WCPFC Project 35b

Final Report 2020

WCPFC TUNA TISSUE BANK
STEERING COMMITTEE

ELECTRONIC MEETING
16 July 2020, from 18:00-19:30 hours Pohnpei time (UTC+11 hours)

Project 35b: WCPFC Tuna Tissue Bank

WCPFC-SC16-2020/RP-P35b-01

SPC-OFP

EXECUTIVE SUMMARY

The WCPFC Tuna Tissue Bank (TTB) operations are supported by the WCPFC through Project 35b. Under this project, the Scientific Services Provider (SPC) is tasked with maintaining, developing and expanding the TTB. This paper updates SC16 on Project 35b activities since SC15 (as they pertain to the 2019-20 work plan endorsed by SC15). A work plan and budget for 2021, and indicative budgets for 2022 and 2023 are provided for this ongoing project. Key topics covered include:-

Biological sampling and TTB progress

i. Between 1 July 2019 and 30 June 2020, 7322 new biological samples, taken from 1551 fish, were added to TTB holdings. SPC now houses 126,566 biological samples taken from 39,032 individual animal specimens.
ii. Notably, port sampling of small (i.e. < 30 cm fork length) skipjack, yellowfin and bigeye tuna captured by Philippines' fisheries in early 2020 has resulted in the creation of new, small-tuna specific conversion factors for Length–Length and Length–Weight, under WCPFC Project 90.
iii. Training for observers, debriefers, and observer trainers continues. 170 observers undertook training in biological sample collection during 2019-20, with a total of 553 samplers trained to date. Training and refresher courses were run in five countries, with 38 debriefers trained in debriefing, and nine observer trainers refreshed in delivering biological sampling training.
iv. New training resources were released. For example, the online publication of the 'Shark and ray identification manual', and a series of online videos documenting standard biological sampling procedures on tunas.
v. To increase biological sampling rates from 2018 levels, two new sampling approaches have been designed to optimise purse-seine observer efforts for tuna sample collection.
vi. In 2019-20, the TTB acquired one new stereomicroscope, an X-ray machine and two -80°C freezers, the latter to guarantee long-term sample quality for genetic studies. Cold storage in Nouméa has been expanded, providing an extra 10m^3 of space. New access to cold-storage capacity has also been organised in General Santos.
vii. Between July 2019 and June 2020, the biological sampling feature in *OnShore* was thoroughly tested in New Caledonia and is currently in use in the Philippines. During this period, training was provided to FSM and RMI port samplers.

TTB Access and Use

i. No formal requests were received from third parties to withdraw samples from the TTB since SC15. However, enquiries have been received to prepare for a request by WCPFC members to undertake radiocarbon analyses of otoliths.
ii. At present, nine projects are classified as 'ongoing' in using TTB samples for WCPFC-related work. Thirty such projects are listed as 'completed' as at 30 June 2020.
iii. Seven Information Papers or Research Papers linked to the TTB will be submitted to SC16 this year. Seven other books, peer-reviewed articles, conference papers or popular articles associated with TTB work were published during 2019-20.

The following recommendations arise from this report. We invite SC16 to:-

- Continue to support initiatives to increase rates of observer biological sampling, noting that this contribution is essential to the ongoing success of WCPFC's work.
- Incorporate the identified budget into the 2021 budget and the 2022-23 indicative budgets. The development of the WCPFC TTB is ongoing and considered essential.
- Support efforts to obtain further super-cold storage capacity to ensure longevity of TTB samples.
- Endorse that the work plan in Section 4 of this report should be pursued by the Scientific Services Provider, in addition to standard duties associated with maintenance and operation of the WCPFC TTB in 2020-21.

1. INTRODUCTION

The WCPFC Tuna Tissue Bank (hereafter, TTB) is a repository of biological samples from marine specimens collected from across the WCPO. The TTB is focussed primarily on samples from bigeye, yellowfin, albacore and skipjack tunas, yet also houses biological material from other pelagic species (e.g. swordfish, mahi mahi). The TTB is embedded within the Pacific Marine Specimen Bank (PMSB) repository that contains a broad diversity of samples from micronekton, seabirds, deep-water benthic and coastal fishes, among other taxa.

The TTB was officially established in 2015 (SPC-OFP 2017, 2019), though samples have been systematically collected since 2001. Through the TTB's creation, the WCPFC aimed to provide research institutions access to the sample collections needed to advance our understanding of the dynamics of tunas and related species in the WCPFC region. The initiative has proved highly successful, the TTB and its associated Biological Data System 'BioDaSys' database fostering inter-agency collaboration and strengthening research capacity across the region, as evidenced through ongoing and productive research partnerships involving TTB samples (see SPC-OFP 2019 and ANNEX 1, Table A4 for examples).

TTB operations are currently funded by the WCPFC through Project 35b. Under this project, SPC, as the Scientific Services Provider, is tasked with maintaining and developing the TTB and with expanding the inventory of samples held through national and regional biological sampling programmes.

In 2019, a TTB Steering Committee was established to guide Project 35b direction, with the inaugural committee meeting held just prior to the Fifteenth Regular Session of the Scientific Committee of the WCPFC (SC15). The 2019 TTB Steering Committee noted that ongoing contribution to the TTB was critical to the success of WCPFC's work, and recommended that financial support be continued to implement a 2019-20 work plan, as set out in Tuna Tissue Bank Steering Committee (2019). SC15 endorsed the work plan for 2019-20, as well as the proposed 2020 budget and indicative budgets for 2021-22.

