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Project 35b: WCPFC Pacific Marine Specimen Bank

WCPFC-SC19-2023/RP-P35b-01

SPC-OFP

EXECUTIVE SUMMARY

The WCPFC Pacific Marine Specimen Bank (hereafter PMSB) 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 PMSB. This paper updates SC19 on Project 35b activities undertaken since SC18 (as they pertain to the 2022-23 work plan endorsed by SC18). A work plan and budget for 2024, and indicative budgets for 2025 and 2026 are provided for this ongoing project. Key topics covered include:

Biological sampling and PMSB progress during the period 1 July 2022 to 30 June 2023

i. 44,286 new biological samples, taken from 9,052 fish, were added to PMSB holdings. SPC now houses 184,249 biological samples taken from 58,842 individual animal specimens.
ii. Training for observers, debriefers, and observer trainers continued. Eighteen staff undertook training in biological sample collection this year, with a total of 664 samplers trained to date. In addition to PIRFO-related training, sampling training and refresher courses were run in Guam, New Caledonia, New Zealand and Philippines.
iii. New training resources were released. For example, the creation of video tutorials, access to an observer course online on the Moodle platform, and the publication of an updated 'Biological Sampling Manual – Guide for samplers at sea and at port'.
iv. The renovation and extension of the PMSB laboratory in Nouméa commenced in June 2022. The new dry laboratory is operational and the wet laboratory should be operational in early 2024.
v. The biological sampling feature in the *OnShore* app is now being used in New Zealand, Papua New Guinea, Solomon Islands, New Caledonia, Western Samoa, French Polynesia, Federated States of Micronesia and Philippines – its functionality continuing to evolve to cater to specific project needs (e.g. Close-Kin Mark-Recapture sampling - see section 4.1). The same biological sampling feature was developed in the *OLLO* app and is currently in use in New Caledonia, Cook Islands and French Polynesia.

PMSB Access and Use during the period 1 July 2022 to 30 June 2023

Several enquiries have been received to organise the withdrawal of samples from the PMSB prior to formal requests being made to WCPFC.

At present, 28 projects are classified as 'ongoing' in using PMSB samples for WCPFC-related work. Thirty-two projects are listed as 'completed' as at 30 June 2023. Two Information Papers or Research Papers linked to the PMSB will be submitted to SC19 this year. Five other books, peer-reviewed articles, conference papers or popular articles associated with PMSB work were published.

The following recommendations arise from this report. We invite SC19 to:

- Continue to support initiatives to increase rates of observer biological sampling, noting that this contribution is essential to the ongoing success of the WCPFC's work.
- Incorporate the identified budget into the 2024 budget and the 2025-26 indicative budgets, as development of the WCPFC PMSB is intended to be ongoing and is considered essential.
- Support efforts to obtain further super-cold storage capacity to ensure longevity of PMSB 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 PMSB in 2023-24.

1. INTRODUCTION

The WCPFC PMSB is a repository of biological samples from marine specimens collected from across the western and central Pacific Ocean (WCPO). The PMSB is focussed primarily on samples from bigeye, yellowfin, albacore and skipjack tunas, but also houses biological material from other pelagic species (e.g. swordfish, mahi mahi). The PMSB also contains a broad diversity of samples from micronekton, seabirds, deep-water benthic and coastal fishes, among other taxa. The PMSB web portal is accessible at www.spc.int/ofp/PacificSpecimenBank.

The PMSB was officially established in 2015 (SPC-OFP 2017, 2019), though samples have been systematically collected since 2001. Through the PMSB's creation, the WCPFC aimed to provide research institutions access to the biological samples needed to advance our understanding of the dynamics of tunas and related species in the WCPFC region. The initiative has proved highly successful, the PMSB 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 PMSB samples (see ANNEX 1, Table A4 for examples).

PMSB 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 PMSB and with expanding the inventory of samples held through national and regional biological sampling programmes.

Due to COVID-19 related travel restrictions in place during 2022, the 4th meeting of the PMSB Steering Committee was held via video conference through Microsoft Teams in early August 2022, ahead of SC18. At this meeting, the PMSB Steering Committee acknowledged that ongoing contributions to the PMSB was critical to the success of WCPFC's work, and recommended that financial support be continued to implement the 2022-23 work plan, as set out in the 2022 Report of the PMSB Steering Committee (PMSB Steering Committee 2022). SC18 endorsed the work plan for 2022-23, as well as the proposed 2023 budget and indicative budgets for 2024-25.

Previous papers to the SC (SPC-OFP 2017, 2018, 2019, 2020, 2021, 2022) detail the history, developments and key objectives of Project 35b. This paper aims to update SC19 on Project 35b activities over the past 12 months (July 2022-June 2023), as they relate to the agreed 2022-23 work plan, and outlines planned actions for the next phase of work.

2. BIOLOGICAL SAMPLING AND PMSB PROGRESS (2022-23)

This section summarises progress between 1 July 2022 and 30 June 2023 on:

1) sampling activities, and PMSB holdings as at June 30 2023;
2) training for biological sample collection;
3) the current status of the PMSB equipment and sample storage facilities;
4) recent developments regarding the BioDaSys database; and
5) the Close-Kin Mark-Recapture (CKMR) project on south Pacific albacore, and the PMSB infrastructure development in Nouméa.

We refer readers to SPC-OFP (2022) [SC18-2022/RP-P35b-01] for background on sample collection protocols, associated observer training standards, and the key features of the BioDaSys database.

2.1 SAMPLING ACTIVITIES AND PMSB HOLDINGS

2.1.1 Overview

The COVID-19-related restrictions on WCPO observer duties have disrupted normal biological sampling activities since early 2020. The situation is returning to normal. The number of samples collected between July 2022 and June 2023 exceeds the number of samples collected during the previous reporting year (Figures 1, 2) for both port and at-sea sampling.

In 2022-23, 44,286 new biological samples were collected from 9,052 fish and added to the PMSB. Table 1 provides species-level breakdowns of the 2022-23 additions (Table 1a), together with total fish sample holdings as at 30 June 2023 (Table 1b). When all samples (e.g. seabirds, micronekton) are included, the PMSB now houses 184,249 biological samples taken from 58,842 individual animal specimens.

