REPORT OF THE SECOND MEETING OF THE WORKING GROUP ON ELECTRONIC MONITORING SYSTEMS (WG-EMS)

(Online, 6-7 June 2022)

1. Opening of the meeting and meeting arrangements

The Chair of the Working Group on Electronic Monitoring Systems (WG-EMS), Mr. Neil Ansell (European Union), opened the meeting and welcomed the participants.

The ICCAT Executive Secretary also welcomed delegates from nineteen Contracting Parties (Angola, Belize, Brazil, Canada, China (P.R.), Curaçao, European Union, Gabon, Guatemala, Japan, Korea (Rep.), Mexico, Morocco, Panama, Senegal, United Kingdom of Great Britain and Northern Ireland, United States, Uruguay and Venezuela), three Cooperating Parties, Entities or Fishing Entities (Bolivia, Chinese Taipei and Costa Rica) and four observer delegations (Birdlife International (BI), International Seafood Sustainability Foundation (ISSF), Pew Charitable Trusts (PEW), and Sharkproject International) to the second meeting of the WG-EMS and informed them of the meeting arrangements.

2. Nomination of rapporteur

Ms. Katie Moore (USA) was appointed as rapporteur.

3. Adoption of Agenda

The Agenda was adopted as drafted and is attached as **Appendix 1**.

The list of participants is contained in **Appendix 2**

4. Update on experiences on the use and implementation of EMS and ongoing pilot projects/trials

Japan presented the document "Progress Report of EMS Trials" (**Appendix 3**) outlining the progress made on EMS Trials in their distant water longline fleets in the Atlantic and Pacific using three EMS available on the market. Japan noted some challenges during the trials including interference with the radio, conflicts between the vessel's GPS and EMS, vibrations that affected data quality, data auto-transmission limitations (including daily reports that the system was working correctly), dirty video lenses, challenging installation environments, and time- and man-hour-intensive data analysis. They reported that EMS currently on the market still have some intrinsic limitations and technical challenges, and it is not reasonable to require fishermen to overcome these challenges as they are inherent to the systems. Japan also stated that the data to be extracted and analysed must be prioritised as there can be huge datasets.

Some lessons learned included that EMS can gather ICCAT-related information such as discards and their condition (live/dead) and seabird interactions but cannot compile other data typically collected by human observers, such as biological samples, sea surface temperature and other information needed for catch-per-unit-effort calculations. However, Japan noted that samples could be collected independently from the vessels regardless of whether or not an EMS is installed on board. Cost comparisons between EMS (hardware, installation, operation, analysis) and human observers (training, pay) were difficult to compare in a direct manner, especially as trip duration can vary, however EMS could be more costly than human observers at this stage. Only EMS were used on the trials and not in combination with human observers as it is already clear what types of information can be collected by the latter. Japan estimated the cost of human observers to be around 8,500 USD per trip, although the length of trips varies. Offshore longline trips last approximately 30 days and cost around 4,500 USD, and distant water fleet trips last up to 4 months at a cost of around 16,000 USD, with the average trip costing about 8,500 USD. Japan noted that the cost comparison between EMS and human observers was not straightforward; however, it will continue to refine these estimates and report to the WG-EMS.

In summary, Japan found that EMS can most probably be successfully deployed on longline vessels and several technical and administrative issues can likely be resolved in the future. Japan concluded that EMS could possibly replace human observers, but other sampling programs will still need to be implemented in parallel to address requirements for data that EMS cannot collect. Further trials will inform their results, which they will report to the WG-EMS.

Uruguay asked if Japan's cost comparisons took into account the cost of having an additional person for data analysis. Japan replied that the costs did include this aspect as well as licensing fees for analysis software. Japan noted that EMS costs including analysis and software could appear to be higher than a human observer, but costs may decrease as EMS develop and new systems become available on the market.

The UK presented the paper "Electronic Monitoring in the UK Pole and Line Fishery. An information paper" (**Appendix 4**) providing details of their initial trials of a commercially available EMS in their small-scale pole and line tuna fishery in the UK Overseas Territory (UK-OT) of St Helena. They reported some challenges including the recording of discards, the use of FADs and the limitations associated with using EMS in a remote location (e.g., downloading hard drives and data transmission). The main issue was dealing with the small vessel sizes of the fleet and the associated limitations with power supplies (currently using solar power). The UK noted that they have not yet determined if EMS can supplement or replace human observers, and this will be the objective of the next phase of the trials. The UK will continue the trials and report back to WG-EMS at further meetings.

The Chair of the SCRS, Dr Melvin, provided an update on the work undertaken by the SCRS Technical Sub-Group EM (Electronic Monitoring) in "Update from the SCRS Technical Sub-Group EM (Electronic Monitoring)" (**Appendix 5**). Since the February 2022 WG-EMS meeting, the Sub-Group's progress has focused on developing EMS minimum standards for longline fisheries, prioritizing the collection of data for scientific purposes, and how EMS can be designed and implemented to complement human observers. He noted that EMS should be employed in a way that can address both compliance and science needs and that the final structure of the EMS will be determined by the Commission. He presented a table comparing data that can be collected by each system and noted some differences including weight, discard, and biological data. Important system considerations included the degree of centralization, financial burden on Secretariat, privacy, data access, periodic reviews to ensure the fulfilment of policy objectives, and evolving technology (e.g., calibration marks on the vessel for estimating specimen length/size), onboard crew EMS operability, battery backup with ability for shutdown without corrupting data, automatic/manual activation of sensors, tampering prevention, number of cameras, installation, maintenance and data collection/storage/review/transmission.

He went on to note that a four-camera system was appropriate but not necessarily solely recommended. He also stated that maintaining a minimum of 5% human observer coverage would be valuable and noted the importance of data reporting. Dr Melvin remarked that this subject included data access, extraction confidentiality and data reporting, which are important issues for CPCs and required detailed discussion by ICCAT.

He concluded by reporting that the Sub-Group will continue to meet every 6 weeks or so and plans to report to the SCRS plenary later in the year.

Japan remarked on the Sub-Group's statement that still images were not sufficient for reaching data collection goals. It conveyed its experience using 3-camera-systems with 1 second interval stills and believes that this was sufficient for collecting most scientific information, including species identification and size data. Dr Melvin responded that a relatively short interval between stills would be necessary to determine if catch was live or not and to allow for different vessel and deck processing configurations.

The United States noted that some data may require significantly more analysis and storage than other data and, hence, EMS may be possible, but not the most feasible option in all cases. The United States went on to convey their experience using 2- or 3-camera systems to monitor their pelagic longline vessels for compliance purposes and stated that minimum standards should maximize efficiency and be tailored to programme objectives. The United States also noted that vessel size or safety concerns may be a reason why human observers cannot be accommodated.

China requested that the Group further consider not only financial constraints, but also legal issues related to reporting data directly to the Secretariat. China favoured a decentralized approach in programme design. They reported that other tuna RFMOs have experience with this topic and cooperation should continue with them to ensure a common approach on this issue. China also noted that one RFMO had recently agreed that EMS could replace human observers.

Japan supported the idea of maintaining the 5% human observer coverage considering that EMS cannot provide all the scientific information gathered by human observers: on the other hand, EMS could be counted to achieve observer coverage of above the 5%. Curacao asked if there are EMS minimum standards for carrier vessels. Dr Melvin responded to a request regarding the intervals between system reviews and stated that frequent reviews were important in the early stages of EMS, perhaps annually at the beginning and increasing to every 5 years. He also confirmed that the SCRS Sub-Group has not discussed EMS on carrier vessels.

China noted that the FAO just adopted some voluntary transshipment guidelines with relevant content regarding EMS on carrier vessels.

The Chair summarized the discussions, underlining the merits of a decentralized system with periodic reviews to ensure that the agreed standard was still meeting the objectives of the measures and keeping abreast of evolving technologies. The importance of training when EMS is rolled out was also noted, as well as the fact that ICCAT should actively coordinate with other RFMOs as they advance with the development of EMS and complementary human observer coverage levels.

5. Development of minimum standards (longline and purse seine) for further consideration

As agreed at the first meeting of the working group, the EU put forward two sets of draft minimum standards — one for purse seine fisheries in "Minimum requirements for EMS onboard purse seine vessels" (**Appendix 6**), and one for longline fisheries in **"**Minimum Standards and Program Requirements for EMS onboard Longline vessels" (**Appendix 7**) — both of which included a description of data fields to be collected using EMS as well as a vessel monitoring plans.

The EU received some comments that the draft had many technical details which were probably better placed in an annex. China provided some input including the consideration of linking EMS to existing vessel GPS systems and questioning the applicability of a Vessel Monitoring Plan to all vessels (including on all longline vessels where observers are not currently required), the data review entity, maintenance periods, and identifying a minimum number of and standards for EMS sensors.

Canada stated that the document was also helpful by serving conceptually as a discussion paper and that intersessional work could help finalize the exact wording of the text. Some comments included language addressing how fish brought alongside (but not on board) the vessel and subsequently released/discarded could be recorded, when changes could be made to the vessel (during a trip), thresholds for key equipment operation and protocols for the vessel when the system was down, contractor versus in-agency data reviewers, and specifications of certified companies for data review/analysis.

Japan suggested that EMS could have a dual role including serving both science and compliance; however, in the longline fishery the existing ICCAT Rec. 21-01 was directed to meeting scientific objectives. For that reason, Japan was against the inclusion of compliance elements in the longline EMS minimum standards in the context of ICCAT. Japan stated that when there are means other than EMS that may also meet the same management objective, such EMS functionality/requirement should not be considered as a 'minimum' standard.

The United States noted the value of clearly laying out including the objectives of EMS in longline and purse seine fisheries, in each document. The draft covered both scientific and compliance objectives, and the United States considered that the minimum standards documents could cover both aspects. CPCs would then be able to choose the application purposes of EMS. The EU reaffirmed that there should be two sets of minimum requirements, one for when the system is used only for science and one for when it is used for compliance. This can be reflected in two different annexes.

There was discussion by the group regarding the duplication of an embedded GPS system, increasing resolution requirements for species identification, storage duration requirements, centralization/decentralization of data analysis, perceived conflicts between the data owner and reviewing authorities, and the areas to be covered by the cameras.

Japan conveyed its preference that EMS should be decentralized, as is the case with observer program data. CPCs could subsequently review, analyse, and submit data in accordance with their domestic laws and, hence, reduce data confidentiality issues.

China conveyed its interest in the 2023 timeline and stated that it had a similar view to Japan regarding compliance versus scientific objectives. Requiring EMS for compliance purposes would result in pushback from the Chinese industry, as vessels currently make a financial contribution to the EMS systems installed on their vessels.

Canada provided input on the timeline for developing the minimum standards, noting that the first versions need not be exhaustive and can be adapted in the future while learning from technological advances, lessons learned from trials, and developments by other RFMOs.

The EU offered to produce revised drafts that incorporated the outcome of the Group's discussion and stated that, in parallel, it would engage with interested CPCs intersessionally via an informal drafting group. The United States and Canada were supportive of the EU offer and requested that the process be reflected in the work plan. It was agreed that WG-EMS members could provide written comments on the current draft to the EU by 13 June 2022. It was further agreed that the informal drafting group would meet virtually on 26 July 2022, and the EU undertook to provide a revised draft prior to that date. The EU would work with the Secretariat to send out a circular. Interpretation services would not be provided, and the Secretariat will retain the online folders from the 2nd meeting of the WG-EMS.

The Chair summarized the discussions including the importance of clear objectives of both compliance and science in the use of EMS while accommodating CPC management preferences. He noted the constructive technical discussions moving forward and encouraged the continued engagement of CPCs, including by means of the agreed intersessional work.

6. Consideration of a draft prioritization/implementation strategy

As agreed at the first meeting of the Working Group, the EU presented their working paper "Working Group on Electronic Monitoring Systems (WG-EMS). Possible priorities, implementation strategies and tentative work plan" (**Appendix 8**). Given its overall objective as a strategy document, the EU stated that it had tried to keep the document concise and general. Following editorial suggestions from CPCs, it evolved into version B.

The United States provided detailed feedback, including explicitly stating the objectives (scientific and/or compliance) that EMS is trying to achieve regarding existing ICCAT recommendations that already make specific reference to EMS. There was also a recommendation to clearly state that close coordination with the SCRS is needed as a recognized part of the process.

Canada stated its view that delivering on the existing ICCAT measures with EMS requirements should be the first priority and expressed their preference that standards be all-encompassing (compliance and scientific) and differentiate between essential elements and 'nice-to-haves'. There was discussion on whether the WG-EMS was to promote, mainstream, facilitate, ensure, explore and/or evaluate (as appropriate) EMS, and if EMS would be useful in some or all ICCAT fisheries. Japan agreed with the United States and Canada that the minimum standards should be guided by the specific objectives of the EMS and proposed that the current EMS recommendation for billfish, tropical tunas and North Atlantic shortfin mako shark be prioritized. Morocco agreed with the priorities established in the document and proposed a 2023 deadline, with presentation of a recommendation to the Commission for consideration at the 2023 Annual Meeting.

A revised version included new language considering the utility of EMS in fisheries other than those covered in current recommendations. Japan saw no need to include it, although the United States preferred that it remain in order to reflect the advances made by CPCs including those presented in the meeting by the UK. Following further discussions, the WG-EMS agreed that they should not be the lead priority of the Group, and the EU provided some further language to clearly separate and reflect the agreed priorities.

7. Consideration of future work plan in accordance with Res. 21-22

The EU proposed a schedule for the completion of the EMS minimum standards for purse seine and longline vessels, taking into account the SCRS Sub-Group's timeline and the 2023 annual meeting. The group discussed the creation of a repository and consultation with the SCRS as a standing agenda item at WG-EMS meetings. Further meetings of the WG-EMS were suggested for January/February 2023, and possibly another in spring 2023.

The United States said that certain CPCs may need some assistance in meeting any EMS minimum standards and that the priorities document should contemplate how to support those CPCs in such cases. The EU and Canada agreed and suggested reflecting this point in the WG-EMS meeting report.

The Chair stated his intention to update the IMM WG later in the week regarding WG-EMS progress, including the need for further meetings into 2023. These additional meetings will be proposed to the Commission with a request for their inclusion in the 2023 ICCAT Meeting Calendar.

8. Other matters

No other matters were discussed.

9. Adoption of report and closure

The Chair thanked the WG-EMS for a productive meeting. It was agreed that the meeting report with the appended implementation strategy and workplan would be adopted by correspondence.

A representative from Pew thanked the WG-EMS for the progress made and expressed their support for more discussion regarding implementation. Pew stated they were contributing to EMS discussions in other tuna RFMOs and hoped to continue supporting ICCAT as it moved forward.

The Chair thanked the interpreters, Secretariat and all participants and adjourned the meeting.

Appendix 1

Agenda

1. Opening of the meeting and meeting arrangements

2. Nomination of rapporteur

3. Adoption of Agenda

4. Update on experiences on the use and implementation of EMS and ongoing pilot projects/trials

5. Development of minimum standards (longline and purse seine) for further consideration

6. Consideration of a draft prioritisation/implementation strategy

7. Consideration of future workplan in accordance with Res. 21-22

8. Other matters

9. Adoption of report and closure

Appendix 2

List of Participants[1*]

CONTRACTING PARTIES

ANGOLA
Tungo, Manuel Bengui
Ministry Agriculture and Fisheries, Luanda
Tel: +244 923 805 835, E-Mail: manueltungo@yahoo.com.br

BELIZE
Howe, Ernie
Keystone Building, Suite 501, 304 Newtown Barracks
Tel: +501 223 4918, Fax: +501 223 5087, E-Mail: ernie.howe@bhsfu.gov.bz

Robinson, Robert
Deputy Director for High Seas Fisheries, Belize High Seas Fisheries Unit, Ministry of Finance, Government of Belize, Keystone Building, Suite 501, 304 Newtown Barracks, Belize City
Tel: +501 223 4918, Fax: +501 223 5087, E-Mail: deputydirector@bhsfu.gov.bz; robert.robinson@bhsfu.gov.bz

BRAZIL
Travassos, Paulo Eurico
Professor, Universidade Federal Rural de Pernambuco - UFRPE, Laboratorio de Ecologia Marinha - LEMAR, Departamento de Pesca e Aquicultura - DEPAq, Avenida Dom Manuel de Medeiros s/n - Dois Irmãos, CEP 52171-900 Recife Pernambuco
Tel: +55 81 998 344 271, E-Mail: pautrax@hotmail.com; paulo.travassos@ufrpe.br

CANADA
Browne, Dion
Senior Compliance Officer, Fisheries and Oceans Canada, 81 East White Hills Road, St. John's, NL A1C5X1
Tel: +1 709 772 4412; +1 709 685 1531, E-Mail: dion.browne@dfo-mpo.gc.ca

Kay, Lise
Policy Advisor, Fisheries and Oceans Canada, 200 Kent Street, Ottawa, ON K1A 0E6
Tel: +1 343 542 1301, E-Mail: Lise.Kay@dfo-mpo.gc.ca

Kerwin, Jessica
Large Pelagic Resource Manager, Fisheries and Oceans Canada, 200 Kent Street, Ottawa, ON K1A 0E6
Tel: +1 613 291 7480, E-Mail: jessica.kerwin@dfo-mpo.gc.ca

CHINA, (P.R.)
Chen, Xuejian
Jingchaodasha room 1216, Haidian District, 100125 Beijing
Tel: +86 106 585 0612, E-Mail: 1528957706@qq.com; chenxuejian@cofa.net.cn

Fang, Lianyong
Assistant Director, China Overseas Fisheries Association, Room 1216, Jingchao Massion, Nongzhanguannan Road, Cahoyang District, 100125 Beijing
Tel: +86 10 65853488, Fax: +86 10 65850551, E-Mail: fanglianyong@cofa.net.cn

Li, Tinglin
Room 1216, Jingchao Massion, Nongzhanguannan Road, Chaoyang District, 100125 Beijing
Tel: +86 1 065 850 683, Fax: +86 1 065 850 551, E-Mail: litinglin@cofa.net.cn; 962146246@QQ.COM

Liu, Xiaobing [1]
Professor, China Overseas Fisheries Association, Shanghai Ocean University, 100081 Beijing

CURAÇAO
Suarez, Carl Michael
Pletterijweg 43, Willemstad
Tel: +59 995 297 213, E-Mail: michael.suarez@gobiernu.cw

[1] Head Delegate
* Some delegate contact details have not been included following their request for data protection.

