2nd Joint t-RFMOs FAD Working Group Meeting
8-10 May SAN DIEGO - SESSION 10

JWGFAD-02-17 Towards the use of non-entangling and biodegradable dFADs: actions to mitigate their negative effects in the ecosystem

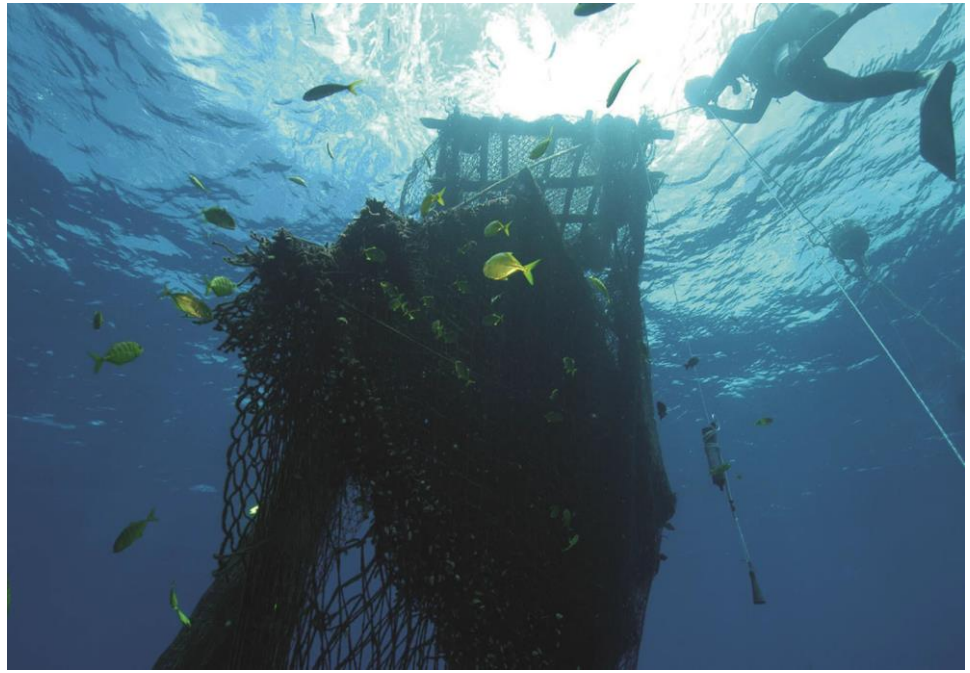
&

JWGFAD-02-15 Preliminary results of the BIOFAD project: testing designs and identify options to mitigate impacts of drifting Fish Aggregating Devices on the ecosystem

JWGFAD-02-17

Towards the use of non-entangling and biodegradable dFADs: actions to mitigate their negative effects in the ecosystem

Iker Zudaire (1), Maitane Grande (1), Jefferson Murua (1), Jon Ruiz (1), Iñigo Krug (1), María Lourdes Ramos (2), Jose Carlos Báez (2), Mariana Tolotti (3), Laurent Dagorn (3), Gala Moreno (4), Victor Restrepo (4), Hilario Murua (1), Josu Santiago (1)



CONTEXT

- About half of the tropical tuna caught by PS with dFADs.
- dFAD has developed together with
  - ✓ Available technology
    → improving fishing efficiency
  - ✓ Synthetic materials for construction
    → higher resistance, durability,
- BUT all these contribute to impacts:
  - ✓ Marine litter
  - ✓ Potential disruption to ecosystems

EU fleet, in collaboration with research institutes and other stakeholders, through several actions is making significant efforts to improve dFAD designs, reduce their impact in the ecosystem, and to commit to RFMOs requirements