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 rate 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 PMSB. Signs of recovery were evident in 2019 and the number of fish sampled has continued the increasing trend since then (Figure 1). While the number of observer trips in 2023 is low, the SPC and the Fisheries Authorities in countries have been working on the writing of LOAs to restart the biological sampling programme. In addition to these collaborations, 13 PIRFO trainers from 10 PICTs attended a trainer training course in Nouméa in March 2023, providing them the capacity to train and support new samplers across the region. The objective for 2023 is to maintain the increasing trend and collect more biological samples than in 2022.

2.1.3 Port sampling

Data on the number of port sampling events and samples collected are provided in Figure 2. As mentioned in previous Scientific Committee reports (2020, 2021, 2022), SPC's plan was to increase efforts on biological sampling at port to compensate for the uncertainty around at-sea sample collection. Since then, the number of fish sampled increased exponentially to reach 7,117 fish sampled in 2022. These achievements were possible thanks to our partnerships with MRAG Asia Pacific Pty, Soltuna Cannery in the Solomon Islands, DR Fishing Ltd in Papua New Guinea and SOCSKARGEN Federation of Fisheries and Allied Industry Inc. / Bureau of Fisheries and Aquatic Resources (SFFAII/BFAR) in the Philippines.

Note that the high sampling rate (i.e. mean number fish sampled per event) observed in 2023 is mostly due to the first trials of the CKMR sampling procedure on south Pacific albacore. Indeed, for this project, only a muscle biopsy is required. That allows the sampling of many fish in a short time (see section 4.1).

Table 1a. Additions to the PMSB between 1 July 2022 and 30 June 2023. Note that the number of samples may sometimes exceed the number of specimens (e.g. muscle samples for skipjack). 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*
Skipjack	4057	2945	2955	2962	1	3544	3002	80	3005	645
Albacore	2674	254	103	236	2	2680	33	0	23	0
Yellowfin	2024	1953	1836	2148	2	2014	1847	79	1839	24
Bigeye	278	251	232	309	0	328	239	38	237	0
Mahi mahi	6	4	0	0	0	5	0	0	0	0
Wahoo	3	3	0	0	0	3	0	0	0	0
Bullet tuna	3	0	1	0	0	3	2	0	3	0
Striped marlin	2	1	1	2	1	2	2	0	0	0
Silky shark	1	1	1	1	0	1	1	0	1	0
Great barracuda	1	0	0	1	0	1	1	0	0	0
Black marlin	1	1	0	1	1	1	1	0	0	0
Oceanic white tip	1	1	1	2	0	4	1	0	1	0
Gould's petrel	1	0	0	0	0	0	0	0	0	0
Total	**9052**	**5414**	**5130**	**5662**	**7**	**8586**	**5129**	**197**	**5109**	**669**

*Fatmeter is a measurement of percentage of fat, not a type of sample. Fatmeter data are included in the table but not counted as a sample

Table 1b. Samples available in the PMSB (at 30 June 2023).

Species	No. of specimens	Hard parts		Reproduction	Multi-purpose				Diet		Other*
		Otolith	Spine	Gonad	Blood	Muscle	Liver	Fin	Stomach	Fatmeter **	
Yellowfin	15754	10850	7115	12390	227	12938	10235	214	7414	1773	27
Skipjack	14439	8710	8034	8853	116	11881	11272	351	8251	3033	75
Albacore	9728	5621	3504	6703	26	6874	1636	88	1103	638	17
Bigeye	6483	4951	1955	5056	116	5487	2912	106	1827	451	25
Mahi mahi / dolphinfish	666	183	26	140	12	537	325	0	166		0
Wahoo	480	145	35	130	1	363	347	0	139		12
Rainbow runner	422	21	1	55	0	304	300	0	93		0
Striped marlin	184	25	31	67	29	131	109	2	35		6
Swordfish	143	21	12	40	9	75	102	25	48		11
Other#	10543	909	55	3309	66	2117	2969	928	108	1	2715
Total	**58842**	**31436**	**20768**	**36743**	**602**	**40707**	**30207**	**1714**	**19184**	**5896**	**2888**

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

** Fatmeter is a measurement of percentage of fat, not a type of sample. Fatmeter data are included in the table but not counted as a sample

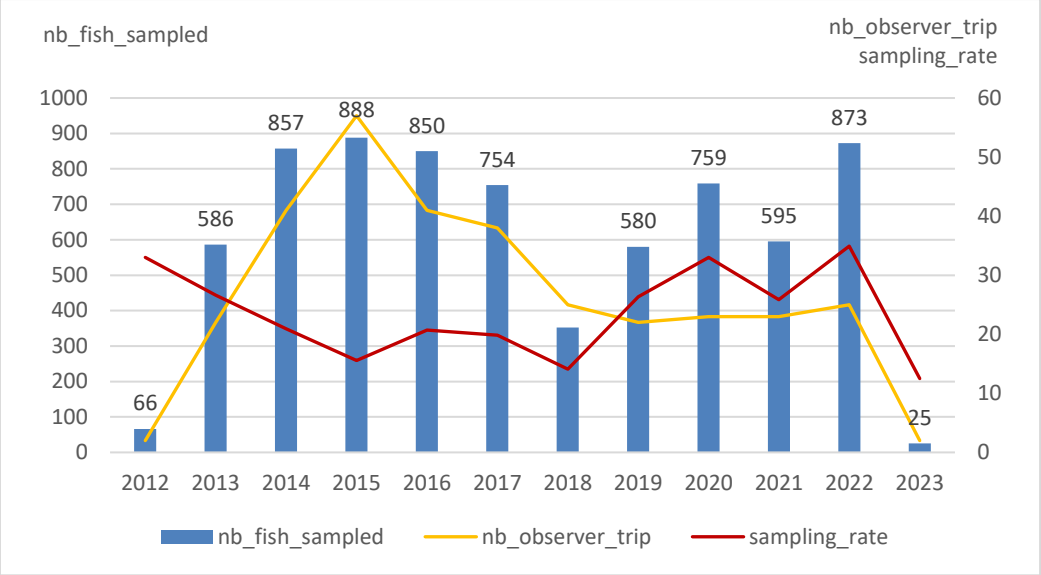

Figure 1. Total number of fish sampled by **observers** (blue histogram and numbers above), the number of observer trips during which biological samples were collected (orange line), and the mean sampling rate per trip (i.e. mean number of fish sampled/trip) (red line) calculated annually between 2012 and 2023. Note that the number of observer trips and sampling rate relate to the secondary y-axis.

