

Consideration of the correspondence between the electronic monitoring system (EMS)
and the regional observer scheme (ROS) in IOTC

Sachiko TSUJI, Daisuke OCHI

Introduction:

This document was prepared for partially respond the item 5 of the IOTC Resolution 23/08 on Electronic Monitoring Standards for IOTC Fisheries, requesting the Scientific Committee to review the ROS minimum required data fields “a) to identify any fields that are logistically difficult for EM and/or human observers to collect, respectively,” and “b) provide advice and recommendations to the Commission on the need and use of those identified fields for scientific purposes, and their collection and reporting status (i.e. mandatory, non-mandatory etc.)”.

The comparative consideration between EMS and ROS was only made on monitoring/ observation of longline fishing events, with special focus on data and information needs for conducting scientific analysis on bycatch and ecosystem-related issues. The document reflects personal views as a scientist and does not represent and presume any formal position of the Government.

While the Resolution 22/04 defined the EMS as “an integrated system of hardware and software that supports acquisition of video footage of fishing activity, positional data and/or sensor, that allows the analysis and reporting of EM records”, in this consideration, the term EMS is considered to cover a whole process until the production of ROS equivalent data through analysis. In other words, the authors considered only processed footage as ROS equivalent, not mere set of footage and other integrated information without processing.

For a sake of comparison, EMS was assumed to operate independently according to the IOTC Resolution 23/08 standard, without any special interference with vessel crews/ fishing master/ captain and being analyzed with image processor at the level which could identify basic taxonomic groups at family level and measure distances between two points automatically detected or provided by analysts.

Methods and results:

The IOTC Resolution 22/04 on a Regional Observer Scheme indicated the obligation of observers as:

- a. record and report fishing activities, verify positions of the vessel;
- b. observe and estimate catches as far as possible with a view to identifying catch composition and bycatch and to monitoring discards including their fate (e.g. released alive) and size frequency;
- c. record the gear type, mesh size and attachments employed by the master;
- d. collect information to enable the cross-checking of entries made to the logbooks (species composition and quantities, live and processed weight and location, where available); and
- e. carry out such scientific work (e.g. collecting samples), as requested by the IOTC Scientific Committee.

ROS/ EMS capabilities were reviewed against each of the IOTC ROS data collection Results for full data field table is in Appendix and here only included summary observation at category level. Correspondence with obligation in Resolution 22/04 was shown in the parentheses.

- I. General Vessel and trip information for all vessel types:

i) Observer trip number and observer identification

Administrative information required for the both ROS and EMS operation, and should be assigned by the CPC system operator at the time of planning and set up. It is important keep a clear separation between ROS and EMS, and therefore the rule to distinguish them in assigning trip number and observer identification. EM analyst(s) is responsible in ROS equivalent data production and therefore suitable to be registered as "EM observer".

ii) Observer trip details

Administrative information indicating areas and duration under monitoring. In the case of EM, the data can be extracted directly integrated GPS, more accurate and objective than ROS where observers recording their embarkation and disembarkation dates, times and locations.

iii) Vessel identification (a)

Information on the vessel to be monitored by ROS/EMS. The CPC system operator should be in the best position to provide the information. Cross evaluation on the data by scientific observer should keep as minimum, in order to avoid unnecessary suspicion from the vessel.

iv) Vessel owner and personnel (a)

Same as iii) in general. The CPC system operator would be in the best position to provide the information on registered owner and operator, while observer or personnel visiting vessel for installation of the system might be in better position to collect information on fishing master, skipper and crews.

v) Vessel trip details (a)

Administrative information accessible by CPC compliance officer, not by ROS/EMS.

vi) Vessel attributes (a)

Information owned by the vessel that can be obtained only through interview for both ROS/EMS with collaboration and acceptance by the vessel.

vii) Vessel electronics (a)

While observer can identify the existence/ absence of individual equipment, in the case of EMS, the information can be obtained only through interview at the time of installation or retrieval of EMS to vessel.

viii) Waste management

Only possible with ROS.

ix) Observed trip summary (a)

Summary of fishing events occurred as well as observed during the observed trip. In both ROS and EMS, summary should be compiled automatically in order to avoid unnecessary human errors. Since the camera is active throughout the observed period, the observed fishing events should correspond to the footage processed. Challenge in in distinguishing resting/ no fishing/ searching with EMS.

II. Longline Gear Specifications

This section asks general information on equipment/ machinery availability and gear configuration, including mitigation devices, e.g. tori line. Although having general idea prior to the observation would be beneficial for human observers, such overview/ summary should be compiled automatically from the data collected from individual fishing events.

i) Special equipment or machinery (c)

Existence/ absence of line setter, line hauler, and bait casting machine based on observation. Depending on camera position, EMS could identify them. Otherwise, the same information can be obtained through interview.

ii) General gear attributes (c)

In general, the information on gear configuration would be difficult to obtain through EMS, though some of the unchanged data, e.g. mainline materials and diameters, could be obtained through interview, but not for branch line configuration and materials that are quite complex.

iii) Mitigation devices, Tori line details (c)

Depending on camera position, some details on tori line use can be obtained through EMS. EMS has an advantage in capacity to cover whole settings, while the human observers can allocate limited time for observation of setting. Overall summary should be compiled automatically based on individual observations.