EUROPEAN UNION

Broche, Jerome
Deputy Head of unit D.4, European Commission DG MARE, Fisheries Control and Inspections, Rue Joseph II 99, B-1049 Brussels, Belgium
Tel: +32 229 86128, E-Mail: jerome.broche@ec.europa.eu

Costica, Florina
DG Mare, Rue Joseph II, 99, 1040 Brussels, Belgium
Tel: +32 493 540 902, E-Mail: florina.costica@ec.europa.eu

Miranda, Fernando
DG MARE, Joseph II St, 99, B-1000 Brussels, Belgium
Tel: +322 299 3922, E-Mail: fernando.miranda@ec.europa.eu

Amoedo Lueiro, Xoan Inacio
Biólogo, Consultor Ambiental, Medio Mariño e Pesca, Pza. de Ponteareas, 11, 3ºD, 36800 Pontevedra, Spain
Tel: +34 678 235 736, E-Mail: tecnico@fipblues.com; lueiro72consultant@gmail.com

Ansell, Neil
European Fisheries Control Agency, Avenida García Barbón 4, 36201 Vigo, Spain
Tel: +34 986 120 658; +34 698 122 046, E-Mail: neil.ansell@efca.europa.eu

Barciela Segura, Carlos
ORPAGU, C/ Manuel Álvarez, 16. Bajo, 36780 Pontevedra, Spain
Tel: +34 627 308 726, E-Mail: cbarciela@orpagu.com; septimocielo777@hotmail.com

Beloso Gonzalez, Jose Luis
SATLINK, S.L., Arbea Campus Empresarial, Edificio 5 || Crta. Fuencarral a Alcobendas M-603 – Km. 3,800, 28108 Alcobendas, Madrid, Spain
Tel: +34 91 327 21 31; +34 629 435 609, Fax: +34 91 327 21 69, E-Mail: jlb@satlink.es

Briand, Karine
Orthongel / Institut de Recherche pour le Dévelppement IRD, Avenue Jean Monnet CS30171, 34200 Sète, Cedex, France
Tel: +33 499 573 204, E-Mail: karine.briand@ird.fr

Connery, Paul
Sea Fisheries Protection Authority Custom, House Druids Lane, H91XV2C Galway, Ireland
Tel: +353 87 929 4738, E-Mail: Paul.Connery@SFPA.ie

Gatt, Mark
Ministry for Agriculture, Fisheries, Food and Animal Rights Fort San Lucjan, Triq il-Qajjenza, Department of Fisheries and Aquaculture, Malta Aquaculture Research Centre, Fort San Lucjan, MRS 3303 Marsaxlokk, Malta

González Suarez, Oscar
Rua dos Padróns, 4. Vial 3. P.E. Porto do Molle, 36350 Nigrán, Pontevedra, Spain
Tel: +34 664 344 566, E-Mail: ogonzalez@marineinstruments.es

Goujon, Michel
ORTHONGEL, 5 Rue des Sardiniers, 29900 Concarneau, France
Tel: +33 2 9897 1957; +33 610 627 722, Fax: +33 2 9850 8032, E-Mail: mgoujon@orthongel.fr

Herrera Armas, Miguel Angel
Deputy Manager (Science), OPAGAC, C/ Ayala 54, 2º A, 28001 Madrid, Spain
Tel: +34 91 431 48 57; +34 664 234 886, Fax: +34 91 576 12 22, E-Mail: miguel.herrera@opagac.org

Legorburu, Gonzalo
Avd. Ribera de Axpe 50, Edificio Udondo 3º - 2, 48950 Erandio Bizkaia, Spain
Tel: +34 944 361 710, E-Mail: glm@digitalobserver.org

Lino, Pedro Gil
Research Assistant, Instituto Português do Mar e da Atmosfera - I.P./IPMA, Avenida 5 Outubro s/n, 8700-305 Olhão, Faro, Portugal
Tel: +351 289 700508, E-Mail: plino@ipma.pt

Loisel, Fanny
Chargée de mission, Bureau du contrôle des pêches, Fisheries Control Unit Direction Générale des Affaires Maritimes, de la Pêche et de l'Aquaculture (DGAMPA), Directorate for Sea Fisheries and Aquaculture, Ministère de l'Agriculture et de l'Alimentation, Tour Séquoia, 75020 La Défense (Paris), France
Tel: +33 140 819 331, E-Mail: fanny.loisel@agriculture.gouv.fr; fanny.loisel@hotmail.fr

Martinez de Lagos Guevara, Estíbaliz
DataFish, Bizkaiko Jauerria 2, 1 Izquierda, 48370 Bizkaia, Spain
Tel: +34 604 077 868, E-Mail: emartinez@datafishts.com

Maufroy, Alexandra
ORTHONGEL, 5 rue des sardiniers, 29900 Concarneau, France
Tel: +33 649 711 587, Fax: +33 2 98 50 80 32, E-Mail: amaufroy@orthongel.fr

Moniz, Isadora
OPAGAC, C/ Ayala, nº 54, 2º A, 28001 Madrid, Spain
Tel: +34 91 431 48 57; +34 608 927 478, E-Mail: fip@opagac.org

Nonga, Olivier
Armement VIA OCEAN, 6 Rue des Chalutiers, 29900 Concarneau, France
Tel: +33 623 835 691, E-Mail: ononga@boltonfood.com

Nuevo, Miguel
European Fisheries Control Agency (EFCA), Avenida Garcia Barbon 4, 36201 Vigo, Pontevedra, Spain
Tel: +34 698 122 058, E-Mail: miguel.nuevo@efca.europa.eu

Paumier, Alexis
Ministère de la mer - Direction Générale des Affaires Maritimes, de la Pêche et de l'Aquaculture (DGAMPA), Tour Sequoia, 75000 Paris, France
Tel: +33 687 964 560, E-Mail: alexis.paumier@agriculture.gouv.fr

Ruiz Gondra, Jon
AZTI-Tecnalia, Txatxarramendi z/g, 48395 Sukarrieta (Bizkaia), Spain
Tel: +34 94 6574000; +34 667 174 375, Fax: +34 94 6572555, E-Mail: jruiz@azti.es

Sabarros, Philippe
IRD, UMR MARBEC, Ob7, Avenue Jean Monnet, CS 30171, 34203 Cedex, France
Tel: +33 625 175 106, E-Mail: philippe.sabarros@ird.fr

Seguna, Marvin
Chief Fisheries Protection Officer, Ministry for Agriculture, Food and Animal Rights Fort San Lucjan, Triq il-Qajjenza, Department of Fisheries and Aquaculture, Ghammieri Ingiered Road, MRS 3303 Marsa, Malta
Tel: +356 229 26918, E-Mail: marvin.seguna@gov.mt

Simão, Ana Paula
DGRM, Avenida Brasilia, 1400-298 Lisbon, Portugal
Tel: +351 213 035 700, E-Mail: asimao@dgrm.mm.gov.pt

Thasitis, Ioannis
Department of Fisheries and Marine Research, 101 Vithleem Street, 2033 Nicosia, Cyprus
Tel: +35722807840, Fax: +35722 775 955, E-Mail: ithasitis@dfmr.moa.gov.cy; ithasitis@dfmr.moa.gov.cy

Torralbo, Pablo
SATLINK, Arbea Campus empresarial, Carretera de Fuencarral, Edificio 5, Planta Baja, 28108 Alcobnedas, Madrid, Spain
Tel: +34 606 202 103, E-Mail: ptr@satlink.es

Tsachageas, Panagiotis
Director of Fisheries Control HMRDF, Hellenic Ministry of Rural Development & Food DG FISHERIES, 150 Syggrou Ave., GR17671 Athens, Greece
Tel: +302 109 287 134, E-Mail: ptsachageas@minagric.gr

Wain, Gwenaëlle
ORTHONGEL, 5 rue des sardiniers, 29900 Concarneau, France
Tel: +33 631 045 147, E-Mail: gwain@orthongel.fr

GABON
Boupana Bola, Bernice Carol
BP: 9498, Libreville Estuaire
Tel: +241 075 39220, E-Mail: carolboupana@gmail.com; caroligaboughi@outlook.fr

GUATEMALA
Aguilar Acabal, Wesley Alexander
Bárcenas, Villa Nueva, Kilometro 22 ruta al pacifico Edificio la Ceiba MAGA, 01064
Tel: +502 4365 4418, E-Mail: alexaguilardipesca@gmail.com

Alvarado Albarado, Stefanny Rebeca
Técnico, km 22 Ruta al Pacífico, Edificio La Ceiba 3er Nivel, 01064 Bárcena, Villa Nueva
Tel: +502 330 30005, E-Mail: stefannyalbarado@gmail.com

Martínez Valladares, Carlos Eduardo
Km 22 Carretera al pacifico, edificio la Ceiba 3er, nivel, 01064 Villa nueva Bárcena
Tel: +502 452 50059, E-Mail: carlosmartinez41331@gmail.com

Rodas Sánchez, María Rachel
Km. Carretera al Pacífico, Edificio "La Ceiba", 01064 Barcena Villa Nueva
Tel: +502 664 09334, E-Mail: ashadud@yahoo.es; mariarodasdpca.dipesca@gmail.com

JAPAN
Daito, Jun
Manager, Japan Tuna Fisheries Co-operative Association, 31-1, Eitai 2-Chome, Koto-ku, Tokyo 135-0034
Tel: +81 356 462 382, Fax: +81 356 462 652, E-Mail: daito@japantuna.or.jp

Fukui, Shingo
Director, International Fisheries Coordination, International Affairs Division, Fisheries Agency, 1-2-1 Kasumigaseki, Chiyoda-Ku, Tokyo 100-8907
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649,, E-Mail: shingo_fukui970@maff.go.jp

Ito, Kohei
Assistant Director, International Affairs Division, Fisheries Agency of Japan, 1-2-1 Kasumigaseki, Chiyoda-Ku, Tokyo 100-8907
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649, E-Mail: kohei_ito060@maff.go.jp

Kumamoto, Jumpei
Technical Official, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, International Affairs Division, Chiyoda-Ku, Tokyo 100-8907
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649, E-Mail: jumpei_kumamoto270@maff.go.jp

Miura, Nozomu
Assistant Director, International Division, Japan Tuna Fisheries Co-operative Association, 2-31-1 Eitai Koto-ku, Tokyo 135-0034
Tel: +81 3 5646 2382, Fax: +81 3 5646 2652, E-Mail: miura@japantuna.or.jp; gyojyo@japantuna.or.jp

Morita, Hiroyuki
Assistant Director, Responsible for the JCAP-2 Programme, International Affairs Division, Resources Management Department, Fisheries Agency of Japan, 1-2-1 Kasumigaseki, Chiyoda-Ku, Tokyo 100-8907
Tel: +81 3 3502 8460, Fax: +81 3 3504 2649, E-Mail: hiroyuki_morita970@maff.go.jp

Nagai, Daisaku
Manager, Japan Tuna Fisheries Co-Operative Association, 31-1, EITAI 2-CHOME, Koto-ku, Tokyo 135-0034
Tel: +81 356 462 382, Fax: +81 356 462 652, E-Mail: nagai@japantuna.or.jp

Uozumi, Yuji
Adviser, Japan Tuna Fisheries Co-operation Association, Japan Fisheries Research and Education Agency, Tokyo Koutou ku Eitai 135-0034

Yoshida, Hiroyuki
Deputy Director, Japan Tuna Fisheries Co-operative Association, 2-31-1 Eitai Koto-Ku, Tokyo
Tel: +81 3 5646 2382, Fax: +81 5646 2652, E-Mail: yoshida@japantuna.or.jp

KOREA (REP.)
Shim, Soobin *
Deputy Director, International Cooperation Division, Ministry of Oceans and Fisheries, Government Complex Bldg.5, Dasom 2-ro, 30110 Sejong
Tel: +82 10 9356 1682; +82 44 200 5333, Fax: +82 44 200 5349, E-Mail: sbin8shim@korea.kr

Chang, Suyoung
Campaigner, Environmental Justice Foundation, EJF, Unit 417, Exmouth House 3/11 Pine Street, Farringdon, London, EC1R 0JH, United Kingdom
Tel: +82 10 9835 1101, E-Mail: suyoung.chang@ejfoundation.org

Choi, Ki-Won
Researcher, Korea Fisheries Resources Agency, 4, Idong-gil, Ilgwang-eup, Gijang-gun, Busan
Tel: +82 51 718 2482, Fax: +82 51 742 3220, E-Mail: kiuniya@fira.or.kr

Kim, Eunhee
Researcher, Citizens' Institute for Environmental Studies, 23 Pirundae-ro, Jongno-gu, 03039 Seoul
Tel: +82 106 723 18123; +82 2 735 7034, Fax: +82 2 730 3174, E-Mail: ekim@kfem.or.kr

Kim, Taeho
Korea Overseas Fisheries Association, 6th Fl. Samho Center Bldg. "A" 83, Nohnyeon-ro, Seocho-gu, 06775 Seoul
Tel: +82 2 589 1615, Fax: +82 2 589 1630, E-Mail: taehokim@kosfa.org

Kim, Taerin
Advisor, Fisheries Monitoring Center, Ministry of Oceans and Fisheries, 638, Gijanghaean-ro, Gijang-gun, 46079 Busan
Tel: +82 10 7254 0401, Fax: +82 51 410 1409, E-Mail: shararak@korea.kr

Kim, Seung-Hyun
Assistant Director / Chief Inspector, Fisheries Monitoring Center, Ministry of Oceans and Fisheries, 638 Gijanghaean-ro, Gijang-gun, 46079 Busan
Tel: +82 10 7254 0401, Fax: +82 51 410 1409, E-Mail: whizksh@korea.kr; fmc2014@korea.kr

Lee, Sukyung
Researcher, Korea Fisheries Resources Agency, 4, Idong-gil, Ilgwang-eup, Gijang-gun, Busan
Tel: +82 51 718 2481, Fax: +82 51 742 3220, E-Mail: sue@fira.or.kr

Lee, Kyung-seon
Researcher, Division Director, Korea Fisheries Resources Agency, 4, Idong-gil, Ilgwang-eup, Gijang-gun, Busan
Tel: +82 51 718 2480, Fax: +82 51 742 3220, E-Mail: ks760229@fira.or.kr

Lee, Jooyoun
Advisor, Ministry of Oceans and Fisheries, Government Complex Bldg.5, Dasom 2-ro Sejong, 30110
Tel: +82 44 200 5379, Fax: +82 44 200 5379, E-Mail: sporyoun@korea.kr

Park, Sunhwa
Citizens' Institute for Environmental Studies (CIES), 23, Pirundae-ro, Jongno-gu, Seoul, 03039
Tel: +82 2 735 7034, Fax: +82 2 730 3174, E-Mail: sona1437@kfem.or.kr

Yang, Jae-geol
Policy Analyst, Korea Overseas Fisheries Cooperation Center, 6th FL, S Building, 253, Hannuri-daero, 30127 Sejong
Tel: +82 44 868 7364, Fax: +82 44 868 7840, E-Mail: jg718@kofci.org

MEXICO
Soler Benitez, Bertha Alicia
Comisión Nacional de Acuacultura y pesca (CONAPESCA), Av. Camarón Sábalo 1210 Fracc. Sábalo Country Club., 82100 Mazatlán, Sinaloa
Tel: +52 669 915 6900 Ext. 58462, E-Mail: berthaa.soler@gmail.com

MOROCCO
Adili, Brahim
E-Mail: adili@mpm.gov.ma

Azdad, Chellal
E-Mail: azdad@mpm.gov.ma

Kecha, Youssef
Chef de la Division de Suivi des Opérations de Contrôle et d'Inspection à la DCAPM, Ministère de l'Agriculture,de la Pêche Maritime, du Développement Rural et des Eaux et Forêts / Département de la Pêche Maritime, Quartier Administratif, haut Agdal, 11010 Rabat
Tel: +212 537 688 371; +212 661 512 191, Fax: +212 537 688 382, E-Mail: youssef.kecha@mpm.gov.ma

Sabbane, Kamal
Cadre à la Direction de Contrôle des Activités de la Pêche Maritime, Ministère de l'Agriculture de la Pêche Maritime, du Développement Rural et des Eaux et Forêts, Département de la Pêche Maritime, Quartier Administratif BP 476, 10090 Agdal, Rabat
Tel: +212 537 688 196, Fax: +212 537 688 382, E-Mail: sabbane@mpm.gov.ma

