Pacific Community
Communauté du Pacifique

International Workshop on
Application Electronic Monitoring Systems
in Tuna Longline Fisheries
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RESULTS AND RECOMMENDATIONS FROM ELECTRONIC MONITORING TRIALS ON TUNA LONGLINE VESSELS IN THE SOLOMON ISLANDS AND NEW CALEDONIA

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Presentation outline

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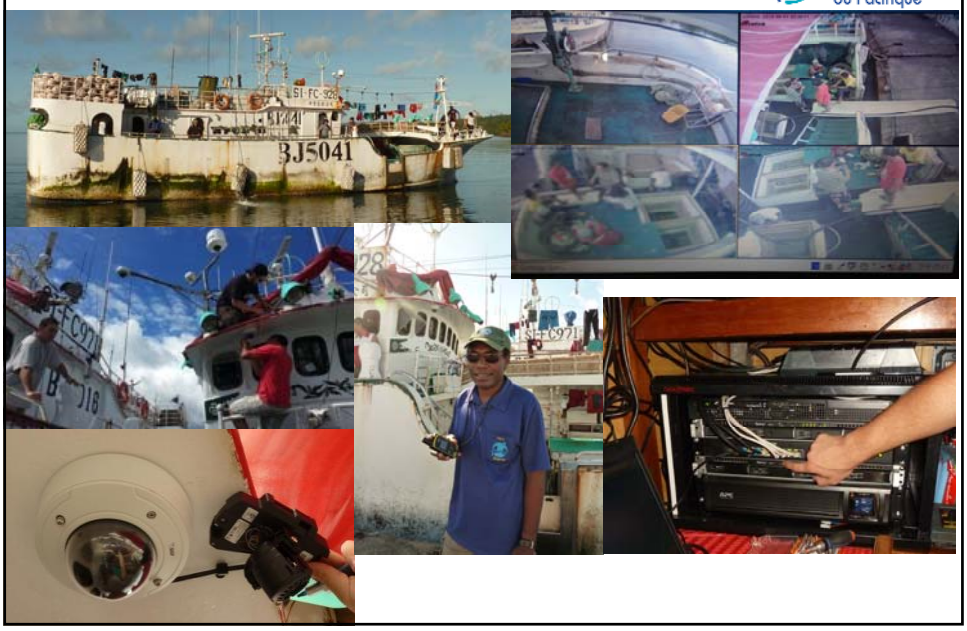
- Solomon Islands EM trial
  - Project objectives
  - Project outcomes
  - Project Methods and Results
  - Recommendations
- New Caledonia EM trial
  - Project objectives
  - Project challenges
- Challenges ahead
- Take home messages

Solomon Islands EM trial - 2014

- **Objective:** Determine if WCPFC ROP min. data fields could be collected using EM
- **Vessels:** Two freezer tuna longline vessels
- **Equipment:** Satlink Sea Tube
- **Duration:** four trips (~70 days, total 199 sets)
- **Observer:** Onboard each trip
- **Results:** Comparison of EM vs. observer data

Vessel, equipment & observer



Project outcomes

- A successful multi-stakeholder project
- Resources intensive (human and $)
- Equipment performed very well in difficult conditions (215 days trial, only ~10 days of malfunctions)

Project outcomes – cont.

- The essential longline positional data collected from EM was inherently more accurate and had a higher resolution than the data collected by the on-board observers
- The essential longline effort data collected from EM was in general more detailed than the data collected by the on-board observers

Project outcomes – cont.

- Data collected by EM was as good as data collected by the observers
- Analysed data imported into SPC's regional databases
- Provides benchmark for 100% analysis
- Comparative analysis between EM and on-board observer data was essential

Project Results

- Trips summaries
- Set tracks
- Comparison of species composition
- Comparison of fate codes
- Comparison of hook numbers
- Comparison of length estimates

Trip # 1 summary

TRIP #1		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #2	
OBSERVER	HAV	JA
Start Observation	16/03/2014	
End Observation	31/05/2014	
Duration of Observation (days)	77	1
Total sets	54	54
Total Baskets set	7,004	7,004
Total Baskets observed	6,806	6,946
% Baskets observed	*97%*	*99%*
Total Hooks sets	189,108	189,108
Total Hooks observed	183,762	154,475
% hooks observed	*97%*	*82%*
Range of Hooks between Floats (HBF)	27	11-43
Average HBF	27	22.4
Total Observed Yellowfin tuna	1324	922
Total Observed Bigeye tuna	169	114
Total Observed Albacore tuna	1470	1513
Total Estimated Yellowfin tuna	*1363*	*1129*
Total Estimated Bigeye tuna	*174*	*140*
Total Estimated Albacore tuna	*1513*	*1852*