Previous papers to the SC (SPC-OFP 2017, 2018, 2019) detail the history, developments and key objectives of Project 35b. This paper aims to update SC16 on Project 35b activities over the past 12 months (as they relate to the agreed 2019-20 work plan), and outlines planned actions for the next phase of work.

2. BIOLOGICAL SAMPLING AND TTB PROGRESS (2019-20)

This section summarises 2019-20 progress on:-

1) sampling activities between 1 July 2019 and 30 June 2020, and TTB holdings as at June 30 2020;
2) training for biological sample collection;
3) an appraisal of new biological sampling approaches for tunas aboard purse seine vessels;
4) the current status of sample storage facilities; and
5) recent developments regarding the BioDaSys database.

We refer readers to SPC-OFP (2019) for background on sample collection protocols, associated observer training standards, and the key features of the BioDaSys database.

2.1 SAMPLING ACTIVITIES AND TTB HOLDINGS

2.1.1 Overview

Despite severe (and ongoing) disruptions to normal biological sampling activities arising in early 2020 due to COVID-19-related restrictions on WCPO observer duties, sample collection by at-sea observers and in-country port samplers continued where possible during 2019-20. However, due to these disruptions the total number of samples returned to the TTB between July 2019 and June 2020 was lower than previous years' tallies (Figures 1, 2). Given the extension of current restrictions on purse seine observer coverage until at least July 31 (WCPFC 2020 – Circular No. 2020/42), further reductions in sampling activity and spatial and temporal sampling coverage are anticipated in the near- to medium-term.

In 2019-20, 7322 new biological samples were collected from 1551 fish and added to the TTB. Table 1a and 1b provide species-level breakdowns of the 2019-20 additions (Table 1a), together with total fish sample holdings as at 30 June 2020 (Table 1b). When all samples (e.g. seabirds, micronekton) are included, the PMSB now houses 126,566 biological samples taken from 39,032 individual animal specimens.

Notably, from December 2019 through to May 2020, biological samples were collected at port from very small (i.e. < 30 cm fork length) skipjack, yellowfin and bigeye tuna captured by ring net and manually-hauled purse seine fisheries in the Philippines. These represent the smallest tunas sampled to date for the TTB. Further, length and weight measurements on these fish have resulted in the derivation of small-tuna specific conversion factors for Length–Length and Length–Weight, under Activity 3.2 in WCFPC Project 90 (Macdonald et al. 2020a for further details).

2.1.2 Observer-based sampling

Annual figures on the total number of fish sampled, the number of observer trips on which biological sampling occurred, and changes in mean sampling effort per trip compiled over the past nine years, are shown in Figure 1.

Following the peak in activity in 2015, the number of observer trips involving biological sampling has gradually declined, with predictable consequences for sample numbers returned to the TTB (Figure 1). Signs of recovery were evident in 2019, with sampling effort rising sharply and a 64% increase in sample returns compared with 2018, due largely to contributions from Papua New Guinea (PNG) and Federated States of Micronesia (FSM). In early 2020, WCPO-wide restrictions on observer coverage (due to COVID-19) have effectively removed opportunities for onboard sample collection, driving observer-based sample returns down despite stable sampling rates (i.e. mean number fish sampled/trip) (Figure 1).

2.1.3 Port sampling

The number of port sampling events and samples collected are provided in Figure 2. The sampling rate has remained relatively stable over the past eight years (Figure 2). After three consecutive years of low sample returns (i.e. 2017, 2018, 2019), port sampling activity increased in the first half of 2020, attributable largely to SPC-led efforts to engage with in-country port samplers and observers limited to land-based duties during the COVID-19 lockdown period.

Given that current restrictions on at-sea observer coverage are set to remain in place until at least 31 July 2020, SPC is doubling its efforts to ensure that this recent positive trend in port sampling returns continues.

Table 1a. Additions to the TTB between 1 July 2019 and 30 June 2020. Note the number of samples may sometimes exceed the number of specimens (e.g. otolith and gonad samples for yellowfin). This occurs when multiple samples of the same tissue are taken from one specimen.

Species	No. of specimens	Hard parts		Reproduction		Multi-purpose			Diet	
		Otolith	Spine	Gonad	Blood	Muscle	Liver	Fin	Stomach	Fatmeter
Albacore	94	91	83	145		88	35		35	
Bigeye	142	163	89	146		142	59	1	59	3
Skipjack	574	432	439	437		449	443	160	443	68
Yellowfin	658	663	450	716		611	427	34	426	16
Pac. bluefin tuna	1	1	1	2		1				
Blue marlin	5			2		5	4		5	
Mahi mahi	48	30		6		37	1		1	
Rainbow runner	29			19		29	29		29	
Total	**1551**	**1312**	**1062**	**1308**		**1362**	**998**	**195**	**998**	**87**

Table 1b. Total holdings in the PMSB (at 30 June 2020).