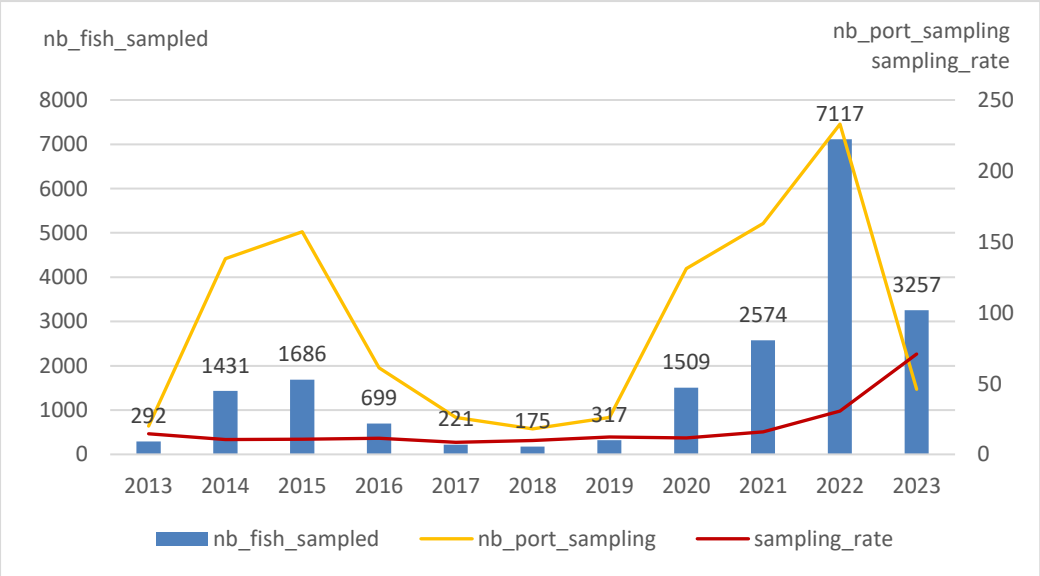

Figure 2. Total number of fish sampled by **port samplers** (blue histogram and numbers above), the number of port sampling events during which biological samples were collected (orange line), and the mean sampling rate per event (i.e. mean number fish sampled/event) (red line) calculated annually between 2013 (when the port sampling programme started) and 2023. Note that the number of port sampling events and sampling rate relate to the secondary y-axis.

2.1.4 Tagging cruises

Tagging cruises continue to be an important source of biological samples for PMSB holdings, contributing 41,167 samples to date. As at June 30, 2023, a total of 12,078 fish have been sampled

during various SPC-led cruises, from which 12,714 samples have been analysed (ANNEX 1, Table A1). For the PMSB as a whole, SPC's tuna tagging cruises conducted through the Pacific Tuna Tagging Programme (PTTP) (see SPC-OFP 2023 [https://meetings.wcpfc.int/node/19408] for the latest update on the PTTP progress under WCPFC Project 42) have supplied 18.4% of the total fish specimens sampled and 20.6% of the total samples collected, with 27% of the analyses conducted for biological or ecological applications to date making use of tagging cruise-related samples.

This contribution of biological samples adds considerable value to the tagging cruises. For example, the 2022 Western Pacific cruise (WP6) added 2,907 new biological samples and 669 fatmeter records to the PMSB (collected on 1,065 fish). 2,898 of these samples were taken from tunas (1,062 individuals), incorporating a range of sample types (e.g. muscle, gonad, liver, otolith, stomach, dorsal spines) that have various downstream scientific applications (ANNEX 1, Table A1, Table A2).

During WP6, about 150 skipjack were utilised for the "Microbiome" project: recent analyses on the microbiome in the stomach of living organisms has demonstrated its utility as an early indicator of changing environmental/ecological conditions (Trujillo-Gonzalez et al., 2022). As such, monitoring of the stomach microbiome in fish populations has the potential to be an early sentinel of change. For this project, SPC has initiated a collaboration with the genomics departments at the University of Canberra (Australia), National fisheries Authority (PNG), Okinawa Institute of Science and Technology Graduate University (Japan) and Victoria University (New Zealand). This collaboration is a component of a PhD thesis by Yufei Zhou (University of Canberra).

The sampling protocol for this specific project is more complicated that the Pacific Marine Specimen Bank standard procedures, with a specific number of fish required to be sampled per set (i.e. 50 skipjack from the same set, 3 sets to sample). This sampling design would have been challenging to implement on a commercial vessel. Thanks to the efforts of the WP6 scientific staff and crew, the microbiome sampling was successful and samples were delivered to the University of Canberra.

2.2 TRAINING OBSERVERS, DEBRIEFERS, TRAINERS AND OTHER SAMPLERS

2.2.1 Training update

Over the past 12 months, 18 observers, port samplers and fisheries officers undertook training in biological sample collection, with a total of 745 samplers trained to date. In addition to PIRFO training, samplers are also trained by local fisheries officers and fisheries scientists for specific projects. Training and refresher courses were run in Guam, New Caledonia New Zealand and Philippines. Table 2 provides a regional summary of those trained in biological sampling, by nationality, and skills that contribute to the PMSB, as at June 30, 2023.

Table 2. Number of samplers (includes at-sea observers, port samplers, debriefers, trainers, cannery employees, fisheries officers, fishing vessel captains and crew) 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 the number of debriefers, trainers, and samplers that were trained by fisheries officers in country are also counted in the number of samplers.

Country	No. of samplers	No. of debriefers	No. of trainers
American Samoa	8	1	0
Chinese Taipei	33		
Cook Islands	3	0	0
Federated States of Micronesia	72	7	4
Fiji	52	8	2
French Polynesia	18	0	0
Guam	8	0	0
Hawaii	1	0	0
Japan	2	0	0
Kiribati	49	3	1
Marshall Islands	49	10	3
Nauru	9	2	1
New Caledonia	33	0	0
New Zealand	4	0	0
Pacific Community	27	2	7
Palau	18	0	0
Papua New Guinea	175	13	6
Philippines	22	5	0
Samoa	27	1	1
Solomon Islands	73	7	2
Tonga	18	4	1
Tuvalu	9	4	1
United States	10	0	1
Vanuatu	25	1	0

2.2.2 New training tools

A series of 19 video tutorials documenting how to identify, extract and collect biological samples from tunas, mahi mahi, wahoo and billfish, are now online (available here) and used as training material for observers, fisheries officers, fishing captains and crew, and as informative technical material for high school and university science students.

