INTER-AMERICAN TROPICAL TUNA COMMISSION

4TH WORKSHOP ON THE TECHNICAL STANDARDS AND DATA COLLECTION PRIORITIES OF AN ELECTRONIC MONITORING SYSTEM (EMS) IN THE EASTERN PACIFICOCEAN (EPO)

(by videoconference)

12-14 December 2022

DISCUSSION SUMMARY

The 4th Workshop on the Technical Standards and Data Collection Priorities of an Electronic Monitoring System (EMS) in the eastern Pacific Ocean (EPO) was held by videoconference from 12 to 14 December 2022. A list of participants is provided in Appendix 1.

The 4th EMS workshop was convened in the context of the terms of reference adopted by the Commission in Resolution C-21-02 for a series of workshops to elaborate on the necessary aspects of an eventual EMS program to be approved by the Members. The goals of these workshops are not only to garner any conclusions and recommendations on the covered topics, but also to educate participants and foster communication and work towards a common understanding among stakeholders on EM matters. Participants were asked to consider and comment broadly on discussion topics concerning the technical stadards and the priorities on data collection, but to consider the application of these EMS concepts to the differentiated components of the EPO tuna fleets.

1. Opening of the meeting

The meeting was chaired by Mr. Brad Wiley of the IATTC Policy and Compliance Division.

There were no comments on the draft agenda, which was adopted without changes.

The Chair indicated that IATTC staff would give two presentations over the course of the Workshop: the first presentation corresponding to EMS-04-01 on the topic of *Technical Standards of an EMS in the EPO*, and a second corresponding to EMS-04-02 on the topic of *Data Collection Priorities of an EMS in the EPO*. He recalled that d the discussion would follow t the Chatham House Rule, meaning that comments would not be attributed to any individual, government or other affiliation, unless attribution was explicitly requested by the speaker.

In addition, several presentations by speakers from other organizations provided further insight and added perspective on the themes under discussion:

Brett Alger (NOAA Fisheries), who is chairing the ICES working group for implementing technologies in commercial fisheries (TIFD), talked about some of the approaches being taken by EMS programs in the US to better standardize how data are collected, managed, and analyzed across EMS systems, fisheries, and governmental jurisdictions (). One example is that many EMS programs are developing templates for vessel monitoring plans (VMPs), which can standardize how each vessel has set up their EM systems, handle fishery catch, etc., to implement performance-based standards and ensure data quality improvement as a program matures. Brett chairs the ICES working group for implementing technologies in commercial fisheries (TIFD), and he shared their working draft data model and specification that could be leveraged by any new EM program to start with a foundation for what EM systems can collect across fisheries and gear types. This work will be carried forward over the next few years as logistical pipelines are being developed for integrating EM data into the ICES stock assessment processes. Brett also mentioned that the ICES working group would like to develop better performance standards for the EM technology, such as leveraging the

EM technical standards published by the European Fisheries Control Agency (EFCA) several years ago.

Hilario Murua, chair of the IOTC Working Group on the Development of Electronic Monitoring Programme Standards (WGEMS), gave a presentation on the progress of the IOTC-EMS program implementation with emphasis on the technical standards and data collection priorities of the purse seine, longline and pole and line fisheries (Progress on data collection priorities in other tuna-RFMOs (IOTC)). He described that one of the objectives of the IOTC regional observer scheme (ROS) (Resolution 22/04) is to collect verified catch data and other scientific data related to fisheries for tuna and tuna-like species in the IOTC area of competence. He also indicated that the observer coverage under the IOTC ROS could be achieved through EM, provided that EM minimum standards are adopted to meet the minimum mandatory ROS data reporting standards. IOTC WGEMS has developed EM program and data standards, that have been subsequently adopted by the IOTC Scientific Committee, including an evaluation of the ROS minimum data requirements that can be collected using EM.

Ben Gilmer from The Natural Conservancy (TNC); which submitted a document titled Electronic monitoring program design considerations), talked about TNC's work to a) remove barriers for EM adoption such as the testing of new EM applications at sea and technology innovation to lower hurdles (e.g. EM analysis costs) and b) setting the landscape for long-term success of EM such as market incentives for EM adoption, and drive adoption of streamlined policies that catalyze EM acceptance. The attributes of a performed-based EM program were also highlighted.

2. Discussion of EMS-04-01, Technical Standards of an EMS in the EPO

Mr. Marlon Roman gave a presentation complementing the paper prepared by IATTC staff (EMS-04-01) Within the context of the paper, the staff proposed a number of draft/strawman recommendations with the goal of stimulating focused discussion on a number of topics**,** with the possibility of reaching agreements in some cases, and in others, to identify the difficulties or challenges in reaching such agreements based on the recommendations contained in the document.

