IOTC-2022-WGEMS02-INF08

AN ELECTRONIC MONITORING SYSTEM FOR TUNA FISHERIES IN THE EPO: STRUCTURE, IATTC WORKPLAN, AND PILOT EM STUDIES

2nd AD HOC WORKING GROUP ON THE DEVELOPMENT OF ELECTRONIC MONITORING PROGRAMME STANDARDS (WGEMS)

Food and Agriculture Organization of the United Nations

Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi

Indian Ocean Tuna Commission - IOTC
13-15 June 2022 (videoconference)

Outline

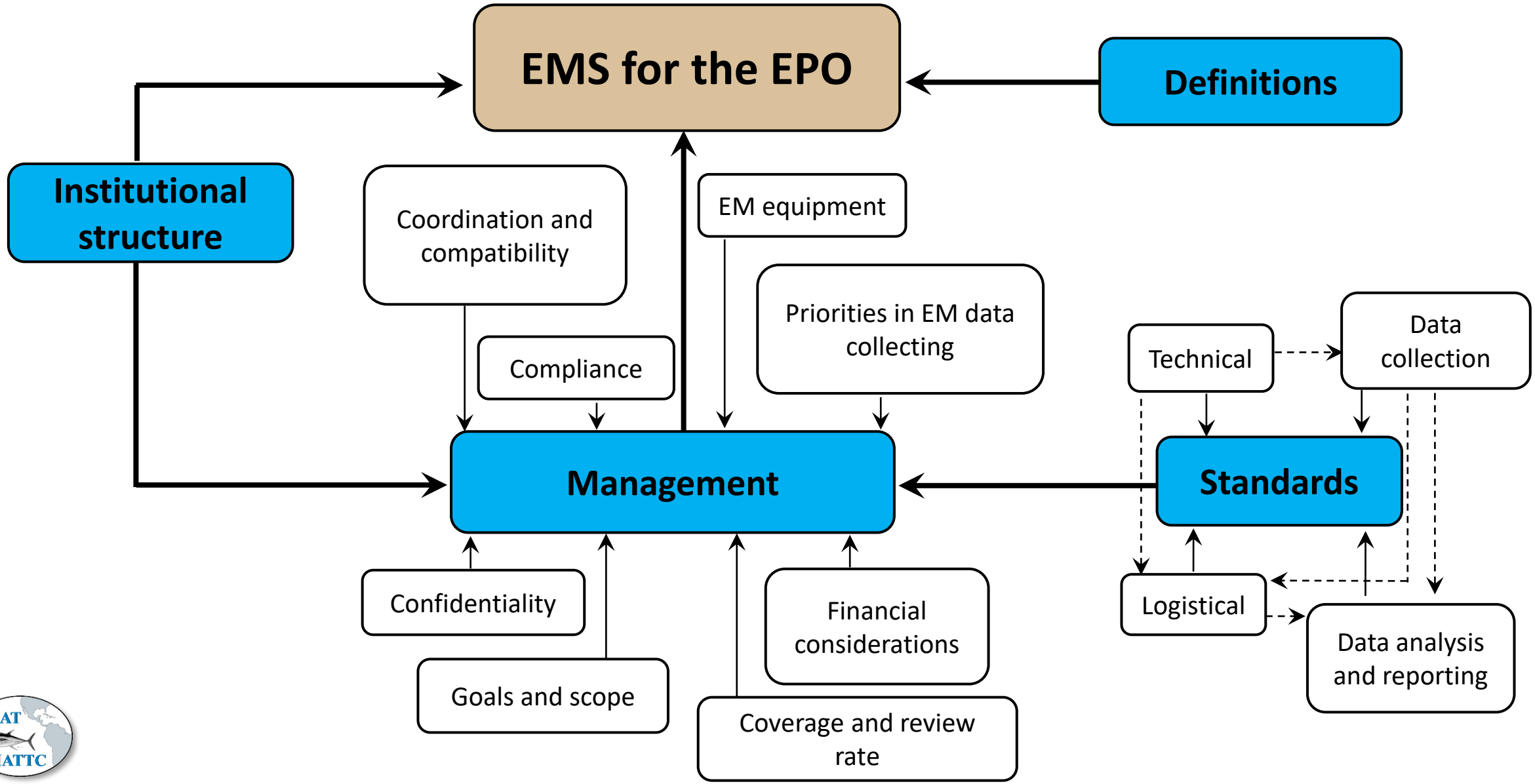
- **Steps taken for the implementation of an EMS for the tuna fisheries in the EPO**.
  - Proposed structure of the EMS.
  - Proposed workplan activities.

- **EM standards on data collection**.
  - Tuna purse-seine vessels in the EPO.
  - Tuna longline vessels in the EPO.

