Australian Government
Australian Fisheries Management Authority

Australia's Perspectives on the Benefits of Electronic Monitoring

Australia's EM Program

The Australian Fisheries Management Authority (AFMA) implemented Electronic Monitoring (EM) in four Commonwealth fisheries in 2015 to verify logbook data and protected species interaction data collected by fishers. Logbook data is used to conduct stock assessments, for the implementation and monitoring of harvest strategies and stock status and therefore, access to accurate logbook data is essential for evidence and science based fisheries management decisions. EM is one of two at sea monitoring tools, that like observers, provides valuable independent validation of fishing activities including validating logbook data. Independent monitoring is an essential component of effective fisheries management and critical for ensuring the confidence of the science underpinning fisheries management decisions. It provides accountability, transparency and confidence that the collected logbook data is comprehensive and complete. It also ensures confidence in the management arrangements themselves by monitoring compliance with the specific management measures.

In pursuing EM, AFMA aimed to investigate the potential for EM to provide an alternative option to onboard at sea monitoring by observers. Extensive trials were conducted between 2005-2014 demonstrated EM is an effective tool providing independent and verifiable data. It was shown that EM can be used to validate target catch, effort, interactions with protected species, and the deployment of required mitigation devices. Following these trials, in 2015 AFMA made EM mandatory in the Eastern Tuna and Billfish Fishery (ETBF), the Western Tuna and Billfish Fishery (WTBF), the Gillnet, Hook and Trap Fishery (GHATF) and the Small Pelagic Fishery (SPF).

AFMA's EM program is built meeting the specific data needs and monitoring objective of each fishery. Different EM data are collected during the review process, depending on the fishery and monitoring objectives under consideration. The footage analysis includes undertaking a full catch composition, discards, interactions with protected species and deployment of mitigation measures. This EM data is compared with logbook data and any discrepancies reported to AFMA. Essential elements of the program includes:

1. 100% EM coverage, that is, all vessels in these fisheries, above a minimum effort threshold, are required to install an EM system and for it to be functioning 95% of the time
2. AFMA applies an audit approach when analysing the collected EM footage, where a random sub-set of the total shots captured in video are selected for review.
    a. A minimum footage analysis requirement of 10% review of shots per boat with a minimum of one shot per month.
    b. Review rates may be higher than 10% in specific circumstances, i.e., to meet a specific spatial or temporal management measure or to monitor interactions with specific species. For example, the GHATF requires 100% footage analysis of protected species interactions in areas know to be important for Australian Sealions.

Benefit of EM

AFMA's EM program has realised and been able to demonstrate benefits in greater flexibility in available at-sea monitoring tools, the accuracy of logbook reporting generally and in particular reporting of discards and protected species.

At sea monitoring

In fisheries where EM has been made mandatory, the use of at sea observers has been fully replaced. Paired trials of observers and EM have demonstrated that the data traditionally collected by human observers has been able to be collected using EM. The well known and documented exception is biological data. In the four fisheries subject to EM, biological data including lengths, weights and biological samples (e.g., otoliths) continues to be collected through port sampling and/or crew based data collection programs.

Logbook data

In 2019 the Australian Bureau of Agricultural and Resource Economics (ABARES) independently assessed the congruence between the data generated during the analysis of EM footage with the associated logbook data[1]. The research demonstrated that, based on the weight of evidence, the use of an integrated EM system has resulted in significant changes in logbook reporting of discarded catch and protected species interactions (Figure 1) and improved the accuracy of logbook reporting generally.