III. Longline Fishing event

i) Set number

Unique identifier for individual fishing event. Should be allocated automatically based on pre-determined rule.

ii) Setting operations (a, c, d)

This part contains many data fields. In principle, EMS can automatically gather accurate dates, times, and location of setting from the integrated GPS. EMS could be powerful to grab overall operational information, including number of floats, radio buoys, and hooks deployed, the human observers need to rely on the information provided by the vessel in many cases.

iii) Mitigation measures (a, c)

Although some information might be obtained through EMS depending on camera position, many fields require detailed gear configuration which would be difficult to obtain through EMS.

iv) Hauling operation

EMS can automatically gather accurate dates, times, and location of hauling from the integrated GPS. Also, EMS can obtain the information of most of data fields as well as ROS.

v) Catch details (b, d, e)

In general, EMS can obtain the equivalent information as ROS, except weight related information. EMS capacity in accuracy of species identification would depend on IT capacity as well as that of EM analyst. Identification of certain taxonomic groups including sea birds would require further evaluation by experts for both EMS and ROS. It is our personal view that either ROS or EMS should only report what is observed and should not provide an estimation of total catch unless provided by the vessel. If needed, this calculation can be done by analysts/ researchers.

vi) Specimen information (b, e)

ROS and EMS seem to encounter the similar difficulty due to the details requested to obtain. Except conditions at capture and release, neither ROS nor EMS function strongly.

vii) Biometric information (e)

EMS is only able to obtain length information with certain constraints. Weight can be estimated from length but in general the data quality is low.

viii) Tag details (e)

It is not possible to tag details only through EMS footage.

The quick review indicated that while the EMS would work much better than ROS for certain data fields, it would not work at all for other data fields. In general, the EMS would indicate high level of monitoring capacity, providing objective, accurate, and cost-effective information in the areas of recording fishing activities and verifying vessel position (corresponding obligation a of Resolution

22/04), and with slightly lesser extent in collecting information for cross-checking of logbooks (corresponding the obligation c of Resolution 22/04). Those are the areas that the ROS would require collaboration with and assistance from the vessel and indicate lower performance as an independent monitoring.

On the other hand, although the EMS could provide general observation on gear specifications and catch composition (corresponding the obligation b of Resolution 22/04), it would encounter a difficulty to fulfil the requests for further detailed information, including detailed gear configuration, mitigation measures used and responses of species of special interests to them. For this obligation ROS indicate better capacity in general and even when showed some difficulty in fulfilling the requirement of detailed information, especially relating to bycatch species and the linkage between their interference to gears and mitigation measures taken, ROS was capable to fulfil the requirement by collecting materials for further evaluation by experts.

Therefore at least regarding to fulfilment of ROS data requirements, EMS and ROS were considered to be in mutually supplementary and development of appropriate combination of two seemed to be the best strategy to achievement for ROS data requirement.

In summary, EMS is a powerful tool to collect general information on fishing events including time and location and catch and efforts but not necessarily suit to collect detailed information on gear configurations and bycatch compositions and cannot collect materials, including biological samples and tags. EMS is a targeted survey efforts determining a range of data items to be collected through number and location of video camera and the balance between two requires cost consideration. Consistent improvement can be expected, according to further development of IT capacity, in processing speed and resolution and accuracy of collected information, in particular in length measurement and species identification, which would allow substantial reduction in burden of analysts. In the case where a broad coverage of fishing vessels can be achieved, proper sampling of footage to process enable to achieve statistically more representative estimates on general fishing events, less affected by vessel dependent factors, than those obtained from existing ROS.

On the other hand, ROS is costly, both in terms of financial as well as resource use, which posing a limitation in expanding its coverage. The working mode that an on-board human observer watching everything would allow holistic observation on events occurring on-board including those not necessarily directly related with fishing events. The same working mode could introduce ambiguity and biases in data collected. However, ROS currently provides an almost only opportunity of collecting biological data and specimens and retrieved tag information on the spot, as well detecting any modifications and innovations occurring in fishing event at the earliest possible timing. ROS also enables to collect extremely detailed information on gears and catch, either through observation by human observers and/or bringing back materials, including photos, biological samples, gear samples, for evaluation by experts.

The EMS and ROS are two totally different monitoring system, each having different strength and weakness, and supplementary each other, not for one to be replaceable to the other. Due to different characteristics and relative quality of data collected, it would be important to clearly distinguish the source in EMS/ ROS database. It would be beneficial to review the existing ROS standard data requirements to reflect change in data requirements and supporting technologies.

For scientific purpose, it is essential to maintain a certain level of ROS in order to keep an opportunity of collecting biological materials and for detecting any modifications and innovations occurring in fishing event as early as possible. The science needs both systematically collected large quantity of objective information as well as anecdotal miscellaneous ones, in particular in the process of research development. For example, research works on bycatch and ecosystem heavily relies on the information obtained from ROS that would be extremely difficult to obtain through EMS at the current

situation.

Appendix Table: Review of ROS and EMS performance against ROS standard data requirement

Meaning of notation:

GENERAL	
SET UP	Hard-coded or recorded prior to the time of placement of the ROS /EM equipment on the vessel
CF	A calculated field arithmetically generated from one or more fields
NP	Not possible
DIFF	Difficult
ROS Component	
OBS	Obtainable through observers' independent observation
VES/OBS	Obtainable through observers in agreement with and assistance by owner/captain/crew
EM Component	
PRE	Obtainable from a pre-trip onsite EM instalation to the vessel and agreement with owner/captain/crew
POST	Obtainable from a post-trip onsite EM removal from the vessel and agreement with owner/captain/crew
EM-A	Recorded by an EM-Analyst based on visual reference to images/footage/sensors,
AG	Automatically generated by the EM system components,
CAM	Might be possible depending on camera coverage

GENERAL VESSEL AND TRIP INFORMATION FOR ALL VESSEL TYPES

Data field name	Data field description	Reporting	R22/04	ROS	EM	Notes
Observed trip number	Record trip unique identifier. This is the observed trip unique identifier. This should begin with trip's start date (YYYY-MM-DD), followed by IOTC observer number, and vessel main gear code as per IOTC classification (E.g. 2018/01/23-IOTCFRA001-PS).	MR	13a	SET UP	SET UP	Need separation of data to be reported to the IOTC and those required for ROS/EMS operation - for which need a clarification of ROS/EMS operational responsibility (check with FAJ)