Biological sampling forms used at sea and at port and debriefing forms have been updated to include fields for genetic analyses. Instructions and procedures to collect biological samples have been

updated and a revised biological sampling manual has been published entitled 'Biological Sampling Manual – Guide for samplers at sea and at port' (Sanchez et al. 2023) (available here). All revised material is also available on the PIRFO website.

Training for observers has been entirely revised and includes now 17 powerpoint presentations with quizzes, scenarios, tutorials videos as well as informative videos and 9 practical sessions including up to date sampling techniques. An observer training course is now hosted on the Moodle platform allowing access to training material online and remotely. Assessment results are now automatically generated by the platform and curated online.

2.3 SAMPLE STORAGE INFRASTRUCTURE

The PMSB is 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 PMSB is equipped with:

- 2 microscopes, 3 stereomicroscopes, 1 X-ray machine for fish examination, 2 low-speed, diamond-blade cutting saw to section otoliths, 3 fume hood to manipulate solvents, 2 high-precision weighing scale, 2 low-precision weighing scales, 1 autoclave, 1 centrifuge, 1 fluorometer, 1 spectrophotometer, 1 gel documentation system, 1 ultrapure water system, 2 thermal cycler, 1 MicroMill, 1 photographic system, 2 fatmeters all located in Nouméa;
- 4 solvent cabinets (2 in Nouméa, 2 in Hobart);
- 5 dry cabinets for otolith storage (4 in Nouméa and 1 in Hobart);
- 3 cabinets to store collection/reference specimens in alcohol (3 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);
- ~47m^3 of -20°C cold-storage facilities at SPC and CSIRO (43m^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 (ANNEX 1, Table A3).

The laboratory in Nouméa has been redeveloped. SPC now has 150m^2 of space available for housing PMSB samples, with new dedicated lab spaces constructed for genetics and genomics, otolith preparation and analysis and histological studies. The extension of the infrastructure will continue with the construction of a 90m^2 wet lab which will include another 30m^2 of cold storage space.

2.4 DEVELOPMENTS IN BioDaSys

2.4.1 Overview and access

A central feature of the PMSB 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, including 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.

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

The ER applications *OnShore* and *OLLO* are used by port samplers to collect data at landing sites and by longline fisheries observers to collect data during at-sea missions. Data collected were initially limited to species, length and weight, but as of 2019, new features added to both *OnShore* and *OLLO* now allow users to record data about the biological samples collected for each specimen sampled.

Twelve countries are currently using *OnShore* or *OLLO* on a regular basis for species/length data collection, eight are using the biological sampling feature in *OnShore*, three in *OLLO* (Table 3).

To facilitate the data management and improve data quality control, SPC is increasingly encouraging the collection of biological sampling data through ER (Figure 3). In 2023, 85% of the fish sampled at port were entered using *OnShore.* SPC will continue to generalise the use of biological sampling ER by developing a new application that allows the data collection of fish sampled on purse seiners and during scientific cruises. The objective in the next few years is to have data for all biological samples collected entered through these applications.

Table 3. *OnShore* and *OLLO* usage per country

Country	Use *OnShore*?	Use the biological sampling feature in *OnShore*?	Use *OLLO*?	Use the biological sampling feature in *OLLO*?
CK	No	No	Yes	Yes
FJ	Yes	No	Yes	No
FM	Yes	Yes	No	No
MH	Yes	No	No	No
NC	Yes	Yes	Yes	Yes
NZ	Yes	Yes	No	No
PF	Yes	Yes	Yes	Yes
PG	Yes	Yes	No	No
PH	Yes	Yes	No	No
SB	Yes	Yes	Yes	No
TO	Yes	No	Yes	No
VU	Yes	No	No	No
WS	Yes	Yes	No	No

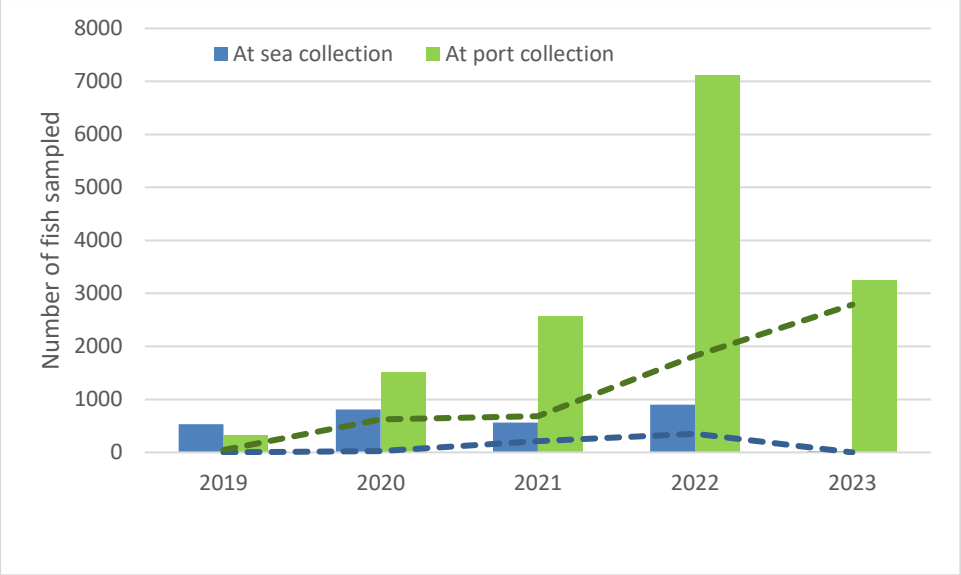

Figure 3. Number of fish sampled by port samplers (green barplot), by port samplers using *Onshore* (dash dark-green line), by observers at sea on longliners (blue barplot) and by observers at sea using *OLLO* (dash dark-blue line).

