

Report of the Small Tunas Year Programme (ICCAT/SMTYP)

Programme objectives

The status of small tuna stocks in the ICCAT Convention area is generally unknown. Nevertheless, these species have a high socio-economic relevance for a considerable number of local communities at the regional level, which depend on landings of these species for their livelihoods.

Fisheries statistics and biological data, which can provide a basis for assessing these resources and thus providing the Commission with appropriate scientific advice for their sustainable exploitation, are generally incomplete and not updated for these species.

The ICCAT Small Tunas Year Programme (SMTYP) was adopted by the SCRS in 2011 and approved by ICCAT during its 2012 Annual Meeting in Agadir (Morocco). The main objectives of the programme are the recovery of historical series of Task 1 and Task 2 data, collecting the available biological data and studies, and conducting biological studies, mainly on age and growth, maturity and stock structure for the main species of small tunas.

This programme has a wide geographical sampling coverage:

1. Mediterranean and Black Sea: bullet tuna (BLT), Atlantic bonito (BON), little tunny (LTA) and plain bonito (BOP);
2. West Africa: Atlantic bonito, little tunny tuna, West African Spanish mackerel (MAW), frigate tuna, wahoo (WAH);
3. Caribbean Sea and Southwest Atlantic: blackfin tuna (BLF), wahoo, king mackerel (KGM) and serra Spanish mackerel (BRS) and dolphinfish (DOL).

The SMTYP collected biological samples aiming at describing the growth, maturity and stock structure on these three small tunas species since the beginning of the programme. Thus, since 2019 until 2022, results on stock structure of two of the three species (BON and LTA) were provided and samples for growth and maturity were considered mostly satisfactory for the areas and species. However, the priority was given to sampling necessary to fill specific gaps to obtain the growth and maturity parameters for LTA and BON from different geographical areas. However, these activities were heavily impacted due to the COVID-19, which has precluded most of the field and laboratory work from being carried out between 2020 and 2022. After the pandemic, progressive results have been achieved on the three main components of the SMTYP, which are expected to allow to close in 2025/26 most studies on the three original species sampled within the study.

Collect biological samples

In 2024, sampling priority was given to fill specific gaps necessary to obtain the growth parameters for LTA, BON, and WAH from geographical areas that the Small Tunas Species Group identified as of high priority (**Table 1**), considering data collected in the last 3 years. We also started to collect samples of BLT and FRI.

A total of 262 individuals were collected during the 2024 contract: 60 BLT from ATL-SE, 100 FRI from ATL-SE, 20 BON from ATL-NE, 29 LTA from ATL-SW, and 53 WAH from ATL-NE. The histogram with the size distributions per species and areas of sampling is presented in **Figure 1**. Thus, overall a total of 3,738 fish samples were collected from 2017 to 2024 across all areas, which included samples of muscle/tissue, spines, otoliths, and gonads. These covered a wide size range of specimens sampled, which allowed identifying the main gaps to target for current and future sampling efforts. To better understand the difficulties in order to address them, gaps by research axis were highlighted in **Table 1**. Unlike other species, FRI and BLT are amongst those more poorly sampled in all areas and by sizes, since sampling for these species only begun two years ago.

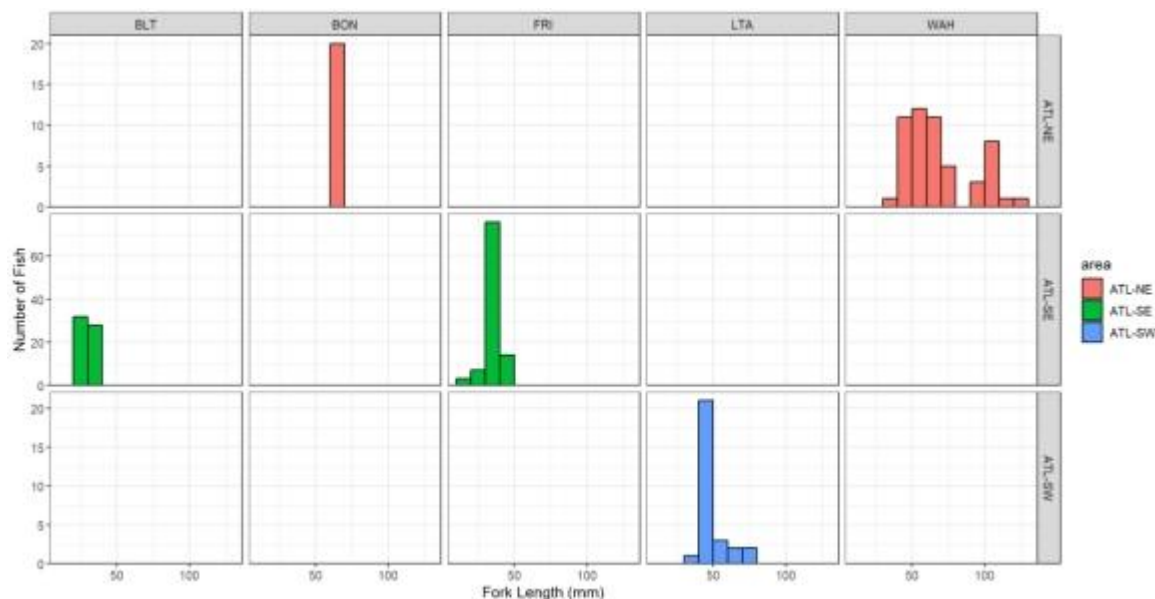


Figure 1. Histogram by size classes (fork length) for BLT, FRI, LTA and WAH specimens sampled by region (ATL-NE: Northeastern Atlantic; ATL-SE: Southeastern Atlantic; ATL-SW: Southwestern Atlantic; and MED: Mediterranean) throughout 2024.