Trip # 2 summary

TRIP #2		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #3	
OBSERVER	JA	HAV
Start Observation	16/03/2014	
End Observation	27/05/2014	
Duration of Observation (days)	73	1
Total sets	60	60
Total Baskets set	6,000	6,000
Total Baskets observed	5,751	5,397
% Baskets observed	*96%*	*90%*
Total Hooks sets	160,082	160,082
Total Hooks observed	153,442	136,490
% hooks observed	*96%*	*85%*
Range of Hooks between Floats (HBF)	25-27	11-44
Average HBF	26	25.3
Total Observed Yellowfin tuna	877	662
Total Observed Bigeye tuna	225	212
Total Observed Albacore tuna	1024	1030
Total Estimated Yellowfin tuna	*915*	*776*
Total Estimated Bigeye tuna	*235*	*249*
Total Estimated Albacore tuna	*1068*	*1208*

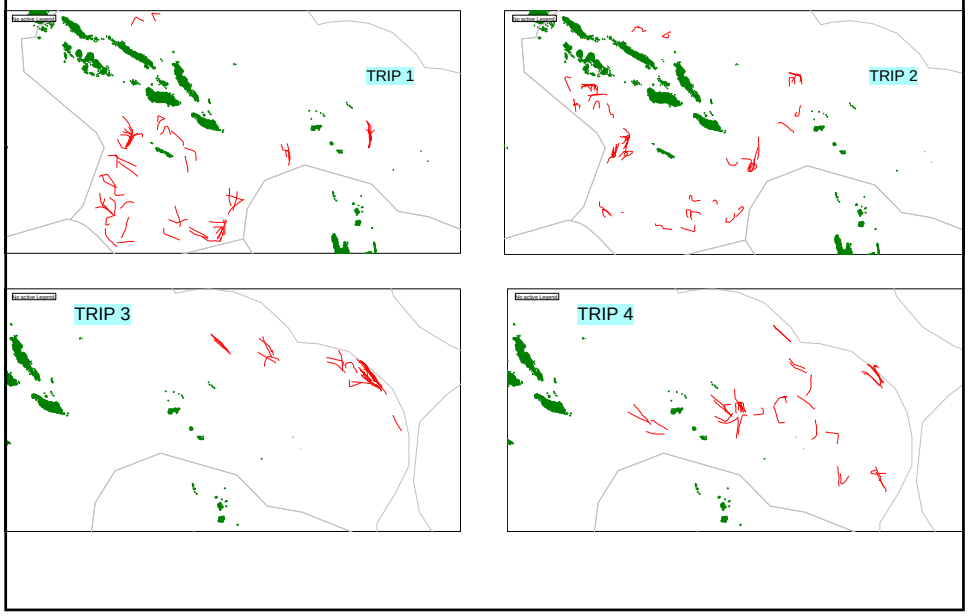
Trip # 3 summary

TRIP #3		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #3	
OBSERVER	LEA	HAV
Start Observation	14/06/2014	
End Observation	26/07/2014	
Duration of Observation (days)	43	1
Total sets	38	38
Total Baskets set	4,722	4,722
Total Baskets observed	3,610	4,600
% Baskets observed	*76%*	*97%*
Total Hooks sets	126,494	126,494
Total Hooks observed	97,470	121,307
% hooks observed	*77%*	*96%*
Range of Hooks between Floats (HBF)	27	25-26
Average HBF	27	25
Total Observed Yellowfin tuna	1073	1360
Total Observed Bigeye tuna	699	851
Total Observed Albacore tuna	1988	2580
Total Estimated Yellowfin tuna	*1393*	*1418*
Total Estimated Bigeye tuna	*907*	*887*
Total Estimated Albacore tuna	*2580*	*2690*

