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Project 35b: WCPFC Pacific Marine Specimen Bank

WCPFC-SC20-2024/ RP-P35b-01

SPC-OFP[1]

[1] Oceanic Fisheries Programme of the Pacific Community

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 SC20 on Project 35b activities undertaken since SC19 (as they pertain to the 2023-24 work plan endorsed by SC19). A work plan and budget for 2025, and indicative budgets for 2026 and 2027 are provided for this ongoing project. Key topics covered include:

Biological sampling and PMSB progress during the period 1 July 2023 to 30 June 2024

i. 48,068 new biological samples, taken from 16,723 fish, were added to PMSB holdings. SPC now houses 273,116 biological samples taken from 101,032 individual animal specimens.
ii. Training for observers, debriefers, and observer trainers continued. 55 staff undertook training in biological sample collection this year. In addition to PIRFO-related training, sampling training and refresher courses were run in Solomon, New Caledonia and Kiribati.
iii. The renovation and extension of the PMSB laboratory in Nouméa commenced in June 2022. The new dry laboratory is operational and the wet laboratory construction has been delayed due to the civil unrest in Noumea. It should be operational in August-September 2024.
iv. The biological sampling feature in the *OnShore* app is now being used in Fiji, Kiribati, Marshall Islands, Tonga, Vanuatu, New Zealand, Papua New Guinea, Solomon Islands, New Caledonia, 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). The same biological sampling feature was developed in the *OLLO* app and is currently in use in Fiji, Papua New Guinea, Solomon Islands, Tonga, New Caledonia, Cook Islands and French Polynesia.

PMSB Access and Use during the period 1 July 2023 to 30 June 2024

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

At present, 42 projects are classified as 'ongoing' in using PMSB samples for WCPFC-related work. Thirty-four projects are listed as 'completed' as at 30 June 2023. Two Information Papers or Research Papers linked to the PMSB will be submitted to SC20 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 SC20 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 2025 budget and the 2026-27 indicative budgets, as development of the WCPFC PMSB is intended to be ongoing and is considered essential.
- Endorse change for Project 35b to report on the 12 months of the civil year (Jan-Dec) preceding SC instead of reporting on the 12 months before SC (July-June) which would allow the provision of better quality data in the SC report.
- Endorse that the work plan in Section 4 of this report be pursued by the Scientific Services Provider, in addition to standard duties associated with maintenance and operation of the WCPFC PMSB in 2024-25.

1. INTRODUCTION

The WCPFC Pacific Marine Specimen Bank (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.

At SC19, 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 2023-24 work plan, as set out in the 2023 Report of the PMSB Steering Committee (PMSB Steering Committee 2023). SC19 endorsed the work plan for 2023-24, as well as the proposed 2024-2025 budget and indicative budgets for 2025-26.

Previous papers to the SC (SPC-OFP 2017, 2018, 2019, 2020, 2021, 2022, 2023) detail the history, developments and key objectives of Project 35b. This paper aims to update SC20 on Project 35b activities over the past 12 months (July 2023-June 2024), as they relate to the agreed 2023-24 work plan, and outlines planned actions for the next phase of work.

2. BIOLOGICAL SAMPLING AND PMSB PROGRESS (2023-24)

This section summarises progress between 1 July 2023 and 30 June 2024 on:

1) sampling activities, and PMSB holdings as at June 30 2024;
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 Quality Management implementation, and the SPC's Nouméa genetics laboratory.

We refer readers to SPC-OFP (2023) [SC19-2023/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 number of samples collected between July 2023 and June 2024 (n=48068) exceeds the number of samples collected during the previous reporting year (n=44286). While in 2022-2023 the main species collected were, in decreasing order, skipjack, albacore, yellowfin and bigeye, this year albacore was the main species collected in the framework of the CKMR project, then yellowfin, skipjack and bigeye.

In 2023-24, 48,068 new biological samples were collected from 16,723 fish (compared to 9052 fish last year) and added to the PMSB. Table 1 provides species-level breakdowns of the 2023-24 additions (Table 1a), together with total fish sample holdings as at 30 June 2024 (Table 1b). When all samples (e.g. seabirds, micronekton) are included, the PMSB now houses 273,116 biological samples taken from 115,632 individual animal specimens.