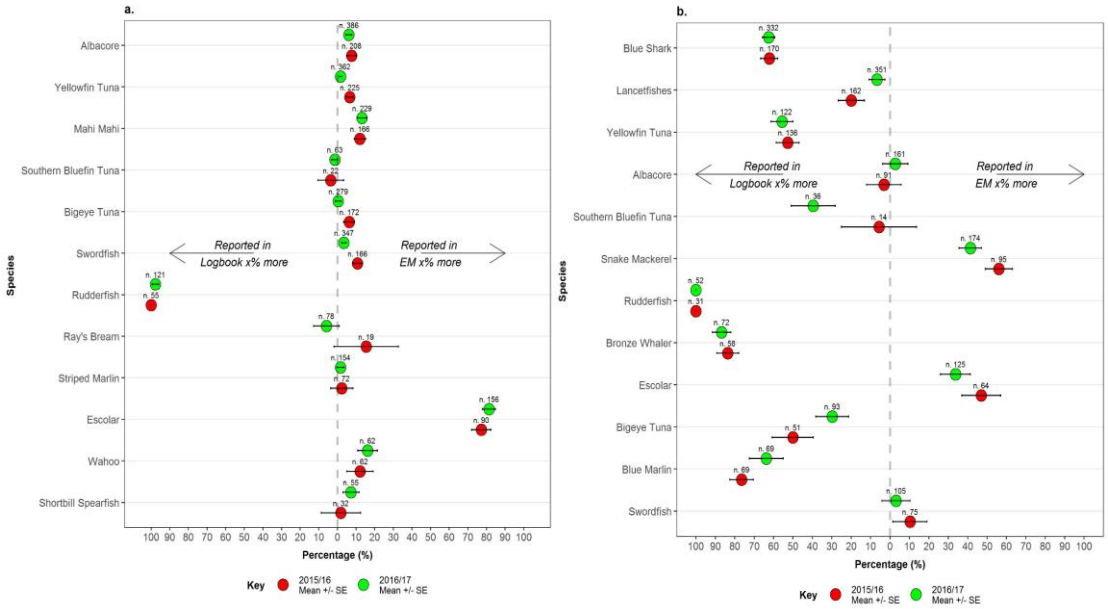

Figure 1: Proportional difference in individual species reported as (a) retained and (b) discarded in the ETBF by fishers in logbook and EM analyst across all sets in 2015/16 and 2016/17 financial years. Species are ordered by top twelve reported (a) retained and (b) discarded species from 2015/16 and 2016/17 logbook data. The number above the mean is the total shots audited where that species was (a) retained or (b) discarded.

Protected species reporting

EM has proved an essential tool for monitoring interactions with protected species. The 2019 congruence analysis undertaken by ABARES demonstrated that, except for sharks, there was a significant increase in logbook reporting by fishers of all protected species interactions between non-

[1] Emery T. J.; Noriega, R.; Williams, A. J; Larcombe, J. (2019). *Measuring the congruence between electronic monitoring and logbook data in Australian Commonwealth longline and gillnet fisheries*. Ocean and Coastal Management, https://doi.org/10.1016/j.ocecoaman.2018.11.003.

EM and EM years (Figure 2). Similarly, AFMA monitors the protected species reporting. Figure 3 shows the protected species reporting in the ETBF and WTFB before and after the implementation of EM in 2015, shown by the orange line. Initially there was an increased reporting of the interactions enabling AFMA to review and amend the protected species mitigation and management arrangements. In the years following the implementation of these amended management arrangements, the reporting has remain very high (congruence with the logbook data confirms this), but there has been a demonstrable declined in protected species interactions and therefore associated reporting as mitigation measures have improved.

