Industrial Fisheries Electronic Monitoring in the Indian Ocean; The Kenya Pilot study

Edward Kimani, Esther Fondo, Janet Mwangata, Almubarak Athman, Fatuma Mzingirwa, Stephen Ndegwa, Donald Obiero, Elizabeth Mueni, Eric Thuranira, Ana Nadal, Christi Smith, Josh Weirsma, Jeremy Crawford Collins Ndoro, George Maina

Overview Kenya EM Piot Project

With IOTC's Resolution 23/08, Electronic Monitoring (EM) can be used to support Regional Observer Scheme (ROS) data collection requirements. Kenya is undertaking a Pilot EM project to evaluate the requirements for full implementation in the industrial fishing fleet. This report provides the progress and experience gathered from the Pilot project. The management of fisheries worldwide depend on data from log books collected by fisheries authorities from the fishers, port-side inspections, scientific surveys or onboard human observers, to evaluate the status of the fishery. The data collection through these approaches is costly in terms of human capacity, often incomplete, biased and vulnerable to manipulation due to the vested interest of those involved. Thus, the use of fishery-dependent data in determining the status of fish stocks has been questioned (Cotter & Pilling, 2007). In particular, logbook data often does not include information on all fish caught, since catch that is discarded at sea represent a large proportion of the total catch (Uhlmann et al., 2014; Ulleweit, Stransky, & Panten,2010). Misreporting may also occur when fishers under-report the catch and by-catch in quota-limited fisheries (Borges, 2015). Without effective monitoring and enforcement, fisheries will struggle to reach sustainability. Most fisheries in the world lack reliable data on what happens on-the-water to inform and implement science-based management.

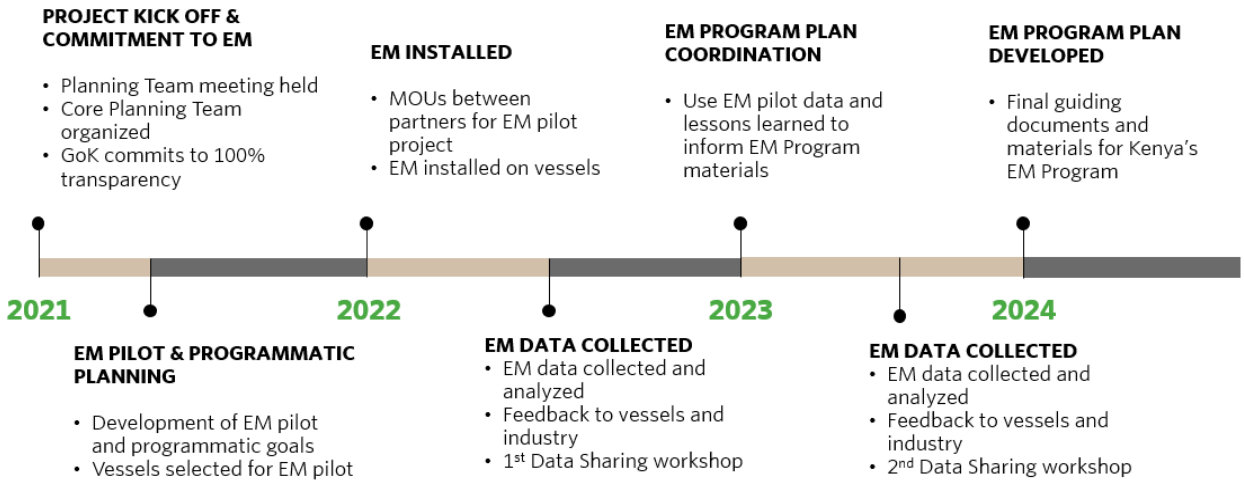
The rapid advancement of technology, including GPS, internet communication, digital cameras and image analysis software, provides an opportunity for continuous remote Electronic Monitoring (EM) and recording of fishing activities on fishing vessels at sea. The EM technology was initially developed by the fishing industry to monitor theft of catch and fishing gears, but it was quickly recognized that EM could also be used for monitoring and control in fisheries and to improve coverage of at-sea observations (McElderry, Schrader, & Illingworth, 2003). The main advantages of EM include cost-efficiency, the potential to provide more representative coverage of the fleet than the fisheries observer programme and the enhanced recording of fishing activity and location (van Helmond et al. 2028). An EM program supplements fisheries observer data and may potentially support fisheries certification and enhance transparency in fishery operations.