Staff Recommendation: ***The standards need to be purpose and performance oriented, flexible enough and periodically reviewed by the Commission to accommodate technological advances and changes in priorities, as well as the particular requirements of vessels of different sizes, gears, and fishing practices*.**

- One participant supported this recommendation, however, noted that, ifif the standards to be established are too specific, the time required for their adoption would be too long; a general purpose and performance-oriented approach would be therefore preferable. Another participant added that the data to be collected should be more precisely defined.

Staff Recommendation: ***Unless (or until) common standards are adopted, the EM equipment installed should be capable of working with all existing hardware and software and be adaptable to future technological developments.***

- One participant suggested removing the word *'all'* and adding 'to the extent possible'. n.

2.1. Cameras

Staff Recommendation: ***Cameras must be sufficient in number and quality to meet the data requirements of the EMS, with high-resolution images that allow the identification of species, specific fishing activities and the vessel's surroundings, and durable enough to withstand conditions at sea.***

Staff Recommendations: ***Cameras should be capable of recording both video and still images, with a minimum frame rate of 15 frames per second (15 fps) and a minimum image capture interval of no more than 2 seconds, respectively.***

- One participant suggested removal of the reference to the vessel's surroundings as the images may not be clear. From the IATTC staff perspective, however, it is very important to have a view of the activities surrounding the vessel (e.g. FADs, and identification of species or taxa interactions when

the branchline is cut without bringing the animal on board).

- Another participant considered that bycatch is part of the catch and fishing operation in longline fishery, but is flexible with respect to purse seine vessels and perhaps the language could be changed while ensuring that language so that FAD information is available.
- A participant noted that clarification is needed on whether the cameras are rugged enough to withstand the conditions at sea and to capture the environment. He noted that the language is too prescriptive at this stage and felt that a recommendation should be sought based largely on the performance of the equipment. The IATTC staff stated regarding the number and configuration of cameras, that it is not the intention to prescribe specific locations and numbers of equipment, but rather the intention is to share what has been observed and learned during the pilot project on purse seine vessels. There are too many variables between vessels and operations. Finally, that participant stressed that 2 frames per second is the minimum necessary to be able to identify the different species.
- Another participant expressed the opinion that 15 frames/sec in the longline fishery is the minimum frame rate to obtain adequate images considering handling, condition, species identification and other operational characteristics. Some other aspects of the fishery may not require that rate, but are essential for this work.
- A participant supported the above comment and remarked that a performance-based EM program is important and not being too prescriptive is ideal, so the language should create room for innovations.
- Another participant felt that recording video and requiring still images, is not possible. What is important is that the image capture interval is the most appropriate without specifying the two-second parameter.

Staff Recommendation: ***For purse seine vessels, the cameras should cover, at a minimum, the working deck (both port and starboard sides), the net sack and the brailer, the foredeck or amidships, and (if applicable) the well deck and conveyor belt. A first proposal for location of cameras in class 2-6 purse seiners is provided in Annex 1, based on the experience of the pilot project D.2.a.***

- A participant asked if at this stage the IATTC is looking to define how and how many cameras will be installed, or if it is trying to define what areas should be covered. The IATTC staff noted that there should be a minimum number of angles and cameras to adequately observe the fishing activity. The language can be revised to better reflect the intent being sought when noting camera locations.

Staff Recommendation: ***On longliners, the cameras should provide, at a minimum, a view of all hooked fauna, both those brought aboard the vessel and those discarded or released without landing them on the vessel. A first proposal for the location of cameras on longliners is provided in Annex 2, based on information provided by the pilot project C.2.b, EM service providers and other international initiatives.***

- One participant with a pilot program mentioned that for large longliners they have concluded that 3 cameras work very well, so they do not support the staff recommendation on this point. He suggested focusing on a results-oriented approach, with the number of cameras to be used unspecified. The IATTC staff stated that their recommendations are prelimnary and based on experience in the IATTC pilot project, and is, like all of the staff recommendations contained in the worksh papers, are subject to further revision. The participant agreed that 3 cameras could be sufficient, but that the additional camera is useful in the event that one camera fails, but noted that there are other ways to address at-sea equipment repair or repalcement. Another participant concurred, stating that issues of camera performance and problems should not be addressed in this part, but under a separate topic.

- Another participant supported the recommendation and expressed the opinion that the current wording effectively reflects a performance standard and implied flexibility in the number of cameras, despite the proposal for specific locations in the Annex. Another important EM data requirement is the type of branchline material (eg. steel, monofilament, etc.). This is another important fact to consider for the location of the cameras.