Tabit Bensliman, Sara
Département de la pêche maritime, Quartier administratif, 476 Agdal Rabat, 10000
Tel: +212 661 449 370, E-Mail: sara.tabit@mpm.gov.ma

PANAMA
Rodriguez, Nicky
Autoridad de Recursos Acuáticos, Unidad de informática
Tel: +507 511 6093, E-Mail: nrodriguez@arap.gob.pa

SENEGAL
Diouf, Ibrahima
Direction des Pêches maritimes, Chef de la Division de la pêche industrielle, BP 289 Dakar
Tel: +221 541 4764, Fax: +221 338 602 465, E-Mail: ivesdiouf@gmail.com

Faye, Adama
Directeur adjoint de la Direction de la Protection et de la Surveillance des pêches, Direction, Protection et Surveillance des Pêches, Cité Fenêtre Mermoz, BP 3656 Dakar
Tel: +221 775 656 958, Fax: +221 338 602 465, E-Mail: adafaye2000@yahoo.fr; adafaye@yahoo.fr

Sèye, Mamadou
Ingénieur des Pêches, Chef de la Division Gestion et Aménagement des Pêcheries de la Direction des Pêches maritimes, Sphère ministérielle de Diamniadio Bâtiment D., 1, Rue Joris, Place du Tirailleur, 289 Dakar
Tel: +221 77 841 83 94, Fax: +221 821 47 58, E-Mail: mdseye@gmail.com; mdseye1@gmail.com; mdouseye@yahoo.fr

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
Arris, Martin
16 Hauxley Drive, Whitley Bay NE25 9ge
Tel: +44 797 184 8562, E-Mail: martin.arris@marinemanagement.org.uk

Deary, Andrew
Head of Blue Belt Compliance, MMO, Marine Management Organisation, Lutra House. Dodd Way. Walton House. Bamber Bridge. Preston Office, PR5 8BX
Tel: +44 782 766 4112, E-Mail: andrew.deary@marinemanagement.org.uk

Nelson, Paul
Chi Gallos, Hayle Marine Renewables Park, North Quay, Hayle, Penzance TR27 4DD
Tel: +44 208 026 9084, E-Mail: Paul.Nelson@marinemanagement.org.uk

Sparks, Jason
Marine Enforcement Officer Saint Helena Government, Jamestown, Saint Helena
Tel: +44 290 25947, E-Mail: jason.sparks@sainthelena.gov.sh

UNITED STATES
Harris, Madison[1]
Foreign Affairs Specialist, Office of International Affairs, Trade, and Commerce (F/IATC), NOAA, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, Maryland 20910
Tel: +1 301 427 8350; +1 202 480 4592, E-Mail: madison.harris@noaa.gov

Blankinship, David Randle
Chief, Atlantic Highly Migratory Species Management Division, NOAA - National Marine Fisheries Service, 263 13th Ave South, Saint Petersburg, Florida 33701
Tel: +1 727 824 5313, Fax: +1 727 824 5398, E-Mail: randy.blankinship@noaa.gov

Brothen, Tanya
Foreign Service Officer, Office of Marine Conservation (OES/OMC), U.S. Department of State, Rm 2758, 2201 C Street NW, Washington DC 20520-7878
Tel: +1 202 647 4000, E-Mail: brothentr@state.gov

Brown, Craig A.
Chief, Highly Migratory Species Branch, Sustainable Fisheries Division, Southeast Fisheries Science Center, NOAA, National Marine Fisheries Service, 75 Virginia Beach Drive, Miami, Florida 33149
Tel: +1 305 586 6589, E-Mail: craig.brown@noaa.gov

Donaldson, Tim
NOAA, 1315 East West Hwy, Silver Spring, Maryland 20910
Tel: +1 301 427 8272, E-Mail: tim.donaldson@noaa.gov
Engelke-Ros, Meggan
Deputy Chief, NOAA Office of General Counsel, Enforcement Section, 1315 East-West Highway, SSMC3-15860, Silver Spring, Maryland 20910
Tel: +1 301 427 8284, Fax: +1 301 427 2202, E-Mail: meggan.engelke-ros@noaa.gov

Leape, Gerald
Principal Officer, Pew Charitable Trusts, 901 E Street NW, Washington DC 20004
Tel: +1 202 431 3938, Fax: +1 202 540 2000, E-Mail: gleape@pewtrusts.org

McHale, Bradley
Fishery manager, NOAA - National Marine Fisheries Service, 55 Great Republic Dr., Gloucester, MA 01930
Tel: +1 978 281 9139, Fax: +1 978 281 9340, E-Mail: brad.mchale@noaa.gov

Miller, Ian
NOAA, 1315 East-West Highway, Maryland 20910
Tel: +1 302 751 6684, E-Mail: ian.miller@noaa.gov

Moore, Katie
Living Marine Resources Program Manager, United States Coast Guard, Atlantic Area-Response, Office of Maritime Security and Law Enforcement, 431 Crawford St., Portsmouth, Virginia 23704
Tel: +1 757 398 6504, E-Mail: katie.s.moore@uscg.mil

Svensson, Christa
10500 N.E. 8th Street Suite 1000 Bellevue, WA, 98004
Tel: +1 425 300 7099, E-Mail: csvensson@trimarinegroup.com

URUGUAY
Domingo, Andrés *
Dirección Nacional de Recursos Acuáticos - DINARA, Laboratorio de Recursos Pelágicos, Constituyente 1497, 11200 Montevideo
Tel: +5982 400 46 89, Fax: +5982 401 32 16, E-Mail: dimanchester@gmail.com

VENEZUELA
Arocha, Freddy
Asesor Científico, Instituto Oceanográfico de Venezuela, Universidad de Oriente, A.P. 204, 6101 Cumaná Estado Sucre
Tel: +58 424 823 1698, E-Mail: farochap@gmail.com

OBSERVERS FROM COOPERATING NON-CONTRACTING PARTIES, ENTITIES, FISHING ENTITIES

BOLIVIA
Alsina Lagos, Hugo Andrés
Director Jurídico, Campomarino Group, Calle Yanacocha No. 441 Efi. Arcoiris, piso 15, oficina 10, La Paz
Tel: +1 321 200 0069, Fax: +507 830 1708, E-Mail: hugo@alsina-et-al.org

Cortez Franco, Limbert Ismael
Jefe de la Unidad Boliviana de Pesca Marítima (UBPM), Calle 20 de Octubre 2502, esq. Pedro Salazar, La Paz
Tel: +591 6 700 9787, Fax: +591 2 291 4069, E-Mail: limbert.cortez@protonmail.ch; limbert.cortez@mindef.gob.bo; licor779704@gmail.com

CHINESE TAIPEI
Chou, Shih-Chin
Section Chief, Deep Sea Fisheries Division, Fisheries Agency, 8F, No. 100, Sec. 2, Heping W. Rd., Zhongzheng Dist., 10070
Tel: +886 2 2383 5915, Fax: +886 2 2332 7395, E-Mail: chou1967sc@gmail.com; shihcin@ms1.fa.gov.tw

Kao, Shih-Ming
Associate Professor, Graduate Institute of Marine Affairs, National Sun Yat-sen University, 70 Lien-Hai Road, 80424 Kaohsiung City
Tel: +886 7 525 2000 Ext. 5305, Fax: +886 7 525 6205, E-Mail: kaosm@mail.nsysu.edu.tw

Lee, Ching-Chao
Technical Specialist, Deep Sea Fisheries Division, Fisheries Agency, 8F., No.100, Sec. 2, Heping W. Rd., Zhongzheng Dist., 10060
Tel: +886 223 835 911, Fax: +886 223 327 395, E-Mail: chaolee1218@gmail.com; chinchao@ms1.fa.gov.tw

Yang, Shan-Wen
Secretary, Overseas Fisheries Development Council, 3F., No. 14, Wenzhou Street, Da'an Dist., 10648
Tel: +886 2 2368 0889 #151, Fax: +886 2 2368 6418, E-Mail: shenwen@ofdc.org.tw

COSTA RICA
Lara Quesada, Nixon
Biólogo Marino, INCOPESCA, 125 metros este y 75 metros norte de planta de atún Sardimar, 60101 Puntarenas
Tel: +506 831 12658, E-Mail: nlara@incopesca.go.cr; nixon.lara.21@gmail.com; nlara@incopesca.go.cr

Pacheco Chaves, Bernald
Instituto Costarricense de Pesca y Acuicultura, INCOPESCA, Departamento de Investigación, Cantón de Montes de Oro, Puntarenas, 60401
Tel: +506 899 22693, E-Mail: bpacheco@incopesca.go.cr

Umaña Vargas, Erik
Jefe, Oficina Regional de Limón
E-Mail: eumana@incopesca.go.cr

OBSERVERS FROM NON-GOVERNMENTAL ORGANIZATIONS

BIRDLIFE INTERNATIONAL - BI
Prince, Stephanie [1]
BirdLife International Marine Programme, Bedfordshire Sandy SG19 2DL, United Kingdom

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION - ISSF
Murua, Hilario
Senior Scientist, International Seafood Sustainability Foundation (ISSF), 3706 Butler Street, Suite 316, Pittsburgh PA 15201-1802, United States
Tel: +34 667 174 433; +1 703 226 8101, E-Mail: hmurua@iss-foundation.org

Restrepo, Víctor
Chair of the ISSF Scientific Advisory Committee, International Seafood Sustainability Foundation, 3706 Butler Street, Suite 316, Pittsburgh PA 15201-1802, United States
Tel: + 1 305 450 2575; +1 703 226 8101, Fax: +1 215 220 2698, E-Mail: vrestrepo@iss-foundation.org; vrestrepo@mail.com

PEW CHARITABLE TRUSTS - PEW
Wozniak, Esther
The Pew Charitable Trusts, 901 E Street, NW, Washington DC 20004, United States
Tel: +1 202 657 8603, E-Mail: ewozniak@pewtrusts.org

SHARKPROJECT INTERNATIONAL
Ziegler, Iris
SHARKPROJECT International, Rebhaldenstrasse 2, 8910 8910 Affoltern am Albis, Switzerland
Tel: +49 174 3795 190, E-Mail: i.ziegler@sharkproject.org; int.cooperation@sharkproject.org; driri sziegler@web.de

OTHER PARTICIPANTS

SCRS CHAIRMAN
Melvin, Gary
SCRS Chairman, St. Andrews Biological Station - Fisheries and Oceans Canada, Department of Fisheries and Oceans, 285 Water Street, St. Andrews, New Brunswick E5B 1B8, Canada
Tel: +1 506 652 95783; +1 506 651 6020, E-Mail: gary.d.melvin@gmail.com; gary.melvin@dfo-mpo.gc.ca

SCRS VICE-CHAIRMAN
Arrizabalaga, Haritz
Principal Investigator, SCRS Vice-Chairman, AZTI Marine Research Basque Research and Technology Alliance (BRTA), Herrera Kaia Portualde z/g, 20110 Pasaia, Gipuzkoa, Spain
Tel: +34 94 657 40 00; +34 667 174 477, Fax: +34 94 300 48 01, E-Mail: harri@azti.es

*****

ICCAT Secretariat
C/ Corazón de María 8 – 6th floor, 28002 Madrid – Spain
Tel: +34 91 416 56 00; Fax: +34 91 415 26 12; E-mail: info@iccat.int

Manel, Camille Jean Pierre
Neves dos Santos, Miguel
Ortiz, Mauricio
Palma, Carlos
Mayor, Carlos
Taylor, Nathan
Cheatle, Jenny
Parrilla Moruno, Alberto Thais
De Andrés, Marisa
Campoy, Rebecca
Donovan, Karen
García-Orad, María José
Motos, Beatriz
Peyre, Christine
Pinet, Dorothée
Peña, Esther
Samedy, Valérie

ICCAT INTERPRETERS
Baena Jiménez, Eva J.
Fleming, Jack
Gelb Cohen, Beth
Herrero Grandgirard, Patricia
Liberas, Christine
Linaae, Cristina

Appendix 3

Progress Report of EMS Trials
(as of 31 May 2022)

(Submitted by Japan)

1. Summary of Trials

Trials for offshore longline vessels were conducted for 3 (three) EMS on the market.

Trials for distant water longline vessels were conducted for 1 (one) EMS on the market as well as 1 (one) EMS developed by Japanese private sector (LL industry and maritime monitoring company).

Offshore Longline	EMS provider A	2021/2 – 2021/6 (WCPFC) 2021/2 – 2021/12 (WCPFC)
	EMS provider B	2021/2 – 2021/5 (WCPFC) 2021/2 – 2021/11 (WCPFC)
	EMS provider C	2021/2 – 2021/4 (WCPFC) 2021/2 – 2022/2 (WCPFC)
Distant Water Longline	EMS Japan Tuna	2021/10 - 2021/12 (ICCAT) 2021/8 - 2021/12 (IOTC/CCSBT) 2022/4 (WCPFC/CCSBT) 2022/5 - 2022/7 (ICCAT/CCSBT)
	EMS provider A	2022/3 - （IATTC）

Technical specifications for each EMS are provided in **Annex 1 to Appendix 3**.

2. Identified Challenges in Collecting Video Footage on the Vessels

i) Flicker noise

Flicker noise caused by lighting was observed. Adjustment of frame rate would be necessary. Or EMS should use cameras that have a software to address/remove flicker noise.

ii) Interference with the radio system

Radio communication systems of fishing vessel was interfered with the EMS. The cause is not identified yet. In some cases, GPS for EMS was not functioning possibly due to an interference with other equipment of the vessel.

iii) Malfunction of camera

Several cases of malfunction in cameras were observed. No image was recorded in those cases. These were due to unsuccessful interlocking between the EMS and UPS (Uninterruptible Power Supply) or overall technical problem in the EMS.

iv) Corrosion of fixing frame/ screw/ bolt

Corrosion of metal frame/ screw/ bolt used for fixing cameras was observed. Treatments on those materials to prevent (electronic) corrosion are necessary.

v) Vibration of the footage

Fixing cameras by bolts was not strong enough in particular for small vessels. Welding could be an alternative way of fixing cameras, but that would be more costly and damage vessel's body.

vi) Unclear image due to dirty lenses

Camera lenses should be cleaned periodically by crew. While 'tamper proof' is sometimes considered as one of EMS requirements, involvement of crew should not be categorically rejected.

vii) Unclear image due to condensation on the inside of camera cover

Condensation is often observed when there was significant temperature difference between day and night or when the vessel changed fishing grounds.

viii) Fogging camera due to physical damage on cameras

Camera covers were damaged by physical contacts with fishing equipment. In those cases, repairing and/or replacement of cameras are necessary.

ix) Failure of automatic transmission of status reports

There were cases where periodic status reports were not received. Since VMS were functioning during these incidents and video footage was properly recorded, it is assumed that there were technical problems within the EMS. This issue indicates the necessity of careful consideration in establishing guidelines in the case of failure of status report. Fishermen should not incur liability for the failure if the cause of such non-reporting is a technical problem within the EMS. If the EMS is for scientific purpose, there is no need to call a port to fix the EMS simple because of non-submission of status reports as the video footage continue to be recorded successfully.

x) Unexpected re-starting of EMS due to lack of electricity

Power supply is sometimes unstable and insufficient in particular in the case of small vessels. In order to secure stable power supply to the EMS, additional UPS that can sustain power supply for the EMS including up to 4 cameras for 30 minutes of power failure would be necessary.

While several EMSs are on the market, how to install such EMS to vessels is not straightforward. The best way to install EMS would be different even among longline vessels depending on their specifications. CPCs need significant experiences and practices to ensure proper instalment of EMS.

There are several problems caused by technical issues of the EMS. Any possible guidelines for implementation of EMS should take into account such intrinsic limitation/uncertainty of EMS. For example, fishermen should not incur all the costs to address the problems of the EMS especially when the cause of such problem is a technical issue of the EMS.

3. Identified Challenges in Extracting Data from the Video Footages

Reviewing and analyzing video footages to extract data is time consuming though each EMS provider has developed software to assist such review. At this stage, such review of video footage has to be conducted manually although AI technology would hopefully replace human in the future. In our trials, in order to analyses a video footage for one longline operation (16-18 hours, # of hooks: 2,500-4,000) as detailed as possible, it took 7-12 hours depending on the capabilities of the analysts.

Those who have experiences in human observers can analyze EM video footages efficiently. However, such human resources are limited. This means increasing observer coverage by EMS will be also subject to the availability of human resources who are well trained and experienced in this field. Until automatic analysis on video footage would become possible, prioritization on data fields to be extracted from the footage would be necessary.

The video footages are encrypted, and provider-specific software is required to review the footages. For this reason, it would be unpractical for inspectors to check the video footages for compliance purpose.