OBSERVER IDENTIFICATION						
Observer IOTC registration number	Record observer registration number allocated by the IOTC Secretariat to be used on all observer data submissions.	MR	-	SET UP	SET UP	Need registration for EM analyst
Observer name	Record the name of the scientific observer(s) that collected the data onboard the fishing vessel. <i>Note: print in full. First name First - Last name Last (do not use initials).</i>	-	-	SET UP	SET UP	Need registration for EM analyst
Observer nationality	Record the nationality of the scientific observer as it appears in passport (<i>Table 9</i>).	-	-	SET UP	SET UP	Need registration for EM analyst
OBSERVER TRIP DETAILS						Only for footage
Location of embarkation	Record the name and/or geographical coordinates of the port where the observer boarded the vessel – also include the country. If the observer embarked via a port launch within port limits, this is still recorded as a port embarkation. If the observer embarked at sea outside port limits via a vessel transfer, record “at sea” and record the position in Latitude and Longitude. <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	-	10	OBS	AG	GPS records for start of footage
Date / time embarkation	Record the date and time that the observer boarded the vessel. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	-	10	OBS	AG	GPS records for start of footage
Location of disembarkation	Record the name and/or geographical coordinates of the port where the observer disembarked– also include the country. If the observer disembarked via a port launch within port limits then this is still recorded as a port of disembarkation. If the observer disembarked at sea outside port limits via a vessel transfer, record “at sea” and record the position in Latitude and Longitude. <i>Note: Latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	-	10	OBS	AG	GPS records for end of footage
Date / time disembarkation	Record the date and time that the observer disembarked from the vessel. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	-	10	OBS	AG	GPS records for end of footage

VESSEL IDENTIFICATION						
Names of the vessel	Record the vessel full name as recorded on vessel official documentation and crosschecked with the name recorded on the vessel itself (any discrepancies are to be reported to the IOTC Secretariat). <i>Note: care should be taken to record the correct spelling of the vessel's name including any corresponding numbers. i.e. "Agnes 83".</i>	MR	13a	VES	SET UP/PRE	
Vessel flag state (or where chartering occurs, chartering state) ³	Record the name of country in which vessel is registered as shown on its registration documents (Table 9). Where chartering occurs, record name of the chartering country. <i>Note: vessel flag state (or chartering state when chartering occurs) may not be the same as the nationality from which the vessel originates.</i>	MR	13a	VES	SET UP/PRE	
Vessel IOTC number	Vessel IOTC number as per the IOTC Record of Authorized Vessels ⁴ and crosschecked with the number recorded on vessel certificates. <i>Note: any discrepancies are to be reported to the IOTC Secretariat.</i>	MR	13a	VES	SET UP	
Vessel IMO or Lloyd's number	Record vessel IMO number. This is the number allocated to the vessel when registered to the International Maritime Organization of the United Nations (e.g.: IMO8814275).	OR	13a	VES	SET UP/PRE	Suggest to change to MR, where applicable
International radio call sign (IRCS)	Record vessel radio call sign if available. This is the number displayed prominently on the vessel's side or superstructure.	-	13a	VES	SET UP/PRE	
Vessel port of registration	Record the name of vessel's port of registry (also called home port) shown on its registration documents and lettered on the stern of the ship's hull – also include the country.	MR	13a	VES	SET UP/PRE	
Vessel registration number	Record the number issued by country in which the vessel is registered, shown on its registration documents and written on the hull of the vessel. This may be a combination of characters and numbers; record them all (e.g.: CBG303).	-	13a	VES	SET UP/PRE	
Vessel phone, fax and email	When available, record vessel contact details, taking note of the ocean region code. A vessel may have several contact numbers and email addresses depending on the satellite communications systems installed onboard; record them all.	-	13a	VES	PRE	

Licensed target species	Record licensed target species (FAO spp. 3-alpha code) as specified in vessel licences or permit conditions (Table 1, Table 2, Table 3, Table 4, Table 8). Vessels will generally target a narrow range or aggregation of species, however one or more might not be an IOTC species; record them all.	OR	13a	VES	PRE	
Main fishing gear	Record vessel main fishing gear (Table 10).	-	13a	OBS	SET UP/ PRE	Suggest to change to MR
VESSEL OWNER AND PERSONNEL						
Registered owner	Record the owner's name, nationality (Table 9) and contact details in full. These can be obtained or cross-checked on the vessel registration forms.	-	13a	VES	SET UP	
Charterer / operator	Where the vessel has been chartered and is operated and managed by a company other than the owner, record operator's full name (company or individual as appropriate), nationality (Table 9) and contact details.	-	13a	VES	PRE	
Fishing Master	Record the fishing master name and nationality in full (Table 9).	-	13a	VES/OBS	PRE	
Skipper	Record skipper name and nationality in full (Table 9). <i>Note: in some instances the fishing master and skipper may be the same person. In such cases record here "N/A" for not applicable.</i>	-	13a	VES/OBS	PRE	
Crew number	Record the number of crew. This should be cross checked against the vessel's crew list.	-	13a	VES/OBS	PRE	
VESSEL TRIP DETAILS						
Port of departure	Record the name and/or geographical coordinates of the port from where the vessel sailed – also include the country. If the vessel started a new trip at sea following transshipment record 'at-sea' plus the geographical coordinates corresponding to the location the trip started. <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	-	13a	VES	SET UP/ PRE	
Date / time vessel sailed	Record the date and time the vessel departed from port or from a transshipment location. <i>Note: specify units (preferably YYYY/MM/DD and hh:mm).</i>	-	13a	VES	SET UP/ PRE	