2.1.2 Observer-based sampling

Annual figures on the total number of fish sampled, of the number of observer trips on which biological sampling occurred, and of changes in mean sampling rate per trip compiled over the past ten 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 until 2019 despite a stable number of observer trips sampled, indicative of a higher sampling rate (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. The benefit is already observed in the January-June 2024 period during which the number of fish sampled is similar to the number sampled collected during the whole (January-December) 2023 period. Following the trainer training course in Nouméa in March 2023 (13 PIRFO trainers from 10 PICTs), trainers met in Suva to gain further knowledge in genetic and improve their skills to avoid contamination while sampling muscle tissue. Trainers from Tonga, Fiji and Tuvalu organised and facilitated their own national upgrade training in biological sampling. Other trainings are currently in preparation in FSM, Vanuatu, Marshall, Cooks and PNG. The objective for 2024 is to maintain the increasing trend and collect more biological samples than in 2023.

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, 2023), SPC's plan was to increase efforts on biological sampling at port to compensate for the uncertainty around at-sea sample collection, particularly in the COVID-context. Since then, the number of fish sampled increased exponentially to reach 6418 fish sampled in 2022, that will be surpassed in 2024, as for the January-June time-period 14,979 fish have already been sampled. These achievements were possible thanks to our partnerships with NIWA, MRAG Asia Pacific Pty, Soltuna Cannery in the Solomon Islands, DR Fishing Ltd in Papua New Guinea, SOCSKARGEN Federation of Fisheries and Allied Industry Inc. / Bureau of Fisheries and Aquatic Resources (SFFAII/BFAR) in the Philippines, Westport Seafood in the USA and Territory Seafood in Canada.

Note that the increasing sampling rate (i.e. mean number fish sampled per event) and increasing number of fish sampled since 2022, and particularly in January-December 2024, is mostly due to the first trials and recent implementation of the CKMR sampling procedure on south Pacific albacore (see SC20-SA-WP-09 for an update). Indeed, for this project, only a muscle biopsy is required. That allows the sampling of many fish in a short time.

Table 1a. Additions to the PMSB between 1 July 2023 and 30 June 2024. 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*
Albacore	8433	377	196	752	0	8546	293	0	295	0
Yellowfin	4145	705	696	757	21	4279	662	0	664	71
Skipjack	2382	1577	1583	1582	1	2231	1581	0	1580	24
Bigeye	1672	170	173	180	31	1850	165	10	162	52
Mahi mahi	21	4	2	16	0	23	15	0	15	0
Wahoo	9	6	1	6	0	9	6	0	6	0
Rainbow runner	8	1	0	1	0	1	1	0	1	0
Blue marlin	7	0	7	7	0	8	7	0	6	0
Swordfish	4	2	4	4	0	4	4	0	4	0
Striped marlin	2	2	1	3	0	3	1	0	1	0
Kawakawa	1	1	0	1	0	1	1	0	1	0
Other	39	0	0	0	0	2	0	37	0	0
Total	**16723**	**2845**	**2663**	**3309**	**53**	**16957**	**2736**	**47**	**2735**	**147**

*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 2024). Note an important increase in Other* samples compared to last year as micronekton samples from scientific cruises have been incorporated into the Biodasys database.

Species	No. of specimens	Hard parts		Reproduction	Multi-purpose				Diet		Other*
		Otolith	Spine	Gonad	Blood	Muscle	Liver	Fin	Stomach	Fatmeter **	
Yellowfin	20830	11557	7799	13084	233	17996	10929	214	8106	1844	27
Skipjack	16934	10325	9669	10480	116	14324	12912	351	9484	3057	79
Albacore	18804	5926	3671	7179	26	15868	1911	88	1368	638	18
Bigeye	8371	5134	2139	5245	133	7425	3088	116	1999	503	25
Mahi mahi	702	192	28	155	12	566	340	0	181	0	0
Wahoo	491	147	36	137	1	369	353	0	145	0	13
Rainbow runner	423	22	1	56	0	305	301	0	87	0	0
Striped marlin	186	27	32	70	29	134	110	2	36	0	6
Swordfish	148	22	16	44	9	79	106	25	52	0	12
Other#	48743	906	62	3317	66	2128	2977	965	115	1	40868
Total	115632	34258	23453	39767	625	59194	33027	1761	21573	6043	41048

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) as well as forage, micronekton 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