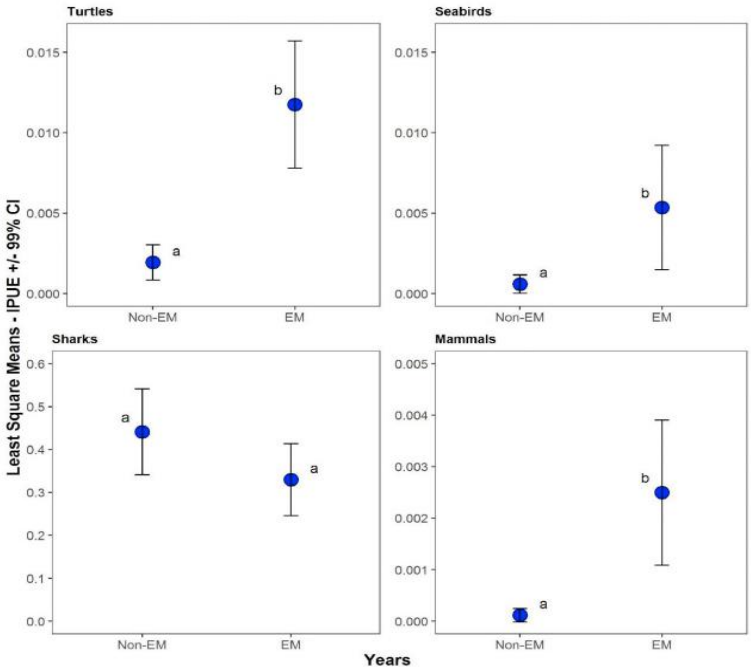

Figure 2: Least squares means ± 99% Confidence intervals of protected species interaction per unit effort (IPUE) (number of individuals interacted with per 1000hooks) by ETBF vessels that fished all years in EM (2015/16, 2016/17) and non-EM (2009/10 to 2014/15) years for groups of protected species. Means no sharing a letter are significantly different. At p <0.01 (Tukey-adjusted comparisons).

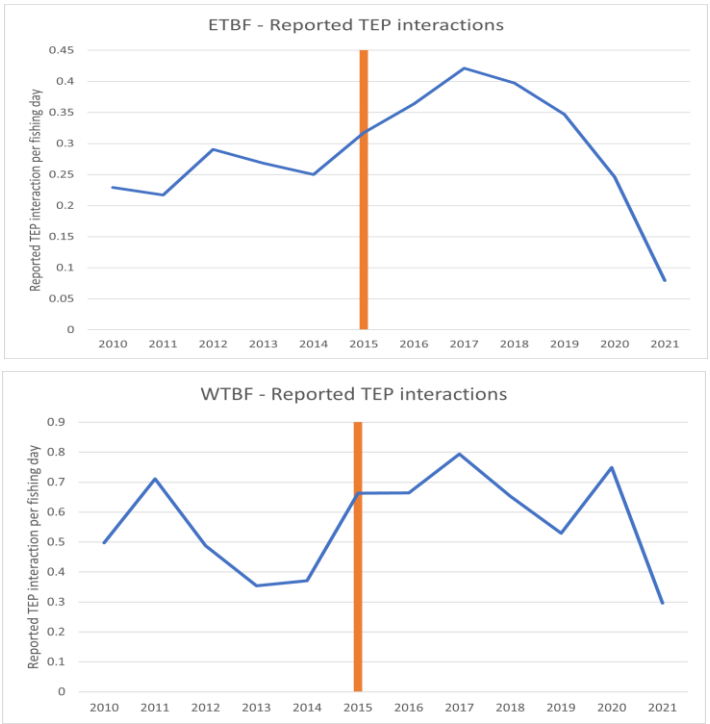

Figure 3: Reported interactions with protected species in the Eastern (above) and Western (below) Tuna and Billfish Fisheries before and after the implementation of electronic reporting (shown by the orange line).

Management and compliance

EM has supported the implementation of more targeted management arrangements, for example discrete spatial closures to reduce the risk of interactions with protected species, for example Australian Sealions. EM has provided opportunities to understand vessel level differences in interactions and actively supported vessel level capacity building to improve the use and outcomes of mitigation strategies.

EM has supported better risk assessment and risk profiling for AFMA's risk based compliance program. EM has supported the compliance planning and enabled better targeting of the activities against the known risks in the fisheries with EM. This contrasts the broader approach to compliance planning in those fisheries without EM. AFMA's compliance team has also demonstrated the implication of EM through time, with a clear reduction in the untoward behaviour reports, for example failing to report interactions with protected species (Figure 4).

