



PORT SAMPLING PROCEDURES FOR TROPICAL TUNA IN THE ATLANTIC AND INDIAN OCEANS



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INTRODUCTION

The multi-species nature of tropical tuna fisheries gives rise to difficulties when estimating catches by species and size. In 1984, the Working Group on Juvenile Tropical Tuna had already observed biased reports of landings per species provided by vessel fishing logs, which particularly affected young specimens (smaller size). To correct this bias, a procedure based on multi-species sampling of catches was put forward and is currently in use for purse-seiners and baitboats based in Dakar, Abidjan and Tema, in the Atlantic Ocean, and Victoria, Mombassa and Diego Suarez, in the Indian Ocean.

In the 1990s, changes were introduced to the fishing strategy of purse-seiners, with the extensive use of floating objects such as FADs. The composition of species and size resulting from this type of fishing varies considerably in comparison to traditional fishing over free schools, since skipjack is the main catch and there is a higher rate of smaller yellowfin and bigeye.

As a result of these changes, and after numerous studies, in 1997, a new sampling system was put forward within the European ET Research Programme (No. 95/37 “Analysis of the Tropical Tuna Multi-species Sampling Scheme”). The current sampling system—multi-species size and two-stage simultaneous counting—has been defined and its objective is to improve statistics by bearing in mind the majority of factors that influence this fishery. This procedure is the database for a chain of specific treatment— T3 (Tropical Tuna Treatment)—facilitating the best estimate possible of catch composition by species and population.

1. - SAMPLING STRATEGY: STRATA SELECTION

The basic information required for sampling is provided by boat captains at the moment of unloading. The first task undertaken every morning by the technician responsible for the sampling process is an onboard visit to collect the log books (Fig. 1) and well plan (Fig. 2). You are recommended to contact the Harbour Master’s Office or the shipping agents to find out when the boats arrive. These documents must be collected as soon as possible, preferably before the vessel begins unloading and before proceedings with the Port Authority begin (an extremely busy time for captains), in order to organise the sampling plan.

For sampling to take place, an agreement must be arranged with the vessel, which will be provided with information about the scientific nature of the process and basic objectives—including discovering the size structure and species composition of the catch—and a guarantee of non-interference with unloading must be given.

The log books are completed by the captains and contain detailed information about the course of the campaign. Routine data include the date, position, vessel activity, the characteristics of each set—time, type (positive or null), association (free school or school over object), catch by species and category of size or weight and no. of wells in which they were unloaded, in addition to other oceanographic information and comments.

The well plan can be completed by the chief engineer, for the French fleet, and by the captains, for the Spanish fleet. The plan provides details for each well (identified by number and position), the date of the set, the no. of sets (in the event of more than one set taking place on the same day) and the catch per species per weight category (+/- 10 Kg.).

In some cases, the loading information for the well plan provided by the vessel is incomplete or disorganised. In these cases, and wherever possible, it is advisable to follow the model plan

(Fig. 2) and rearrange them, in order to select the appropriate wells for sampling (consulting information in the fishing logs if necessary).

Once the log books and well plan have been collected, well selection will be undertaken according to the specifications of the new sampling strategy. This is a simultaneous multi-species stratified sampling of the catch for size structure and specific composition. By sampling a well, we discover the catch composition of the set/s stored within and the predefined time-area strata to which they belong.

The purpose of this prior selection is to establish a list of wells suitable for sampling for all the vessels unloading, by following certain criteria of quality (homogeneous sets: same type of association and time-area proximity) and quantity (minimum number of samples per stratum). This activity is top priority and must necessarily be undertaken before the sampling teams are transferred to the vessels.

DEFINED STRATA

Stratification for purse-seiners has been defined using detailed analyses from the European ET Project. It is carried out according to three criteria: zone, time and association. One of the most important results from the analysis revealed that adding a supplementary stratum: “fleet” was unnecessary. Consequently, the vessel flag is not taken into consideration from the moment fishing has occurred in the same stratum.

1. - Zone and Association Stratum

In the Indian Ocean, ten large fishing zones are considered—identical irrespective of the type of association (Figure 8c and 8d)—and defined in the following table:

ZONE 1	Somalia	12°N-50°E	12°N-70°E
		0°N-70°E	0°N-35°E
ZONE 2	Northwest Seychelles	0°S-35°E	0°S-58°E
		7°S-58°E	7°S-49°E
		10°S-49°E	10°S-35°E
ZONE 3	Eastern and Southern Seychelles	0°S-58°E	0°S-70°E
		12°S-70°E	12°S-49°E
		7°S-49°E	7°S-58°E
ZONE 4	Mozambique	10°S-35°E	10°S-49°E
		45°S-20°E	45°S-45°E
ZONE 5	Chagos	5°N-70°E	5°N-80°E
		12°S-70°E	12°S-80°E
ZONE 6	South of the Indian Ocean	12°S-49°E	12°S-141°E
		25°S-45°E	25°S-141°E
ZONE 7	Gulf of Arabia	N of 12°N and W of 70°E + Gulf of Aden and Red Sea	
ZONE 8	India-Laccadivas	23°N-70°E	Coast of India

		5°N-70°E	5°N-80°E
ZONE 9	Gulf of Bengal	N de 5°N	E de 80°E
ZONE 10	West Indonesia	5°N-80°E	Coast of Indonesia
		12°S-80°E	12°S-129°E

In the Atlantic Ocean, the zones vary slightly for a set over a free school (FS) or over a log school (LS).

Sets over **FS** (Figure 8a)

ZONE 1	Senegal	30°N-12°N	35°W-coastline
ZONE 2	North Piccolo	12°N-5°N	35°W-coastline
		5°N-0°	35°W-20°W
ZONE 3	Piccolo	5°N-0°	20°W-10°W
ZONE 4	Northeast Equator	latitude coast-0°	10°W-5°E
ZONE 5	Cape Lopez	latitude coast-15°S	5°E-coastline
ZONE 6	South of Equator	0°-15°S	35°W-5°E
			35°W-coastline

Sets over **LS** (Figure 8b)

ZONE 1	Senegal	30°N-12°N	35°W-coastline
ZONE 2	North Piccolo	12°N-5°N	35°W-11°W
		12°N-0°	35°W-20°W
ZONE 3	Piccolo	5°N-0°	22°W-10°W
		4°N-0°	20°W-10°W
ZONE 4	Coast	7°N-4°N	11°W-5°E
ZONE 5	Cape Lopez	latitude coast-15°S	5°E-coastline
ZONE 6	South of Equator	4°N-0°	10°W-5°E
		0°-15°S	35°W-5°E
			35°W-coastline

2. - Time stratum

A three-month period (quarter) is considered, which results in four strata:

1. - January – March
2. - April – June
3. - July - September
4. - October - December

3. - Association Stratum

Two strata are considered:

Set over Free School (FS)

Set over school associated to floating object (LS)

The Table 1 contains a detailed list of the codes normally used and their correspondence to these two strata.

DETERMINATION OF WELLS SUITABLE FOR SAMPLING

The person in charge of sampling will use the log books and well plan to determine the wells that comply with the requirement of containing fish from sets belonging to a single stratum and therefore eligible for sampling. Wells with fish from at least two different strata are to be discarded. Consequently, checks must be carried out to ensure that wells containing fish from two or more sets belong

- To the same type of school (FS/LS)
- To the same fishing zone (ET zones)
- To the same quarter.

Wherever possible, only wells complying with these three conditions are to be sampled, with priority being given to strata where there are fewer samples.

In exceptional cases, depending on the amount of sampling and forecasts made, wells in which sets not belonging to the same zone or time stratum but close in position (less than 5° difference) or in time (fewer than 15 days difference) could be considered valid.

However, where type of school is concerned, in no case whatsoever may sampling be undertaken on wells containing fish from different associations. It is recommended that sampling not be concentrated either in time (all the months in the quarter must be sampled) or in space (all zones).

15-25 samplings are recommended for each stratum. Depending on unloading, priority when choosing wells will be given in order to achieve these objectives, aiming to reach the minimum number in all the strata considered. Although the recommended samplings per stratum may be exceeded, these should continue as long as there are no other priority strata on the same day. It is important to remember that the vessel's flag is not considered a significant sampling factor. Consequently, the choice will be based on the strata available for the entire purse-seine fleet landings, irrespective of flag—that is, the Spanish and French fleet and associated flags—and not the flag of origin.

SAMPLING PLAN

Having selected the wells for sampling, the technician responsible for following up the activities will provide each team with the “sampling plan” form (Fig. 3). This form is intended to coordinate sampling work between the different teams.

The form indicates the vessel name and date of entry into port and shows the wells apt for sampling. Priority wells are highlighted (in order to cover the maximum number of strata). A specific well that has been sampled will be marked with a cross. In the event of not being able to work, the cause will be stated. Seven likely causes have been considered:

1. - Unloading without brine

2. - Selection by species
3. - Insufficient amount
4. - Previously unloaded
5. - Priority to other wells
6. - Too many people working on the well (no space available)
7. - Unloaded directly to net.