4. Collectable Data Fields

i) Data fields that can be collected by EMS

- Catch information (species, condition (dead/alive), length, the number of branch line)
- Condition of discards (dead/alive)
- Date, time & geographical coordinates of each set
- Number of floats, number of branch lines
- Bait type (fish/squid)
- Bycatch mitigation measures (blue dyed bait, line shooter, side setting)

Note: Items such as length, bait type, number of floats and number of branch line can be collected more easily by human observers.

ii) Data fields with significant difficulty in collecting by EMS

- Catch information (weight, sex)
- Biological samples (e.g., otolith, muscle)
- Oceanographic and metrological information
- Specifications of gear (e.g., length of main line, length of branch line, interval between branch lines, hook type)
- Depth of hooks
- Bycatch mitigation measures (offal disposal, type of tori-line, equipment for releasing sea turtles)

Note: Specifications of gear can be collected from logbook

EMS can collect bycatch information, including discards and fate of discards, that is the main purpose of deploying a human observer. Also, EMS can collect information on seabird mitigation measures being implemented, that is one of the roles of a human observer.

EMS cannot collect environment information such as Sea Surface Temperature and gear specifications to be used for scientific analysis (e.g., standardization of CPUE). Other data source such as satellite image, logbook as well as interview with crew should be considered to complement EMS. Biological samples cannot be collected by EMS. If more biological samples are needed, independent data collection program such as port sampling should be considered.

5. Cost

Human observer (per trip): 8,500 USD

EMS (per vessel):

Main Unit of EMS:	3,600 –12,500 USD
Installation to a vessel:	11,000 – 25,000 USD
Running cost:	3,900 USD
Maintenance & Repair:	1,600 – 11,000 USD
Review & Analysis:	6,100 USD
Software:	7,800 – 19,700 USD/year

With regard to initial cost, EMS (i.e., purchase main unit and install to a vessel) would be more costly than human observer (training cost). Even though running cost for EMS seems to be non-significant, costs for reviewing video footages as well as license fee for software should be taken into account in comparing the running cost of EMS to that of human observer.

In the case of human observer, fishing vessels to which observers will be deployed can be chosen flexibly every year. In the case of EMS, given the high cost of installation of EMS to a vessel, the same vessels will continue to be monitored by EMS.

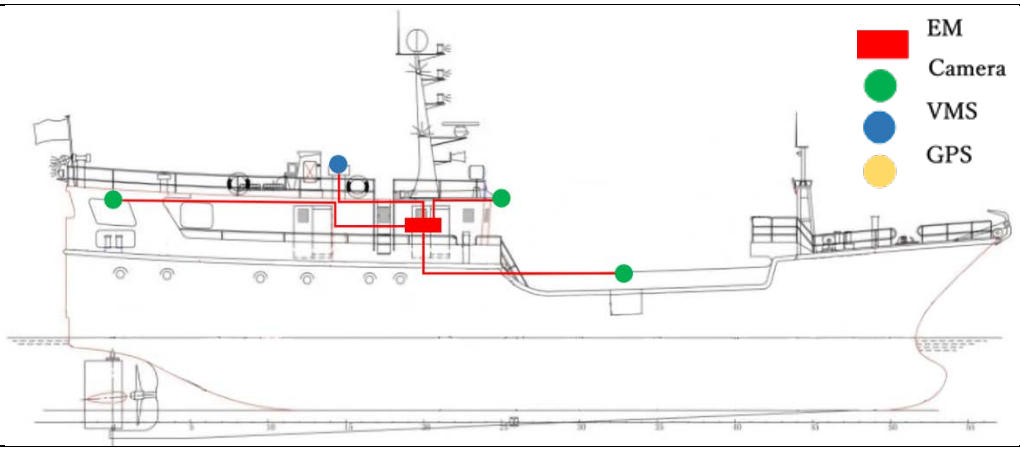
6. Future plan

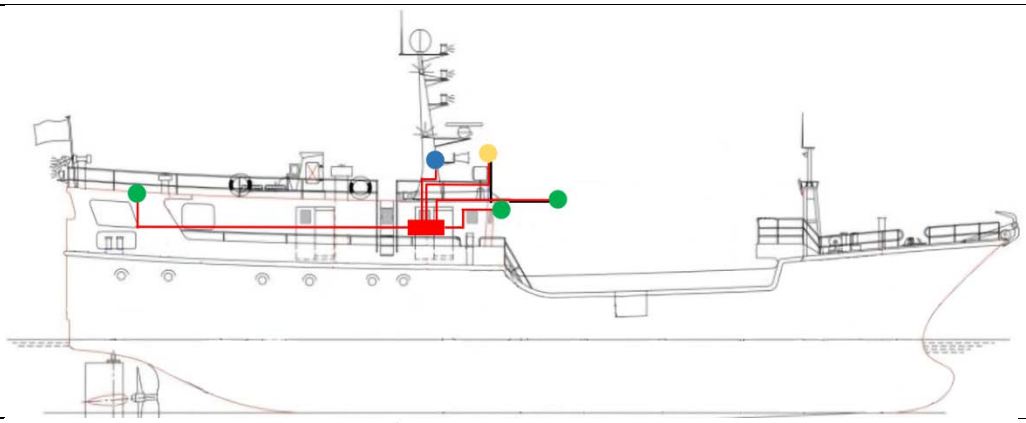
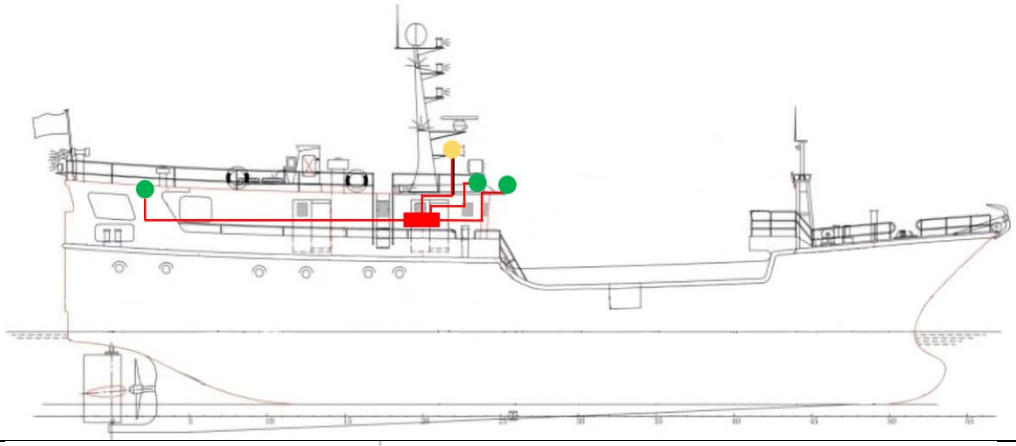
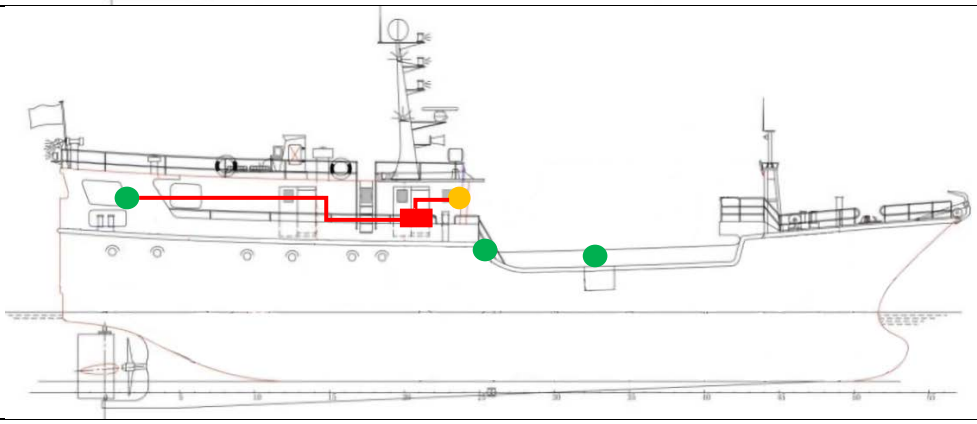
More trials for distant water longline vessels are planned, including those in the Atlantic.

Annex 1 to Appendix 3

Specifications of EMS examined by Japan

	EMS provider A	***EMS provider B***	***EMS provider C***	***Japan Tuna***
# of cameras	3	3	3	3 connected by Wi-Fi
Storage (default)	SSD 2.0TB * 2	SSD 2.0TB	HDD 8.0TB	HDD 5.0TB
VMS/GPS	Inmarsat	Irridium + GPS	GPS or VMS	GPS
Data Transmission	via SSD	via 4G (info on fishing trip) via SSD (video data)	via HDD	via HDD
Encryption of video data	Yes	Yes	No	No
Frame Rate	24fps （default） (can be changed from 1 to 30)	1fps, 2fps, 3fps, 5fps (default), 8fps, 10fps, 15fps, 30fps	25fps	1 picture/second (during fishing operation) 1 picture/hour (otherwise)
Resolution	1280*720 (default) Can be changed in 35 steps	1360*786 (default) Can be changed in 6 steps	1280*720 704*576	280*72
Recordable Times (default settings)	50 – 100 days	150 – 200 days	100 – 150 days	400-420 days
Status Report	Yes	Yes	No	No
Initial Cost (equipment only)	9,400 USD	12,500 USD	3,600 USD	7,800USD

EMS provider A	

EMS provider B	
EMS provider C	
Japan Tuna	

Appendix 4

Electronic Monitoring in the UK Pole and Line Fishery
An Information Paper
(Submitted by the United Kingdom)

Introduction

The UK is providing this paper to offer details of an initial trial of an Electronic Monitoring (EM) system on a small vessel, small-scale, pole and line tuna fishery. The trial is being carried out in the UK Overseas Territory (UK-OT) of St Helena.

The purpose of this paper is to share the scope, technical specifications and lessons learned from the trial with ICCAT CPCs. The UK is not aware of similar trials being conducted on small-scale ICCAT fisheries by other CPCs. The UK hopes that the information shared in this paper will support and encourage future discussions on trials in such fisheries at the Working Group on Electronic Monitoring Systems (WG-EMS).

The UK's intentions at the outset of the trial are:

- Improve the efficacy of the management of the fishery through additional scientific data collection.
- Investigate the suitability of the system to collect the scientific data required under Rec. 16-14.
- Assess the system's ability to compliment or replace human observer coverage of the fishery.

At this stage the trial is not focused on EM as a compliance tool.

Due to difficulties in finding observers that can deploy to this remote location, the UK is exploring EM systems as an alternative to or to compliment human observer coverage. The UK is evaluating the system's ability to fulfil certain observer requirements. As a first phase of the trial EM equipment has been fitted to a single 10.94 m length fishing vessel operating in the fishery. The trial is voluntary at this stage and a decision on mandatory application of EM as a license condition has not yet been taken by the Government of St Helena.

The vessel is targeting yellowfin tuna and utilising live bait and fish with either rod/reel or pole and line while drifting with shoals of tuna. The vessels operate on short trips from port, typically one day in duration.

The vessels attempt to catch 1 tonne of tuna per day which matches the processing capacity on St Helena.

It is the aspiration of the Government of St Helena that the EM coverage of the fishery will be 100% in the future.

Technical description

The system has the following components and capabilities:

- It is powered by a combination of solar and battery power with a system to manage charging and power output. This system is adequate to provide power for the length of fishing trips the vessel undertakes.

- The system collects sensor data every 10 seconds and the video system is triggered by the vessel exiting a pre-defined port area.
- A GPS antenna to geolocate the video footage and detect the vessel's departure and entry from port.

- A two-camera system comprised of:

    - A "general overview" camera to capture the general activity of the vessel – this camera is positioned high on the vessel to give an overview.

  - A "fish measuring camera" with the capability to allow human analysts to take species ID and measurement data after capture – this camera is positioned at a collaborated location above the fish processing area.

- A hard and software package for data storage and analysis. Video data are deleted manually post review unless they are required for any control or enforcement purposes.

- The system can transfer data either by remote access using 3G or 4G network or by using interchangeable hard drives. The latter has been used in the case of this trial due to the remote location of St Helena and prohibitive costs of remote connection.

- Weather station to record environmental conditions.

- The system has a "privacy mask" capability applied to the video images to protect the private crew areas of the vessel. The system does not record any sound for the same reasons.

- Human analysis of a full fishing trip currently takes an experienced analyst approximately 1-2 hours.

- Fish measurements are carried out by the analysts clicking on video images using the software.

Capability of the system

A key aim of the trial is to determine the capabilities of the system in comparison to the requirements of *Recommendation by ICCAT to Establish Minimum Standards for Fishing Vessel Scientific Observer Programs* (Rec. 16-14).

Trials with human observers collecting data to compare with the system are on-going.

A comparison of the requirements of *"task of observers"* within Rec. 16-14 is provided in the table below. This is intended as a measure of the capability of the system.

Rec. 16-14 reference	*Requirement*	*System capability*
7. a). i.	Data collection, that includes quantifying total target catch, discards and bycatch (including sharks, sea turtles, marine mammals, and seabirds), estimating or measuring size composition as practicable, disposition status (i.e. retained, discarded dead, released alive), the collection of biological samples for life history studies (e.g., gonads, otoliths, spines, scales);	– The general overview camera captures: • All fishing vessel activity – including the number of rods or poles that are being used • Discards are captured but human analysis is required to determine the disposition status – The fish measuring camera uses an electronic grid imposed on the camera system that is calibrated to the fishing vessels specific deck space – The fish must be laid out on a bench by the vessel's crew for 5 seconds to allow subsequent measurement of the fish by an analyst – Current measurement accuracy estimate is +-1cm – Species identification is achieved by the analysts using the fish measuring camera view – Collection of life histories and other biological samples are not possible

7. a). ii.	Collect and report on all tags found;	– Tags can be presented to the camera by the vessels crew to record the date and location of any capture
7. a). iii.	Fishing operation information, including: – location of catch by latitude and longitude; – fishing effort information (e.g., number of sets, number of hooks, etc.); – date of each fishing operation, including, as appropriate, the start and stop times of the fishing activity; – use of fish aggregating objects, including FADs; and – general condition of released animals related to survival rates (i.e., dead/alive, wounded, etc.);	– The general overview camera captures: • The number of rods or poles being used – Video footage records the catch and positional data from the GPS antenna are linked by the systems software
7. b)	Observe and record the use of bycatch mitigation measures and other relevant information;	Not applicable in the case of this fishery
7. c)	To the extent possible, observe and report environmental conditions (e.g., sea state, climate and hydrologic parameters, etc.).	– The weather station is capable of recording wind speed/direction, air temperature, barometric pressure and angle and rate of the vessels pitch and roll as a proxy for sea state
7. d)	Observe and report on FADs, in accordance with the ICCAT Observer programme adopted under the multi-annual conservation and management programme for tropical tuna; and	– The deployment of FADs at sea would potentially be captured by the general overview camera
7. e)	Perform any other scientific tasks as recommended by the SCRS and agreed by the Commission.	– Other tasks within the systems capability are possible but would require testing

In cases where the system is not able to collect required data, onshore data collection at the single landing point on St Helena will complement the EM.

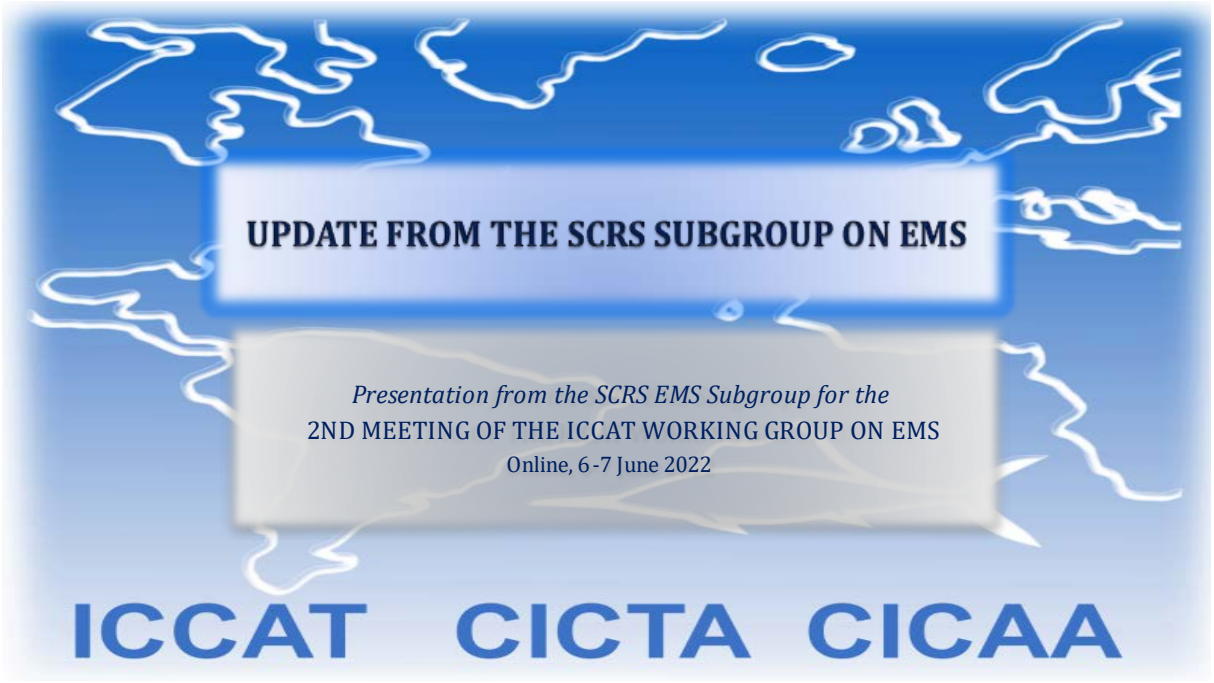
Costs:

The costs of this EM trial are borne by the UK Government as part of its assistance to the UKOTs.

