
Onshore biological sampling protocol - Purchases and factory - Victoria, Seychelles

Version 2 – 2026-06-30



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Regional Coordination Group
Large Pelagics



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Author: Ob7 team

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Context and objectives

The biological monitoring of tropical and temperate tuna, carried out by the French National Research Institute for Sustainable Development (IRD), was co-funded by the Data Collection Framework programme (DCF Reg 199/2008 and 665/2008) and is currently co-funded by the EU-Multi Annual Programme (EUMAP Reg 199/2008 and 665/2008 EU-2017/1004) of the Directorate-General for Maritime Affairs and Fisheries of the European Union. For logistical reasons of access and handling of fish, monitoring is usually carried out at factories (canneries) in Victoria (Seychelles). Fish purchases from the shipping companies are also made.

Knowledge of the breeding patterns of tropical tunas as well as their growth and mortality characteristics are essential factors that define the viability and sustainability of populations and their response capacities to exploitation. This information is essential for the development of stock assessment models and for broader fisheries management and conservation issues. The main objectives of the sampling are to collect morphometric data and information on the biology of the three major commercial species of tropical tunas: skipjack tuna (*Katsuwonus pelamis*), bigeye tuna (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*). Albacore tuna (*Thunnus alalunga*) is also one of the species for which IRD must ensure biological monitoring, but inputs to factories are low and occasional.

Otolith and spines are common biological material used to estimate all parameters linked to age and growth used in stock assessment models (A_{max} , L_{inf} , growth curve). The establishment of a biological sample bank and dataset necessary for these parameters is a long-term task due to the difficulties to cover all the size distribution of major tunas' species. Muscles can be used for a wide range of analyses as population structure, fat content or heavy metal concentration. This tissue is so an important source of information of research.

Morphometric data (lengths, weight, etc.) constitute essential biological information for the analysis of fishing statistics and the study of the dynamics of fleets and exploited stocks. Length-weight relationships are used, for example, to convert size-catch frequencies to weight-catch frequencies, input data for age-structured assessment models. The statistical relationships established between the first dorsal length (LD1) and the fork length (FL) are necessary to convert the measurements carried out in LD1 on the purse seiners in which the handling of large callipers is not easy. Morphometric data such as circumference, parameters of length-weight relationships and weight of different organs (stomach, liver, etc.) are also used to calculate condition indices. These indices make it possible to follow seasonal and inter-annual changes in the condition (health) of individuals, a characteristic of fish which is directly linked to their ability to find and store energy under given environmental conditions. The data collected on stomach contents also make it possible to monitor the variability of the diet of individuals directly linked to their environment.

The data collected on sex, maturity stage and gonad weight are used to monitor the reproduction cycle of tuna and integrate reproductive aspects into stock assessment models. Visual examination of the gonads to identify the stage of maturity makes it possible in particular to define the proportions of mature individuals at sizes and/or ages and to deduce the size of first maturity. The calculation of a gonado-somatic index (ratio between the weight of the gonads and the weight of the individual) makes it possible to follow the reproduction periods during the year. One-off sampling of gonads makes it possible to conduct histological analyses in the laboratory in order to have more precise estimates on the maturity stages and also to measure the fertility of females through estimates of the number of oocytes and their size structure in the ovaries. Finally, estimating the sex ratio (number of males/number of females) in exploited populations is fundamental for stock assessment when mortality, growth or gear selectivity differ between sexes.

Sampling plan

Stratification

The objective of the sampling plan is to have a **number of fish representative of the population** exploited by the purse seiners **throughout the year**. The plan is stratified by quarter and size classes. It is desirable that the **samplings be spread out during each quarter** rather than concentrated over a few days as this makes it possible to have fish from different schools, areas and fishing periods. For reproduction, for example, the individuals undergoing treatment (after sorting in factories) are generally of the same size and often in the same state of reproduction (identical stage of maturity), which reduces their representativeness in the population. It is the same for stomach contents.

The main objective of stratification is to sample the maximum range of sizes for the four-tuna species and complete (at best) the sampling plan for each quarter based on the availability of fish at the factory (Erreur ! Source du renvoi introuvable. **and details in Appendix 1**). Additional purchases should be made if necessary to comply with the sampling plan.

Table 1: Annual number of samples per species and sample type

FAO code	Species (En)	Scientific name	Morphometry	Viscera	Otolith	Spine	Muscle
BET	Bigeye	<i>Thunnus obsesus</i>	600	600	100	0	50
YFT	Yellowfin	<i>Thunnus albacares</i>	256	256	100	0	50
ALB	Albacore	<i>Thunnus alalunga</i>	Opportunistic			0	0
SKJ	Skipjack	<i>Katsuwonus pelamis</i>	600	600	100	100	50

Sample traceability

It is imperative to collect **information relating to the trip** from which the sampled fish came. At Indian Ocean Tuna Limited (IOT Ltd.) cannery in Victoria, it is very difficult to go back to the original well and fishing set because the tuna in the bins can come from multiple wells and sort by commercial categories (species and weight) are operated in a second step within the cannery. This is all the more difficult for Spanish and Seychellois vessels, which tend to empty several wells at the same time on the conveyor belts. At IOT Ltd., the **vessel code information must imperatively be retrieved during sampling** as it allows to find the boat and the corresponding landing date. The **name of the boat and the creation date of the buy/sell batch of the fish in the cannery** must be collected. This information makes it possible to find the corresponding fishing trip in the IRD databases and thus offer a means of validating the vessel code information.

Secondly, the **environmental data** (fishing date, positions, temperature, gear, etc.) of the fish are retrieved at the trip scale or in the wells via the **logbook**. For fish but directly on board by the sampling team, note the well and extract the corresponding data from the logbook (see “Data entry section”).

Material and methods

Sampling locations

Sampling can take place in various locations depending of the fisheries activities and facilities at the port. Generally, the data collection at the cannery is recommended in priority as it is often free of charge. However, purchase of fish directly in vessel board is conceivable to complete the missing species and length class not covered with cannery sampling. Finally, local market and artisanal fishery can also be a complementary source for sampling if necessary.

Sampling at cannery

Coordination with the cannery is maintained to ensure the sampling teams have access and to be informed of the species and weight categories processed.

Sampling is **subordinate to the work of factory**. It is necessary to respect work standards and scrupulously follow health and safety standards (shoes, cap, blouse, etc.). Under no circumstances should the work of operators be interrupted or delayed, always trying to adapt to their pace of work.

Between 20 and 50 fish per sampling will be collected at the cannery. All measurements should be taken on each fish.

