

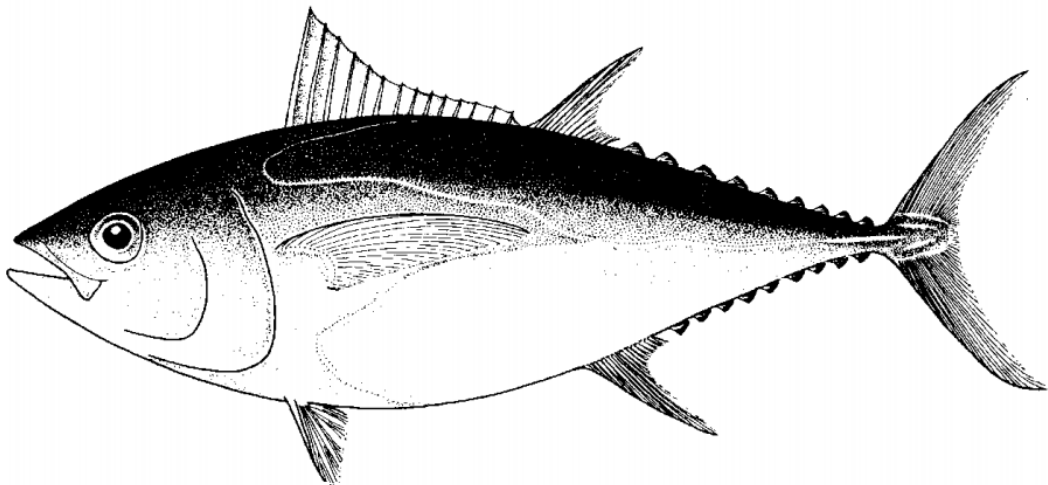
ELEVENTH MEETING OF THE TUNA FISHERY DATA COLLECTION COMMITTEE

20-24 AUGUST 2018, BRISBANE AUSTRALIA

**INFORMATION PAPER DCC11-IP03 (agenda item 5)**

**Summary of tuna fishery E-Reporting and E-Monitoring data  
submitted to SPC by member countries**

Prepared by the Oceanic Fisheries Programme of the Pacific Community (SPC)



Pacific  
Community  
Communauté  
du Pacifique



**FFA**

Pacific Community

Forum Fisheries Agency

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## **Background information**

The Pacific Community (SPC) has been assisting with trials of Electronic Reporting (ER) and Electronic Monitoring (EM) systems undertaken by its member countries, which involve fisheries observers, fisher and service provider through the development of software and reception of electronic data into its database systems.

### Electronic logsheets

Trials of Electronic Reporting (ER) software for fishers to report their effort and catch data (e-logsheets) began in 2013. E-logsheets have been received at SPC's regional database system TUFMAN2. This report focuses on the electronically reported logsheet data for the Pacific Islands Countries and Territories (PICTs). Other countries in the region have also undertaken e-logsheets trials and some of the data was received at SPC but are not presented in this report.

Three main e-logsheet software have been trialled between 2013 and 2017:

- eTUNALOG: this software is PC based and can be used by Longline fishers (now replaced by OnBoard)
- OnBoard: this software is Android based and be used by Longline fishers
- iFIMS eLog: this software is PC and Android based and can be used by Longline and Purse Seine fishers

### Electronic Observer Data

Trials of ER software for fisheries observers to report on their monitoring activities onboard Purse Seine vessels began in 2014. Electronic observer data have yet to be received at SPC and so are not presented in this report, at this stage.

There is only one electronic observer software that has been trialled between 2013 and 2017:

- iFIMS eObs: this software is Android based and can be used for Purse Seine fisheries observers to report on their monitoring activities

### Electronic Monitoring Data

Trials of Electronic Monitoring (EM) systems for monitoring the activities of Longline fishing vessels licenced to operate in the PICTs began in 2014. Electronic Monitoring data have been received at SPC and imported into its regional database systems TUBS and TUFMAN2. All EM data produced by PICTs have been sent to SPC and are reported here. The majority of EM systems are installed on Longline vessels. Only two Purse Seine vessels are equipped with EM systems but no EM data have been sent to SPC from these trials, at this stage.

There is only one electronic monitoring system used in the PICTs at this stage:

- The Satlink Sea Tube Lite (system installed on the vessels) and the Satlink View Manager (EM records analysis software).

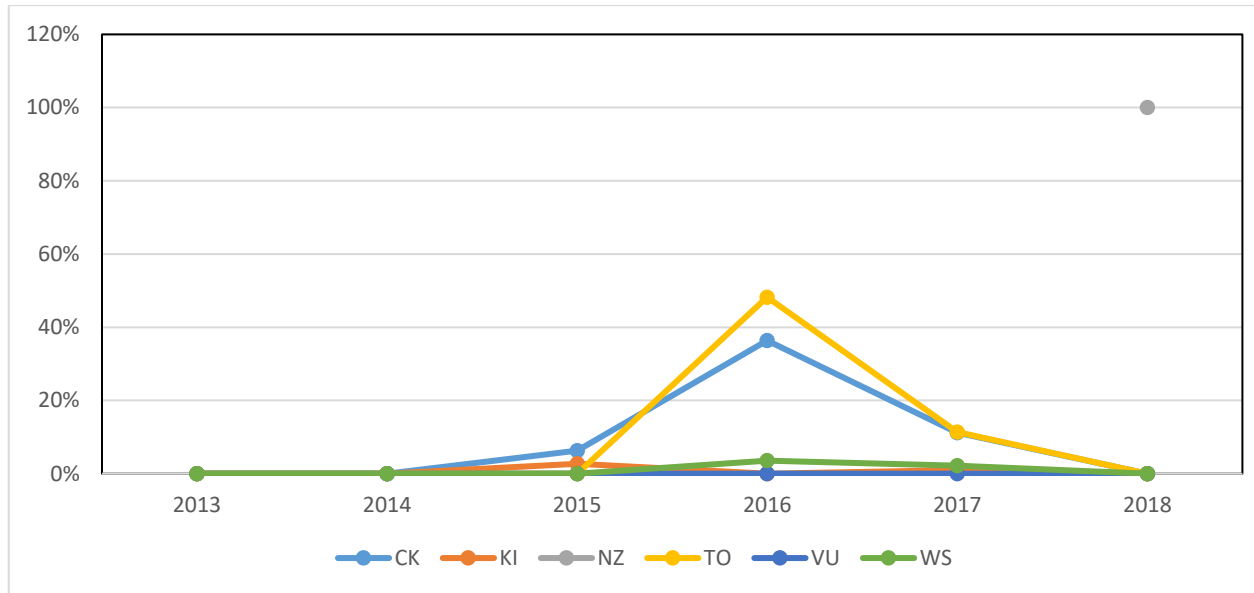
## Longline Electronic Logsheet Data

Table 1. Annual trends in Longline Logsheet E-Reported data by Pacific Island (PI) fleet, 2013–2018