EM costs	*Cost in Yr.1*	*Annual maintenance costs*
System hardware costs	€7,700, £6,556, USD9,716	None
Software license costs	€6,500, £5,534, USD8,201	€3,900, £3320, USD4,921
Total	**€14,200, £12091, USD17,918**	**€3,900, £3320, USD4,921**

Appendix 5

Update from the SCRS Technical Sub-group EM (Electronic Monitoring);
Presentation from the SCRS Technical Sub-group EM (Electronic Monitoring) for the 2nd Meeting of the ICCAT Working Group on EMS



SCRS EMS Subgroup - Background

- In 2019 ICCAT,established Recs 19-02 and 19-05 (pertaining to tropical tunas and billfishes):

The Permanent Working Group for the Improvement of ICCAT Statistics and Conservation Measures (PWG), in cooperation with the SCRS, shall work to develop recommendations on the following issues for consideration at the 2021 annual meeting of the Commission:

*a) **Minimum standard for an electronic monitoring** system such as:*

(i) the minimum specification of the recording equipment (e.g. resolution. recording time capacity, data storage type, data protection)

(ii) the number of cameras to be installed at which points on board

*b) **What shall be recorded***

*c) **Data analysis standards**, e.g., converting video footage into actionable data by the use of artificial intelligence*

*d) **Data to be analyzed**, e.g., species, length, estimated weight, fishing operation details*

*e) **Reporting format** to the Secretariat*

*In 2020 **CPCs are encouraged to conduct trials** on electronic monitoring and report the results back to the PWG and the SCRS in 2021 for their review.*

- **This request started to be addressed by the Billfishes Species Group in 2021** (BILL meeting, March 2021)

2

ICCAT CICTA CICAA

SCRS EMS Subgroup – updates

- The SCRS provided an update during the 1st EMS meeting (28 Feb), with regards to the work achieved in 2021 and early 2022
  - Revision of literature with regards to EMS trials (mostly in comparison with HO)
  - Comparison of what can be achieved with EMS vs HO (using ST-09 fishery observer data)
- The work since has focused mostly on developing the minimum standards for Scientific pelagic LL fisheries
- Here we will provide the following:
  - Summary of the comparison between EMS and HO for scientific ICCAT data (from ST-09)
  - Status of the development of the pelagic LL minimum standards

NOTE: What we are presenting here is preliminary ongoing work. Not yet seen or adopted by the SC STATS and SCRS.

3

ICCAT CICTA CICAA

ST-09 – FISHING DATA

Most "Fishing characteristics data" can be obtained with EMS

ST-09 DATA FIELDS			Possible to collect by human observers?	Possible to collected by EMS?	Notes
Fishing operations & fleets	Fish. Oper. (FO)	RO group ID	Not applicable	Not applicable	Coding variable applied post-processing
	Fleet attributes	Flag of Vessel (code)	Yes	Yes	Obtained from mEMS installation ID
		Base port/home	Yes	Yes	Obtained from mEMS installation ID
		Vessel (date class)	Yes	Yes	Obtained from mEMS installation ID
Temporal attributes	Year, month/trimester	Year	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		T. Period (ID)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
Geographical attributes	Resolution and position (Lat, Lon)	Square type (code)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
		Lat (centroid) (ddddd)	Yes	Yes	
		Lon (centroid) (ddddd)	Yes	Yes	Need to assure the EMS system has a GPS or VMS included as standard
Effort attributes	All fishing gears	Gear group (code)	Yes	Yes	
		N°Vessels	Not applicable	Not applicable	Grouping variable applied post-processing
		N°Fish. Oper. (observed)	Not applicable	Not applicable	Grouping variable applied post-processing
		Fish Oper. Type (code)	Yes	Yes	
		School type (code)	Not applicable to LL	Not applicable to LL	Not applicable to LL
	Longline (LL) only	LL type	Yes	Yes	Possible with additional info from logbooks or the skipper. Should also be possible to detect the LL type/configuration with a camera recording the deployment
		N°hooks (total)	Yes	Yes	Might be possible to get from logbooks. Could also count at deployment, as hooks/floats are seen with a deployment camera (but could be time consuming to count all hooks)
		No. hooks (observed)	Yes	Yes	
		Hks ktype (main)	Yes	Possible	Possible but need integration with additional info from logbooks or the skipper
		Set depth (hooks per basket)	Yes	Yes	Need to put cameras during deployment to count hooks between floats. Will also allow for total set effort (n hooks). Note that HBF might not be the best proxy for depth of setting
Mitigation measures (MM) on bycatch species	Seabirds	MM 1	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
		MM 2	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Other bycatch	MM 3	Yes	Yes	Possible for EMS to detect some MM, like for example Tori line, night setting or painted bait.
	Additional notes	Description (MM)	Yes	Yes	Optional field in ST-09. Possible to add information with any complimentary information

4

ICCAT CICTA CICAA

ST-09 – CATCH DATA

Most "Catch data" can be obtained with EMS, but there might be the need for some adaptations

ST-09 DATAFIELDS			Collected by human observers?	Collected by EMS?	Notes
Catch composition by fishing operation	Fish. Oper. (FO)	FO group ID	Not applicable	Not applicable	Coding variable applied post-processing
	Species (attributes)	Species (cod)	Yes	Yes	EMS could have problems with identification of bycatch that are not brought onboard, and in those cases higher level taxa IDs likely needed. As a standard, the EMS system should have one camera for the retained species and another for the area close to the vessel in case they cut the line for discarding. For the retained catch EMS systems record video that can be seen many times, while human observers have the advantage of being able to look into detailed taxonomic characteristics if needed.
		Targeted (Y/N)?	Yes	Possible	Possible but need integration with additional info from logbooks or the skipper
	Catches (retained)	Weight (kg)	Yes	Possible in some cases	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales. Or there might be a way to connect the scale to the EMS directly
		Product type (cod)	Yes	Possible in some cases	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales.
		Number (catch number)	Yes	Yes	
	Discards (Number)	Dead (DD)	Yes	Possible in some cases	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Alive (DL)	Yes	Possible in some cases	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release. Need video and not only still images. Requires review of all relevant video footage to get total numbers
		Unknown	Yes	Yes	Important to be collected (even for some management recomendations and compliance issues). The EMS would need cameras or other systems in specific positions to determine specimen condition at release.
	Sampling (data)	N° sampled	Yes	Yes	

Note: many types of scientific data collected by observers are possible to collect through EMS, but some are much more labour intensive to obtain (e.g. reviewing many hours of video footage, placing catch in specific places for measurements, cameras at specific locations for discards, etc).

5

ICCAT CICTA CICAA

ST-09 – BIOLOGICAL DATA

Collection of "Biological data" with EMS is more challenging and will need adaptations

ST-09 DATA FIELDS			Collected by human observers?	Collected by EMS?	Notes
Specimens & fishing operations (FO)	Specimen Identifier	Unique specimen ID	Not applicable	Not applicable	Coding variable applied post-processing
		FO group ID	Not applicable	Not applicable	Coding variable applied post-processing
		Species (cod)	Yes	Yes	
Biological data (observed)	Sex	Sex (cod)	Yes	Possible in some cases	With observers it is possible for elasmos (externally) and bony fishes when they are eviscerated. With EMS might be possible for elasmobranchs with specific specimen position by the crew and cameras
	Size	Length (cm)	Yes	Yes	Possible if the crew positions the specimens in front of a specific camera for measurements. Need for calibrated areas
		Size discharge (cod)	Yes	Yes	
	Weight	Weight (kg)	Yes	Possible in some cases but need adaptations	Both HO and EMS can only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessels have scales the HO can take weights directly. For EMS might be possible to put cameras facing the scales, or there might be a wayto connect the scales to the EMS directly
		Product type (cod)	Yes	Possible in some cases but need adaptations	Both HO and EMS could only do in vessels that have scales to weigth individual specimens. Most vessels don't have these onboard (some large LL only). If the vessles have scales, could put cameras facing the scales. Or there might be a way to connect the scales to the EMS directly
	Samples obtained (Y/N)	Genetics (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Otoliths (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Stomach (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
		Gonads (YN)?	Yes	No	Collection of samples by HO depends on the logistics onboard, specific studies objectives, etc
Release attributes and others	Condition (external injuries)	Released (YN)?	Yes	Possible in some cases	The operation is visualized by seeing the surrounding water. If the catch is not hoisted but part of the body is seen, it is sometimes possible to reach the level of the genus (e.g., Alopias, Sphyrna). Also in leatherback turtles. In other species (e.g., hardshead turtles, other fishes), if they are not hoisted to remove the hook it is more complicated to reach the species or even genus. Depends also on the cleanliness of the cameras and the release mirrors over.
		Injuries (scale)	Possible in some cases	Possible in some cases	Injuries from depredation or from the fishing process can be seen sometimes. But if the specimens are released in the water it might be difficult for both HO and EMS
	Others	Tagnumber	Yes	No	
		Notes	Yes	Yes	Any additional notes can be input both by HO and EMS evaluation

Note: Some scientific important aspects, such as biological samples, are simply not possible to take with EMS.

6

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

Objectives of the EMS (Commission to decide details)

- At the SCRS level, the priority is **implementing EM systems that allow the collection of fisheries data that are usable for scientific purposes**.
- Should be designed in a way which **compliments, and to the extent possible is consistent, with what is currently collected by human observers**.
- EM systems may also be used for compliance and other purposes. As such, any EM system to be implemented should be done in a way that can address both scientific data collection and compliance objectives.
- **Note**: Scientific data often must be collected at a finer resolution (e.g. spatial, temporal) than would be required for compliance purposes. **In such a situation, meeting the minimum requirements needed for science, would likely allow use in both scenarios**.

7

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

Structure (who is responsible- Commission to decide details)

Option 1: Decentralized system:

- **Each CPC is responsible for the EM system implementation in its own fleets**, including the recordings, processing and data extraction, and submission of data to ICCAT
- **Similar to what currently exists for national human observer programs** for scientific purposes.
- Costs are borne by CPCs programme, so there would be **little financial costs for the Commission and less administrative burden on the ICCAT Secretariat**.
- Potential **issue with inconsistent implementation of the EM requirements across the ICCAT membership** – as has been the case with regard to the implementation of ICCAT's minimum standards for scientific observer programs (Rec. 16-14).

8

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

Structure (who is responsible- Commission to decide details)

Option 2: Centralized system:

- A system that would be **coordinated at the Secretariat level**.
- Benefits are **more consistent implementation across the ICCAT membership**.
- More significant challenges associated with this approach, particularly related to the **financial costs to the Commission and the administrative burden on the Secretariat**.
- Issues of data sharing and **confidentiality (e.g. raw videos) would also need to be addressed**.

There are important trade-offs associated with the approach selected, which should be further considered by scientists and managers.

In consideration of data needs and given the significant financial costs and other development and implementation challenges associated with a centralized EM system, the sub-group has focused on the development of input related to a decentralized system.

9

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

Periodic reviews

- EM systems should have **regular evaluations** to ensure it reaches the objectives outlined.
- These also **give opportunity to incorporate new technologies** (i.e. improved cameras, artificial intelligence) as they become available, as well as updated and incorporate new objectives.
- A **review framework should also allow a faster implementation** of the updated minimum standards, that can be reviewed and adapted as needed in the future.

10

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

Standards described in this presentation in the following slides

- *1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance;*
- *2) Standards for data storage requirements and what data are subject to those provisions;*
- *3) Standards for data collection, review and transmission to ICCAT;*
- *4) Standards for data protection and potential privacy issues.*

11

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

1) Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance

- Capable to **resist rough conditions at-sea with minimum human intervention**.
- Linked to a **receiver which records for e.g., coordinates, speed, and heading data** (e.g., GPS).
- **Battery backup** with capacity to allow proper shutdown and not corrupt the data if power from the vessel fails.
- **Proof against any manual data input or external data manipulation**, and record any attempt to tamper with the equipment or the archived data.
- Specifications for EM systems **should be based on performance standards** rather than being too prescriptive in terms of pure technical requirements.
- Cameras must be placed to **provide clear, unobstructed views of the areas that are being covered**.
- Vessels should be equipped with a **sufficient number of cameras to allow data collection to the required standards** (we provide an example of a 4-camera system next)

12

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

- Example of a 4 camera set-up for pelagic LL vessels scientific EMS

Camera location	Action covered	Possible data collected
Aft of the boat	Setting operation	Set position, date, time
		Total number of hooks; hooks between floats
		Bait type/species
		Bait ratio (%)
		Some MM (painted bait, tori lines, line weight)
Work deck	Catch at hauling	Species ID/composition
		Specimen sizes
		Condition (dead/alive)
		Fate (retained/discarded)
		Predators observed
	Discarding (if hauled before discarded)	Discards by set
		Discards ID/composition
Processing area	Catch while processing	Species ID/composition
		Total catch by set
		Specimen sizes
		Sex
		Weights?
		Product type (fresh/processed)
Surrounding water area	Discarding (if discarded in the water)	Discards by set
		Discards ID/composition
		Condition of discards?

13

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

1) Continuation: Standards for onboard EM system technology, including equipment and camera system requirements, installation and maintenance

- Crew should ensure that all specimens caught, even the discards, are **handled in a manner that enables the video to record such specimens to the extent possible**.
- Assumed that most cases will be **using video are the primary data collection** method, but it **may be possible for some CPCs to collect the data with still images** .
- **Quality of the data must be sufficient to allow species ID and detailed measurements of specimens** .
- System should be **independent from the crew during the trip**, with the exception of some basic maintenance such as periodically cleaning the camera lenses.
- It is in general not necessary to record 24h/day, but only when relevant operations are taking place, to save storage space. The EM system **could have sensors and be capable of recording** only during the period of gear deployment (aft camera) and gear retrieval (work deck, processing area, surrounding water cameras).
- The system should have a wheelhouse monitor with a **user interface for the vessel operator to monitor the control box, cameras** and provide information about the system.

14

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

2) Standards for data storage requirements and what data are subject to those provisions

- Must contain **data storage systems adequate for the trip duration** that each national program is designed to cover.
- Regulations relating to **data storage and transmission should be flexible as new technology may allow for different ways of storing or transmitting data** that are less logistically challenging or more efficient.
- System must be **verified to be functioning properly before the start of each trip, remain powered on and positioned correctly for the duration of each trip** .

15

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

3) Standards for data review and transmission to ICCAT

- In decentralized system, **raw data/images is managed by each CPC**.
- **Review of the video footage is done by the CPCs** authorities and/or by a contracted EM service provider.
- Each CPC national program must **assure that the observer data required by ICCAT (ST -09) should, at minimum, be collected by the EM system**.
- EM systems cannot fully replace all the functions of human-based scientific observer programs. Given that, **EM should be used as a complement or supplement to such programs (not full replacement)** , and a **minimum Human Observer coverage should still be maintained for scientific purposes (e.g. 5%)**.
- There may be the **need for CPCs to train EM analysts for their programs** . ICCAT Secretariat might be involved in providing standardized training for EM analysts or signoff/approve training programmes followed by each CPC.
- For size measurements to be taken,**catch will need to be presented by the crew onboard in one or more calibrated areas** (example provided in next page)

16

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

3) Standards for data review and transmission to ICCAT

- **Example of a calibrated hatch onboard a commercial fishing vessel** . These areas will vary from vessel to vessel, depending on available surfaces and the species (sizes) being measured.

17

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

3) Standards for data review and transmission to ICCAT

- Once data is collected it should be subject a **quality checking (QC) procedure**, as is standard with most observer programmes, to ensure data quality.
- **CPCs are responsible for the data transmission to the ICCAT Secretariat** .
- The **electronic ICCAT ST-09 form should be used**, or any other forms that are in the future developed and approved by the SCRS for EM reporting.