- One participant mentioned that his country has a pilot project on longlines in which 3 and 4 cameras are used, but noted thatit is difficult to record discarded species because they are underwater. Another participant noted that in EM projects done in Costa Rica and French Polynesia, they had problems when sharks approach the boat in terms of having a sufficient number of images, in that case placing a camera over the rail could be considered. He noted that if fishermen can bring the bycatch into camera view, it is possible to identify it and that hey could provide videos of French Polynesian vessels to verify this point.

Staff Recommendation: ***CPCs will require their vessels to cooperate with and facilitate the installation, maintenance and repair of cameras and other EM equipment according to the device placement design plan for their vessel or vessel type.***

- One participant recommended adding the phrase " *other stakeholders and relevantauthorities involved* ", after "…..*their vessels*" to the paragraph to refer to the entities that will cooperate in the work on the use and operation of the EM equipment. A second participant supported this suggestion.

2.2. Sensors

Staff Recommendation: ***EM equipment may also include sensors for recording non-visual data (e.g. vessel movement, hydraulic pressure, environmental information), and also possibly mechanisms for activating/disactivating cameras so as to focus visual data collection during activities of interest.***

- One participant did not support this recommendation because the sensor equipment is very sophisticated and specialized and if damaged could affect fishing operations or even stop them. Perhaps other methods can be used to detect fishing activities such as using the information from the VMS. The IATTC staff stated that the sensors inform the system when to turn the system on and off, which helps reduce data storage requirements. In response, this participant stated that they use VMS to know when a vessel is fishing and when it is cruising and not fishing. The participant did not agree that sensors should be a mandatory requirement.

- Another participant stated that the recommendation states that "may also include", so it is not a requirement as written. In that case, they prefer to keep the sensor language as is, as there are many studies that show the importance of using the sensor in EMS.

2.3. Data storage

Staff Recommendation: ***EM equipment should include sufficient capacity to store all required EM records, at a minimum, for the duration of a fishing trip.***

- One participant proposed that it is necessary to work on a definition of 'fishing trip'.

Staff Recommendation: V***essels should have onboard enough blank data storage devices (preferable solid-state drives) in case these must be replaced at sea. A specially trained crew member may need to replace the devices during a fishing trip if the data storage capacity is exhausted, always in coordination with the EM service provider***.

- There were no comments objecting to this recommendation.

Staff Recommendation: ***EM equipment should include separate duplicate backup devices, to ensure that data are not lost if one device fails.***

- One participant commented regarding the requirements for separate duplicate backup devices, that hard drives can be replaced. As noted now in the recommendation, many hard drives will be required, and this should not be considered as a requirement but an optional recommendation.

2.4. Compatibility

Staff Recommendation: ***EM equipment should use and generate records and/or data in a format compatible with IATTC databases and IT resources.***

- A participant noted that the data are collected by the flag State and the flag State must send the summarized data to the Secretariat. while stressing also that EMS should be considered only as a complementary program to the human observer program and for scientific purposes. Another participant seconded this comment. The IATTC staff mentioned that, unless standardized, the data formats are sometimes difficult to handle, so it is desirable to convert everything to a format that is easily usable. It is suggested that a single format be used, which will improve usability and management. Another participant expressed support for the IATTC's request that data be provided in a usable format and awaits guidelines on what is needed.
- The IATTC staff stressed that a great deal of improvement is needed to make longline data usable. A major effort is currently underway to improve the data sets, including a workshop to be held in January 2023. The 5% of data currently obtained from longliners with observers on board is not sufficient, the data needed are not being obtained, and there is great hope that the EMS will provide the required data.

2.5. Malfunctions/tampering

Staff Recommendation: ***EM equipment should be tamper-evident/resistant and send automatic alerts in real time to the appropriate EM program in cases of malfunctions, manual activation/shutdown, manual data input, external data manipulation, or attempts to tamper with the equipment or EM records. It should also be possible for data recording to be controlled manually, but only in case the EM equipment fails to start or stops automatically, and any manual activation should trigger an automatic alert. Manual shutdown should not be permitted.***

- One participant mentioned that in general terms, the recommendation is adequate, while stressing that EMS should have the sole purpose of collecting scientific data and should not be implemented for compliance purposes. However, language should not be included stating that the equipment should be tamper-proof. In addition there is also the question whether this recommendation would result in additional costs to the fishermen. The IATTC staff pointed out that, from a scientific perspective, it is important to verify whether the data are reliable and for this it is important to know whether the EM system has been tampered with. Another participant agreed with the IATTC staff and noted that the recommendation should be maintained.
- A participant mentioned that "help alerts" are already built into the EM equipment, and costs are basically already built into all vendor equipment, as vendors want to know when and why their hardware is malfunctioning.