3. PMSB ACCESS AND USE

3.1 ACCESS PROTOCOLS

A protocol for accessing the PMSB for laboratory and data analyses by third party organisations was endorsed by the Commission in 2016 (Anon. 2016, SPC-OFP 2019).

A page dedicated to sample requests has been created to clarify the workflow and provide more details to future applicants, details of which are available here: https://www.spc.int/ofp/PacificSpecimenBank/Home/RequestSamples.

3.2 USE OF PMSB AND PMSB SAMPLES (2009-2023)

Several informal enquiries were registered from university-based researchers around sample availability and access rights in the context of future collaborative projects.

At present, 28 projects are classified as 'pending' in accessing samples from the PMSB for WCPFC-related work, led by SPC and/or other national and international organisations (Table 4). Thirty-two projects utilising PMSB samples are 'completed' as of 30 June 2023 (ANNEX 1, Table A4).

Fish otoliths and stomachs comprise roughly half of the biological samples analysed to date (Figure 4). Historically, SPC analysed many stomachs for dietary studies, specifically morphological taxonomy studies of stomach contents, as well as age and growth studies using information coded in otoliths. The number of samples used for genetics analyses is steadily increasing, and this trend should continue into the future with many new genetics and genomics projects coming online (Figure 4).

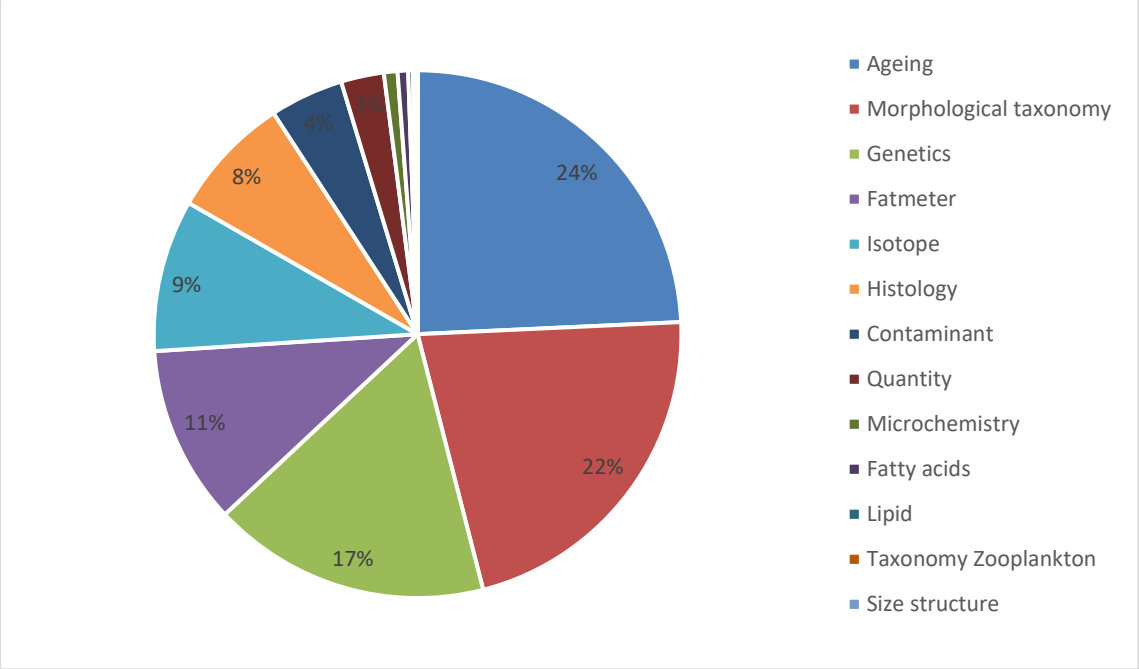

Figure 4. Distribution of samples sent for analysis, by analysis type.

3.4 OUTPUTS ASSOCIATED WITH THE PMSB (2022-23)

Two papers, linked either directly or indirectly to the PMSB, will be submitted to SC19 this year as Information Papers or Research Papers. A total of five other books, peer-reviewed journal articles, conference papers or popular articles associated with PMSB work were published during the 2022-23 reporting period. These are Anderson and Macdonald (2022, 2023), Anderson et al. (2023), Mayne et al. (2023) and Sanchez et al. (2023). Three additional research papers utilising PMSB samples have been either recently submitted or are in the final stages of preparation for submission to scientific journals (i.e. Anderson et al. In review; Andrews et al. Submitted; Dahl et al. In preparation).

Table 4. Projects that currently access the PMSB.

Project description	Samples Used	Analysis	Lead agency	WCPFC-SC Project No.	Status
Age and growth					
^{14}C analysis of WCPO bigeye, yellowfin and skipjack otoliths	otolith	ageing, microchemistry	FRA* SPC, CSIRO	98	ongoing
Using otolith growth chronologies and chemistry in deep-water *Etelis* species to answer key ecological questions in the Indo-Pacific.	otolith	otolith growth chronologies, microchemistry	University of Adelaide	TBP	ongoing
Climate impacts on Pacific pelagic fishes	otolith, gonad	otolith microchemistry, histology	University of Melbourne	TBP	ongoing
Trophic dynamics					
Isoscapes and trophic dynamics of ocean sunfish in eastern Pacific Ocean	diet data	taxonomy	University of Victoria	TBP	ongoing