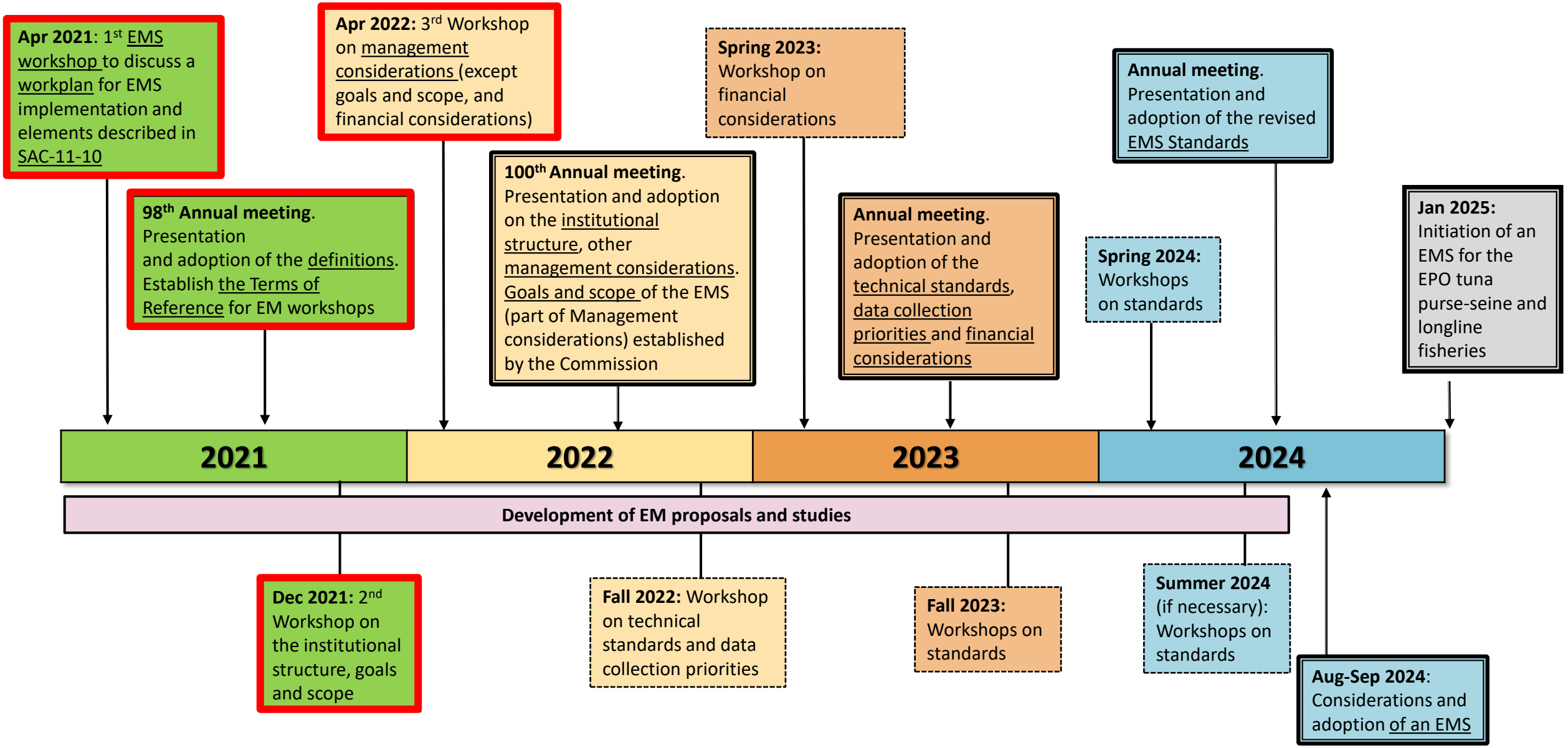
EMS for the tuna fisheries in the EPO. Background

- SAC-10 → C-19-08, the IATTC staff was requested to draft minimum standards and data collection and reporting requirements for EMS for the EPO tuna fishery.
- Document SAC-11-10 was presented in SAC-11.
- 1st EM workshop on Implementation of an Electronic Monitoring System (EMS). (Apr 2021):
  - An overall structure of the proposed EMS framework was presented (SAC-11-10 and EMS-01-01).
  - Immediate actions recommended for adoption by the Commission:
    - Adopt the definitions of EMS-01-01. Adopted during 98th IATTC Meeting (Res. C-21-03).
    - Adopt the proposed workplan of document EMS-01-02. Adopted during 98th IATTC Meeting.
    - Establish Terms of Reference for the EM workshops. Adopted during 98th IATTC Meeting (Res. C-21-02).

Proposed structure of the EMS for the tuna fisheries in the EPO



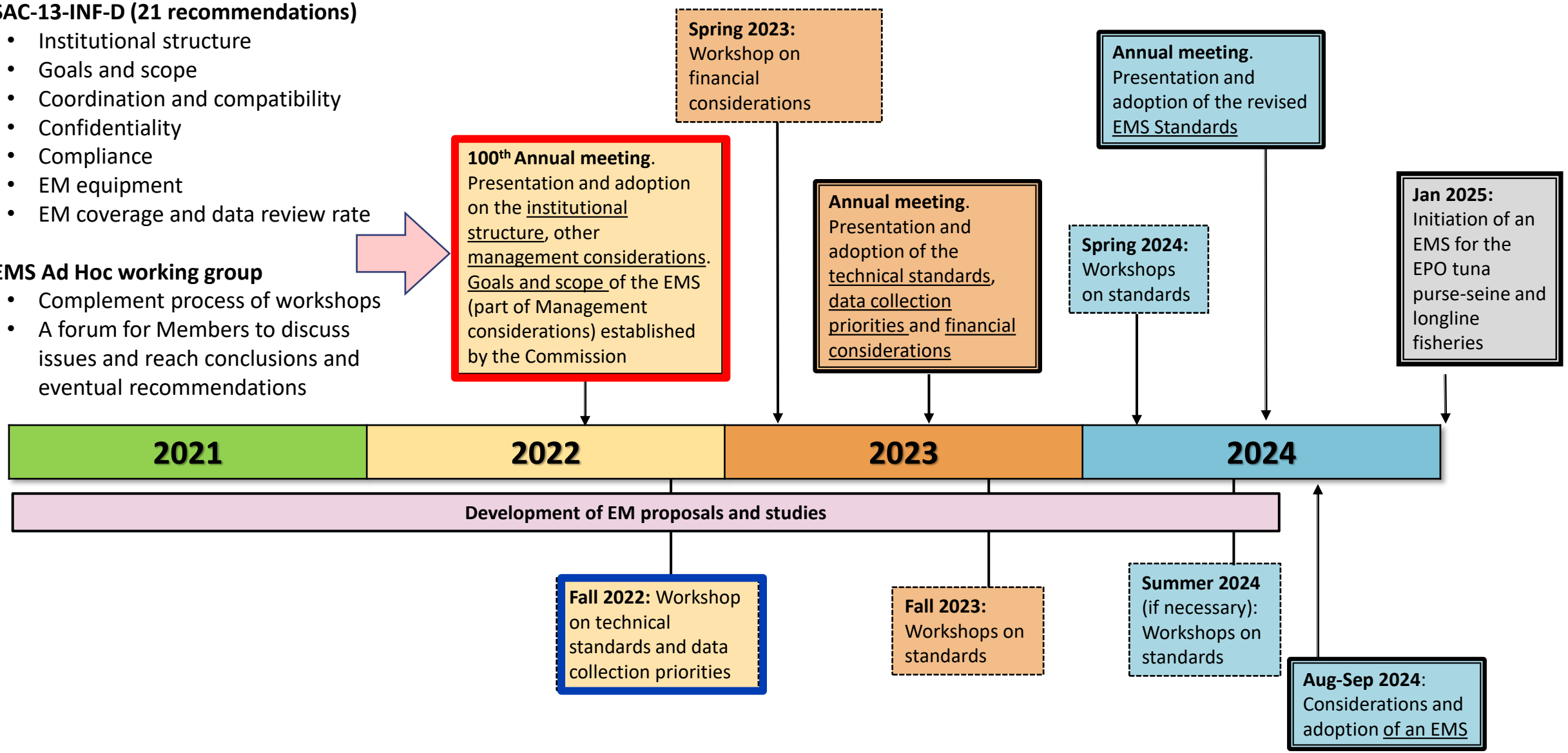
Workplan of the EMS for the tuna fisheries in the EPO