2.6. Data encryption

Staff Recommendation: ***EM equipment should be capable of transmitting EM records in encrypted form.***

- One participant noted that they do not consider this recommendation to be necessary. If the data are used for compliance purposes, encryption would be important, but not for scientific purposes. The IATTC staff mentioned that encrypting the data is important to maintain confidentiality. Only one password would be used to open the information. It is necessary to consider that there could be

an illegal appropriation of the information, and if it is encrypted it will help to overcome this problem.

- The participant insisted that the review of the information should be done by the flag State. They do not see the need to send images by e-mail. Encryption would not be necessary in that case.

2.7. EM equipment maintenance

Staff Recommendation: ***At sea, all maintenance, repairs and replacement activities of EM equipment should be conducted by a specially trained vessel crew member, only in coordination and when instructed to do so remotely by the EM service provider.***

Staff Recommendation: ***On land, all maintenance, repairs and replacement activities of EM equipment should be conducted by an official technician, in coordination with EM service provider.***

Staff Recommendation: ***Each vessel must have a designated crew member responsible for routine camera lenses cleansing, per a specific protocol, to ensure the clarity of EM records. The protocol should include the following instructions: i) the lenses of cameras operating within 10 meters of any fishing activity must be wiped clean before every set; ii) the lenses of all other cameras must be wiped clean once every week. Appropriate cleaning materials must be used to avoid lenses damage and should always be available onboard.***

- As for these three recommendations on equipment maintenance, one participant did not support the second recommendation because of the inclusion of a reference to the need for an "official technician". For the third recommendation, the requirement to clean the lenses every week should be sufficient since requiring it before each fishing set is too much. The IATTC staff mentioned that perhaps the terminology could be improved by noting "approved technician" instead of official. The third recommendation could improve the language and emphasized that cleaning the lenses is important since at the end of each set the lenses get splashed and fogged.

- Regarding the third recommendation above, a participant mentioned that safety issues should be considered when requiring the crew to clean the cameras since most of the EM equipment is located in high positions.

- Another participant mentioned that the recommendations are extremely specific, but efforts should be made to obtain quality images and CPCs should ensure that each vessel provides quality information. The IATTC staff mentioned that perhaps this could be expressed in terms of a performance standard. Another participant agreed with these comments and remarked that it is essential to ensure data quality.

- Finally, another participant mentioned that security should not be a concern since the cameras are not in high locations. In addition, water spots on the cameras have always been a problem that affects data quality, so they agreed that the EM programs should indicate that the lenses should be cleaned frequently.

3. Discussion of EMS-04-02, Data Collection Priorities of an EMS in the EPO

Mr. Marlon Roman gave a presentation complementing the paper prepared by IATTC staff (EMS-04-02). Within the context of the paper, the staff proposed a number of draft/strawman recommendations with the goal of stimulating focused discussion on a number of topics.

Staff Recommendation: ***Priorities for EM data collection should be established, taking into account, among others, the provisions of the Antigua Convention, the IATTC Strategic Science Plan, the status and vulnerability of species, and the needs for compliance monitoring.***

- One participant noted that, according to the Antigua Convention, it is indeed necessary to identify what data should be collected, but what is stated in the recommendation is too specific, especially

since the Scientific and Strategic Plan (SSP) changes from time to time. In this case, he proposed deleting the rest of the sentence after "*the Antigua Convention*". The IATTC staff noted that the SSP is adopted for a 5-year period and reflects the priorities identified by the Scientific Advisory Committee and the CPCs.

- The same participant mentioned that he could agree with the inclusion of a reference the SSP, but could not do so with the inclusion of the text mentioning the needs for compliance monitoring, since he was of the view that the purpose of the EMS should only be to collect scientific data. If an EMS is introduced for compliance, it would automatically mean 100% coverage, with considerable costs to bear.t.
- From this discussion it became clear that the task to discuss and agree on the definition of the objectives of the EMS is still pending i particularly if it is intended only to complement scientific information, or if it also supports the review of compliance with the measures adopted by the IATTC.

Staff Recommendation: ***The Commission should support and ensure the funding of research activities that would improve EM data collection for scientific and compliance purposes (e.g., sensors that could remotely identify satellite buoys attached to FADs, accurate identification of certain fishing activities, other fishery components).***

- One participant objected to the use of EMS for compliance purposes for longline fishery as well as the use of sensors as a mandatory requirement. But added that purse seine vessels might be treated differently, with.EMS as an extension or supplementary to human observer coverage for that category of vessels

3.1. Purse-seine vessels

Staff Recommendation: ***Recognize, on a provisional basis, the need to collect for the purse seine fishery, at a minimum, the fields presented in Appendix 2.***

- There were no comments on this recommendation.