Fish purchase onboard

For purchases on purse seiners, a copy of the **well plan and logbook** must be requested from the captain or from the owner. These two documents make it possible to choose the well which is of interest for the data collection. A purchase request must be sent to the ship-owner specifying the species, the commercial category (bigeye -10 kg or + 10 kg) and the desired tonnage. The team will not be able to go to the ship and start sorting without the owner's validation. It is necessary not to delay the work of the dockworkers who empty the wells.

“Pre-orders” can be made while the vessel is at sea and before it returns to port. A purchase request is sent to the owner again specifying the species, commercial category and desired tonnage. The crew members will then put tags on the desired fish that will be easily recognizable when landing.

It is better to **buy of 30 fish each month, especially for BET and YFT**, because only individuals smaller than 90 cm can be sampled at the factory while their size can reach 180 cm or more. If there are logistical constraints for large individuals, a minimum of 15 fish is accepted.

Purchase invoice has to be sent to the IRD sampling responsible.

Example of sampling over a quarter for the YFT:

- cannery: only individuals < 90 cm can be sampled at the factory. For a quarter a minimum of 60 fish < 90 cm should be sampled. Therefore, three samples (one per month) of 20 fish minimum must be carried out in a quarter.
- purchase: there are 90 fish > 90 cm to sample and therefore to buy. So 3 purchases (one per month) of 30 fish must be made in a quarter. In the event that it is not possible to store 30 fish, the number of fish per purchase can be reduced to 15. But the number of purchases is doubled.

Material

The full list of materials and specificities for each type of sample is sum up in the **Table 3**.

Table 2: list of materials required to carry out each type of sampling

General tool kit	
	Printed Sample Data Sheets
	- Office material (pencils, rulers, indelible marker pens...) - Lab tongs and tweezers - Deionized water - Ethanol for cleaning the material - Absorbing paper
	- Sharp knife - Surgical scissors - Disposable scalpels with solid blade
	Electronic balance with 0.1g precision
	- Disposable latex gloves - laboratory clothing and clothing for the canning factory
Specific for morphometry and viscera	
	- Tape measure and calliper 80 cm and 180 cm - Scale 150 kg or 15 kg (precision 10 g) - Scale 6 kg or 4 kg (precision 1 g) - Reference table on maturity stages - Labels and thread (monitoring of tuna along the supply chains, raw-pack case) - Plastic bags for samples
Specific for otoliths (OTO)	
	2mL microtubes 100-well microtube storage boxes (Plastic cryoboxes)
Specific for dorsal fin spines (SPI)	
	Paper envelopes
Specific for muscles	
	2 mL microtubes - Labels for Eppendorf tubes 100-well microtube storage boxes (Plastic cryoboxes) - Cool box (with ice, for cool storage of samples) - Freeze-dryer

Documents to be used/completed

Several documents are used for tracking and data entry:

- **EUMAP biological sampling form**: Field sheet to record biological data during sampling. Do not throw it away after use. Scan the sheets and email them to the IRD at the end of the month for monitoring of the biological data collection (online sharepoint). If more than one sheet is required for a single sample, all information identifying the sample must be noted on each sheet (species, sampling date, platform, well, IOT vessel code, IOT boat date, ship name, ship code, sampler and transcriber names). Note the page number.
- **Tunabio_OI.xlsx**: Excel file for data entry. Read the METADATA sheet to fill the document. Send it to the IRD at the end of the month (online sharepoint).
- **Bio-tuning.xlsx**: Excel file for data entry specific for muscle sampling.
- **Calendrier echantillonnage**: file to follow the days of factory sampling and purchases. Describes the reasons why a factory day could not have taken place. Send it to the IRD manager at the end of the month.

Biological sampling

Sampling procedure for morphometry

The fish must be **thawed** for sampling. For the factory, it is important to call the **racking supervisor**, that is, the person in charge of the fish preparation section, the day before the sampling so that he can prepare the fish.

First, measurements on the whole thawed fish are taken (**Figure 1 and Table 3**). The accuracy of the measurements depends on the equipment and the functioning of the teams. Use the **OI_EUMAP_bio_samp_form** to record the data.

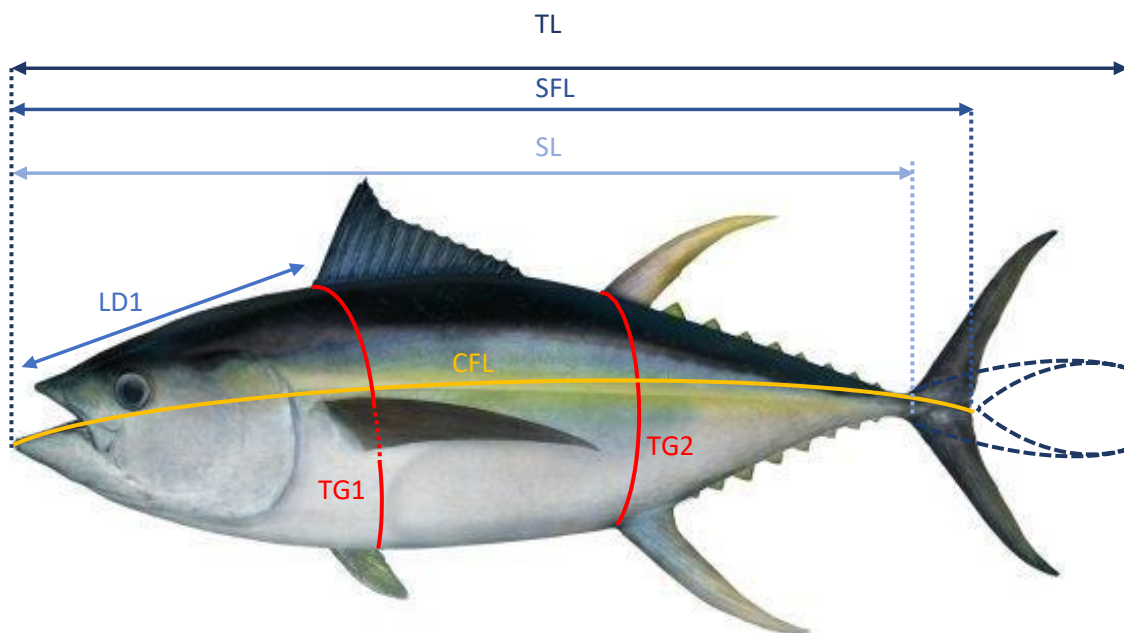


Figure 1. Morphometric measurements

*Table 3. Size and weight measurements to take***The fish mouth is closed** to take measurements