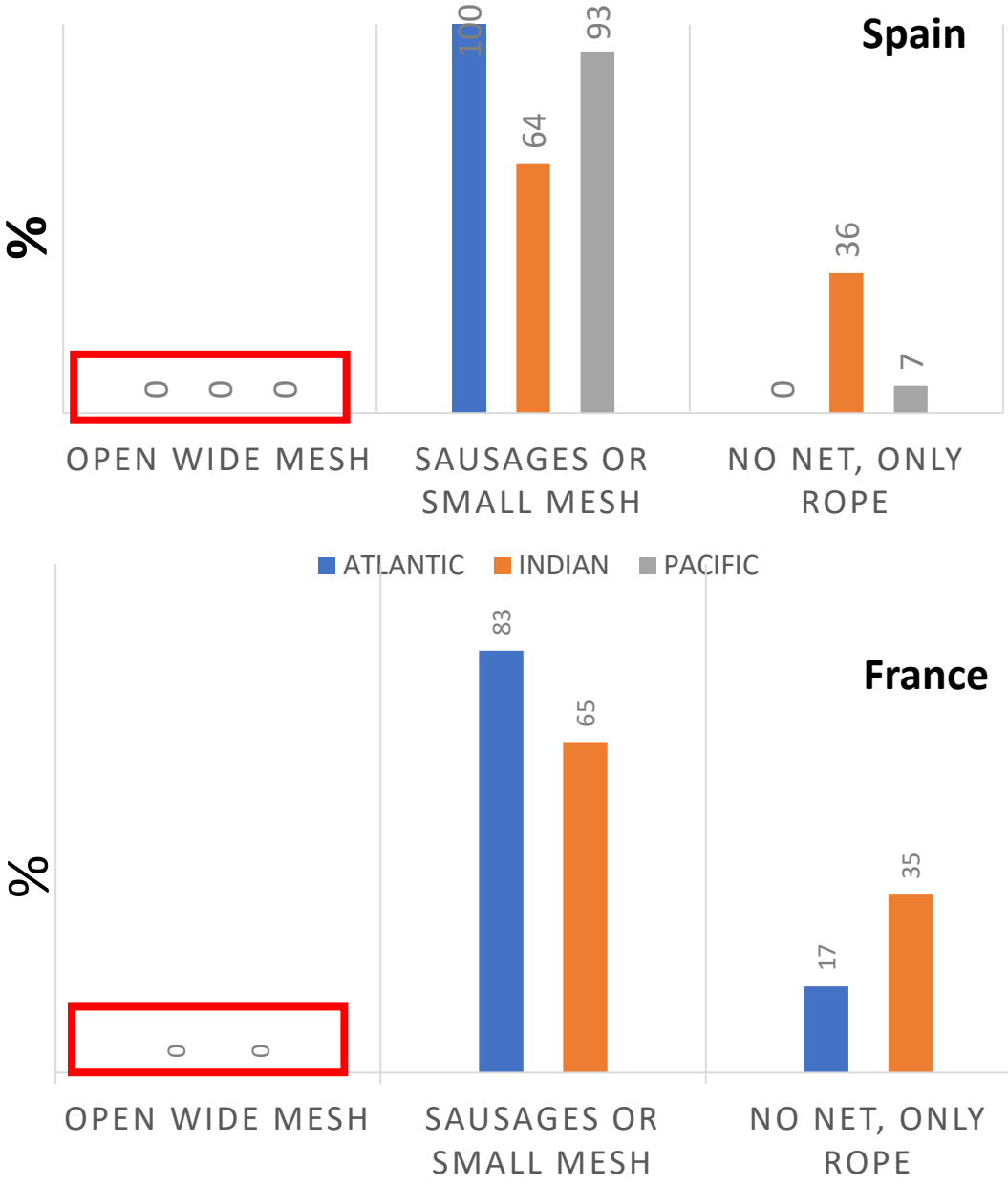
ACTION 1: ISSF Skippers Workshop

Since 2009, ISSF 90 workshops and 25 fleets:

- Workshops address themes: non-entangling FADs (NEFADs), biodegradable FADs, FAD retrieval, reduction of small tuna catches, bycatch release, etc.
- In Recent years focusing on ways to minimize the impact of dFAD structures on the ecosystem: beaching, ghost fishing and marine pollution
- Fishers provide their feedback on the viability of some mitigation options

Location	# WS	Years	Skippers	Crew	Fleet Owners	Fleet Reps
Sukarrieta (Spain)	9	2010- 2018	408	55	3	19
Cangas (Spain)	1	2014	20	10	0	0
Vigo (Spain)	3	2016-2018	104	151	0	1
Mahe (Seychelles) & Port Louis (Mauritius)*	3	2011-2012	16	7	0	2
Concarneau (France)	3	2015, 2017-2018	58	15	0	11

RESULTS OF THE QUESTIONNAIRE

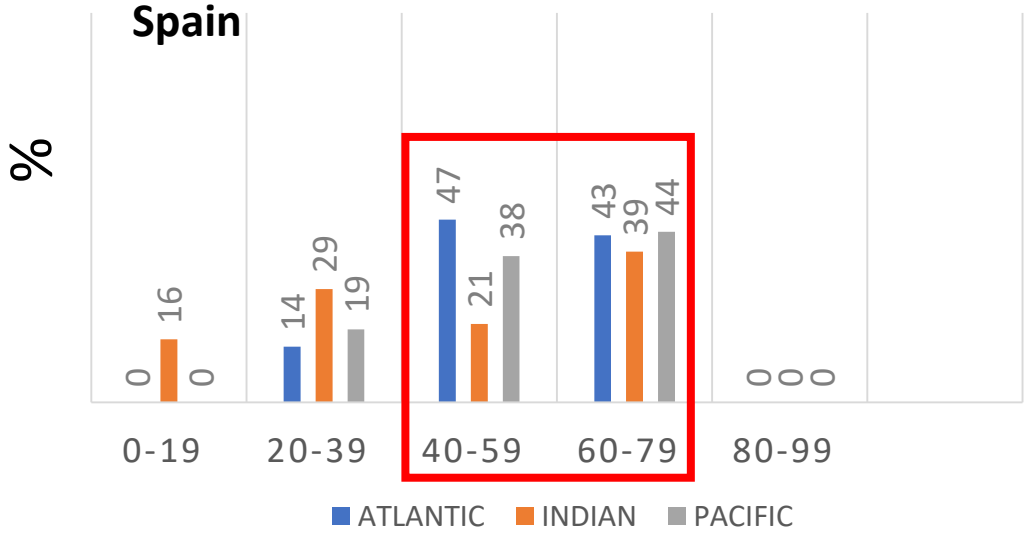


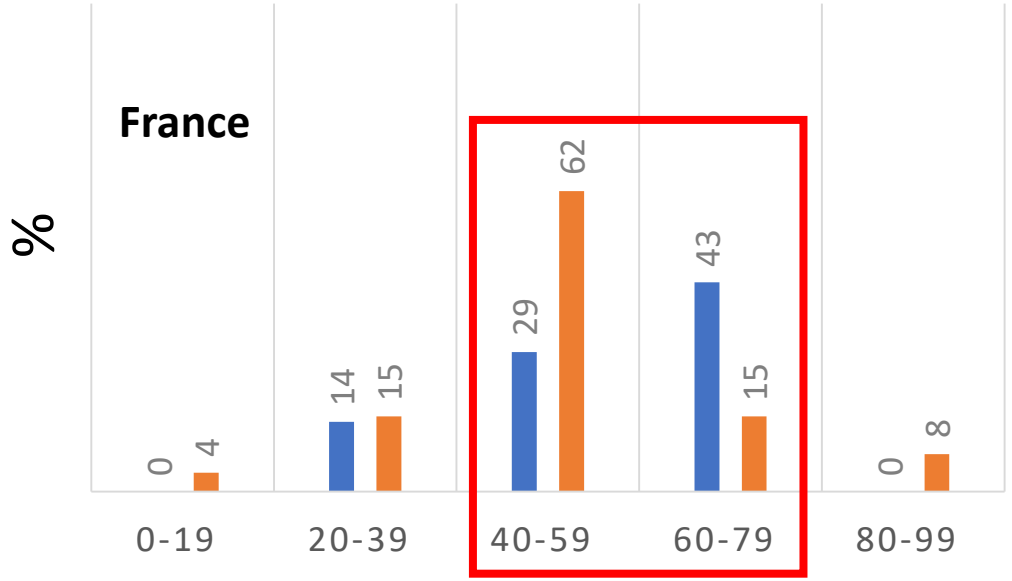
EU FLEET FAD DESIGN BY OCEANS

High entanglement risk FADs (with open wide mesh nets) are no longer used

- Most DFADs' tails are constructed with small mesh (< 7 cm) and/or mesh tied in bundles.
- Only in the Indian Ocean there is a significant proportion of NEFADs (35%) constructed with no netting according to fishers.