3.2. Longline vessels

Staff Recommendation: ***Recognize, on a provisional basis, the need to collect for the longline fishery, at a minimum, the fields presented in Appendix 3.***

- The IATTC staff commented that the data established in the annex are still provisional/preliminary, and it is considered that the results of the pilot project will allow for further revision. There is not much experience in this regard so the practice will make it possible to move forward in a well-informed manner.
- Another participant noted that collecting information on the geographical location of vessels every two seconds for longliners is excessive. The Secretariat insisted that there have been internal discussions about the two-second interval. In this regard, the central computer of the EM equipment automatically watermarks the location data from the GPS at that time-intervals, and it has been proposed because it may avoid the need of a VMS equipment since it records location information with similar resolution.

4. Additional discussions of matters related to documents EMS-04-01 and EMS-04-02

Dan Ovando, from the IATTC staff, gave a presentation on the critical issues in determining EM coverage, the EM review rate as well as the costs and the implications for data collection. This presentation is an introduction to the issues to be addressed in the upcoming workshop on financial issues, but it is important to be aware of the factors that are important for the design of EM coverage. Cost is an important factor and with Mr. Ovando's work, data collection costs could be efficiently reduced.

- A participant sasked whatthe complications that coverage rate introduces would be with a hypothetical 100% EM coverage, and an ideal review rate, The answer was that there would not be an issue when coverage is a perfect random sample. Coverage matters if there's systemic bias (e.g. spatial, vessel sizes) in coverage. Essentially, how well does the data in your review dataset extrapolate to the data that isn't in the dataset? No amount of review will correct for bias coverage.
- A second participant asked if the IATTC staff is ready to determine objectives and performance standards and the review rate needed, or if further research will be required. The staff commented that the information obtained to date is preliminary, in addition to the fact that the data are from purse seiners, so a similar analysis in the longline fishery could yield different results, since not all vessels have the same operational characteristics and fishing strategies, so the assumptions with this small dataset are significant. Currently, more studies on purse seine and longline fisheries datasets are ongoing, and will hopefully be available for the spring workshop when the financial considerations will need to be discussed.
- Another participant asked on the need of whether is necessary to define review rates linked to EM coverage rates at the outset, or can decisions be made on one prior to the other. Dan mentioned that it is very important to consider both, since the EM coverage rate cannot be ignored when deciding the EM review rate, but is important to have coverage rates stablished since in order to do an analysis of review rate you have to have a good handle on true coverage rates. It was also emphasized that a sample study based on 5% observer coverage on longline vessels is not sufficient nor does it lead to a statistically representative sample. In this sense, Dan's simulations are merely informative, but it is necessary to be able to estimate the variability/error around the estimates.

5. Appendices

Appendix 1. List of participants.

Representing	Company	Name	Email
BLZ	Ministry of Finance	Delice Pinkard	delice.pinkard@bhsfu.gov.bz
BLZ	Ministry of Finance	Ernie Howe	ernie.howe@bhsfu.gov.bz
CAN	Fisheries and Oceans Canada	Jose Benchetrit	jose.benchetrit@dfo-mpo.gc.ca
CAN	Fisheries and Oceans Canada	Dustin De Gagne	dustin.degagne@dfo-mpo.gc.ca
CHN	Shanghai Ocean University	Xiaobing Liu	xiaobing.liu@hotmail.com
CHN	Shanghai Ocean University	Zehua Lv	zhlv@shou.edu.cn
CHN	Shanghai Ocean University	Feng Wu	fwu@shou.edu.cn
CHN	Shanghai Ocean University	Qinqin Lin	qqlin@shou.edu.cn
CHN	Shanghai Ocean University	Xiaodong Li	lixiaodong2019310@163.com
CHN	China Overseas Fisheries Association	Yan Li	liyancnfj@outlook.com
CHN	China Overseas Fisheries Association	Mengjie Xiao	xiaomengjie1128@126.com
CHN	China Overseas Fisheries Association	Kairui Zhang	zhangkairui@cofa.net.cn
CRI	Incopesca	Jose Miguel Carvajal	jcarvajal@incopesca.go.cr
CRI	Incopesca	Nixon Lara	nlara@incopesca.go.cr
CRI	Incopesca	Bernald Pacheco	bpacheco@incopesca.go.cr
ECU	Ministerio de Producción, Comercio Exterior, Inversiones y Pesca	Henry Mero	hmero@produccion.gob.ec
ECU	Ministerio de Producción, Comercio Exterior, Inversiones y Pesca	Jose Velez	jvelezt@produccion.gob.ec
ECU	Ministerio de Producción, Comercio Exterior, Inversiones y Pesca	Carlos Zambrano	czambrano@produccion.gob.ec
ECU	Ministerio de Producción, Comercio Exterior, Inversiones y Pesca	Karla Bravo	kbravo@produccion.gob.ec
ECU	Tunacons	Leonardo Caicedo	data.observadores@tunacons.org
ECU	Tunacons	Pedro Santistevan	psantistevan@tunacons.org
ECU	Universidad de Guayaquil	Rene Zambrano	eddie_zam89@hotmail.com
ECU	Probecuador	Luis Torres	probecuador@gye.satnet.net
EU	Portuguese Institute for the Ocean and Atmosphere, I.P. (IPMA)	Rui Coehlo	rpcoelho@ipma.pt
EU	Orpagu	Carlos Barciela	cbarciela@orpagu.com
EU	Azti	Jon Ruiz	jruiz@azti.es
SLV	Centro de Desarrollo de la Pesca y la Acuicultura	Raul Cortez	raul.cortez@mag.gob.sv
GTM	Dipesca	Carlos Martinez	carlosmartinez41331@gmail.com
GTM	Dipesca	Wesley Aguilar	alexaguilardipesca@gmail.com
GTM	Dipesca	Rachel Rodas	ashadud@yahoo.es
JPN	Fisheries Agency of Japan	Takumi Fukuda	takumi_fukuda720@maff.go.jp