Species	No. of specimens	Hard parts		Reproduction		Multi-purpose			Diet		Other *
		Otolith	Spine	Gonad	Blood	Muscle	Liver	Fin	Stomach	Fatmeter	
Albacore	6336	4505	3179	6107	75	3416	1526	1	2000	638	19
Bigeye	4752	4975	836	3852	217	3745	1948	3	2055	137	27
Skipjack	6799	2369	1827	2623	167	5623	5363	160	5537	2248	7
Yellowfin	9754	6711	2368	6644	349	7985	5643	34	5902	1578	31
Striped marlin	152	11	45	38	41	113	91	2	66	0	0
Swordfish	134	22	10	37	27	107	100	27	113	0	13
Mahi mahi	475	78	6	46	33	424	276	0	343	0	0
Wahoo	361	50	9	20	0	308	274	0	315	0	15
Rainbow runner	402	9	1	40	0	396	329	0	398	0	0
Other #	9867	3859	94	3315	129	3408	3111	1574	1315	0	3098
Total	**39032**	**22589**	**8375**	**22722**	**1038**	**25525**	**18661**	**1801**	**18044**	**4601**	**3210**

includes: 153 species from 60 different families (Acanthuridae, Alepisauridae, Alopiidae, Anoplogastridae, Apogonidae, Balistidae, Berycidae, Blenniidae, Bramidae, Carangidae, Carcharhinidae, Caristiidae, Chiasmodontidae, Dactylopteridae, Dalatiidae, Dasyatidae, Diodontidae, Echeneidae, Emmelichthyidae, Engraulidae, Ephippidae, Exocoetidae, Fistulariidae, Fregatidae, Gempylidae, Holocentridae, Istiophoridae, Kyphosidae, Lamnidae, Lampridae, Lethrinidae, Lobotidae, Lophotidae, Lutjanidae, Malacanthidae, Mobulidae, Molidae, Monacanthidae, Myliobatidae, Nemichthyidae, Nomeidae, Octopodidae, Ommastrephidae, Ostraciidae, Paralepididae, Pomacentridae, Procellariidae, Pseudocarchariidae, Scombridae, Scombrolabracidae, Scopelarchidae, Serranidae, Sphyraenidae, Sphyrnidae, Sulidae, Syngnathidae, Tetraodontidae, Trachipteridae, Trichiuridae) and zooplankton samples

* includes: beak, gill, vertebrae, jaw, brain, guano, skeleton, bird regurgitate, feather, heart, whole community

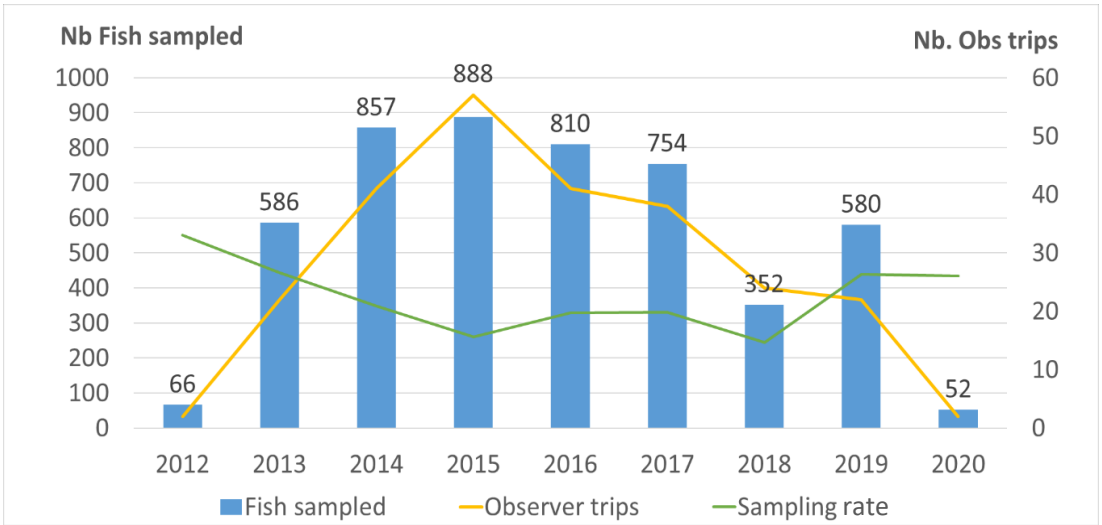

Figure 1. Total numbers of fish sampled by observers (blue histogram and numbers above), observer trips during which biological samples were collected (orange line), and the mean sampling rate per trip (i.e. mean number fish sampled/trip) (green line) calculated annually between 2012 and 2020. Note that sampling rate relates to the secondary y-axis.