Likewise, the technician will distribute the equipment according to availability.

Not all the fish from the campaign may be unloaded, and the vessel may leave for the fishing grounds carrying part of the load (partial unload). Attention must be paid to this eventuality, since the log books from the previous trip must be consulted in order to identify the set in this case.

2. LANDING PROCESS

The combined efforts of at least two persons are required to adequately undertake sampling (in the Indian Ocean, a team of three persons is recommended). One person will identify and measure the specimen, while the other will complete the appropriate forms.

Unloading continues on Saturdays and public holidays, so it will probably be necessary to work on the occasional Saturday.

It is important to carry out checks before sampling. Having decided on the well to be sampled, and before commencing, we must ensure that the information contained in the well plan coincides with that found on unloading (the same wells with fish, and same type of fish). If this is not so, we must attempt to discover the cause. Two situations may arise: the well plan is incorrect, or the numbering system used by the captain is different from ours. If doubts persist even after checking, do not proceed with sampling.

Sampling should be performed randomly: there should be no selection of either species or size. Ideally, fish should be identified and measured as they leave the well, but during unloading, several scenarios may occur that will oblige us to consider how to go about sampling. During landing, the deck pond is swarming with people. This is particularly true in Diego Suarez and on Spanish vessels that unload in Abidjan and Dakar, where there are a lot of people and very little space in which to work around the well. Risk situations must be avoided. Due care must be taken, since work is carried out on specimens that are often large and when thrown into the air may cause injury to persons. It is very important to carefully choose the sampling site, ensuring that unloading is not hindered and that access to the fish is easy and safe. This will vary with each vessel, depending on how unloading is carried out and the space available in the deck pond.

The following scenarios may be seen during the unloading of a well:

1. - Unloading without brine, no stopping on deck. The load is placed directly in the net. The larger tuna are grouped together by the tail and hoisted directly onto the merchant ship or quay. This type of unloading is essentially used by the French fleet and does not permit sampling in reasonably safe conditions.
2. - Unloading without brine, with stop on deck. The catch is unloaded as before, but is kept on deck in the net, or tied by the tail before transfer. This is when sampling is undertaken, subject to the agreement of the captain.
3. - Unloading in brine by conveyor belt. The catch is unloaded directly onto the conveyor belt. Samplers measure the large specimens on the belt and simultaneously separate a sample of the

small specimens to be measured apart. You must ensure that the fish being measured are only from the well being sampled, since fish from different wells may be mixed up on the belt.

4. - Unloading in brine with no conveyor belt. Common on Spanish vessels. The large specimens are unloaded directly to the ground, while the small ones are placed in baskets. If the wells are placed just below the opening of the deck, the catch is loaded directly into the net, making sampling practically impossible (as with unloading without brine, no stopping on deck). In the remaining wells, the specimens are measured separately: the large ones on leaving the well and the small ones separated into baskets—ensuring that they have not been selected beforehand.

3. SAMPLING

The super sampling process (where all the specimens in a well are measured) undertaken in the ET project revealed a variability between specific composition and catch size, depending on whether the sampling was performed at the beginning, in the middle or at the end of unloading the well. If this is not taken into account, the distribution of sizes per species would be biased. To avoid this, sampling should always be carried out on each well in two stages or through subsampling. The first stage should be done shortly after the well is opened, and the second, several hours later, but before well unloading has finished. The team will estimate the speed of unloading and the amount of fish remaining, with a view to performing a second sampling before the well is fully unloaded (unloading a whole well may take from 3 hours—if the fish come out easily—to up to several days).

If unloading involves any selection of species (by species or weight category), the sampler must take the sample directly from the well; if there has been no selection, sampling must be performed during unloading, but always at random.

Depending on fish size, three types of sampling are possible:

1. - The well only contains large fish. (> 70 cm.)

100 specimens are identified and measured during each sampling stage (200 in total). All the specimens (mixed species) are randomly taken until the optimum number is reached. Measurements are made in LD1 (length from the base of the first spine of the dorsal fin) and ½ centimetre below.

2. - The well only contains small fish. (< 70 cm.)

During the first sampling stage, a total of 300 specimens will be measured and/or counted (all species included). If this involves skipjack, frigate tuna or little tunny, the first 25 specimens per species are measured, and the rest are counted. If this involves bigeye, yellowfin or albacore, all the specimens are measured until the recommended number is reached.

During the second stage, 200 specimens will be measured and/or counted in a similar fashion: for skipjack, frigate tuna or little tunny, only the first 25 specimens per species will be measured, and the rest counted; for bigeye, yellowfin or albacore, all the specimens will be measured until the recommended number is reached.

Measurements are taken to the FL (total length from upper jaw to the base of the fork) and the cm. below.

3. - Wells containing a mixture of large and small specimens

During the first sampling stage, a total of 300 specimens will be measured and/or counted (all species included). If this involves skipjack, frigate tuna or little tunny, the first 25 specimens per species are measured to FL and to the cm. below, and the rest are counted. If this involves bigeye, yellowfin or albacore, all the specimens are measured until the recommended number is

reached. While sampling is underway, all the large specimens from the well will be measured to LD1 and ½ cm below.

During the second stage, 200 specimens will be measured and/or counted in a similar fashion: for skipjack, frigate tuna or little tunny, only the first 25 specimens per species are measured, and the rest are counted; for bigeye, yellowfin or albacore, all the specimens are measured until the recommended number is reached. Likewise, all large specimens will be measured to LD1 and ½ cm. below.

The weight of both weight categories in the well (+/- 10 k) must be known. If this is not possible, sampling will continue, although no other wells are accessible.

BAITBOATS

For baitboats unloading in Dakar, sampling is carried out following the same specifications as for purse-seiners, the only difference being that the sampling unit in this case is the entire boat instead of the well. Generally speaking, only one sampling will be performed, except for larger vessels in which case there will be two.

When the catch is selected by size, species or commercial category before unloading, or if it is accessible to the samplers, a fraction of the fish will be sampled. Therefore, all the categories present will be randomly sampled. We will have as many samplings as number of categories into which the catch has been divided. The weight for each category should be noted down (including landings that have not been sampled).

For example, fresh fish (from the most recent sets) are usually unloaded on one side and frozen fish on the other. In these cases, two samplings will be made: one of the unloaded fresh fish and the other of the frozen fish. Similarly, the weight must be known for both landings.

GHANESE FLEET

The Ghanese fleet is composed of purse-seiners and baitboats. Tema and Abidjan are the most customary landing ports. The baitboat fleet may behave similarly to the Dakar fleet, but there may be numerous cases in which the catch from several vessels is mixed together (baitboats unloading onto purse-seiners or merchant ships). In these cases, no information is available about the fishing area or the mode of fishing. Consequently, a single sampling of the entire vessel will be done.

In the latter case, the sampling process must be described in minute detail for appropriate insertion into data processing programmes. This information will be coded according to sampling type.

SIZE FORMS

If the sampling team on board during unloading consists of two persons, one will identify and measure the specimens, while the other will complete the unloading size forms. If the team consists of three persons, one will collect and position the fish, another will measure them, and the third will make notes.

There are two types of forms depending on fish size:

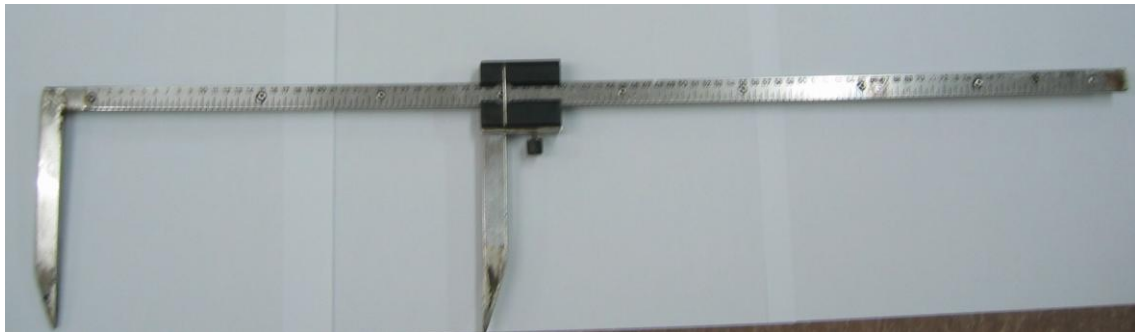
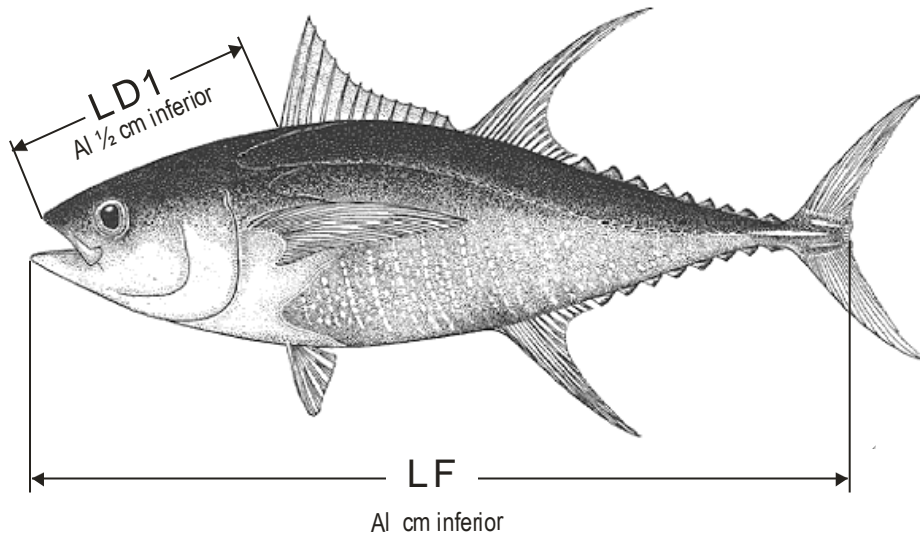
- Size sampling LD1 (Fig. 4)
- Size sampling FL (Fig. 5.1 - Fig. 5.2).