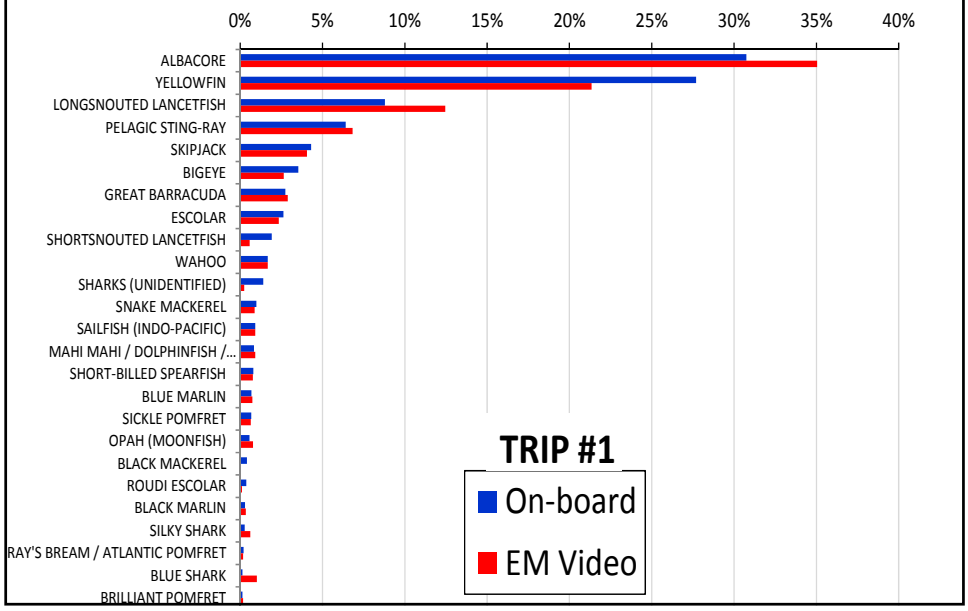
Trip # 4 summary

TRIP #4		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #2	
OBSERVER	PHK	JA
Start Observation	17/06/2014	
End Observation	14/08/2014	
Duration of Observation (days)	59	1
Total sets	47	47
Total Baskets set	6,005	6,005
Total Baskets observed	4,439	6,005
% Baskets observed	*74%*	*100%*
Total Hooks sets	140,607	140,607
Total Hooks observed	103,728	140,607
% hooks observed	*74%*	*100%*
Range of Hooks between Floats (HBF)	23-25	20-30
Average HBF	23	23
Total Observed Yellowfin tuna	1438	2100
Total Observed Bigeye tuna	286	353
Total Observed Albacore tuna	1331	1864
Total Estimated Yellowfin tuna	*1949*	*2100*
Total Estimated Bigeye tuna	*388*	*353*
Total Estimated Albacore tuna	*1804*	*1864*

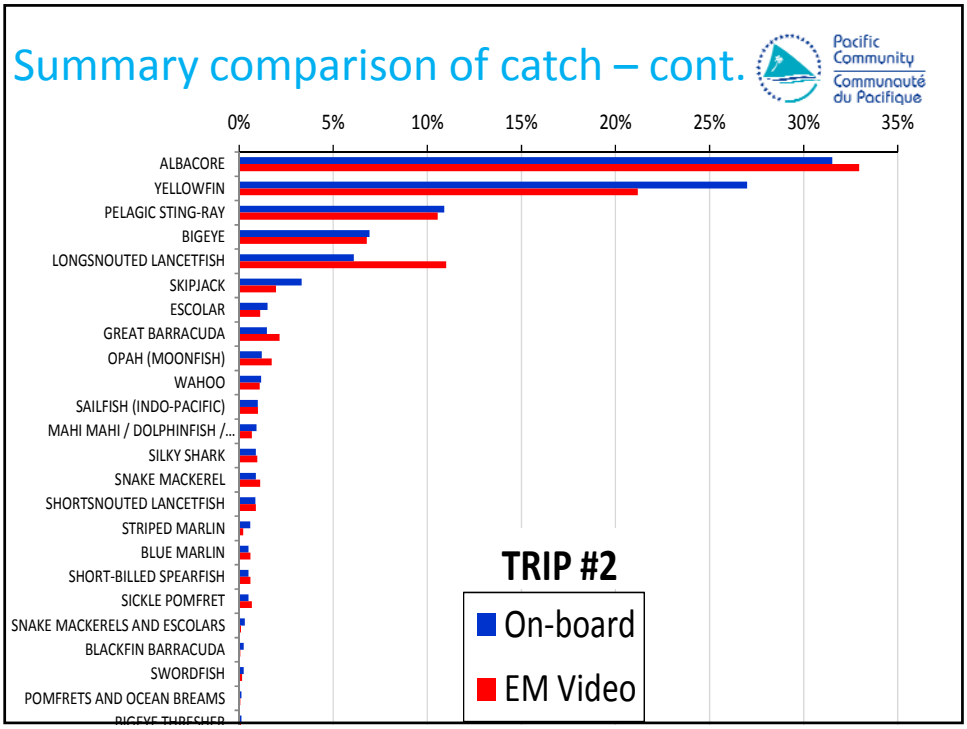
Key Results – Trip tracks (sets)



