96	MEXICO	31		
CYPRUS	48	MAROC	16		
DENMARK	7	NEI	73		
DOMIN.R.	37	NETHERLA	70		
EGYPT	60	NLD.ANT.	76		
E.GUINEA	81	NIGERIA	88		
FIS	32	NORWAY	17		
FRANCE	8	OTHERS	99		
FRA.ESP	59	PANAMA	28		
GABON	68	POLAND	18		
GER.D.R.	49	PORTUGAL	19		
GER.F.R.	9	ROUMANIE	52		
GHANA	27	SAO TOME	79		
GHANA B.	44	SENEGAL	53		
GHA.ICAT	78	SI.LEONE	40		

Country codes (in numeric order)

1	ALGERIE	42	URUGUAY	83	BERMUDA
2	ARGENTIN	43	US VIR.I	84	CAMEROON
3	BRASIL	44	GHANA B.	85	VEN-FOR
4	CANADA	45	CANARY B	86	JP-CA-OB
5	CHI.TAIW	46	KOR+PAN	87	JP-US-OB
6	CUBA	47	BULGARIA	88	NIGERIA
7	DENMARK	48	CYPRUS	89	GHALMD
8	FRANCE	49	GER.D.R.	90	ARUBA
9	GER.F.R.	50	C.IVOIRE	91	IT.TY-LI
10	GREECE	51	LIBERIA	92	TUN.MON.
11	ITALY	52	ROUMANIE	93	JPN REF
12	JAPAN	53	SENEGAL	94	G.BISSAU
13	KOREA	54	CHI.ICAT	95	CAN.JPN.
14	LIBYA	55	JPN.ICAT	96	CUB.ICAT
15	MALTA	56	BRAS.KOR	97	JP-SH-OB
16	MAROC	57	BRAS.JPN	98	
17	NORWAY	58	P.RIC.TR	99	OTHERS
18	POLAND	59	FRA.ESP		
19	PORTUGAL	60	EGYPT		
20	S.AFRICA	61	S.HELENA		
21	ESPANA	62	COLOMBIA		
22	SWEDEN	63	BARBADOS		
23	TUNISIE	64	SYRIA		
24	TURKEY	65	CAP VERT		
25	USA	66	IRELAND		
26	YUGOSLAV	67	BENIN		
27	GHANA	68	GABON		
28	PANAMA	69	CONGO		
29	VENEZUEL	70	NETHERLA		
30	GRENADA	71	HONDURAS		
31	MEXICO	72	TOGO		
32	FIS	73	NEI		
33	MARTINIQ	74	CAYMAN I		
34	ANGOLA	75	BRAS.ESP		
35	USSR	76	NLD.ANT.		
36	GUADELOU	77	ST.LUCIA		
37	DOMIN.R.	78	GHA.ICAT		
38	ISRAEL	79	SAO TOME		
39	LEBANON	80	BRAS.CAY		
40	SI.LEONE	81	E.GUINEA		
41	TRINIDAD	82	MAURITAN		

Gear codes

1	LL	BB	17
2	LLMB	BBF	16
3	LLFB	BBI	15
4	LLHB	BLL	32
5	PSC	GILL	24
6	PS	HAND	19
7	PSS	HARP	18
8	PSD	HS	29
9	TROL	LL	1
10	TRAP	LLD	33
11	SURF	LLFB	3
12	SPOR	LLHB	4
13	UNCL	LLMB	2
14	TRAW	MWT	23
15	BBI	MWTD	34
16	BBF	PS	6
17	BB	PSD	8
18	HARP	PSFB	25
19	HAND	PSFS	26
20	PSM	PSG	5
21	PSLB	PSLB	21
22	R R	PSM	20
23	MWT	PSS	7
24	GILL	R R	22
25	PSFB	RRFB	27
26	PSFS	RRFS	28
27	RRFB	SPHL	31
28	RRFS	SPOR	12
29	HS	SURF	11
30	TN	TN	30
31	SPHL	TRAP	10
32	BLL	TRAW	14
33	LLD	TROL	9
34	MWTD	UNCL	13

Species codes

1	BFT	ALB	4
2	SBF	BET	5
3	YFT	BFT	1
4	ALB	BGT	22
5	BET	BIL	24
6	BLF	BLF	6
7	LTA	BLM	16
8	SKJ	BLT	30
9	BON	BON	9
10	FRI	BOP	11
11	BOP	BUM	17
12	WAH	CER	29
13	SSM	FRI	10
14	KGM	KGM	14
15	SAI	KGX	26
16	BLM	LTA	7
17	BUM	MAW	28
18	WHM	MIX	31
19	SWO	OTH	21
20	SPF	SAI	15
21	OTH	SBF	2
22	BGT	SKJ	8
23	YOU	SLT	27
24	BIL	SMT	25
25	SMT	SPF	20
26	KGX	SSM	13
27	SLT	SWO	19
28	MAW	WAH	12
29	CER	WHM	18
30	BLT	YFT	3
31	MIX	YOU	23

Region (Task I)

0	EAST
1	NW
2	WTRO
3	SW
4	GOFM
5	WEST
6	ATL
15	CVER
39	NWC
40	NORT
41	SOUT
42	NE
43	ETRO
44	SE
45	CANA
46	VISC (BISC)
47	MEDI
48	ATMRD
58	TYRR
59	LIGU
60	ADRI
61	TROP
62	AZOR
63	MDRA

Time

1-12	Months
13	1st QUARTER
14	2nd "
15	3rd "
16	4th "
17	YEARLY
18	Jan-June
19	July-Dec

K. Frequency

1st digit	
NUM	0
RAISED	10
PERCNT	20
PERMIL	30
TRANSHIP	90

2nd digit	
LENGTH (FL)	1
LD1	2
WEIGHT	3
AGE	4
LD1-FL	5
LJFL	6
EYEFORK	7
WGT-FL	8
CURVED	9

K. Catch

1	METRIC TONS
2	SHORT TONS
3	NO.FISH
4	GG DWT R*
5	CONV.RD
6	FILET

K. Effort

0	NO DATA
1	D.FISH.
2	D.FISH.G
3	D.AT SEA
4	NO.SETS
5	SUC.SETS
6	NO.TRIPS
7	NO.HOOKS
8	N.POLE-D
9	NO.LINES
10	NO.BOATS
11	TRAP D.
12	FISH.HOUR
13	NO.TRAPS
14	SUC.D.FI

K. Square

0	no square
1	5 x 10
2	10 x 20
3	10 x 10
4	20 x 20
5	1 x 1
6	5 x 5
7	USA area
8	BFWG area
9	ICCAT area
10	Region in 1st only

* Gilled and gutted weight for large tunas, dressed weight for billfishes and round weight for small tunas.