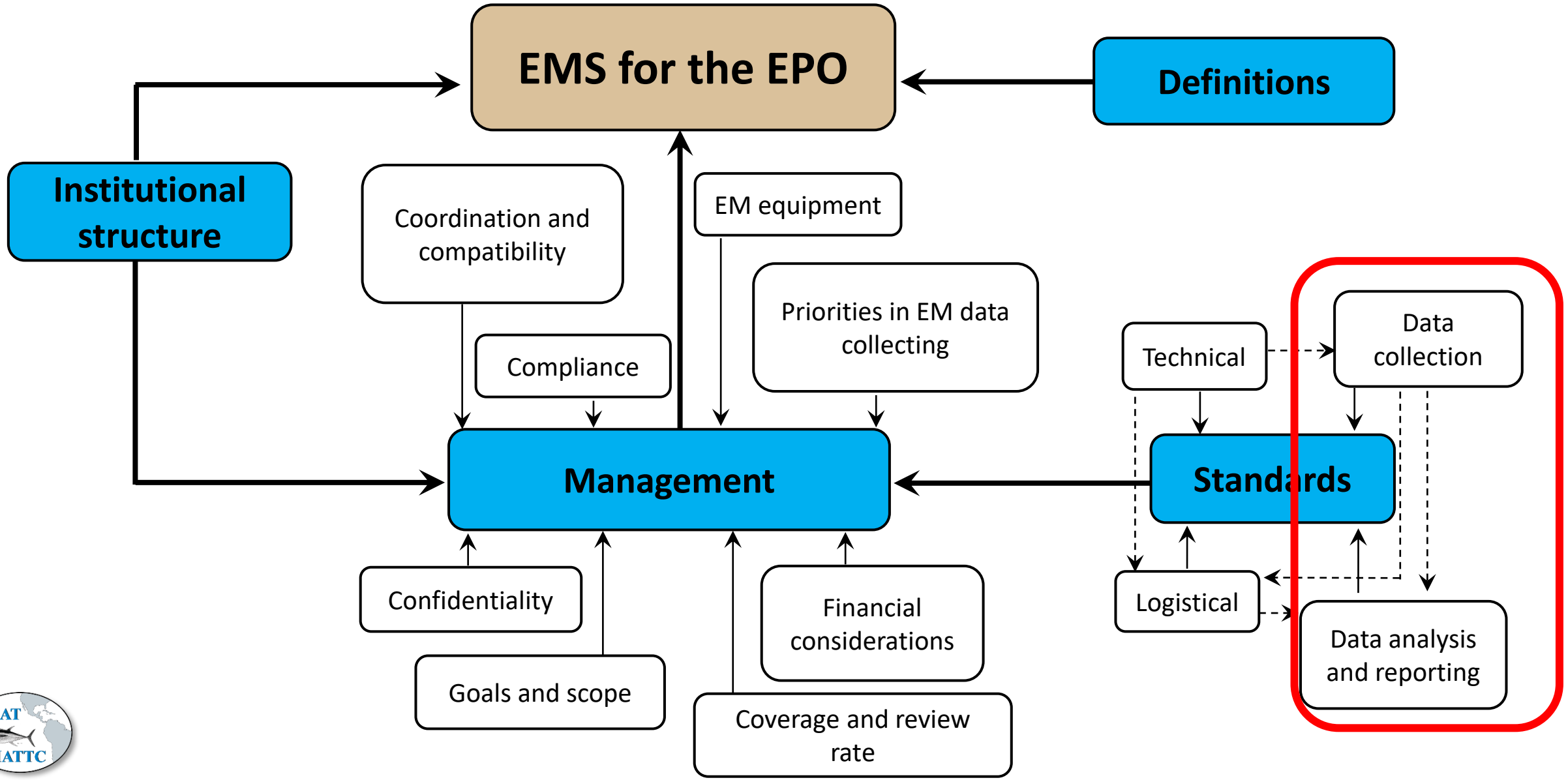
Workplan of the EMS for the tuna fisheries in the EPO

- **SAC-13-INF-D (21 recommendations)**
  - Institutional structure
  - Goals and scope
  - Coordination and compatibility
  - Confidentiality
  - Compliance
  - EM equipment
  - EM coverage and data review rate

- **EMS Ad Hoc working group**
  - Complement process of workshops
  - A forum for Members to discuss issues and reach conclusions and eventual recommendations



EMS standards on data collection



EMS standards on data collection

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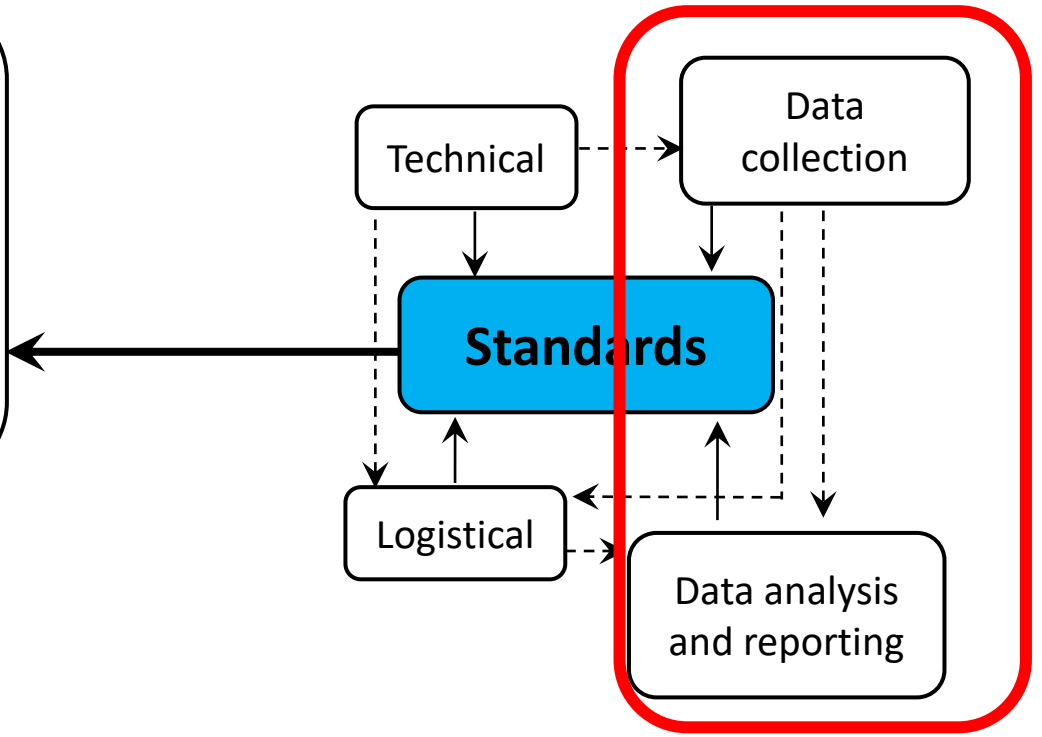
1) Pilot EM Project on small and large purse-seine vessels.
2) Pilot EM Project on Longline vessels.
3) Exploration of technologies for remote identification of FAD buoys.