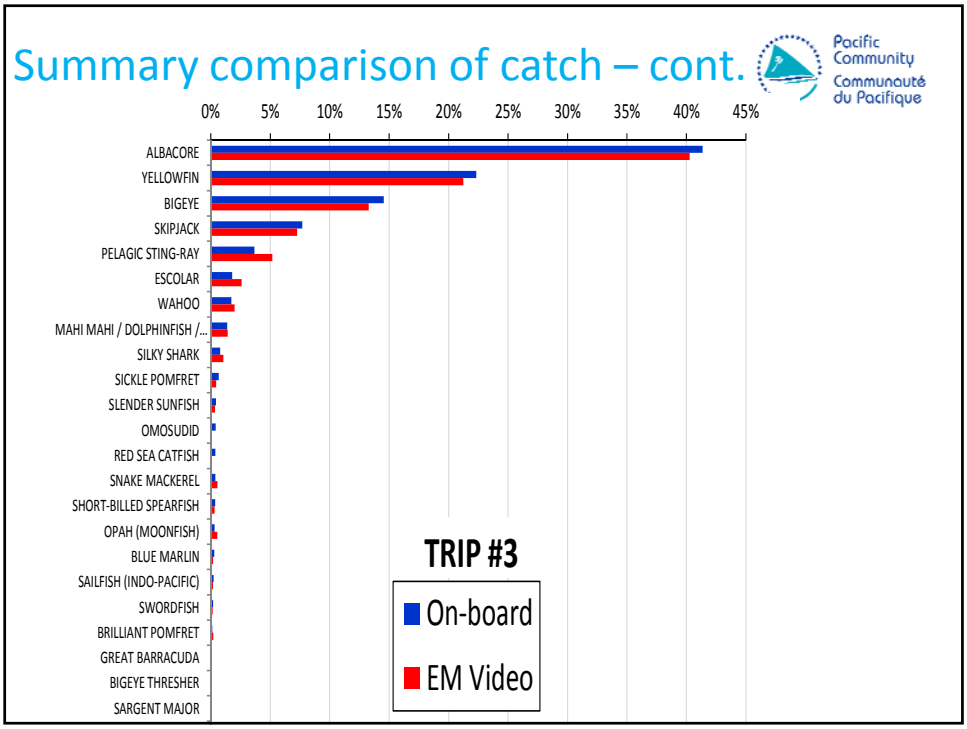
Summary comparison of catch



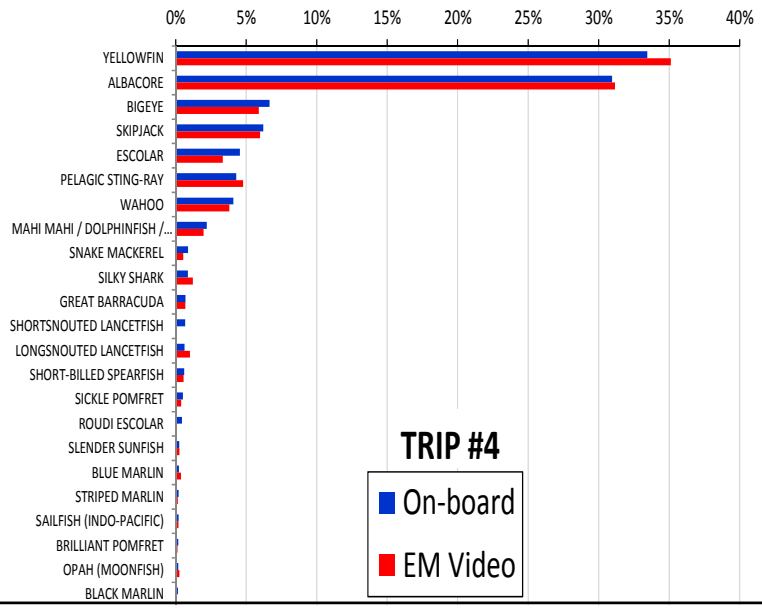
Summary comparison of catch – cont.



Summary comparison of catch – cont.



Summary comparison of catch – cont.



Comparative Analysis Method

- During the four trips, **not all sets were recorded by both methods** (i.e. when at sea observers were on breaks and when the EM equipment malfunctioned).
- **Statistical analyses were thus performed on 146 sets** surveyed during the four trips.

Trip	Number of sets surveyed by both methods	Number of sets only surveyed by the observers	Number of sets only surveyed by office observers
1	50	4	2
2	33	14	9
3	31	0	7
4	32	7	13
Total	146	25	31

Sorensen similarity index

- The number of fish recorded per set was compared between methods using the **Sorensen similarity index.**
- The Sorensen similarity index (S) compares the fish recorded between the two distinct observations.
- The index ranges from 0 (no similarity) to 1 (total similarity) and was calculated as follows:

$$S = \frac{2a}{2a + b + c}$$

where:

a = number of fish recorded in common (may include misidentification)
b = number of fish only recorded by the observer at sea
c = number of fish only recorded by the office observer

- The similarity was considered as **high** when **S > 0.75**, medium for 0.50 < S < 0.75 and low for S < 0.50.

Comparative Analysis Results

Sorensen index calculated on the number of fish recorded by each method

Similarity between the number of fish surveyed	Sorensen index	Number of set
High	0.75 < S	141
Medium	0.50 < S < 0.75	3
Low	S < 0.50	2

Comparative Analysis Results

- The number of fish recorded was **highly similar between methods for the majority of the sets** surveyed ($0.38 < S < 0.99$, S_{mean} = **0.88**
- Neither of the two methods was significantly better than the other to record total fish caught (in number).
- This **EM trial was therefore a viable method** for generating total fish number at the set level which was at least as accurate as the on–board observer.