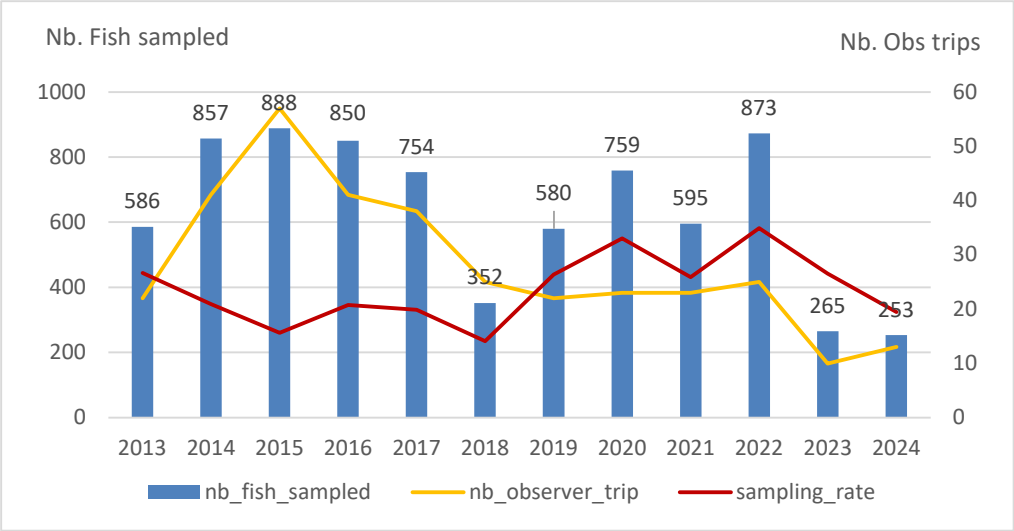

Figure 1. Total number of fish sampled by **observers** (blue histogram and numbers above), the number of observer trips during which biological samples were collected (orange line), and the mean sampling rate per trip (i.e. mean number of fish sampled/trip) (red line) calculated annually between 2013 and 2024. Note that the number of observer trips and sampling rate relate to the secondary y-axis. Note that data for 2024 only covers the period January to June.

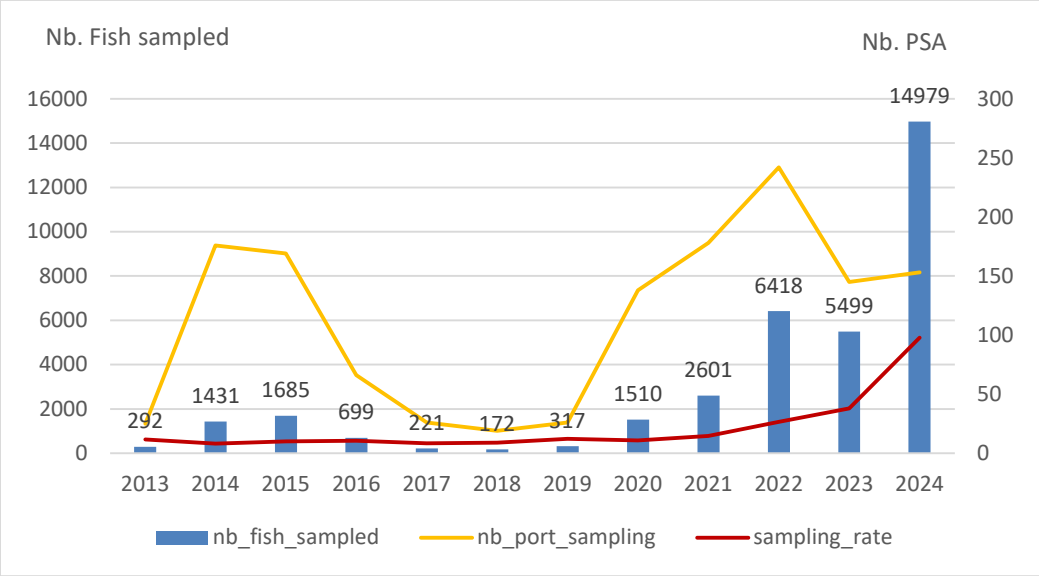

Figure 2. Total number of fish sampled by **port samplers** (blue histogram and numbers above), the number of port sampling events during which biological samples were collected (orange line), and the mean sampling rate per event (i.e. mean number fish sampled/event) (red line) calculated annually between 2013 and 2024. Note that the number of port sampling events and sampling rate relate to the secondary y-axis. Note that data for 2024 only covers the period January to June.