18

ICCAT CICTA CICAA

Aspects related the EMS minimum standards for LL

4) Standards for data protection and potential privacy issues

- With a decentralized program, in which each CPC is responsible for the implementation, recordings, extraction of data, and submission of data to ICCAT, **the aspects relative to potential privacy issues of the crew, depend on national regulations and legislation**.
- In such a system, **only the CPC that is responsible for the collection of the data has access to the original recordings.**
- What is **submitted to ICCAT is the data extracted from those original recordings** .
- Data submitted to the Secretariat should follow the**ICCAT Rules and Procedures for the Protection, Access to, and Dissemination of Data.**

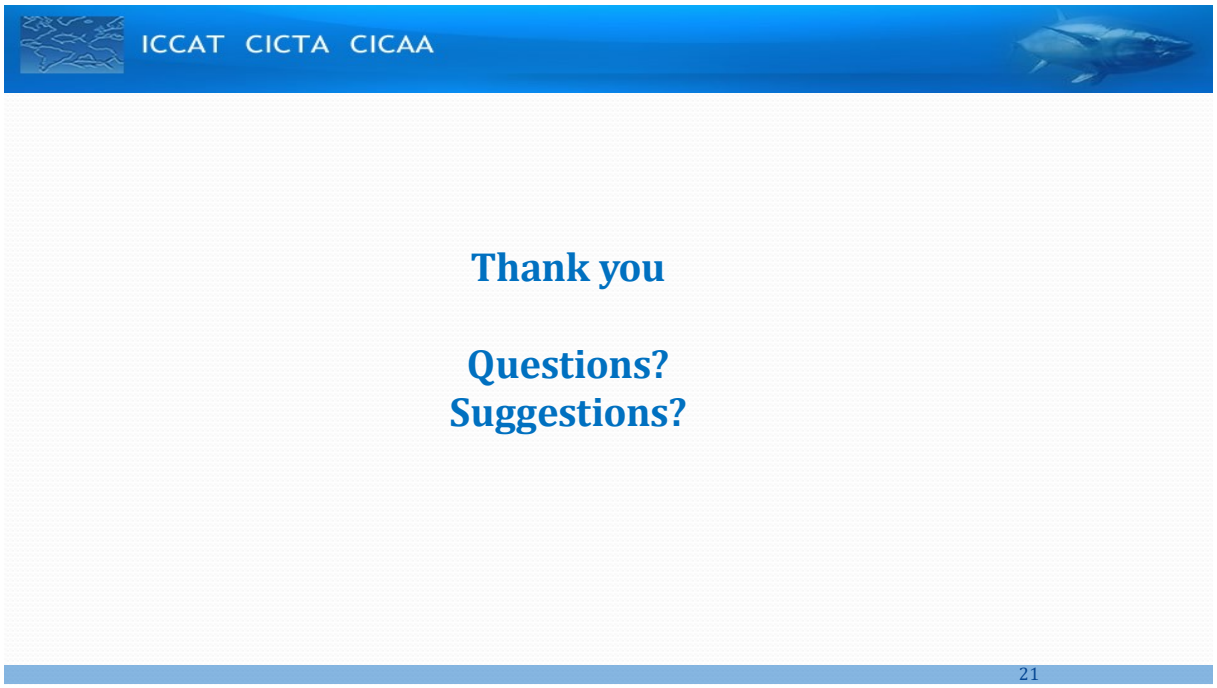
19

ICCAT CICTA CICAA

Next steps (ongoing work in 2022)

- **Continue the work and present the final recommendations to the SCRS in 2022**:
  - The Subgroup **continues to work in 2022** (frequent ~2h meetings, every 5-6 week and intersessional work).
- **Aim to finalize work on:** Final document with these technical specifications of minimum standards that were briefly presented here (nº of cameras and location, etc.).
- **The final recommendations from the Subgroup will be presented to the SCRS/SC-STATS in September 2022.**

20


ICCAT CICTA CICAA
Thank you
Questions?
Suggestions?
21

Appendix 6

Minimum requirements for EMS onboard purse seine vessels
(Submitted by the European Union)

1. Background

During the first meeting of the Working Group on Electronic Monitoring Systems (EMS) on 28 February 2022, it was agreed to draft the Minimum Technical Standards for the implementation of EMS on purse seiners.

Several ICCAT Recommendations currently contemplate the use of EMS, in particular *Recommendation 16-01 by ICCAT on a multi-annual conservation and management programme for tropical tunas* (Rec. 19-02), *Recommendation by ICCAT on the conservation of North Atlantic stock of shortfin mako caught in association with ICCAT fisheries* (Rec. 19-06) and *Recommendation by ICCAT to establish rebuilding programs for blue marlin and white marlin/roundscale spearfish* (Rec. 19-05). These three recommendations contemplate EMS primarily as an alternative to the use of human observers.

EMS is a technology of the future, which is developing rapidly and can make an important contribution to improve the effectiveness of monitoring and control as well as the collection of scientific data.

In this sense, the development of EMS minimum technical standards is a fundamental task to ensure that when these systems are used, there is a guarantee as to their effectiveness in achieving the purposes for which they are intended.

General objectives

This document aims to describe the minimum standards for Electronic Monitoring Systems (EMS) for purse seine fisheries activities for Contracting Parties, cooperating non-Contracting Parties, Entity or Fishing Entities (CPC) operating under the ICCAT Framework.

EMS coverage

The following fields to be recorded using EMS systems:

a) Vessel track: all EMS systems shall be provisioned with Global Positioning Systems (GPS) to allow the monitoring of the position of the vessel during the route of its fishing operations and to monitor the speed the vessel is circulating.[1]
b) Set location: embedded GPS system would allow to register the coordinates (latitude and longitude) of each of the sets during the fishing trips.
c) Number of sets.
d) Type of set.
e) Recording of the total catch per set: cameras shall be positioned to allow the recording of the number of individuals brought onboard during the hauling operation. Current task is already covered under the ICCAT observer programme.
f) Estimation of the species composition: the recording of the hauling operation shall allow the proper identification of the individuals brought on board during the hauling operation.[2]
g) Bycatch estimation: camera placement and recording shall allow for proper estimation on bycatch species during a concise hauling operation on a specific set.[3]
h) Full retention/obligation to release certain species: EMS can be used to review the fate of the species during the hauling operations (e.g., ICCAT Res. 09-07, ICCAT Res. 10-07…).[4]

[1] The GPS on the EMS system would also allow the review where the operations are taking place, when are taken place and if they are being taken place during periods of closure.
[2] Because of the large set of volume, species composition (especially BET and YFT at early stages of development) can be under or overestimated. This proportion is better estimated at port-sampling. Despite this, most studies on EMS and EMS providers discuss the ability to review the same footage over and over to allow for proper identification features to allow for species identification.
[3] An important part would be allowing the cameras to keep recording (video or pictures) after the hauling operation of a specific set to allow the review of the fate of those bycatch species.
[4] Most EMS providers allow the feature on the software to register the fate of each individual (e.g., Released injured, Dead, Retained whole, Retained gutted…).

i) FAD monitoring: The right equipment is capable of recording data on fishing operations with FADs and the deployment of new FADs. In the case of a vessel's visit to a FAD without any other action, such as buoy replacement, information from EMS may be limited. However, in cases where the FAD is elevated and fully retrieved, EMS has been able to identify its structure and the materials used for its construction (e.g., entangling or non-entangling material). [5]
j) Transhipments at sea[6]: keeping the cameras running would allow to monitor if there are illegal transhipments at sea or if any boat would approach.

A more detailed analysis of the several data fields on purse seine fisheries using EMS are listed under **Annex 1 to Appendix 6**.

Vessel areas coverage

Although it will depend on the configuration of each particular vessel, as a general setup, cameras shall capture the following areas stated in **Table 1**.

In order to determine the number of cameras needed and the type, the following parameters shall be taken into consideration:

a. Distance of the camera to the point of interest.
b. Aperture of the focal lens.
c. Required resolution needed for the purpose of the camera.
d. Capability to measure fish length, for relevant cameras, when necessary (lens dependable).

Vessel Monitor Plan

As each fishing vessel may have a different or unique configuration (even within the same fleet segment), each individual vessel should have its own Vessel Monitor Plan (VMP) that must cover all monitoring needs and protocols. The VMP should allow to adapt the installation to the vessel characteristics and optimize the quality of data and especially the video footage.

1. The Vessel Monitor Plan shall be compulsory for each vessel and shall be delivered to the competent authorities.
2. The Vessel Monitor Plan shall be developed in collaboration with the EMS provider, vessel owner and fishing authorities.
3. A survey on the vessel to have an EMS shall be carried and the following factors shall be taken into consideration:
    a. Camera positioning and settings.
    b. Number of cameras to be installed to ensure optimization of the view of the catch-handling area.
    c. Key areas to be surveyed are catch handling areas for species identification and storage of the individuals.
    d. At least one camera should be placed on location so a full view of the processing area and/or fishing deck can be made.
    e. High-risk areas shall be monitored 24/7 using imagery monitoring (discard areas).
    f. Cameras shall be positioned to allow the assessment of the quantities and species retained onboard for compliance purposes.
4. The minimum sections to be contained in a VMP are:
    - Contact information: Contact information for the vessel owner, vessel operator and EMS service provider as long as the contract lasts.
    - General vessel information: Basic information about the vessel and its fishing activities and operations (e.g., vessel name, registration number, target fishery, areas, fishing gear, LoA…).

[5] On the other hand, during the monitoring of the FAD related operations, observers record buoy information at the same time (buoy ID unique number, brand, echo sounder presence and type…). EMS is not capable to collect that information to-date, but it is possible to be collected with the cooperation of the crew members and changes in fishing practices (FADs would be required to be lifted from the water, bringing the buoy close to the camera to record the information, etc.).
[6] ICCAT Rec 12-06.

- Vessel layout: Equipment of the vessel with detailed information, plan of the vessel disposition and different areas (deck, processing, storage…)[7].
- EMS equipment set up: Description of the settings of the EMS system, such as time running, number of cameras and areas covered, time recording for each of the cameras, number of sensors, software used, control box disposition…
- Catch handling procedures: Description of the crew and their operations (number of fisherman and their job).
- Any physical changes on the vessel, fishery, categorization of the vessel (fleet segmentation), catch handling deck… should be reported to the flag State authorities, and the VMP should be updated accordingly before the next fishing trip.
- A shot of each camera should be inserted in the VMP.

5. The VMP should be signed off by the vessel owner and finally approved by the flag State competent authority.
6. Any physical changes on a vessel, changes in its fishery, changes in the categorisation of the vessel in relation to the fleet segmentation, changes to the catch handling deck or the fishing deck, including the designated discard area should be reported to the flag state competent authorities. The VMP should be updated and approved again by the competent authority before the next fishing trip can take place.

A template of a VMP is detailed in **Annex 2 to Appendix 6.**

2. Rules of operation

To ensure compliance under the ICCAT Framework by all parties involved:

Obligations of the Master

1. The Master of the vessel shall report to the competent authorities if the systems fails to operate properly at sea or if a critical warning has been displayed.
2. The Master of the vessel shall ensure the proper transmission of the sensor data.
3. If the transmission of the video footage is decided to be:
   a. Via exchange of hard drive, the operator must ensure the safe deliver to the hard drive to the competent authorities on a secure case. A proof of custody may be required.
   b. Via satellite or Wi-Fi transmission, the operator must ensure the proper connection for the whole content of the video footage to be delivered to the competent authorities or to the analyst. This type of transmission must ensure proper encrypted data.
4. The Master of the vessel must ensure that the cameras have unobstructed view.
5. The Master of the vessel shall ensure that the crew will not tamper with the catch handling process to ensure the proper identification and estimation of the catch composition.
6. The Master of the vessel (and the crew by extension) shall not tamper with the EMS (e.g., disconnect the system, unauthorized rearrangement of cameras, disconnect sensors, switch-off manually, intentionally breaking the system…).
7. If the Master of the vessel is the owner of the data, they shall ensure proper storage of the video and the sensor data for at least 3 years prior.
8. If the Master of the vessel is the owner of the data, they shall have the freedom to select their own EMS provider, and a contract to allow the access to the data by the fishery managers or authorities shall be drafted and signed by all parties involved.
9. The Master of the vessel (or the crew by extension) shall ensure the proper maintenance of camera lenses (such as daily cleaning) and system diagnostics. Protocols on how to proceed with daily cleaning and proper functioning should be attached as part of the VMP and should be signed by all parties involved.

[7] A risk assessment of the vessel should be included, especially of those areas where illegal activities may take place.

Obligations of the CPC

1. The CPC shall ensure the proper notification and follow-up of the final reports regarding allegedly infringements detected using EMS.
2. The CPC shall ensure that the video footage and the analysis of the data retrieved from the vessel is done by certified companies.[8]
3. The CPC shall ensure that the proper data protection regarding the sensitive data collected from the vessel is applied.[9]
4. The CPC of the vessel shall ensure that the data analyst reviewing the footage of the vessel operating under their CPC is not a citizen of that CPC.[10]
5. If the CPC is owning the data of the EMS system, they shall ensure proper storage of the video and sensor data to allow for historical data audit (at least 5 years prior).
6. If the CPC is the owner of the data, they shall determine who will be the reviewer/analyst of the data.

Additional obligations or tasks for the analysts or EMS providers could be established.

3. Technical requirements[11]

Minimum requirements for Control Box or EM Control Centre

The EM control centre is an onboard computer that acquires and stores all sensor and imagery footage (modified computer with possibilities to connect a number of different cameras and sensors). The following minimum requirements are recommended:

- GPS sensor or equivalent.
- 4G/5G/LTE mobile data connection.
- Fan-less passive cooling.
- Max power according to the vessel technical specification.
- Wired interconnection between the rest of the components of the system.
- Ability to connect via WiFi (802.11ac or faster) or other wireless system (e.g. Bluetooth).
- Data storage capability to store both sensor and imagery footage. Minimum storage requirement shall vary according to the vessel activity (days at sea), number of cameras and data storage duration.
- At least one removable/swappable back-up data storage device with variable sizes.
- Onboard screen connection for verification including keyboard (and mouse) OR touch screen.
- UPS (uninterrupted power supply) of controlled shutdown, logging in case of power loss. If possible, allowing the recording for relevant timespan. Information on the power failure shall be automatically recorded to subsequent notification to the Secretariat and CPCs.
- Sensor and imagery data are to be properly encrypted and compressed.
- Digital signature (date and tie stamp, vessel name, vessel registration and GPS coordinates).
- If data transmission is temporarily not possible, the request shall be stored on the control box and the requested data shall be secured to prevent possible deletion or tampering. The requested data shall be automatically transmitted when data transmission is feasible.
- Utilization of onboard satellite connection for sensor data transmission. For vessels only fishing within the cell phone range it can be used for sensor transmission.
- Support the required number of cameras (spare camera capacity).
- Support remote access/configuration.
- 12-24 V DC isolated power input.
- Automatic prioritisation of best suitable connection for data transfer and remote access.

[8] These companies must ensure that the reviewers have proper training on the ICCAT Observer Programme, training in species identification and proper background on the legal basic concerning the general ICCAT Framework should be a must for the reviewers in order to identify alleged infringements.
[9] Rules of accessing the data, data disseminations, confidentiality clauses may be drafted beforehand to ensure data protection.
[10] Avoiding conflict of interest.
[11] Technical characteristics obtained from "EFCA Technical Guidelines and Specifications for the implementation on Remote Electronic Monitoring (REM) in EU fisheries".

- System shall be able to upload all the required parts automatically at specific intervals when connectivity prioritisation allows. The data transmitted, stored for backup on the EM control centre should be securely encrypted.
- Transmission of encrypted data shall be done using secure communication protocols (FTPS, HTTPS).
- Build-in remote access should be possible, for system configuration and verification of system health if required.
- Remote access should include access to health checks of the camera and configuration (e.g. frame rate). A common format for analysis is needed to allow access to configurations.
- Possibility for remote access to support transmission requests of all or parts of recorded sensor data and video footage, from any camera, should be made.
- Possibility to have a wireless option (e.g., via WiFi/Bluetooth) to interconnect the parts of the system. Possibility to have a wireless option (e.g., via WiFi) for uploading the data from vessel to land-based system.

Minimum technical requirements of cameras

The cameras shall be constructed out of material that resist harsh weather conditions on board and can resist tampering.[12]

- Type: Digital IP Cameras (IP= Internet Protocol).
- Ingress Protection: IP66 Rating. A higher IP for cameras exposed to heavy weather conditions is recommended.
- Cabling: Minimum CAT 5e Ethernet cable preferably CAT SFTP cable.
- Resolution: Minimum 2MP (1080P), depending on the purpose of each camera.
- Specified range of fixed and zoom lens option cameras, with replaceable lenses.
- Housing: Replaceable camera dome/housing glass.
- Video:

    - Compression: Supports standard video compression formats. Minimum H264.
    - Remote configuration: Capability to configure the following parameters both remotely and on board.

        - FPS (Frames per second) adjustable depending on camera purpose.
        - Image resolution.
        - Image quality.
        - Digital/optical zoom level.

    - Measuring capability: Capability to measure fish length for relevant cameras.
    - Masking capability (desirable): Possibility to blank or blur faces to protect persons and to select the region of interest, with higher quality than the rest of the image.

In order to determine the number of cameras needed and the type, the following parameters shall be taken into consideration:

- Distance of the camera to the point of interest.
- Aperture of the focal lens.
- Required resolution needed for the purpose of the camera.

Minimum technical requirements for sensors

The minimum requirement for sensors depends on the type of vessel (LoA). Several sensors shall be based on a common requirement independently from the type of vessel (e.g., GPS). As minimum, vessel sensors should have:

- GPS
- Winch rotation with direction detection

[12] Using small cameras should be prioritized. Closure fittings need to be robust and durable.

- Hydraulic pressure
- Electric current
- Fish hatch/door open/close
- Temperature (fish hauls)
- Power block

4. Data management

Data analysis software and hardware

The EMS provider usually provides for both the software and hardware to the company that will do the analysis review. The software shall be able to read and de-encrypt the video and sensor data received and an analyst will perform a detail report using the same software.

Data storage and retention

Standards for where, how, and how long video footage will be stored after it has been reviewed, should be specified. Storage decisions should be based on the EM program's goals and the personnel who will need to access monitoring records, at what frequency, and for what purpose.

Depending on the program's objectives and standards, footage can range from video of an entire fishing trip to video stills from key fishing events (e.g., transshipment). Once footage is reviewed, it may be deleted or stored, indefinitely or for a finite period.

Storage considerations shall include the size and number of hard-drives that record the EM data, whether the hard-drives need to be removable or a cloud-storage service shall be in use. or the amount of time the data shall be stored.