Project description	Samples Used	Analysis	Lead agency	WCPFC-SC Project No.	Status
Diet diversity of the human predator	diet data, isotope data	taxonomy, isotope	University of Hawaii	TBP	ongoing
Western Tropical Pacific Ecopath model	stomach	morphological taxonomy	SPC	TBP	ongoing
Fat content analysis on yellowfin, bigeye and skipjack tunas as an indicator of ecosystem state.	muscle	fatmeter	SPC	TBP	ongoing
Movement					
Spatial variation in concentrations of metal contaminants in food webs	muscle, blood	isotopes	IRD[#], SPC	TBP	ongoing
Stock structure					
Sex identification by genetic markers, application to the albacore tuna (*Thunnus alalunga*)	muscle, gonads	genetics	CSIRO	TBP	ongoing
Population connectivity in south Pacific albacore	muscle, otoliths	Genetics, otolith microchemistry	SPC	TBP	ongoing
Genetic structure of Pacific albacore	fin, muscle	genetics	Oregon State University	TBP	ongoing
Development of a Genotyping-in-Thousands by sequencing (GT-seq) panel to evaluate Pacific albacore tuna (*Thunnus alalunga*) stock structure and sex-specific distribution patterns	muscle, fin	genetics	Oregon State University	TBP	ongoing
WCPO yellowfin tuna stock structure	otolith	shape morphometrics	SPC	TBP	ongoing
Stock structure of tropical tunas in the Indo-Pacific	muscle	Genetics	CSIRO	TBP	ongoing
Testing the panmixia hypothesis in WCPO skipjack tuna	otolith, muscle	otolith shape morphometrics and microchemistry, genetics, stable isotopes	SPC, IRD[#]	TBP	ongoing
Blue marlin trophic and spatial ecology	muscle	fatty acids	Macquarie University	TBP	ongoing
Biology, ecology and population structure of sailfish	muscle	genetics	University of Queensland	TBP	ongoing
Food safety and tuna flesh characterisation					
Global mercury YFT-BET	data	Chemical / contaminant determination	IRD[#]	TBP	ongoing

Project description	Samples Used	Analysis	Lead agency	WCPFC-SC Project No.	Status
Mushy Tuna Syndrome	muscle	biochemistry	University of Queensland	TBP	ongoing
Fatty acid content in South Pacific tunas and swordfish	muscle	fatty acids	IRD[#]	TBP	ongoing
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
Taxonomy					
Genomic and AI tools for identifying tuna species	muscle	genetics	Michigan State University	TBP	ongoing
Cryptic *Etelis* Discrimination using FT-NIRS	otolith	Fourier transform near-infrared spectroscopy scanning	NOAA Honolulu	TBP	ongoing
Maurolicus phylogeography	specimens	genetics	University of Bergen	TBP	ongoing
Epigenetic age calibration					
Applying new genetic methods to age deep- and shallow-water snappers in the WCPO and Indian Ocean	muscle, otoliths	genetics, otolith ageing	SPC, CSIRO	TBP	ongoing
Foundation science and technologies to transform Indo-Pacific tuna assessment and management under climate change	muscle	genetics	CSIRO	TBP	ongoing

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

4. SOME HIGHLIGHTS OF 2022-23

4.1 CLOSE-KIN MARK-RECAPTURE PROJECT

Close-Kin Mark-Recapture (CKMR) uses modern genetic methods to identify pairs of close relatives (or kin) of the same species among large collections of tissue samples. The key concept of CKMR is that every animal was born with exactly one living mother and one living father, which it "marks" genetically. When applied to fisheries, the number of kin-pairs found, and the way they are distributed in space and time, can be embedded into a population dynamics model and used to estimate

important demographic parameters for stock assessments, such as absolute adult abundance, mortality rates, and connectivity.

For south Pacific albacore, the inclusion of CKMR data has the potential to substantially improve the robustness of the stock assessment process. A paper to the 16th Regular Session of the WCPFC Scientific Committee (SC16) (SC16-SA-IP-15: Bravington et al. 2020) provided an initial scoping of feasibility (e.g. sample size requirements) and benefits of a south Pacific albacore CKMR project. The follow-up paper to SC17 (SC17-SA-IP-14: Bravington et al., 2021) elaborated on a few issues that are specifically important for this albacore stock, presented an interim update of design calculations and summarised briefly the remaining steps, including an indicative sampling plan and schedule.

Tissue sampling for the south Pacific albacore CKMR project commenced in early February 2023 in Westport on New Zealand's South Island, targeting age-1 and age-2 juveniles captured by the domestic troll fishery. Over three days of sampling effort, our team, comprising SPC, CSIRO and NIWA staff, successfully sampled over 1200 fish using the Widget gene tagging tool developed by CSIRO. A further 1500 tissue samples were collected by NIWA staff in Westport and Greymouth over the following two weeks. This initial sampling campaign on troll-caught juveniles allowed us to test, refine and optimise CKMR sampling protocols on tunas in port – protocols that will now be applied more broadly across the south Pacific as the sampling programme for longline-caught adults rolls out over the next two years.

4.2 LABORATORY CONSTRUCTION IN SPC NOUMÉA

As mentioned previously, the laboratory infrastructure in Nouméa is under redevelopment, with funding support from Aotearoa New Zealand. The dry lab extension is completed and the wet lab construction will start in the next few months, with an expected completion date in early 2024.

The redevelopment builds SPC's capacity as a cutting-edge research and training facility in the region for technical work in fisheries genetics and genomics, otolith ageing and microchemistry and histology. The labs are now fitted out with new instruments and equipment which will allow SPC scientists, and researchers, fisheries professionals and students from across the region to come together and learn new skills, undertake analyses in-house, and contribute to collaborative projects and inter-lab comparisons with outside agencies.

The 150m² dry lab now comprises:

- one taxonomy lab with X-ray room and collection storage (75m²)
- one genetics lab (26m²)
- one histology and otolith lab (17m²)
- one training/meeting room (19m²)
- one storage room (4m²)
- one hallway with security equipment (9m²)

The 90m² wet lab extension will comprise:

- 2 cold rooms (2x15m²)
- 1 inventory room, freezers and bench (17m²)
- 1 wet lab (29m²)
- 1wet/dry lab (9m²)
- 1 storage room (5m²)

5. PMSB 2023-24 WORK PLAN

Actions planned for 2023-24, continuing from previous years, include:

- Completion of a document on standard operating procedures for the PMSB.
- Provision of training to members interested in using *OnShore* and *OLLO* for biological sampling.
- Continue to update and improve training materials for biological sampling.
- Continue the development and enhancement of ER apps.
- Continue the development of a WCPO-wide sampler network for the collection of tuna genetics samples.
- Continue the development of our procedures to meet international standards.
- Development of the PMSB website to better highlight the use of the PMSB samples and associated outputs.

New actions planned for 2023-24 include:

- Construction of the wet laboratory extension in Nouméa.
- Establish guidelines for general use and maintenance of the redeveloped dry and wet laboratory facilities in Nouméa.
- Improve the coverage of the sample collections now that most Covid 19 restrictions are lifted.
- Integration of micronekton data into BioDaSys.
- Encourage the use of ER for biological sampling data collection.

