Update on SBT catch monitoring and capacity building for biological sampling of spawning ground catches in Indonesia

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Abstract

Since the 1990s, monitoring the size and age distribution of southern bluefin tuna (SBT) catches by Indonesian longline vessels has been crucial for stock assessment. The program expanded in the mid-2000s to include tissue sampling for Close-kin Mark Recapture (CKMR) studies. Recent challenges, including COVID-19, institutional changes in Indonesia and changes in the Indonesian fleet distribution, prompted a call from the CCSBT to review and rebuild the program and in early 2024 a CCSBT-funded project was initiated to undertake the work. Training workshops were held in Bali in January and August 2024, focusing on practical training and capacity building. Sampling commenced during the first workshop, with 236 SBT sampled by April 2024 (2023/24 season). Due to a decline in fresh SBT landings from Area 1, discussions were held to expand the program to include sampling from Area 2 to meet targets. Although a proportion of fish caught in Area 2 are unlikely to be returning from spawning on the spawning ground, the Cape Town Management Procedure and stock assessment models explicitly account for the probability that each sampled fish was a likely parent of juveniles born in the years before its capture, thus maintaining the integrity of the CKMR data. For the 2024/25 season, a target of 3,000 SBT has been set, prioritising muscle tissue collection for CKMR analysis (500 samples/month) over otolith sampling (50 samples/month) as age estimation can be undertaken using epigenetic ageing methods. A collaborative team (BRIN, MMAF and CSIRO) has been established to analyse the various sources of SBT size data from the longline fishery, including catch monitoring, catch documentation scheme (CDS), logbooks, and observer data to determine the most appropriate method for obtaining representative length and age frequency data for the spawning ground catches. The results will be reported to the CCSBT ESC meeting in 2025.

Introduction

Southern Bluefin Tuna (SBT) spawn between Indonesia and northwest Australia from September to April. Indonesian longline fisheries traditionally target other tuna species such as bigeye and yellowfin tuna in this area, with SBT as bycatch in this area. Accurate estimates of Indonesia's SBT landings are crucial for population modelling, stock assessments, and the CKMR method used by CCSBT to monitor spawning populations and recommend the TAC.

Recent changes in Indonesian fleet distribution (from Statistical Area 1 to area 2; Figure 1) and institutional restructuring have affected the SBT monitoring program, which resulted in no SBT sampled in 2021/22 and only 148 SBT sampled in 2022/23. Key issues include:

- New administrative and permitting requirements
- Loss of experienced staff and facility access
- Change in routine monitoring responsibilities between the Ministry of Marine Affairs and Fisheries (MMAF) and the Research Centre for Fishery - National Research and Innovation Agency (RCF-BRIN)
- Reduced resources for SBT monitoring in 2021-22

Progress was made in 2023 including clarifying responsibilities, restarting the monitoring program in Benoa, and initial training in otolith and muscle tissue sampling. However, further investment in

capacity building and quality control was needed to ensure the program's long-term effectiveness and sustainability.

In 2023, the Extended Scientific Committee (ESC) supported a project to rebuild capacity in Indonesia for the SBT spawning ground monitoring program. The aim was to support the transition and recommencement of SBT monitoring by MMAF and RCF-BRIN, collaboratively with CSIRO, including the catch monitoring, biological sampling and capacity building in analyses and reporting.

The project encompasses two key activities to support the recommencement of the biological sampling and necessary capacity building to resolve the outstanding issues associated with the catch monitoring program following the disruption of the past 2 years:

1. Training and supervision for dedicated enumerators for SBT monitoring program in primary landing ports for SBT (e.g. Benoa, Cilacap and Muara Baru); and

2. Capacity building and analytical support for review of catch monitoring program, in particular, determining the most appropriate standard method for obtaining representative length and age frequency for the spawning ground catches and CKMR tissue samples and understanding the drivers and implications of the recent shifts in catch and effort between Area 1 and 2.

This paper summarises the progress made thus far in addressing the issues to ensure the long-term sustainability of this critical monitoring program.

1. Training dedicated enumerators for SBT monitoring program

Training workshops took place in Bali, Indonesia, in January and August 2024. The workshops focused on coordinating with the Ministry of Marine Affairs and Fisheries (MMAF), the National Research and Innovation Agency (BRIN), and local fishing ports to resume the catch monitoring and tissue sampling program supervised by CSIRO.