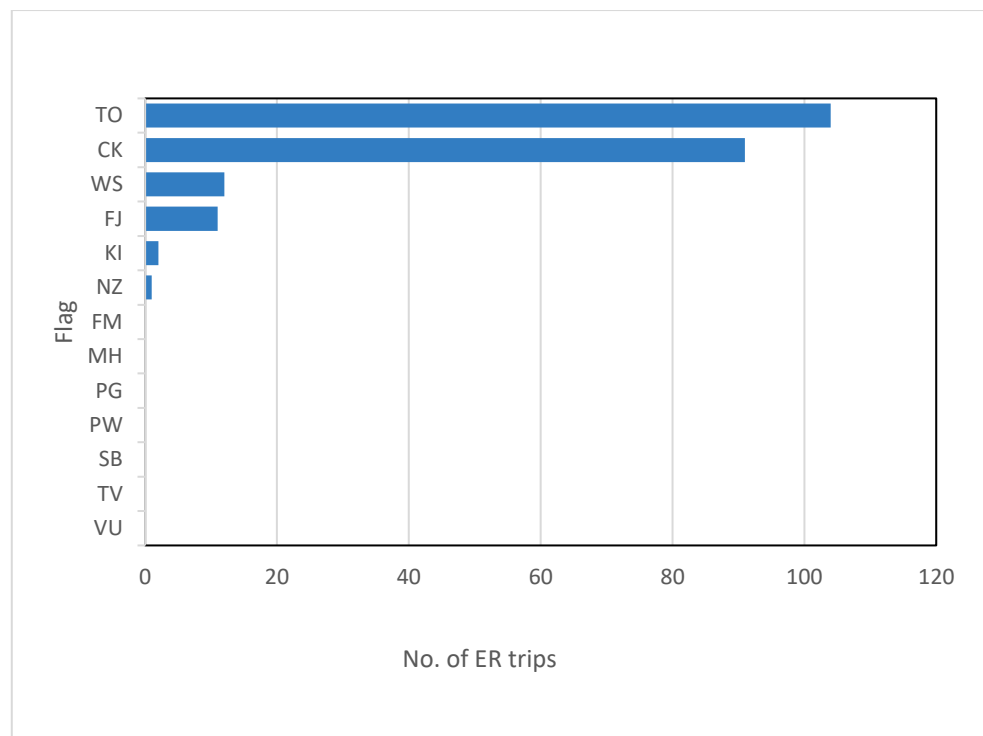
|              | 2013     |              |             | 2014     |              |             | 2015      |              |             | 2016       |              |             | 2017      |              |             | 2018     |            |             |
|--------------|----------|--------------|-------------|----------|--------------|-------------|-----------|--------------|-------------|------------|--------------|-------------|-----------|--------------|-------------|----------|------------|-------------|
|              | ER       | Total        | %           | ER       | Total        | %           | ER        | Total        | %           | ER         | Total        | %           | ER        | Total        | %           | ER       | Total      | %           |
| CK           | 0        | 109          | 0.00        | 0        | 155          | 0.00        | 9         | 144          | 6.25        | 60         | 165          | 36.36       | 22        | 197          | 11.17       | 0        | 48         | 0.00        |
| FJ           | 0        | 774          | 0.00        | 0        | 706          | 0.00        | 2         | 775          | 0.26        | 1          | 816          | 0.12        | 7         | 891          | 0.79        | 1        | 342        | 0.29        |
| FM           | 0        | 288          | 0.00        | 0        | 308          | 0.00        | 0         | 363          | 0.00        | 0          | 272          | 0.00        | 0         | 229          | 0.00        | 0        | 105        | 0.00        |
| KI           | 0        | 8            | 0.00        | 0        | 11           | 0.00        | 1         | 37           | 2.70        | 0          | 100          | 0.00        | 1         | 108          | 0.93        | 0        | 7          | 0.00        |
| MH           | 0        | 17           | 0.00        |          |              |             | 0         | 3            | 0.00        | 0          | 280          | 0.00        | 0         | 548          | 0.00        | 0        | 206        | 0.00        |
| PG           | 0        | 74           | 0.00        | 0        | 100          | 0.00        | 0         | 87           | 0.00        | 0          | 36           | 0.00        | 0         | 70           | 0.00        |          |            |             |
| PW           |          |              |             |          |              |             |           |              |             | 0          | 7            | 0.00        | 0         | 35           | 0.00        | 0        | 2          | 0.00        |
| SB           | 0        | 350          | 0.00        | 0        | 390          | 0.00        | 0         | 506          | 0.00        | 0          | 15           | 0.00        | 0         | 7            | 0.00        | 0        | 35         | 0.00        |
| TO           | 0        | 26           | 0.00        | 0        | 99           | 0.00        | 0         | 134          | 0.00        | 81         | 168          | 48.21       | 23        | 202          | 11.39       | 0        | 58         | 0.00        |
| TV           | 0        | 12           | 0.00        | 0        | 10           | 0.00        | 0         | 11           | 0.00        | 0          | 10           | 0.00        | 0         | 10           | 0.00        |          |            |             |
| VU           | 0        | 368          | 0.00        | 0        | 396          | 0.00        | 0         | 833          | 0.00        | 0          | 443          | 0.00        | 0         | 284          | 0.00        | 0        | 68         | 0.00        |
| WS           | 0        | 300          | 0.00        | 0        | 190          | 0.00        | 0         | 174          | 0.00        | 7          | 197          | 3.55        | 5         | 226          | 2.21        | 0        | 56         | 0.00        |
| <b>Total</b> | <b>0</b> | <b>2,326</b> | <b>0.00</b> | <b>0</b> | <b>2,367</b> | <b>0.00</b> | <b>12</b> | <b>3,067</b> | <b>0.39</b> | <b>149</b> | <b>2,509</b> | <b>5.94</b> | <b>58</b> | <b>2,807</b> | <b>2.07</b> | <b>2</b> | <b>928</b> | <b>0.22</b> |

### Notes

1. Based on E-reported data imported into the TUFMAN 2 system from eTunaLog, OnBoard and iFIMS eLog
2. Acknowledges that there may be other E-Reported data not yet provided to SPC and so not included in this table.
3. Unit used is TRIP. “Total” represents VMS trips. “ER” represents ER trips. “%” represents percentage of ER to Total
4. Acknowledges that other effort metrics for determining coverage may be used by member countries, including fishing days, days at sea and hooks.



**Figure 1. Trends in Longline Logsheet E-Reporting coverage by PI fleet, 2013-2018**



**Figure 2. Total longline logsheet E-Reporting trips by PI fleet over the period 2013-2018**

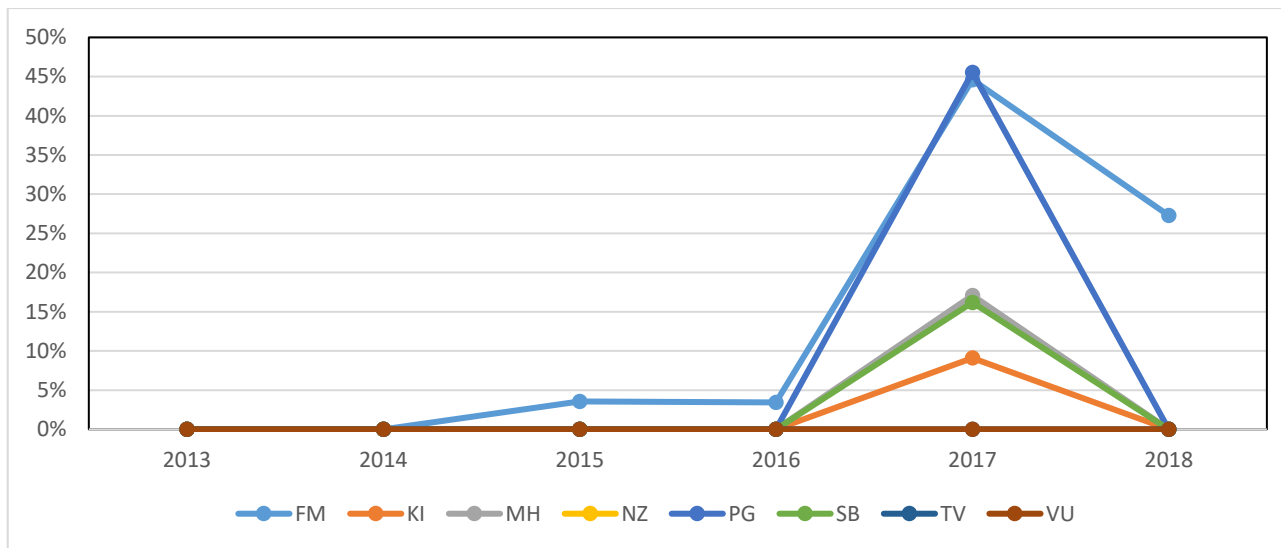
## Purse-seine Electronic Logsheet Data

Table 2. Annual trends in Purse-seine Logsheet E-Reported data by Pacific Island (PI) fleets, 2013–2018

|              | 2013     |            |             | 2014     |            |             | 2015     |            |             | 2016     |            |             | 2017       |            |              | 2018     |           |             |
|--------------|----------|------------|-------------|----------|------------|-------------|----------|------------|-------------|----------|------------|-------------|------------|------------|--------------|----------|-----------|-------------|
|              | ER       | Total      | %           | ER       | Total      | %           | ER       | Total      | %           | ER       | Total      | %           | ER         | Total      | %            | ER       | Total     | %           |
| FM           | 0        | 74         | 0.00        | 0        | 63         | 0.00        | 3        | 84         | 3.57        | 4        | 117        | 3.42        | 33         | 74         | 44.59        | 3        | 11        | 27.27       |
| KI           | 0        | 94         | 0.00        | 0        | 154        | 0.00        | 0        | 209        | 0.00        | 0        | 210        | 0.00        | 18         | 198        | 9.09         | 0        | 32        | 0.00        |
| MH           | 0        | 101        | 0.00        | 0        | 109        | 0.00        | 0        | 106        | 0.00        | 0        | 86         | 0.00        | 14         | 82         | 17.07        | 0        | 27        | 0.00        |
| PG           | 0        | 364        | 0.00        | 0        | 316        | 0.00        | 0        | 323        | 0.00        | 0        | 271        | 0.00        | 194        | 426        | 45.54        | 0        | 4         | 0.00        |
| SB           | 0        | 73         | 0.00        | 0        | 72         | 0.00        | 0        | 80         | 0.00        | 0        | 101        | 0.00        | 17         | 105        | 16.19        | 0        | 4         | 0.00        |
| TV           | 0        | 10         | 0.00        | 0        | 9          | 0.00        | 0        | 5          | 0.00        | 0        | 7          | 0.00        | 0          | 6          | 0.00         | 0        | 4         | 0.00        |
| VU           | 0        | 29         | 0.00        | 0        | 25         | 0.00        | 0        | 10         | 0.00        | 0        | 6          | 0.00        | 0          | 11         | 0.00         | 0        | 5         | 0.00        |
| <b>Total</b> | <b>0</b> | <b>757</b> | <b>0.00</b> | <b>0</b> | <b>753</b> | <b>0.00</b> | <b>3</b> | <b>822</b> | <b>0.36</b> | <b>4</b> | <b>802</b> | <b>0.50</b> | <b>276</b> | <b>902</b> | <b>30.60</b> | <b>3</b> | <b>87</b> | <b>3.45</b> |