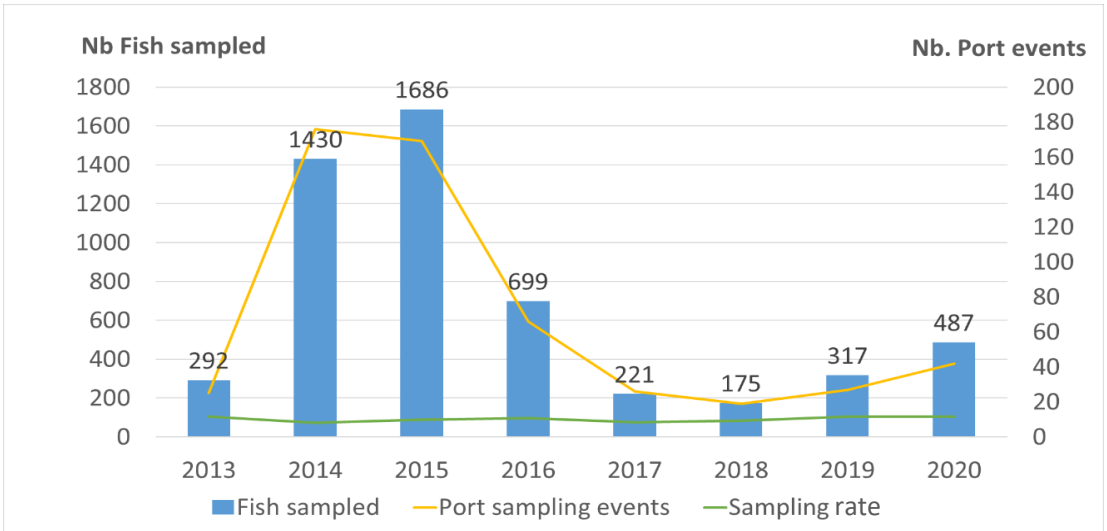

Figure 2. Total numbers of fish sampled by port samplers (blue histogram and numbers above), port sampling events during which biological samples were collected (orange line), and the mean sampling rate per event (i.e. mean number fish sampled/event) (green line) calculated annually between 2013 (when the port sampling programme commenced) and 2020. Note that sampling rate relates to the secondary y-axis.

2.1.4 Scientific cruises

Scientific cruises continue to be an important source of biological samples for TTB holdings, contributing 29,108 samples to date. As at June 30 2020, a total of 8,566 fish have been sampled during various SPC-led cruises, from which 10,987 samples have been analysed (ANNEX 1, Table A1). For the TTB as a whole, tagging cruises have supplied 24.6% of the total fish specimens sampled and 24% of the total samples collected, with 32.6% of the analyses conducted for biological or ecological applications to date using cruise-related samples.

This contribution of biological samples adds considerable value to the tagging cruises (SPC-OFP 2017). The 2019 WP5 added 475 new biological samples to the TTB, 440 of these from tunas, incorporating a range of sample types (e.g. muscle, gonad, liver, otolith, stomach, dorsal spines, fin clips) that have various downstream scientific applications (ANNEX 1, Table A1, Table A2).

During WP5, tunas tagged with conventional white tags also received an injection of strontium chloride ($SrCl_2$) (SPC-OFP 2020). This leaves a permanent, visible mark on the tagged fishes' otoliths that, upon recapture, allows the number of growth increments formed post-release to be compared with the known days at liberty – in effect, providing an age validation tool. As at 30 June 2020, a total of 492 skipjack and 9 yellowfin tuna have been injected with $SrCl_2$, with 7 sets of marked otoliths returned to the TTB and 4 whole fish still awaiting processing.

2.2 TRAINING OBSERVERS, DEBRIEFERS AND TRAINERS

2.2.1 Training update

Fisheries observers that remain active within the national observer programmes continue to be provided with training in biological sampling.

Over the 2019-20 reporting period, 170 observers undertook training in biological sample collection, with a total of 553 samplers trained to date. Training and refresher courses were run in several countries, including the Solomon Islands, New Caledonia, Fiji, Papua New Guinea and the Philippines. Materials and standards for training of debriefers in biological sampling was updated as of 2018-2019, with 38 debriefers trained in debriefing, and nine observer trainers refreshed in delivering biological sampling training in 2019-20. Table 2 provides a regional summary of those trained in biological sampling, by nationality, and skills, as at June 30, 2020.

2.2.2 New training tools

The publication of the illustrated new 'Shark and ray identification manual' (Park et al. 2019) was completed in 2019. The primary purpose of this guide is to improve identification of shark and ray species encountered by observers and crew working in WCPO tuna fisheries.

Hard copies of the guide were sent to the observer programmes in the region in first half of 2020, and a digital version is available at:- https://coastfish.spc.int/en/component/content/article/44-handbooks-a-manuals/507-shark-and-ray-identification-manual.

In addition, SPC has recently produced a series of online training videos documenting standard biological sampling procedures on tunas. These videos are particularly important at present, given the current COVID-related travel restrictions which are precluding face-to-face training opportunities. The videos will serve as useful tools for observers wishing to undertake / refresh training in biological sampling in the near term.

Table 2. Current numbers of samplers* (includes at-sea observers, port samplers, debriefers, trainers, cannery employees, fisheries officers) trained or refreshed in the collection of biological samples, debriefers trained in debriefing biological sampling, and observer trainers trained to deliver biological sampling training, by nationality. Note that numbers of debriefers and of trainers are also counted in the number of samplers.

Country	No. of samplers*	No. of debriefers	No. of trainers
Cook Islands	5		
Fiji	34	7	
Federated States of Micronesia	64	8	2
Kiribati	48	3	1
Marshall Islands	39	9	1
Nauru	9	2	1
New Caledonia	2		
French Polynesia	5		
Papua New Guinea	162	10	4
Palau	11		
Philippines	7		
Solomon Islands	61	7	2
Chinese Taipei	33		
Tonga	17	4	
Tuvalu	9	3	
Vanuatu	25	1	
Samoa	22	2	

2.3 NEW TUNA SAMPLING APPROACHES

SPC is currently undertaking work to develop and trial new biological sampling approaches that optimise purse-seine observer efforts for tuna sample collection. The primary goal is to expand sampling coverage for the TTB in space and time, and in a systematic fashion, and to ensure that the highest-quality biological material is available for the scientific analyses/applications needed to meet WCPFC objectives.