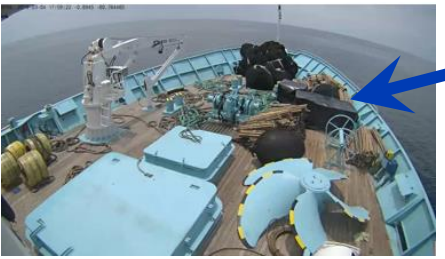
EMS standards on data collection

- For the IATTC to carry out the functions established by the AC: high-quality data from fisheries e.g., catch composition and CPUE are required for science-based fisheries management.
- **Small purse-seine vessels (Class 1-5): current sources of detailed data**
  - Vessel logbooks: limited information on non-target species, none on discards of target species. Information present is not debriefed.
  - Port sampling: species and size composition data is for target species only.
  - Observers: mostly large vessels (Class-6), rarely on small vessels.
- **Large purse-seine vessels (Class 6):**
  - EM complementing observers' data: observers might be unaware of activities occurring in different places at the same time. EM could assist them/take over activities so observers could perform others.
- Evaluate if EM can be used to collect information on set type, FAD deployments, catches, and bycatches.
- A preliminary evaluation of EM performance by comparing it to human observer is required.

Participating vessels – Class-6 purse-seiners

Large vessels

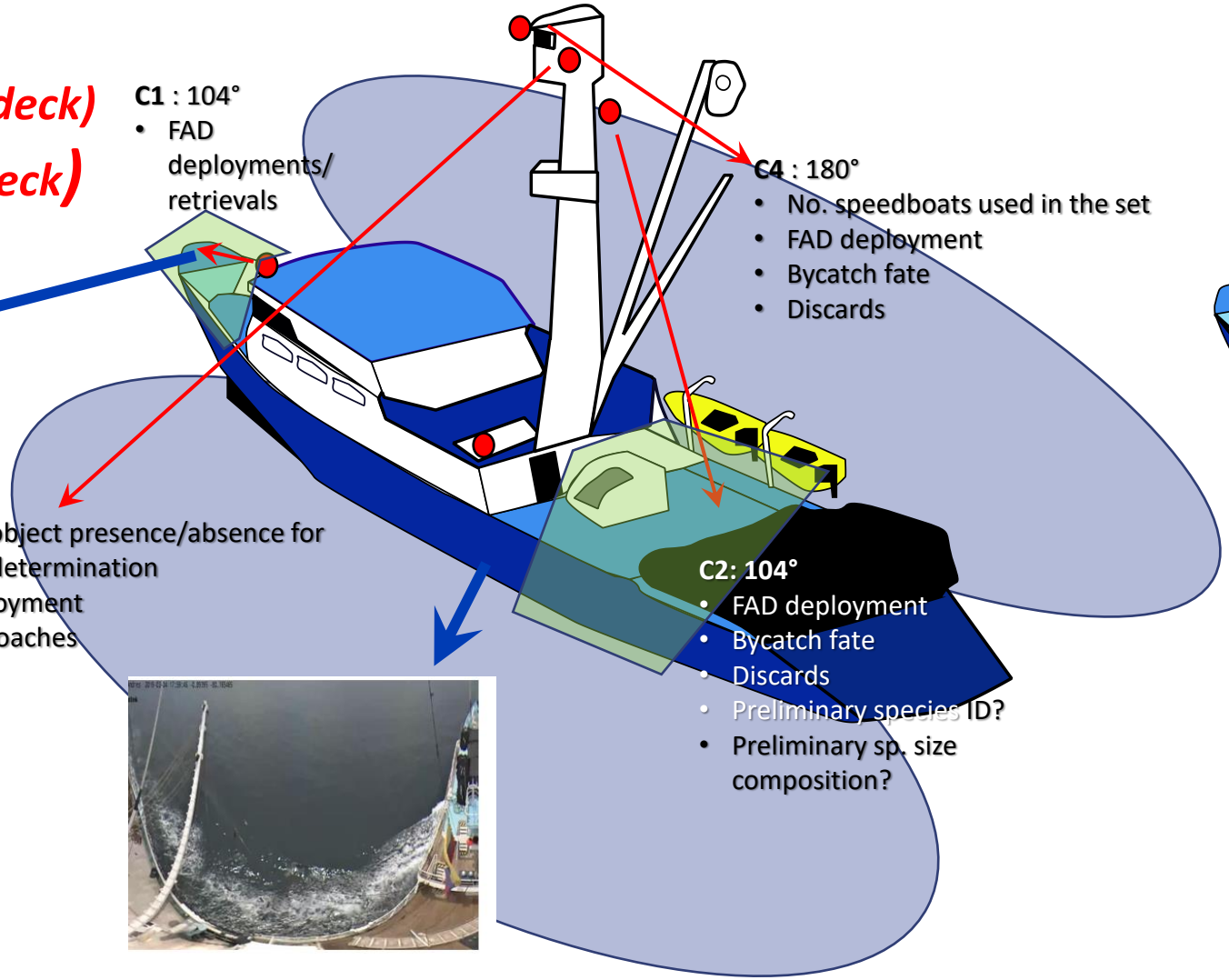
- *5 cameras (Main deck)*
- *3 cameras (Wet-deck)*