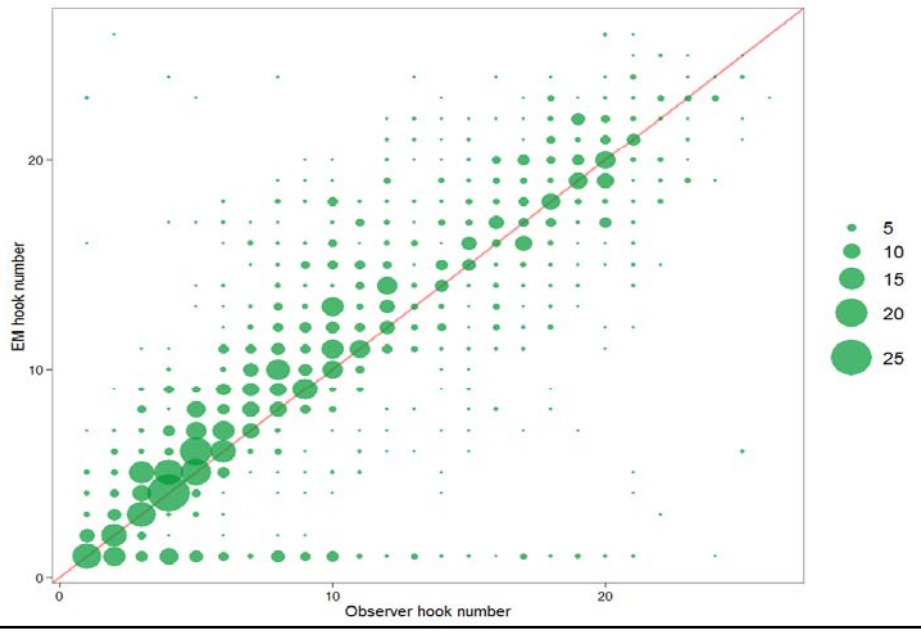
Comparative Analysis Results

- The identification of fish based on the matching of the office and onboard observers' data showed high correlation **(13 219 fish [94%] had the same identification).**
- Only six per cent of fish (832 fish) were identified differently.
- Most differences concerned tuna species such as bigeye , albacore, yellowfin and skipjack (379 fish).

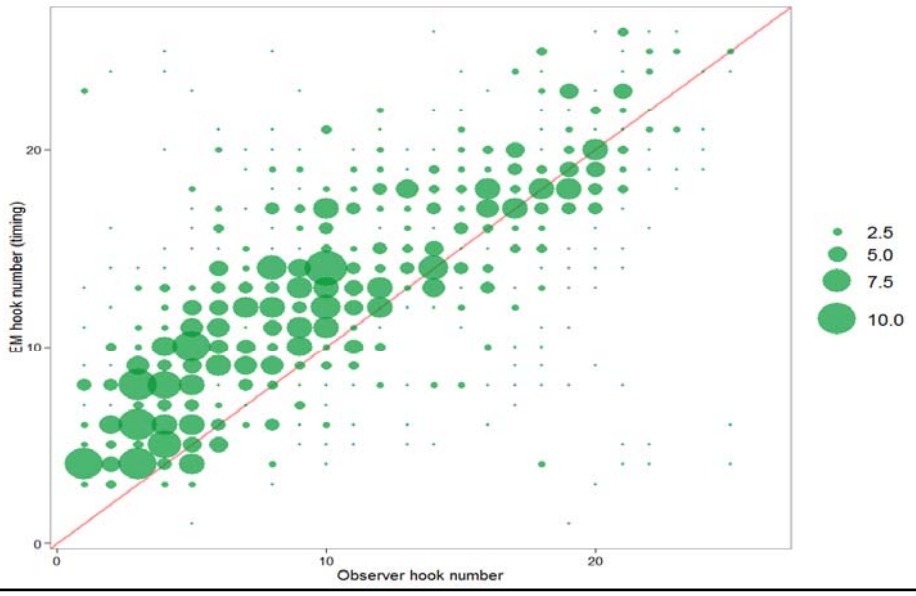
Comparison of fate codes

			% of matches of FATE code for each target tuna catch			
FATE		N	TRIP #1	TRIP #2	TRIP #3	TRIP #4
RWW	Retained - whole	5,497	98%	94%	94%	93%
RGT	Retained - gilled gutted and tailed	3,709	99%	94%	98%	98%
DTS	Discarded - too small	159	0%	78%	85%	63%
DWD	Discarded - Whale damage	83	91%	73%	50%	46%
RSD	Retained - Shark damage	67	29%	3%	0%	100%
DSD	Discarded - Shark damage	52	63%	100%	92%	63%
RCC	Retained - Crew Consumption	27	8%	0%	20%	0%
RWD	Retained - Whale Damage	18	0%	0%	0%	0%
	[Other FATE codes combined]	38	0%	50%	0%	0%