2.1.4 Tagging cruises

Tagging cruises continue to be an important source of biological samples for PMSB holdings, contributing 44,049 samples to date. As at June 30, 2024, a total of 13,336 fish have been sampled during various SPC-led cruises, from which 13,319 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 2024 for the latest update on the PTTP progress under WCPFC Project 42) have supplied 14.79% of the total fish specimens sampled and 11.6% 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 2023 Central Pacific cruise (CP16) added 2,843 new biological samples and 147 fatmeter records to the PMSB (collected on 1,256 fish). 2,705 of these samples were taken from tunas (1,198 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 CP16, two special projects were conducted in addition to standard PMSB biological sampling. First, 821 strontium chloride-tagged (and released live) bigeye and 129 yellowfin tunas were also genetically sampled using the CSIRO widget. Access to both a strontium-marked otolith and genetic sample per specimen will provide significant value to age validation efforts. This work addresses a sampling bias underpinning current bigeye tuna age calibrations, which are dominated by samples from the Coral Sea and have only limited representation of Central Pacific specimens. This project is conducted in collaboration with CSIRO and Fish Aging Services. Additionally, 55 tunas (33 bigeye, 21 yellowfin and 1 skipjack) were specially sampled to create a tissue-specific calibration of mercury and fatty acid levels. This calibration trial will allow to clarify if mercury and fatty acid contents are the same in muscle tissue collected in different parts of the fish (dorsal and anal). If this is the case it would

allow to combine several studies conducted worldwide to create a global map of mercury and fatty acid concentrations in tuna to compare areas characterised by different ecosystem functioning. This work is done in collaboration with IRD.

2.2 TRAINING OBSERVERS, DEBRIEFERS, TRAINERS AND OTHER SAMPLERS

Over the past 12 months, 55 observers, port samplers and fisheries officers undertook training in biological sample collection. 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 Solomon, New Caledonia and Kiribati.

Since the development of a large number of new training tools last year, no new training material has been created this year, however the observer training course hosted on the moodle platform is now used by trainers in countries when internet access allows it. Debriefing checklist and trainer manual are under development and should become available this coming year.

2.3 SAMPLE STORAGE INFRASTRUCTURE AND EQUIPMENT

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:

- For taxonomy and general biology: 1 microscope, 4 stereomicroscopes, 1 Leica camera for stereomicroscope 1 X-ray machine for fish examination; 2 fume hoods to manipulate solvents; 1 high-precision scale; 2low-precision weighing scales; 1 photographic system, 2 fatmeters, 1 freeze-dryer, 1 label printer with QR code generator + QR code scanner; 1 graphic tablet, 1 micropipette 5 mL (all in Nouméa)
- For otolithometry: 2 low-speed, diamond-blade cutting saw to section otoliths; 1 fume hood to manipulate solvents; 2 high-precision weighing scale; 1 MicroMill, (all in Nouméa)
- For genetics: 1 fume hood to manipulate solvents; 1 autoclave, 1 centrifuge, 1 fluorometer, 1 spectrophotometer, 1 gel documentation system, 1 ultrapure water system, 2 thermal cycler, 1 Automated microfluidic capillary electrophoresis separation system, 2 Liquid Handling Robots for DNA extraction and Sequencing Library Preparations; 1 MinION Hi-thoughput Sequencing Platform for short and long read sequencing; 1 Drying Oven / Incubator; 1 Flake Ice Maker; 2 -30°C Laboratory Freezers; 4 Adjustable electronic multichannel pipettes; 1 Thermal Block Mixer, (all in Nouméa)
- For sample storage:
    - 4 solvent cabinets (2 in Nouméa, 2 in Hobart);
    - 5 dry cabinets for otolith storage (4 in Nouméa and 1 in Hobart);
    - 1 compactus storage for collection specimens in ethanol (1 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 since 2022. SPC now has 150m² 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 continues with the construction of a 90m² wet lab which will include another 30m² of cold storage space. This wet lab construction was supposed to be completed in June 2024 but, due to the civil unrest in New Caledonia, the estimated time of completion is now September 2024. The taxonomy lab which is the oldest facility of the PMSB is under renovation and is expected to be fully functional in an improved setting by September 2024.

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 respectively 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 fish 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.

Fourteen 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 2).