RESULTS OF THE QUESTIONNAIRE



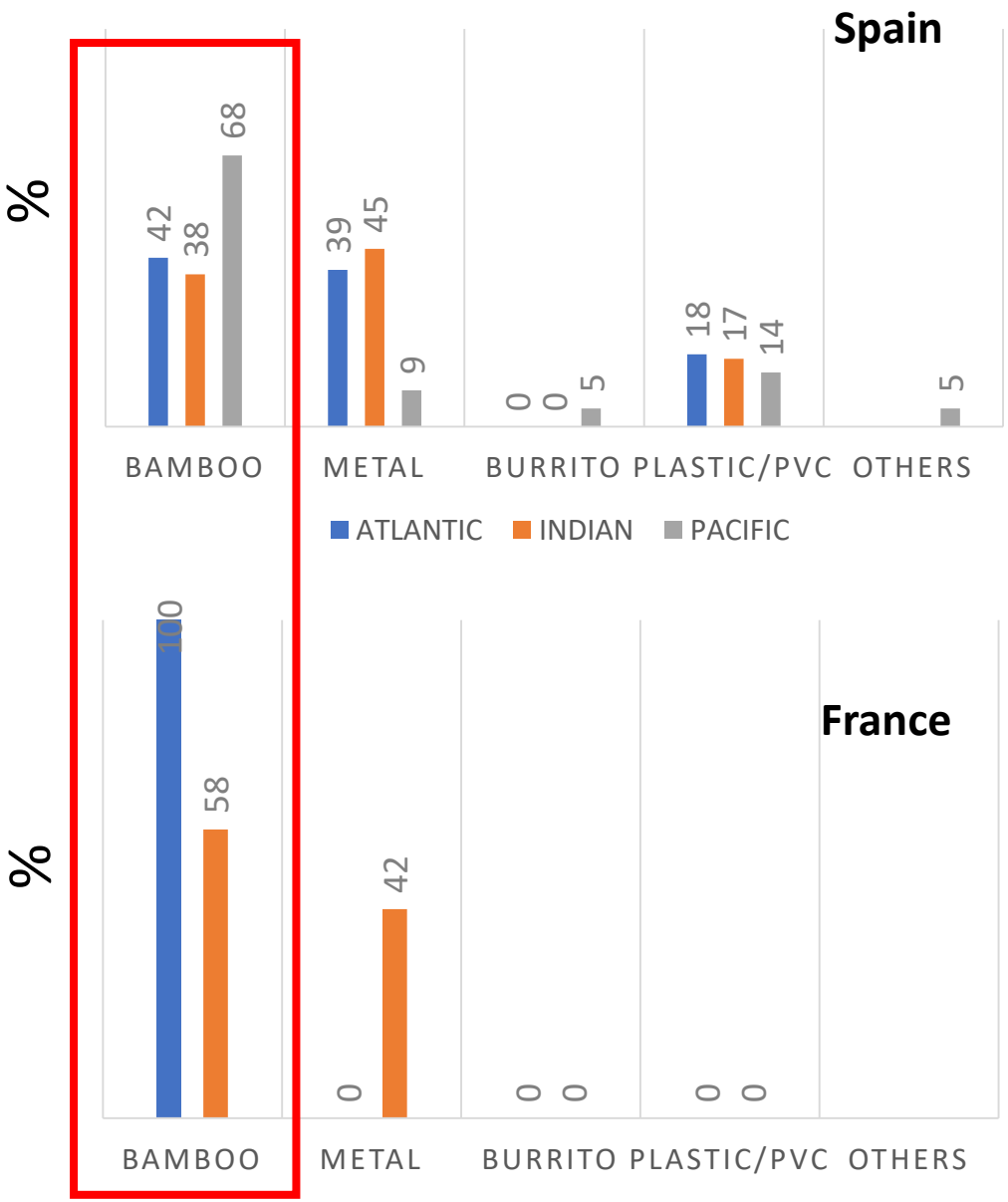


EU FLEET dFAD DEPTH BY OCEAN

dFAD depth in recent years has been increasing in most oceans and fleets

- Dominant depth classes for the different oceans between 40 and 80 m
- AO and PO showed the lowest proportion (both < 20 %) of shallow DFADs under 40m
- Only in IO 4-16% of skippers using DFADs below 20 m