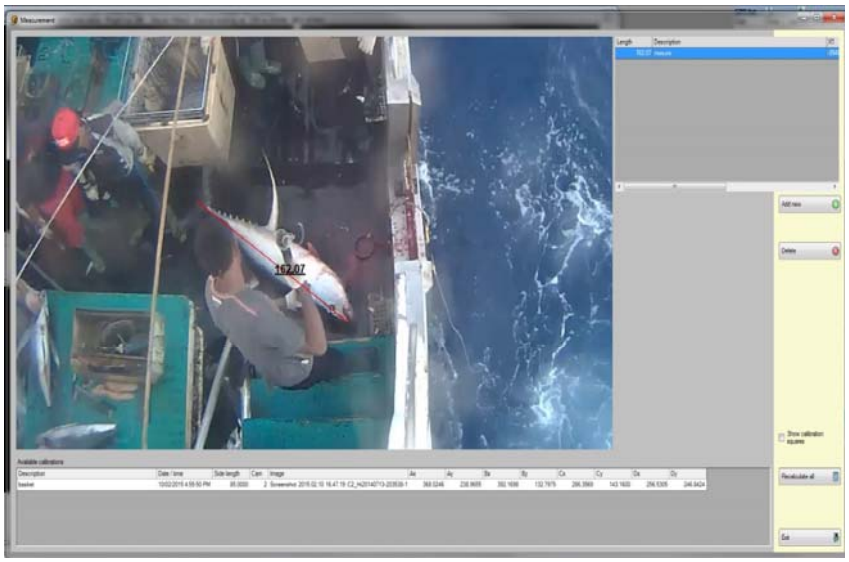
Comparison of hook

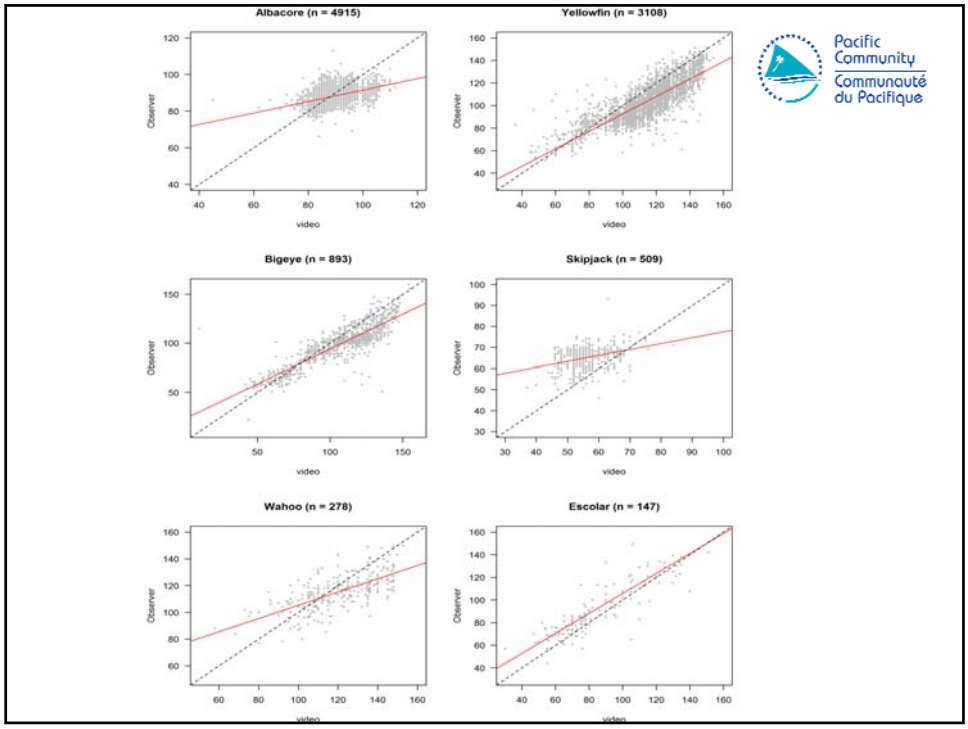


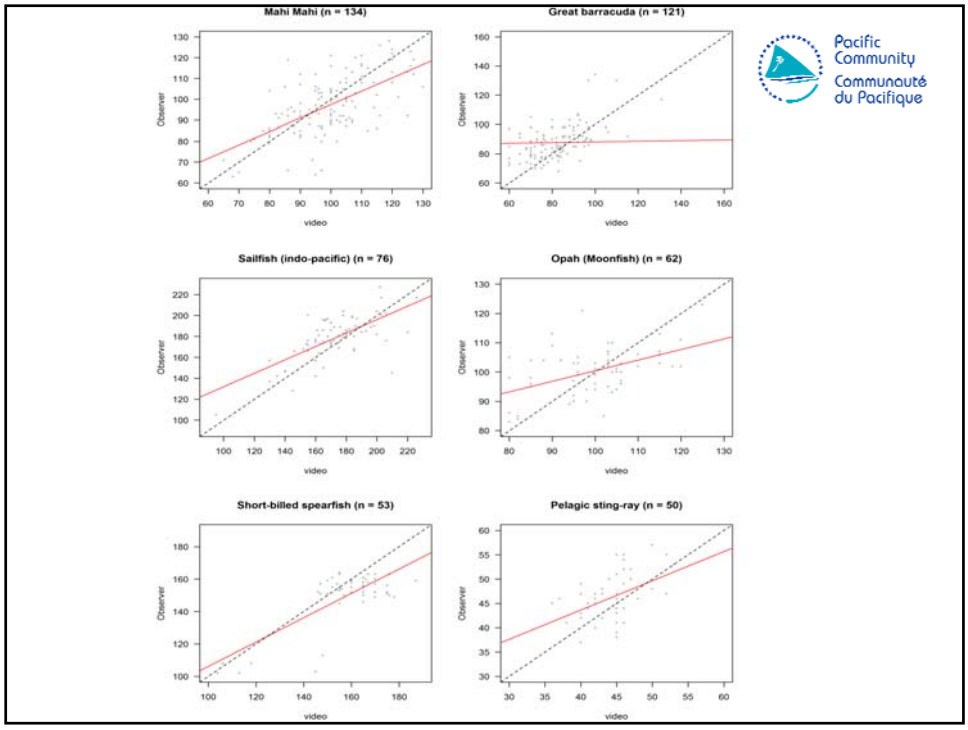
Comparison of hook # between floats

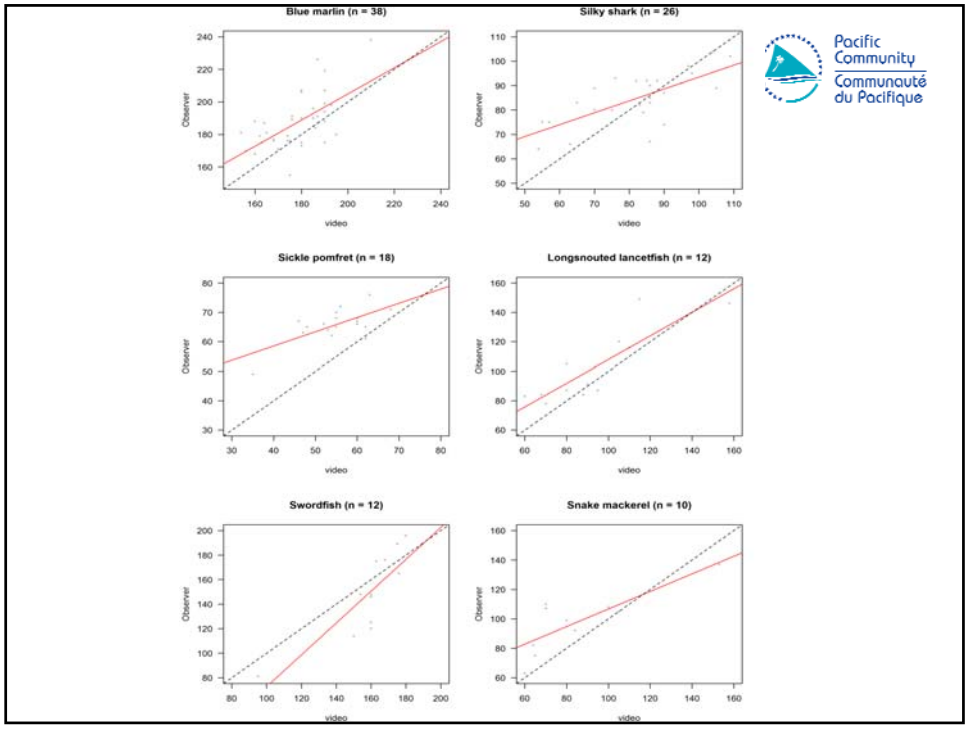


Length Measurements




Albacore (n = 4915)
Yellowfin (n = 3108)
Bigeye (n = 893)
Skipjack (n = 509)
Wahoo (n = 278)
Escolar (n = 147)
Observer
video


Mahi Mahi (n = 134)
Great barracuda (n = 121)
Sailfish (indo-pacific) (n = 76)
Opah (Moonfish) (n = 62)
Short-billed spearfish (n = 53)
Pelagic sting-ray (n = 50)
Observer
video



Key Recommendations

- The report identified 14 recommendations
- The following slides review some of key recommendations

Key Recommendations

- Future trials of E-Monitoring should **be established through an MOU clearly outlining the work involved and the roles of each stakeholder.**
- Any future E-Monitoring trials should consider a **review of how each of the WCPFC ROP minimum data fields** can be collected before the trial starts.

Key Recommendations - ctd

- The technical services providers should consider updating their system to **support the entry of data using formatting and data quality control equivalent to the TUBS system.**
- SPC-OFP and the technical service providers should develop **detailed protocol and procedures for undertaking the EM video analysis**

Key Recommendations - ctd

- The **amount of time and resources** for data preparation and analyses for future trials should be carefully planned.
- SPC-OFP and the service providers should consider **developing standard procedures and materials for training and auditing** to familiarise new office observers to the video analysis tool.

Key Recommendations - ctd

- Future EM trials should **consider how to collect the FLOAT and HOOK count data more efficiently**
- For example, the technical service providers should **investigate the possibility if electronic tagging of floats and hooks** which are integrated into their software.