These forms are completed on board and the information is subsequently transferred to the size coding forms once in the office.

Callipers of 70 to 1m (or more) will be used for measuring. These callipers may be made of different materials such as PVC, aluminium, etc. Measurements are taken from the tip of the upper jaw to the base of the caudal fin (FL) or to the base of the 1st spine of the dorsal fin (LD).

At some ports, working with an ichthyometer is preferred, due to lack of space (baitboats, in-factory sampling) or faster sampling (Tema or Dakar). The calliper is recommended in all cases, since it is more accurate, and essential for all LD1 measurements. The recommended setting is to the ½ cm instead of to the mm, thus avoiding biased readings.

Measurements should be very carefully taken, ensuring that no errors are made. Approximate measurements should be to the cm or ½ cm, depending on the case.



Callipers



Ichthyometer



1. - FL: The juvenile specimens of large tuna yellowfin, bigeye and albacore, less than 70 cm FL, and small tuna species are measured along the entire length to the base of the caudal fin and to the cm below.



2. - LD1: Species of large tuna—over 70 cm FL—will be measured along the length to the base of the 1st spine of the dorsal fin and to ½ cm below.

SIZE SAMPLING FOR LD1 (F4)

This form (Figure 4) is used to note down the measurements of large specimens of yellowfin, bigeye and albacore (over 70 cm in total length) from the length to the base of the first dorsal spine and to half a centimetre below (Photo 1).

The following data must be collected:

- **Vessel:** Boat code and name
- **Number and position** of well
- **Type** of sampling (corresponding to landing method)
 - Unloading: fish are sampled as they leave the wells.
 - Observer: an observer performs sampling on board during the fishery.
 - Fish selected: marked when species or weight selection has taken place during unloading.
 - Undetermined: when none of the three previous categories apply.
- **Date** of sampling
- **Name** of samplers (the person measuring and taking notes). Preferably the same person should take the measurements during each sampling (both stages).
- **Starting time** of each sampling stage
- **End time** of each sampling stage
- **Species-size columns**: the species is specified (code or initials) in the first column and the LD1 size (to the lower ½ cm) in the second.

SIZE SAMPLING FOR FL (F5.1 and 5.2)

Two different forms are used: one for each sampling stage (Figures 5.1 and 5.2). Specimens of skipjack, Frigate tuna and little tunny, and young/juvenile bigeye and yellowfin are measured. Measurements are taken of the total length (FL) and to half a centimetre below (Photo 2).

The following data must be collected:

- **Vessel:** code and name of vessel
- **Number and position** of well
- **Date** of sampling
- **Name** of samplers (the person measuring and taking notes). Preferably the same person should take the measurements during each sampling (both stages).
- **Starting time** of each sampling stage
- **End time** of each sampling stage
- **Type** of sampling (corresponding to unloading method)
- **Columns** of species-sizes: The first column contains the measurements of the first 25 skipjack (a species that appears in practically all samplings of small specimens). The rest are merely counted (noted down in the species box, but not measured).

For frigate tuna and little tunny, the same procedure is followed as for skipjack: a maximum of 25 specimens are measured, while the rest are counted.

For the remainder—yellowfin, bigeye and albacore—, the species and sizes of all specimens appearing throughout the sampling are noted down.

The first form (Figure 5.1), with a capacity for up to 300 specimens, will be used for the first sampling stage, and the second form (Figure 5.2), with a capacity for up to 200 specimens, for the second stage.

The number of specimens counted per species in each column is added up in the bottom box. This count per species and columns in the samplings is to check and easily discover any errors that might occur when data are passed from the unloading forms to the end forms in the office (errors are commonplace, due to the routine and large numbers of specimens measured and counted). In this way, we know that the total number per species must coincide on both forms.

Once sampling is over, and according to the type of unloading, we will have the following:

- One single LD1 form (F4, which includes both stages), if the well only contained large fish;
- Two FL forms (F5.1 and F5.2), if the fish are small; and
- Three forms (F4, F5.1 and F5.2), if there is a mixture of large and small sizes.

VESSEL ACCESSIBILITY

According to vessel location during unloading, we are faced with two different situations that will influence samplers' behaviour.

The vessel is moored to the quay, either unloading directly (to local canning factories) or to merchant ships alongside. Access is easy—you just pass from one vessel to another. Boats are often grouped alternately—purse-seiner/merchant ship/purse-seiner/merchant ship/purse-seiner, etc—, which facilitates unloading two purse-seiners at the same time onto one merchant ship, one on each side. This situation is most common (Seychelles, Dakar, Diego Suarez, Mombassa and Abidjan) for the French and part of the Spanish fleets.

The vessel is anchored at a considerable distance from the quay. This is the case for part of the Spanish fleet and NEI unloading onto merchant ships in Abidjan and occasionally in Victoria. The boat is accessed using local canoes or skiffs, and by taking advantage of the trips made by the team hired for unloading.

In the first case, the samplers can take advantage of the time between the first well sampling and the second to sample other wells or boats, or to go to the office and monitor the landing process and decide on the best time to carry out the second stage. In the latter case, samplers are obliged to wait on board since being ashore involves the risk of missing the second stage. As a result, the time interval between both samplings may be smaller. As there are usually two purse-seiners unloading at the same time onto the same merchant ship, sampling should be undertaken on both, alternating them to leave a minimum period between both stages of each sampling. In the event of unloading being slow, the second stage should be done the next day.

The baitboat fleet that unloads in Dakar may involve unloading the fish directly onto a lorry for transport to the cannery. If sampling has not been possible during unloading onto the lorry, it should be undertaken at the moment the lorry offloads at the factory. Samplers must travel to the factory to carry out the sampling (sometimes outside the port enclosure).

LD1 SIZE CODING FORMS (F6)

Information shown on the size forms at unloading is coded in these forms (Figure 6). They are completed in the office once sampling has finished.

Depending on the number of teams and personnel available, coding could be undertaken by a person other than the samplers, or if necessary by the samplers themselves. The measurements obtained in LD1 forms (F4) of large specimens of yellowfin, bigeye and albacore per species and size to the ½ cm should be copied onto these forms.

The coder should note down the following data:

- **Number** of sampling: this should be consecutive and annual.
- **Vessel:** Name of sampled boat
- **Arrival date** of boat
- **Port:** Code of port where sampling is carried out.
- **Number and position** of the sampled well (port or starboard)
- **Name** of the coder.
- **LD1 Sizes:** the size data obtained on unloading are transferred to the corresponding column. A stroke is placed in the appropriate size box (to the ½ cm) for each specimen. Then all the strokes in each size range of half a centimetre are counted for each species (yellowfin, bigeye and albacore). The bottom boxes counted together show the total number of specimens measured for each species.

The rest of the form will be completed by the technician responsible for sampling follow-up.

- **Type** of sampling (corresponding to the type of unloading)
 1. - Unloading: sampling has been carried out in port as the fish leave the wells, with no selection.
 2. - Observer: carried out on board by an observer.
 3. - Selection of fish: a selection of species or weight has been made during unloading.
 4. - Mixture of free school-log school: sampling has been undertaken despite the existence of two different associations.
 9. - Undetermined: does not belong to any of the three previous categories.
- **Quality** of sampling

The technician will assess the quality standards according to the following coding:

1. Good for sizes and specific composition. According to multi-species sampling and ET stratification criteria (with a tolerance of +/- 15 and +/- 5°). Each set can be attributed to its stratum of origin.
2. Apt for biological and size studies. When there has been species selection, but sampling has been carried out by following ET strata. Specific composition cannot be estimated, but sizes can be processed.
3. Apt for biological study. Cannot be transferred to an ET stratum.
4. Bad. Cannot be used for subsequent study.
5. Undetermined.