Of the sampling approaches tabled to date, two have shown most promise:

- *Approach 1: 'VMS bag and store'*
- *Approach 2: 'VMS Widget'*

These approaches are outlined in detail in Macdonald et al. (2020b). In brief, both make use of vessel monitoring system (VMS) data to identify a suite of purse seine vessels operating simultaneously, but in different regions, from which tuna samples are then collected. Both rely on effective dialogue with fisheries authorities, fishing companies and observer programmes. A key difference between approaches relates to where sample processing occurs. In Approach 1, fish are set aside, and stored whole at sea, with sample processing undertaken at port. Approach 2 makes use of the CSIRO 'Widget' biopsy tool (Bradford et al. 2016).

SPC notes that a proposal for a field trial of Approach 1 was formally endorsed at the 20th Regional Observer Coordinator Workshop held in Funafuti, Tuvalu, in February 2020. The roll-out of this trial has now been delayed due to COVID-19 related travel restrictions.

2.4 SAMPLE STORAGE INFRASTRUCTURE

The TTB and PMSB are jointly curated at SPC Headquarters, in Nouméa, New Caledonia, and at CSIRO in Brisbane and in Hobart, Australia (SPC-OFP 2019; Portal et al. 2020).

Collectively, the TTB are equipped with:-

- 1 microscope, 2 stereomicroscopes, 1 X-ray machine for fish examination, 1 low-speed, diamond-blade cutting saw to section otoliths, 1 fume hood to manipulate solvents, 1 high-precision scale, 2 low- precision scales, 1 photographic system, all located in Nouméa;
- 3 solvent cabinets (1 in Nouméa, 2 in Hobart);
- 5 dry cabinets for otolith storage (4 in Nouméa and 1 in Hobart);
- 2 cabinets to store collection/reference specimens in alcohol (2 in Nouméa);
- 2 dry cabinets to store gonads in paraffin and gonads and otoliths mounted on slides (1 in Nouméa, 1 in Hobart);
- 1 dry cabinet to store dorsal spines (1 in Hobart);
- 2 ultra-cold -80°C freezers to guarantee long-term quality of samples for genetic analyses (~1m^3 in Nouméa);
- ~23m^3 of -20°C cold-storage facilities at SPC and CSIRO (23m^3 in Nouméa, 2m^3 in Hobart, 2m^3 in Brisbane); and
- numerous short-term/staging -20°C storage facilities in the key ports of the WCPO (**Table**).

In 2019-20, the PMSB and TTB acquired one new stereomicroscope, one X-ray machine and two -80°C freezers.

Notably, cold storage in Nouméa has been expanded by renovating a disused walk-in -20°C freezer, providing and extra 10m^3 storage space for samples. New access to cold-storage capacity has also been organised in General Santos in the Philippines, with previous arrangements for storage options in other regions still in place (ANNEX 1, Table A3).

Note that strategic investment in a large super-cold storage facility is required to ensure the longevity and relevance of the TTB (see Smith et al. 2017 for further discussion on this point).

2.5 DEVELOPMENTS IN BIODASYS

2.5.1 Overview and access

A central feature of the TTB repository is BioDaSys – a relational database that catalogues samples and their associated metadata, and records when changes in sample status occur, thus ensuring traceability of the work conducted. The key features of the database are reported in (SPC-OFP 2019), including information and rules around access via the standalone web portal at: (www.spc.int/ofp/PacificSpecimenBank).

The website, which incorporates searching tools and interactive maps, is publicly accessible to WCPFC members and scientists, providing an interface for the BioDaSys database (see Fig. 7 in SPC-OFP 2019 for an example).

In agreement with WCPFC data access rules, certain information on each sample is unavailable to researchers outside of SPC-OFP, who must apply for a login (directly from SPC) to gain access. Even with a login, only those data fields necessary for designing research projects are accessible to authenticated users. Moreover, any specific requests for samples still require approval via the access protocol outlined in Section 3.1 (below) and detailed in SPC-OFP (2019).

2.5.2 Electronic Reporting (ER) links to BioDaSys – an update

During 2019, a feature for recording biological sampling data was developed within the ER application '*OnShore*', used by port samplers to collate data at landing sites. This feature has been updated, with biological sampling data is now directly uploaded to the 'TUFMAN2' database and then automatically transferred into BioDaSys. Between July 2019 and June 2020, the *OnShore* biological sampling feature was thoroughly tested in New Caledonia (biological data recorded for 169 specimens), and is currently in use in the Philippines (data recorded for 252 specimens to date). During this period, training was provided to FSM and Marshall Islands' port samplers.

3. TTB ACCESS AND USE

3.1 ACCESS PROTOCOLS

A protocol for accessing the TTB for laboratory and data analyses by third party organisations was endorsed by the Commission in 2016 (Anon. 2016; SPC-OFP 2019), details of which are available here: www.spc.int/ofp/PacificSpecimenBank/Home/About.