Port of return	Record the name and/or geographical coordinates of the port where the vessel returned – also include the country. If the vessel arrived at a transshipment location record ‘at-sea’ plus the geographical coordinates corresponding to the location the transshipment started. If the observer disembarked before the vessel returned then record expected port of return as provided by the vessel. <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	-	13a	VES	SET UP/ POST	
Date / time vessel returned to port	Record the date and time the fishing vessel finishes its fishing campaign. i.e. returns to port or to a transshipment location for unloading. If the observer disembarks before the vessel returns then record expected date and time of arrival (ETA) as provided by the vessel. <i>Note: specify units (preferably YYYY/MM/DD and hh:mm).</i>	-	13a	VES	SET UP/ POST	
VESSEL ATTRIBUTES						All through interview
Tonnage	The vessel tonnage as specified in vessel registration papers. <i>Note: specify units, i.e. if the vessel is registered using Gross Tonnage (GT) or Gross Registered Tonnage (GRT).</i>	MR	13a	VES	PRE	
Length overall	The vessel overall length (LOA) as specified in vessel registration papers. <i>Note: specify units (preferably metres).</i>	MR	13a	VES	PRE	
Hull material	Record the vessel hull material (s) (steel, wood, aluminium, fibre glass, etc.) (Table 11).	MR	13a	VES	PRE	
Main engines (make and power)	The make (brand) and power of the main engines. <i>Note: specify units (HP, Kilowatt or BHP).</i>	MR	13a	VES	PRE	
Fish storage capacity	The vessel total maximum capacity to store catches. This should include blast freezer(s) capacity. <i>Note: specify units (metric Tons (mT.) or cubic metres (m3)).</i>	MR	13a	VES	PRE	
Fish preservation methods	Fish preservation methods: Record the method(s) used by the vessel to preserve the catch (Table 12).	-	13a	VES	PRE	

Fish storage type	Record the type of structure(s) present on-board used by the vessel to store the catch (Table 13).	-	13a	VES	PRE	
Vessel autonomy / range	Record vessel autonomy, expressed by the time (days) a vessel can spend at sea without refuelling. If this information is not available then record vessel range expressed in cruising distance (nautical miles). If a figure for the range cannot be obtained, the observer should calculate vessel range as follows. <Vessel range (nm)> = <Vessel average cruising distance per metric ton (nm/mT)> : <Tonnage of fuel carried (mT)> <i>Note: specify units(days or nautical miles)</i>	-	13a	VES	PRE/ CF	With long obs, may possible to estimate
VESSEL ELECTRONICS						All through interview
Global Positioning System (GPS)	Indicate Yes if on board No if not sighted. <i>Note: a GPS may be an independent unit or linked or incorporated into track plotters and acoustic systems.</i>	MR	13a	OBS/VES	PRE	
Vessel Monitoring System (VMS)	Indicate Yes if on board No if not sighted.	MR	13a	OBS/VES	PRE	
Radars	Indicate Yes if on board No if not sighted. <i>Note: include high frequency radars used by the vessel to search for seabird activity or activity on the sea surface.</i>	MR	13a	OBS/VES	PRE	
Track Plotter	Indicate Yes if on board No if not sighted.	MR	13a	OBS/VES	PRE	
Depth Sounder	Indicate Yes if on board No if not sighted.	MR	13a	OBS/VES	PRE	
Sonar	Indicate Yes if on board No if not sighted.	MR	13a	OBS/VES	PRE	
Doppler Current Meter	Indicate Yes if on board No if not sighted. <i>Note: acoustic doppler current meter is used to ascertain current speed.</i>	MR	13a	OBS/VES	PRE	
Expendable bathythermographs (XBT)	Indicate Yes if on board No if not sighted. XTBs are usually mounted on the bridge wings. <i>Note: XTBs are periodically used to determine the depth of the thermocline.</i>	MR	13a	OBS/VES	PRE	
VHF radios	Indicate Yes if on board No if not sighted.	-	13a	OBS/VES	PRE	
HF radios	Indicate Yes if on board No if not sighted.	-	13a	OBS/VES	PRE	

Satellite communication systems	Indicate Yes if on board No if not sighted.	-	13a	OBS/VES	PRE	
Sea Surface Temperature (SST) gauge	Indicate Yes if on board No if not sighted. SST gauge is usually mounted on the bridge. <i>Note: the vessel may also have access to SST charts received from Fisheries Information Services systems.</i>	-	13a	OBS/VES	PRE	
Weather facsimile	Indicate Yes if on board No if not sighted. <i>Note: weather information may also be received from Fisheries Information Services systems.</i>	-	13a	OBS/VES	PRE	
Fisheries information services	Indicate Yes or No if the vessel has access to a Fisheries information service. <i>Note: Vessels may access fishery information services for instant information on weather and oceanographic features (SST, phytoplankton densities or sea height).</i>	-	13a	OBS/VES	PRE	
VESSEL MANAGEMENT (MARPOL Agreement Annex 5)						
Waste category	Record the category of the waste produced by the vessel (Table 14).	OR	?	OBS	NP	
Storage/ Disposal method	Record how the waste was disposed of (Table 15). For example, incinerated, stored in sacks or disposed of overboard.	OR	?	OBS	NP	
OBSERVED TRIP SUMMARY						In principle, should compile automatically
Number of fishing events/sets conducted by the vessel while the observer was on-board.	Record the total number of fishing events/sets conducted by the vessel while the observer was on-board, independently of their success and of being sampled or not by the observer. <i>Note: this should not include pole and line bait fishing events/sets.</i>	MR	13a	OBS	AG	
Number of fishing	Record the total number of fishing sets/events monitored by the an observer.	MR	13a	OBS	EM-A	Should be automatically compiled