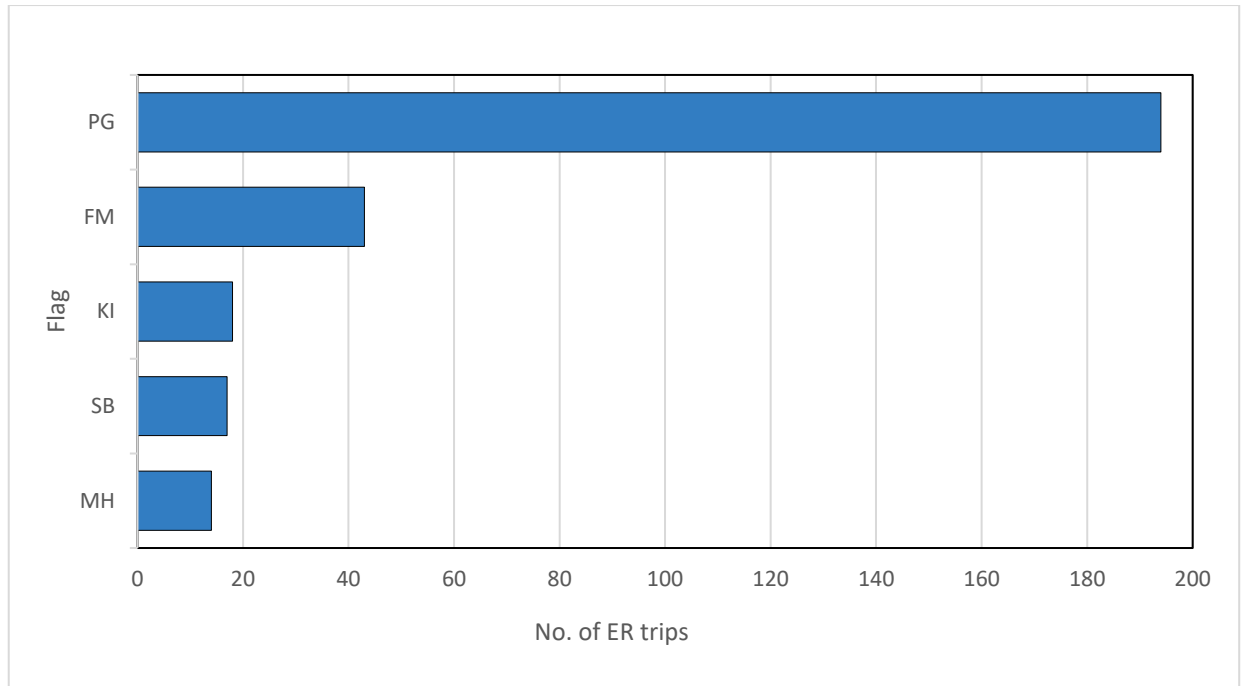
### Notes

1. Based on E-reported data imported into the TUFMAN 2 system from PNA iFIMS eLog data provisions
2. Acknowledges that there may be some E-Reported data not yet provided or with data quality issues, and so not included in this table.
3. Unit used is TRIP. “Total” represents VMS trips. “ER” represents ER trips. “%” represents percentage of ER to Total
4. Acknowledges that other effort metrics for determining coverage may be used by member countries, including fishing days, days at seas.
5. The VMS trips (“Total”) may not represent chartering arrangements.



**Figure 3. Trends in Purse-seine logsheet E-Reporting coverage by PI fleet, 2013-2018**





**Figure 4. Total Purse-seine Logsheet E-Reporting trips by PI fleet over the period 2013-2018**

## Longline Observer Data Coverage

Table 3. Annual trends in longline observer data coverage by Pacific Islands (PI) fleet, 2013–2018

|              | 2013          |                  |             | 2014          |                  |             | 2015          |                  |             | 2016          |                  |             | 2017          |                  |             | 2018          |
|--------------|---------------|------------------|-------------|---------------|------------------|-------------|---------------|------------------|-------------|---------------|------------------|-------------|---------------|------------------|-------------|---------------|
|              | OBS Hks       | Est. Hks         | %           | OBS Hks       | Est. Hks         | %           | OBS Hks       | Est. Hks         | %           | OBS Hks       | Est. Hks         | %           | OBS Hks       | Est. Hks         | %           | OBS Hks       |
| CK           | 3,712         | 68,828           | 5.39        | 4,775         | 61,547           | 7.76        | 3,969         | 62,764           | 6.32        | 1,185         | 115,549          | 1.03        | 1,088         | 127,773          | 0.85        |               |
| FJ           | 20,749        | 648,201          | 3.20        | 32,508        | 518,568          | 6.27        | 46,350        | 474,834          | 9.76        | 57,673        | 555,853          | 10.38       | 28,464        | 531,771          | 5.35        | 10,043        |
| FM           | 2,347         | 110,066          | 2.13        | 6,673         | 80,481           | 8.29        | 6,692         | 178,358          | 3.75        | 10,770        | 223,182          | 4.83        | 354           | 201,143          | 0.18        | 64            |
| KI           | 1,517         | 33,251           | 4.56        |               | 25,572           |             | 1,837         | 49,307           | 3.73        | 765           | 76,444           | 1.00        | 195           | 47,180           | 0.41        |               |
| MH           |               |                  |             |               |                  |             |               |                  |             | 4,093         | 63,218           | 6.47        | 6,810         | 139,737          | 4.87        |               |
| PG           | 3,117         | 41,004           | 7.60        | 2,938         | 49,634           | 5.92        |               | 26,584           |             | 335           | 36,261           | 0.92        |               | 28,778           |             |               |
| SB           | 5,349         | 339,295          | 1.58        | 8,175         | 1,207,718        | 0.68        | 3,092         | 1,183,851        | 0.26        | 169           | 213,237          | 0.08        |               |                  |             |               |
| TO           |               |                  |             | 255           | 11,755           | 2.17        | 539           | 12,544           | 4.30        | 374           | 12,380           | 3.02        | 473           | 16,408           | 2.88        |               |
| TV           |               | 18,009           |             |               | 17,305           |             |               | 20,847           |             | 2,252         | 15,303           | 14.72       |               | 20,095           |             |               |
| VU           | 16,738        | 654,108          | 2.56        | 2,921         | 475,885          | 0.61        | 5,951         | 709,499          | 0.84        | 4,858         | 398,309          | 1.22        | 1,586         | 462,049          | 0.34        |               |
| WS           | 325           | 57,844           | 0.56        |               | 31,983           |             | 312           | 36,895           | 0.85        |               | 45,231           |             | 625           | 121,227          | 0.52        |               |
| <b>Total</b> | <b>53,854</b> | <b>1,970,607</b> | <b>2.73</b> | <b>58,245</b> | <b>2,480,447</b> | <b>2.35</b> | <b>68,742</b> | <b>2,755,481</b> | <b>2.49</b> | <b>82,474</b> | <b>1,754,967</b> | <b>4.70</b> | <b>39,595</b> | <b>1,696,160</b> | <b>2.33</b> | <b>10,107</b> |

### Notes

6. Based on observer data entered into the TUFMAN 2 system
7. Unit of effort used is 100s of Hooks
8. Acknowledges that there may be other observer data not yet provided to SPC and so not included in this table.
9. Acknowledges that other effort metrics for determining coverage may be used by member countries, including fishing days, days at sea and hooks.
10. Acronyms:
  - i. OBS Hks = Number of hooks observed (by onboard observers)
  - ii. Est. Hks=Raised hooks from Logbook data representing 100% coverage
  - iii. %=Percentage of OBS Hks to Est. Hks