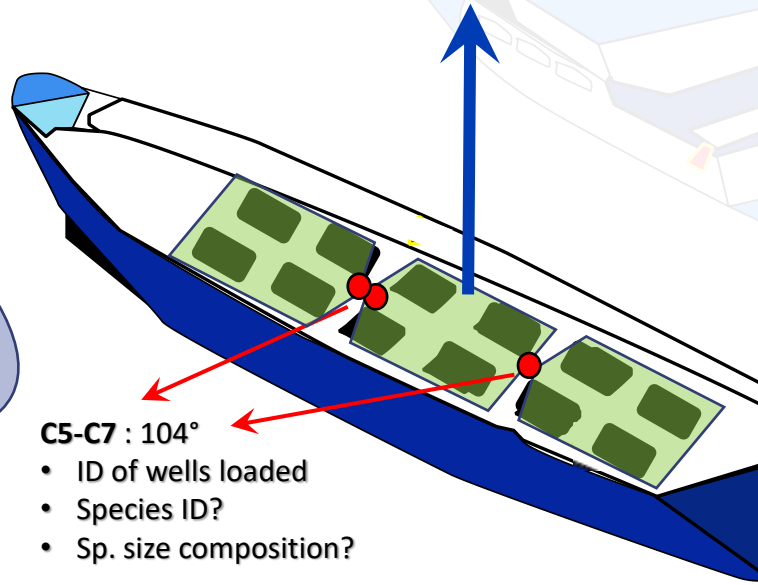
C3: 180°
- Floating object presence/absence for set type determination
- FAD deployment
- FAD approaches

C1 : 104°
- FAD deployments/ retrievals

C4 : 180°
- No. speedboats used in the set
- FAD deployment
- Bycatch fate
- Discards



C2: 104°
- FAD deployment
- Bycatch fate
- Discards
- Preliminary species ID?
- Preliminary sp. size composition?



C5-C7 : 104°
- ID of wells loaded
- Species ID?
- Sp. size composition?

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Participating vessel – Class-2

Small vessel

- *4 cameras (Main deck)*

C1: 180°
- Floating object presence/absence for set type determination
- FAD deployment

C3 : 104°
- FAD deployment
- Preliminary species ID?
- Preliminary sp. size composition?
- Bycatch fate
- Discards

C2: 104°
- Species ID?
- Bycatch fate
- Discards
- sp. size composition?
- No. speedboats used in the set

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Results EM-observer comparison

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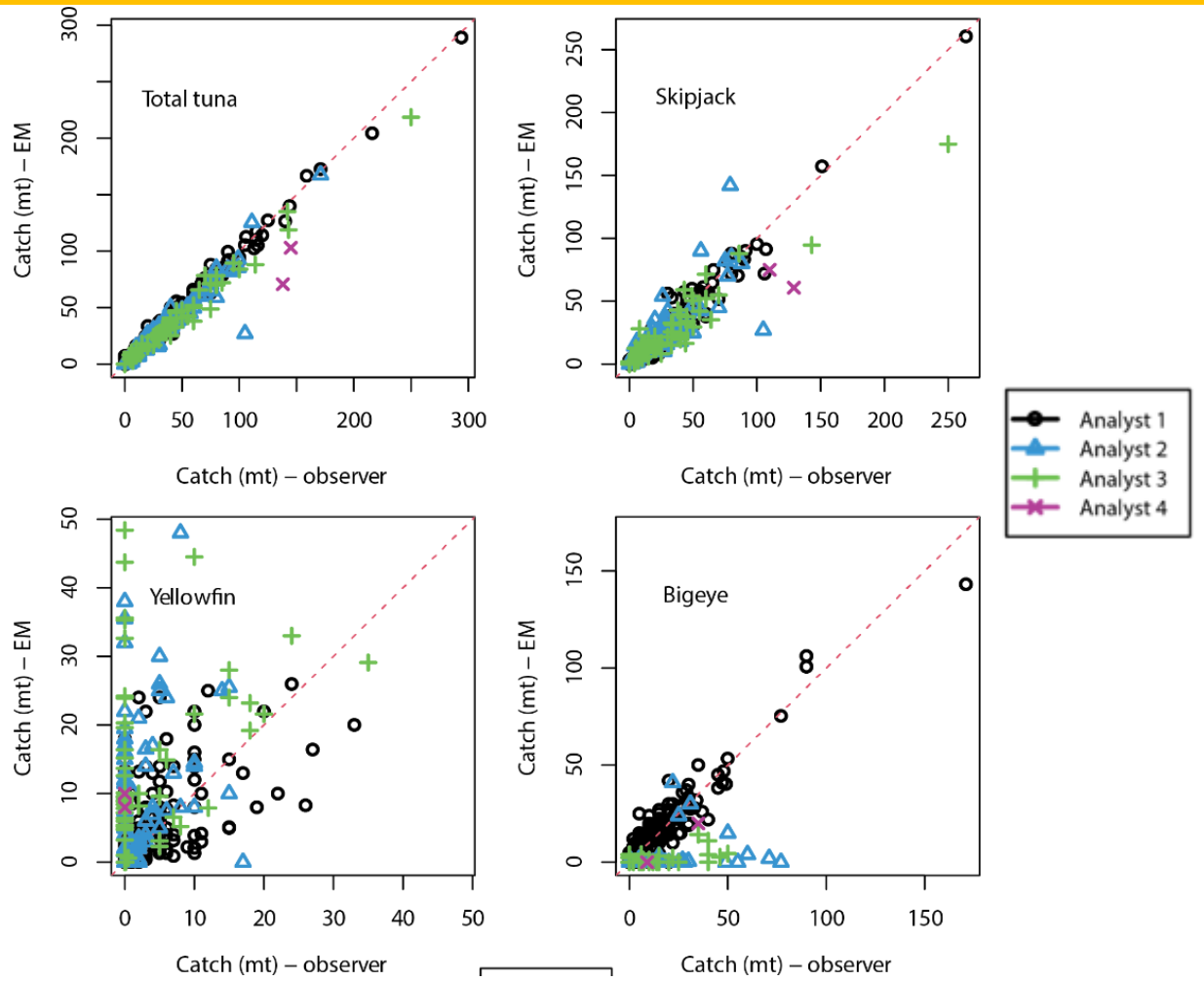


1. Observer and EM data similar for total tuna catch, and for catch of SKJ.
2. Relationship degrades for YFT. Although slope for one Analyst is close to 1.0, SE is large.
3. Poor relationship for BET, except for one EM analyst, despite the fact that the model fit to the data is acceptable.

tmp.gamobj<-gam(em_BETTotalCT~(-1)+reviewer.fac+obs_BETTotalCT:reviewer.fac,data=frm)
Results (first 3 rows are intercepts; next 3 are slopes)