3.2 USE OF TTB AND PMSB SAMPLES (2009-2020)

There were no formal requests from third parties to withdraw samples from the TTB or PMSB in 2019-20. However, several informal enquiries were registered from university-based researchers around sample availability and access rights in the context of future collaborative projects. There are also expectations for requests arising from SC16 associated with radiocarbon analyses of otoliths and potentially further work associated with yellowfin biology.

At present, nine projects are classified as 'pending' in accessing samples from the TTB for WCPFC-related work, led by SPC and/or other national and international organisations (Table 3). Around 30 projects utilising TTB/PMSB samples are 'completed' as at 30 June 2020 (ANNEX 1, Table A4). Of particular note is the new work exploring radiocarbon dating techniques for age validation in bigeye tuna under WCPFC Project 98 (Farley et al. 2020).

3.3 OUTPUTS ASSOCIATED WITH THE TTB (2019-20)

Annual progress reports from all projects currently accessing specimens from the TTB have been provided to the WCPFC Secretariat. Seven additional papers, linked either directly or indirectly to the TTB, will be submitted to SC16 this year as Information Papers or Research Papers. A total of seven other books, peer-reviewed journal articles, conference papers or popular articles associated with TTB work were published during the 2019-20 reporting period. These include Anderson et al. (2019), Park et al. (2019), Sanchez (2019), Logan et al. (2020), Lorrain et al. (2020), Macdonald et al. (2020c) and Portal et al. (2020). Moreover, several completed projects have journal articles currently in review for publication in scientific journals (e.g. Anderson et al. in review).

Table 3. Projects that currently access the TTB and/or the PMSB.

Project description	Samples Used	Analysis	Lead agency	WCPFC-SC Project No.	Status
Age and growth					
C14 analysis of WCPO-BET otoliths	otolith	ageing, microchemistry	CSIRO	98	ongoing
Trophic dynamics					
Western Tropical Pacific Ecopath model	stomach	morphological taxonomy	SPC	TBP	ongoing
Movement					
C14 analysis of WCPO-BET otoliths	otolith	ageing, microchemistry	FRA*	98	ongoing
Spatial variation in concentrations of metal contaminants in food webs	muscle, blood	isotopes	IRD[#], SPC	TBP	ongoing
Stock structure					
WCPO tuna stock structure	Otolith muscle	shape morphometrics	SPC	TBP	ongoing
Food safety and tuna flesh characterisation					
TIPTOP: South Pacific tunas - persistent organic pollutants and microplastics	muscle	microplastics, persistent organic pollutants	IRD[#], IFREMER°, SPC	TBP	ongoing
Spatial variation in metal contaminant concentrations in food webs of the South Pacific Ocean	muscle, blood	mercury, fatty acids	IRD[#], SPC	TBP	ongoing
MERTOX: Unravelling the origin of methylmercury toxin in marine ecosystems	muscle	mercury, isotopes, selenium, metals, nutrients	IRD[#]	TBP	ongoing
Fatmeter	muscle	fatmeter	SPC	TBP	ongoing

* Japanese National Research Institute of Far Seas Fisheries, [#] French National Research institute for Sustainable Development, ° French National Institute for Ocean Science

4. TUNA TISSUE BANK 2020-21 WORK PLAN

Actions planned for 2020-21, continuing from previous years, include:

- Standard maintenance of the TTB, ensuring the curation of new samples received and improvements to infrastructure.
- Exploration of new biological sampling opportunities, including sampling trials proposed in Section 2.3.
- Continuous development of BioDaSys to improve traceability of samples, sample preparation protocols and analyses.
- Ongoing training of observers, observer-trainers, port samplers and debriefers.
- Ongoing development and improvement of the E-reporting app *OnShore* based on users' feedback.

New actions planned for 2020-21 include:

- Development of a document on standard operating procedures for the TTB.
- Provision of training to Vanuatu and Samoa and to members interested in using *OnShore* for biological sampling.
- Creation of species reference guides to improve species identification. In particular, the production and distribution of new ID books (shark and rays, in French; seabirds, in French and in English) and the production of a new ID book on billfishes.
- Investigation of the use of temperature probes to monitor conditions in portable cold-storage units (e.g. 'Eskies') during transportation for sample quality traceability.
- Updating and improving training materials for biological sampling.
- Development and enhancement of E-reporting apps, such as integration of biological sampling data within the *Ollo* app, and investigation into other standalone biological sampling apps.

5. BUDGET

The annual cost of supporting the WCPFC Tuna Tissue Bank now that it is established is USD97,200 baselined in 2018, with an annual inflation adjustment agreed by the Commission in 2018 for out-years. The proposed budget for 2020 is USD 99,195 and the indicative annual budgets for 2021 and 2022 are USD 101,180 and USD 103,204 respectively. This comprises 60% for tuna tissue bank coordination, information management and training for samplers, 23% for sampling fees and freight, and 17% for the additional storage facility in Brisbane.