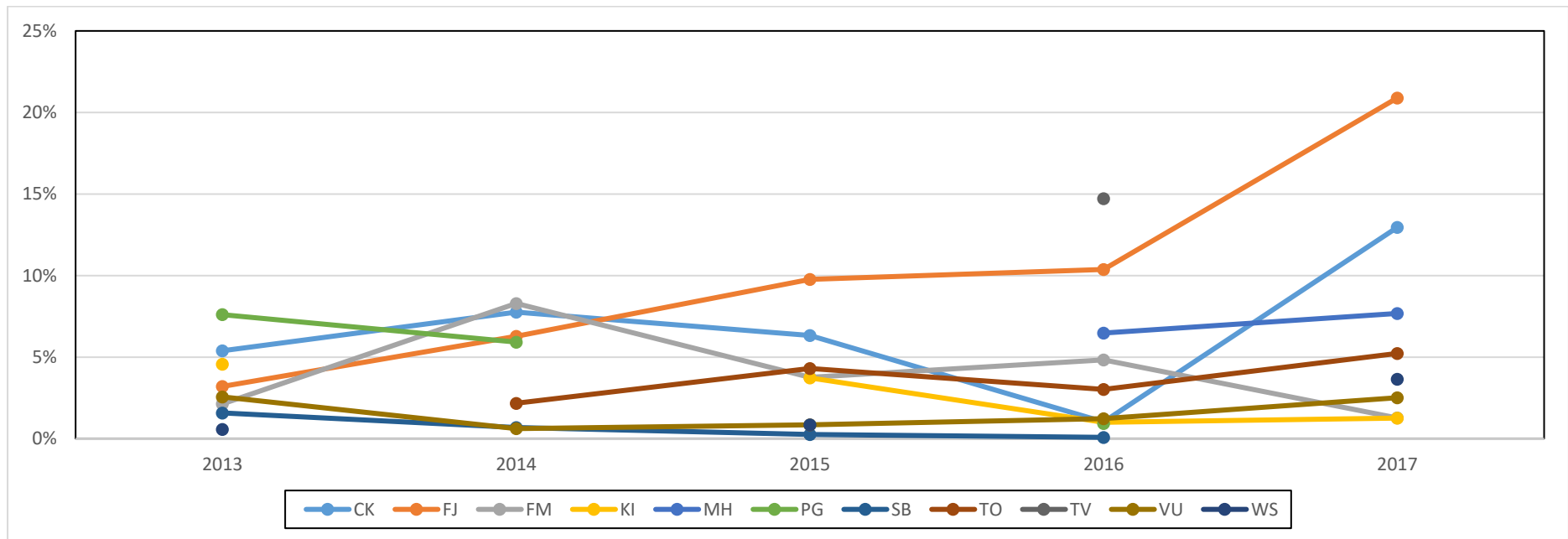
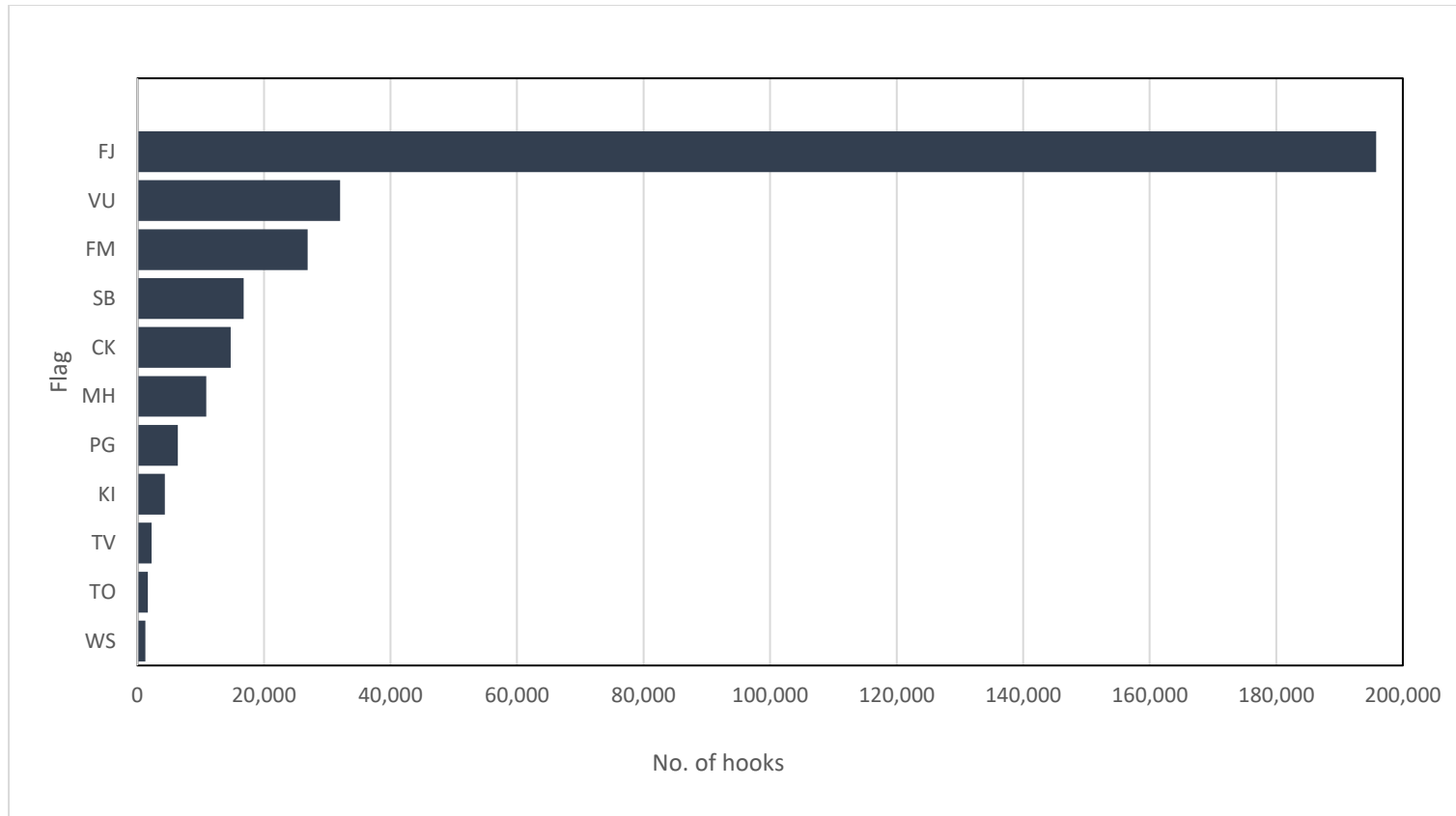


Figure 5. Trends of % coverage in Longline Observer for PI fleets, 2013-2017



**Figure 6. Total number of hooks for longline Observer by PI Fleet, 2013-2018**

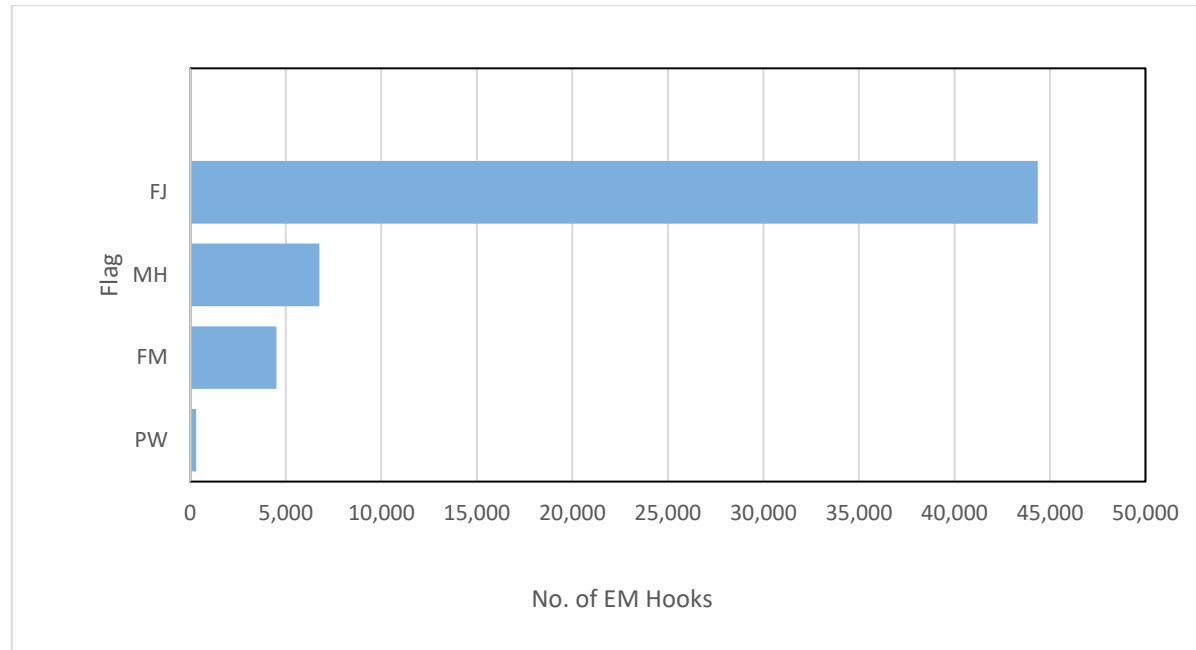
## Electronic Monitoring Data

**Table 4. Annual trends in longline EM activities by Pacific Island (PI) fleet, 2015–2018**

|    | 2015   |          |     | 2016   |          |      | 2017   |          |      | 2018   |
|----|--------|----------|-----|--------|----------|------|--------|----------|------|--------|
|    | EM Hks | Est. Hks | %   | EM Hks | Est. Hks | %    | EM Hks | Est. Hks | %    | EM Hks |
| FJ | 2,351  | 474,834  | 0.5 | 10,397 | 555,853  | 1.87 | 30,701 | 531,771  | 5.77 | 905    |
| MH |        |          |     |        |          |      | 6,261  | 139,737  | 4.48 | 494    |
| FM |        |          |     | 2,123  | 224,968  | 0.94 | 2,386  | 201,143  | 1.19 |        |
| PW |        |          |     | 299    | 626      | 47.8 |        |          |      |        |

### Notes

1. Based on EM data imported into the TUBS database
2. Unit of effort used is 100s of Hooks
3. Acknowledges that there may be other EM data not yet provided to SPC and so not included in this table.
4. Based on EM Data imported in the regional observer database
5. Acknowledges that other effort metrics for determining coverage may be used by member countries, including fishing days, days at sea and trips.
6. Acronyms:
  - a. EM Hks = Number of hooks observed (by E-monitoring Analysts)
  - b. Est. Hks = Raised hooks from Logbook data representing 100% coverage
  - c. % = Percentage of EM Hks to Est. Hks
7. For Palau, Est. Hks in 2016 data Not Available  
For 2017, Est. Hks data Not Available yet.