Total tuna

	Estimate	Std. Error	t value	Pr(>|t|)	
reviewer.2	0.31284	0.67636	0.463	0.64393	
reviewer.3	0.37896	1.06334	0.356	0.72173	
reviewer.1	1.35884	0.48039	2.829	0.00489	**
reviewer.2:obsTotcatch	0.89778	0.01637	54.838	< 2e-16	***
reviewer.3:obsTotcatch	0.87024	0.01723	50.504	< 2e-16	***
reviewer.1:obsTotcatch	0.97371	0.00931	104.583	< 2e-16	***

R-sq.(adj) = 0.975 Deviance explained = 98.7%
GCV = 31.261 Scale est. = 30.833 n = 438

SKJ

	Estimate	Std. Error	t value	Pr(>|t|)	
reviewer.2	1.36480	1.00639	1.356	0.1758	
reviewer.3	2.90927	1.41864	2.051	0.0409	*
reviewer.1	-0.40231	0.67150	-0.599	0.5494	
reviewer.2:obs_SKJTotalCT	0.84421	0.03519	23.993	<2e-16	***
reviewer.3:obs_SKJTotalCT	0.71302	0.02861	24.919	<2e-16	***
reviewer.1:obs_SKJTotalCT	0.94291	0.01917	49.193	<2e-16	***

R-sq.(adj) = 0.893 Deviance explained = 93.5%
GCV = 71.106 Scale est. = 70.132 n = 438

YFT

	Estimate	Std. Error	t value	Pr(>|t|)	
reviewer.2	5.14955	0.75505	6.820	3.08e-11	***
reviewer.3	10.96698	1.07803	10.173	< 2e-16	***
reviewer.1	2.25204	0.53335	4.222	2.95e-05	***
reviewer.2:obs_YFTTotalCT	0.96742	0.19967	4.845	1.77e-06	***
reviewer.3:obs_YFTTotalCT	0.63340	0.13371	4.737	2.94e-06	***
reviewer.1:obs_YFTTotalCT	0.64035	0.09422	6.796	3.58e-11	***

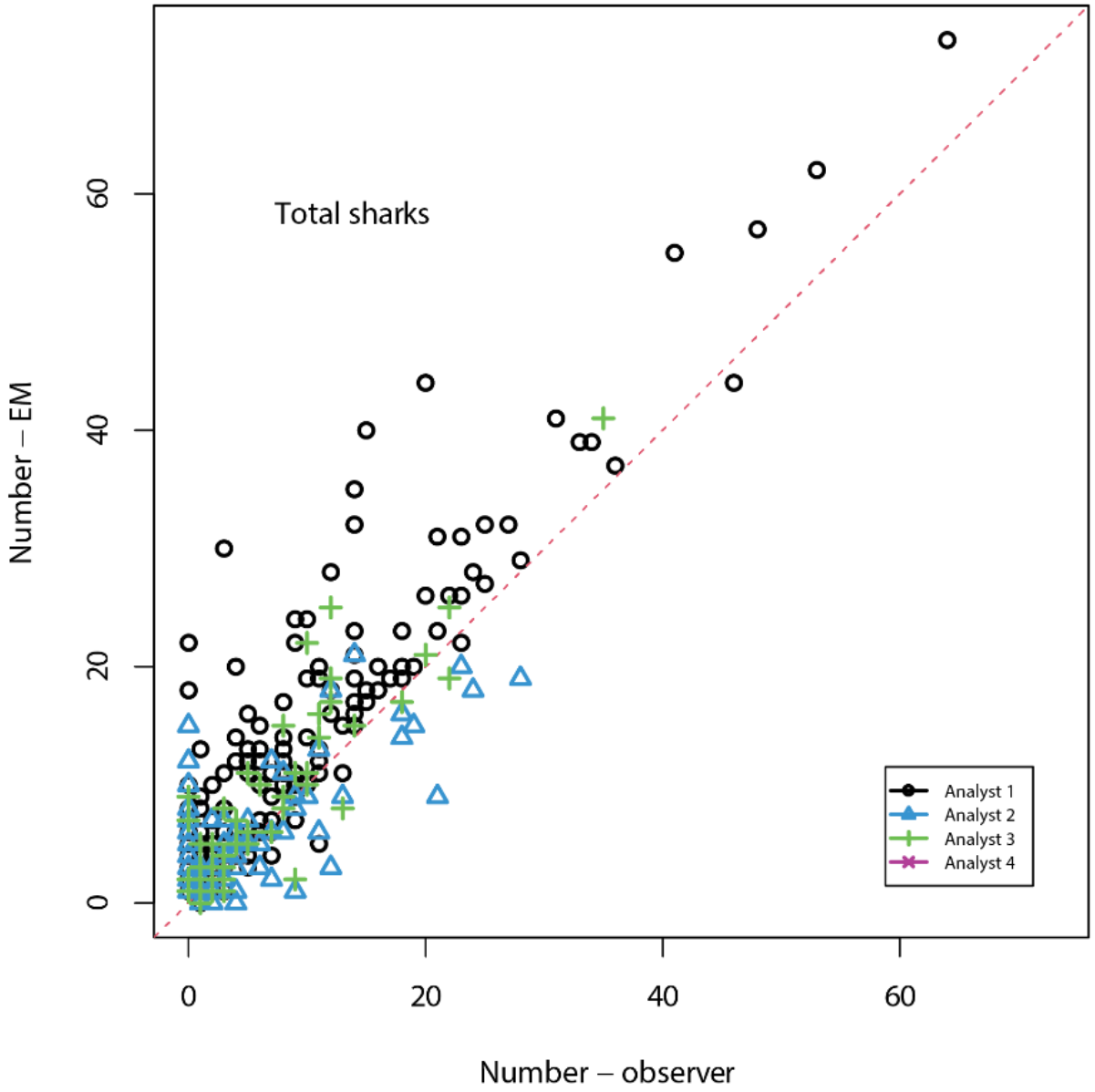
R-sq.(adj) = 0.274 Deviance explained = 51.9%
GCV = 55.723 Scale est. = 54.96 n = 438

BET

	Estimate	Std. Error	t value	Pr(>|t|)	
reviewer.2	0.27089	0.49179	0.551	0.582042	
reviewer.3	-0.14796	0.80258	-0.184	0.853819	
reviewer.1	1.61860	0.36501	4.434	1.17e-05	***
reviewer.2:obs_BETTotalCT	0.10774	0.03044	3.540	0.000444	***
reviewer.3:obs_BETTotalCT	0.11020	0.05032	2.190	0.029064	*
reviewer.1:obs_BETTotalCT	0.92826	0.01812	51.232	< 2e-16	***