Reproductive parameters

According to the area coordinator, no samples were received throughout 2024.

Atlantic bonito (*Sarda sarda*)

A total of 420 fish were used for the preliminary analysis of L_{50} using microscopic staging, and 876 fish were used for the preliminary analysis of L_{50} and spawning season combining macroscopic and microscopic data. As a summary of the results, the classification proposed by Viñas *et al.* (2020) includes:

For Stock #1:

- Active females (Stages III and IV), which were found from March to July;
- Spawning females (Stage IV) were observed from May to July. It should be noted that no samples from April were obtained;
- Active males (Stages III and IV) were found from May to August;
- Spawning males (Stage IV) were observed in May and July. It should be noted that no samples from April were obtained and very few samples from June (14) were collected.

For Stock #2, the following results were achieved:

- Reproductive active BON (Stages III and IV) were found from October to August and spawning individuals (Stage IV) were observed from October to August. It should be noted that no samples from April were obtained.

For Stock #3, it was observed:

- Active females (Stages III and IV) were found from May to October;
- Spawning females (Stage IV) were observed from May to October, but an important decline in October was noted;
- Active males (Stages III and IV) were found from May to October;
- Spawning males (Stage IV) were observed from June to September.

Little tunny (*Euthynnus alletteratus*)

A total of 716 fish (279 female, 172 male, and 265 undetermined), 65 more than in the previous report, were used for the analysis of L_{50} and spawning season, combining macroscopic and microscopic data. Of those, 294 fish were microscopically staged, while the remaining 422 fish (the majority of the Stage I individuals) were macroscopically staged. The majority of the fish that were microscopically analyzed (92) were classified as immature fish (Gonad Stage I), while 99 active fish (Stages II and IV) of which 47 were identified as being in spawning stage (Stage IV).

Following the work done in the previous years, the data were analyzed by grouping samples according to two hypotheses: 1) ICCAT areas: BIL95, BIL94B, and BIL 97; and 2) by stock/species as suggested by Ollé *et al.* (2020) – Stock/species 1 (MEDI_NEATL): BIL 95+ Portugal (BIL 94B); Stock 2 (NE_SE ATL): BIL 94 B (except Portugal) + BIL 97.

We have now updated the stock hypothesis for the Stock NE_SE ATL:

- Reproductive active LTA (Stages III and IV) were found from January to October, but no samples from March and April were obtained;
- Spawning individuals (Stage IV) were found from January, February and May, and from July to September.

These results are in accordance with the hypothesis of a large spawning season for these stocks, with spawning peaks observed in January and September.

Wahoo (*Acanthocybium solandri*)

A total of 363 fish (208 female, and 155 male) were sampled for reproduction, including 245 samples from the BIL94B ICCAT area, and 118 from BIL97 area. The analyses have now included 43 new fish samples. In addition, the temporal coverage of the sampling increased with samples being obtained in January, March, June, July, and from October to December. The microscopic analysis was completed for 192 individuals (133 more than in the previous year), that were collected in the NE Atlantic (129) and SE Atlantic (63). The majority of these fish were identified as females (186). The analysis of L_{50} was conducted for sex-combined and females using the microscopic data. For males, the ogive was not estimated due to the small size of the sample size.

Regarding spawning season, active WHA (Stages III and IV) were observed in March and from June to September. Spawning fish were observed in March and from July to September, with a trend from August to December being noted. In addition, it was indicated by the mean GSI by Gonad Stages that, Stage III (Spawning capable) showed a higher gonadosomatic index (GSI) mean value. A downward trend was observed from Stage IV (Spawning) to the post-spawning stage (Va and Vb). The results indicate that the spawning peak of WAH in the area occurs in August-September, although spawning fish were observed from March to October.

Age and growth

A preliminary analysis of the relationship between section spine diameter (mm) and fish size (fork length (FL), cm), showed that the area effects (Northeast Atlantic, Mediterranean and Southeast Atlantic) for LTA were significant. No differences were observed between areas for BON. At this stage, no preliminary growth models were fit by area due to the low number of processed samples, particularly considering that the models have to be investigated at stock level. For WAH, for which preliminary results were required within the current contract for the Southwest Atlantic, from the 277 otoliths sampled for annual growth analysis, 157 slides were prepared (56%), 35 were already cut (13%), and 87 were embedded to be cut (31%). For the daily growth analysis, we have prepared 5 samples from an expected number of 75 otoliths, which corresponds to 6% of the overall available sampled specimens.