**Figure 7. Total number of hooks for Longline EM, by PI fleet 2015-2018**

## Comparisons of E-Monitoring vs Observer vs Logsheet data

### Tropical Longline Fisheries

**Table 5: Aggregated Catch Summary- EM vs Observer vs Logsheet (tropical longline fisheries)**

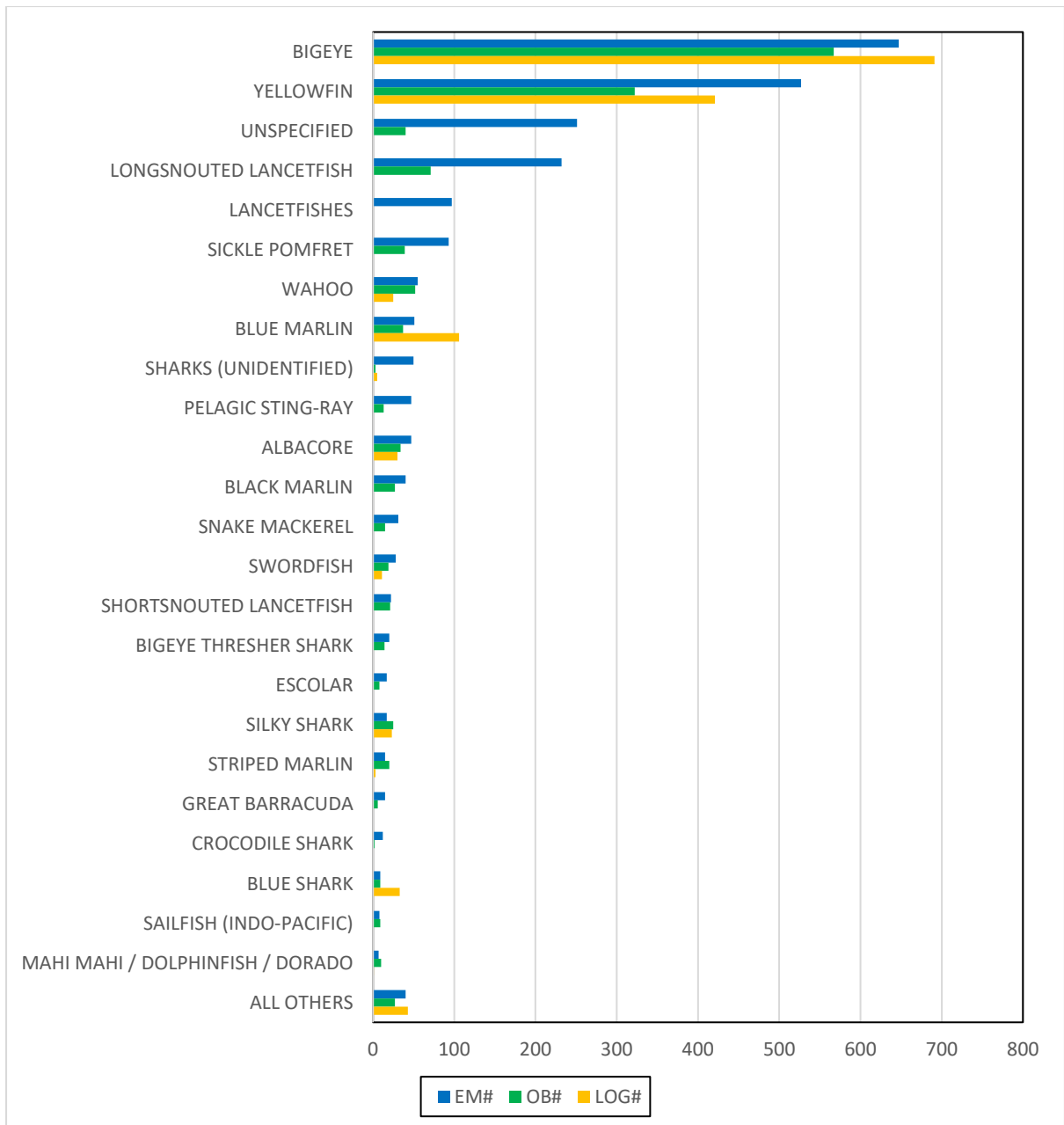
| SP_NAME                                         | SP_CODE | EM# | EM%   | OB# | OB%   | LOG# | LOG%  |
|-------------------------------------------------|---------|-----|-------|-----|-------|------|-------|
| BIGEYE                                          | BET     | 647 | 27.21 | 567 | 40.79 | 691  | 49.64 |
| YELLOWFIN                                       | YFT     | 527 | 22.16 | 322 | 23.17 | 421  | 30.24 |
| UNSPECIFIED                                     | UNS     | 251 | 10.56 | 40  | 2.88  | 0    | 0.00  |
| LONGSNOUTED LANCETFISH                          | ALX     | 232 | 9.76  | 71  | 5.11  | 0    | 0.00  |
| LANCETFISHES                                    | ALI     | 97  | 4.08  | 0   | 0.00  | 0    | 0.00  |
| SICKLE POMFRET                                  | TST     | 93  | 3.91  | 39  | 2.81  | 0    | 0.00  |
| WAHOO                                           | WAH     | 55  | 2.31  | 52  | 3.74  | 25   | 1.80  |
| BLUE MARLIN                                     | BUM     | 51  | 2.14  | 37  | 2.66  | 106  | 7.61  |
| SHARKS (UNIDENTIFIED)                           | SHK     | 50  | 2.10  | 3   | 0.22  | 5    | 0.36  |
| PELAGIC STING-RAY                               | PLS     | 47  | 1.98  | 13  | 0.94  | 0    | 0.00  |
| ALBACORE                                        | ALB     | 47  | 1.98  | 34  | 2.45  | 30   | 2.16  |
| BLACK MARLIN                                    | BLM     | 40  | 1.68  | 27  | 1.94  | 0    | 0.00  |
| SNAKE MACKEREL                                  | GES     | 31  | 1.30  | 15  | 1.08  | 0    | 0.00  |
| SWORDFISH                                       | SWO     | 28  | 1.18  | 19  | 1.37  | 11   | 0.79  |
| SHORTSNOUTED LANCETFISH                         | ALO     | 22  | 0.93  | 21  | 1.51  | 0    | 0.00  |
| BIGEYE THRESHER SHARK                           | BTH     | 20  | 0.84  | 14  | 1.01  | 0    | 0.00  |
| ESCOLAR                                         | LEC     | 17  | 0.71  | 8   | 0.58  | 0    | 0.00  |
| SILKY SHARK                                     | FAL     | 17  | 0.71  | 25  | 1.80  | 23   | 1.65  |
| STRIPED MARLIN                                  | MLS     | 15  | 0.63  | 20  | 1.44  | 3    | 0.22  |
| GREAT BARRACUDA                                 | GBA     | 15  | 0.63  | 6   | 0.43  | 0    | 0.00  |
| CROCODILE SHARK                                 | PSK     | 12  | 0.50  | 2   | 0.14  | 0    | 0.00  |
| BLUE SHARK                                      | BSH     | 9   | 0.38  | 9   | 0.65  | 33   | 2.37  |
| SAILFISH (INDO-PACIFIC)                         | SFA     | 8   | 0.34  | 9   | 0.65  | 0    | 0.00  |
| MAHI MAHI / DOLPHINFISH / DORADO                | DOL     | 7   | 0.29  | 10  | 0.72  | 1    | 0.07  |
| POMFRETS AND OCEAN BREAMS                       | BRZ     | 6   | 0.25  | 0   | 0.00  | 0    | 0.00  |
| PELAGIC THRESHER SHARK                          | PTH     | 6   | 0.25  | 12  | 0.86  | 0    | 0.00  |
| SKIPJACK                                        | SKJ     | 5   | 0.21  | 2   | 0.14  | 0    | 0.00  |
| SHORT-BILLED SPEARFISH                          | SSP     | 4   | 0.17  | 1   | 0.07  | 0    | 0.00  |
| MARLINS, SAILFISHES, SPEARFISHES (UNIDENTIFIED) | BIL     | 3   | 0.13  | 0   | 0.00  | 0    | 0.00  |
| THRESHER SHARK (VULPINAS)                       | ALV     | 3   | 0.13  | 0   | 0.00  | 0    | 0.00  |
| Devil Manta Ray (Mobula nei)                    | RMV     | 2   | 0.08  | 0   | 0.00  | 0    | 0.00  |
| OCEANIC WHITE-TIP SHARK                         | OCS     | 2   | 0.08  | 6   | 0.43  | 4    | 0.29  |
| ATLANTIC POMFRET / RAY'S BREEM                  | POA     | 2   | 0.08  | 1   | 0.07  | 0    | 0.00  |
| OPAH / MOONFISH                                 | LAG     | 1   | 0.04  | 1   | 0.07  | 0    | 0.00  |
| ROUDI ESCOLAR                                   | PRP     | 1   | 0.04  | 0   | 0.00  | 0    | 0.00  |
| ANGELSHARKS, SAND DEVILS NEI                    | ASK     | 1   | 0.04  | 0   | 0.00  | 0    | 0.00  |
| GREEN TURTLE                                    | TUG     | 1   | 0.04  | 0   | 0.00  | 0    | 0.00  |
| OLIVE RIDLEY TURTLE (NEW FAO)                   | LKV     | 1   | 0.04  | 0   | 0.00  | 0    | 0.00  |

| SP_NAME                 | SP_CODE      | EM#         | EM%  | OB#         | OB%  | LOG#        | LOG% |
|-------------------------|--------------|-------------|------|-------------|------|-------------|------|
| COOKIE CUTTER SHARK     | ISB          | 1           | 0.04 | 0           | 0.00 | 0           | 0.00 |
| BLUEFIN TUNA (ATLANTIC) | BFT          | 1           | 0.04 | 0           | 0.00 | 0           | 0.00 |
| MAKO SHARKS             | MAK          | 0           | 0.00 | 0           | 0.00 | 7           | 0.50 |
| OTHER FISH              | OTH          | 0           | 0.00 | 0           | 0.00 | 11          | 0.79 |
| OCEAN SUNFISH           | MOX          | 0           | 0.00 | 1           | 0.07 | 0           | 0.00 |
| LONG FIN MAKO SHARK     | LMA          | 0           | 0.00 | 1           | 0.07 | 0           | 0.00 |
| OILFISH                 | OIL          | 0           | 0.00 | 1           | 0.07 | 0           | 0.00 |
| SHORT FIN MAKO SHARK    | SMA          | 0           | 0.00 | 1           | 0.07 | 0           | 0.00 |
| PORBEAGLE SHARK         | POR          | 0           | 0.00 | 0           | 0.00 | 21          | 1.51 |
|                         | <b>TOTAL</b> | <b>2378</b> |      | <b>1390</b> |      | <b>1392</b> |      |