events/sets observed	<i>Note: this should not include pole and line bait fishing events/sets.</i>					
Number of days searching	Record the total number of days that the vessel was engaged in actively searching for fish (this includes active fishing days).	MR	13a	OBS	NP	Not sure whether it possible to distinguish rest vs search
Number of active fishing days	Record the total number of days that the vessel actually fished (i.e. when the vessel had gear in the water). <i>Note: for some fishing events this may be for only a few hours of the day. Alternatively a single fishing event/set may span part of two days."</i>	MR	13a	OBS	EM-A	
Number of days lost	Record the total number of days where a vessel was unable to fish due to factors such as adverse weather conditions, mechanical failure or other unforeseen events.	MR	13a	OBS	NP	Not sure whether it possible to distinguish rest vs search
Reason(s) for days lost	Record the reason(s) a vessel was unable to fish: (i) adverse weather conditions, (ii) mechanical breakdown or inoperative gear or (iii) unforeseen events (specify).	OR	13a	OBS	NP	
Number of days in the fishing area	Record the number of days the vessel spent in the fishing area while the observer was onboard. This does not include transit time even if the area being transited is within the fishing area.	-	13a	OBS	AG	When the definition of "fishing area" given
Number of days transiting	Record the number of days the vessel spent steaming or transiting to/between/from fishing areas while the observer was onboard.	-	13a	OBS	CF	

LOGLINE INFORMATION:**GEAR SPECIFICATIONS**

Data field name	Data field description	Reporting	R22/04	ROS	EM	Notes
SPECIAL EQUIPMENT OR MACHINERY						
Line setter	Indicate Yes if on board No if not sighted. Many long line vessels will be fitted with equipment or machinery that regulates line setting speed allowing the line to be set at uniform depth.	MR	13c	OBS	PRE	

Line hauler	Indicate Yes if on board No if not sighted. Most long line vessel will be fitted with equipment or machinery that hauls the line in after it has been set.	MR	13c	OBS	EM-A	
Bait casting machine	Indicate Yes if on board No if not sighted. Most vessels manually deploy branch lines with the bait. However there are a number of vessels that use automatic bait casting machines.	MR	13c	OBS	PRE	
GENERAL GEAR ATTRIBUTES						
Mainline material	Record the material the mainline is made out of, e.g. kevlar, nylon, nylon multifilament (Table 16).	MR	13c	OBS	PRE/EM-A	
Mainline length	Record the total length of the mainline (i.e. mainline maximum length). This information can be obtained from the Captain or Fishing Master. <i>Note: specify units (preferably 'Kilometres')</i>	MR	13c	OBS	PRE or EM-A/CF	
Mainline diameter	Record the diameter of the mainline. This information can be obtained from the Captain or crew and crosschecked by measuring mainline diameter with callipers. <i>Note: specify units (preferably 'millimetres')</i>	-	13c	OBS	PRE	
Branchline configuration number	Unique number for a specific branchline specification as detailed based on the fields below.	MR	13c	OBS	NP	
Branchline material	Record the branchline material for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader; note that wire trace may be sheathed by a plastic or nylon coating (Table 16).	-	13c	OBS	NP	
Branchline length	Record the length of the branchline for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader. <i>Note: specify units (preferably 'metres')</i>	MR	13c	OBS	NP	
Branchline diameter	Record the diameter of the branchline for each of the four sections where section 1 is that closest to the mainline and section 4 is the leader. <i>Note: specify units (preferably 'millimetres')</i>	MR	13c	OBS	NP	
Branchline storage	Record if the branch lines are coiled up and packed into baskets (BSK), or layered out in tubs (TBS), or coiled up onto reels (RLS).	-	13c	OBS	EM-A	

MITIGATION DEVICES						
DMDs used	Record depredation mitigation device/s DMDs used by the vessel (if any) (Table 37).	-	13c	OBS	PRE	
TORI LINE DETAILS	If the vessel was equipped with a tori line provide tori line details below. If no tori line was present on-board fill in NA for not applicable.	-	13c	OBS	NP or EM-A (CAM)	
Tori line length	Record the total length of the tori line (not including streamers). <i>Note: specify units (preferably metres)</i>	MR	13c	OBS	EM-A/CF but low quality	
Streamer type	Indicate the type of streamers which are used with the tori line (e.g. paired or single)	MR	13c	OBS	EM-A	
Streamer line length	Record length of individual streamer lines (minimum and maximum where lengths vary). Record only one length if they do not vary. <i>Note: specify units (preferably metres)</i>	MR	13c	OBS	EM-A/CF but low quality	
No. streamers per line	Record the number of streamers that are attached to a single tori line	MR	13c	OBS	EM-A but low quality	
Distance between streamers	Record the distance between streamers. <i>Note: specify units (preferably metres)</i>	-	13c	OBS	EM-A/CF but low quality	
Attached height	Record the height hat the tori line is attached above the water level. <i>Note: specify units (preferably metres)</i>	MR	13c	OBS	PRE or EM-A/CF	
Streamers reach surface	Indicate Yes if the streamers are long enough to touch the surface of the water in calm conditions and No if they are not.	-	13c	OBS	EM-A/CF but low quality	
Towed objects	Record the total number and type of towed objects used to maintain tori line tension and achieve aerial extent when deployed.	-	13c	OBS	NP	
Diagram	Sketch/complete a diagram containing Tori line key features (e.g. Fig. 1 of IOTC Resolution 12/06).	-	13c	OBS	NP	

FISHING EVENT

Data field name	Data field description	Reportin g	R22/04	ROS	EM	Notes
-----------------	------------------------	---------------	--------	-----	----	-------