Measurement	Description	Measuring device	Minimum precision
Total length (TL)	For species without caudal fork and sharks. Projected straight distance from the tip of the longest jaw to the tip of the caudal fin. If the caudal fin is heterocercal (lobes of unequal length), the measurement is made with the larger lobe. The fin must be folded. The fish's mouth should be closed. The measure can be made on species with a caudal fork but favour the FL.	Calliper or fish ruler	Centimeter below
Fork length (SFL)	For species with caudal fork but without rostrum: projected straight distance from the tip of the lower jaw to the shortest caudal ray (fork). The fish's mouth should be closed.	Calliper or fish ruler	Centimeter below
First dorsal length (LD1)	Projected straight distance from the upper jaw to the anterior base of the first dorsal fin.	Calliper	Half centimeter below
Curve fork length (CFL)	For species with caudal fork but without rostrum: curved-body distance from the tip of the lower jaw to the base of the caudal fork, by the side, above the pectoral fin.	Tape measure	Centimeter below
First thorax girth (TG1)	Circumference of the thorax just behind the pectoral and pelvic fins and in front of the first dorsal fin.	Tape measure	Nearest centimeter
Second thorax girth (TG2)	Circumference of the thorax before the second dorsal fin and the anal fin.	Tape measure	Nearest centimeter
Whole fish weight	Total weight of fish (thawed)	Scale 150 kg or 15kg	10 grams
Gutted fish weight	Weight of the fish after the internal cavity has been emptied of organs	Scale 150 kg or 15kg	10 grams

Sampling procedure for viscera organ

1. An incision of the fish from the anus to the operculum is made and the various organs are extracted to be weighed (to the nearest gram) using a 6 kg or 4 kg scale (**Figure 2**Figure 2).
2. The gonads are taken from the abdominal cavity. The **gonads** are weighed. If **one gonad is missing or damaged**, weigh only the other gonad and report the measurement in the gonad_1_weight column in Tunabio. It is possible to weigh both gonads individually. The first value is noted in the gonad_1_weight column, the second value is noted in the gonad_2_weight column. **Sex** and **maturity stage** are identified by macroscopic examination using the scale proposed by Stequert (1976), Cayré & Farrugio (1986) and Saber et al. (2019) (**Appendix 1, Appendix 2, Table 4**). These scales are present in the **sex and macro_maturity sheets** of Tunabio. To identify the macroscopic stage, the gonad is cut in the middle and not at the outer edges (same if a sample is taken). In the case of juvenile tuna, sex identification can be difficult (very fine filaments) and the sex of the fish is then considered undetermined. The **males** are indicated by the code **M with a scale from 1 to 5**, the **females** by the code **F with a scale from 1 to 5**, and the **indeterminate** by the code **I with the macro-maturity stage = 0**. **Hermaphrodite** fish (rare cases) are noted **H** (

4. Appendix 3).

Table 4: Macroscopic identification of female and male gonads for yellowfin tuna (*Thunnus albacares*) in the Atlantic Ocean (Diaha et al., 2015; Coll Vol. Sci. Pap 71(1): 489-509)

Stage	Criteria	
	Males	Females
I (I=Indeterminate)	Gonads small ribbon-like, not possible to determine sex by gross examination	Gonads small ribbon-like, not possible to determine sex by gross examination
1	Immature: testes extremely thin, flattened and ribbon-like, but sex determinable by gross examination	Immature: ovaries elongated, slender, but sex determinable by gross examination
2	Enlarged testes, triangular in cross section, no milt in central canal	Early maturing: ovaries enlarged but individual ova not visible to the naked eye
3	Maturing: milt flows freely if testes pinched or pressed	Late maturing: ovaries enlarged; individual ova visible to the naked eye
4	Ripe: testes large, milt flows freely from testes	Ripe: ovary greatly enlarged, ova translucent, easily dislodged from follicles or loose in lumen of ovary
5	Spent: testes flabby, bloodshot, surface dull red, little or no milt in central canal	Spawned: includes recently spawned and post spawning fish, mature ova remnants in various stages of resorption, and mature ova remnants about 1.0mm in diameter

5. The **liver weight** is measured taking care to detach its different lobes from the rest of the organs. Liver can also be used to validate the species identification between YFT and BET (**Appendix 4**).
6. The **full stomach** is extracted by cutting off the initial end of the oesophagus (at the level of the mouth) and weighed, then its contents completely emptied by severing. The chyme can be washed out by washing the inside of the stomach. The **empty stomach** is weighed. An **identification of the main taxonomic groups of the prey** present in the stomach is carried out. The list of groups is present in the **prey group sheet of Tunabio**.

The **rest of the viscera** (heart, pyloric cecum, intestine, spleen, gall bladder, etc.) is grouped together and weighed.

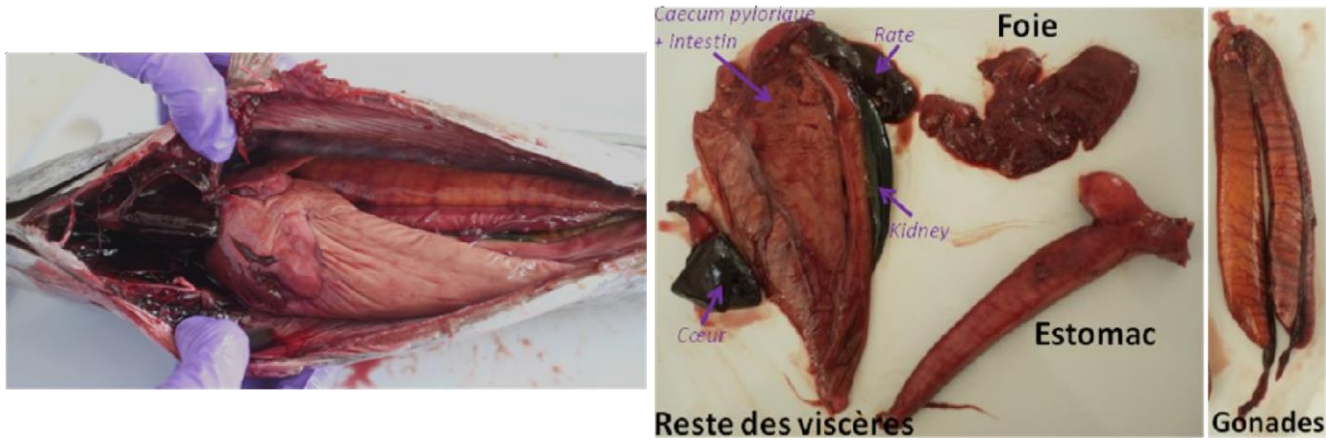


Figure 2. Identification of the organs to be extracted from the abdominal cavity of the tuna