By way of example, a description of possible cases is provided and a code is assigned to each one:

Sampling where there is a mixture of FS/LS (code 3).

Two different quarters, with a difference of + 15 days between two sets (code 3, although if stratum coverage for the quarter-zone-association is below threshold, it could be assigned as code 1).

Two situation strata considerably distanced from each other (more than 5°) (Code 3)

There is no detail (no situation or type of association) (code 3).

Only the first stage of sampling has been undertaken, or few specimens have been sampled (Code 1 or 3 depending on sampling coverage or number of specimens measured).

They do not coincide with the data obtained from the well plan or from the log books (Code 1 if both sets of information belong to the same stratum: code 3 if they are from different strata).

Those where selection has taken place, but only a single category has been sampled (Code 4).

Juveniles have not been identified (code 4).

Well characteristics: estimated from the vessel well plan

- Total well weight in t
- Weight -10 k: weight (t) of specimens under 10 k in the well
- Weight +10 k: weight (t) of specimens over 10 k in the well

Details of the sets present in the sampled well. The following will be noted down for the set or sets that were emptied into the well (either partially or totally):

- Date of the fishery
- Number of the set when there has been more than one on the same day.
- The weighted catch: the fraction of the total weight of the set represented in the sampling.

The ET working group analysis concluded that the effective sampling unit assigned (the well) was representative of the set. Subsequently, when the capture of a set is emptied into two or more wells, we need to know the ratio that the capture represents of the well(s) sampled in relation to the total catch in the set. This is called a weighted catch.

In order to carry out the sampled weighting of the catch, the technician must wait until the boat has finished unloading, since a set catch spread over different wells may have been sampled more than once. Once the technician has collected all the samplings performed on the vessel, he can proceed to estimate the weighted catch of each set, defined by the date of fishery and the number of set.

Apply the following formula to make the calculation:

$$\text{Weighting} = (W1 / W2) * TW$$

being

W1 = Weight of the set or sets in the well.

W2 = Amount of the weight of the set or sets for all the wells sampled.

TW = Total weight of the set or sets.

Example: the *Mar de Sergio* has made a set of 90 t shared over 3 wells. 40 t were placed in well 1; 30 t in well 2; and 20t in well 3. We have sampled wells 2 and 3.

For 2, the weighting will be: $(30/50)*90 = 54$ t.

For 3, the weighting will be: $(20/50)*90 = 36$ t.

To check the calculation of the weightings, we can add the total weightings made of the same sampled set. This sum must be the same as the total catch of the set.

Checking our example: $54+36 = 90$ is correct, since the set was 90 t.

If the set has only been sampled once (either because the entire contents have been emptied into one well or shared over other wells that have not been sampled): the weighted catch will be the same as the total catch of the set (weighting = TW).

To make these calculations easier, a simple Excel application has been created which directly calculates the weighted catches for each set based on the total catch (TW) and the catches sampled in each well (W1, W",...).

It may be the case that the catch being weighted (log books) is smaller than shown in the well plans. In these cases, the information must be checked and chosen accordingly.

In the case of the French fleet unloading in Abidjan, the set number does not usually appear in the well plan. Consequently, we should make an approximation of the catch in each set or, where this is not possible, refer it to the total catch of the day.

Information is generally available for baitboats unloading in Dakar. A single sampling—or two in the case of larger boats—of the total catch per vessel is performed, and the catch is weighted against the total catch (or against half in the event of two samplings). To enter the information into the programme, the weighted catch of each sampling is associated to a day when catches were taken (randomly).

When part of the catch is sold for the fresh market and another for canneries, two different samplings will be undertaken whenever possible. The weighting for each one will be to the total that corresponds to each type of sale (provided in port manifests).

FL SIZE CODING FORMS (F7)

These forms (Figure 7) are used to code the information in the size forms at unloading (Figures 5.1 and 5.2). They are completed in the office and include samplings of small tuna (skipjack, frigate tuna and little tunny) and/or young yellowfin or bigeye. The boxes to be completed are identical to those described in the LD1 size forms (F6), except that the sizes are taken to the lower cm., and the number of specimens counted is noted down, along with the number of specimens measured by species (for skipjack, frigate tuna or little tunny).

SAMPLING FOLLOW-UP FORMS (F8 A, B and C)

In accordance with the specifications obtained in the ET project, sampling is spatially stratified over large homogenous areas (ET zones) that have been selected according to the mode of fishing (FS/LS) and time period (quarter). For sufficient accuracy, the analyses have estimated a minimum (15) and optimum number (25) of samplings to be made in each stratum (mode of fishing/ET zone/quarter). The technician can use two types of form, according to type of fishing (type of association).

Free school zones (FS): F8a (Atlantic) F8c (Indian)

Log school zones (LS): F8b (Atlantic) and F8d (Indian)

Care must be taken over the fact that, while in the Atlantic Ocean ET zones are different according to type of association, in the Indian Ocean they are identical (although two forms must be completed: one for fishery over FS and the other over LS).

Once information from the wells sampled each day has been received, a cross will be used to mark the area corresponding to the catch sampled in the appropriate form (the location and type of association is available in the log books). The forms contain maps to assist with interpretation, and these are changed every month.

These forms help monitor samplings already made. They pinpoint the least sampled strata and prioritise them, in order to achieve the minimum number of 15 samples per stratum and, wherever possible, the optimum number of 25. When these objectives have been reached (or when it is not possible to undertake them in priority strata), sampling will continue in strata where catches are significant.

LANDING FOLLOW-UP FORMS (SHIPPING AGENT AND CANNERY) (F9)

At least once a month (or more often if necessary), shipping agents and canning factories (and/or other competent authorities) that have worked with the fleet will be contacted, to collect landing statements for each vessel by species and commercial category. A specific form (F9) will be used for each landing, in which the catch (in kilos) for each commercial category will be entered.

4. BIOLOGICAL SAMPLING

The objective is to estimate the sex ratio and gonadosomatic index by size and month of large specimens of yellowfin and bigeye processed at the canning factories in Victoria and Abidjan.

THE SEYCHELLES

4-5 monthly samplings are planned for 100 specimens (ideally for 50 YFT and 50 BET) over 1 metre long (+ 20 k). Specimens are measured (FL and LD1) and weighed, and their sex determined. From the females, the gonads are obtained and weighed.

Sampling will be subject to the work routine of the canning factory. Labour standards must be respected, with particular attention to hygiene (shoes, hat, coat etc). In no case whatsoever must operators be interrupted or delayed in their work, and attempts must always be made to adapt to their working pace.

Large yellowfin are more abundant and are usually processed daily. Good information is generally available about dates and fishing areas, so there is a strong likelihood of obtaining good, quality samplings.

However, only very small amounts of bigeye are processed, resulting in very limited samplings. Regular contact must be kept with the manager of the canning factory, so that the sampling team can reach the factory in time for processing and perform the maximum number of samplings.

Collaboration between the canning industry and the SFA is quite good, so few problems are expected.

Data are pencilled directly onto the form or onto a PVC or plastic sheet (easier to handle in dirty conditions, or when there is no surface to lean on). In the latter case, data are copied onto the biological sampling forms (Figure 10) once back in the office.

Forms will include the following information:

General sampling information:

- **Date** of sampling
- **Starting time**
- **End time**
- **Name** of the person responsible for sampling
- **Form** number

Information about each specimen sampled:

Note down the lot number and corresponding trip number. Ask the production supervisor who may be able to provide us with data in answer to the first four on the following list:

- **Date** of entry into factory
- **Vessel** where the sample came from
- **Boat** code
- **Number** of the campaign
- **Species**
- **Number** of the specimen—assigned when sampling began—to trace it as it goes through the processing line
- **LF** size
- **LD1** size
- **Round weight**, accurate to 100 g
- **Sex**: 1 (male) 2 (female)
- For the females, the **gonad weight** accurate to 10 g

Biological sampling at the canning factory will be shared 50% between both teams (Spain/France).

ABIDJAN

As in the Seychelles, work is carried out in collaboration with the local canning industry. Work characteristics are also similar, in that large yellowfin are processed every day, whereas large bigeye are only processed when a certain amount has been accumulated over several days, or in small quantities over a short period every day. It is essential to be prepared for when processing begins, by maintaining regular contact with the cannery staff.

The vessel's name and date of unloading are noted down. This information is obtained either by asking the supervisor or personally observing the cages being processed. Care must be taken over the fact that fish are normally processed irrespective of origin, which can lead to fish from different campaigns being mixed according to processing line requirements. Samplings from different vessels and dates are common. These data enable us to know the area and date of fishery, thanks to the details processed from the fishing logs.

Sampling methodology varies depending on the species in question.