JPN	Fisheries Agency of Japan	Shinji Hiruma	shinji_hiruma150@maff.go.jp
JPN	Fisheries Agency of Japan	Aya Matsushima	aya_matsushima190@maff.go.jp
JPN	Japan Tuna Fisheries Co-operative Association	Jun Daito	daito@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Daisaku Nagai	nagai@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Reiko Ohashi	ohashi@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Fuyuki Hayashi	fhayashi@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Yoshida Hiroyuki	yoshida@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Miura Nozomu	miura@japantuna.or.jp
JPN	Japan Tuna Fisheries Co-operative Association	Yuji Uozumi	uozumi@japantuna.or.jp
KOR	Ministry of Oceans and Fisheries	Geun Ryeong Kim	geunryeongkim@korea.kr
KOR	National Institute of Fisheries Science	Haewon Lee	roundsea72@korea.kr
KOR	National Institute of Fisheries Science	Youjung Kwon	kwonuj@korea.kr
MEX	Conapesca	Bertha Soler	bertha.soler@conapesca.gob.mx
PAN	Autoridad de los Recursos Acuáticos de Panamá	Yarkelia Vergara	yvergara@arap.gob.pa
PAN	Autoridad de los Recursos Acuáticos de Panamá	Mario Aguilar	meaguilar@arap.gob.pa
PAN	Autoridad de los Recursos Acuáticos de Panamá	Yesuri Pino	yesuri.pino@arap.gob.pa
PAN	Autoridad de los Recursos Acuáticos de Panamá	Samuel Gomez	sgomez@arap.gob.pa
PAN	Pronaob	Stephanie Diaz	administracion@pronaob.org
PAN	Pronaob	Enrique Espinoza	pronaob@pronaob.org
PAN	Pronaob	David Silva	davidsilvat@yahoo.com
PAN	Fipesca	Maria P. Diaz	mpdiaz@fipesca.com
PER	Instituto del Mar del Perú	Ana Alegre	palegre@imarpe.gob.pe
PER	Instituto del Mar del Perú	Allison Torres	allisonpeb18@gmail.com
PER	Instituto del Mar del Perú	Miguel Perez	mperez@imarpe.gob.pe
PER	Instituto del Mar del Perú	Sandra Cahuin	scahuin@imarpe.gob.pe
TWN	Fisheries Agency	Hsiang Yi Yu	hsiangyi@ms1.fa.gov.tw
TWN	Overseas Fisheries Development Council	Shu Man Pai	shuman0823@ms1.fa.gov.tw
TWN	Taiwan Tuna Association	Han-yu Lin	tony@tuna.org.tw
USA	NOAA	Ryan Wulff	ryan.wulff@noaa.gov
USA	NOAA	Rachael Wadsworth	rachael.wadsworth@noaa.gov
USA	U.S. Department of State	Carolyn Gruber	grubercd@state.gov
USA	NOAA	Amanda Munro	amanda.munro@noaa.gov
USA	NOAA	Katrina Poremba	katrina.poremba@noaa.gov