RESULTS OF THE QUESTIONNAIRE

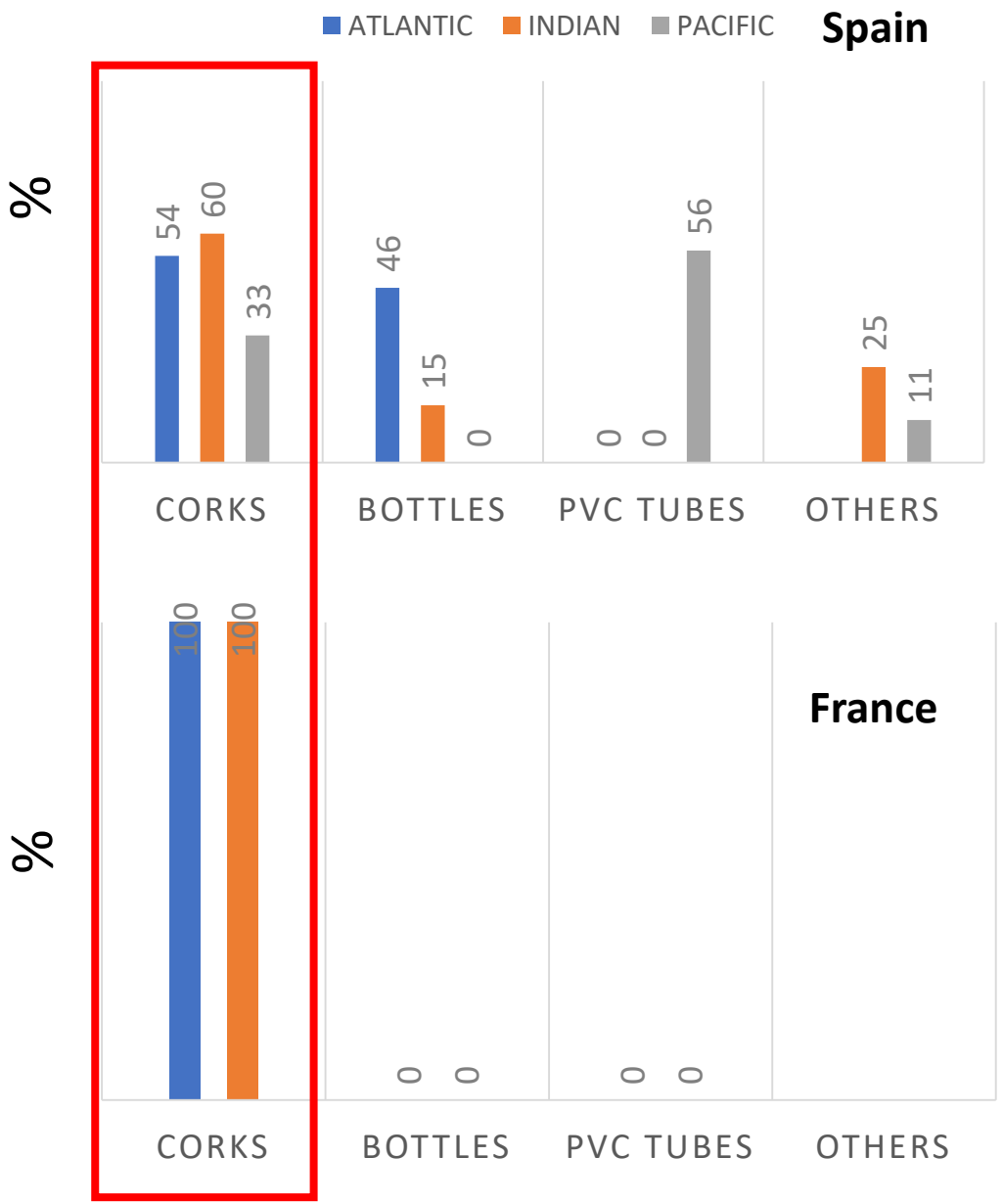


EU FLEET dFAD RAFT FRAME CONTRUCTION MATERIALS

Bamboo continues to be an important element

- In recent years, particularly in AO and IO, GALVANIZED METALLIC TUBE FRAMES have gained importance (durability and lighter weight).
- Asian or USA fleets tend to use more the “burrito” rafts, not adopted by EU skippers

RESULTS OF THE QUESTIONNAIRE



EU FLEET dFAD RAFT FLOTATION MATERIALS

In FR fleet is primarily reused net corks-floats, while for SP fleet varies between oceans

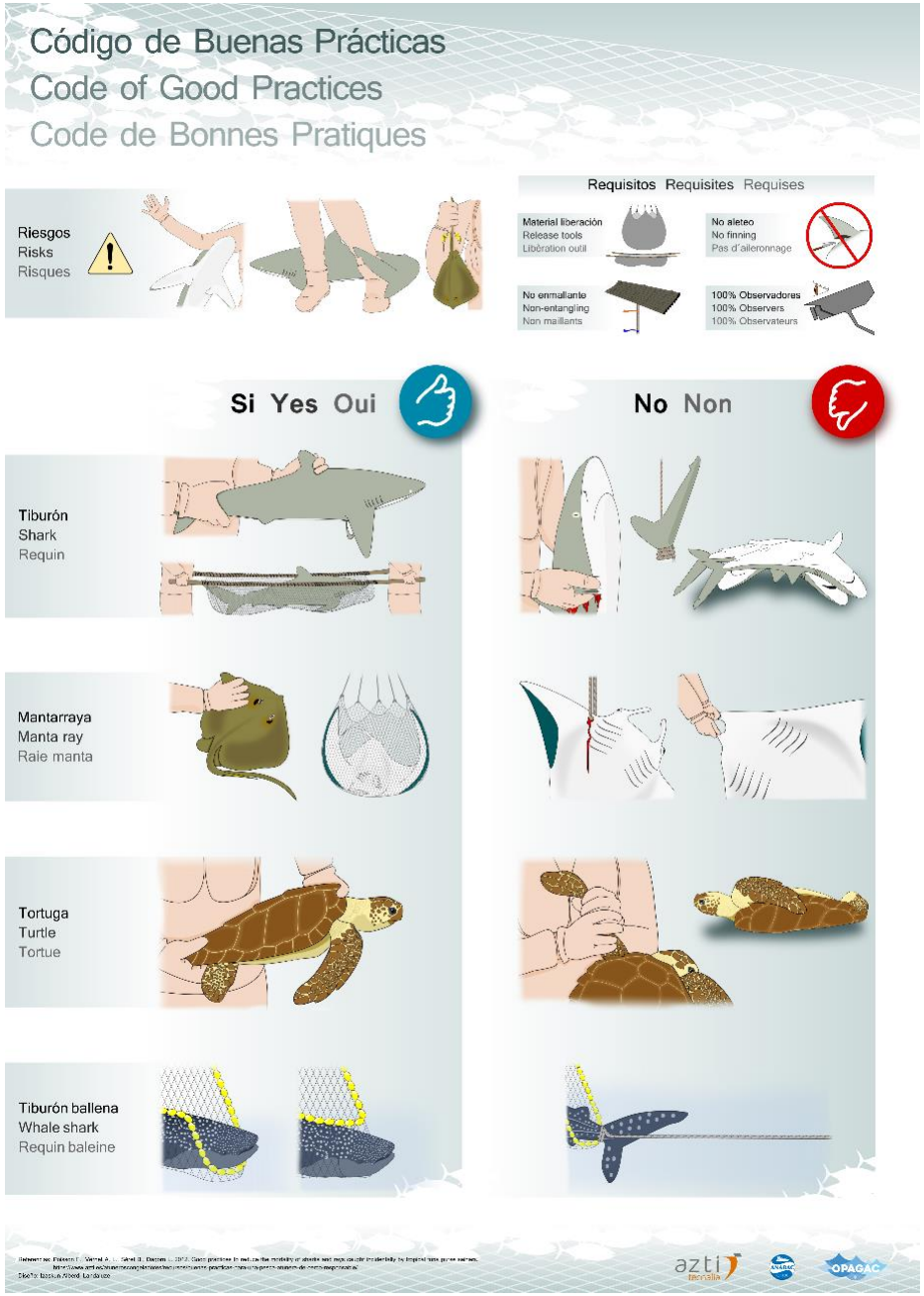
- In PO most SP reported using PVC pipes.
- In IO SP use old PS net corks (bolos - EVA) or plastic corks (floats).
- In AO SP some use corks, but an important proportion use plastic containers.