6. BUDGET

The annual cost of supporting the WCPFC PMSB now that it is established is USD 97,200 baselined in 2018, with an annual inflation adjustment agreed by the Commission in 2018 for outyears. The proposed budget for 2023 is USD 105,269 and the indicative annual budgets for 2024 and 2025 are USD 107,374 and USD 109,522, respectively. This comprises 60% for PMSB coordination, information management and training for samplers, 23% for sampling fees and freight, and 17% for the additional storage facility in Brisbane.

7. RECOMMENDATIONS

The following recommendations arise from this report on the PMSB in 2022-23. We invite SC19 to:

- Continue to support initiatives to increase rates of observer biological sampling, noting that this contribution is essential to the ongoing success of the WCPFC's work.
- Incorporate the identified budget into the 2024 budget and the 2025-26 indicative budgets, as development of the WCPFC PMSB is intended to be ongoing, and is considered essential.
- Support efforts to obtain further super-cold storage capacity to ensure longevity of PMSB samples.
- Endorse that the work plan in Section 5 of this report should be pursued by the Scientific Services Provider, in addition to standard duties associated with maintenance and operation of the WCPFC PMSB in 2023-24.

8. ACKNOWLEDGEMENTS

The PMSB is principally funded by WCPFC through Project 35b with additional support provided by the Pacific Community, CSIRO and the European Union. Support is also provided through the provision of storage facilities and coordination services by the agencies identified in this report.

The PMSB is reliant on the observers, debriefers, observer trainers and observer managers across the region. Support is also received from fishing companies across the region, and from research institutes for providing access to fish and support for observer-based biological sampling.

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

9. REFERENCES

Anderson, G. and Macdonald, J. 2022. An ode to ear stones: A summary of activities around IPWoFA 22. *Fisheries Newsletter*, 169: 7. (link to article)

Anderson, G. and Macdonald, J. 2023. Tick tock tuna stock: The advent of the epigenetic clock as an aging tool for fisheries stock assessments. *Fisheries Newsletter* 170: 6–8. (link to article)

Anderson G., Macdonald J.I., Potts J., Feutry P., Grewe P.M., Boutigny M., Davies, C.R., Muir, J.A., Roupsard, F., Sanchez, C. and Nicol, S.J. 2023. Evaluating DNA cross-contamination risk using different tissue sampling procedures on board fishing and research vessels. *ICES Journal of Marine Science* 80: 728–738.

Anderson, G., Macdonald, J.I., Lal, M., Hampton, J., Smith, N. and Rico, C. In review. Sample contamination explains evidence of close kin proximity in yellowfin tuna (*Thunnus albacares*) in the Western and Central Pacific Ocean. Submitted to *Frontiers in Marine Science*.

Andrews, A.A., Welte, C., Eveson, P., Okamoto, K., Satoh, K., Krusic-Golub, K., Roupsard, F., Lougheed, B.C., Macdonald, J.I. and Farley, J.H. Submitted. Lifespan of yellowfin and bigeye tuna (*Thunnus albacares* and *Thunnus obesus*) in the western and central Pacific Ocean – Corroboration of otolith thin-section age reading using post-peak bomb radiocarbon dating. Submitted to *ICES Journal of Marine Science.*

Dahl, K., O'Malley, J., Barnett, B., Kline, B. and Boiston Widdrington, J. In preparation. Otolith morphometry and Fourier transform near-infrared (FT-NIR) spectroscopy as tools to discriminate archived otoliths of newly detected cryptic species, *Etelis carbunculus* and *Etelis boweni*.

Mayne, B., Farley, J., Anderson, C., Aulich, J., Potter, N. and Davies, C. 2023. Epigenetic Age Prediction of Deepwater Snapper. CSIRO, Australia. Technical report.

Portal, A., Roupsard, F., Vourey, E., Allain, V. 2020. A carefully protected treasure the Pacific Marine Specimen Bank. SPC Fisheries Newsletter 161,40–44.

Pacific Marine Specimen Bank Steering Committee 2022. Report of the Pacific Marine Specimen Bank Steering Committee. WCPFC-SC18-2022/RP-P35b-02 presented to the Pacific Marine Specimen Bank Steering Committee ahead of the Eighteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, online meeting, 26 July 2022.

Sanchez, C., Anderson, G. and Macdonald, J.I. 2023. Biological Sampling Manual – Guide for samplers at sea and at port. Technical report, SPC, Nouméa.

SPC-OFP 2017. Project 35: Bigeye biology, and Project 35b: WCPFC tuna tissue bank. WCPFC-SC13 2017/RP-P35-01 presented to the Thirteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Rarotonga, Cook Islands, 9-17 August 2017.

SPC-OFP 2018. Project 35b: WCPFC Tuna Tissue Bank. WCPFC-SC14-2018/RP-P35b-01 presented to the Fourteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Busan, Republic of Korea, 8-16 August 2018.

SPC-OFP 2019. Project 35b: WCPFC Tuna Tissue Bank. WCPFC-SC15-2019/RP-P35b-01 Rev. 1 presented to the Fifteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia, 12-20 August 2019.

SPC-OFP 2020. Project 35b: WCPFC Tuna Tissue Bank. WCPFC-SC16-2020/RP-P35b-01 presented to the Sixteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, online meeting, 11-20 August 2020.

SPC-OFP 2021. Project 35b: WCPFC Tuna Tissue Bank. WCPFC-SC17-2021/RP-P35b-01 presented to the Seventeenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, online meeting, 11-19 August 2021.

SPC-OFP 2022. Project 35b: WCPFC Tuna Tissue Bank. WCPFC-SC18-2022/RP-P35b-01 presented to the Eighteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, online meeting, 10-18 August 2022.

SPC-OFP 2023. Project 42: Pacific Tuna Tagging Project report and work-plan for 2022-2025. WCPFC-SC19-2023/RP-PTTP-01 presented to the Nineteenth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, Koror, Palau, 16-24 August 2023.