With Kenya's industrial fleet increasing in the West Indian Ocean Region and human observer capacity remaining stationary, there is value of using EM to improve fisheries monitoring, enhance transparency, provide faster communication, and avoid complacency with the current human observer program. The Government of Kenya (GoK), in collaboration with The Nature Conservancy (TNC) with funding for IKI, is piloting Electronic Monitoring (EM) to determine the

requirements in human capacity and infrastructure required to develop a full-scale EM program covering all industrial fishing vessels. The EM pilot project is being used to test and gather lessons on how an EM program could be designed to support 100% EM application in industrial vessels, including installation and recurrent costs, human capacity required to man the program, and infrastructure requirements. While Fisheries management will use EM to address management and compliance issues, the data collected will be used to validate logbooks records. The project is a collaborative effort including research, fisheries management and the support and buy-in from the fishing industry. The goal of the project is to use innovative technology to improve management of offshore fisheries, reduce illegal, unreported, and unregulated (IUU) fishing activities, and decrease bycatch of endangered, threatened and protected (ETP) species. This report provides the results of the pilot project collected from the EM system in selected vessels between August 2023 and February 2024 compared fisheries observer data.

Pilot project work plan

The project was initiated by undertaking a scoping process to determine the potential stakeholders with interest in industrial fisheries, the number of vessels to be involved and the roles and responsibilities of the key agencies and stakeholders. Communication material including factsheets and targeted presentations were prepared and shared with the fishing industry to informed them of the project during the project preparation meetings. This was followed by the identification of the vessel owners willing to participate in the EM pilot. A roadmap with key activities and milestones was prepared to guide the project (Figure 1). The core team hosted an in-person meeting with industry to go over the EM project, roles and responsibilities and solicit feedback from industry. The meetings also provided a chance for the industry to indicate their willingness to participate in the Pilot project. The core team from research and fisheries management prepared data requirements for each vessel gear type. The data requirements were used to support the procurement for a suitable service provider to support the project by providing the required equipment and infrastructure. Information non-disclosure agreements and cooperative agreements were prepared for signing and shared with the cooperating fishing companies to guide the cooperation between the fishing companies and the fishing authority. The installation of the equipment in the participating vessels was the next activity followed by data collection and analysis. Training of local experts on data processing was also undertaken using the data collected during the project. The sharing of the reports with individual fishing companies to present the “good” and the “bad” activities and provide recommendations for improvement was the next millstone the project. The final activity is to prepare a final report with all the information required to guide Kenya I implementing EM in the marine industrial fishing fleet.



The pilot fleet

Four vessels are participating in the Pilot EM project including three longliners and one trawler. Each vessel was surveyed to determine the fishing operation areas including the fishing gear deployment and retrieval, as well as the fish processing and packaging area to determine the position and number of video cameras requirements for each vessel. The Video cameras installed are HIKVISION Network Camera, Verifocal Bullet camera (8MP) with a Server POC – 451VTC Computer and Starlink Satellite maritime system. The video cameras were installed in position to capture the activities that take place during gear deployment, gear recovery and processing of the catch in each vessel on different dates between August 2023 and April 2024. The cameras were set to capture video images in real-time to clearly record the activities during the deployment, recovery of fishing gear and processing of the catch. Together with the video record other support data captured by the system include GPS location and time recorded by the server The data captured by the equipment was transmitted through Starlink to cloud storage.

Table 1. Vessel type, date of installation, Starlink serial number and number of cameras installed.

No	Vessel Name	Date	Model	Serial number	Number of cameras installed
1	Longliner	2nd August 2023	UTA-222	HPCP300283003301	4
2	Trawler	5th August 2023	UTA-222	HPCP2090650A4201	5
3	Longliner	8th January 2024	UTA-224	HPCP2090650A44	5
4	longliner	9th April 2024		HPCP301020302901	5

EM data review

The video data is stored at the cloud and can be retrieved for analysis through an authorized password, set to protect the data. An expert engaged by the service provider extracts the data from the video footage. During analysis, the video is projected on a wide screen and all fishing events are marked and attached to an internet link. The link is then entered into a spreadsheet with the associated GPS location and time. The IOTC guidelines on the status of fish species are used to select the species of concern in the region. This status of species of special concert is recorded as dead, alive and active, and the fate recorded as released alive, or processed and retained. From a marked scale of the deck of the vessel, the size (Total Length, Lower Jaw Length) of each fish is estimated and the size converted to weight using the length weight relationship formula for the species from FishBase and other literature. The species, numbers and weights for each fishing event are recorded for further analysis and evaluation. Data analysis was undertaken to describe the EM data and compare it to observers' data.