ACTION 2: EU Fleet toward NEFAD

- The Spanish fleet (ANABAC and OPAGAC), established in 2012 a voluntary agreement known as the “Code of Good Practices” (CGP) for responsible tuna fishing activities.

- French fleet (ORTHONGEL) has developed specific programs “CAT DCP éco”, “Requins” and “CAT Sélectivité” to eradicate the entanglement of sensitive species

The use of non-entangling dFAD is promoted by EU fleet during last years.



The Code of Good Practices in SP Fleet

1. Use of **non-entangling FADs (NEFADs)** → **No meshed material or open net mesh size <7 cm or >7 cm if constructed in sausages**

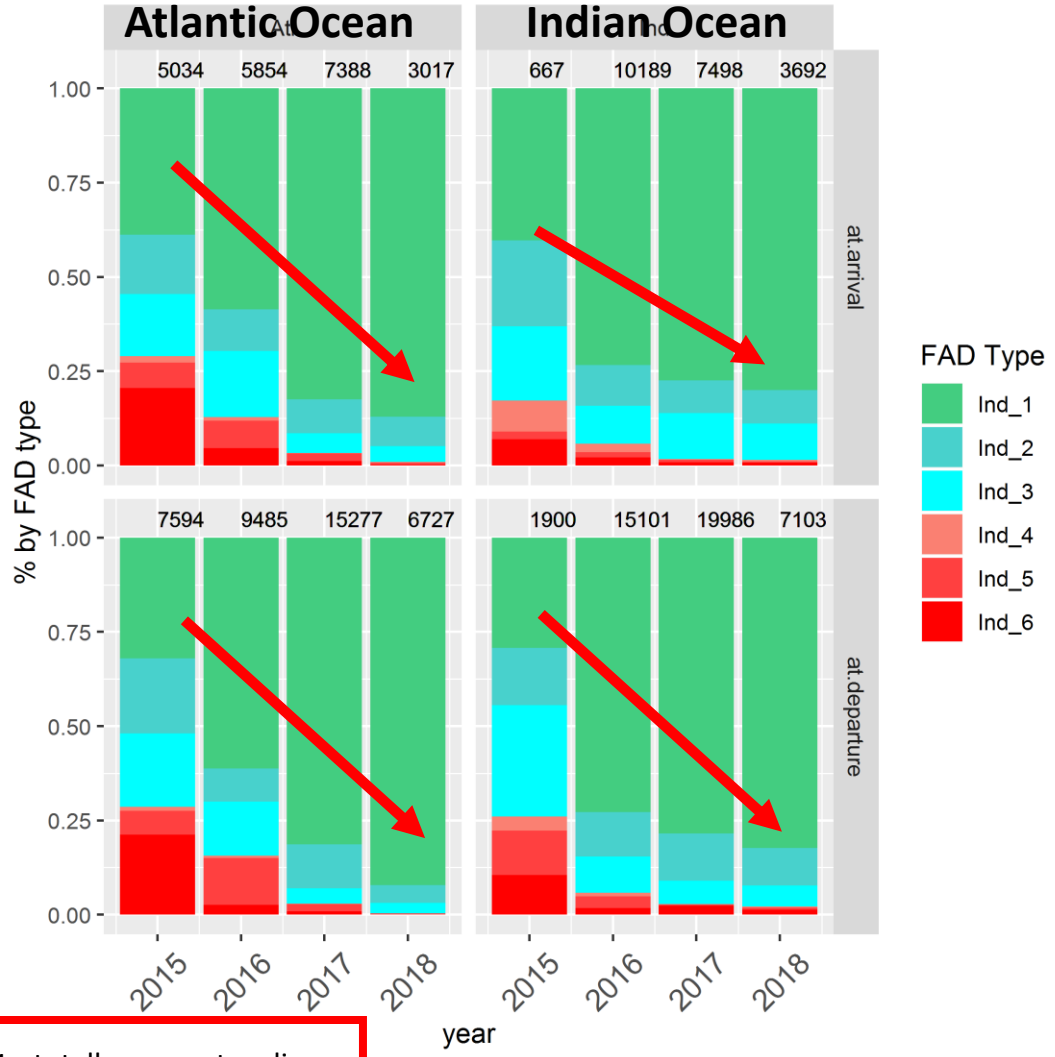
2. Best practice fauna **Safe Release Operations** (for sharks, mantas, rays and turtles).

3. **100% observer coverage** (EM or HO) (since 2017 gradually implemented in supply vessels)

4. Harmonization of **FAD logbooks**

5. **Training** of fishing crew and scientific observers

6. **External verification** of all fishing activities and Creation of a **Steering Committee** (science-industry members)



Ind 1 - totally non-entangling;
Ind 2 - net of >7 cm in the bottom part of the raft;
Ind 3- net of >7cm in the upper part of the raft;
Ind 4: pieces of net >7cm in the underwater part;
Ind 5: underwater part with open net >7cm;
Ind 6: raft and underwater part with net >7cm.