Sampling procedure for otolith and spine

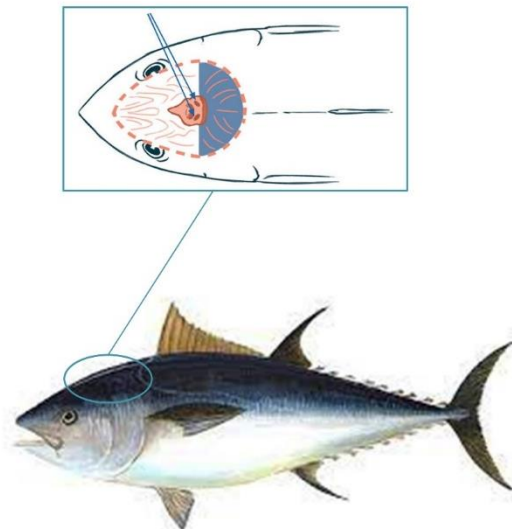
Source: Itunnes project

The otoliths can be sampled once all other tissues are sampled (**Figure 3**). Tunas have fragile, thin, and elliptic otoliths that require particular care during extraction and posterior preparation

Even with care, you will unavoidably break some of the otoliths during removal from the fish or through cleaning. In most cases, we can still use these broken otoliths, so retain all the pieces.

Figure 3 Sampling for otoliths (adapted from ©PlanetTunaIEO).

1. If tuna heads have been previously frozen, **ensure that thawing is complete before starting the extraction**. Extracting otoliths from partly frozen canals could break them.
2. Cut into the fish head **CAREFULLY** to make certain that you don't break the otoliths. The easiest way is to cut the head with a large knife in the frontal plane above the supraorbital ridge (**Figure 4a**). At first



attempts, it is better **not to cut too close from the eyes**, and to do successive small cuts then until the brain appears.

3. **CAREFULLY** remove the brain tissue, **it is very important to work carefully because the otolith can**

easily be damaged at this stage! (**Figure 4b**). Otoliths will be located at the back of the brain cavity, inside semi-circular canals (**Figure 4c**). Gently prospect into the canals. The posterior end of the otolith is the most fragile. Use small tweezers to CAREFULLY extract the otolith from the bony capsules.

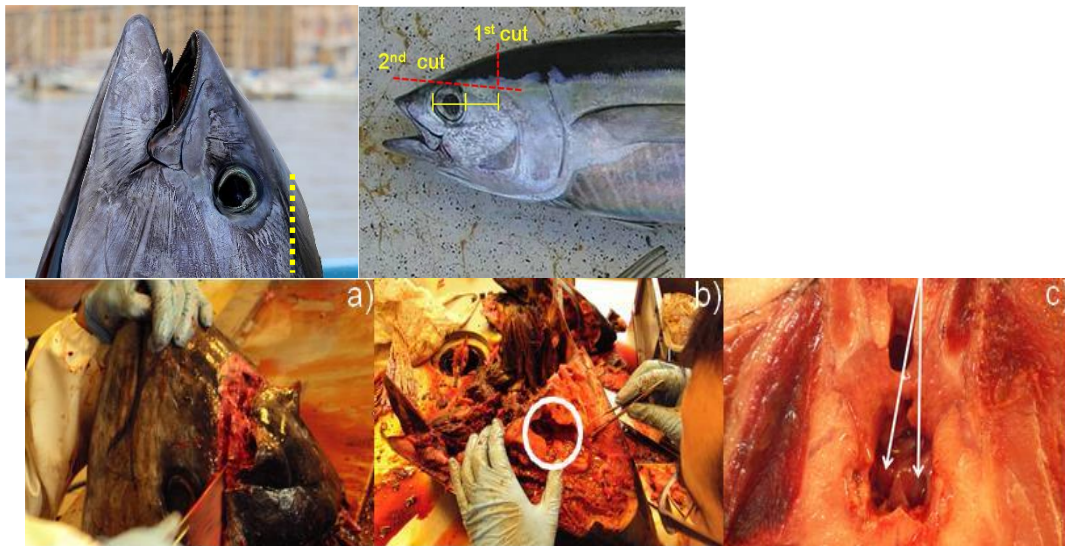


Figure 4 Extraction of sagittal otoliths from a bluefin tuna head.

4. GENTLY remove the membrane surrounding the otolith immediately after extraction (the membrane is harder to remove after it has dried).
5. Clean the otolith with deionized water, until it is certain that there is no biological material adhering to the otolith. You can remove excess water by briefly resting them on a napkin or absorbent paper.
6. Store in plastic vials with the corresponding code, and let the otoliths dry with the plastic vial lid open for at least 24 hours at ambient temperature (**Figure 5**).

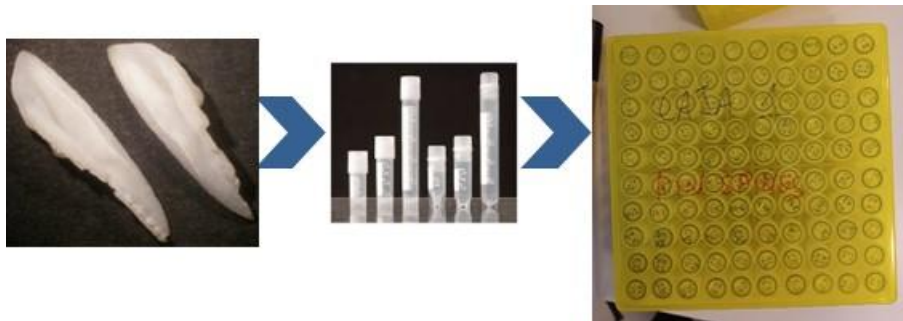


Figure 5 Illustration of storing otolith once extracted and cleaned c) storing clean and dried otolith tubes in labelled cryo-boxes.

Sampling procedure for spine (only for skipjack tuna)

The fin spine used for ageing purposes is the first ray of the first dorsal fin (**Figure 6**). It is important to extract a complete spine from the base including the condyle where the spine inserts in the fish avoiding any damage of the spine base.