Data transmission

Once data is collected by EM systems on-board vessels, it will need to be transferred for review and analysis. Three options could be possible to transfer the data:

1. Hard drive exchange: Best-suited for fisheries operating for long periods across vast distances.
2. Wi-Fi/4G/5G transmission: Wi-Fi transmission, including via mobile data networks, is possible when vessels are in range of shore. This is the cheapest system, but it requires network connectivity in all ports of entry.
3. Satellite transmission: Is the most-expensive option. However, it could become more cost-effective with the use of emerging technologies such as sensors or artificial intelligence. This would allow the most near-real-time transmission of data.

A detailed protocol on how to retrieve the data from the vessel to the authorities or to the data analyst shall be detailed and agreed on the vessel monitor plan by both the vessel owner, the respective authorities and the data analyst.

It should be noted that the transmission of the data should be done at the end of the fishing trip. If the transmission of the data is done by satellite or Wifi/4G/5G, the transmission should be done at the entry of port without delay.

Data review and reporting

Video footage review is a key element of an EM program and potentially the costliest. The more footage is reviewed, and the more detailed the data, the more expensive the process will be. Artificial intelligence may eventually make the reviewing process more efficient, but this technology is still not fully developed and shall not be yet assessed in this document.

The needs for review of the data collected by the EMS will vary depending on the objective of the program. In general, programs focused on compliance will have significantly lower demands (i.e. limited to certain functions or events) and the process will be assisted by the information received from the sensors and/or an associated risk analysis.

The system should have a dedicated software to assist in data review. This software shall permit the analysis of all the stored data, images and sensor data in a synchronized way. At a minimum, analysis software should allow for the report of the minimum following:

- FAD deployment.
- Identification of fishing operations date/time.
- Identification of set type.
- Estimation of total catch by set.
- Estimation of target species catch composition and sizes.
- Detection of bycatch species and their fate, and
- Estimation of discards of target species.

Three main options will be available when deciding who will review the EMS data: national fisheries agencies, third parties, or RFMO staffs.

Protocol of reporting of alleged infringements detected using EMS shall be establish by the CPCs, and the final report to be submitted to the authorities shall be reviewed and signed by an inspector with proper training.

Table 1. Areas of the vessel and actions that must be covered by cameras in an EM system. Source: Minimum Standards for Electronic Monitoring Systems in tropical tuna purse seine fisheries. ISSF – International Seafood Sustainability Foundation. ISSF Technical Report 2018-04.

AREA COVERED	ACTION COVERED	PURPOSE	MINIMUM DATA REQUIREMENTS TO BE MONITORED
Work deck (port side)	Brailing	Total catch by set Species composition	Number of brails & fullness by brail. Weight, size and species of retained tuna
	Tuna discards	Total tuna discards by set	Weight, size and species of discarded tuna
	Bycatch handling	Best practices Total bycatch by set	Handling mode
Work deck (starboard side)	Bycatch handling	Best practices	Handling mode
	Bycatch release	Total bycatch by set Best practices	Number of individuals and species ID
In-water purse seine area	Brailing	Total catch by set	Number of brails & fullness by brail
	Bycatch handling of big species (whale sharks, manta rays…)	Best practices	Handling mode
	Bycatch release of big species (whale sharks, manta rays…)	Total bycatch by set Best practices	Number of individuals and species ID
Foredeck or amidships	FAD activity (deploying, replacement, repairs…)	Total number of FAD activities by trip	Number, material (natural or artificial), and FAD characteristics (entangling or non-entangling)
Well deck and conveyor belt	Catch well sorting	Species composition	Weight, size and species of retained tuna.
	Bycatch handling	Best practices	Handling mode
	Bycatch discarded, released or retained	Total bycatch by set Species composition Best practices	Number, size or weight of individuals, species ID and fate

Annex 1 to Appendix 6

Description of data fields to be collected using EMS

A more detailed analysis of the data fields that can be collected using EMS are listed on **Table 2** below (Ruiz *et al*., 2017[13]). The categories for assessing the review capabilities are:

- R1: ready now
- R2: requiring crew support
- R3: additional cameras/sensor required
- R4: ready but inefficient for analyst to interpret
- P1: possible with minor work
- P2: possible with major work

Table 2. Activities of interest to be monitored, including ICCAT/IOTC Recommendations related with them and EMS capability to properly monitor them.

Purse Seine Data Fields		Relevant ICCAT Recommendation/Resolution	Can this field be collected using EMS?
Vessel attributes	Refrigeration Method		NO
FAD	FAD operation type	ICCAT 14-01	R1
	FAD monitoring		
Gear attributes	Material		NO
	Length		NO
Setting and Hauling Operation	Date and Time of the start of the operation	ICCAT 14-01 ICCAT 10-10	R1
	Latitude and Longitude of the start of set		R1
	Date and time of the end of set		R1
	Latitude and Longitude of the end of set		R1
	Duration of the fishing operation		R1
	Target species	ICCAT 10-10	R1
	Depth		R1
	Supply vessel monitoring		R1
Information on catch on each haul	Species caught	ICCAT 10-10	R1
	Bycatch species	ICCAT 10-10 ICCAT 11-10 ICCAT 10-07 ICCAT 11-08	R1

[13] Ruiz, J., Krug, I., Justel-Rubio, A., Restrepo, V., Hammann, G., Gonzalez, O., Legorburu, G., Pascual Alayon, P.J., Bach, P., Bannerman, P. & Galán, T. (2017). Minimum standard for the implementation of electronic monitoring systems for the tropical tuna purse seine fleet. *ICCAT Col. Vol. Sci. Pap*, *73*(2), 818-828.

		ICCAT 13-11	
	Bycatch fate	ICCAT 10-10 ICCAT 10-07 ICCAT 11-08 ICCAT 13-11	R1
	Length of the fish	ICCAT 10-10	R1
	Size of the fish		R4
	Length measurement code		R1
	Gender (dimorphic species)		R2
	Discards	ICCAT 10-10 ICCAT 11-10	R1
	Condition when released	ICCAT 10-10 ICCAT 10-07 ICCAT 11-08 ICCAT 13-11	R1

Annex 2 to Appendix 6

Description of a Vessel Monitor Plan

Part A

(Shall be handed over by the vessel owner)

1. Information provided by the owner of the vessel.

External registration		Main fishery(es)	
Vessel name		Gear type(s)	
EU Fleet register number		Crew size	
IRCS		May carry an observer	
Home port		Name of the owner(s) representative	
Vessel length		Phone no.	
Vessel type		E-mail	

2. Description of the crew fish handling and any other useful details.

3. If available, copy or image of the vessel general arrangement plan.

4. General layout and handling (not necessarily to scale).

5. General remarks.

Part B

(Responsibility of the competent authority and to be validated by the competent authority)

1. Vessel image

2. System configuration

    a. System operation – General description

Sensor recording:	Description of the settings:
Video recording:	Description of the settings:

    b. System components location

Control box: - Image of location of the control box	User interface:
GPS: - Image of location of the GPS	GPS details:
Drum Rotation Sensor: - Image of location of the Drum Sensor	Drum rotation sensor details:
Hydraulic Pressure Sensor: - Image of location of the Hydraulic Pressure Sensor	Hydraulic Pressure Sensor details:

Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:

Camera 1 - Deck Camera	
Image of location of camera 1	View and objectives
Image deck camera	Camera settings
Camera 2 - Retain/General View Camera	
Image of location of camera 2	View and objectives
Image retain/general view camera	Camera settings
Camera 3 - Sorting Belt Camera	
Image of location of camera 3	View and objectives
Image sorting belt camera	Camera settings
Camera 4 - Discard Camera	
Image of location of camera 4	View and objectives
Image discard camera	Camera settings

Camera XX - XX Camera	
Image of location of Camera XX	View and objectives
Image XX Camera	Camera settings
Camera XX - XX Camera	
Image of location of Camera XX	View and objectives
Image XX Camera	Camera settings
Camera XX - XX Camera	
Image of location of Camera XX	View and objectives
Image XX Camera	Camera settings
Camera XX - XX Camera	
Image of location of Camera XX	View and objectives
Image XX Camera	Camera settings

Control Box Setting Summary Main configuration screen	Camera Setting Summary

Sorting Area measurement details

Part C

(To be completed by the service provider)

1. EM User guide

    a) Description on how to retrieve hard drives.
    b) Description on how to power up the system.
    c) Description on how to do a function test.

2. Vessel-specific handling protocols.

Description of any special protocols that may apply to the vessel referred in the VMP.

    a) Description and diagrams of control points with specific procedures carried out. For each area description, there must be a protocol on how to ensure the catch remains in camera view.

Part D

(To be completed by the service provider)

List of EMS service providers contact information:

Name and last name	Phone	Email	Office address

Part E

(To be completed by the vessel owner and the service provider)

This part should certify that the vessel owner/operators have been trained in the function and operation on the Electronic Monitoring System (EMS) on the vessel, and that the operator agrees to comply to the Vessel Monitoring Plan (VMP).

Vessel operator name and last name: _____

Vessel owner/operator signature: _____

Date and time: _____

EMS service provider name and last name: _____

EMS service provider signature: _____

Date and time: _____

Appendix 7

Minimum Standards and Program Requirements for EMS onboard Longline vessels
(Submitted by the European Union)

1. Background

During the first meeting of the Working Group on Electronic Monitoring Systems (EMS) on 28 February 2022, it was agreed to draft the Minimum Technical Standards for the implementation of EMS on longliners.

Several ICCAT Recommendations currently contemplate the use of EMS, in particular the Recommendation by ICCAT to replace the *Recommendation by ICCAT replacing Recommendation 19-02 replacing Recommendation 16-01 on a multi-annual conservation and management programme for tropical tunas* [Rec. 21-01], the *Recommendation by ICCAT on the conservation of North Atlantic stock of shortfin mako caught in association with ICCAT fisheries* [Rec. 21-09] and the *Recommendation by ICCAT to establish rebuilding programs for blue marlin and white marlin/roundscale spearfish* [Rec. 19-05]. [United States]

EMS is a technology widely used nowadays which can make important contributions to improve the effectiveness of monitoring and control as well as the collection of scientific data. The possible use of this technology has been included in ICCAT Recommendations since 2019.

In this sense, the development of EMS minimum technical standards is a fundamental task to ensure that when these systems are used, there is a guarantee as to their effectiveness in achieving the purposes for which they are intended.

General Objectives

This document aims to describe the common minimum technical standards and program requirements for Electronic Monitoring Systems (EMS) for longline fisheries activities that may be implemented by Contracting Parties, cooperating non-Contracting Parties, Entity or Fishing Entities (CPC) operating under the ICCAT framework. The document also describes additional specifications for particular programmatic objectives for the use of EMS (e.g., scientific data collection, compliance monitoring), including those objectives currently required in relevant ICCAT Recommendations.

EMS Coverage

All EMS shall collect fishery data and associated metadata necessary to meet the requirements and/or check compliance with the rules laid out in ICCAT conservation and management measure, as well as the needs of the SCRS. When using EMS, the following data shall be recorded by that system:

a) Vessel track: all EMS shall be provisioned with Global Positioning Systems (GPS) to allow the monitoring of the position and speed of the vessel during the route of its fishing operations.[1]
b) Set location: EMS integrated GPS would allow the coordinates (latitude and longitude) of each of the sets during the fishing trips to be recorded.
c) Haul back location
d) Number of sets.
e) Data allowing estimation of fishing effort (i.e., use of winches used to set and haul the gear, speed of the vessel, etc.).
f) Recording of the total catch per set: cameras shall be positioned to allow the recording of the number of individuals brought onboard during the hauling operation.
g) Estimation of the species composition: the recording of the hauling operation shall allow the proper identification of the individuals brought on board during the hauling operation.[2]

[1] The GPS on the EMS would also allow a review of where the operations have taken place and if they occurred during periods of closure.
[2] Because of the large set of volume, species composition (especially BET and YFT at early stages of development) can be under or overestimated. This proportion is better estimated at port-sampling. Despite this, most studies on EMS and EMS providers discuss the ability to review the same footage over and over to allow for proper identification features to allow for species identification.

h) Data allowing bycatch estimation: camera placement and recording shall allow for proper estimation of bycatch species during a specific hauling operation on a specific set.[3]
i) Where applicable EMS may be used to monitor full retention/obligation to release certain species: EMS can be used to review the disposition of the species during the hauling operations (e.g., ICCAT Res. 09-07, ICCAT Res. 10-07, etc.).[4]
j) [Transhipments at sea[5]: where applicable sensor information (i.e., GPS indicating that the vessel is stopped, sensors on cranes or hold hatches indicating that there may be transhipment activity) can trigger cameras and subsequent analysis of the video footage.]

A more detailed analysis of the several data fields to be covered on longline fisheries using EMS are listed under **Annex 1 to Appendix 7**, distinguishing the requirements of the system in case it is used for science purposes or for compliance purposes.

Vessel Areas Coverage

Although it will depend on the configuration of each particular vessel, EMS cameras and sensors shall be installed in order to properly capture all relevant fishing activity, including the following:

1. General view of the fishing deck
2. Haulback
3. Discard events
4. Setting area

In order to determine the number of cameras needed and the type, the following parameters shall be taken into consideration:

a) Distance of the camera to the point of interest
b) Aperture of the focal lens
c) Required resolution needed for the purpose of the camera
d) Capability to measure fish length for relevant cameras, when necessary (lens dependable)

Vessel Monitor Plan (VMP)

As each fishing vessel has a different or unique configuration (even if those vessels are listed under the same fleet segment), each individual vessel on which EMS is to be installed, should develop a unique Vessel Monitor Plan (VMP) that must cover all monitoring needs and protocols. The VMP should allow to adapt the installation to the vessel characteristics and optimize the quality of data and especially the video footage.

1. The vessel monitor plan shall be compulsory for each vessel and shall be delivered to the competent authorities.

2. The vessel monitor plan shall be developed in collaboration with the EMS provider, vessel owner and fishing authorities.

3. A survey of the vessel to have an EMS shall be carried out and the following factors shall be taken into consideration:

    a) Camera positioning and settings.
    b) Number of cameras to be installed to ensure optimization of the view of the catch-handling area.
    c) Key areas to be surveyed are catch handling areas for species identification and storage of the individuals.
    d) Cameras shall be positioned to allow the assessment of the quantities and species retained onboard.

[3] An important part would be allowing the cameras to keep recording (video or pictures) after the hauling operation of a specific set to allowing the review of the fate of those bycatch species.
[4] Most EMS providers allow the feature on the software to register the fate of each individual (e.g., Released injured, Dead, Retained whole, Retained gutted, etc.).
[5] ICCAT Rec. 12-06.

4. The minimum sections to be contained in a VMP are:

   - Contact information: current contact information for the vessel owner, vessel operator and EMS service provider as long as the contract lasts.
   - General vessel information: basic information about the vessel and its fishing activities and operations (e.g., vessel name, registration number, target fishery, areas, fishing gear, LoA, etc.).
   - Vessel layout: equipment of the vessel with detailed information, plan of the vessel disposition and different areas (deck, processing, storage, etc.)[6].
   - EMS equipment set up: description of the settings of the EMS system, such as time running, number of cameras and areas covered, time recording for each of the cameras, number of sensors, software used, control box disposition, etc.
   - Catch handling procedures: description of the crew and their operations (number of fishermen and their job).
   - Any physical changes on the vessel, fishery, categorization of the vessel (fleet segmentation), catch handling deck, etc., should be reported to the Flag State authorities, and the VMP should be updated accordingly before the next fishing trip.
   - A shot of each camera should be inserted in the VMP.

5. The VMP should be signed off by the vessel owner and finally approved by the Flag State competent authority.

6. The EMS equipment should not adversely affect vessel stability by posing risk to vessel operations, crew, or environment, nor should it impede the vessel's safe navigation.

A template of a VMP is detailed in **Annex 2 to Appendix 7.**

2. Basic Program Requirements

To ensure proper usage of the EMS under the ICCAT Framework by all parties involved:

Obligations of the Master [Consider separating science and compliance requirements]

1. The Master of the vessel shall, within a prescribed period of time, report to the competent authorities if the systems fails to operate properly at sea or if a critical warning has been displayed.

2. The Master of the vessel shall ensure the proper transmission of the EMS data [and onboard access to the EMS if requested by and ICCAT-authorized observer and/or inspector].

3. If the transmission of the video footage is decided to be:

   a) Via exchange of hard drive, the operator must ensure the secure and safe delivery of the hard drive to the competent authorities

   b) Via satellite or Wi-Fi transmission, the operator must ensure the proper connection for the whole content of the video footage to be delivered to the competent authorities or to the analyst, excepting port Wi Fi infrastructure which is the responsibility of the port authority. If port Wi Fi is unavailable, the operator must ensure footage is properly stored and delivered as soon as reasonably possible. This type of transmission must ensure proper encrypted data, when required/decided by national authorities.

4. The Master of the vessel must ensure that the cameras have an un-obstructed view.

5. The Master of the vessel shall ensure that the crew will not change the handling process to ensure the proper identification and estimation of the catch composition.

[6] A risk assessment of the vessel should be included, especially of those areas where illegal activities may take place.

6. The Master of the vessel (and the crew by extension) shall not tamper with the EMS (e.g., disconnect the system, unauthorized rearrangement of cameras, disconnect sensors where applicable, switch-off manually, unless so instructed by the authorities, intentionally breaking the system, etc.).