6. RECOMMENDATIONS

The following recommendations arise from this report on the TTB in 2019-20. We invite SC16 to:-

- Continue to support initiatives to increase rates of observer biological sampling, noting that this contribution is essential to the ongoing success of WCPFC's work.
- Incorporate the identified budget into the 2021 budget and the 2022-23 indicative budgets, as development of the WCPFC TTB is intended to be ongoing, and is considered essential.
- Support efforts to obtain super-cold storage capacity to ensure longevity of TTB samples.
- Endorse that the work plan in Section 4 of this report should be pursued by the Scientific Services Provider, in addition to standard duties associated with maintenance and operation of the WCPFC TTB in 2020-21.

7. ACKNOWLEDGEMENTS

Though currently funded by WCPFC through Project 35b, a number of other funding agencies have supported the TTB project in the past (SPC-OFP 2019; Portal et al. 2020). SPC are most grateful for the provision of storage facilities coordinated by the agencies identified in this report.

A special thanks to the observers, debriefers, observer trainers and observer managers across the region that make the TTB possible. Thank you also to the staff of the agencies responsible for coordinating the biological sampling programme. We are also very grateful for the support received from fishing companies across the region, and from research institutes for providing access to fish and support for observer-based biological sampling. This project continues to be a Pacific Island Country and Territory collaboration, from inception to completion.

Material for this report was provided by: C. Sanchez, F. Roupsard, V. Allain, S. Fukofuka, M. Hosken, T. Park, S. Nicol, N. Smith and J. Macdonald.

8. REFERENCES

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ANNEX 1.

Table A1. Total number of samples collected from scientific tagging cruises and analysed as at 30 June 2020.

Predator species		Fish collected	Total samples	Blood	Gonad	Liver	Muscle	Otolith	Spine/fin	Stomach	Fat meter	Samples analysed	% analysed
ALB	Albacore	404	1801		269	276	277	259	188	245	287	1073	60%
BET	Bigeye	647	2737	63	258	544	597	406	185	546	138	871	32%
BRZ	Pomfrets and ocean breams	3	3							3		3	100%
BSH	Blue shark	1	1				1					0	0%
BUM	Blue marlin	26	96	5	15	24	26		5	21		3	3%
CFW	Pompano dolphinfish	1	3			1	1			1		1	33%
CNT	Ocean triggerfish (spotted)	1	5		1	1	1	1		1		0	0%
DOL	Mahi mahi / dolphinfish	103	319		31	88	89	8	1	102		46	14%
FAL	Silky shark	4	12			4	4			4		4	33%
FRI	Frigate tuna	99	309		4	99	99	3	4	99	1	96	31%
KAW	Kawakawa	135	317			96	96			124	1	118	37%
MSD	Mackerel scad / saba	5	15			5	5			5		5	33%
NXI	Giant trevally	1	1							1		1	100%
PLS	Pelagic sting-ray	1	3			1	1			1		1	33%
RRU	Rainbow runner	192	611		40	185	185	9	1	191		112	18%
SKJ	Skipjack	4022	13116		524	3024	3116	520	610	3074	2248	4747	36%
SSP	Short-billed spearfish	1	3			1	1			1		0	0%
SWO	Swordfish	6	15		1	4	4			6		10	67%
WAH	Wahoo	21	71		6	20	20	4		21		6	8%
YFT	Yellowfin	2892	9670	41	394	2254	2290	418	356	2338	1579	3889	40%
YTL	Amberjack (longfin yellowtail)	1	3			1	1			1		1	33%
Total		**8566**	**29108**	**109**	**1543**	**6628**	**6814**	**1628**	**1155**	**6782**	**4254**	**10987**	**38%**

Table A2. Total number of stomach samples collected during tagging cruises and analysed to 30 June 2020.

Predator species		*Collected*	Analysed	% analysed
ALB	Albacore	245	245	100%
BET	Bigeye	546	428	78%
BRZ	Pomfrets and ocean breams	3	3	100%
BUM	Blue marlin	21	3	14%
CFW	Pompano dolphinfish	2	2	100%
CNT	Ocean triggerfish (spotted)	1	0	0%
DOL	Mahi mahi / dolphinfish	102	46	45%
FAL	Silky shark	4	4	100%
FRI	Frigate tuna	99	95	96%
KAW	Kawakawa	124	118	95%
MSD	Mackerel scad / saba	5	5	100%
NXI	Giant trevally	1	1	100%
PLS	Pelagic sting-ray	1	1	100%
RRU	Rainbow runner	191	112	59%
SKJ	Skipjack	3083	2474	80%
SSP	Short-billed spearfish	1	0	0%
SWO	Swordfish	6	6	100%
WAH	Wahoo	21	6	29%
YFT	Yellowfin	2338	2093	90%
YTL	Amberjack (longfin yellowtail)	1	1	100%
Total		**6795**	**5643**	**83%**

Table A3. Locations and cold-storage capacity in key ports for the Tuna Tissue Bank.