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 2024, 96% of the fish sampled by port-samplers were entered using *OnShore* and 25% of the fish sampled by observers at sea were entered using Ollo. 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 2. *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	Yes	Yes	No
FM	Yes	Yes	No	No
KI	Yes	Yes	No	No
MH	Yes	Yes	No	No
NC	Yes	Yes	Yes	Yes
NZ	Yes	Yes	No	No
PF	Yes	Yes	Yes	Yes
PG	Yes	Yes	Yes	No
PH	Yes	Yes	No	No
SB	Yes	Yes	Yes	No
TO	Yes	Yes	Yes	No
VU	Yes	No	No	No
WS	Yes	Yes	No	No

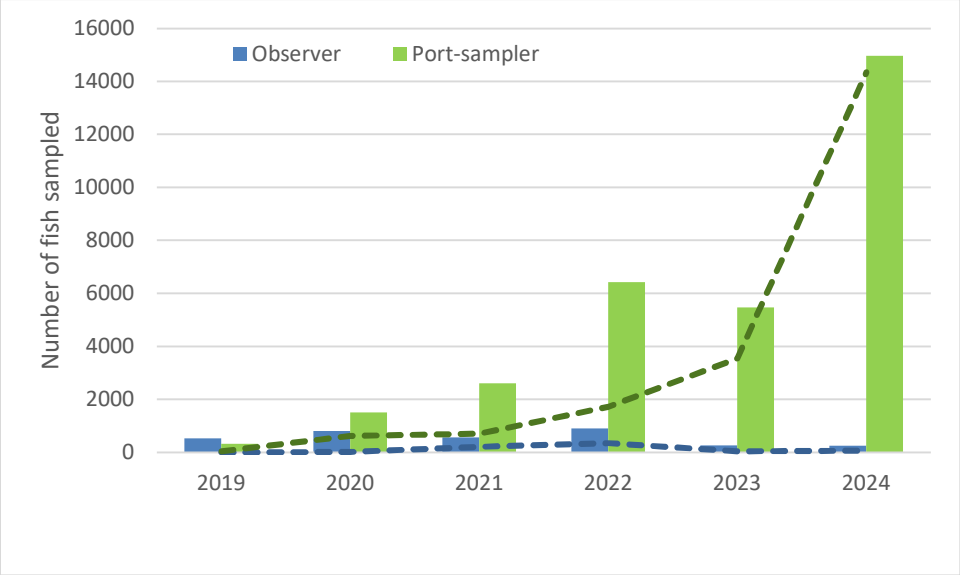

Figure 3. Number of fish sampled by port samplers (green barplot), by port samplers using *Onshore* (dash dark-green line), by observers at sea on longliners (blue barplot) and by observers at sea using *OLLO* (dash dark-blue line).

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 (2009-2024)

At present, 42 projects are classified as 'pending' (i.e. work in progress) in accessing samples from the PMSB for WCPFC-related work, led by SPC and/or other national and international organisations (Table 3). Thirty-four projects utilising PMSB samples are 'completed' as of 30 June 2024 (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, particularly with the new genetic SPC lab facilities (Figure 4).

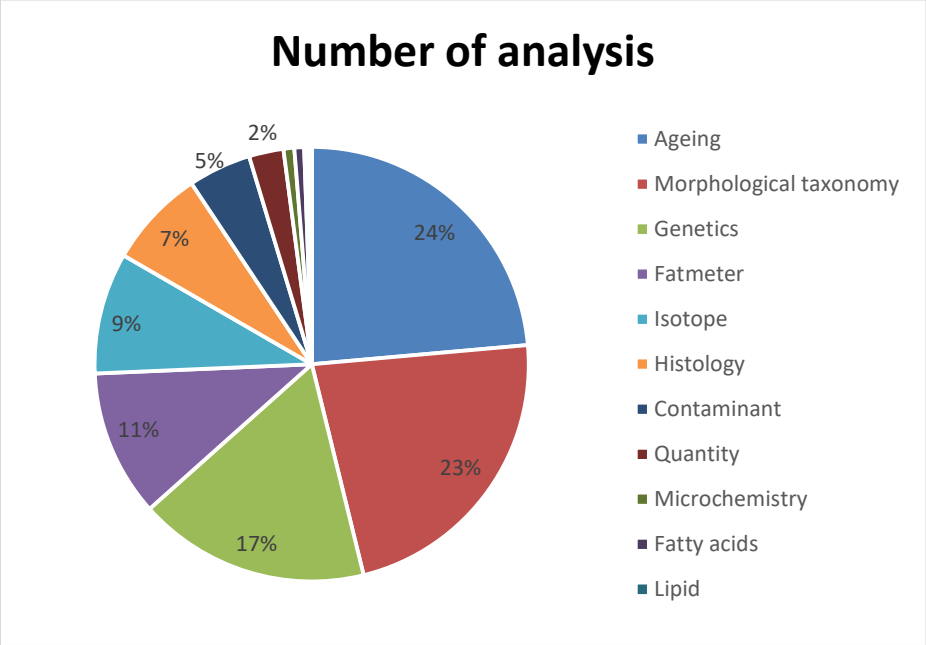

Figure 4. Distribution of samples sent for analysis, by analysis type.