The first workshop combined practical hands-on training with capacity building for MMAF's Directorate General of Capture Fisheries (DGCF) enumerators, who had previously received training in SBT biological sampling in January 2023. Activities included presentations and discussion on the monitoring program, visiting fish processors at Benoa to review sampling conditions and methods with the enumerators, discussing the sampling program and needs with staff at the processors, and acquiring necessary equipment for the sampling program. A key outcome of the workshop was the development of an evaluation table detailing issues, risks, and solutions for the monitoring program (see Appendix A). Discussions focused on allocating responsibilities, obtaining permissions to sample, coordinating sampling at companies that process fresh SBT, finalising the Standard Operating Procedure (SOP), and assessing potential bias between "rejected" and "exported" SBT sizes. Sampling commenced during the workshop, with 236 SBT sampled by April 2024, which was lower than anticipated. Processors noted a decline in fresh SBT landings compared to previous years, potentially challenging the goal of sampling 1,500 SBT per season if limited to fresh fish alone.

A key focus of the second workshop was to assess the potential to sample muscle tissue from SBT caught in Area 2, to increase the likelihood of reaching sampling targets. Although a proportion of fish from Area 2 are unlikely to be returning from the spawning ground after spawning, the Cape Town management procedure and stock assessment models (i) do not compare juveniles/adults born/captured in the same year, and (ii) explicitly account for the probability that the captured adult *could* have been a parent (given its size) of a juvenile born in the years before its capture thus maintaining the integrity of the CKMR data. Fish from area 2 are landed frozen and are then defrosted (5-10%) or sold frozen. Sampling of defrosted fish can follow the current sampling protocol (~25-35 fish/day) and methods to sample frozen fish will be trialled in September 2024 when the sampling program for the 2024/25 season commences.

A sampling target of 3,000 SBT has been set for the 2024/25 season in Benoa, to offset the lower-than-expected sampling in previous years. The primary focus will be on collecting muscle tissue for CKMR analysis with a goal of 500 samples per month over the 6-month sampling season. A reduced target of 50 otolith samples per month has been set, as otolith extraction is more time-consuming reducing the total number of fish that can be sampled in a day. Additionally, age estimation can now be undertaken using the muscle tissue samples and recently developed epigenetic ageing methods (refer to CCSBT-ESC/2308/13). Otolith and epigenetic age estimated for the same fish will be compared to examine precision. Sampling in other ports (i.e., Cilacap and Muara Baru) will be investigated once the sampling in Benoa has commenced.

To monitor sampling progress, a Google Form has been implemented for weekly updates. Sampling sheets have been updated to include frozen fish from Area 2, and a gridded map has been developed to obtain more precise catch location information from vessels. Progress against the evaluation table, detailing issues, risks, and solutions, has been documented (see Appendix A).

2. Capacity building and analytical support for review of the catch monitoring program

The key issues for consideration in this component of the project were:

1. *Small fish on the spawning ground*

   Since 2012/2013, small, young SBT have been observed in Area 1 catches. Efforts to separate these from Area 2 catches have had some success but have not eliminated the issue (Sulistyaningsih et al 2018; Fahmi et al., 2020). To address this, uncertainty in fishery selectivity was increased in operating models. Initially considered potential exceptional circumstances, this was later removed from that list in the 2020 stock assessment review (paragraphs 136-137, Anon 2020).

2. *Differences in estimated length and age composition of the catch*

   Age distributions of the Indonesian SBT catch are estimated using the age-length key method, requiring random sampling from Area 1. Discrepancies in age distributions were noted when using different length frequency data sources (scientific catch monitoring vs. Catch

Documentation Scheme) (Farley et al., 2021), highlighting the need for consistent data collection methods.

3. *Recent increases in SBT catches in Area 2*

From 2021, a significant shift occurred in the distribution of Indonesian SBT catches, with Area 2 accounting for 57-87% of catches, compared to a historical average of 13% (Table 2, Sadiyah et al., 2024). This shift has challenged the ability to maintain consistent monitoring and sampling of the spawning population in Area 1, with sample sizes falling below the target of 1,500 in recent years. In 2022 and 2023, only 1,389 and 2,039 SBT were reported caught in Area 1 respectively (Figure 1, Sadiyah et al., 2024) falling near or below target levels. These numbers assume all SBT could be sampled, which is unlikely.

A collaborative team (BRIN, MMAF and CSIRO) has been established to obtain and analyse the various sources of size data available for SBT caught in Indonesian's longline fishery to determine the most appropriate method for obtaining representative length and age frequency data for the spawning ground catches. This includes data from the catch monitoring/sampling program, CDS, logbook and observer data.

Summary

The Indonesian SBT monitoring program, crucial for CCSBT's population assessments and TAC recommendations, faced recent challenges due to fleet distribution changes and institutional restructuring. In response, a CCSBT-funded project was initiated in 2024 to rebuild capacity, focusing on training enumerators and improving catch monitoring. Workshops in Bali addressed sampling methods, data collection, and program sustainability. The 2024/25 season targets 3,000 SBT samples, prioritising muscle tissue for CKMR analysis. Key issues being addressed include the presence of small fish in spawning grounds, discrepancies in catch composition estimates, and the shift of catches to Area 2. A collaborative team (BRIN, MMAF and CSIRO) has been established to analyse various data sources to enhance the program's effectiveness and ensure accurate monitoring of the SBT spawning population. The results will be reported to the CCSBT ESC meeting in 2025.