Process of data collection being implemented in the WIO region

The fisheries data collection in the region is a responsibility of each country. Through the fisheries agencies the countries gather all fisheries landing data and share with the FAO for which reports global fisheries statistics every year. For marine transboundary fishery species, countries report their catch data and any other data to Regional Fisheries Organizations. The RFO puts the data together and analyses to provide the status of key species to guide their exploitation. The RFO for the Indian Ocean is the IOTC which organizes the management of selected transboundary species.

Final products and their use

The first product from EM is the trip reports. This provides information on the fishing operation including vessel movement log as GPS positions, vessel activity - deploying, revival of fishing gear, steaming, as well as the catch information. The information on the catch includes the species, the size, weight, and fate of each individual fish. The data is then summarized to provide the total catches, the total and species of discarded fish, as well as the handling and fate of species of conservation concern in the Indian Ocean. This information is analyzed and a periodic technical report prepared for the fishery. The size frequency data will further be used to provide some of the indicators for stock status of the key commercial species in the Indian Ocean. This information is used to prepare management recommendations and guidelines for the fishery.

Highlights

Most of the activities planned for the scoping phase including preparation of project documents and communication materials and bringing the stakeholders together achieved in time. The target

number of vessels also arrived early in the project. This report will use 8 trips covered by EM between August 2023 and March 2024. The data offers an opportunity to compare EM and fisheries observer data collected on four trips (Annex 1). During the time a scale of the deck of the operation area was done and the crew requested to ensure each fish was laid on the scale to provide a size estimate of each fish. The EM was able to accurately read off the size of the fish during data video review and weight estimated from existing length-weight relationship formula therefore providing both individual weight and total weight of the catches. However, there were challenges that slowed the implementation of the project including

Challenges

- Getting the confidence of fishing companies to participate in the pilot was a major challenge. In the end four vessels were willing to participate. However, one of the longline vessels has been out fishing for several trips, the second longline vessel went out for two trips only while one has not been able to go out for fishing.
- There is still suspension among the stakeholders on the confidentiality issues on fisheries data. Fishers feel that data collected through the EM may fall into the hands of competitors while the government agencies have concerns on the security of satellite communication.
- The signing of the non-discloser and cooperative agreement has not happened. The cooperative agreement was to provide a framework to guide the activities of the fishing company and their crew and the fishing authority.
- The maintenance of the equipment on board the trawler has been a challenge with video footage available for only a short time. Getting to the vessel to repair the equipment at sea has been a challenge too.
- The identification of a few species, especially the smaller species, was found to be a challenge. However, the species identity was easily cleared during further consultations among the experts
- The support provided by the top fishery management has been inadequate in particular through committing to have EM as a key requirement for fishing vessels

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The species list for EM and Human Observers

	Scientific Name	**Common name**	**Research Data**	**EM Data**	**Variance (EM-Research)**
1	*Acanthocybium solandri*	Wahoo	1	1	0
2	*Alepisaurus spp.*	Lancetfish	0	13	-13
3	*Carcharhinus falciformis*	Silkey shark	18	24	-6
4	*Coryphaena hippurus*	Mahi mahi (common dolphin fish)	8	8	0
5	*Dermochelys coriacea*	Leatherback turtle	1	1	0
6	*Epinephelus lanceolatus*	Giant grouper	1	0	1
7	*Galeocerdo cuvier*	Tiger shark	1	0	1
8	*Istiophorus platypterus*	Indo-Pacific sail fish	6	6	0
9	*Isurus oxyrinchus*	Shirtfin Mako shark	1	1	0
10	*Kajikia audax*	Striped Marlin	5	7	-2
11	*Lepidocybium flavobrunneum*	Escolar	2	0	2

12	*Manta birostris*	Giant Manta ray	1	0	1
13	*Mobula spp.*	Mobula nei	**0**	1	-1
14	*Prionace glauca*	Oceanic Blue shark	11	10	1
15	*Ruvettus pretiosus*	Oilfish	1	5	-4
16	*Sphyraena barracuda*	Barracuda	26	27	-1
17	*Sphyrna lewini*	Scalloped hammerhead	1	0	1
18	*Sphyrna mokarran*	Great hammerhead shark	1	2	-1
19	*Tetrapturus angustirostris*	Short-billed spearfish	3	2	1
20	*Thunnus albacares*	Yellowfin tuna	7	14	-7
21	*Thunnus maccoyii*	Southern bluefin tuna	0	6	-6
22	*Thunnus obesus*	Bigeye tuna	6	1	5
23	Unknown Species Type	Unidentified species	0	1	-1
24	*Xiphias gladius*	Swordfish	363	325	-38
	Total		**464**	**454**	