3.4 OUTPUTS ASSOCIATED WITH THE PMSB (2023-24)

Three papers, linked either directly or indirectly to the PMSB, will be submitted to SC20 this year as Information Papers or Research Papers, on mercury in tuna, sampling tagging and the present paper on the PMSB. A total of nine other books, peer-reviewed journal articles, conference papers or popular articles associated with PMSB work were published during the 2023-24 reporting period. These are Konstantinidis & Vourey (2023), Garrigue et al. (2023), Dahl et al. (2024), Andrews et al. (2024), Walker et al. (2024), Hardy et al. (2024), Barbin et al. (2024), Medieu et al, (2024a, 2024b). Two additional research papers utilising PMSB samples have been submitted or are in the final stages of preparation for submission to scientific journals (Machful et al. on tuna diet, Medieu et al. on mercury in billfish).

Table 3. Projects that currently access the PMSB.

Leading organization	Project	Project category	WCPFC project
National Research Institute of Far Seas Fisheries	C14 analysis of WCPO-BET otoliths	Age and growth	WCPFC 98
SPC - Noumea	14C YFT and BET age validation	Age and growth	WCPFC 98
SPC - Noumea	SKJ age validation	Age and growth	WCPFC 98
SPC - Noumea	SWO age validation	Age and growth	WCPFC 98
IRD	Role of larval dispersion	Age and growth / Movement / Taxonomy / Species description	
IRD	Micronekton biochemical tracers	Ecosystem monitoring, Food safety / Trophic Ecology	
CSIRO - Hobart	BET and YFT epigenetic age estimation	Epigenetic age calibration	
CSIRO - Crawley	DWS epigenetic	Epigenetic age calibration	
SPC - Noumea	Fatmeter	Food safety and tuna flesh characterisation	
University of Queensland	Mushy Tuna Syndrome	Food safety and tuna flesh characterisation	
IRD	MERTOX: Unravelling the origin of methylmercury toxin in marine ecosystems	Food safety and tuna flesh characterisation	
IRD Brest	Food safety and mercury toxicity	Food safety and tuna flesh characterisation	
IRD Brest	Global mercury YFT-BET	Food safety / Trophic Ecology	
University of Adelaïde	Indo-Pacific deepwater snapper	Movement	
IRD	VACOPA project	Movement / Food safety and tuna flesh characterisation	
SPC - Noumea	CKMR albacore feasibility assessment	Protocol development	
SPC - Noumea	Genetic sampling protocol extension - biopsy punch field test	Protocol development	
SPC - Noumea	Genetic cross-contamination quantification and sampling protocol development	Protocol development	
SPC - Noumea	Genetic sampling protocol extension	Protocol development	
Michigan State University	Genomic and AI tools for identifying tuna species	Species identification	
CSIRO - Hobart	Stock structure of tropical tunas in the Indo-Pacific	Stock structure	
SPC - NOUMEA	Testing the panmixia hypothesis in WCPO SKJ	Stock structure	
Macquarie University	Blue Marlin trophic and spatial ecology	Stock structure	
Oregon State University	Genetic Structure of Pacific Albacore	Stock structure	
University of Queensland	Population structure of sailfish in the Indo-Pacific	Stock structure	

Leading organization	Project	Project category	WCPFC project
SPC - Noumea	YFT population genetic structure 2019 re-analysis	Stock structure	
Oregon State University	Genetic structure of Pacific ALB	Stock structure	
Oregon State University	ALB stock structure and sex-specific distribution patterns	Stock structure	
CSIRO - Hobart	Resequencing	Stock structure	
SPC - Noumea	Albacore connectivity NC-PF	Stock structure	
SPC - Noumea	Close Kin Mark Recapture	Stock structure	
Nanyang Technological University, Singapore	Status and Future of Fisheries from the Indo-Pacific Region	Stock structure	
CSIRO - Hobart	ALB sex marker	Stock structure	
University of Bergen	Maurolicus phylogeography	Taxonomy	
SPC - Noumea	Metabarcoding on tuna stomach contents	Taxonomy / other	
NOAA Honolulu	Cryptic Etelis Discrimination using FT-NIRS	Taxonomy / Species description	
SPC - Noumea	Ecopath	Trophic dynamics	
University of Victoria	Diet diversity of the human predator	Trophic dynamics	
IRD	TIPTOP	Trophic dynamics / Food safety and tuna flesh characterisation	
IRD	OMEGA	Trophic dynamics / Food safety and tuna flesh characterisation	
University of Hawaii	Trophic dynamics of ocean sunfish	Trophic ecology	
IRD	RESCUE - Stranded marine mammals study	Trophic ecology	