USA	NOAA	Celia Barroso	celia.barroso@noaa.gov
USA	NOAA	Valerie Post	valerie.post@noaa.gov
USA	NOAA	Yonat Swimmer	YONAT.SWIMMER@NOAA.GOV
USA	NOAA	Annette Henry	annette.henry@noaa.gov
USA	NOAA	Madison Harris	madison.harris@noaa.gov
USA	NOAA	Amy Lubrano	amy.lubrano@noaa.gov
USA	NOAA	Brett Alger	brett.alger@noaa.gov
USA	NOAA	Claire Fitz-Gerald	claire.fitz-gerald@noaa.gov
USA	NOAA	Heather Cronin	heather.a.cronin@noaa.gov
USA	NOAA	Melanie King	melanie.king@noaa.gov
USA	NOAA	Lynn Rassel	lynn.rassel@noaa.gov
USA	Pacific Fishery Management Council	Brett Wiedoff	brett.l.wiedoff@noaa.gov
USA	Western Pacific Regional Fishery Management Council	Mark Fitchett	mark.fitchett@wpcouncil.org
VEN	Ministerio del Poder Popular de Pesca y Acuicultura	Elena Quintero	elenaquintero.t@gmail.com
VEN	Ministerio del Poder Popular de Pesca y Acuicultura	Johan Padron	hawkergenius@gmail.com
VEN	Fundatun	Alvin Delgado	fundatunpnov@gmail.com
BOL	Unidad Boliviana de Pesca Marítima	Limbert Cortez	limbert.cortez@protonmail.ch
BOL	Unidad Boliviana de Pesca Marítima	Hugo Alsina	hugo@alsina-et-al.org
CHL	Subsecretaria de Pesca y Acuicultura	Lezlie Bustos	lbustos@subpesca.cl
CHL	Instituto de Fomento Pesquero	Patricio Barria	patricio.barria@ifop.cl
CHL	Instituto de Fomento Pesquero	Marcelo San Martin	marcelo.sanmartin@ifop.cl
HND	Digepesca	Eloisa Espinoza	eloisa_espinoza@hotmail.com
HND	Digepesca	Bernal Chavarria	bchavarria@lsg-cr.com
NGO	American Tunaboat Association	Beth Vanden Heuvel	bvandenheuvel@capefisheries.com
NGO	Sustainable Fisheries Partnership	Alexia Morgan	alexia.morgan@sustainablefish.org
NGO	ISSF	Hilario Murua	hmurua@iss-foundation.org
NGO	The Pew Charitable Trusts	Jamie Gibbon	jgibbon@pewtrusts.org
NGO	The Pew Charitable Trusts	Esther Wozniak	ewozniak@pewtrusts.org
NGO	The Nature Conservancy	Craig Heberer	craig.heberer@tnc.org
NGO	The Nature Conservancy	Ben Gilmer	ben.gilmer@TNC.ORG
NGO	The Nature Conservancy	Alvaro Teran	alvaro.teran@TNC.ORG
NGO	The Nature Conservancy	David Itano	daveitano@gmail.com
Obs	Satlink	Jose Beloso	jlb@satlink.es
Obs	Satlink	Javier de la Cal	jdc@satlink.es
Obs	Satlink	Manuel Menchaca	mmp@satlink.es
Obs	Digital Observer Service	Gonzalo Legorburu	glm@digitalobserver.org
Obs	Zunibal	Iratxe Arraiba	iratxe.arraibi@zunibal.com

Obs	Zunibal	Aitor Aizpurua	aitor.aizpurua@zunibal.com
Obs	Sharky Management and Consulting	Carlos Polo	carlosjpolo@gmail.com
Obs	Scripps Institution of Oceanography	Brendan Talwar	talwar.brendan@gmail.com
IATTC	Bycatch Co-chair	Manuel Correia	manuelcorreia.a@gmail.com
IATTC	IATTC	Marlon Roman	mroman@iattc.org
IATTC	IATTC	Alex Da Silva	alexdasilva@iattc.org
IATTC	IATTC	Arnulfo Franco	afranco@iattc.org
IATTC	IATTC	Ricardo Belmontes	rbelmontes@iattc.org
IATTC	IATTC	Enrique Ureña	eurena@iattc.org
IATTC	IATTC	Jon Lopez	jlopez@iattc.org
IATTC	IATTC	Brad Wiley	bwiley@iattc.org
IATTC	IATTC	Jean Francois Pulvenis	jpulvenis@iattc.org
IATTC	IATTC	Cleridy Lennert	clennert@iattc.org
IATTC	IATTC	Dan Ovando	dovando@iattc.org
IATTC	IATTC	Leanne Fuller	lfuller@iattc.org
IATTC	IATTC	Shane Griffiths	sgriffiths@iattc.org
IATTC	IATTC	Melanie Hutchinson	mhutchinson@iattc.org
IATTC	IATTC	Salvador Siu	ssiu@iattc.org
IATTC	IATTC	Jeff Morgan	jmorgan@iattc.org
IATTC	IATTC	Robert Sarazen	rsarazen@iattc.org
IATTC	IATTC	Monica Galvan	mgalvan@iattc.org
IATTC	IATTC	Barbara Cullingford	bcullingford@iattc.org
IATTC	IATTC	Marisol Aguilar	maguilar@iattc.org
Interpreter	Cardiso	Gaby Retana	gaby.retana@gmail.com
Interpreter	Cardiso	Cynthia Diez	cdiez@cardisocr.com