Non-entangling FADs in CGP:
No meshed material or ;
Open net mesh size <7 cm or;
>7 cm if constructed in sausages

RESULTS ON GOOD PRACTICES: EVALUATION ON FADS

More than 80% of dFAD "at departure" and "at arrival" are NEFADs in AO and IO in 2017

- In 2017, entangling netting (i.e. open netting with mesh size >7cm) in the submerged structure of FADs used was a residual component of the total numbers of evaluated FADs at sea

IATTC Observer Data

More than 70% of dFAD “at departure” and “at arrival” have <7cm mesh size nets in PO in 2017

- A progressive improvement is observed since 2015 towards reducing the mesh size
- Based on CGP criteria more than 95% of dFAD were non-entangling in 2017

Specific programs onboard FR fleet

- Modified dFAD construction to eradicate the entanglement of sensitive species
- Further improve the selectivity strengthening the ecological character of dFADs
- Working on tools allowing the release alive of sharks at sea.

SPECIFIC PROGRAMS “CAT DCP ÉCO”, “REQUINS” AND “CAT SÉLECTIVITÉ”

These programs intended to modify dFADs of the whole FR PS in order to eradicate the entangling of turtles and sharks.

ACTION 3: EU Fleet Trial Towards Biodegradable FAD

- First tests were mainly looking for natural suitable materials like jute, sisal, coconut fiber, high-resistance cotton and palm leaves (Delgado de Molina et al., 2004, 2007; Franco et al., 2009, 2012;Lopez et al., 2016; Moreno et al. 2017a)
- These studies had limitations derived from small-scale trials
- Foundation to develop recently launched larger-scale experiments:
  - ✓ **IOTC Resolution 18/04 BIOFAD** (Indian Ocean) – 1000 BIOFAD deployment
  - ✓ NEDs (East Pacific Ocean) – 800 NEDs deployment
  - ✓ Biodegradable FAD (Atlantic Ocean) – 600 FADs deployment

BIODEGRADABLE AND NON-ENTANGLING dFAD TRIALS

In the last decade, public and private sector funded initiatives to test suitable natural materials and designs for biodegradable dFADs

JWGFAD-02-15

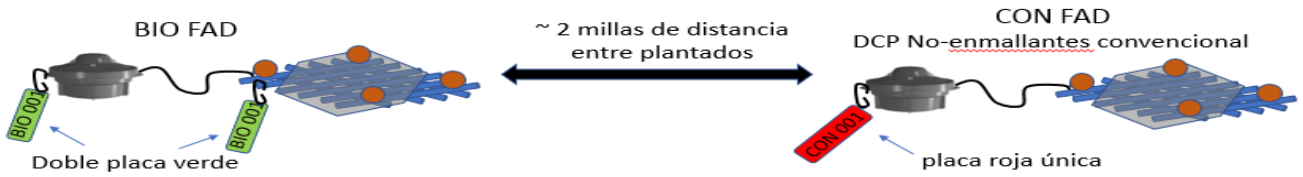
Preliminary results of the BIOFAD project: testing designs and identify options to mitigate impacts of drifting Fish Aggregating Devices on the ecosystem

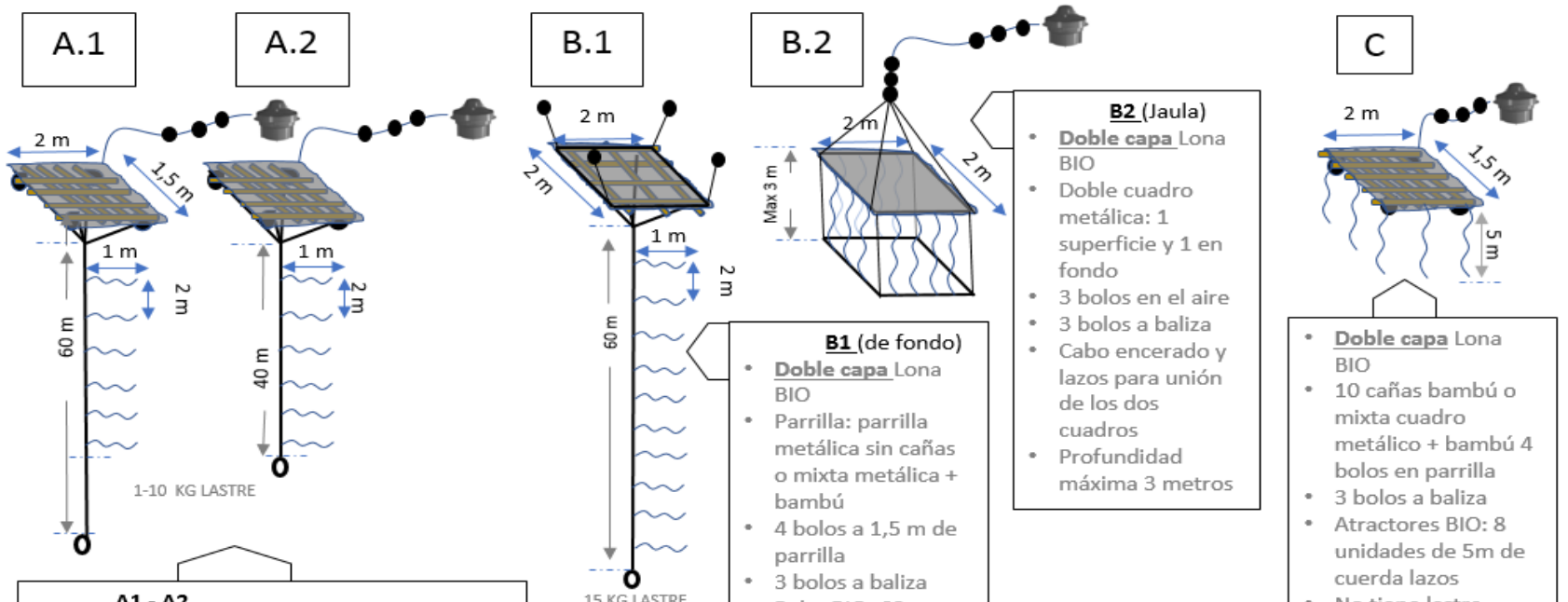
Iker Zudaire (1), Mariana Tolotti (2), Jefferson Murua (1), Manuela Capello (2), Margarita Andrés (1), Oihane Cabezas (1), Iñigo Krug (1), Maitane Grande (1), Igor Arregui (1), Jon Uranga (1), Nicolas Goñi (1), Jose Mari Ferarios (1), Jon Ruiz (1), Yannick Baidai (2), María Lourdes Ramos (3), Jose Carlos Báez (3), Francisco Abascal (3), Gala Moreno (4), Josu Santiago (1), Laurent Dagorn (2), Hilario Murua (1).