Set number	Record set number. This should be a four digit numerical code beginning 0001. Set numbers should be consecutive from the start of the first line set to the last line set of the observed trip. A unique number is to be allocated to each individual set.	MR	-	OBS	SET UP	
SETTING OPERATIONS						Gear configuration would be hard to obtain from EMS
Start setting date and time	Record the date and the time the first dhan buoy and / or radio buoy is deployed to start the setting of the line. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	MR	13a,d	OBS	AG	
Start setting position	Record the position in latitude and longitude for the start of the setting operation <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	MR	13a,d	VES/OBS	AG	
End setting date and time	Record the date and the time that the last dhan buoy and / or radio buoy is deployed. Longline vessels often set lines at the night and the setting operation may continue beyond midnight and into the following day. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	MR	13a,d	OBS	AG	
End setting position	Record the position in latitude and longitude for the end of the setting operation <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	MR	13a,d	VES/OBS	AG	
Vessel speed	Record the vessel's average speed during setting (knots). <i>Note: Collect vessel speed from the GPS several times during the operation and take the average.</i>	-	13c	VES/OBS	CF	

Line setter speed	Record the speed setting of the line setter (metres/second).	-	13c	VES/OBS	PRE or EM-A/CF	Not possible to obtain from footage. With additional information, e.g. distance between buoys, rough estimation may not be impossible; probably low utility
Length of mainline set	Record mainline total set length (i.e. the total deployed length of the mainline for the specific set). Usually calculated by multiplying the total time to set the line and the average line setter speed, taking into account any interruption times. This information can be obtained from the Fishing Master and cross checked against observer calculations. <i>Note: specify units (preferably in Kilometres).</i>	MR	13c	VES/OBS	PRE or EM-A/CF	Not possible to obtain from footage. With additional information, e.g. distance between buoys, rough estimation may not be impossible; probably low utility
Branchline clip on time	Record the average time interval in seconds between the “beeps” that indicate to the crew to clip on a branch line. <i>Note: the timing of this is usually controlled by the Fishing Master.</i>	-	13c	VES/OBS	PRE and EM-A/CF	
Buoys clip on time	Record the average time interval in seconds between the “beeps” that indicate to the crew to clip on a buoy. <i>Note: the timing of this is usually controlled by the Fishing Master.</i>	-	13c	VES/OBS	PRE and EM-A/CF	
Total number of hooks set	Record the total number of hooks deployed for the set. Usually calculated by multiplying number of baskets by the average number of hooks between the baskets. This information can be obtained from the Fishing Master and cross checked against observer calculations. <i>Note: total length of line set and spacing between branch lines can also be used to determine the number of hooks set.</i>	MR	13a,c	OBS	EM-A	
Total number of floats set	Record the total number of floats deployed during the set (this should not include the radio/dhan buoys). Usually calculated by subtracting the number of buoys in their holders before setting by the number of buoys in their holders after setting. This information can be obtained from the Fishing Master and cross checked against observer calculations.	-	13c	OBS	EM-A	

No of hooks set between floats	Record the number of hooks set between floats. This will correspond to the number of hooks stored in each basket/tub, or on a reel and will be equivalent to the number of branch lines set.	-	13c	OBS	EM-A	
Distance between branchlines	Record the distance between branch lines (i.e. the interval at which they were set along the mainline) in metres. Usually calculated by multiplying 'Branch line clip on time (s)' by the 'line setter speed' (m/s).	-	13c	VES/OBS	POST	
Floatline lengths (1, 2 and 3)	Record the different lengths of the floatlines used (1, 2 and 3). <i>Note: specify units (preferably metres).</i>		13c	VES/OBS	NP	
Total radio/dhan buoys set	Record the total number of radio and /or dhan buoys deployed.	-	13c	OBS	EM-A	
Attached lights	Record number of lights attached to the branchlines per type (Table 22) and colour (Table 23)."	-	13c	OBS	NP	
Shark lines set	Indicate Y or No if shark lines were set during the operation. <i>Note: shark lines are branch lines running directly off the longline floats or drop lines, specifically for targeting sharks.</i>	MR	13c	OBS	EM-A	
No of shark lines set	Record the number of shark lines set during the operation. If no shark lines are set then record zero (0).	-	13c	OBS	EM-A	Duplication with above
Target specis	Record the target species for the set (FAO spp. 3-alpha code), (Table 1, Table 2, Table 3 and Table 4).	MR	13c	VES/OBS	POST	
VMS on	Indicate Y or No to sign if he VMS was on or not while setting and hauling.	OR	13a,d	VES/OBS	AG	
Mitigation measures						
Number of Tori lies deployed	The total number of tori lines deployed during the setting operation. Record zero if none were deployed.	MR	13a	OBS	NP or EM-A (CAM)	
Low light night setting	Indicate Y or No for whether minimum deck lighting is used during night setting (as defined in Table 1. Mitigation measures of IOTC Res 12/06). <i>Note: night setting is binary. i.e. if all hooks are set between dusk and dawn, then night setting was used. If some hooks are set outside of nautical darkness, then night setting was not used. [Consistent with IOTC Res 12/06]</i>	MR	13a	OBS	AG?	