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Figure 1. Map showing the CCSBT statistical areas.
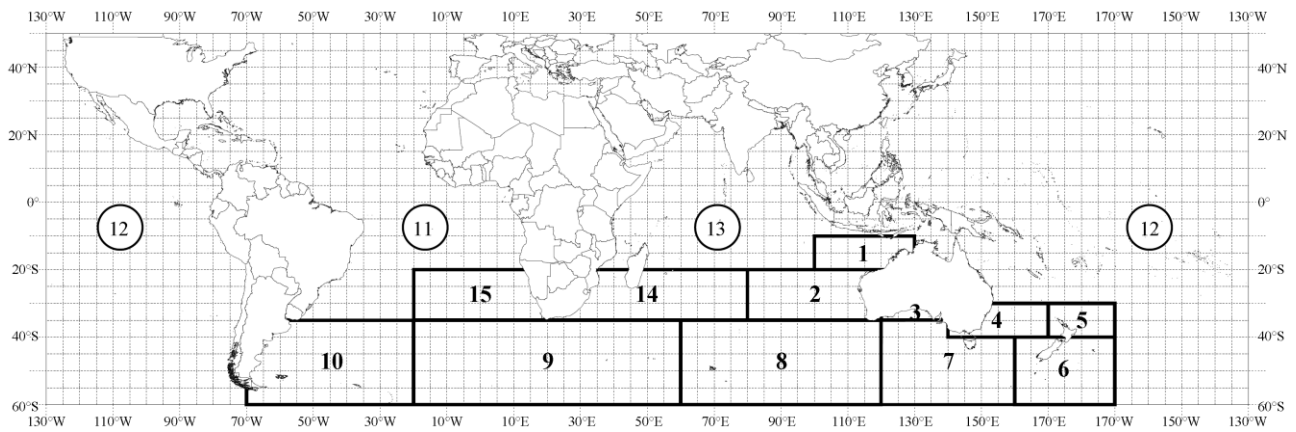
Source:
https://www.ccsbt.org/sites/default/files/userfiles/file/docs_english/operational_resolutions/Resolution_CDS.pdf)

EVALUATION AND RECAP FROM THE SBT CATCH MONITORING WORKSHOPS
16-19 January and 5-6 August 2024
Translated into English from Bahasa

No	Issue	Risk	Solution	Progress
1	Clarify implementation structure, for the SBT monitoring given the dichotomy of organisational roles research (BRIN) and management (KKP). Indonesia is a CCSBT member country that is required to report the results of SBT monitoring.	Involving several different divisions: 1. KKP (SDI; Port; and PDK); 2. BRIN. The KKP auditor's understanding is that monitoring activities fall within the research realm (sampling may not be carried out). The BRIN auditor's understanding is that monitoring is a mandate of the Ministry of Marine Affairs and Fisheries (does not receive funding).	Funding is supported from external sources (CCSBT) which is only temporary. BRIN researchers can provide assistance as long as they do not use BRIN's budget. KKP can assign contract workers to carry out SBT sampling activities.	The existing KKP Work Order (SPK) that governs activities of the DGCF staff contains a clause (Point 5) relating to 'other assignments' which can cover the CCSBT monitoring activities. Arranging the enumerator work schedule (6 people) is prioritized by the Post-Production Coordinator to assess tuna fishing vessels, especially those landing SBT (to record the catch according to the post-production format and conduct SBT length and/or weight sampling). Monitoring results are filled in daily in a Google spreadsheet document.
2	The need for SBT biological samples is expected to meet the CCSBT sample target of 1500 samples in the 2022/23 season (i.e., January – April 2024). To account for lower sample sizes in previous seasons, a target of 3,000 is set for the	Sampling is highly dependent on Company access. There is a risk that SBT sampling activities cannot be carried out because there is no one to coordinate.	An officer is required who can communicate and open access to the Company (PT. Perintis Jaya International; PT. Sumber Mina Samudera; PT. Bali Nusa Windu Mas). Currently, those assigned as Coordinators are Mr. Hitler Sumah and Mrs. Ni Putu Ari.	Already have access from PT. Perintis Jaya International and PT. Sumber Mina Samudera (for fresh tuna). PT. Bali Nusa Windu Mas is a tuna export company with processed products ("loin", "saku" both from fresh and frozen products). The volume of SBT is a little less than 3 fish purchased from other companies so that entry access is tight so there is no sampling at the Company.