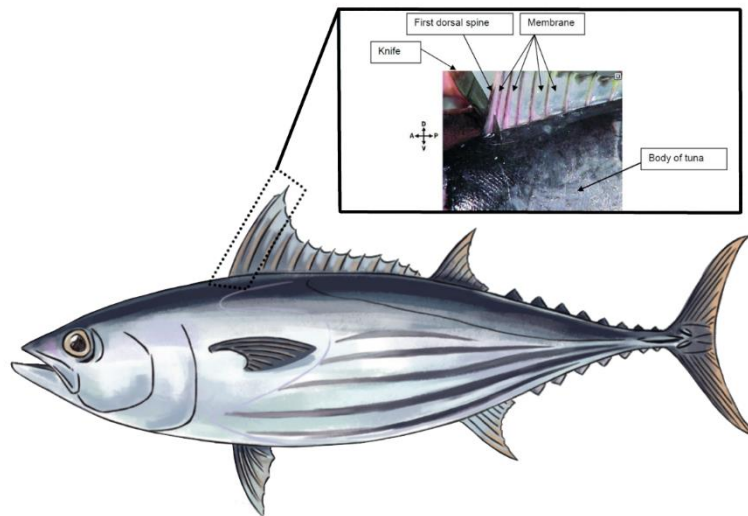


Figure 6 Sampling for first dorsal spine. Insertion of the knife into the membrane separating the first two spines of the 1st dorsal fin (adapted from PlanetTuna & Panfili et al., 2002).

7. Spread out the first dorsal fin and **cut the membrane joining the two first dorsal rays (spines)** by using a knife.
8. Then, push the spine forward and downwards progressively (Figure 7B), then cut and turn it alternately to the right and to the left until the ligament breaks (Figure 7C).
9. Finally, the spine must be twisted and pulled it out (Figure 7D). **Care should be taken in order not to twist the spine in its base.**
10. For **larger specimens**, it is recommended to **use a sharp knife** or scalpel to cut carefully the strong ligaments that support the spine base deep in the fin insertion in the body depression.

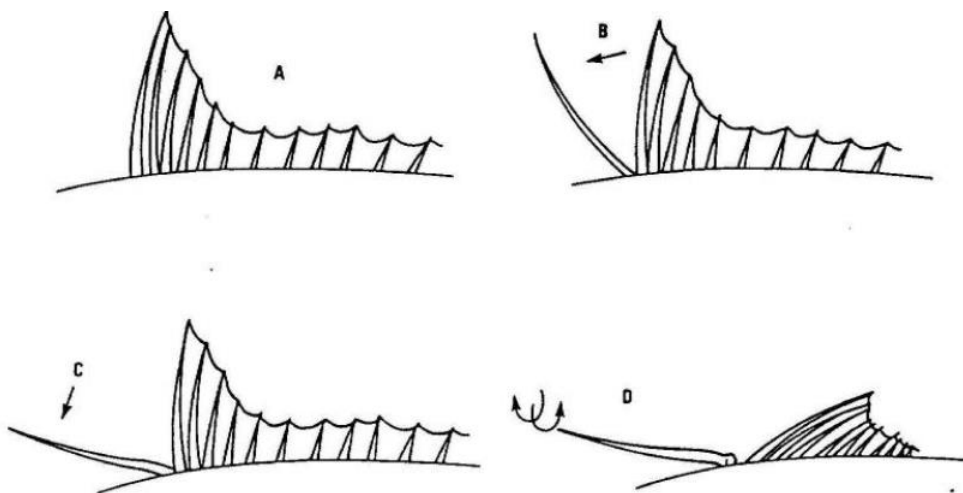


Figure 7 Technique of extraction of the first spine of the bluefin tuna dorsal fin. (from Compeán-Jiménez, 1980).

11. It is recommended to carry out the whole **cleaning step just after the spine has been extracted**, as the connective tissue is still fresh and can be removed easily (Figure 8a).
12. Before storing the sample, it is advisable to remove all remaining tissue and **dry the spine out on blotting paper** (Figure 8b).

13. **Spines** are stored dry in a paper envelope, which should be kept in a cool place (refrigerated) if they are not going to be cut immediately (Figure 8c).

IMPORTANT NOTE: Do not use plastic bags for storing them as that can trap any remaining moisture.



Figure 8 Illustration of cleaning and storing the fin spine samples a) cleaning remaining tissues, b) before and after cleaning process, c) storing clean and dried spines in labelled paper envelopes.

In the case of SKJ, fin spines are small but just in case the spine is too large to fit in an envelope, it can be cut in half and both pieces kept in the envelope, **remembering that the piece forming the base of the spine is the most important since it is the part used for age interpretation**. However, both parts should be kept because spine length will be measured, which is a morphometric used to develop size-age relationships.

Sampling procedure for muscles

The aim is to collect muscle samples for the continuous, long-term monitoring of mercury and omega-3 concentrations in the main species of tropical tuna.

- For each tuna, enter on the dedicated sampling form the fish's unique identifier as recorded in the IRD Tunabio database (e.g. YFT_20261119_07), along with the species, the date and location of sampling, and the name of the person responsible for the specific sample.
Record the following morphometric details on the form: fork length, sex and total weight (in kg) of the fish
- Wearing gloves, and using a knife or scalpel and tweezers, **remove a piece of white muscle**, whilst the animal is in the dorsal position, measuring approximately 4 cm long, 2 cm wide and 3 cm thick (**Figure 9**).

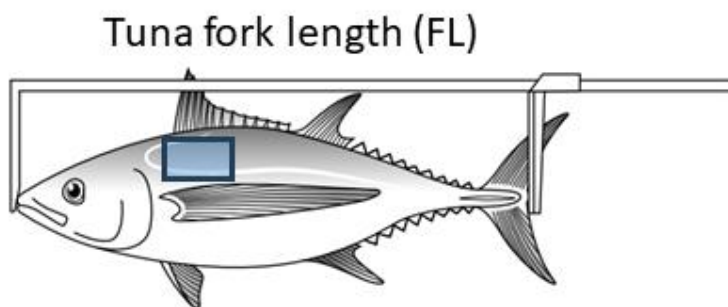


Figure 9: Measurement of the tuna's fork length (FL) on the right side, collection of a white muscle sample from the dorsal region, and storage of one of the two subsamples in a 2 mL Eppendorf tube.