Port	Country	Freezer Capacity	Comments
Noro	Solomon Islands	15 m^3 Blast freezer (-30^oC)	Soltuna Cannery
Honiara	Solomon Islands	0.7 m^3 (-18^oC)	Min. Fisheries and Marine Resources
Port Moresby	Papua New Guinea	0.36 m^3 (-18^oC)	National Fisheries Authority
Kavieng	Papua New Guinea	0.7 m^3 (-18^oC)	National Fisheries College
Rabaul	Papua New Guinea	0.3 m^3 (-18^oC)	National Fisheries Authority
Lae	Papua New Guinea	0.36 m^3 (-18^oC)	National Fisheries Authority
Madang	Papua New Guinea	0.7 m^3 (-18^oC)	National Fisheries Authority
Wewak	Papua New Guinea	0.7 m^3 (-18^oC)	National Fisheries Authority
Koror	Palau	0.1 m^3 (-18^oC)	Natural Resources, Environment, Tourism
Yaizu	Japan	15 m^3 (-18^oC)	National Research Institute of Far Seas Fisheries, Shimizu
Pohnpei	FSM	0.7 m^3 (-18^oC)	National Oceanic Resources Management Authority
Majuro	Marshall Islands	0.7 m^3 (-18^oC)	Marshall Islands Marine Resources Authority
		15 m^3 Blast Freezer (-30^oC)	Marshall Islands Fishing Venture
			Pan Pacific Foods cold storage

		15 m^3 Blast Freezer (-30^oC)	
Honolulu	USA	10 m^3 (-18^oC)	NOAA
Aiwo	Nauru	0.15 m^3 (-18^oC)	Fisheries and Marine Resources Authority
Tarawa	Kiribati	15 m^3 Blast Freezer (-30^oC)	Kiribati Fish Limited
Papeete	French Polynesia	0.7 m^3 (-18^oC)	Resources marine et minières
Pago Pago	American Samoa	0.5 m^3 (-18^oC)	NOAA
General Santos	Philippines	0.5 m^3 (-18^oC)	SOCSKSARGEN Federation of Fishing and Allied Industries, Inc
		15 m^3 Blast Freezer (-30^oC)	Well-Delight Network Corporation
Apia	Samoa	0.5 m^3 (-18^oC)	Min. Agriculture and Fisheries
Suva	Fiji	0.7 m^3 (-18^oC)	Min. Fisheries and Forests
Port Villa	Vanuatu	0.2 m^3 (-18^oC)	Min. Agriculture, Livestock, Forestry, Fisheries Biosecurity

Table A4. Projects that have previously accessed the TTB and/or the PMSB.

Project description	Samples used	Analysis	Lead agency	WCPFC-SC Project No.	Completion date
Age and growth					
Yellowfin growth curves	Otolith, spine	ageing	CSIRO, SPC	82	2018
Bigeye/yellowfin ageing comparison	otolith	ageing	CSIRO, IATTC		2018
Bigeye growth curves	otolith	ageing	SPC, CSIRO, Sun Yat-Sen University	35, 81	2016
Swordfish growth curves	Otolith, spine	ageing	CSIRO	71	2016
Deepwater snapper project	otolith	ageing	SPC	?	2015
Albacore growth curves	otolith	ageing	SPC, CSIRO	39	2012
Reproductive biology					
Bigeye maturity ogives	gonads	histology	SPC, CSIRO	35	2016
Deep water snapper project	gonads	histology	SPC	?	2015
Albacore maturity ogives	gonads	histology	SPC, CSIRO	39	2012
Albacore reproductive biology	gonads	histology	SPC, CSIRO	39	2012
Trophic dynamics					
Ecosystem effects of fishing	stomach, muscle	diet analyses, DNA metabarcoding, Taxonomy, fatty acid	SPC, University of Canberra Curtin University, CSIRO	37, 46	2014

FAD impacts on trophic dynamics	muscle	isotopes	SPC University Southampton	37	2013
Size-based Food Web	muscle	isotopes	Rhodes University		2013
Movement					
Pacific Bluefin tuna movement dynamics	Muscle, otolith	isotope microchemistry	Texas A&M University Galveston		2019
DNA microbiome	stomach	DNA microbiome	University of Canberra, SPC		2018
Deepwater snapper project	muscle, fin	DNA	University of Canterbury		2015
PFRP tuna trophic & movement	muscle	mercury	Louisiana State University, SPC		2007
		isotopes			
	muscle	isotopes	Louisiana State University, University of Hawaii, SPC		
South Pacific albacore	otolith	microchemistry	SPC	38	2012
Ecosystem monitoring					
BIOPELAGOS: pelagic biodiversity	micronekton	morphological taxonomy	SPC, MNHN Concarneau		2019
	seabird stomach regurgitate	DNA	University of Canberra, SPC		
	fish eye	DNA	IRD, SPC		
	acoustic data	acoustic	IRD, SPC		
Stock structure					
Population genomic variation in North and South Pacific albacore	muscle	DNA	Oregon State University		2019
Bigeye and wahoo ocean basin attribution	muscle	DNA	Thünen Institute of Fisheries Ecology		2018
WCPO tuna stock structure	muscle	DNA	CSIRO		2018
WCPO tuna stock structure and movement (albacore, skipjack, yellowfin and bigeye)	muscle	DNA	University of the South Pacific		2016
Black marlin	muscle, liver	DNA	University of Queensland		2016
Global tropical tuna stock structure	fin	DNA	University of Bologna		2014
Albacore	muscle	DNA	AZTI		2012

Blue shark and Mako shark	fin	DNA	University of Aberdeen	2011
Indonesia-west Pacific tropical tuna stock structure	fin	DNA	CSIRO	2009
Food Safety and tuna flesh characterisation				
Omega-3 project	muscle	lipids	CSIRO	2010
Selenium and mercury in yellowfin and bigeye tuna	muscle	mercury, selenium	University of Washington	2009