4. SOME HIGHLIGHTS OF 2023-24

4.1 Quality Management

While the existing processes within the PMSB allow the operation of the biobank, the requirements for the highest quality of samples and data involve a thorough reorganization of the current management system. Moreover, the PMSB and the associated laboratories are currently expanding in terms of activities, infrastructure and staff number. These different points led to the decision by the PMSB management to develop a Quality Management System based on international standards. It has been decided to begin with the ISO9001 standard which is a globally recognized standard for quality management but we also want to include from the start some requirements of the ISO20387 standard which is specific to biobanking.
The process started in early 2024 by the internal review of the system and the gathering of all information relevant to the development of the Quality Management System. In June 2024, the review by a consultant specialized in the ISO9001 standard provided some good outputs with a norm conformity evaluation of 49%. To fully comply with the standard, we need to organize very specific

processes such as internal audits, management review or control of suppliers and also improve some of our procedures. There is an ongoing Request For Proposal to select a consultant who will support the Quality Management implementation for the next 9 months, the estimated time necessary to pass the mock audit of the standard certification.

4.2 SPC's Nouméa genetics laboratory

SPC's Nouméa genetics laboratory is now equipped with hi-throughput and automated instrumentation allowing the analyses of hundreds of samples and multiple genes in parallel. We have two automated liquid handling robots which address several challenges for DNA/RNA extraction and Next Generation Sequencing (NGS) library preparation including: reducing human errors, simplifying procedures, increasing throughput, and improving performance at each step. Also, our in-house Next Generation Sequencing and Quality Control capabilities will enable overnight turnaround times. This capability significantly diminishes the lead time of assay development and batch sequencing allowing the analysis of a large number samples as required.
Indeed, current and future projects catered by the SPC genetics lab include the processing of several 10,000's of samples such as

- Metagenomics analyses of Tuna Stomach samples for prey identification using assays that target hypervariable and universal genes of interest. Expected samples to be analysed in the order of several 1000's across multiple genes.
- Species identification of micronekton samples for taxonomic purposes using assays that target hypervariable and universal genes of interest. Expected samples to be analysed in the order of several 100's across multiple genes.
- Quality control of DNA samples; species identification and sex identification. Expected samples to be analysed in the order of several 10000's.

5. PMSB 2023-24 WORK PLAN

Actions planned for 2024-25, continuing from previous years, include:

- Completion of a document on standard operating procedures for the PMSB.
- Continue to update and improve training materials for biological sampling.
- Continue the development and enhancement of electronic recording ER apps and associated trainings.
- Continue the development of a WCPO-wide sampler network for the collection of tuna genetics samples.
- Continue the development of our Quality Management System to meet international standards of the PMSB.
- Development of the PMSB website to better highlight the use of the PMSB samples and associated outputs.
- Completion of the construction of the wet laboratory extension and renovation of the taxonomy laboratory in Nouméa.

New actions planned for 2024-25 include:

- Transfer of BioDaSys to a web-based technology
- Quality Management System implementation based on ISO9001 standard.
- Improve the reporting of PMSB activities through PMSB website.
- 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 2024 USD 107,373 and the indicative annual budgets for 2025 and 2026 are USD 109,520 and USD 111,711, 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 2023-24. We invite SC20 to:

- Continue to support initiatives to increase rates of observer and port sampler biological sampling, noting that this contribution is essential to the ongoing success of the WCPFC's work.
- Incorporate the identified budget into the 2025 budget and the 2026-27 indicative budgets, as development of the WCPFC PMSB is intended to be ongoing, and is considered essential.
- Endorse change for Project 35b to report on the 12 months of the civil year (Jan-Dec) preceding SC instead of reporting on the 12 months before SC (July-June) which would allow to publish better quality data.
- 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 2024-25.

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, port samplers, 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, M. Ghergariu, C. Sanchez, M. Hosken, S. Nicol, N. Smith and J. Macdonald.

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ANNEX 1.

Table A1. Total number of samples collected from scientific tagging cruises and analysed to 30 June 2024.