3. **Remove the skin** from the muscle and any subcutaneous fat (if present), then take two muscle subsamples to fill two Eppendorf tubes to two-thirds capacity, as shown in **Figure 9**. At this stage, it is important not to put too much muscle into the Eppendorf tubes to prevent the sample from spilling out of the tube during freeze-drying.
4. For each tuna sampled, **prepare two labels provided by the project**. On the first label, write the fish's unique identifier followed by '_Hg'. On the second label, write the fish's unique identifier followed by '_FA'. Stick both labels onto the two Eppendorf tubes containing a muscle sample. For example, for the tuna YFT_20261119_07, you will have two Eppendorf tubes: the first labelled 'YFT_20261119_07_Hg' and the second 'YFT_20261119_07_FA'.
5. Store the Eppendorf tubes in the order in which they were collected in the Eppendorf tube box. Place this box **immediately in the cool box with ice packs** to prevent sample degradation. On returning to the laboratory, place the samples **in the -20°C or -80°C freezer as soon as possible**, if available. If, whilst the samples are being stored, the cold chain is interrupted for several hours or days – for example, during a power cut – please note this in the comments section of the form, clearly specifying the identifiers of the samples concerned. This will enable the identification of samples that may have been partially degraded during the omega-3 analyses.

Freeze-drying before sending of samples

Approximately twice a year, the muscle samples collected will be sent to LEMAR lab (Brest, France) for analysis. The sending of samples must be coordinated with Anaïs Médiu (anais.medieu@ird.fr) and Fany Sardenne (fany.sardenne@ird.fr) to ensure that someone is available to receive the samples at LEMAR and to prevent the samples from remaining at room temperature for several days upon their arrival in Brest. Please copy the IRD data collection coordinator into all correspondence to ensure follow-up.

To ensure the samples remain in good condition during transport, it is best to freeze-dry them approximately two weeks before sending.

At least two weeks before the scheduled date of sending of the samples:

1. Weigh all the samples collected in the tubes using a precision balance and record the total mass, rounded to the nearest tenth of a gram, on the form;
2. The following day, once all the samples are properly frozen, open the tubes (to allow the water to escape) and then freeze-dry the samples for 48 hours;
3. Reseal the tubes, weigh them again after freeze-drying and record the mass, rounded to the nearest tenth of a gram, on the form;
4. Return all the tubes to the -20°C or -80°C freezer, if available;
5. Place ice packs in the -20°C freezer in preparation for sending.

When weighing and freeze-drying, take care to maintain the original position of the Eppendorf tubes in the box, in the order of sampling.

Weighing the samples before and after freeze-drying allows the water content of the samples to be determined. Storing the samples in the freezer prevents the degradation of omega-3 fatty acids until sending.

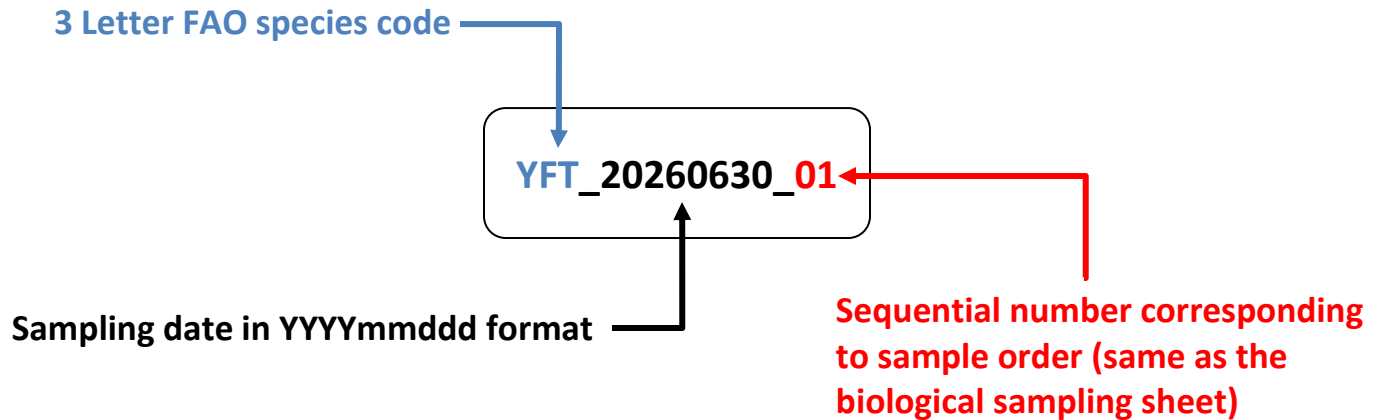
On the day of sending:

In the parcel, surround the box(es) containing the samples with frozen ice packs to ensure the cold chain is maintained throughout transport to LEMAR.

Data entry

Tunabio fish identifier labelling

The Tunabio fish identifier is a unique code assigned to each fish. It is standardized as follows:



The sequential numbering starts from 1 on each new sampling day and for each species. The fish identifier is the primary key for fish traceability and have to be always correctly note in every line of data corresponding to the same fish.

Tunabio file

All data (SPECIMEN and ENVIRONMENT sheets) must be filled. **If a fish is present in SPECIMEN, then the environmental data for that fish must also be entered in ENVIRONMENT.** If at the delivery, the data is incomplete, then the fish for which information is missing are sent completed on the next delivery. Use a **BLANK Tunabio_OI FILE for each sampling month.** The year and month corresponding to the sampling should be added to the file name, example: "Tunabio_OI_202105" for data collected in May 2021.

the **fish identifier is unique in the SPECIMEN sheet** but can be multiple in the ENVIRONMENT sheet. The **absence of data** is indicated by the code "na".

Biological data: all biological data are entered in the Excel file **Tunabio_OI**, in the **SPECIMEN sheet**. There are control and validation points (reference lists, cell format, type of data, etc.). **A BLANK FILE MUST BE USED FOR EACH MONTH OF COLLECTION**, to facilitate tracking of collection and corrections. Any element on the sampling that cannot be entered in the columns of the different variables must be entered in the comment column (fish not thawed, incomplete stomach content, etc.).

Environmental data: the vessel and the well(s) are noted after going through the factory or on the boat for purchases. The idea is to find the corresponding data. In a well, there may be several sets, and therefore several dates and fishing positions. It is necessary to seize all the possibilities of the wells of origin for each fish.

It is often impossible to know the well. In this case, all dates and fishing positions must be entered (in MULTIPOINT format). The same position should only appear once.

All environmental data are entered in the **ENVIRONMENT sheet**. There are also control and validation points. Any item on the fishing trip that cannot be entered in the columns of the various variables must be entered in the

comment column.

The **METADATA sheet**, present in this same file, summarizes all the data entered and the checkpoints. Although the data is entered by computer, it is essential to **keep the paper sheets** on which the data is recorded (always keep the first source of information), and to scan them.