7. If the Master of the vessel is the owner of the data, they shall ensure proper storage of the video and the sensor data for at least 3 years.

Obligations of the CPC

1. If the CPC applies EMS for compliance purposes, they shall ensure the proper notification and follow-up of the final reports regarding alleged infringements detected using EMS.

2. The CPC shall ensure that the video footage and the analysis of the data retrieved from the vessel is done by companies[7] or by institutions or authorities, with the necessary knowledge or experience to ensure effective data analysis.

3. "CPCs shall require EMS analysts to be independent from all vessels and companies operating in the fishery."

4. If the CPC is owning the data of the EMS system, they shall ensure proper storage of the video and sensor data to allow for historical data audit at least [5 years].

5. If the CPC is the owner of the data, they shall determine who will be the reviewer/analyst of the data.

Additional obligations or tasks for the analysts or EMS providers could be established.

3. Data Management

Data analysis software and hardware

The EMS provider usually provides both the software and hardware to the company that will do the analysis review. The software shall be able to read and decrypt the video and sensor data received and an analyst will complete a detailed report.

Data storage and retention

Standards for where, how, and how long video footage will be stored after it has been reviewed, should be specified. Storage decisions should be based on the EM program's goals and the personnel who will need to access monitoring records, at what frequency, and for what purpose.

Depending on the program's objectives and standards, footage can range from video of an entire fishing trip to video stills from key fishing events [(e.g., transshipment)]. Once footage is reviewed, it should be stored for at least 3 years.

Storage considerations shall include the size and number of hard-drives that record the EM data, whether the hard-drives need to be removable, or a cloud-storage service shall be in use, or the amount of time the data shall be stored.

Data transmission

Once data is collected by EM systems on-board vessels, it will need to be transferred for review and analysis.

[7] These companies must ensure that the reviewers have proper training on the ICCAT Observer Program, training in species identification and proper background on the legal basic concerning the general ICCAT Framework should be a must for the reviewers in order to identify alleged infringements.

Three options could be possible to transfer the data:

1. Hard drive exchange;
2. Wi-Fi/4G/5G transmission: Wi-Fi transmission, including via mobile data networks;
3. Satellite transmission.

A detailed protocol on how to retrieve the data from the vessel to the authorities or to the data analyst shall be detailed and agreed on the vessel monitor plan by both the vessel owner, the respective authorities and the data analyst.

It should be noted that the transmission of the data should be done at the end of the fishing trip where possible or if not possible (due to port Wi Fi being unavailable, due to low transmission speed, etc.,) the data must be securely stored and transmitted without unreasonable delay/at the earliest opportunity. If the transmission of the data is done by satellite or Wi-fi/4G/5G, the transmission should be done at the entry of port without delay.

Data review and reporting

The system should have dedicated software to assist in data review. This software shall permit the analysis of all the stored data, images and sensor data in a synchronized way. At a minimum, analysis software should allow for the report of the minimum following:

- Identification of fishing operations date/time;
- Identification of set type;
- Estimation of the total catch by set;
- Estimation of target species catch composition and sizes;
- Detection of bycatch species and their fate; and
- Estimation of discards of target species.

[Protocol of reporting of alleged infringements detected using EMS shall be establish by the CPCs, and the final report to be submitted to the authorities shall be reviewed and signed by an inspector with proper training] (compliance, obligation of the CPC)

Annex 1 to Appendix 7

Description of data fields to be collected using EMS

A more detailed analysis of the data fields that can be collected using EMS are listed on **Table 1** (science purposes) (Emery *et al.*, 2018[8]) and **Table 2** (compliance purposes). The categories for assessing the review capabilities are:

- R1: ready now
- R2: requiring crew support
- R3: additional cameras/sensor required
- R4: ready but inefficient for analyst to interpret
- P1: possible with minor work
- P2: possible with major work

Table 1. Data fields for ICCAT longline activities to be collected when an EMS system is to be implemented for science purposes. [the table will be based on the work carried out by the SCRS].

Longline Data Fields		*Can this field be collected using EMS?*
Vessel attributes	Refrigeration method	NO
Special equipment or machinery	Line setter	R3
	Line hauler	R3
	Bait casting machine	R3
Gear attributes	Mainline material	NO
	Mainline length	NO
	Mainline diameter	P2
	Branchline material	NO
Special Gear attributes	Wire trace	R1
	Mainline hauler	R3
	Branchline hauler	R3
	Line shooter	R3
	Automatic bait thrower	R3
	Automatic branch line attacher	R3
	Hook type	P2
	Hook size	NO
	Tori line	R3
	Side setting with bird curtain	R3
	Weighted branch lines	R3
	Shark lines	R1
	Blue dyed bait	R1
	Distance between weight and hooks	NO
	Deep setting line shooter	R3

[8] Emery, T. J., Noriega, R., Williams, A. J., Larcombe, J., Nicol, S., Williams, P., Smith, N., Pilling, G., Hosken, M., Brouwer, S., Tremblay-Boyer, L. & Peatman, T. (2018). The use of electronic monitoring within tuna longline fisheries: implications for international data collection, analysis and reporting. *Reviews in Fish Biology and Fisheries*, *28*(4), 887-907.

	Management of school discharge	R3
	Strategic offal disposal	R3
Setting and Hauling Information	Date & Time of start of set	R1
	Latitude & Longitude of start of set	R1
	Date & Time of end of set	R1
	Latitude & Longitude of end of set	R1
	Depth	R3
	Total number of baskets or floats	R1
	Number of hooks per basket, or number of hooks between floats	R4
	Total number of hooks used on a set	R1
	Line shooter speed	R3
	Length of float line	P2
	Distance between branch lines	R3
	Length if branch lines	NO
	Time-depth recorders (TDRs)	NO
	Number of light sticks	R4
	Target species	R1
	Bait species	R3
	Date & Time of start of haul	R1
	Date & Time of end of haul	R1
	Total amount of baskets, floats monitored by observer in a set	R1

Information on catch on each set	Hook number between floats	R4
	Species caught	R1[9]
	Bycatches	R1[10]
	Bycatch fate	R1
	Length of fish	R1
	Size	R4
	Length measurement code	R1
	Sex (dimorphic)	R2
	Condition when caught	R1
	Discards	R1
	Condition when released	R1
	Tag recovery information	R1

[9] Early stages of YFT and BET may be slightly underestimated or overestimated.
[10] Reporting of bycatch to the level of species may sometimes be difficult due to the morphological distinctive characteristics of similar Family or Genus. Identification keys shall be provided to the electronic observer and the reviewers shall demonstrate proper knowledge of marine species identification.

Table 2. Data fields for ICCAT longline activities to be collected when an EMS system is to be implemented for compliance purposes [to be completed].

Longline Data Fields	

Annex 2 to Appendix 7

Description of a Vessel Monitor Plan

Part A

(Shall be handed over by the vessel owner)

1. Information provided by the owner of the vessel

External registration		Main fishery(es)	
Vessel name		Gear type(s)	
EU Fleet register No.		Crew size	
IRCS		May carry an observer	
Home port		Name of the owner(s) representative	
Vessel length		Phone No.	
Vessel type		E-mail	

2. Description of the crew fish handling and any other useful details

3. If available, copy or image of the vessel general arrangement plan

4. General layout and handling (not necessarily to scale)

5. General remarks

Part B

(Responsibility of the competent authority and to be validated by the competent authority)

1. Vessel image

2. System Configuration

a) System Operation – General Description

Sensor recording:	Description of the settings:
Video recording:	Description of the settings:

b) System Components Location

Control box: - Image of location of the control box	User Interface:
GPS: - Image of location of the GPS	GPS details:
Drum Rotation Sensor: - Image of location of the Drum Sensor	Drum Rotation Sensor details:
Hydraulic Pressure Sensor: - Image of location of the Hydraulic Pressure Sensor	Hydraulic Pressure Sensor details:

Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:
Sensor XX - Image of location of the XX Sensor	XX Sensor details:

Camera 1 - Deck Camera	
Image of Location of Camera 1	View and Objectives
Image deck camera	Camera Settings
Camera 2 - Retain/General View Camera	
Image of Location of Camera 2	View and Objectives
Image Retain/General View Camera	Camera Settings
Camera 3 - Sorting Belt Camera	
Image of Location of Camera 3	View and Objectives
Image Sorting Belt Camera	Camera Settings
Camera 4 - Discard Camera	
Image of Location of Camera 4	View and Objectives
Image Discard Camera	Camera Settings

Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings
Camera XX - XX Camera	
Image of Location of Camera XX	View and Objectives
Image XX Camera	Camera Settings

Control Box Setting Summary Main Configuration Screen	Camera Setting Summary

Sorting Area Measurement Details

Part C

(To be completed by the service provider)

1. EM User Guide

    a) Description on how to retrieve hard drives
    b) Description on how to power up the system
    c) Description on how to do a function test

2. Vessel-specific handling protocols

Description of any special protocols that may apply to the vessel referred in the VMP

    a) Description and diagrams of control points with specific procedures carried out. For each area description, there must be a protocol on how to ensure the catch remains in camera view.

Part D

(To be completed by the service provider)

List of EMS service providers contact information:

Name and Last Name	*Phone*	*Email*	*Office address*

Part E

(To be completed by the vessel owner and the service provider)

This part should certify that the vessel owner/operators have been trained in the function and operation on the Electronic Monitoring System (EMS) system installed on the vessel, and that the operator agrees to comply to the Vessel Monitoring Plan (VMP).

Vessel operator name and last name: _____

Vessel owner/operator signature: _____

Date and time: _____

EMS Service provider Name and Last name: _____

EMS Service provider signature: _____

Date and time: _____

Annex 3 to Appendix 7

Technical Requirements[11]

Minimum requirements for Control Box or EM Control Centre [Consider simplification]

The EM control centre is an onboard computer that acquires and stores all sensor and imagery footage (modified computer with possibilities to connect a number of different cameras and sensors). The following minimum requirements are-required:

- GPS sensor or equivalent
- Fan-less passive cooling
- Max power according to the vessel technical specification
- Wired interconnection between the rest of the components of the system
- Ability to connect via Wi-Fi (802.11ac or faster) or other wireless system (e.g., Bluetooth)
- Data storage capability to store both sensor and imagery footage. Minimum storage requirement shall vary according to the vessel activity (days at sea), number of cameras and data storage duration.
- At least one removable/swappable back-up data storage device with variable sizes
- Onboard screen connection for verification including keyboard (and mouse) OR touch screen
- UPS (uninterrupted power supply) of controlled shutdown, logging in case of power loss. If possible, allowing the recording for relevant timespan. Information on the power failure shall be automatically recorded to subsequent notification to the Secretariat and CPCs.
- Sensor and imagery data are to be properly encrypted and compressed
- Digital signature (date and time stamp, vessel name, vessel registration and GPS coordinates)
- If data transmission is temporarily not possible, the request shall be stored on the control box and the requested data shall be secured to prevent possible deletion or tampering. The requested data shall be automatically transmitted when data transmission is feasible.
- Utilization of onboard satellite connection for sensor data transmission. For vessels only fishing within the cell phone range it can be used for sensor transmission.
- Support the required number of cameras (spare camera capacity)
- Support remote access/configuration
- 12-24 V DC isolated power input
- Automatic prioritisation of best suitable connection for data transfer and remote access
- System shall be able to upload all the required parts automatically at specific intervals when connectivity prioritisation allows. The data transmitted, stored for backup on the EM control centre should be securely encrypted.
- Transmission of encrypted data shall be done using secure communication protocols (FTPS, HTTPS).
- Build-in remote access should be possible, for system configuration and verification of system health if required.
- Remote access should include access to health checks of the camera and configuration (e.g., frame rate). A common format for analysis is needed to allow access to configurations.
- Possibility for remote access to support transmission requests of all or parts of recorded sensor data and video footage, from any camera, should be made.
- Possibility to have a wireless option (e.g., via Wi-Fi/Bluetooth) to interconnect the parts of the system. Possibility to have a wireless option (e.g., via Wi-Fi) for uploading the data from vessel to land-based system.

[11] Technical characteristics obtained from "EFCA Technical Guidelines and Specifications for the implementation on Remote Electronic Monitoring (REM) in EU fisheries".

Minimum technical requirements of cameras

The cameras shall be constructed out of material that resist harsh weather conditions on board and can resist tampering.[12]

- Type: Digital IP Cameras (IP= Internet Protocol)
- Ingress Protection: IP66 Rating. A higher IP for cameras exposed to heavy weather conditions is recommended.
- Cabling: minimum CAT 5e Ethernet cable preferably CAT SFTP cable
- Resolution: minimum 2MP (1080P), depending on the purpose of each camera
- Specified range of fixed and zoom lens option cameras, with replaceable lenses
- Housing: replaceable camera dome/housing glass
- Video:
  - Compression: supports standard video compression formats. Minimum H264
  - Remote configuration: capability to configure the following parameters both remotely and on board.
    - FPS (Frames per second) adjustable depending on camera purpose
    - Image resolution
    - Image quality
    - Digital/optical zoom level
  - Measuring capability: capability to measure fish length for relevant cameras

In order to determine the number of cameras needed and the type, the following parameters shall be taken into consideration:

- Distance of the camera to the point of interest
- Aperture of the focal lens
- Required resolution needed for the purpose of the camera

Minimum technical requirements for sensors

The minimum requirement for sensors depends on the type of vessel (LoA). Several sensors shall be based on a common requirement independently from the type of vessel (e.g., GPS). As minimum, a vessel must have sensors for:

- GPS
- Winch rotation with direction detection
- Hydraulic pressure
- Electric current
- Fish hatch/door open/close
- Temperature (fish hauls)
- Power block

[12] Using small cameras should be prioritized. Closure fittings need to be robust and durable.

Appendix 8

Working Group on Electronic Monitoring Systems (WG-EMS)
Possible priorities, implementation strategies and tentative workplan

(Submitted by the European Union)

1. Background and objective

The first meeting of the Working Group on Electronic Monitoring Systems (WG-EMS) took place on the 28 February 2022.

During this meeting a preliminary discussion on the role of the Working Group, implementation strategies and priorities took place. The Working Group also discussed the need to have a work programme (2022-2024) to guide its future work, with a focus on its initial priorities.

The present document sets out possible priorities and implementation strategies in order to initiate more detailed discussions within the WG-EMS. The second part of the document details a possible workplan for the implementation of the identified priorities.

2. Priorities and implementation strategies

In line with paragraph 2(j) of the *Resolution by ICCAT for the establishment of a Working Group on the use of Electronic Monitoring Systems (EMS)* (Res. 21-22), the main priorities and implementation strategies of the WG-EMS for the period 2022-2024 are as follows:

a) to develop minimum technical standards for the implementation of CPC national programs of EMS technology in longline and purse seine fisheries, as called for in Recs. 21-01, 19-05, and 21-09.

- These minimum standards and requirements will be grouped according to those that are common to all EMS and, where applicable, those that differ depending on the identified objectives of the specific EMS, namely scientific data collection and compliance monitoring.
- In developing these minimum standards, the EMS work being carried out by the SCRS will be considered and relevant aspects incorporated.

b) to keep abreast of practical experiences and technological developments on EMS, including by:

- following ICCAT EMS projects, ongoing and future, and analysing results, making suggestions, and drawing conclusions, as appropriate.
- identifying EMS developments, including technological or process-related developments in the framework of other RFMOs, CPCs' domestic programs, and the private sector.
- building on accumulated knowledge, and creating synergies, where possible.

c) to continue to advance and support the use of EMS in ICCAT fisheries:

- explore whether and how relevant EMS projects and initiatives in other RFMOs and by CPCs could be replicated in ICCAT fisheries, where appropriate.
- explore how new EMS technological developments might be used to improve the monitoring, control, and management of ICCAT fisheries.
- serve as a consultative and technical advisory body to ICCAT bodies and working groups in relation to EMS, including recommending EMS projects of interest to ICCAT fisheries, where so requested or upon the EMS WG's own initiative.
- Without impacting the tasks mentioned in a) above, consider the possible utility of EMS in commercial fisheries other than those covered by Recs. 21-01, 19-05, and 21-09 including by exploring the development of minimum standards and program requirements, as appropriate.

d) to explore coordination and synergies between the monitoring, control, surveillance (MCS), and scientific applications of EMS:

   – ensure regular exchanges and coordination with the SCRS and PWG, including through Integrated Monitoring Measures Working Group (IMM WG), as appropriate.

3. Tentative workplan for 2022-2024

Task	*Deliverable*	*Tentative schedule*
Develop minimum technical standards for the implementation of CPC national programs of EMS technology in longline and purse seine fisheries, as called for in Recs. 21-01, 19-05, and 21-09	Minimum technical standards	- Agreement at WG level: - 1st meeting of WG in 2023 - Validation by SCRS: - during the course of 2023 - Adoption: - end of 2023
Keep abreast of practical experiences and technological developments on EMS	- Compilation of relevant work by other RFMOs - Repository with relevant reports and papers	- Compilation of relevant work by other RFMOs: - end 2022 - Repository with relevant reports and papers: - end 2022 - In general: - recurrent
Continue to advance and support the use of EMS in ICCAT fisheries	Possible suggestions of new EMS projects	In general, recurrent, with first discussion at first WG-EMS meeting in 2023
Explore coordination and synergies between the monitoring, control, surveillance (MCS), and scientific applications of EMS		Item for discussion at every WG-EMS meeting