Branchline weighting	Indicate Yes or No if the branch line is weighted. <i>[Consistent with IOTC Res 12/06]</i>	MR	13c	OBS	NP	
Sinker average weight	Record the average weight of weights or sinkers attached to the branchlines (weights deployed on the snood prior to setting). <i>Note: specify units (preferably grams (g)). [Consistent with IOTC Res 12/06]</i>	MR	13c	VES/OBS	NP	
% branchlines weighted	Record the proportion of branchlines weighted (%). If all weighted, record 100%.	MR	13c	CF	NP	
Hook-sinker distance	The distance of the weights/sinkers from the eye of the hook. <i>Note: specify units (preferably centimetres (cm)).</i>	MR	13c	VES/OBS	NP	
Underwater setting	Indicate Yes or No if the bait is protected on the branchlines until they are a certain depth below the surface.	-	13c	OBS	NP (CAM)	
Other mitigation measures used	Record any other mitigation measures observed (Table 37).	-	13c	OBS	NP (CAM)	
No of branchline set by type	Record the number of branchlines set by type (branchline configuration number. Branchline types must be in accordance to types previously defined under the "Gear specifications" section.	-	13c	OBS	NP	
Hook type	Record the type of hooks used (Table 17).	MR	13c	OBS	NP	
% hooks set by type	Record the percentage (%) of hooks set by type. <i>[As per SC20.23 recommendations]</i>	MR	13c	CF	NP	
Variations in hook type	Where possible indicate any variations in hook type, hook material and presence/absence of hook ring (Table 17).	-	13c	VES/OBS	NP	
Bait type	Record bait type/condition used (Table 25).	MR	13c	OBS	NP/EM-A	
Bait species	Record the species of bait used (FAO spp. 3-alpha code) (Table 8).	MR	13c	OBS	EM-A with low quality	
Bait ratio (%)	Record the approximate proportion of bait species and condition used across all hooks in the set (%).	MR	13c	CF	CF	
Bait dye colour	Record the colour or colours that the different baits are dyed (e.g. blue to avoid bird bycatch). If none, write NONE.		13c	OBS	EM-A	
HAULING OPERATIONS						

Start hauling date and time	Record the date and the time when the first dhan buoy and / or radio buoy is hauled back on-board to start hauling the line. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	MR	13a,d	OBS	AG	
Start hauling position	Record the position in latitude and longitude for the start of the hauling operation. <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	MR	13a,d	VES/OBS	AG	
End hauling date and time	Record the date and the time when the when the last component of the longline gear (dhan buoy and / or radio buoy) is hauled back onboard. <i>Note: specify units (preferably hh:mm and YYYY/MM/DD).</i>	-	13a,d	OBS	AG	
End hauling position	Record the position in latitude and longitude for the end of the hauling operation. <i>Note: latitude and longitude to be recorded mentioning if collected South or North of the equator and specifying units (preferably $\pm(d)dd.dddd^\circ$).</i>	-	13a,d	VES/OBS	AG	
Offal management	Record fate given to the offal (fish heads, guts, etc.) and bait produced during the observed set. Indicate if these are retained for batch disposal (BD) at a later stage and/or disposed of ad hoc (AH) as they accumulate.	-	13a	OBS	NP (CAM)	
Position of offal disposal	Record the position where offal and used bait was disposed. Indicate if these are disposed at port side (BB), starboard (SB) or aft (AF).	-	13a	VES/OBS	NP (CAM)	
Method/s to stun fish	Record the method/s used to stun fish during hauling (Table 24).	-	13c	OBS	EM-A	
Bird scaring device at hauler	Indicate Yes if a bird scaring device was deployed during hauling operations and No if not. <i>Note: report on the construction and effectiveness of all devices used in the comments section and trip report.</i>	-	13a	OBS	EM-A	
Number of bite-offs (by branchline type)	Record for each type of branchline set up previously identified how many have had the hook bitten off. This only includes bite-offs observed while the observer was in a position to observe and record the hooks coming directly out of the water.	-	13e	DIF	NP	

Number of retrieved hooks observed	Record the number of hooks observed	MR	10	OBS	EM-A	
Sampling protocol	Indicate sampling protocol followed by the observer (Table 38).	MR	10	OBS	EM-A	For EM, this should correspond to the component processed
CATCH DETAILS						
Set number	Unique within a specific trip	MR	-	OBS	SET UP	Already defined above
Catch detail number	Unique within a specific set	MR	-	OBS	SET UP	
Species	Record the species code for each specimen observed using FAO three figure alpha codes (Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 and Table 7). If species FAO code is not available, record the species scientific name. <i>Note: Record “unknown” for species that cannot be positively identified and give it a reference number. Use the same reference number throughout the trip for that species. Retain a sample and / or take a photograph of the unidentified organism for latter identification.</i>	MR	13b,d,e	OBS	EM-A	
Fate	Specify the fate which includes whether it was retained or discarded and the reason, e.g. “Discarded – too small” (Table 41).	MR	13b,d,e	OBS	EM-A	Retained OK, but difficult to monitor all discards and their reason
Sampling methods for obtaining total catch estimates per species	Indicate the sampling method used to obtain total catch estimates per species for the catch detail (Table 40).	MR	13b,d,e	VES/OBS	NP	Neither ROS and EMS should do total catch estimation;
Number	Record the number of individuals per species for each specified fate. If weight is recorded, insert NA here (for large fish, record number of individuals).	MR	13b,d,e	CF	CF	Summary only within processed footage; only retain part trust-worthy
Weight	Record the weight corresponding to the specified species and fate category. If number of individuals is recorded, insert NA here (for small fish, record weight).	MR	13b,d,e	OBS	NP or CF from LW	