Appendix 2. A first assessment of data fields that should be collected, at a minimum, for the purse seine fishery, based on SAC-11-10 and the pilot project D.2.a.

1) **Trip information**
   a) Depart port, arrival port.
   b) Depart date/time, arrival date/time.
2) **Vessel activity**
   a) Speed and geographical position of the vessel every 2 seconds.
3) **Set information**
   a) Type of the set.
   b) Date/time of the start of the set, rings up, and the end of the set.
   c) Position (latitude and longitude, in decimal degrees) of the set.
   d) Wind speed (Beaufort scale).
   e) The time and date, as well as potential reason, of any major malfunction that stops or delays the setting maneuver.
4) **Target species**
   a) Total catch, size and discards per set for skipjack, and for yellowfin and bigeye, as feasible as EM technology allows. In cases where species identification is not possible, the combined catch may be reported. For sizes, weight categories shall be used whenever possible (i.e. small <2.5 kg., medium >2.5 kg.- <15kg., large >15 kg.).
5) **Non-target species**

   Catch, size and fate of individuals: requiem sharks, hammerhead sharks, thresher sharks, lamnid sharks, whale shark, mobulid rays, billfishes, scombrids, carangids, triggerfishes, sea turtles, sea birds, and marine mammals, where each individual will be identified to the lowest taxonomic resolution possible (i.e., species), as feasible as EM technology allows. In cases where species identification is not possible, the animal may be identified to a broader taxonomic resolution (e.g., genus, family). Wherever possible, individuals shall be measured to the nearest cm as follows: sharks in total length, billfishes in post-orbital fork length, fishes in fork length, rays in disc width, turtles in curved carapace length. In cases where individual measurement is not possible, the animal may be classified by size category (i.e., small, medium, large) following IATTC observer practices.
6) **Floating objects/FADs**
   a) Location, date, time for each FAD deployment.
   b) Location, date, time for each FAD retrieval.

Appendix 3. A first assessment of data fields that should be collected, at a minimum, for the longline fishery, based on SAC-11-10.

The ability of EM to collect the data specified in C-19-08 (option (i)) is summarized in Appendix 3 of SAC-11-10. However, the staff has no practical experience of EM on longline vessels and, since fisheries are region-specific, it will be in a better position to assess the capabilities of EM on longline vessels after the proposed pilot study (Project C.2.b) is completed. For the purposes of this document, and although it could be revised in the future, the recommendations of the IATTC staff on the observer data fields for longliners that EM should collect, at a minimum, are as follows:

1) **Trip information**
   a) Depart port, arrival port.
   b) Depart date/time, arrival date/time.
2) **Vessel activity**
   a) Speed, geographical position of the vessel, at a minimum, every 2 seconds.
3) **Set information**
   a) Date/time of the start, and the end of the set.
   b) Position (latitude and longitude, in decimal degrees) of the start and end of the set.
   c) Date/time of the start, and the end of the hauling.
   d) Position (latitude and longitude, in decimal degrees) of the hauling.
   e) Haul direction.
   f) Use of blue-dyed bait (Yes-No).
   g) Total number of baskets or floats.
   h) Total number of hooks used.
   i) Wire traces on some or all of its branch lines (Yes-No).
   j) Number of shark lines (branch lines running directly off the longline floats or drop lines).
4) **Target and non-target species**
   a) The species identification of each individual caught.
   b) Size of each individual caught, using the recommended measurement approach and the appropriate measurement code (standard, furcal, post-orbital, width of the disc, etc.) for the species.
   c) The estimated condition of the individual when caught, brought on deck and released.
   d) Fate of the individual brought on deck (e.g. retained, discarded, etc.)
   e) Tag recovery information.

The type of interaction with the catch (e.g. entangled, hooked internally, hooked externally, interaction with vessel only.)