R-sq.(adj) = 0.878 Deviance explained = 90.5%
GCV = 24.49 Scale est. = 24.155 n = 438

Results EM-observer comparison



Model:
tmp.gamobj<-gam(em_tsharks~reviewer+s(obs_tsharks,
by=reviewer.fac,k=3),data=frm,family=nb(link="identity"))
Results:
Parametric coefficients:

	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	7.6676	1.0384	7.384	1.53e-13	***
Reviewer2	0.8801	1.2875	0.684	0.4942	
Reviewer1	2.8870	1.1429	2.526	0.0115	*

Approximate significance of smooth terms:

	edf	Ref.df	Chi.sq	p-value	
s(obs_tsharks):reviewer.2	1.805	1.962	26.63	2.57e-05	***
s(obs_tsharks):reviewer.3	1.000	1.000	42.49	< 2e-16	***
s(obs_tsharks):reviewer.1	1.000	1.000	188.22	< 2e-16	***

R-sq.(adj) = 0.817 Deviance explained = 63.4%
-REML = 944.84 Scale est. = 1 n = 336

1. Significant positive relationship between the observer counts of sharks between Observer and EM.
2. Relationship varies among EM analysts.
3. Spike at 0 (observed count) for all reviewers and a high proportion of the data are above the 1-to-1 line (EM total counts are often greater than observer counts).

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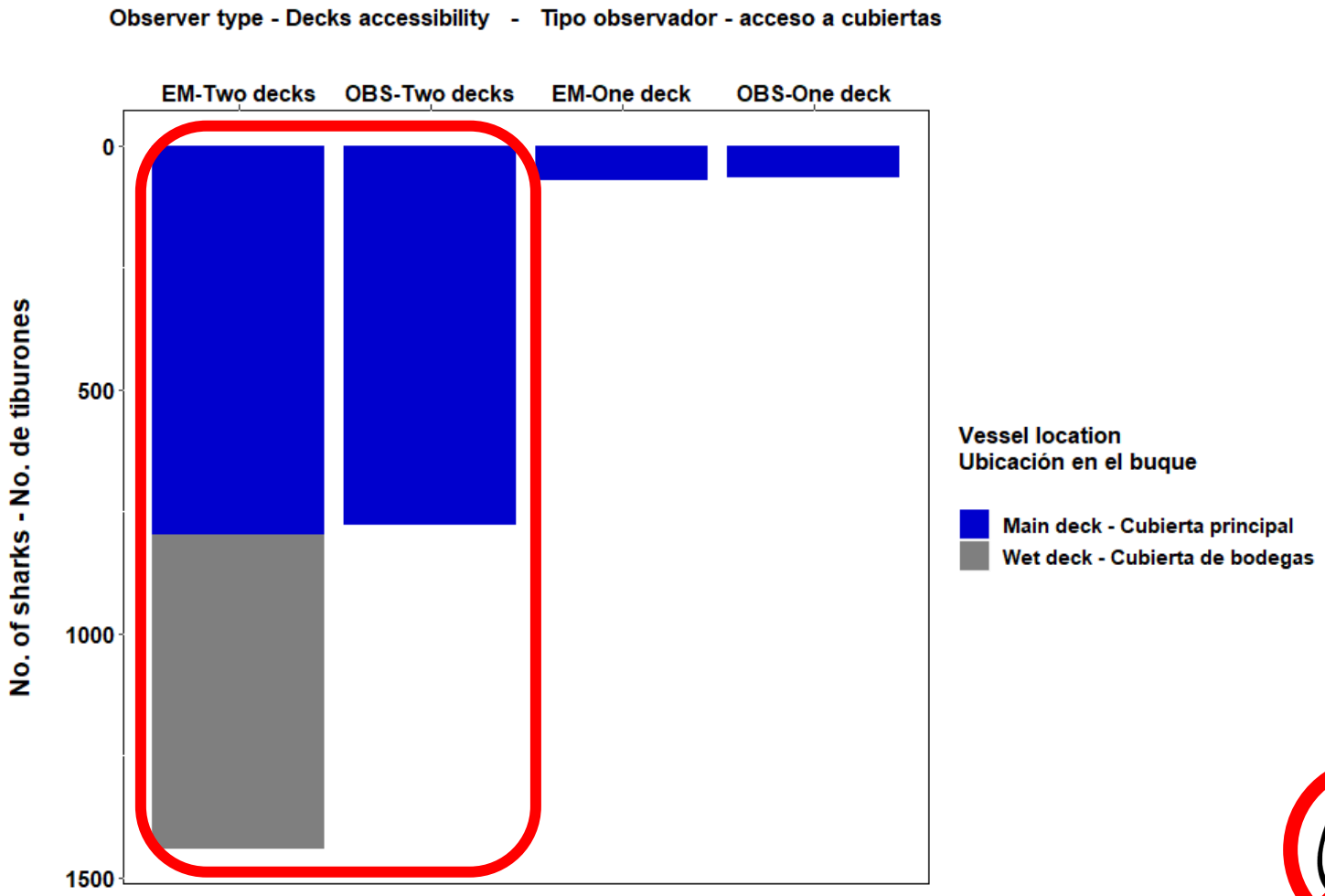
Shark sightings by deck location



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Some conclusions on EM analysis

- EM can collect key data fields for the tuna purse-seine fishery.
  - EM seems to be ready to collect 83.4% of PS data. 16.4% require extra work or is not possible.
  - Useful for collecting data in different vessel areas occurring at the same time.
- EM analysis costly and time consuming.
  - Optimize the time of analysis (AI).
  - Define priorities for EM data to be collected-analyzed.
- Some data not ready to be collected by EM.
  - Exploring technologies for remote FAD Id.
  - Explore technologies for accurate electronic measuring.
- Data analysis and reporting standards: necessary adequate experience/training of EM analysts.