The yellowfin are hung on hooks that pass along a track, which transports them through the first stages of processing (evisceration, head removal, etc). The sampler will take measurements (LD1) before the tuna is hung. To avoid mixing, each sample is identified by attaching a number to its back, so that it can be followed along the processing line to evisceration, when its sex will be determined. This procedure is quite fast, so you cannot consider measuring all specimens, which must be done whenever possible and without causing delays in the factory's normal working conditions. Make the most of accumulations, which force the staff to wait, allowing you to work more easily.

The cannery usually waits until a certain number of bigeye has accumulated before processing. The fish are normally emptied into a cage with an opening for the saw, where an operator cuts them into pieces (without evisceration). Only one specimen is measured each time (LD1). The sex is determined after cutting, which requires some skill since the specimen goes directly into a chute. Operator collaboration is valuable, since this will enable you to spot the appropriate part with the gonads.

7. MARKET FISH OR OTHER SPECIES DESTINED FOR THE LOCAL MARKET

A sometimes significant part of the fish caught by the tuna fleet does not enter the official marketing circuit of the canning industry: very small, damaged, badly conserved tuna or non-commercial species such as the smaller tuna (frigate tuna or little tunny), marlins and other species of billfish, rainbow runners, etc. Depending on the case (landing port, vessel size), these fish can be discarded at sea, or kept on board and landed (as long as there is a local marketing circuit). This basically occurs in the Atlantic Ocean (Abidjan and Dakar) and to a lesser extent in the Indian Ocean (Diego Suarez). This fish sold at local markets is known as market fish. It is important to point out that it is the main source of income for unloading staff, which makes estimates difficult, since attempts are made to hide it because of the interests involved.

Antsiranana is the only port in the Indian Ocean where any follow-up is organised. In Mombassa, sales are controlled by the canning industry, through which this information can be obtained.

In **Antsiranana**, the work is undertaken in two stages:

Sampling on board: a two-person team takes FL or LD1 measurements of the different species when they leave the wells. The total number of specimens measured generally varies between 50 and 150, depending on working conditions. Staff involved in unloading are usually concentrated around these points, so access to specimens is not always straightforward. The main species are frigate tuna and little tunny, in addition to damaged specimens of commercial tuna. This operation can give us an idea of the specific composition of the fish that will be landed in groups at the end of the day.

Counting/weighing on the quay: in the evening, estimates are made of the amounts of damaged fish landed. This is a laborious operation and can continue well into the night. All the damaged fish leave the vessel through one single hatch after 5 p.m. They are normally sold in packets of around 30 specimens, for small species, and one by one, for larger species. Informers stand near the exit hatch and count all the packets that leave. They also identify and count the species of the large specimens (sharks, marlins, sailfishes, damaged tuna, wahoo, rainbow runners, etc). Several of the packets containing smaller fish are weighed at random to estimate the average weight.

The USTA (Antsiranana Tuna Statistical Unit) is responsible for processing this information in an annual ACCESS database.

In the Atlantic Ocean, follow-ups are also organised in Abidjan. In Dakar, the calculation is obtained directly from landing statements.

In **Abidjan**, work is carried out as follows:

Estimates are made by two informers in the port, one working by day and the other by night. Landing generally takes place in small trucks (average load from 3 to 4.5 t of fish), although small 4L vans are also used (two vans are the equivalent of one small truck), or HINO trucks (average 6.5 t). All these amounts are subjective since there is no chance of direct weighing. Informers identify and count the number of units loaded each day. They also make a visual estimate of specific composition in percentages, noting them down on the market fish forms (Figure 11). The forms include:

- Vessel name
- Date of arrival
- Date of unloading
- Time of unloading
- Registration number of the vehicle that loads the market fish
- Visual estimate of the percentage of species present

The informer must pay close attention to unloading, since market fish follow other commercial channels and can be unloaded at any time of the day or night, at different points of the port and even on Sundays and public holidays.

SPECIES

Characteristics to facilitate identification of the main species of tuna landed by purse-seiners:

	SPANISH	FRENCH	ENGLISH	SCIENTIFIC	
BET	PATUDO	THON OBÉSE o PATUDO	BIGEYE	<i>Thunnus obesus</i>	LARGE TUNA
YFT	RABIL o CIMARRÓN	ALBACORE	YELLOWFIN	<i>Thunnus albacares</i>	
ALB	ATÚN BLANCO	GERMON	ALBACORE	<i>Thunnus alalunga</i>	

SKJ	LISTADO	BONITE A VENTRE RAYÉ o LISTAO	SKIPJACK	<i>Katsuwonus pelamis</i>	SMALL TUNA
FRI	MELVA	AUXIDE	FRIGATE TUNA	<i>Auxis sp.</i>	
BLT	BACORETA	THONINE	LITTLE TUNNY	<i>Euthynnus alleteratus</i>	
KAW	BACORETA ORIENTAL	THONINE ORIENTAL	KAWAKAWA	<i>Euthynnus affinis</i>	

YFT.- YELLOWFIN *Thunnus albacares*

Both adults and young can be found. Fusiform body, more slender than bigeye. Small head and eyes, the second dorsal and anal fins are longer than for any other tuna (increase with age). Pectoral fins usually extend beyond the second dorsal fin, but not much more than the base. The dorsal area presents dark blue and yellow lateral bands. The ventral area is silvery grey and normally has vertical lines alternating with spots. The second dorsal and anal fins are yellow. Finlets are lemon yellow and edged in black. Note: specimens may be damaged during landing, often resulting in torn fins and a different colouring to the original.



Adult yellowfin



Young yellowfin

BET.- BIGEYE *Thunnus obesus*

Stocky body and rather large eyes. The first dorsal fin is bright yellow, while the second dorsal and the anal fins are brownish or yellowish, with fine black edges. Finlets are yellow, with blackish edges.



Adult bigeye



Young bigeye

DIFFERENTIATION BETWEEN YOUNG BIGEYE AND YELLOWFIN

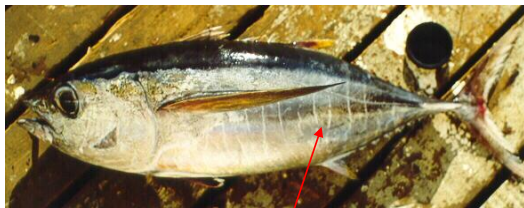
Considerable care must be given so as not to confuse the two species when they are small. Knowing how to distinguish between the two species is very important for sampling.

The yellowfin has finer white side stripes than the bigeye, and they curve backwards, alternating with more numerous dotted bands. The eyes are smaller and the body shape is more elongated.

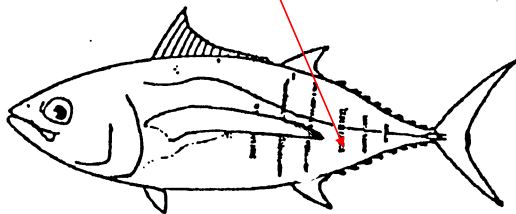
The bigeye also has side bands, but fewer, broader and straighter than the yellowfin. The eye is bigger, and the body shape more rounded.

You must remember that fish are frozen and stored in wells and, as a result, lines that are easily distinguishable when fresh, are often not very visible when frozen.

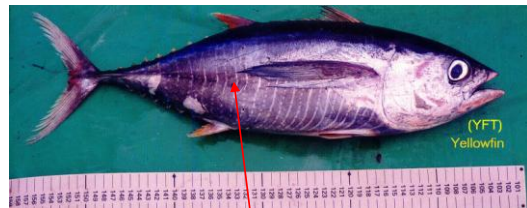
Small bigeye



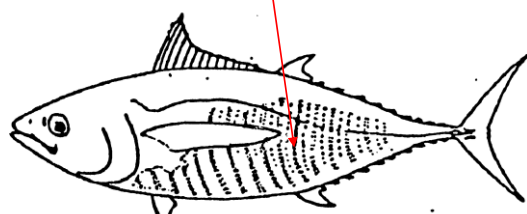
vertical lines without alternating spotted lines



Small yellowfin



vertical or curled lines alternating with spots



Lines are often not very visible.

SKJ.- SKIPJACK *Katsuwonus pelamis*

Normally 4 or 6 very visible longitudinal stripes from the belly and flanks to the tail. Very short pectoral and ventral fins. Both dorsal fins are separated from the base by a small interstitium.



BLT.-LITTLE TUNA (*A. rochei*)

15 oblique, almost vertical dark stripes on both sides of the dorsal area. Broad space between the dorsal fins. Short pectoral fin does not reach the vertical line in the scaleless area.