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	2315	8273	94	799	1089	2986	919	723	1084	504	1467	17%
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	42	180	5	31	40	47	1	20	36	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	194	727	0	109	178	194	36	17	193	0	46	6%
EBS	Brilliant pomfret	2	10	0	2	2	2	0	2	2	0	0	0%
FAL	Silky shark	87	105	0	0	4	14	0	83	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	137	327	0	2	98	98	2	0	126	1	118	36%
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	38	42	0	1	0	3	0	38	0	0	0	0%
PLS	Pelagic sting-ray	1	3	0	0	1	1	0	0	1	0	1	33%
RRU	Rainbow runner	213	722	0	56	206	212	22	1	212	0	125	17%
SKJ	Skipjack	5146	17322	1	847	3341	4376	985	926	3390	3057	5952	34%
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	92	428	0	74	91	98	61	12	92	0	6	1%
YFT	Yellowfin	3454	12517	62	724	2584	3146	735	681	2670	1849	4338	34%
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	684	13	1%
Total		13337	44049	162	2950	8056	11959	3039	2721	8218	6383	13319	30%

¤ 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 2024.

Predator species		Samples collected	Samples analysed	% analysed
ALB	Albacore	245	245	100%
BET	Bigeye	1013	503	46%
BLT	Bullet tuna	3	0	0%
BRZ	Pomfrets and ocean breams	3	3	100%
BUM	Blue marlin	32	3	8%
CFW	Pompano dolphinfish	10	2	20%
CNT	Ocean triggerfish (spotted)	2	0	0%
DOL	Mahi mahi / dolphinfish / dorado	181	46	24%
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	59%
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	82%
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.

Leading organization	Project	Project category	WCPFC project
CSIRO - Hobart	Yellowfin growth curve	Age and growth	WCPFC 82
CSIRO - Hobart	Bigeye growth curve	Age and growth	WCPFC 35, WCPFC 81
CSIRO - Hobart	Bigeye/yellowfin ageing comparaison	Age and growth	
CSIRO - Hobart	Albacore growth curve	Age and growth	WCPFC 39
CSIRO - Hobart	Albacore growth curve - extension project	Age and growth	WCPFC 100b
SPC - Noumea	STRAMP	Age and growth	
SPC - Noumea	Procfish	Age and growth	
SPC - Noumea	SCTB 13	Age and growth	
CSIRO - Hobart	Swordfish growth curve	Age and growth	WCPFC 71
CSIRO - Hobart	Striped marlin ageing/maturity project	Age and growth/Reproductive biology	WCPFC 99
SPC - Noumea	Deepwater snapper project	Age and growth/Reproductive biology/Movement	
SPC - Noumea	Biopelagos	Ecosystem monitoring	
Thunen Institute of Fisheries Ecology	MARINEFOOD	Food safety	
University of Washington	Selenium and mercury in yellowfin and bigeye tuna	Food safety	
CSIRO - Hobart	Omega-3 Project, CSIRO Food Futures Flagship	Food Safety and tuna flesh characterisation	
Texas A&M University Galveston	PBT movement dynamics	Movement	
University of Melbourne	South Pacific Albacore movement	Movement	
SPC - Noumea	GEF-OFMP / PFRP tuna trophic & movement	Movement	
SPC - Noumea	DNA/microbiome	Movement	
CSIRO - Hobart	Albacore reproductive biology	Reproductive biology	WCPFC 39
CSIRO - Hobart	Bigeye maturity ogives	Reproductive biology	WCPFC 35
Oregon State University	ALB population genomic variation	Stock structure	
University of Queensland	GENOJAWS	Stock structure	
University of Queensland	Black marlin	Stock structure	

USP Fiji	WCPO tuna stock structure and movement	Stock structure	
CSIRO - Hobart	WCPO tuna stock structure	Stock structure	
SPC - Noumea	Albacore	Stock structure	
University of Bologna	Global tropical tuna stock structure	Stock structure	
CSIRO - Hobart	Indonesia-West Pacific tropical tuna stock structure	Stock structure	
CSIRO - Hobart	Blue & Mako Shark genetics	Stock structure	
SPC - Noumea	Morphological description of Bathysaurus mollis larva	Taxonomy / species description	
SPC - Noumea	Ecosystem effects of fishing	Trophic dynamics	WCPFC 37, WCPFC 46
SPC - Noumea	FAD and Tuna behavior	Trophic dynamics	WCPFC 37
Rhodes University-IsoEnvironmental	Size-based Food Web	Trophic dynamics	