Trujillo Gonzalez, A., Gleeson, D., Li, T., Nicol, S. J., Allain, V., Potts, J., Godwin, S., Vourey, E., Portal, A., Kumasi, B., Usu, T. and Rodrigo, A. 2022. Can stomach content and microbiomes of tuna provide near real-time detection of ecosystem composition in the Pacific Ocean? Front. Mar. Sci. 9:1-14. (doi: 10.3389/fmars.2022.811532)

ANNEX 1.

Table A1. Total number of samples collected from scientific tagging cruises and analysed to 30 June 2023.

Predator species		Fish collected	Samples collected	Blood	Gonad	Liver	Muscle	Otolith	Spine/fin	Stomach	Fat meter	Samples analysed	% analysed
ALB	Albacore	404	1801	0	269	276	277	259	188	245	287	1121	60%
BET	Bigeye	1389	6719	63	725	1014	1884	846	648	1013	452	1414	20%
BLT	Bullet tuna	3	9	0	0	2	3	0	1	3	0	0	0%
BSH	Blue shark	1	1	0	0	0	1	0	0	0	0	0	0%
BUM	Blue marlin	37	155	5	26	35	41	1	15	32	0	3	2%
CFW	Pompano dolphinfish	9	37	0	8	9	10	0	1	9	0	1	3%
CNT	Ocean triggerfish (spotted)	2	9	0	2	2	2	1	0	2	0	0	0%
DOL	Mahi mahi / dolphinfish	182	679	0	98	166	182	36	16	181	0	46	7%
EBS	Brilliant pomfret	2	10	0	2	2	2	0	2	2	0	0	0%
FAL	Silky shark	74	92	0	0	4	14	0	70	4	0	4	4%
FRI	Frigate tuna	99	309	0	4	99	99	3	4	99	1	96	31%
GBA	Great barracuda	1	4	0	1	1	1	0	0	1	0	0	0%
KAW	Kawakawa	136	322	0	1	97	97	1	0	125	1	118	37%
LAG	Moonfish / opah	2	10	0	1	2	2	1	2	2	0	0	0%
LEC	Escolar	7	41	0	7	7	8	5	7	7	0	0	0%
MLS	Striped marlin	10	45	0	7	8	12	2	8	8	0	0	0%
MSD	Mackerel scad / saba	5	15	0	0	5	5	0	0	5	0	5	33%
NXI	Giant trevally	1	1	0	0	0	0	0	0	1	0	1	100%
OCS	Oceanic white-tip shark	14	18	0	1	0	3	0	14	0	0	0	0%
PLS	Pelagic sting-ray	1	3	0	0	1	1	0	0	1	0	1	33%
RRU	Rainbow runner	212	710	0	55	205	211	21	1	211	0	118	17%
SKJ	Skipjack	5104	17012	0	800	3302	4304	956	887	3351	3033	5908	35%
SSP	Short-billed spearfish	4	20	0	3	4	5	1	3	4	0	0	0%
SWO	Swordfish	6	15	0	1	4	4	0	0	6	0	21	81%
TST	Sickle pomfret	2	13	0	2	2	3	2	2	2	0	0	0%
WAH	Wahoo	88	410	0	70	87	94	59	12	88	0	6	1%
YFT	Yellowfin	3224	11644	41	641	2501	2778	657	598	2586	1778	4265	36%
YTL	Amberjack (longfin yellowtail)	1	3	0	0	1	1	0	0	1	0	1	33%
OTH	Other	1059	1060	0	0	0	349	4	2	13	0	13	1%
Total		**12079**	**41167**	**109**	**2724**	**7836**	**10393**	**2855**	**2481**	**8002**	**5552**	**13142**	**32%**

¤ Fatmeter is a measurement of percentage of fat not a type of sample. Fatmeter is included in the table but not counted as a sample

Table A2. Total number of stomach samples collected during tagging cruises and analysed to 30 June 2023.

Predator species		Samples collected	Samples analysed	% analysed
ALB	Albacore	245	245	100%
BET	Bigeye	1013	503	50%
BLT	Bullet tuna	3	0	0%
BRZ	Pomfrets and ocean breams	3	3	100%
BUM	Blue marlin	32	3	9%
CFW	Pompano dolphinfish	10	2	20%
CNT	Ocean triggerfish (spotted)	2	0	0%
DOL	Mahi mahi / dolphinfish / dorado	181	46	25%
EBS	Brilliant pomfret	2	0	0%
FAL	Silky shark	4	4	100%
FRI	Frigate tuna	99	95	96%
GBA	Great barracuda	1	0	0%
KAW	Kawakawa	125	118	94%
LAG	Moonfish / opah	2	0	0%
LEC	Escolar	7	0	0%
MLS	Striped marlin	8	0	0%
MSD	Mackerel scad / saba	5	5	100%
NXI	Giant trevally	1	1	100%
PLS	Pelagic sting-ray	1	1	100%
RRU	Rainbow runner	211	118	56%
SKJ	Skipjack	3360	2728	81%
SSP	Short-billed spearfish	4	0	0%
SWO	Swordfish	6	6	100%
TST	Sickle pomfret	2	0	0%
WAH	Wahoo	88	6	7%
YFT	Yellowfin	2586	2178	84%
YTL	Amberjack (longfin yellowtail)	1	1	
Total		**8001**	**6062**	**76%**

Table A3. Locations and cold-storage capacity in key ports for the PMSB.

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
		15 m^3 Blast Freezer (-30^oC)	Pan Pacific Foods cold storage
Honolulu	USA	10 m^3 (-18^oC)	NOAA
		4 m^3 (-18^oC)	Chill Space (commercial storage)
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 PMSB.

Project description	Samples used	Analysis	Lead agency	WCPFC-SC Project No.	Completion date
Age and growth					
Albacore growth curve - extension project	Otolith	ageing	CSIRO	100b	2021
Striped marlin ageing project	Otolith	ageing	CSIRO	99	2021
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

Project description	Samples used	Analysis	Lead agency	WCPFC-SC Project No.	Completion date
Deepwater snapper project	muscle, fin	DNA	University of Canterbury		2015
PFRP tuna trophic & movement	muscle	mercury isotopes	Louisiana State University, SPC		2007
	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

Project description	Samples used	Analysis	Lead agency	WCPFC-SC Project No.	Completion date
Selenium and mercury in yellowfin and bigeye tuna	muscle	mercury, selenium	University of Washington		2009