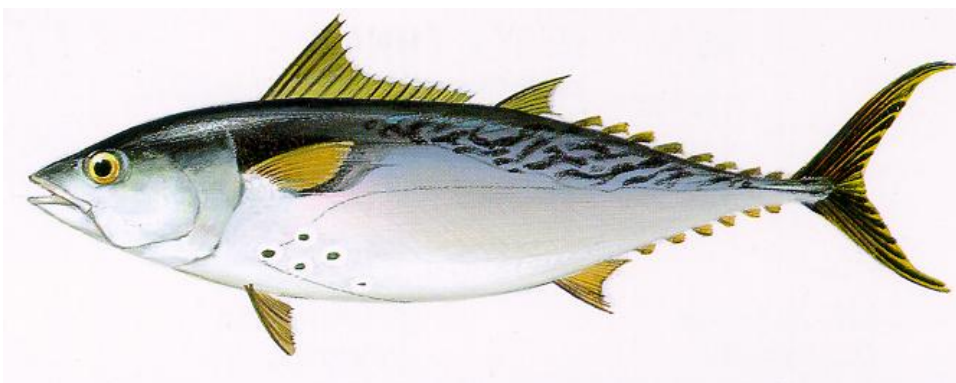
FRL-FRIGATE TUNA *Auxis thazard*

Fifteen oblique or almost horizontal dark stripes on both sides of the dorsal area. Less space between the dorsal fins than *A. rochei*. The pectoral fin is short but reaches the vertical line of the scaleless area.



LTA.- LITTLE TUNNY *Euthynnus alleteratus*

4 or 5 spots like fingerprints, located between the pectoral and ventral fins. These species also have wavy marks on the back above the lateral line, located inside the well-defined area that never extends beyond the first dorsal fin. Geographic distribution in the Atlantic.



ALB.- ALBACORE *Thunnus alalunga*

Its main feature in relation to other tuna is its pectoral fin, which can extend beyond the anal fin. In young specimens, this fin is similar in size to yellowfin tuna or bigeye. Large black eyes and small jaws, with small conical teeth. The caudal fin with white posterior edge. Fins are dark, except for yellowish dorsal finlets. Anal finlets are silvery or blackish.



KAW.- KAWAKAWA *Euthynnus affinis*

Spots like fingerprints are located between the pectoral and ventral fins. Wavy marks on the back above the lateral line. Geographic distribution in the Indian and West Pacific Oceans.



Table 1.- Most common codes of association.

Codes	FS	LS	FS/LS
0			UNKNOWN
10		FISHING ON SEAMOUNT	
11			FISHING ON THERMAL FRONT
12			FISHING ON FRONT
13			FISHING NEAR THE CONTINENTAL SHELF
14			NIGHT FISHING
20		FLOATING OBJECT	
21		NATURAL LOG (pieces of straw or wood...)	
22		NATURAL LOG WITH A BUOY	
23		FISHING AGGREGATING DEVICE (box, buoy, ropes)	
24		FISHING AGGREGATING DEVICE WITH A BUOY (raft)	
25		ANCHORED FAD	
26		FISH UNDER THE VESSEL OR THE SKIFF	
27		FISHING WITH A BAITBOAT	
28		FISHING WITH A SUPPLY OR OTHER VESSEL (not baitboat)	
30	BIRDS (in general)		
31	BIRD FLOCK		
32	SCHOOL DETECTION BY SONAR		
33	SCHOOL DETECTION BY SOUNDER		
34	SCHOOL DETECTION BY AIRPLANE		
35	SCHOOL DETECTION BY HELICOPTER		
36	SCHOOL DETECTION BY RADAR		
37			SCHOOL SIGNALLED BY ANOTHER VESSEL
38	FISHING AREA SIGNALLED BY EXTERNAL SYSTEM (satellite map ...)		
40	PLANCTON		
41	SMALL PELAGIC SPECIES (anchovy, sardines...)		
42	FLYING FISH		
43	CRUSTACEANS		
50	PORPOISE,DOLPHIN		
51	WHALE		
52	SPERM WHALE		
53	PILOT WHALE		
60		WHALE SHARK	
61	SHARK		
62	MANTA RAY		
70	FISH (in general)		
71	SWORDFISH		
72	MARLIN		
73	SAILFISH		
80	TURTLE		
81		DEAD WHALE	
91	FREE SCHOOL YFT (detected ,without setting or not captured)		
92	FREE SCHOOL SKJ (detected ,without setting or not captured)		
93	FREE SCHOOL MIXED SPECIES (detected ,without setting or not captured)		
94	FREE SCHOOL AUX, LTA (detected ,without setting or not captured)		
95	ISOLATED YFT or one by one (detected ,without setting or not captured)		
96	ISOLATED SKJ or one by one (detected ,without setting or not captured)		
97	ISOLATED undetermined species or one by one (detected ,without setting or not captured)		

Table 2.- Landing port codes.

Codes	Ports	Lat	Long	Information
1	POINTE NOIRE	-4.46	11.49	
2	ABIDJAN	5.15	-4.00	
3	DAKAR	14.41	-17.26	
4	CONCARNEAU	48.00	-3.55	
5	BOULOGNE			
6	ST JEAN DE LUZ			
7	PORT GENTIL	-0.58	7.57	
8	FORT DE FRANCE			
9	ANGOLA			
10	TEMA	5.40	-0.01	
11	LAS PALMAS	30.00	-13.00	
12	CAPE TOWN	-33.54	18.26	
13	BUENOS AIRES	-34.36	-58.22	
14	PORT OF SPAIN			
15	WALVIS BAY	-22.56	14.30	
16	TENERIFE	28.28	-16.15	
17	FREETOWN			
18	MONTEVIDEO	-34.54	-56.15	
19	KOREA			
20	JAPAN			
21	CHINA			
22	PANAMA			
23	SAN MARTIN			
24	MADAGASCAR			
25	SAMOA			
26	MALAYSIA			
27	LIBREVILLE	0.27	9.25	
28	SAO TOME	0.27	6.50	
29	AZORES			
30	SPAIN			
31	VIGO	42.14	-8.46	
32	RIBEIRA	43.06	-8.59	
33	ALGECIRAS	36.08	-5.25	
34	VILLAGARCIA	42.37	-8.46	
35	BERMEO	43.25	-2.43	
36	SANTANDER	43.27	-3.48	
37	LA PUEBLA			
39	TRANSSHIPMENT AT SEA			
40	U.S.A			
41	PUERTO RICO			
42	SEYCHELLES	-4.37	55.27	Mahé
43	MAURICE	-20.10	57.30	
44	REUNION	-21.00	55.40	
45	DIEGO SUAREZ	-12.15	49.20	
46	DJIBOUTI	11.30	43.05	
47	COLOMBO	6.57	79.40	
48	MOMBASSA	-4.20	39.40	
50	ITALY			
51	SINGAPORE	1.22	103.55	
52	BANGKOK	13.36	100.36	
53	GAN	-0.40	73.09	Maldives
54	BANDAR-ABBAS	27.21	56.36	Iran
55	CHABAHAR	25.41	60.45	Iran
56	PHUKET	8.12	98.31	Thailand
57	D'ZOUZDI	-12.46	45.17	Mayotte
58	MAYOTTE			
60	YUGOSLAVIA			
61	GUANTA/CUMANA	10.14	-64.36	Venezuela
62	DURBAN	-29.50	30.56	
70	MOROCCO			
80	CAPE VERDI			
90	CANADA			
91	SAINT ANDREWS			
92	DUBAI	25.15	55.16	
93	MAJUNGA	-15.30	46.30	
94	FUJAYRAH	25.20	56.15	United Arab Emirates
999	Port to be corrected			

WELL PLAN

NAME OF THE BOAT _____

DEPARTURE DATE: _____

ARRIVAL DATE _____

PORT								STARBOARD							
WELL	DATE	YELLOWFIN (YF)		SKIPJACK(SK)	BIGEYE(BE)		OTHERS	WELL	DATE	YELLOWFIN (YF)		SKIPJACK(SK)	BIGEYE(BE)		OTHERS
	No SET	t		t	t		t		No SET	t		t	t		t
		-10	+10	-10	-10	+10				-10	+10	-10	-10	+10	
1								1							
							0								0
2								2							
							0								0
3								3							
							0								0
4								4							
							0								0
5								5							
							0								0
6								6							
							0								0
7								7							
							0								0
8								8							
							0								0

Figure 2.- Well plan

MEASUREMENT LD1 (cm)													
VESSEL													
WELL NUMBER				TYPE		LANDING		DATE OF SAMPLING					
PORT				OF SAMPLING		OBSERVER		Day		Month		Year	
STARBOARD						FISH SELECTED							
						MIX FS/LS							
						UNDETERMINED							

START TIME:				1st Stage				END TIME :			
No.	SP	LD1	SP	LD1	SP	LD1	SP	LD1	SP	LD1	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

START TIME:				2nd Stage				END TIME :			
No.	SP	LD1	SP	LD1	SP	LD1	SP	LD1	SP	LD1	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

Sampler 1 (Measurements):

Sampler 2 (Transcriber) :

Figure 4.- LD1 size sampling form

VESSEL														WELL No.		PORT		OBSERVATIONS		
SAMPLING DATE		/ /													STARBOARD					
FL (cm) FIRST STAGE																				OBSERVATIONS START TIME END TIME UNDETERMINED MIX FSLS FISH SELECTED OBSERVER LANDING TOTAL
No.	SKIPJACK	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
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25																				
26																				
27																				
28																				
29																				
30																				
↓		↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	
YFT	0																		YFT	
SKJ	30																		SKJ	
BET	0																		BET	
BLT	0																		BLT	
FRI	0																		FRI	
TOT	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	300	TOT	

Sampler (Measurements) : _____ Sampler (Transcriber) : _____

Figure 5.1.- FL size sampling form, first stage.