	<i>Note: specify units (preferably tons).</i>					
Weight estimation method	Indicate the weight estimation method used to collect weight (Table 42). <i>Note: If number of individuals is recorded, insert NA here.</i>	MR	13b,d,e	OBS	NP	
Weight code	The code corresponding to the type of processing the specimen underwent prior to weighing (Table 43). If the fish has not been processed, record code for unprocessed (or round, whole, live) weight (i.e. RD). <i>Note: If number of individuals is recorded, insert NA here.</i>	MR	13b,d,e	OBS	NP	
SPECIMEN INFORMATION						
Set number	Unique within a specific trip	MR	-			Already defined above
Catch detail number	Catch detail number	MR	-			Already defined above
Specimen number	Unique within a specific catch detail	MR	-	OBS	NA	No records on specimens' type?
Depredation details	[In agreement with SC18.16 (para. 53)]					
Depredation source	For depredated specimens, record the depredation source based on depredation scar characteristics (Table 44). For non-depredated specimens record NA.	MR	13b,e	OBS		EM-A but low quality
Predator observed	For depredated specimens, record the predator species directly observed and identified (FAO spp. 3-alpha code). If the predator was not observed record UNK (unknown). For non-depredated specimens record NA. <i>Note: species observed in the area may not necessarily be associated with depredation unless directly observed. Similarly for shark and squid damage the species may be difficult to determine.</i>	MR	13b,e	OBS	NP	
Additional details on non-target species	Catch details on non-target species to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.					

Condition at capture	State the condition of the specimen at capture (Table 45).	OR	13b,e	OBS	EM-A	
Condition at release	State the condition of the specimen at the time of release (Table 45).	OR	13b,e	OBS	EM-A? (CAM)	NP for EM, when released outside camera coverage
Additional catch details on SSIs	Additional catch details on Species of Special Interest (Table 46) to be collected where possible and reported to the IOTC Secretariat as recommended by the Scientific Committee.					
Gear interaction	For SSI only, specify the type of interaction of the specimen with the fishing gear (Table 47).	OR	13b,e	OBS	EM-A	
Hook type	For SSI only, record the type of hook the individual was hauled on (Table 17) [Consistent with IOTC Res 12-04]	OR	13b,e	OBS	NP	
Bait type	For SSI only, record the type/condition of bait the individual was hauled on (Table 25). [Consistent with IOTC Res 12-04]	OR	13b,e	DIFF	CF	only possible after cross-checking with setting information, but only roughly
Leader material	For SSI only, record the leader material the individual was hauled on (Table 16). [Consistent with IOTC Res 12-04 and IOTC Res. 17/05]	OR	13b,e	OBS	NP	
Leader thickness	For SSI only, record the thickness of the leader the individual was hauled on. [Consistent with IOTC Res 12-04 and IOTC Res. 17/05] <i>Note: precise units (preferably millimetres (mm)).</i>	OR	13b,e	DIFF	NP	
De-hooker/line cutter	Specify de-hooking or line cutting device used to extract the hook (Table 49). [Consistent with IOTC Res 12-04]	OR	13b,e	OBS	NP	
Brought on board	Indicate Yes or No, if the specimen was brought on board. [Consistent with IOTC Resolutions 13/04; 13/05; 12/04; 12/06; 12/09]	OR	13b,e	OBS	EM-A	
Hauling method	Detail how the specimen was brought on-board (Table 48). [Consistent with IOTC Res 12-04]	OR	13b,e	OBS	EM-A	
Resuscitation (for turtles only)	For turtles indicate Yes if the release took place with resuscitation and No if not.	-	13b,e	OBS	?? (CAM)	
Photo ID	If a photo is taken, record photo number/code so that it can be linked back to the specimen for onshore examination.	-	-	OBS	NA	

BIOMETRIC INFORMATION Details concerning any extra biometric measurements, sex, maturity and the collection of biological samples.						
Sampling methods for the collection of biological information	Indicate the sampling method used for the collection of biological subsample (Table 40).	MR	-			
Length code 1	Specify the length code used for the measurement (Table 52).	MR	13e	OBS	EM-A	
Length 1	Record the length corresponding to the length type taken rounded to the lower centimetre.	MR	13e	OBS	EM-A with less quality	
Length code 2	When an additional length measurement is taken, the corresponding length code should be recorded (Table 52).	OR	13e	OBS	NA	
Length 2	When an additional length measurement is taken, the corresponding length should be recorded rounded to the lower centimetre.	OR	13e	OBS	NA	
Weight code	Record the code corresponding to the type of processing the specimen underwent prior to weighing (Table 43).	OR	13e	OBS	FIX	
Weight	Record the specimen's weight (in kilograms) corresponding to the specified product type recorded in 'weight code'. If the fish has not been processed, record the unprocessed (or round, whole, live) weight (i.e. RD).	OR	13e	OBS	NP/CF (LW)	
Weight estimation method	Specify the weight estimation method used to obtain the weight (Table 42).	OR	13e	OBS	FIX	
Sex	Record the sex of the sampled fish specimen (Table 50). If unknown record UNK.	OR	13e	OBS	NP	
Maturity stage	Record the stage of maturity of the sampled fish specimen according to standard maturity scales approved by the IOTC. If unknown record UNK.	OR	13e	OBS	NP	

Sample collected	Record the following details on the collection of samples: a) type (e.g. otoliths, spine clippings, and genetic samples) b) preservation method (e.g. alcohol, frozen, etc.) c) destination (i.e. location to be sent/stored)	OR	13e	OBS	NA	
TAG DETAIL Note that all tagged specimens are to be identified to species level and to be sampled for length. Elasmobranches and turtles are also to be sexed and ascertained for maturity.						
Tag release	Indicate Yes or No, whether this individual was re-released with a tag attached.	MR	13e	OBS	NP	
Tag recovery	Indicate Yes or No, whether a tag was recovered from this individual.	MR	13e	OBS	NP	might be possible to detect from different behavior of crews
Tag number	Provide the tag number. If a turtle, provide both tag numbers (right and left flipper).	MR	13e	OBS	NP	
Tag type	Record the type of tag used (Table 51).	MR	13e	OBS	NP	
Tag finder	Record the name and contact details of the person who recovered the tag.	MR	13e	OBS	NP	