TO TEST THE USE OF BIODEGRADABLE MATERIALS FOR THE CONSTRUCTION OF FADS IN NATURAL ENVIRONMENTAL CONDITIONS TO REDUCE IMPACTS IN THE ECOSYSTEM

- Each vessel will deploy 24 BIOFADs in one year (2 BIOFADs per month and vessel)
- The objective is to assess the feasibility of the prototypes regarding:
  - ✓ dFAD Lifetime and durability
  - ✓ Degradability in real conditions
  - ✓ Fishing efficiency (aggregation) in comparison to conventional non-entangling FADs

BIOFAD DEPLOYMENT PROCEDURE





A1 - A2

- **Doble capa** Lona BIO
- Parrilla: 10 cañas bambú o mixta cuadro metálico + bambú
- 4 bolos en parrilla
- 3 bolos a baliza
- Rabo BIO: 40 ó 60m
- Atractores BIO: 1m cada 2 m de rabo
- Lastre: 1-10 Kg

B1 (de fondo)

- **Doble capa** Lona BIO
- Parrilla: parrilla metálica sin cañas o mixta metálica + bambú
- 4 bolos a 1,5 m de parrilla
- 3 bolos a baliza
- Rabo BIO: 60 m
- Atractores BIO: 1m cada 2 m de rabo
- Lastre: 15 Kg

B2 (Jaula)

- **Doble capa** Lona BIO
- Doble cuadro metálica: 1 superficie y 1 en fondo
- 3 bolos en el aire
- 3 bolos a baliza
- Cabo encerado y lazos para unión de los dos cuadros
- Profundidad máxima 3 metros

- **Doble capa** Lona BIO
- 10 cañas bambú o mixta cuadro metálico + bambú 4 bolos en parrilla
- 3 bolos a baliza
- Atractores BIO: 8 unidades de 5m de cuerda lazos
- No tiene lastre

NOT USE at BIOFAD

Metallic frame

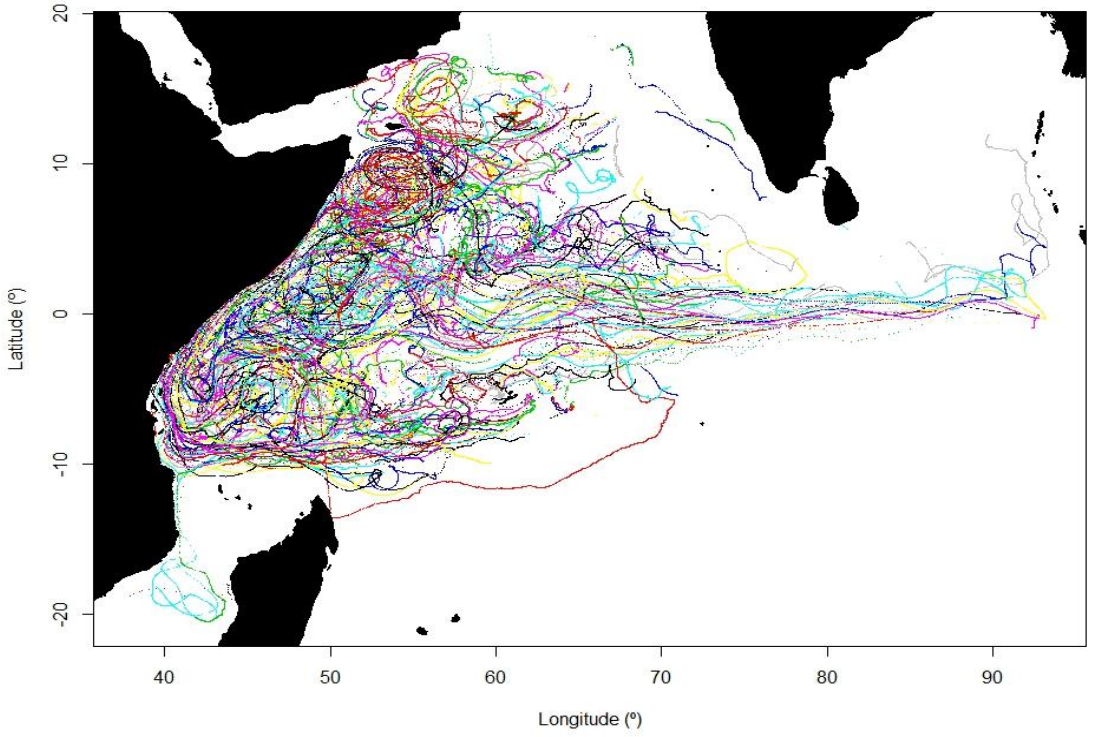
Synthetic rope (tail)