VESSEL												WELL NO	PORT	
SAMPLING DATE													STARBOARD	
<h2 style="text-align: center;">FL (cm)</h2> <h3 style="text-align: center;">SECOND STAGE</h3>														
No.	SKIPJACK	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	SP	FL	OBSERVATIONS START TIME:..... END TIME :..... LANDING <input type="text"/> OBSERVER <input type="text"/> FISH SELECTED <input type="text"/> MIX FS/LS <input type="text"/> UNDETERMINED <input type="text"/>
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
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17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
														TOTAL
YFT	0													ALBACORE
SKJ	30													SKIPJACK
BET	0													BIGEYE
BLT	0													LITTLE TUNNY
FRI	0													FRIGATE TUNA
TOT	30	30	30	30	30	30	30	30	20	200			TOTAL	

Sampler (Measurements) : _____

Sampler (Transcriber) : _____

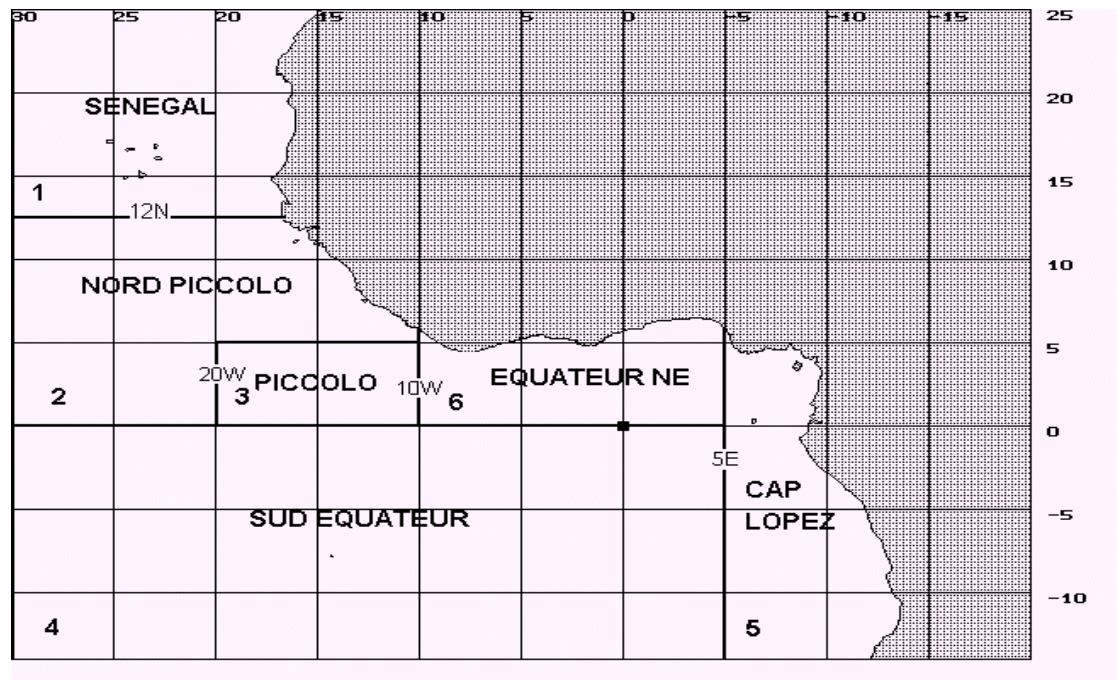
Figure 5.2.- FL size sampling form, second stage.

TYPE		QUALITY	LD1 (cm)				Coder: _____		
SAMPLING No.			WELL No.			DATE OF FISHERY	No.SET	WEIGHTING	
			BOAT CODE						
			TOTAL WELL						
			WEIGHT -10 KG						
VESSEL									
ARRIVAL	/ /		WEIGHT +10 KG						
PORT									
LD1	YELLOWFIN (YFT) (1)				LD1	BIGEYE (BET) (3)		LD1	ALBACORE (ALB)
20					20			20	
21					21			21	
22					22			22	
23					23			23	
24					24			24	
25					25			25	
26					26			26	
27					27			27	
28					28			28	
29					29			29	
30					30			30	
31					31			31	
32					32			32	
33					33			33	
34					34			34	
35					35			35	
36					36			36	
37					37			37	
38					38			38	
39					39			39	
40					40			40	
41					41			41	
42					42			42	
43					43			43	
44					44			44	
45					45			45	
46					46			46	
47					47			47	
48					48			48	
49					49			49	
50					50			50	
51					51			51	
YELLOWFINS					BIGEYES				ALBACORES
TOTAL MEASURED					TOTAL MEASURED				TOTAL MEASURED

Figure 6.- LD1 size coding form

TYPE		QUALITY		FL (cm)		Coder: _____					
SAMPLING No.				WELL No.		DATE OF FISHERY	No.	WEIGHTING			
VESSEL				BOAT CODE							
ARRIVAL				TOTAL WELL							
PORT				WEIGHT -10 KG							
				WEIGHT +10 KG							
YELLOWFIN (1)				SKIPJACK (2)		BIGEYE (3)					
				COUNTED TOTAL							
FL	NUMBER			FL	NUMBER		FL	NUMBER			
20				20			20				
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				
30				30			30				
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				
40				40			40				
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				
50				50			50				
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				
60				60			60				
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				
70				70			70				
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				
70				70			70				
TOTAL MEASURED				TOTAL MEASURED				TOTAL MEASURED			

Figure 7.- FL size coding form

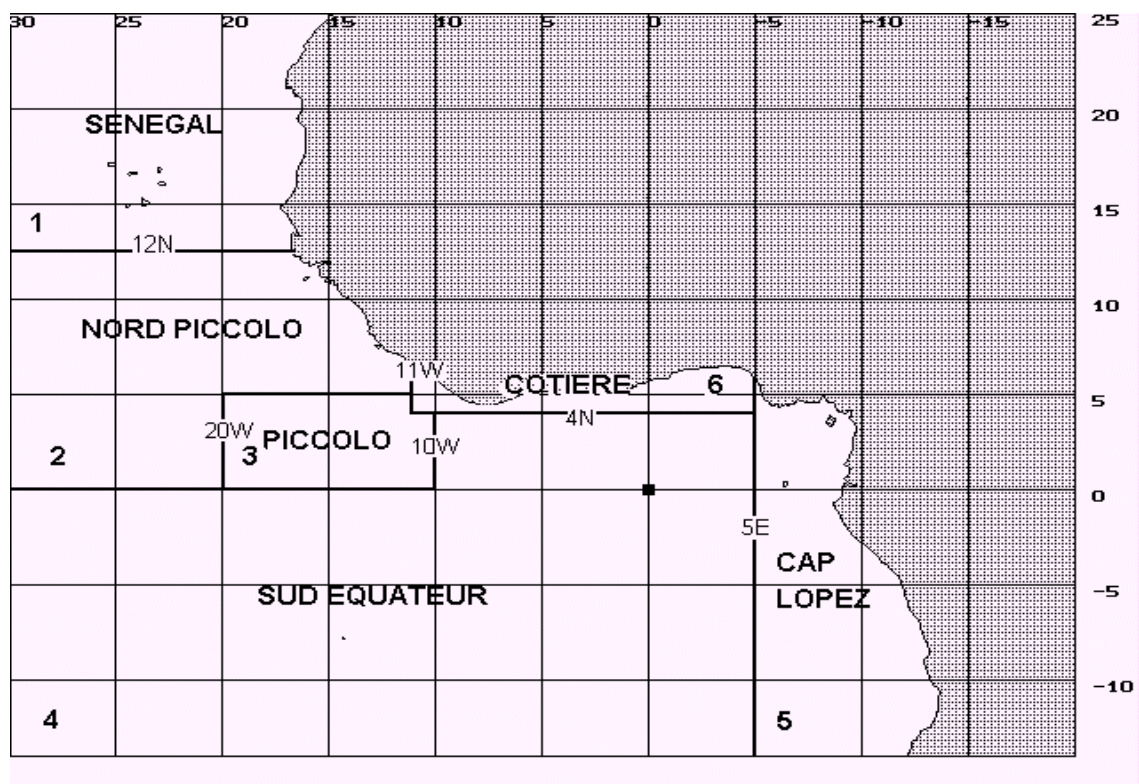


No SAMPLES		
ZONE 1	Senegal	
ZONE 2	North Piccolo	
ZONE 3	Piccolo	
ZONE 4	South Equator	
ZONE 5	Cape Lopez	
ZONE 6	NE Equator	