IMPORTANT NOTE: Please contact the IRD coordinator to update the reference tables or for any issue with the file.

Data and document delivery

All the documents mentioned in "Documents to be used/completed" and the scans must be transferred at the **end of the month to Ob7 or the beginning of the following month.**

Sample delivery

Specifically, the following are important recommendations for the transport:

HARD TISSUES (otoliths and fin spines)

- Otoliths stored in tube should be shipped into the tube boxes
- Fin spines fully air-dried stored in paper envelopes should be shipped
- Put the samples in a storage box with the reference "IRD Ob7". Ship the box by Express Courier mail to the **Ob7 address** (contact section)

IRD/Observatoire des Ecosystèmes Pélagiques Tropicaux Exploités
Station Ifremer,
Avenue Jean Monnet,
CS 30171 34203 Sète cedex, France

SOFT TISSUES (muscles)

Approximately twice a year, the muscle samples collected will be **sent to LEMAR lab** (Brest, France) for analysis. The sending of samples must be coordinated with Anaïs Médieu (anais.medieu@ird.fr) and Fany Sardenne (fany.sardenne@ird.fr) to ensure that someone is available to receive the samples at LEMAR and to prevent the samples from remaining at room temperature for several days upon their arrival in Brest. Please copy the IRD data collection coordinator into all correspondence to ensure follow-up.

Address LEMAR (**muscles only**)

Laboratoire LEMAR
Institut Universitaire Européen de la Mer
Technopôle Brest-Iroise
Rue Dumont D'urville
29280 Plouzané, France

IMPORTANT NOTE

Please make sure that all tubes are properly closed. Aircraft pressure can cause the lids to open accidentally. That is recommended always to use screw tubes. If there is any space between the tube lids and the top of the box, it is advisable to fill it, e.g. with paper napkins.

Contact

Name	Institute	Function	email
Antoine Duparc	IRD OB7	Onshore data collection coordinator	antoine.duparc@ird.fr
Julien Lebranchu	IRD OB7	OB7 responsible	Julien.lebranchu@ird.fr

References

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Versioning table

Num	Date	Description	author	Version
1	04/11/2009	Creation on elements and practices in the field		
2	27/01/2010	Add new forms and photo Pages 5, 7, 8		
3	15/05/2014		E. Chassot	
4	08/07/2014	Pages 5	E. Chassot	
5	16/07/2014	addition of Appendix « Identification of macro maturity stages » Pages 8, 9		
6	18/07/2014	Change of 'scow' by tag number following a discussion with P. Lloyd (MWBrands) Pages 3	E. Chassot	
7	16/11/2018		A. Guillou	1
8	20/01/2020	Modification of the gonad sampling	A. Guillou, M. Pernak	
9	13/02/2020		A. Guillou	
10	28/04/2020		A. Guillou	
11	19/05/2020		A. Guillou	
12	28/01/2021		A. Guillou	
13	22/07/2021	Sampling plan/fish number per size classes, appendix on hermaphrodite	by A. Guillou and T. Fily	
14	30/06/2026	• General review and reorganization • Add otolith and pine sampling • Add muscle sampling	Antoine Duparc	2

Appendices

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Appendix 1 - Details of the sampling effort for each species and sample type

Table A1-1: Quarterly Sampling plan of **morphometric and viscera samples** for each species and length class (SFL)

SFL (CM)	YFT	BET	SKJ	ALB	SFL (CM)	YFT	BET	SKJ	ALB
25-30	4	2	8	Opportunistic sampling	105-110	5	2	-	Opportunistic sampling
30-35	4	2	8		110-115	5	2	-	
35-40	4	2	11		115-120	5	2	-	
40-45	4	2	11		120-125	5	2	-	
45-50	4	2	12		125-130	5	2	-	
50-55	5	2	12		130-135	5	2	-	
55-60	5	2	14		135-140	5	2	-	
60-65	5	2	14		140-145	5	2	-	
65-70	5	2	12		145-150	5	2	-	
70-75	5	2	12		150-155	5	2	-	
75-80	5	2	10		155-160	5	2	-	
80-85	5	2	10		160-165	4	2	-	
85-90	5	2	8		165-170	4	2	-	
90-95	5	2	8		170-175	4	2	-	
95-100	5	2	-		175-180	4	2	-	
100-105	5	2	-		>180	4	2	-	

Table A1-2: Quarterly Sampling plan of **otolith samples** for each species and length class (SFL)

SFL (CM)	YFT	BET	SKJ	ALB
<40	2	2	5	Opportunistic sampling
40-60	4	4	10	
60 - 90	4	4	10	
90 - 120	4	4	-	
120 - 150	4	4	-	
150 - 180	4	4		
> 180	3	3		
N TOTAL	25	25	25	

Table A1-3: Quarterly Sampling plan of **muscle samples** for each species and length class (SFL)

SFL (CM)	YFT	BET	SKJ
< 60	10	10	25
60 – 90	15	15	25
90 – 130	15	15	-
> 130	10	10	-
N TOTAL	50	50	50

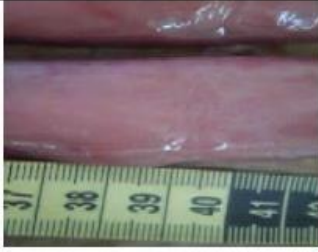
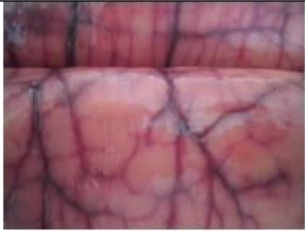
Appendix 2 - Sexual maturity stages in males (teleost)

Attention, in males' a 5th stage is also observed (Cf. sheet macro_maturity)

(Diaha et al., 2015; Coll Vol. Sci. Pap 71(1): 489-509)

General aspect	External characteristics	Internal characteristics
		
Stage 1 : Immature : testes extremely thin, flattened and ribbon-like, but sex determinable by gross examination		
		
Stage 2 : Enlarged testes, triangular in cross section, no milt in central canal		
		
Stage 3 : Maturing ; milt flows freely if testes pinched or pressed		
		
Stage 4 : Ripe ; testes large, milt flows freely from testes		

Appendix 2 – Sexual maturity stages in females (teleost)