	2023/24 spawning season (September 2024 – April 2025).	The ability and speed of enumerators in taking samples. Ability to carry out sample management according to SOP. The main task of contract workers (enumerators) is to carry out post-production tasks.	Training and experience are required, proper sampling techniques (drilling from one side and drilling from two sides). SOP in Bahasa Indonesia is required (English version will be prepared by CSIRO and translated by Mr. Jim and Mrs. Ririk). Supervision is required to work according to SOP. Create additional assignment decree for SBT biological sampling from SesDit DJPT. Invite the division (Mr. Mahrus) to the next CCSBT Workshop event.	PT. Bandar Nelayan has a fairly large SBT landing in frozen products so that SBT monitoring will be carried out at the company. Assistance is needed from Port officers (Mr. Hitler/Mr. Rois/Mrs. Ari) to open access to monitor the SBT fishing season from September 2024 to April 2025. Training has been conducted and the enumerators' skills in SBT sampling are improving. It is expected that the trained enumerators will not be replaced/moved so that they can carry out the SBT fishing season in full from September 2024 to April 2025. The draft SOP is available but still requires language refinement. Supervision will be carried out with the following approaches: 1. Online monitoring of Google spreadsheets. 2. BRIN members assigned to KKB Denpasar accompanied by the Post-Production Coordinator supervise enumerators at least once a month. 3. Monitoring and evaluation involving teams from Jakarta (BRIN and DJPT) and CSIRO (will facilitate if necessary) will be carried out according to the availability of funds and time. Communication has been conducted with the Directorate of Fisheries Ports regarding the need for SBT enumerator SK. Directions from the Directorate of Fisheries Ports for SK can refer to SPK point 5.
3	Improvement of SBT quota data collection and control.	The occurrence of bias in recording SBT catch results and quota implementation.	Conducting a workshop on finalizing previous year's SBT data and determining quota distribution.	The SBT data finalization workshop will be held in February/March 2025 in Jakarta/Bali.

4	SBT sample storage.	There is no backup generator at the Port office.	Information received is that at the Port location the power outage never lasts more than 24 hours, however it is still considered necessary to have a special mini generator for the freezer.	Based on observations and consultations, the availability of electricity at the port is quite adequate, if there is a blackout it will not last too long. Until now, there has been no need for a mini-generator.
		Sample storage and sampling equipment.	Provision of sample storage cabinets and sampling equipment was carried out on January 17, 2024 by CCSBT.	Enumerators make a list of the equipment needed and submit it to the BRIN CCSBT Activity Coordinator.
5	There is a need for length frequency data for tuna longline catches, currently data collection by post-production officers only records weight data.	There are no officers collecting fish length data.	Officers who carry out data collection for fish length are required to be able to provide information on the distribution of length of at least 10% of the total catch.	Length data collection is intended to obtain confirmation that weight data is still within the range of length and weight relationships. If length collection can still be carried out, it is recommended to continue measuring length. Additional fish length information obtained from area 1 and area 2 can help to understand the differences in length-weight relationships in 2 different areas. However, biological sampling remains a top priority in the implementation of SBT monitoring in the September 2024 to April 2025 season.
6	The current understanding is that the results of measurements (sampling) carried out using reject fish are not significantly different from sampling taken from exported fish, but current conditions are considered to have changed so that further investigations (studies) need to be carried out to prove whether this is still relevant.	If sampling using rejected fish is still carried out, it is suspected that it will cause bias.	Re-study is needed for tuna longline catches, especially fresh SBT and from area 1 for reject and export products.	The weight and length data of export and reject SBT can be obtained from CDS data. SBT weighing is carried out at the port (landing site) for each individual SBT (census). For length data, the measurement method needs to be checked.
	The implementation of SBT otolith sampling is taken from		In carrying out sampling, it is also necessary to take muscle tissue	If permission received, first step would require a trial experiment to determine whether the sampling method used by Company

	reject products. This is understood to obtain samples in limited quantities (small) because some are not sampled and cannot reflect the actual conditions. For export SBT products, sampling for otoliths and muscle tissue cannot be carried out to date.	Not getting a complete picture for export products.	samples from all reject products including frozen product (age estimation can be done using DNA). Ask companies if it is possible to use tissue samples obtained during fish-quality grading process. Enumerator coordinator to seek permission from the Company owner.	fish grading specialists are free from cross-contamination. Ideally codevelop a sampling strategy with company specialists and enumerators.
7	Mapping of SBT fishing areas.	It is unknown where the biological sample of the SBT was captured.	A CCSBT Area map will be created to make it easier for enumerators to obtain position information.	A map for CCSBT area will be produced in 5x5 degree by Bu Jessica.

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