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Pilot EM Project on longline vessels

- February 2021 to May 2023
- Three vessels participating

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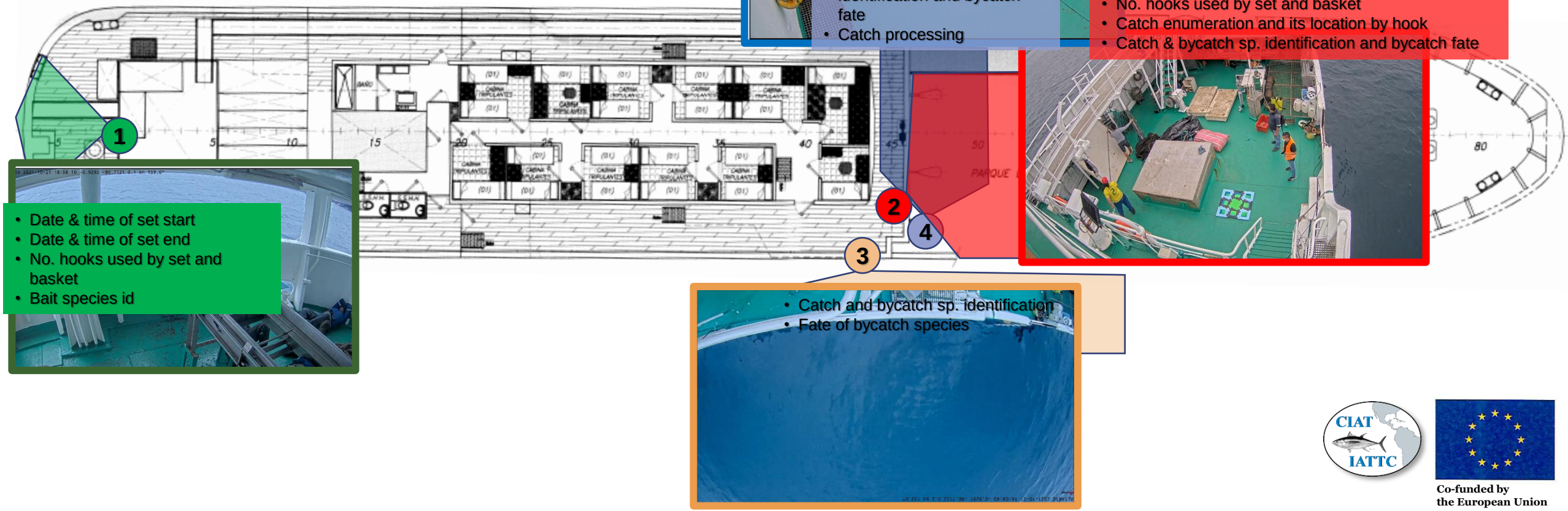
Pilot EM Project on longline vessels

- Four-camera EM system installed
- Currently collecting EM records at sea



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Pilot EM Project on longline vessels

Next steps

- Generate EM data.
- EM data will be compared with observer data.
- Results will indicate whether EM could be reliably used in the LL fishery of the EPO.

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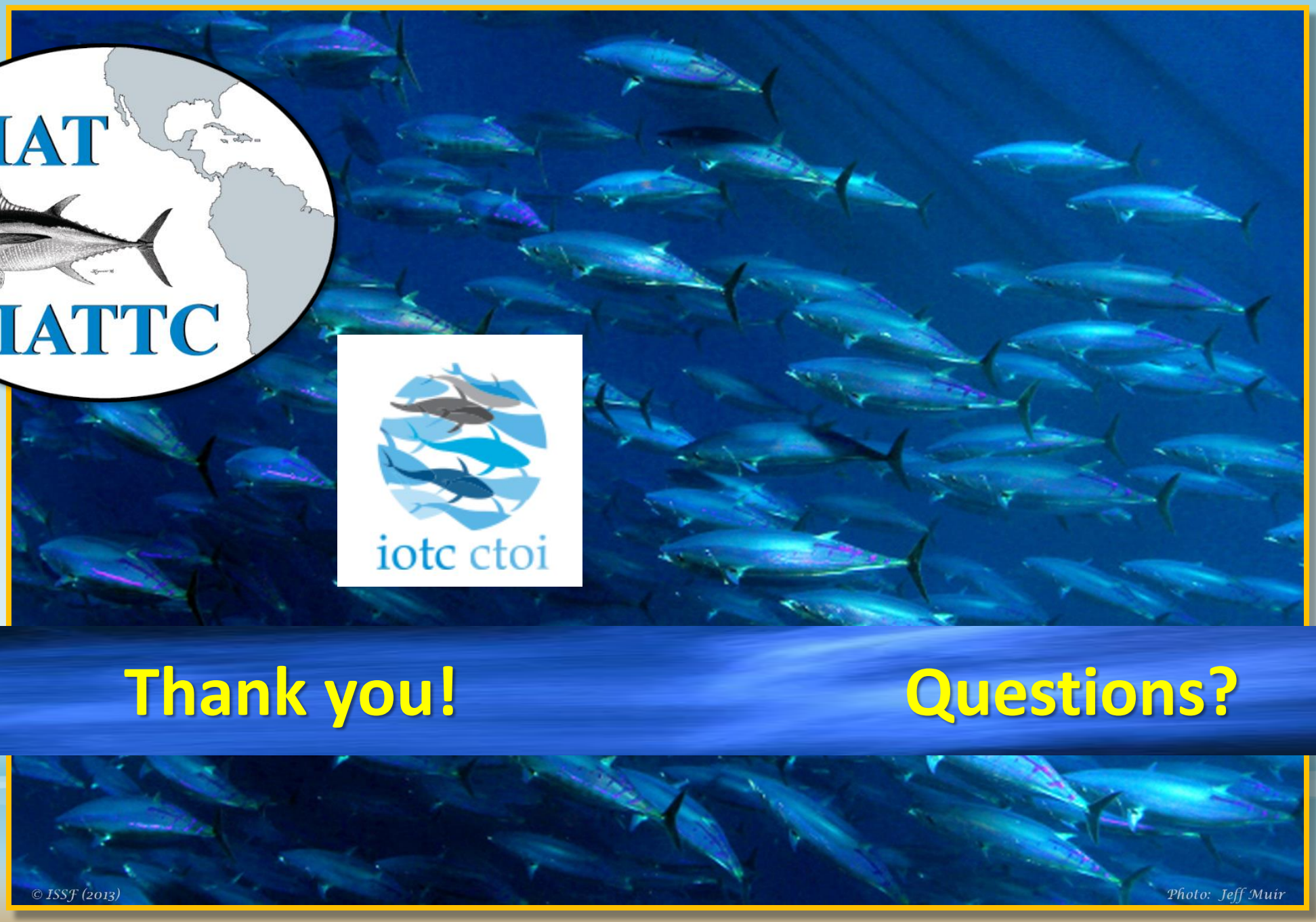
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Thank you!
Questions?
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