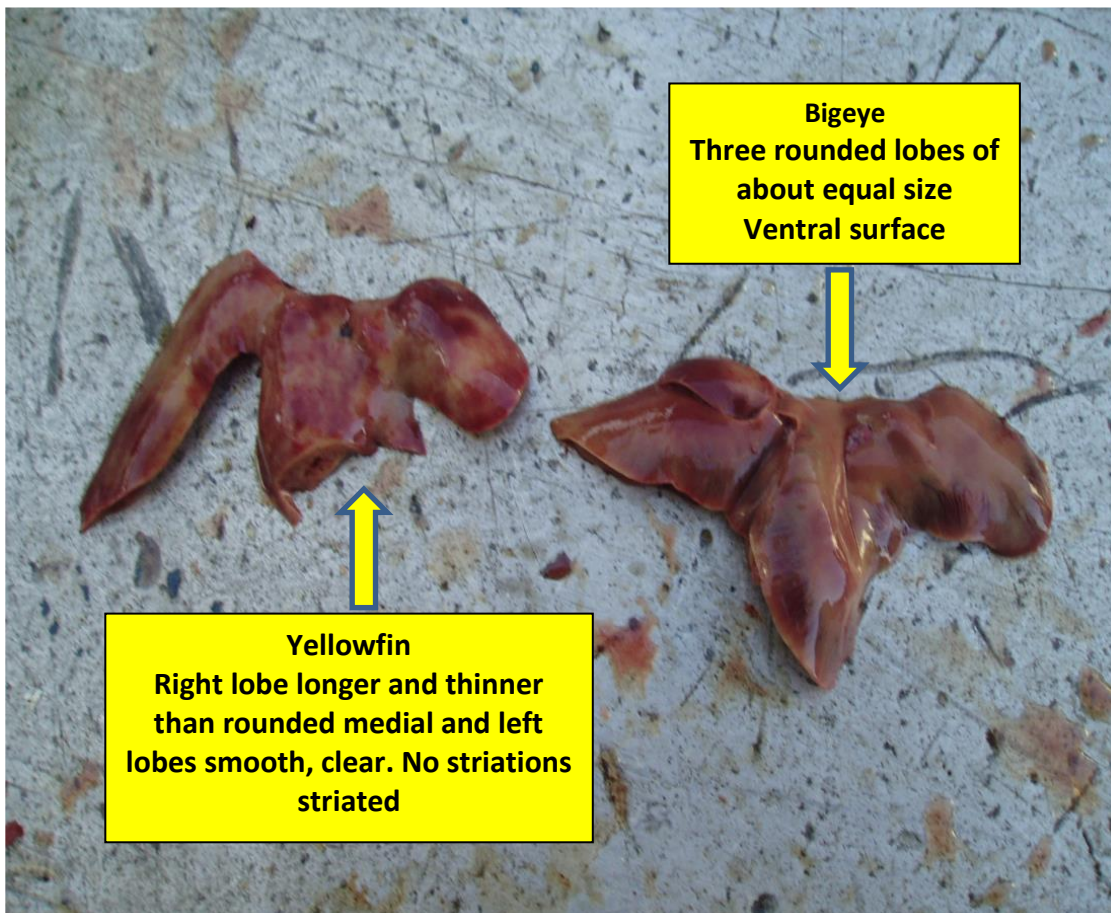
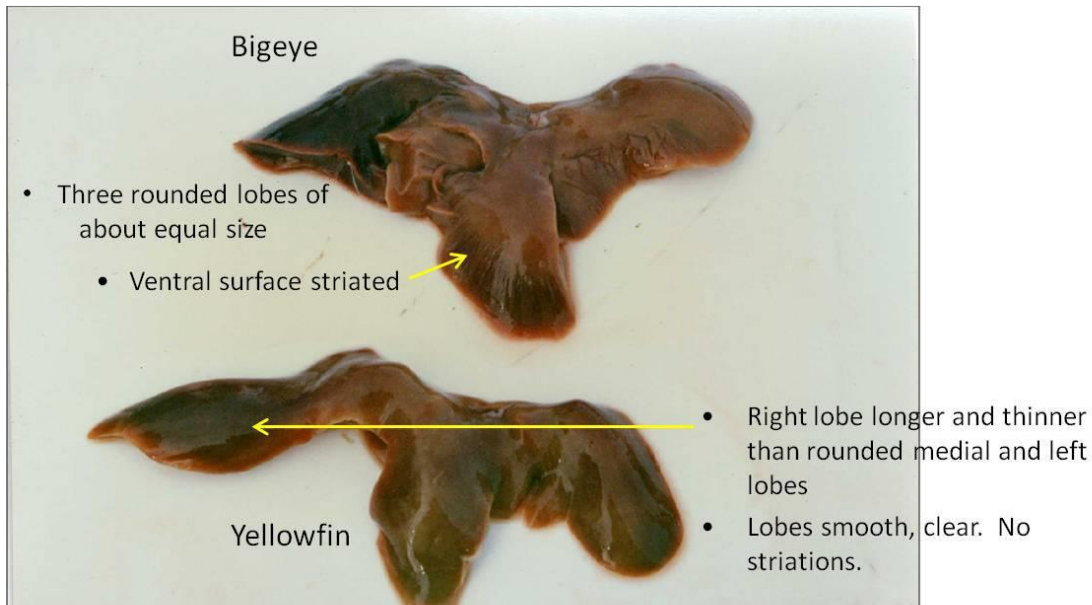
General aspect	External characteristics	Internal characteristics
		
Stage 1 : Immatures : Gonads elongated, slender, but sex determinable by gross examination		
		
Stage 2 : Early maturing : Gonads enlarged but individual ova not visible to the naked eye		
		
Stage 3 : Late maturing : gonads enlarged, individual ova visible to the naked eye		
		
Stage 4 : Ripe : ovary greatly enlarged, ova translucent, easily dislodged from follicles or loose in lumen of ovary		
		
Stage 5 : Spawned ; includes recently spawned and post spawning fish, mature ova remnants in various stages of resorption, and mature ova remnants about 1.0mm in diameter		

Appendix 3 - Photo of hermaphrodite skipjack (CRO Abidjan, 2016)



Appendix 4 - Liver differences between Yellow fin tuna and Bigeye tuna

Source: AZTI



Appendix 5 - EUMAP Biological sampling sheet1

Page : /

Species (FAO code):

Factory well :

Sampling date (DD-MM-YYYY):

Vessel well :

IOT boat date:

Vessel name:

Sampling platform:

Avdth well:

IOT boat code:

Vessel code:

[illegible]

Stomach: CB: crab, CE: cephalopod, CR: crustacean, E: empty, F: fish, INI: inorganic item, ML: mollusc, O: undermined prey, PL: plant, SAL: salp, W: worm, YI: intraocular filter

Transcriber:

Sampler:

