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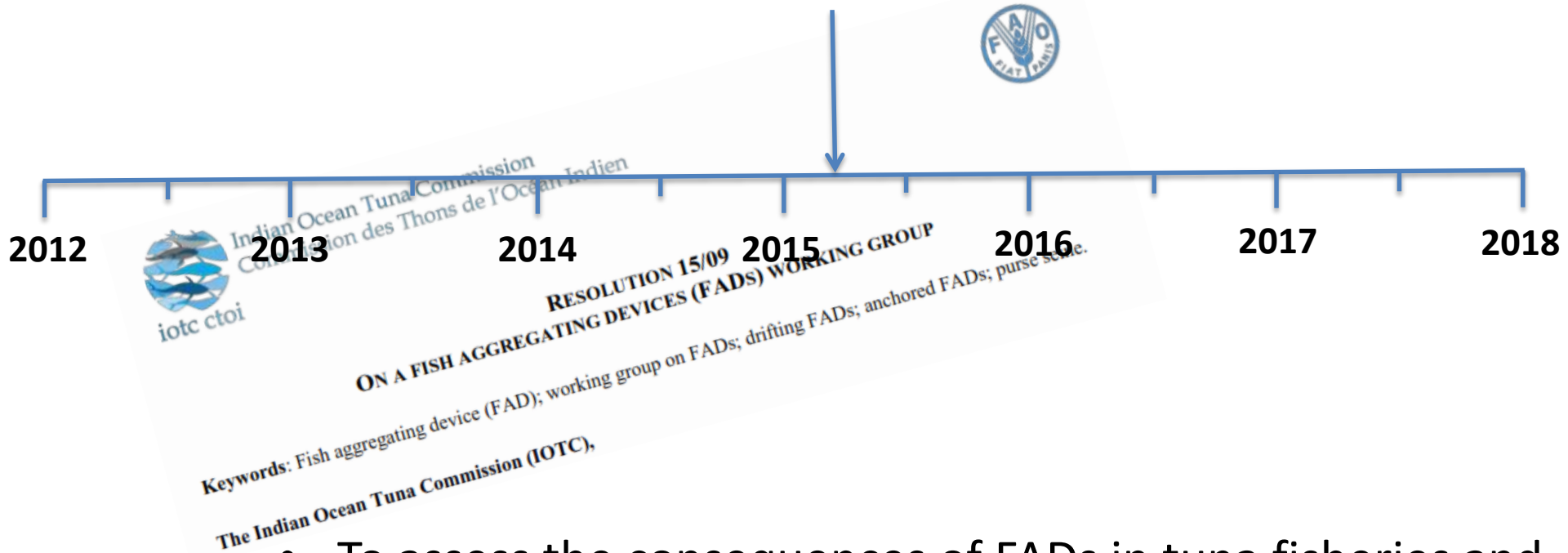
Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien

iotc ctoi

2nd Joint Tuna RFMO FAD Working Group Meeting

San Diego USA (7 – 10 May 2019)

**RESOLUTION 15/09
on a FAD WG**



- To assess the consequences of FADs in tuna fisheries and their ecosystems, in order to inform and advise on future FAD- related management options.
- Multi-sectorial nature
- The working group shall deliver its findings in time for the 2017 IOTC Scientific Committee.

Background

FAD data collection and reporting requirements for IOTC member states, as well as management measures related to FADs of both anchored and drifting type, have been captured and formalized by a number of separate Resolutions, including:

IOTC Resolution 18/08 (*“Procedures on a Fish Aggregating Devices (FADs) management plan (...)”*)

- Providing details and requirements related to FAD data collection and reporting (in combination with IOTC Resolution 15/02) (Annex I and II);
- Setting a limit to the number of instrumented buoys active at sea at any one time (350 per each vessel of a given flag state) (Paragraph 3 and 7);
- Limiting number of instrumented buoys which may be acquired annually by each CPC fishing vessel to 700 (Paragraph 3 and 7)

IOTC Resolution 18/01 (*“On an interim plan for rebuilding the Indian Ocean Yellowfin tuna stock”*)

- Reiterates many of the points of 18/08

IOTC Resolution 18/04 (*“On BIOFAD Experimental Project”*)

- To acknowledge and support the Biodegradable FAD (BIOFAD) project with the objective of reducing the impact and the amount of synthetic marine debris of the use of non-biodegradable FAD in the ecosystem

Resolution 18/08 provides a list of all mandatory data *collection* requirements related to FAD and FAD operations, including (but not limited to):

For drifting FADs:

- DFAD design characteristics;
- Any visit on a DFAD;
- For each visit on a DFAD, whether followed or not by a set, the
- - position,
 - date,
 - DFAD Identifier
 - DFAD type,
 - DFAD design characteristics,
 - type of the visit (deployment, hauling, retrieving, loss, intervention on electronic equipment);
- If the visit is followed by a set, the results of the set in terms of catch and bycatch.

For anchored FADs:

- Any visit in a AFAD;
- For each visit on an AFAD, whether followed or not by a set or other fishing activities, the
 - position,
 - date,
 - AFAD identifier
 - type of the visit (deployment, towing, loss);
- If the visit is followed by a set or other fishing activities, the results of the set in terms of catch and bycatch



6. Given that the activities of purse seine supply vessels and the use of **Fish Aggregating Devices (FAD)** are an integral part of the fishing effort exerted by the purse seine fleet, the following data shall be provided by CPCs:
- a) The number and characteristics of purse seine supply vessels: (i) operating under their flag, (ii) assisting purse seine vessels operating under their flag, or (iii) licensed to operate in their exclusive economic zones, and that have been present in the IOTC area of competence;
 - b) Number of days at sea by purse seine and purse seine supply vessels by 1° grid area and month to be reported by the flag state of the supply vessel;
 - c) The total number set by the purse seine and purse seine supply vessels per quarter, as well as:
 - i. The positions, dates at the time of setting, FAD identifier and FAD type (i.e. drifting log or debris, drifting raft or FAD with a net, drifting raft or FAD without a net, anchored FADs and other FADs e.g. Payao, dead animal etc.);
 - ii. The FAD design characteristics of each FAD (consistent with Annex 1 to Resolution 15/08 *[superseded by Resolution 17/08 then by Resolution 18/08] Procedures on a fishing aggregating devices (FADs) management Plan, including a limitation on the number of FADS, more detailed specifications of catch reporting from FAD sets, and the development of improved FAD designs to reduce the incidence of entanglement of non-target species*).

These data would be for the exclusive use of IOTC Scientific Committee and its Working Parties, subject to the approval of the data owners and in accordance with [Resolution 12/02 Data confidentiality policy and procedures](#), and should be provided in a timely fashion.

Two distinct classifications have been proposed by the secretariat as a complement to IOTC Resolution 18/08, one for FAD types:

Code	Description	FAD category	Has nets	Has tracking equipment
ANF	Anchored FAD	ANCHORED	N/A	N/A
F	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
FDT	Drifting raft or FAD without a net located using a tracking system (satellite transmission)	DRIFTING (ARTIFICIAL)	No	Yes
[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
NFT	Drifting raft or FAD with a net located using a tracking system (satellite transmission)	DRIFTING (ARTIFICIAL)	Yes	Yes
LOG	Drifting log or debris NOT located using a tracking system (satellite transmission)	DRIFTING (LOG)	No	No
LGT	Drifting log or debris located using a tracking system (satellite transmission)	DRIFTING (LOG)	No	Yes
DFR	Other drifting objects NOT located using a tracking system (satellite transmission) (e.g. dead animal, etc.)	DRIFTING (OTHER)	No	No
DRT	Other drifting objects located using a tracking system (satellite transmission) (e.g. dead animal, etc.)	DRIFTING (OTHER)	No	Yes

And one for FAD visit types:

Code	Description	FAD category	Sets expected
AD	Deployment of anchored FAD	ANCHORED	No
AH	Revisiting and towing of anchored FAD	ANCHORED	Yes
AL	Loss of anchored FAD (detached from anchorage point or damaged heavily)	ANCHORED	No
AR	Revisiting anchored FAD	ANCHORED	Yes
DD	Deployment of drifting FAD	DRIFTING (ARTIFICIAL)	No
DH	Retrieval/encounter and hauling of drifting FAD	DRIFTING (ALL)	Yes
DI	Retrieval/encounter, hauling, and intervention on electronic equipment of drifting FAD	DRIFTING (TRACKED)	Yes
DL	Loss of drifting FAD (tracking signal lost)	DRIFTING (TRACKED)	No
DR	Retrieval of drifting FAD	DRIFTING (ARTIFICIAL)	Yes

In which specific *interaction events* with both anchored and drifting FADs are defined and characterized by 1) a specific target FAD category and 2) the possibility for the event to be followed by one or more sets, implicitly creating *business rules or procedures* that should drive the reporting of FAD data to the IOTC Secretariat.



Strata identification

FAD and visit types Efforts

Catches

MONTH	GRID				AREA	ESTIMATION	Type of FAD	Type of Visit	NO. FAD SET	EFFORT	Catches				
	SIZE	QUADRANT	LATITUDE	LONGITUDE							YFT	SKJ	BET	ALB	AG00
											<i>Thunnus albacares</i>	<i>Katsuwonus pelamis</i>	<i>Thunnus obesus</i>	<i>Thunnus alalunga</i>	#N/A
1	5	1	0	60	5100060	AV	FDT	DH	1	1	8	32	0	0	0
1	5	1	0	61	5100061	AV	FDT	DH	0	1	33	0	1	0	0
1	5	1	0	61	5100061	AV	FDT	DI	0	1	0	0	0	0	0
1	5	2	0	58	5200058	AV	FDT	DH	0	1	8	9	0	0	0
1	5	2	0	61	5200061	AV	FDT	DH	0	1	14	0	3	0	0
1	5	2	1	56	5201056	AV	FDT	DH	1	1	21	69	0	0	0
1	5	2	1	62	5201062	AV	FDT	DI	1	1	10	0	0	0	0
1	5	2	1	63	5201063	AV	FDT	DH	1	1	4	11	0	0	0
1	5	2	1	64	5201064	AV	FDT	DI	1	1	0	0	0	0	0
1	5	2	1	67	5201067	AV	FDT	DH	0	1	0	0	0	0	0
1	5	2	1	67	5201067	AV	FDT	DH	1	1	37	65	0	0	0
1	5	2	1	67	5201067	AV	FDT	DI	0	1	155	0	0	0	0.2
1	5	2	1	68	5201068	AV	FDT	DI	0	1	16	0	0	0	0
1	5	2	1	68	5201068	AV	FDT	DI	1	1	0	20	0	0	0
1	5	2	2	66	5202066	AV	FDT	DI	0	1	36	0	0	0	0
1	5	2	3	58	5203058	AV	FDT	DI	0	1	90	0	15	1	0
1	5	2	3	58	5203058	AV	FDT	DI	1	1	0	0	0	0	0
1	5	2	3	66	5203066	AV	FDT	DI	0	1	33	0	0	0	0
1	5	2	3	67	5203067	AV	FDT	DH	0	0	117	0	1	1	0
1	5	2	3	67	5203067	AV	FDT	DI	0	1	54	0	0	0	0
1	5	2	3	68	5203068	AV	FDT	DH	0	0	127	0	108	0	0
1	5	2	4	58	5204058	AV	FDT	DI	1	1	0	2	0	0	0
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1	5	2	4	68	5204068	AV	FDT	DH	0	0	0	0	0	0	0
1	5	2	4	68	5204068	AV	FDT	DH	1	1	3	4	0	0	0
1	5	2	0	61	5200061	AV	FDT	DH	0	0	0	0	0	0	0
2	5	2	0	45	5200045	AV	FDT	DH	0	0	13	0	12	0	0
2	5	2	0	60	5200060	AV	FDT	DD	1	1	0	0	0	0	0
2	5	2	0	63	5200063	AV	FDT	DH	1	1	20	25	15	0	0
2	5	2	1	53	5201053	AV	FDT	DI	1	1	0	0	0	0	0
2	5	2	2	45	5202045	AV	FDT	DD	0	1	0	0	0	0	0
2	5	2	2	45	5202045	AV	FDT	DH	0	0	116	0	2	0	0
2	5	2	2	45	5202045	AV	FDT	DI	0	1	0	0	0	0	0
2	5	2	2	45	5202045	AV	FDT	DI	1	1	0	0	0	0	0
2	5	2	2	46	5202046	AV	FDT	DD	0	1	0	0	0	0	0
2	5	2	2	46	5202046	AV	FDT	DD	1	1	0	0	0	0	0
2	5	2	2	46	5202046	AV	FDT	DH	0	0	23	0	22	0	0
2	5	2	2	46	5202046	AV	FDT	DI	1	1	0	0	0	0	0
2	5	2	2	48	5202048	AV	FDT	DD	0	1	0	0	0	0	0

Event

Multiple events for the same strata

An excerpt of a real sample of Form 3FA



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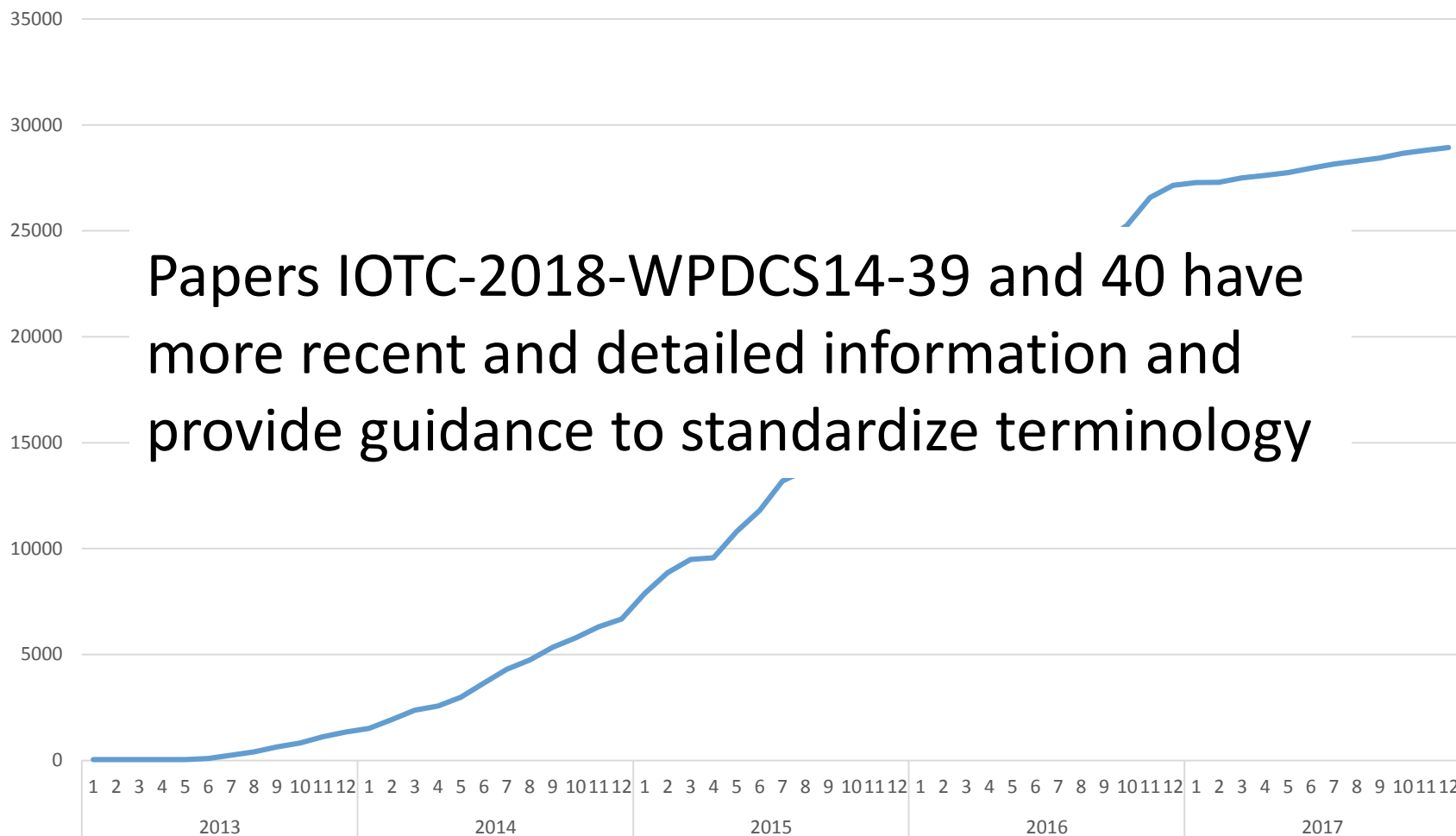
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Form 3FA_1 has been adopted with different levels of completeness and accuracy by all the six CPCs currently submitting FAD data to the Secretariat, and used to report information that so far covers the 2013-2017 timeframe.

No anchored FAD data has been submitted by any CPC.

Accumulation of FADs at sea by year and month, all CPCs and FAD types

Increase in no. FADs at sea by year / month since Jan. 1st 2013



Papers IOTC-2018-WPDCS14-39 and 40 have more recent and detailed information and provide guidance to standardize terminology

A number of issues have been detected when incorporating and collating FAD data provided by CPCs. In particular, among the most relevant issues there are:

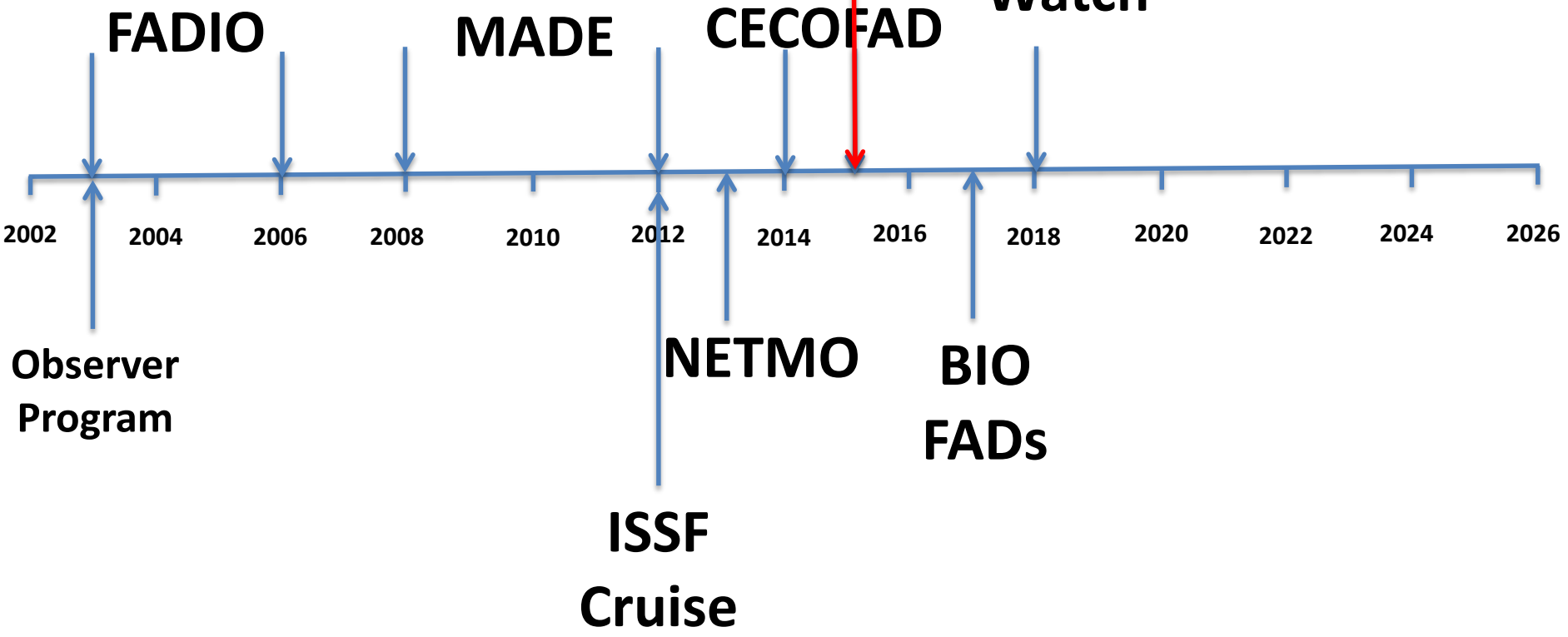
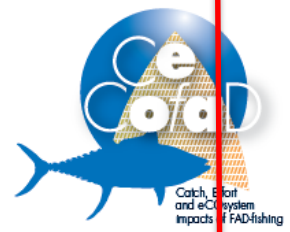
- **Incomplete or partial time series**: reported data cover the years between 2013 and 2017 only (not even in their entirety, for some CPCs). New data submissions expected by end June 2019 might improve the quality and completeness of the data;
- **Lack of active FAD baseline and incomplete submission of deployments and retrieval events**: data is only available from 2013 onwards and the lack of consistent reporting of deployments and retrieval events reduces the accuracy in the estimation of active FADs over time;
- **Violation of implicit business rules**: correct data reporting for a combination of FAD types and FAD visit types is subject to a set of implicit business rules described by document IOTC-2017-WGFAD01-14. In many circumstances, these are inadvertently violated by CPCs when reporting data to the Secretariat;
- **No FAD numbers or no FAD sets reported**: these should always be provided – possibly with a value of zero when the type of reported event allows so. For the time being, missing quantities could be estimated by applying average proportions or conversion factors from known proxy strata and fleets: in the future, the lack of such details will prevent the successful acknowledgement of submitted data to the IOTC Secretariat;

- **Need for improvement of FAD and FAD visit type classifications**: depending on the case, CPCs might find the standing classifications as either too detailed or, on the contrary, as lacking relevant information – especially when it comes to describing the technology adopted by the different FAD types. Although these classifications have been successfully used to submit and incorporate current data within the IOTC Secretariat statistical systems, they can be seen as a starting point and further improvements and updates are expected;
- **Harmonization of Nominal Catches, Catch-and-effort (log-school) and FAD catches**: A number of CPCs (namely Spain, France and Seychelles) are known for submitting Catch-and-Effort that are already raised to total (nominal) catches. Other CPCs might at times do the same or on the contrary report FAD catches that exceed the total (nominal) catches for a given species / year strata. Document IOTC-2017-WGFAD01-09 provides an overview of the discrepancies between Nominal Catches, Catch-and-effort log-school catches and FAD catches by CPC and year (when available). Future FAD data submission are expected to be in line with Nominal Catches and Catch-and-effort log-school catches to be properly accepted for inclusion within the IOTC Secretariat statistical systems.

RESEARCH

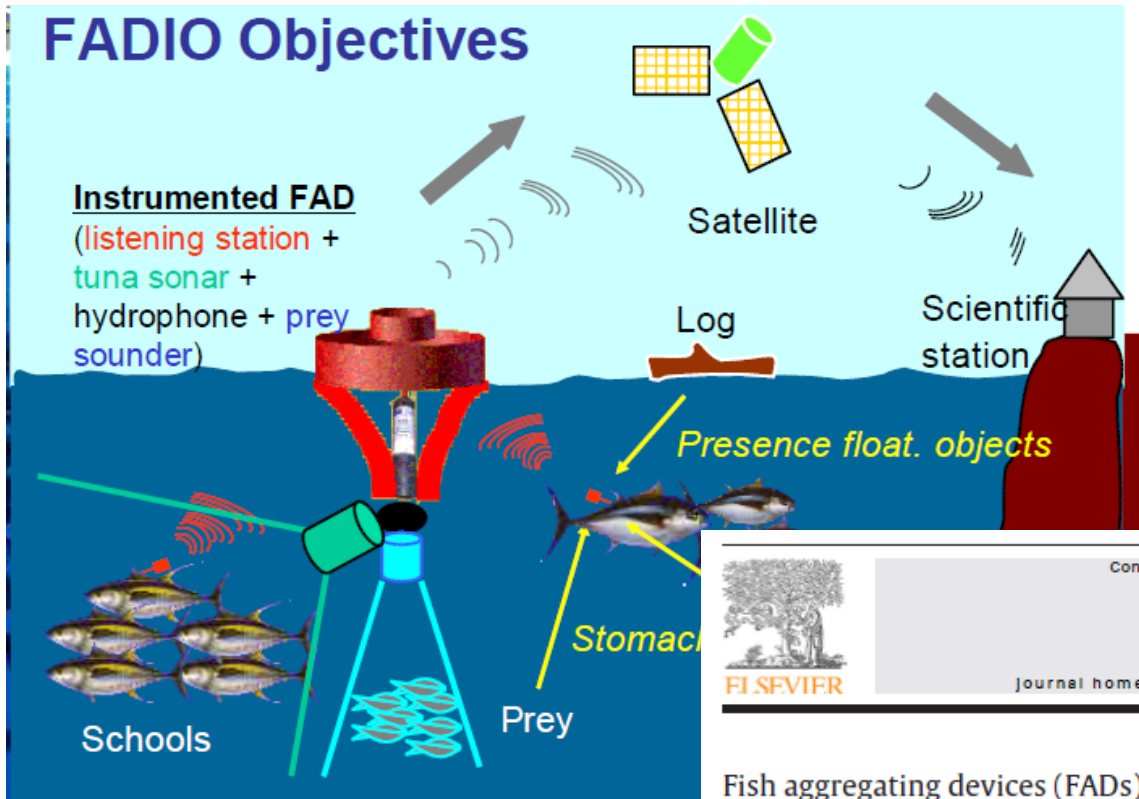


**RESOLUTION 15/09
on a FAD WG**



Monitoring and Management of FADs

- FADs as scientific platforms (FADIO)



Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres



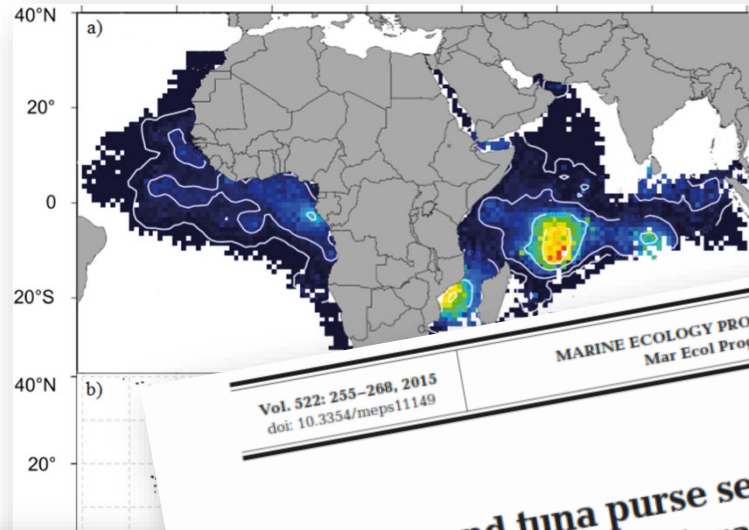
Fish aggregating devices (FADs) as scientific platforms

G. Moreno^{a,b,*}, L. Dagorn^c, M. Capello^c, J. Lopez^{b,e}, J. Filmlalter^{a,d}, F. Forget^{a,c},
I. Sancristobal^b, K. Holland^f

(Moreno et al. 2015)

Non-Target species / BC reduction

- Observer programs : collection of by-catch information



Vol. 522: 255–268, 2015
doi: 10.3354/meps11149

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published March 2

Cetaceans and tuna purse seine fisheries in the Atlantic and Indian Oceans: interactions but few mortalities

Lauriane Escalle^{1,2,*}, Anna Capietto^{1,2}, Pierre Chavance², Laurent Dubroca², Alicia Delgado De Molina³, Hilario Murua⁴, Daniel Gaertner², Evgeny Romanov⁵, Jérôme Spitz⁶, Jeremy J. Kiszka⁷, Laurent Floch², Alain Damiano², Bastien Merigot¹

Biological Conservation 174 (2014) 147–151

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/bioco



Short communication

Mortality of marine megafauna induced by fisheries: Insights from the whale shark, the world's largest fish

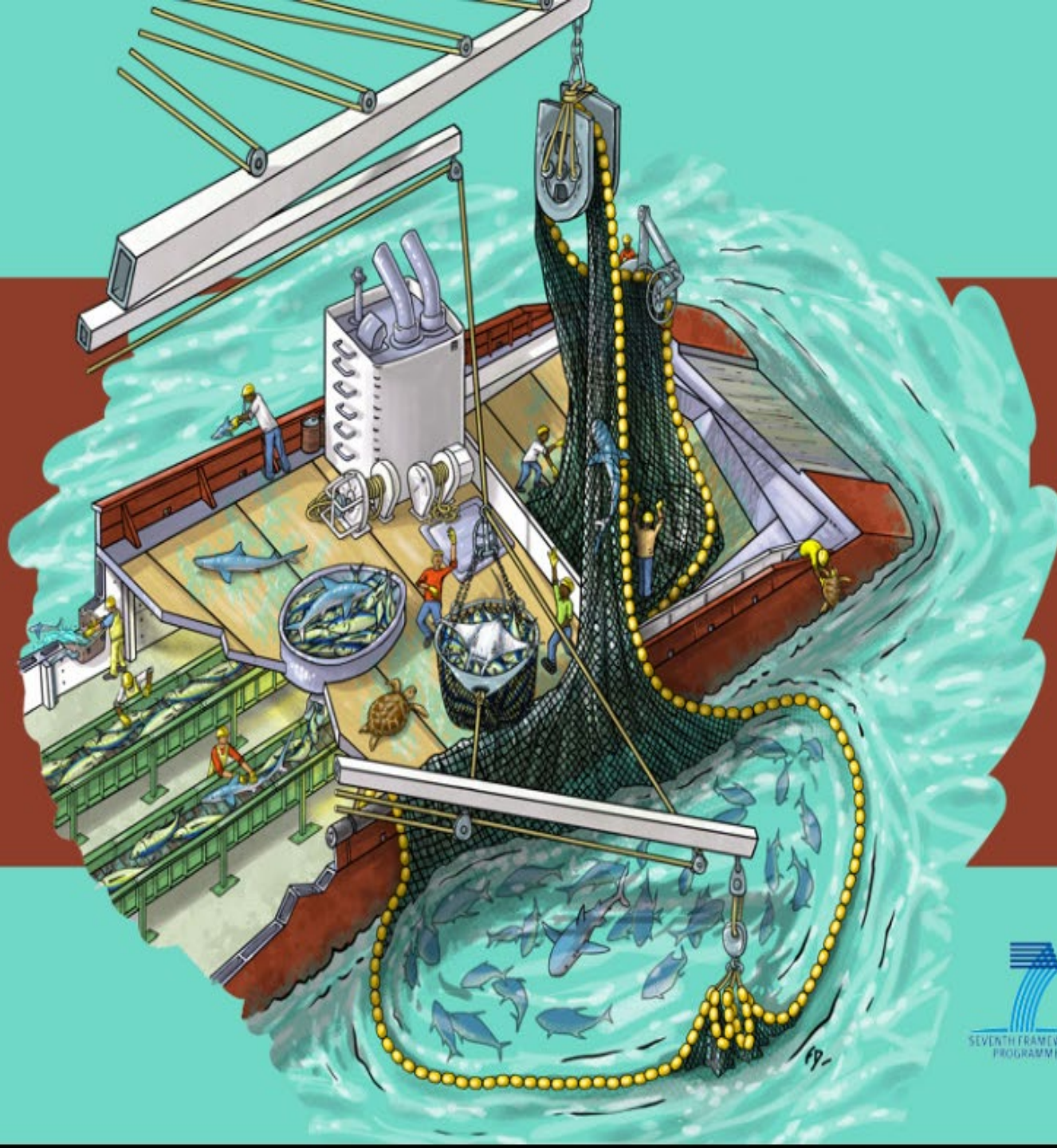
Anna Capietto^{a,b,1}, Lauriane Escalle^{a,b,1,*}, Pierre Chavance^b, Laurent Dubroca^b, Hilario Murua^d, Laurent Floch^b, Alain Damiano^b, David Rowat^e, Bastien Merigot^f

Biological Conservation

journal homepage: www.elsevier.com/locate/bioco

Marine turtle interaction with purse-seine fishery in the Atlantic and Indian oceans: Lessons for management

Jérôme Bourjea^{a,*,1}, Sandra Clermont^{a,b,c}, Alicia Delgado^d, Hilario Murua^e, Jon Ruiz^e, Stéphane Ciccione^b, Pierre Chavance^{f,*}



Good practices to
reduce the
mortality of sharks
and rays caught
incidentally by
tropical tuna purse
seiners.

Poisson F., Vernet A. L.,
Séret B., Dagorn L.





Non-Target species / BC reduction

- Observer programs : collection of by-catch information



795

RAPID COMMUNICATION

Mortality rate of silky sharks (*Carcharhinus falciformis*) caught in the tropical tuna purse seine fishery in the Indian Ocean

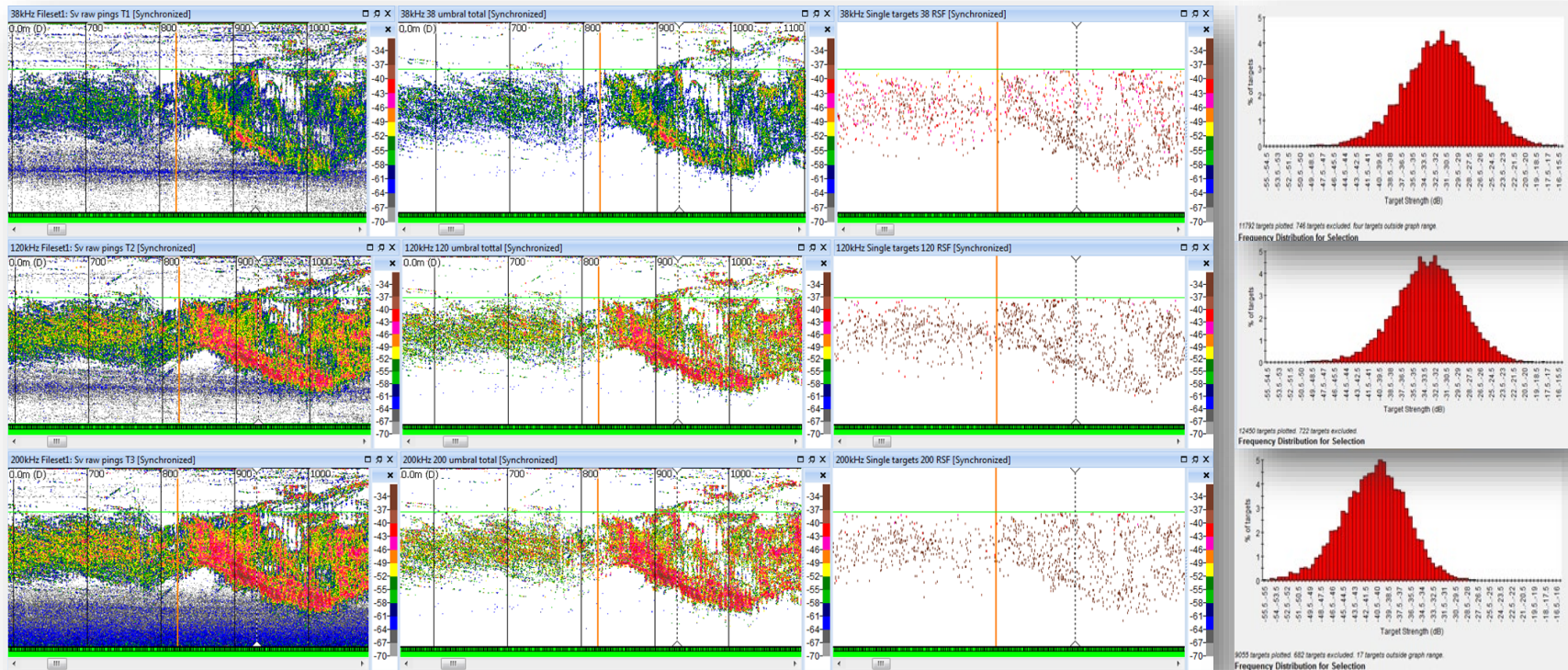
François Poisson, John David Filmalter, Anne-Lise Vernet, and Laurent Dagorn

72-85%
(Poisson et al, 2014)



Non-Target species / BC reduction

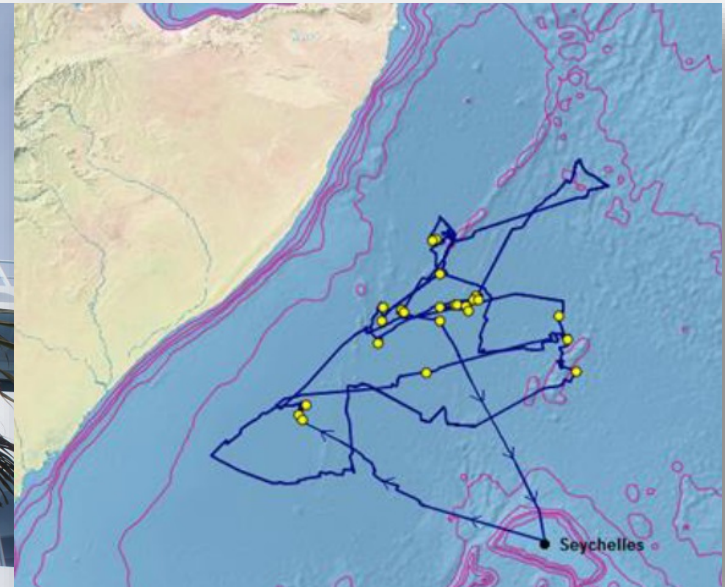
- ISSF in collaboration with other institutes



1- Raw Echogram → 2- Plancton Filter → 3- Individual targets(TS) → 4- In situ TS

Non-Target species / BC reduction

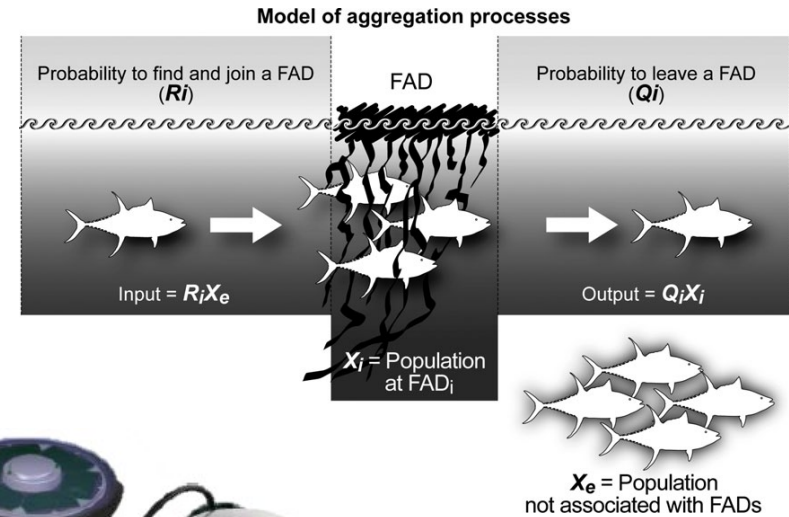
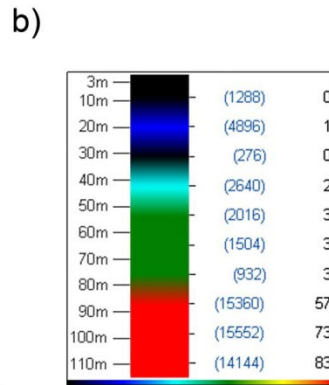
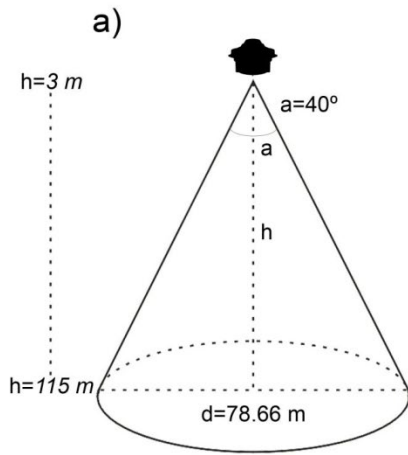
- NON-ENTANGLING & BIODEGRADABLE FADs (NETMO 2013)



New designs of non-entangling and biodegradable FADs.

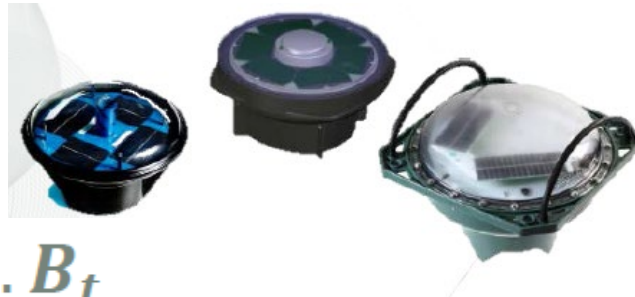
Population assessments

- Fishery independent abundance index from ES Buoys



(Lopez et al., accepted)

TUNABAI



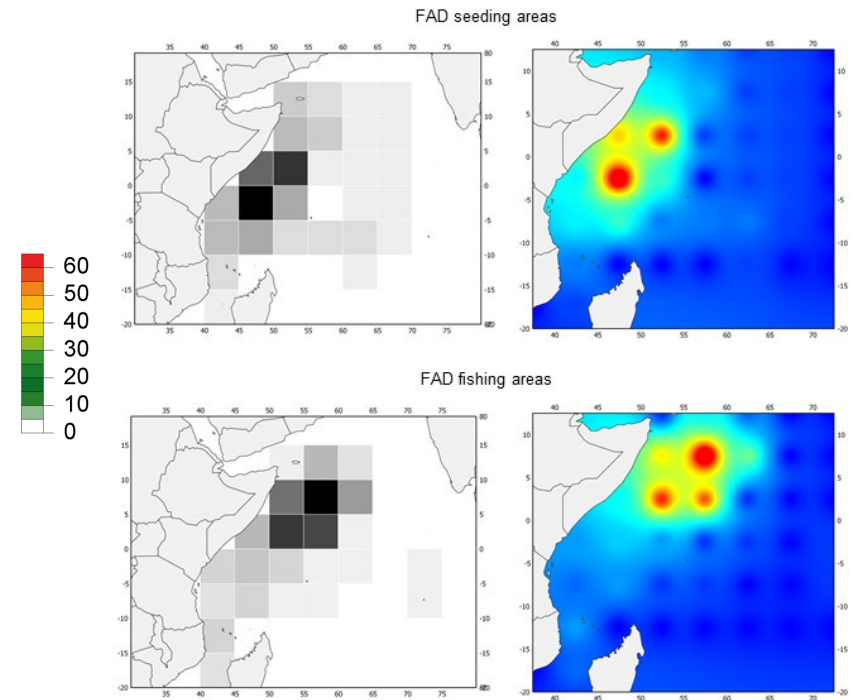
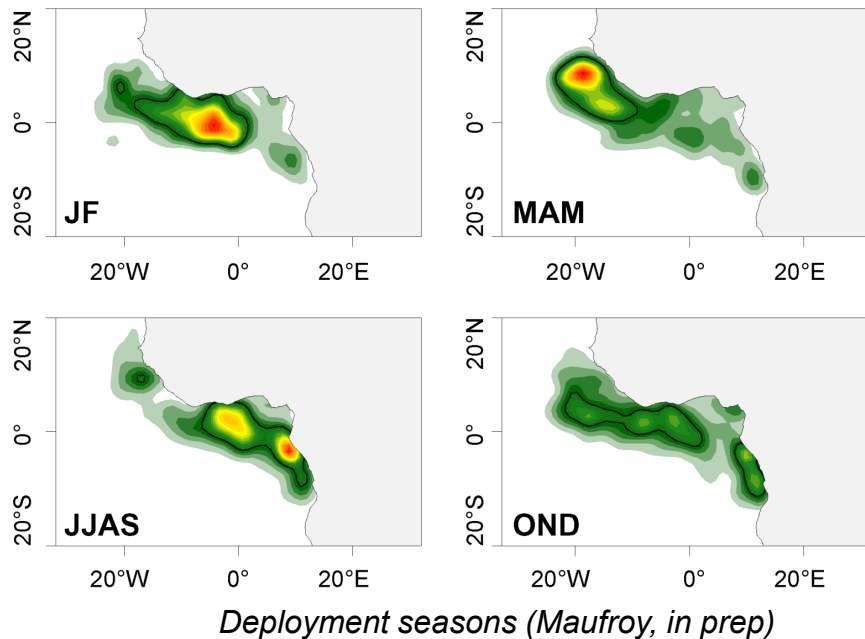
(Sempo et al., 2013)

$$BAI_t = \varphi \cdot B_t$$

(Santiago et al., 2015)

CPUE Improvement

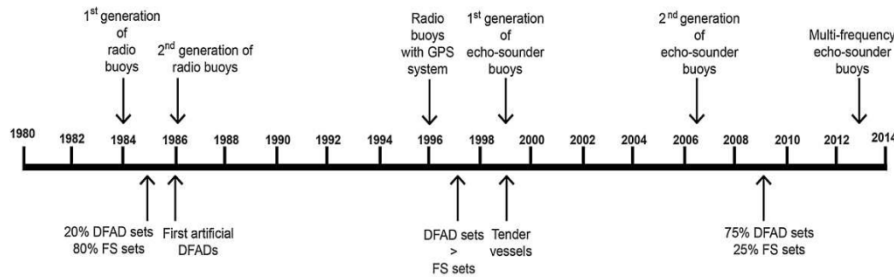
- Fishing strategy: seeding strategy, seasonality, etc.





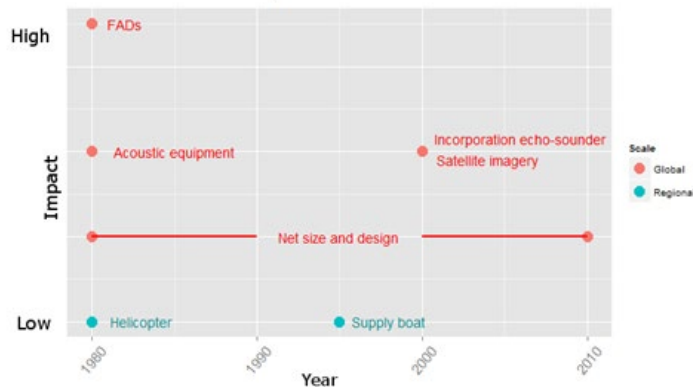
CPUE Improvement

- Evolution of Fishing Technology



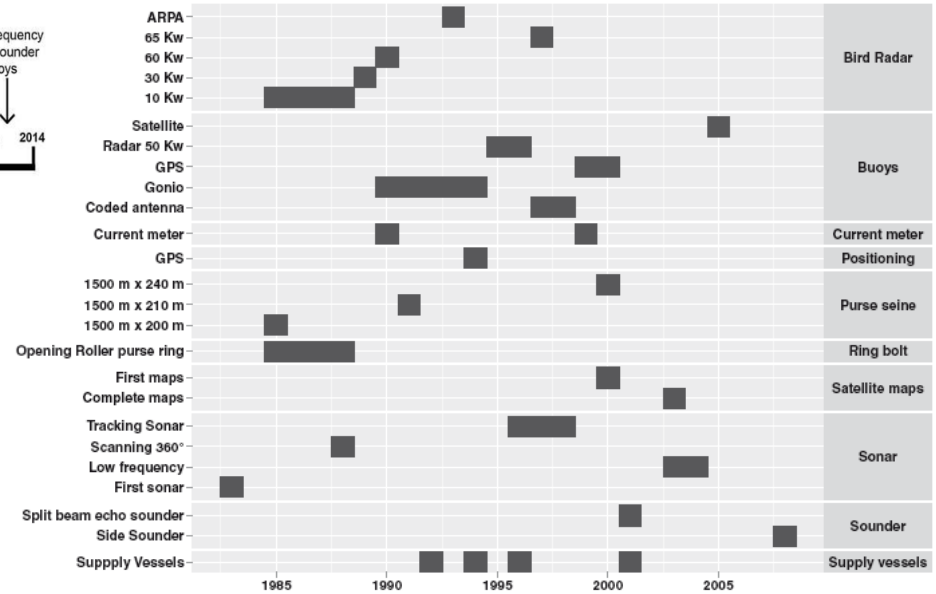
(Lopez et al., 2014)

Technological advances over time



(Lopez et al., 2015)

(Torres-Irineo et al., 2014)



Received: 21 & 25 October 2015

IOTC-2015-WPTT17-32 Rev_1

Technological and fisher's evolution on fishing tactics and strategies on FADs vs. non-associated fisheries



Biology - Habitat - Biodiversity

- Habitat modelling: bycatch hotspots (Silky shark)
- Biodiversity
- Effect on biology and reproduction



ARTICLE

Comparison of condition factors of skipjack tuna (*Katsuwonus pelamis*) associated or not with floating objects in an area known to be naturally enriched with logs

Marianne Robert, Laurent Dagorn, Nathalie Bodin, Fabrice Pernet, Eve-Julie Arsenault-Pernet, and Jean Louis Deneubourg

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Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Reproductive potential of Yellowfin Tuna (*Thunnus albacares*) in the western Indian Ocean

Iker Zudaire (contact author)
Hilario Murua¹
Maitane Grande²

Contents lists available at ScienceDirect
Fisheries Research
journal homepage: www.elsevier.com/locate/fishres

Accumulation and mobilization of lipids in relation to reproduction of yellowfin tuna (*Thunnus albacares*) in the Western Indian Ocean

Iker Zudaire^{a,*}, Hilario Murua^a, Maitane Grande^a, Fabrice Pernet^c, Nathalie Bodin^b
DOI 10.1007/s00227-015-2763-0

ORIGINAL PAPER

Variations in the diet and development of female yellowfin tuna (*Thunnus albacares*) in the Western Indian Ocean

Iker Zudaire^{1,2,3} · Hilario Murua² · Maitane Grande² · Frédéric Ménard⁴ · Emmanuel Chasso⁵

Fecundity regulation strategy of the yellowfin tuna (*Thunnus albacares*) in the Western Indian Ocean
Iker Zudaire^{a,*}, Hilario Murua^a, Maitane Grande^a, Maria Korta^a, Haritz Arrizabalaga^a, Juan Jose Areso^b, Alicia Delgado-Molina^c, Iker Goñi² · Michel Potier³ · Nathalie Bodin⁵

Biodivers Conserv
DOI 10.1007/s10531-015-0951-3
ORIGINAL PAPER

Biodiversity in the ecosystem in the

N. Lezama-Ochoa¹ · H. Murua¹ · G. Chaves¹
J. Ruiz¹ · P. Chavance² · A. Delgado de Molina¹
A. Caballero¹ · I. Sancristobal¹

Thanks to the various RFMO secretariats, Institutes, Management bodies etc..
that participated in the meeting.

Special thanks to the IOTC SC chair

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Commission des Thons de l'Océan Indien