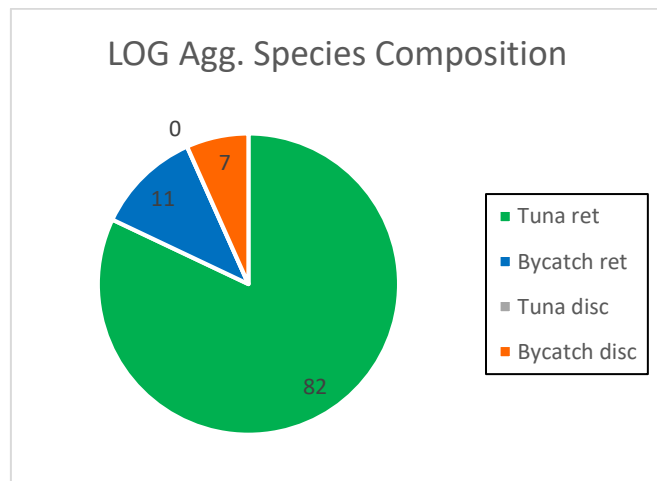
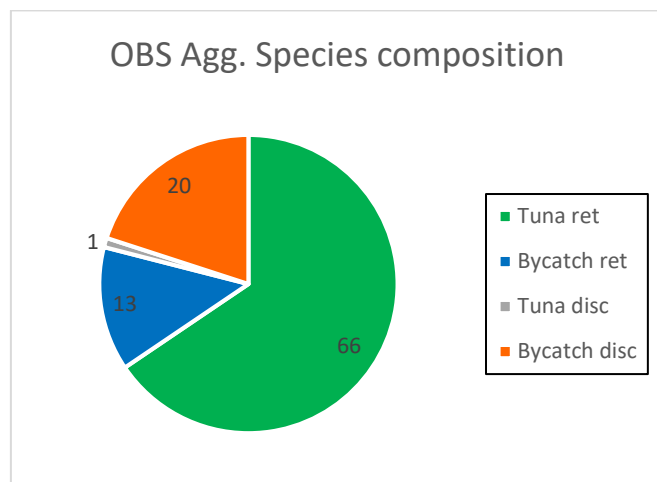
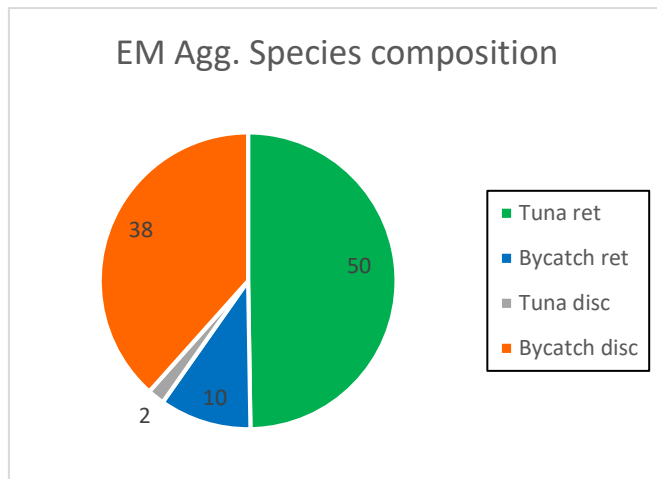
#### Notes

1. The above aggregated data comparisons are based on 9 EM trips conducted in 2017 which have been linked to respective trips by on-board observers and from logbook data.
2. Table Header Definitions:
  - i. EM# - Number of specimens observed (by E-monitoring Analysts)
  - ii. EM% - Percentage of EM# to total number of specimens
  - iii. OB# - Number of specimens observed (by onboard observers)
  - iv. OB% - Percentage of OB# to total number of specimens
  - v. LOG# - Number of specimens caught (as reported on the Logsheets)
  - vi. LOG% - Percentage of LOG# to total number of specimens caught





**Figure 8. Aggregate species composition- EM vs OB vs LOG (tropical longline fisheries)**



**Figure 9. Breakdown of Tuna and bycatch by retain/discard categories, EM vs OB vs LOG (tropical longline fisheries)**

## Southern Albacore Tuna Longline Fisheries

**Table 6: Aggregated Catch Summary- EM vs Observer vs Logsheet (Southern Albacore Tuna Longline Fisheries)**

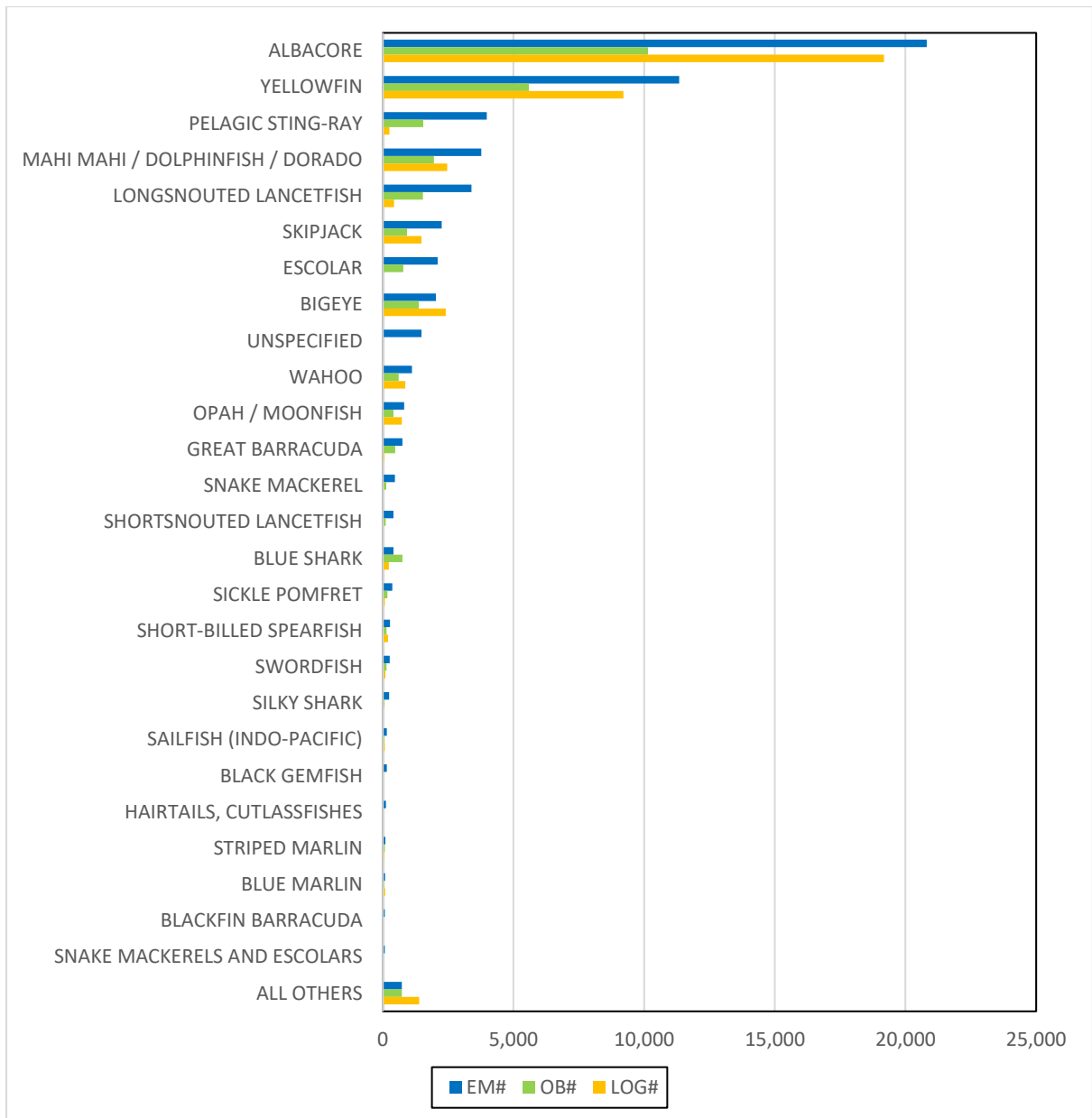
| SP_NAME                               | SP_CODE | EM#    | EM%   | OB#    | OB%   | LOG#   | LOG%  |
|---------------------------------------|---------|--------|-------|--------|-------|--------|-------|
| ALBACORE                              | ALB     | 20,811 | 36.05 | 10,143 | 36.48 | 19,180 | 48.85 |
| YELLOWFIN                             | YFT     | 11,337 | 19.64 | 5,589  | 20.10 | 9,203  | 23.44 |
| PELAGIC STING-RAY                     | PLS     | 3,978  | 6.89  | 1,541  | 5.54  | 248    | 0.63  |
| MAHI MAHI / DOLPHINFISH / DORADO      | DOL     | 3,763  | 6.52  | 1,960  | 7.05  | 2,467  | 6.28  |
| LONGSNOUTED LANCETFISH                | ALX     | 3,390  | 5.87  | 1,537  | 5.53  | 429    | 1.09  |
| SKIPJACK                              | SKJ     | 2,249  | 3.90  | 928    | 3.34  | 1,481  | 3.77  |
| ESCOLAR                               | LEC     | 2,098  | 3.63  | 781    | 2.81  | 0      | 0.00  |
| BIGEYE                                | BET     | 2,029  | 3.51  | 1,377  | 4.95  | 2,408  | 6.13  |
| UNSPECIFIED                           | UNS     | 1,474  | 2.55  | 7      | 0.03  | 0      | 0.00  |
| WAHOO                                 | WAH     | 1,119  | 1.94  | 604    | 2.17  | 857    | 2.18  |
| OPAH / MOONFISH                       | LAG     | 813    | 1.41  | 403    | 1.45  | 725    | 1.85  |
| GREAT BARRACUDA                       | GBA     | 754    | 1.31  | 478    | 1.72  | 61     | 0.16  |
| SNAKE MACKEREL                        | GES     | 467    | 0.81  | 136    | 0.49  | 0      | 0.00  |
| SHORTSNOUTED LANCETFISH               | ALO     | 407    | 0.70  | 107    | 0.38  | 0      | 0.00  |
| BLUE SHARK                            | BSH     | 402    | 0.70  | 755    | 2.72  | 226    | 0.58  |
| SICKLE POMFRET                        | TST     | 358    | 0.62  | 172    | 0.62  | 72     | 0.18  |
| SHORT-BILLED SPEARFISH                | SSP     | 276    | 0.48  | 146    | 0.53  | 192    | 0.49  |
| SWORDFISH                             | SWO     | 258    | 0.45  | 138    | 0.50  | 93     | 0.24  |
| SILKY SHARK                           | FAL     | 246    | 0.43  | 65     | 0.23  | 21     | 0.05  |
| SAILFISH (INDO-PACIFIC)               | SFA     | 153    | 0.27  | 69     | 0.25  | 71     | 0.18  |
| BLACK GEMFISH                         | NEN     | 151    | 0.26  | 5      | 0.02  | 0      | 0.00  |
| HAIRTAILS, CUTLASSFISHES              | CUT     | 125    | 0.22  | 0      | 0.00  | 0      | 0.00  |
| STRIPED MARLIN                        | MLS     | 94     | 0.16  | 72     | 0.26  | 49     | 0.12  |
| BLUE MARLIN                           | BUM     | 92     | 0.16  | 51     | 0.18  | 89     | 0.23  |
| BLACKFIN BARRACUDA                    | BAB     | 79     | 0.14  | 7      | 0.03  | 0      | 0.00  |
| SNAKE MACKERELS AND ESCOLARS          | GEP     | 77     | 0.13  | 0      | 0.00  | 0      | 0.00  |
| Slender sunfish                       | RZV     | 56     | 0.10  | 14     | 0.05  | 0      | 0.00  |
| GEMFISH (SOUTHERN OR SILVER KINGFISH) | GEM     | 56     | 0.10  | 11     | 0.04  | 0      | 0.00  |
| BLACK MARLIN                          | BLM     | 53     | 0.09  | 11     | 0.04  | 66     | 0.17  |
| SHORT FINNED MAKO SHARK               | SMA     | 51     | 0.09  | 79     | 0.28  | 14     | 0.04  |
| OCEANIC WHITE-TIP SHARK               | OCS     | 49     | 0.08  | 40     | 0.14  | 23     | 0.06  |
| SOAPFISH                              | GSE     | 46     | 0.08  | 15     | 0.05  | 0      | 0.00  |
| CRESTFISH/UNICORNFISH                 | LOP     | 38     | 0.07  | 10     | 0.04  | 0      | 0.00  |
| PELAGIC PUFFER                        | LGH     | 32     | 0.06  | 9      | 0.03  | 0      | 0.00  |
| ROUDI ESCOLAR                         | PRP     | 27     | 0.05  | 2      | 0.01  | 0      | 0.00  |
| OILFISH                               | OIL     | 25     | 0.04  | 73     | 0.26  | 925    | 2.36  |
| RAZORBACK SCABBARDFISH                | ASZ     | 22     | 0.04  | 2      | 0.01  | 0      | 0.00  |
| RAINBOW RUNNER                        | RRU     | 18     | 0.03  | 10     | 0.04  | 0      | 0.00  |
| BIGEYE THRESHER SHARK                 | BTH     | 17     | 0.03  | 14     | 0.05  | 0      | 0.00  |
| BARRACOUTA (SNOEK)                    | SNK     | 16     | 0.03  | 217    | 0.78  | 0      | 0.00  |

| SP_NAME                            | SP_CODE | EM# | EM%  | OB# | OB%  | LOG# | LOG% |
|------------------------------------|---------|-----|------|-----|------|------|------|
| DEALFISHES                         | TRX     | 16  | 0.03 | 0   | 0.00 | 0    | 0.00 |
| LEATHERBACK TURTLE (NEW FAO)       | DKK     | 15  | 0.03 | 4   | 0.01 | 0    | 0.00 |
| ATLANTIC POMFRET / RAY'S BREAM     | POA     | 13  | 0.02 | 10  | 0.04 | 0    | 0.00 |
| HAWKSBILL TURTLE                   | TTH     | 13  | 0.02 | 2   | 0.01 | 0    | 0.00 |
| BRILLIANT POMFRET                  | EBS     | 11  | 0.02 | 0   | 0.00 | 0    | 0.00 |
| BRONZE WHALER SHARK                | BRO     | 9   | 0.02 | 45  | 0.16 | 0    | 0.00 |
| SILVER-TIP SHARK                   | ALS     | 9   | 0.02 | 2   | 0.01 | 0    | 0.00 |
| FLESH-FOOTED SHEARWATER            | PFC     | 9   | 0.02 | 0   | 0.00 | 0    | 0.00 |
| LOGGERHEAD TURTLE                  | TTL     | 8   | 0.01 | 6   | 0.02 | 0    | 0.00 |
| POMFRETS AND OCEAN BREAMS          | BRZ     | 8   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| Giant manta                        | RMB     | 7   | 0.01 | 2   | 0.01 | 0    | 0.00 |
| LONG FINNED MAKO SHARK             | LMA     | 7   | 0.01 | 29  | 0.10 | 0    | 0.00 |
| OCEAN SUNFISH                      | MOX     | 6   | 0.01 | 4   | 0.01 | 0    | 0.00 |
| CRESTFISH                          | LLL     | 6   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| OARFISHES NEI                      | RRG     | 6   | 0.01 | 1   | 0.00 | 0    | 0.00 |
| VELVET DOGFISH                     | SSQ     | 5   | 0.01 | 2   | 0.01 | 0    | 0.00 |
| COOKIE CUTTER SHARK                | ISB     | 5   | 0.01 | 1   | 0.00 | 0    | 0.00 |
| PUFFERS (FAMILY)                   | PUX     | 5   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| FILEFISH (UNICORN LEATHERJACKET)   | ALM     | 5   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| PELAGIC THRESHER SHARK             | PTH     | 5   | 0.01 | 3   | 0.01 | 0    | 0.00 |
| OCEANIC TRIGGERFISH (UNIDENTIFIED) | TRI     | 4   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| OLIVE RIDLEY TURTLE (NEW FAO)      | LKV     | 4   | 0.01 | 2   | 0.01 | 0    | 0.00 |
| BIGEYE SCAD                        | BIS     | 3   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| SEAL SHARK / BLACK SHARK           | SCK     | 3   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| BLUEFIN TUNA (ATLANTIC)            | BFT     | 3   | 0.01 | 0   | 0.00 | 0    | 0.00 |
| GREEN TURTLE                       | TUG     | 3   | 0.01 | 7   | 0.03 | 0    | 0.00 |
| DEEPWATER RED SNAPPER              | ETA     | 3   | 0.01 | 1   | 0.00 | 0    | 0.00 |
| THRESHER SHARK (VULPINAS)          | ALV     | 2   | 0.00 | 3   | 0.01 | 0    | 0.00 |
| DOGTUOTH TUNA                      | DOT     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| DEEPWATER LONGTAIL RED SNAPPER     | ETC     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| SHARPTAIL MOLA                     | MRW     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| RAYS (DASYATIDIDAE)                | STT     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| GREAT HAMMERHEAD                   | SPK     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| TIGER SHARK                        | TIG     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| SLENDER TUNA                       | SLT     | 2   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| BULL SHARK                         | CCE     | 2   | 0.00 | 1   | 0.00 | 0    | 0.00 |
| AMBERJACK / GIANT YELLOWTAIL       | YTC     | 1   | 0.00 | 1   | 0.00 | 0    | 0.00 |
| BLACK MACKEREL                     | SXH     | 1   | 0.00 | 4   | 0.01 | 0    | 0.00 |
| FILEFISHES (FAMILY)                | FFX     | 1   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| GREAT WHITE SHARK                  | WSH     | 1   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| DOLPHIN, SPOTTED                   | DPN     | 1   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| PACIFIC BLUEFIN TUNA               | PBF     | 1   | 0.00 | 0   | 0.00 | 0    | 0.00 |
| MAKO SHARKS                        | MAK     | 1   | 0.00 | 0   | 0.00 | 0    | 0.00 |

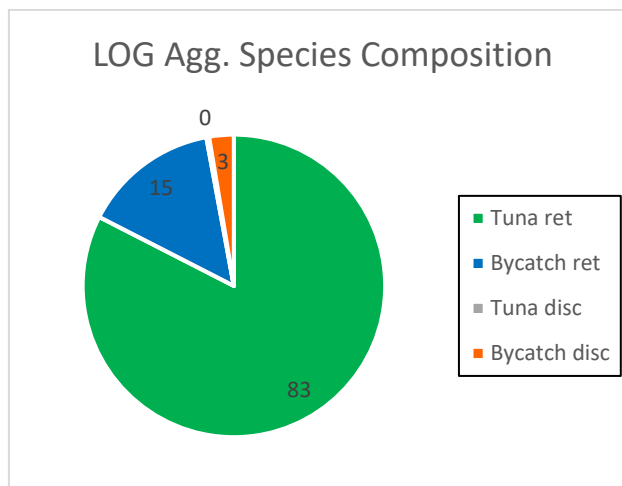
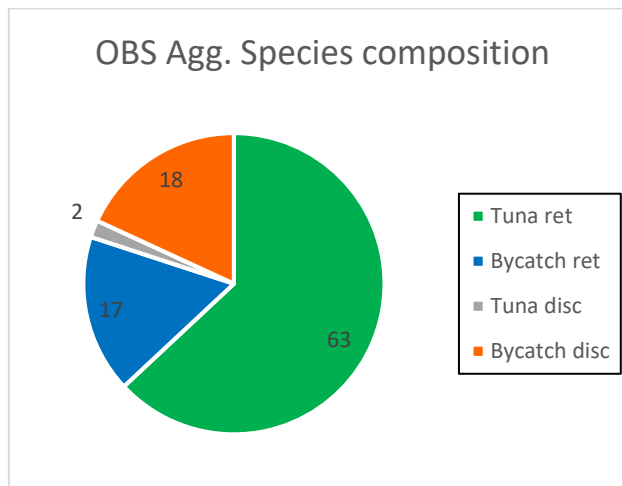
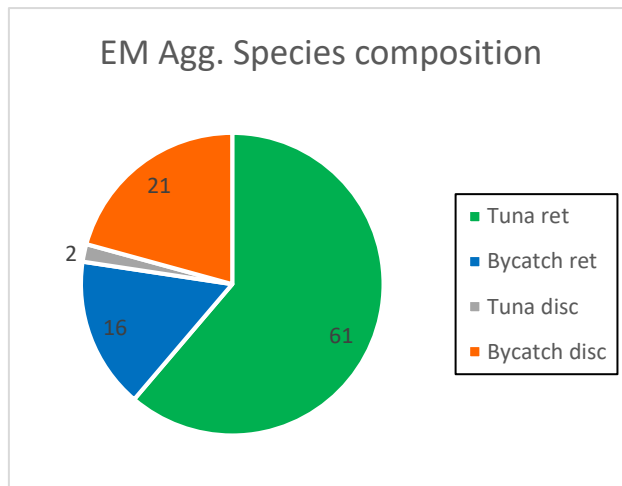
| SP_NAME                                            | SP_CODE      | EM#           | EM%  | OB#           | OB%  | LOG#          | LOG% |
|----------------------------------------------------|--------------|---------------|------|---------------|------|---------------|------|
| GAPING NEEDLE FISH                                 | BAF          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| SQUIDS (OMMASTREPHIDAE)                            | OMZ          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| BIGNOSE SHARK                                      | CCA          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| SOUTHERN BLUEFIN TUNA                              | SBF          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| SARGENT MAJOR                                      | ABU          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| ANGELSHARKS, SAND DEVILS NEI                       | ASK          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| MARLINS, SAILFISHES, SPEARFISHES<br>(UNIDENTIFIED) | BIL          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| OMOSUDID                                           | OMW          | 1             | 0.00 | 73            | 0.26 | 0             | 0.00 |
| RAYS, STINGRAYS, MANTAS NEI                        | SRX          | 1             | 0.00 | 0             | 0.00 | 0             | 0.00 |
| BLACKTIP SHARK                                     | CCL          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| ALBATROSS                                          | ALZ          | 0             | 0.00 | 2             | 0.01 | 0             | 0.00 |
| LEATHERBACK TURTLE                                 | LTB          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| FALSE KILLER WHALE                                 | FAW          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| SPANISH MACKEREL (NARROW-BARRED)                   | COM          | 0             | 0.00 | 2             | 0.01 | 0             | 0.00 |
| ARROW SQUID (WELLINGTON FLYING SQUID)              | TSQ          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| SMOOTH HAMMERHEAD                                  | SPZ          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| MAKO SHARKS                                        | MAK          | 0             | 0.00 | 0             | 0.00 | 10            | 0.03 |
| OTHER FISH                                         | OTH          | 0             | 0.00 | 0             | 0.00 | 24            | 0.06 |
| POMFRETS AND OCEAN BREAMS                          | BRZ          | 0             | 0.00 | 0             | 0.00 | 2             | 0.01 |
| BOTTLENOSE DOLPHIN                                 | DBO          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| ALASKA POLLOCK(=WALLEYE POLL.)                     | ALK          | 0             | 0.00 | 2             | 0.01 | 0             | 0.00 |
| SHARKS (UNIDENTIFIED)                              | SHK          | 0             | 0.00 | 2             | 0.01 | 0             | 0.00 |
| WHALE SHARK                                        | RHN          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| LAYSAN ALBATROSS                                   | DIZ          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| LONG-BEAKED COMMON DOLPHIN                         | DCZ          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| RAJA RAYS NEI                                      | SKA          | 0             | 0.00 | 2             | 0.01 | 0             | 0.00 |
| MOBULA (A.K.A. DEVIL RAY)                          | RMV          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| CHINA ANCHOVY                                      | ESC          | 0             | 0.00 | 1             | 0.00 | 0             | 0.00 |
| BARRACUDAS (UNIDENTIFIED)                          | BAR          | 0             | 0.00 | 0             | 0.00 | 76            | 0.19 |
| TUNA (UNIDENTIFIED)                                | TUN          | 0             | 0.00 | 0             | 0.00 | 246           | 0.63 |
| MARLINS, SAILFISHES, SPEARFISHES<br>(UNIDENTIFIED) | BIL          | 0             | 0.00 | 0             | 0.00 | 1             | 0.00 |
| PORBEAGLE SHARK                                    | POR          | 0             | 0.00 | 0             | 0.00 | 7             | 0.02 |
|                                                    | <b>TOTAL</b> | <b>57,731</b> |      | <b>27,802</b> |      | <b>39,266</b> |      |

#### Notes

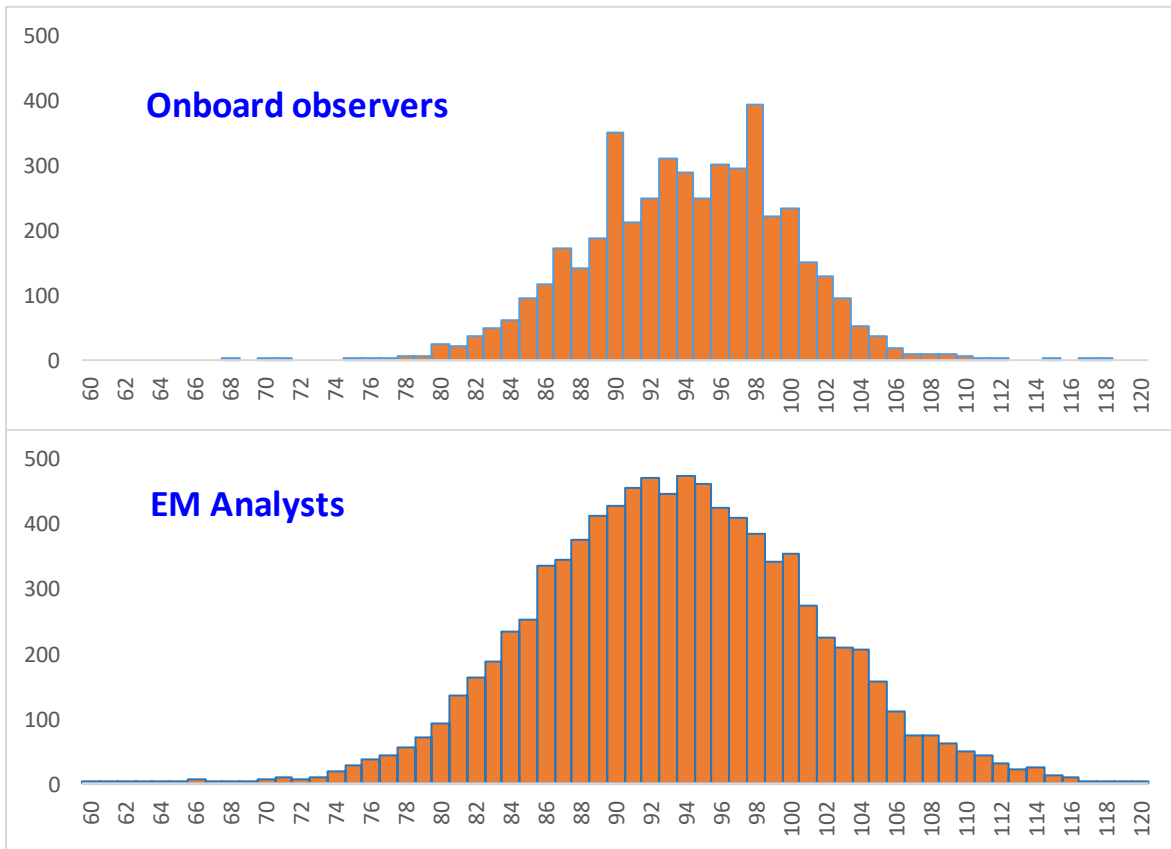
1. The above aggregated data comparisons are based on EM trips conducted in 2015-2017, that have corresponding trips from onboard Observers and from Logsheet data.



**Figure 10. Aggregate species composition- EM vs OB vs LOG (Southern Albacore Tuna Longline Fisheries)**



**Figure 11. Breakdown of Tuna and bycatch by retain/discard categories, EM vs OB vs LOG (Southern Albacore Tuna Longline Fisheries)**



**Figure 12. Comparison of Albacore tuna length frequency obtained from paired onboard observer (top) and EM trips (bottom), 2016–2018 (Southern Albacore Tuna Longline Fisheries)**