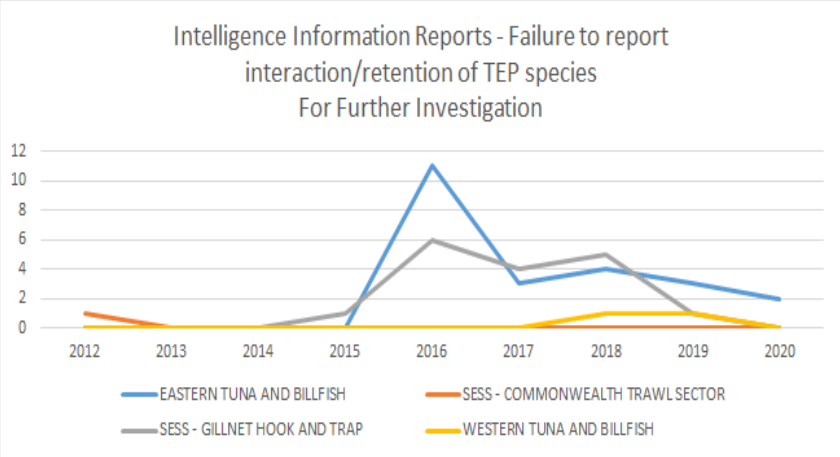

Figure 4: AMFA Compliance intelligence report demonstrating the initial spike in non-compliance with protected species reporting, followed by a significant and lasting decline in non-compliance, i.e., there is greater reporting of protected species in fisheries using EM.

Geolocation data

AFMA has been able to demonstrate that the geolocation data from the EM system can provide the same data as traditional vessel tracking using VMS. Of note was that using EM as the geolocation data source provided a more detailed understanding of the vessel activities because of the linked sensor feed. AFMA's compliance teams were able to clearly delineate 'innocent passage' from fishing event with the integrated sensor data on the GPS feed (Figure 5). AFMA is continuing to explore options of streamlining regulated technology requirements for fisheries management purposes.

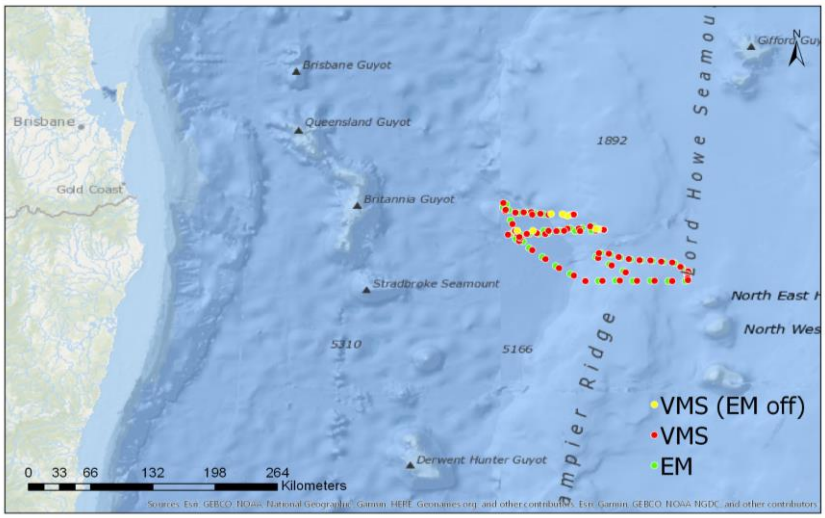

Figure 5: VMS and EM geolocation tracks, blue showing the VMS and red showing the EM tracks including the sensor data.

AFMA's Perspectives on the Benefits of EM

Over the past eight years, AFMA has been able to demonstrate a range of benefits from the EM program. Although it is desirable to have a quantified cost-benefit analysis, this is difficult to achieve for an EM program. That said, there are quantified examples showing that EM has:

1. Increased the accuracy and confidence in the logbook data
2. Supported more targeted risk-based management arrangements, including the implementation of discrete spatial and temporal management arrangements
3. Enabled compliance programs to target the risks in the fishery, rather than applying broad approaches
4. Supported greater vessel specific compliance programs
5. Improved the ability to detect and address untoward behaviour, including the identification and rectification of previously unknown compliance issues
6. Improved transparency between stakeholders including supporting more rigorous management discussions.