YEAR:

MONTH:

Figure 8a.- Atlantic Zones Free School Form



		No SAMPLES
ZONE 1	Senegal	
ZONE 2	North Piccolo	
ZONE 3	Piccolo	
ZONE 4	South Equator	
ZONE 5	Cape Lopez	
ZONE 6	Coastal	

YEAR:

MONTH:

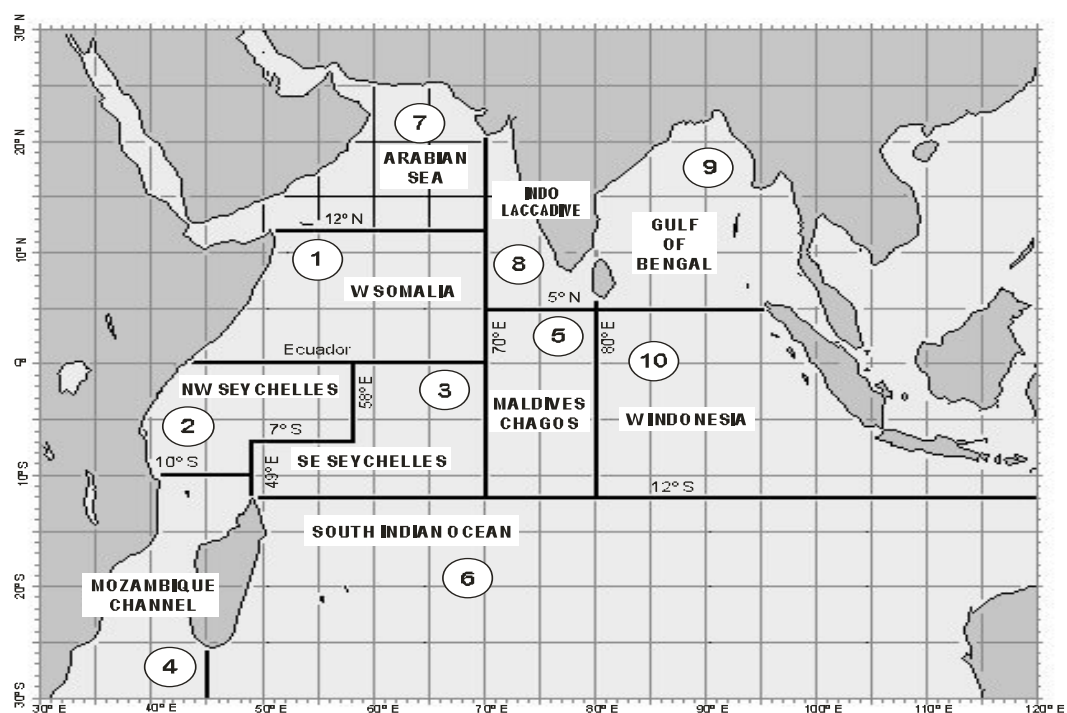
Figure 8b.- Atlantic Zones Log School Form

		No SAMPLES
ZONE 1	W Somalia	
ZONE 2	NW Seychelles	
ZONE 3	SE Seychelles	
ZONE 4	Mozambique channel	
ZONE 5	Chagos	
ZONE 6	South indian ocean	
ZONE 7	Arabian sea	
ZONE 8	Indo-Laccadive	
ZONE 9	Gulf of Bengal	
ZONE 10	West Indonesia	

YEAR:

MONTH:

Figure 8c.- Indian Zones Free School Form



		No SAMPLES
ZONE 1	W Somalia	
ZONE 2	NW Seychelles	
ZONE 3	SE Seychelles	
ZONE 4	Mozambique channel	
ZONE 5	Chagos	
ZONE 6	South indian ocean	
ZONE 7	Arabian sea	
ZONE 8	Indo-Laccadive	
ZONE 9	Gulf of Bengal	
ZONE 10	West Indonesia	

YEAR:

MONTH:

Figure 8d.- Indian Zones Log School Form

Vessel				—		<table border="1"> <tr> <td>MONTH:</td> <td>YEAR :</td> </tr> <tr> <td> </td> <td> </td> </tr> </table>		MONTH:	YEAR :		
MONTH:	YEAR :										
Shipping agent				-							
Date of arrival:				—							

YELLOWFIN (1)				Weight (KG)	Destination	Weight (KG)	Destination	Total
YFT	-10	1 - 1						
YFT	+10	1 - 2						
YFT	+13.6	1 - 50	GG					
YFT	[3.4 - 13.6]	1 - 51	R1					
YFT	[1.8 - 3.4]	1 - 52	R2					
YFT	-1.8	1 - 53	R3					

SKIPJACK (2)				Weight (KG)	Destination	Weight (KG)	Destination	Total
SKJ	-1.8	2 - 1						
SKJ	+1.8	2 - 2						
SKJ	-1.5	2 - 3						
SKJ	[1.5 - 1.8]	2 - 4						
SKJ	+3.4	2 - 50	JUMBO					
SKJ	[1.8 - 3.4]	2 - 51	R1					
SKJ	[1.4 - 1.8]	2 - 52	R2					
SKJ	-1.4	2 - 53	R3					
SKJ	UNKNOWN	2 - 9						

BIGEYE (3)				Weight (KG)	Destination	Weight (KG)	Destination	Total
BET	+10	3 - 2						
BET	-10	3 - 1						
BET	-15	3 - 3						
BET	+15	3 - 4						
BET	+35	3 - 5						
BET	UNKNOWN	3 - 9						
BET	+13.6	3 - 50	GG					
BET	[3.4 - 13.6]	3 - 51	R1					
BET	[1.8 - 3.4]	3 - 52	R2					
BET	-1.8	3 - 53	R3					
MIXES		9 - 9						

TOTAL LANDED		-	TOTAL KNOWN	
. Tonnes				

Figure 9.- Follow-up of landing in the cannery/shipping agent

<div> DATE:..... START:..... END:..... PAGE.....OF..... </div>												
No.	FACTORY ENTRY DATE	VESSEL	BOAT CODE	TRIP No.	NO. VAN	SPECIES	No. Fish	LF	LD1	WEIGHT	SEX	GONAD Weight
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Figure 10.- Biological sampling form

Landing date:													
Landing time:													
Registration :													
TUNA BOAT :	DATE OF ARRIVAL:	Species	%	Species	%	Species	%	Species	%	Species	%		
		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin	
		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin	
		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition	
		Small skipjack		Small skipjack		Small skipjack		Small skipjack		Small skipjack		Small skipjack	
		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack	
		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye	
		Small bigeye		Small bigeye		Small bigeye		Small bigeye		Small bigeye		Small bigeye	
		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye	
		Little Tunny		Little Tunny		Little Tunny		Little Tunny		Little Tunny		Little Tunny	
		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna	
		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner	
		Barracuda		Barracuda		Barracuda		Barracuda		Barracuda		Barracuda	
		Marlin		Marlin		Marlin		Marlin		Marlin		Marlin	
		Sailfish		Sailfish		Sailfish		Sailfish		Sailfish		Sailfish	
	Shark		Shark		Shark		Shark		Shark		Shark		
	Albacore		Albacore		Albacore		Albacore		Albacore		Albacore		
	Large tunas		Large tunas		Large tunas		Large tunas		Large tunas		Large tunas		
	Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		
	Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		
Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish			

Landing date :													
Landing time :													
Registration :													
TUNA BOAT :	DATE OF ARRIVAL:	Species	%	Species	%	Species	%	Species	%	Species	%		
		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin		Small Yellowfin	
		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin		Damaged Yellowfin	
		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition		Skipjack good condition	
		Small skipjack		Small skipjack		Small skipjack		Small skipjack		Small skipjack		Small skipjack	
		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack		Damaged skipjack	
		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye		Pieces of bigeye	
		Small bigeye		Small bigeye		Small bigeye		Small bigeye		Small bigeye		Small bigeye	
		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye		Damaged bigeye	
		Little Tunny		Little Tunny		Little Tunny		Little Tunny		Little Tunny		Little Tunny	
		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna		Frigate Tuna	
		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner		Rainbow runner	
		Barracuda		Barracuda		Barracuda		Barracuda		Barracuda		Barracuda	
		Marlin		Marlin		Marlin		Marlin		Marlin		Marlin	
		Sailfish		Sailfish		Sailfish		Sailfish		Sailfish		Sailfish	
	Shark		Shark		Shark		Shark		Shark		Shark		
	Albacore		Albacore		Albacore		Albacore		Albacore		Albacore		
	Large tunas		Large tunas		Large tunas		Large tunas		Large tunas		Large tunas		
	Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		Triggerfishes		
	Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		Horse mackerel		
Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish		Dolphin fish			

Figure 11.- Market fish estimate form