The Nature Conservancy

At-Sea Monitoring:

Electronic Monitoring (EM)

Photo: Mediterranean Conservation Society

Monitoring fishing activities at sea is a key component of modern fisheries management and provides fisheries managers and scientists with independently verified data on catch, fishing effort, location, fishing duration, and interactions with protected species, with that collected by fishers in their daily catch and effort logbooks.

A range of monitoring tools are available to provide independent fisheries data. These include geolocation data from vessel monitoring systems (VMS), and verification of catch, effort, and interactions with marine species through observers onboard the vessels. Increasingly, fisheries managers are using Electronic Monitoring (also known as Remote Electronic Monitoring or REM) to gather independently verified data on catch, effort, fishing location, duration, interactions with protected species, and discarding. While any electronic tool (e.g., VMS or electronic logbooks) can be considered as 'electronic monitoring', the term EM generally refers to the use of onboard cameras to monitor fishing activities.

What is EM?

Electronic Monitoring (EM) refers to the use of cameras onboard fishing vessels, integrated with a geolocation device (GPS) and sensors that detect specific vessel actions, such as setting or hauling of fishing gear that trigger video recording.

EM is a closed system, meaning the camera, GPS, and sensor data is tamper-evident, with any manipulation of the data evident to authorities. The data collected by the EM system is recorded on either external hard drives or stored in the cloud and transmitted to the relevant fishery authority and/or approved third-party for review.

> *"Electronic Monitoring (EM) uses tamper-evident cameras, GPS, and sensors on fishing vessels to securely record activity and transmit data to authorities for review."*

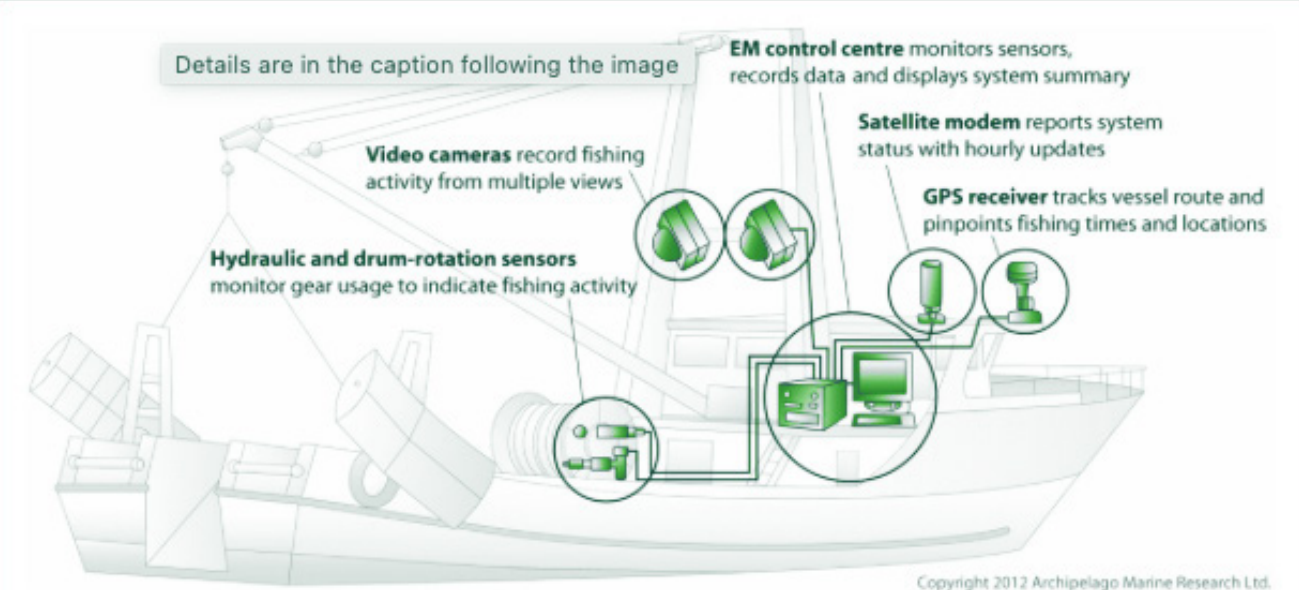

Figure 1. Schematic of an electronic monitoring systems onboard a vessel, showing the components of the EM system.