Concerning LTA, the analysis has been completed and age readings of more than 250 LTA for all ICCAT areas were carried out. Throughout this contract additional samples have been processed, 10 dorsal spines of LTA from Tunisia (MED), 52 dorsal spines of WAH from Senegal, and 46 otoliths of WAH from Senegal (30 for daily ageing and 16 for annual ageing).

Stock structure analysis

Regarding the stock structure and species identification the short-term contract signed between ICCAT and FADRUPE prioritized the following activities:

Objective 1: Refine stock structure analysis for WAH, BON and LTA, and determinate the structure analysis of FRI and BLT;

Objective 2: Investigate genetic species differentiation between FRI and BLT.

Between 2022 and 2024 a total of 284 samples of different species were genetically analyzed and added to those collected in previous years. The new samples included:

- BON: 33 samples from Côte d'Ivoire ;
- LTA: 13 samples from Tunisia and 4 samples from São Tomé e Príncipe;
- WAH: 55 individuals from Morocco and 7 from Côte d'Ivoire;
- BLT: 138 individuals form EU-Portugal and 9 from Côte d'Ivoire;
- FRI: 24 individuals from Côte d'Ivoire.

It should be noted that the samples from BLT and FRI are used for both stock structure and species identification. Following the previous strategy any new samples that arrived at the genetics laboratory were analyzed and included in the report.

Although stock structure and species identification analyses will be further developed, since some additional samples have not yet arrived at the genetics laboratory, some preliminary results were presented at SCRS meeting in September 2024, which can be summarized as follows:

- A comprehensive genetic study of Atlantic bonito (BON) has been carried out, revealing significant geographic population structure across its range of distribution. Preliminary results suggest that the tropical eastern Atlantic stock should be managed separately due to clear genetic differentiation.
- The potential species differentiation within little tunny (LTA) has been suggested, noting the importance of morphometric and meristic data to support this hypothesis. Such species differentiation (based on possibility of biological divergence) is also supported by the fact that the two distinct LTA stocks exhibit consistently different patterns of growth and reproductive behaviour.
- The genetic analysis conducted on wahoo (WAH) samples collected in the Atlantic, in conjunction with previous analysis and samples collected in other Oceans revealed that there is a single stock of this species ocean-wide.

Other activities developed in 2023 and 2024

A regional Workshop on Data-limited Assessment Methods for Small Tunas (in person, 4 days) on the application of data-limited methods to assess small tuna stock was organized in May 2023. Following the first workshop, the Second Workshop on Data-limited Assessment Methods for Small Tunas was held in Madrid (Spain) between 10-13 September 2024, to advance research and application of data-limited methods to some small tuna species. All stock assessment modelling was done using the Stock Assessment Continuum (SAC) Tool that creates a flexible modelling environment using the Stock Synthesis 3 stock assessment framework. The course included a hands-on demonstration of the SAC tool and the flexibility in the use of different types and combinations of the four main types of data (catches, indices of abundance, and age and length compositions). More than 10 models were built and run, which were the basis for the discussion on how to diagnose and interpret each model, emphasizing the value of model build-up in order to understand signals in data. Sensitivity plots were also explored, as well as likelihood profiles and making ensemble models runs.

A Workshop on Small Tunas Reproductive Biology, involving maturity staging (reproduction) for small tuna stocks was held in Malaga (Spain) between 21 and 24 October 2024. The main objective was to identify and validate the reference scale for studying the reproductive biology of different small tuna species. To this end, available scales were examined, and a summary was created to serve as a reference scale for assigning gonad maturity. In addition, capacity building was conducted to harmonize the different laboratory processes for gonad processing. An update of samples collected for the SMTYP project was completed to highlight gaps by species.

Activities planned for 2025

The Small Tunas Species Group will hold an intersessional meeting in 2025 for three days. The main objective is to review the SMTYP achievements and update the research programme aiming the next 3 years, with a particular emphasis on the application of data-limit models for the provision of advice, and to keep filling knowledge gaps in terms of biology and stock structure and species and new priorities stocks.

A new contract shall be signed with ICCAT to continue the activities planned for 2025, and it is expected that the age and growth and reproduction studies for BON, LTA and WAH shall be completed. In addition to the ongoing research activities with SMTYP (reproduction and aging, as well as stock and species differentiation studies), a comparison on morphometric and morphological parameters between fresh/frozen specimens of *Euthynnus spp.* from the Northeast Temperate Atlantic and Mediterranean Sea and the eastern tropical Atlantic will be carried out to assess if physical characters can be used to discriminate the two genetically different stocks. Aiming to conclude the ongoing aging studies, a workshop will be scheduled for 2025.

Nevertheless, as in previous years, these objectives cannot be achieved with the single financial support of ICCAT and will only be possible through additional external funding. It is hoped that this will be provided through significant voluntary contributions from ICCAT CPCs, as has specifically been the case of the European Union.

References

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