Decreasing uncertainty in fisheries data is paramount for stock assessments, for the implementation of harvest strategies, and for measuring the success of management measures. The demonstrated congruence between the EM data and the logbook data has improved AFMA's confidence in the accuracy of the logbook data being collected and has supported AFMA's original supposition that EM can:

- ✓ Verify data collected by other monitoring tools, for AFMA is this logbook data including protected species logbook data, and
- ✓ Collect data that is also collected by other monitoring tools, suggesting that with improvement in AI-ML there is possibility of using EM as a primary data collection tool.

It is likely that the congruence analysis also supports AFMA's 10% footage analysis rate as providing a good reflection of all the logbook data. However, it is also likely to be affected by the EM coverage rate, the number of vessels with EM onboard in the fishery, and the random selection of the shots to be reviewed. AFMA's EM program requires 100% EM coverage, that is all vessels in the four fisheries are required to have EM onboard and conducts analysis on a random 10% of shots by boat.

These elements combined with the known presence of EM on a vessel impacts the behaviour of crew (e.g., logbook reporting). This is a well-known effect of surveillance referred to as the 'camera effect'. Industry is aware that they are subject to EM analysis but are not aware of which shot from the trip will be analysed. This 'camera effect' seems to be resulting in more accurate logbook reporting across the fishery generally which in turn is increasing the accuracy of all logbook data collected from the fishery generally and importantly for protected species interactions. Complete logbook reporting by fishers of their interactions generally enables more accurate estimates of total interactions to be determined leading to more confidence in the management and/or mitigation measures.

The independent and verified results obtained through EM are definitive and has been instrumental in underpinning management conversations between stakeholders. In one instance, EM data has been instrumental in proving that the fishery mitigation methods were effective and that the continued decline of the protected species was external to the fishing industry.

Critical for both management and compliance, the behavioural changes resulting from the use of EM are long lasting. The outcome of this are more accurate data and increased confidence in the data underpinning management arrangements and with the improved compliance, greater confidence in the effectiveness of the management arrangements at achieving their objectives supporting more discrete and risk based management rather than fishery wide management arrangements.

AFMA is an EM advocate, but AFMA also recognised that EM is not a panacea. EM is one in a suite of monitoring tools used by AFMA to manage and monitor fisheries and a one size fits all approach to monitoring fisheries is no longer the best approach.

Essential to AFMA is that the data needed for fisheries management decisions drive the mix of monitoring tools to be used in the fishery. The use of EM will depend on the fishery and the monitoring objective under consideration. The collection of biological data and or samples is likely to remain under the remit of the observer and port monitoring programs while EM could replace the use of VMS as a geolocation tool in some fisheries.

EM programs are costly to plan and implement. AFMA's EM program took significant time and resources to design, develop and implement. Along with the change management and engagement with industry, a range of legislative, regulatory, policy, procedures and arrangements need to be developed to support the program. However, once established, the EM program has largely operated without significant oversight.

AFMA's EM program is 100% cost recovered from relevant industry sectors, so the benefits of EM need to be demonstrated and realised to maintain confidence in the program and broader management measures. Although costs remain an issue, industry is supportive of EM as a monitoring tool. It has provided accountability and transparency that were not as apparent with other monitoring tools.

AFMA's EM journey and the lesson learnt has identified the follow key ingredients in a successful EM program:

- ✓ That the data needs of the fishery drive the design of the EM program, and that industry is a co-designer of the program's design
- ✓ A requirement for 100% coverage, that is that all fishing activities in the fishery are subject and captured by EM
- ✓ An audit approach for EM footage analysis, that is that a random selection of total shots are selected for footage analysis

- ✓ Industry ownership of the EM systems to support ongoing maintenance of the systems including while at sea
- ✓ Regulations specifying the maintenance of the systems to ensure the collection of high quality footage, for example a requirement for regular testing and cleaning and for vendors to provide rigorous services to industry, and
- ✓ Seeking to integrate and/or provide greater interoperability between the various monitoring tools required by fishers under the regulation.