How does EM work?

Depending on the fishery, the types of vessels operating in that fishery and the objectives of the EM program, EM may be set up and operate slightly differently. Generally, EM uses video camera technology coupled with sensors. The sensors can be physical sensors, such as those on the drum and/or winch, or sensors integrated in the review software.

The cameras record specific fishing activities and/or areas of the vessel, either when triggered by sensors or continuously. For example, the camera might focus on where the catch is hauled onto the vessel or where it is processed.

An onboard computer and associated hard drive store the video footage, or the system may automatically upload the footage to a cloud-based storage location.

Irrespective of cloud-based system or external hard drive, the video footage from the vessel is uploaded to the relevant flag state authorities or an external third-party review company. At this stage, the footage is often analysed and compared with the fisher's daily catch and effort logbook record for the same event.

"EM systems vary by fishery but generally use cameras and sensors to record key fishing activities, storing footage onboard or in the cloud for later review against logbook data by authorities or third parties."

Why is EM needed?

EM is used to monitor activities at sea and provides managers with independently verified data on catch, effort, location, fishing duration, and interactions with protected species, which is collected by fishers in their daily catch and effort logbooks. Collecting independently verified data enables the fisheries managers and scientists to understand and assess the reliability of the statistical data, that is, the daily catch and effort data collected in logbooks, by removing inaccuracies due to human effort or biases, that are being used to:

- Conduct stock assessments
- Determine the status of the target species population
- Support the development and refinement of management procedures or harvest strategies
- Drive continuous improvement of bycatch handling and sage release
- Support improved product quality, handing, and commercial insights

The use of at-sea monitoring is also critical in assessing a fisher's compliance with the regulations, rules, and policies. By understanding the level of compliance with the management arrangements, fisheries managers are better equipped to refine or implement new management measures to address the real risks in the fishery. EM also enables the detection of unscrupulous operators and their illegal, unregulated or unreported (IUU) catch.

Data collection is fundamental to effective fisheries management. As this data is gathered at increasingly finer scales, it will also enable adaptive fisheries management under future climate conditions.

What information does EM record?

EM records all fishing activities in the camera's field of view onboard the vessel. The specific objectives of the EM program determine the placement of the cameras. Review protocols will dictate the data is analysed during the video footage review stage, and how this data is compared with the daily catch and effort logbook data.

The flag state authority may set predetermined tolerances for any discrepancies between the data reported by fishers in their daily catch and effort logbook and the data collected from the EM system.

The EM data is first collected as video footage files that are, once reviewed, converted into data files (e.g., species, numbers, etc.), the same as logbook files, and stored in databases.

> *"EM captures fishing activity for review and comparison with logbooks, with discrepancies assessed by flag state rules."*

How is the information used?

The overarching objective of fisheries monitoring is to provide independent verification of the fishing activities at sea. EM systems are one key tool to achieve this, offering independently verified data on fishing effort, compliance, and catch composition. This enables fisheries managers and scientists to:

- **Improve the accuracy of statistical data** that is used to conduct stock assessments, determine the status of the target species population, and support the development and refinement of management procedures or harvest strategies.

- **Monitoring fisher's implementation** and compliance with fisheries regulations, rules, and policies enables management measures to be refined and implemented to address the real risks of fishing.

- **Enhance the detail and precision of data collection** from the fishery, particularly at fine spatial and temporal scales, which are critical for adaptive management.

- **Build stakeholder and consumer trust** in the fisheries management and supporting third-party accreditation of the fishery with greater transparency and efficiency/ efficacy of activities at-sea.

The Nature Conservancy