Key Recommendations - ctd

- Future EM trials should consider the issues raised in the **generation of the length data using a digital measuring tool**, including assurance that the office observer is correctly using the tool.
- The **WCPFC ROP minimum data fields that are not possible to complete** using EM will need further investigation to assess which will or will not be possible to collect through E-Monitoring video analysis.

Accessing the Report

- Report is in draft version at the moment.
- Please send your request to maloh@spc.int for a copy of the report.

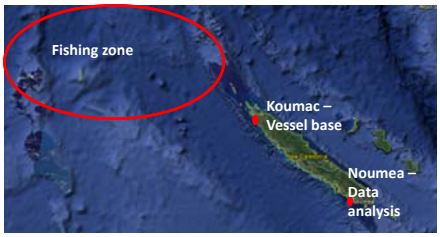
New Caledonia EM project

New Caledonia EM trial – 2015

- **Objective:** Determine if an EM programme can be established in NC
- **Vessel:** One ‘on ice’ tuna longline vessel
- **Equipment:** Satlink Sea Tube Lite
- **Trips duration:** Max 15 days – 12 sets/trip
- **Observer:** Onboard during one trip
- **Results:** June 2016

Why conduct this trial?

- Can EM be used to accurately monitor effort and catch activities.
- Increase observer coverage for fishing activities in a remote location.
- To determine the potential for fitting EM on other LL vessels in New Caledonia.



EM equipment

- 3 High definition cameras
- VMS antennae
- Central unit with 4 hard drives and

Cameras views

•Cam 1: Starboard and forward

•Cam 2: Aft section (shooter and bait station)

• Cam 3: Fish processing area

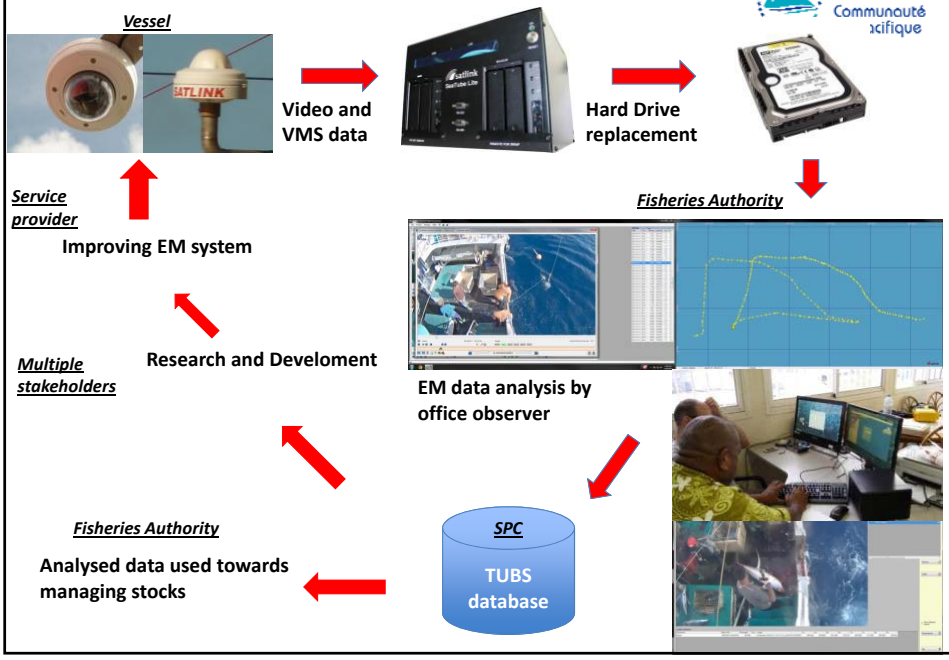
Project challenges

- Quality of the footage:
  - Camera positions not ideal (cam. 3)
  - Crew not cleaning lenses as often as needed
- Analysis of the footage:
  - Only one observer available (alternating between office/at sea work)

Next steps

- Comparative analysis:
  - Compare EM vs. on-board observer data
  - Focus on species and size composition data
- Reporting:
  - Technical and financial report for decision making
- Review and improve:
  - Camera positions
  - Crew maintenance procedures
  - EM data analysis procedures

Trials summary



Challenges Ahead

- Clearly identifying project needs and available resources
- Defining EM standards at national and regional levels
- Adapting national legislation
- Work on certification processes
- Standards for training office observers
- Costs of EM equipment and data analysis
- Industry support and acceptance
- EM raw data ownership

Take home messages

- EM in tuna fisheries is a budding technology with significant challenges
- **More trials are needed to address questions**
- **Industry support is essential**
- Consultation with SPC-OFP prior to launching EM projects
- No jobs at risk – capacity building of new skills – Need dedicated staff
- **Need to work towards win-win situations**

Testimony

Having experienced work as an office observer, MFMR senior fisheries observer, Harold Vilia stated that:

> *" As an observer, I am often at sea for long periods of time working in rough conditions.*
>
> *E-Monitoring allows me to do my job while seated comfortably in the office without getting splashed by a wave and to spend evenings with my family at home. "*

Thank you for your attention
Time for Q&A