Net

Plastic bottle/drum

BIOFAD DEPLOYMENT IN THE INDIAN OCEAN

BIOFAD DRIFT AND DISTRIBUTION



554 BIOFADs have been deployed during the first 12 months (56% of the goal)

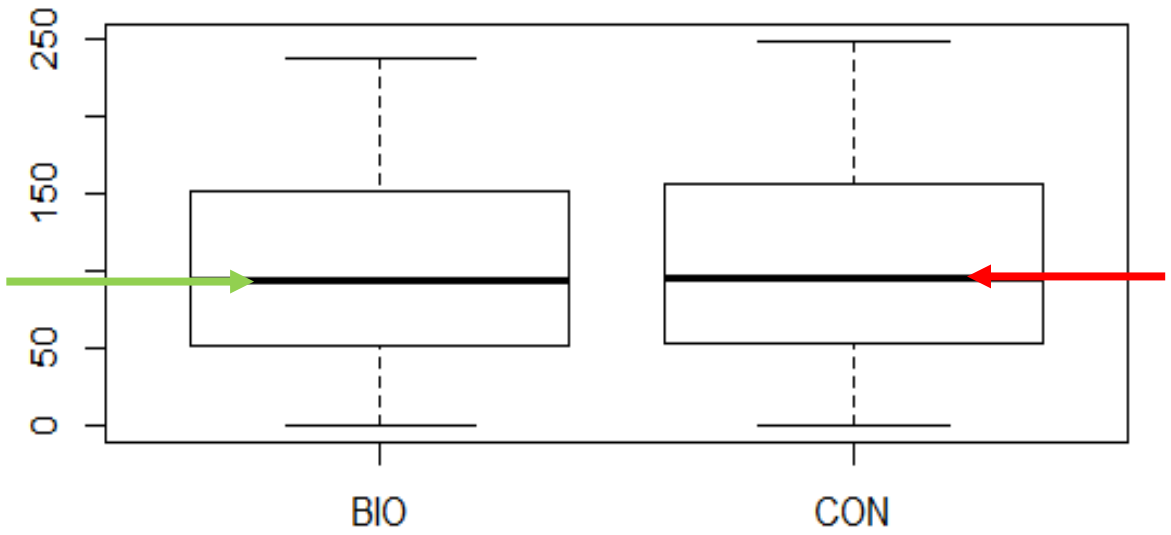
81% corresponded to A1 prototype, 12% to A2, 5% to B1 and 3% to C1

Quarter	Deployment	Goal	% Goal	Sum
Q.1	93	250	37%	93
Q.2	218	250	87%	311
Q.3	163	250	65%	474
Q.4	80	250	32%	554
Q.5	0	…..	0%	
Total	554	**1000**	55%	

FAD TYPE LIFESPAN

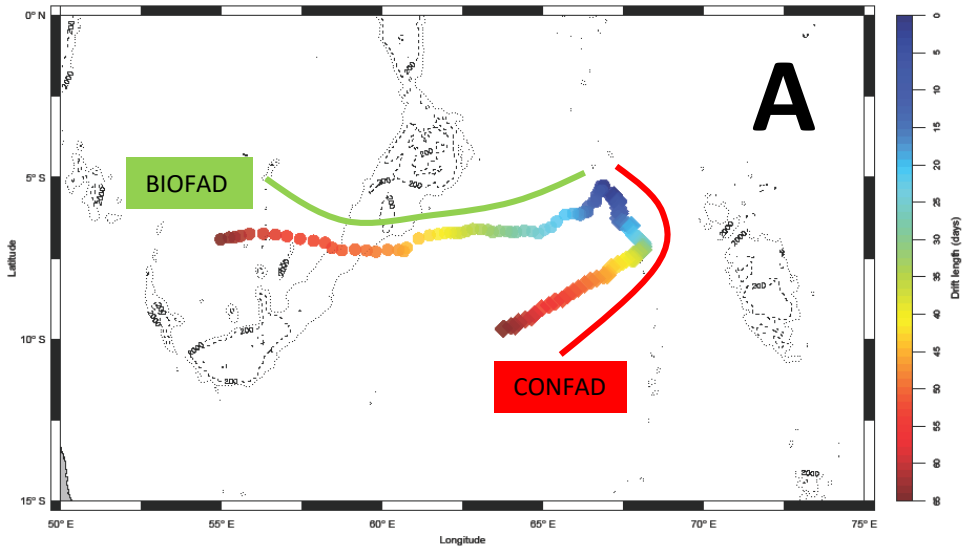
BIOFAD

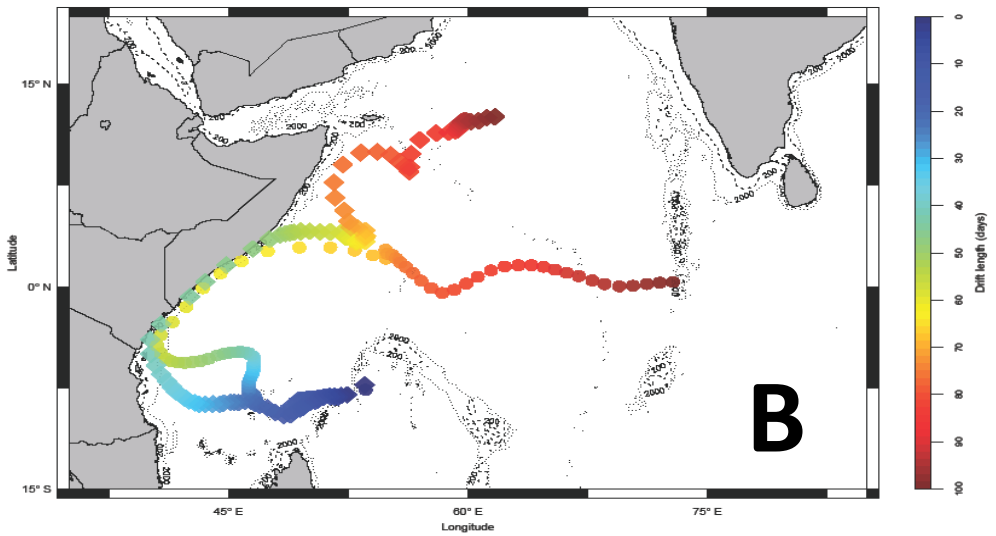
CONFAD



No lifespan difference was observed by FAD type, BIOFAD vs CONFAD

FAD DRIFT PATTERNS

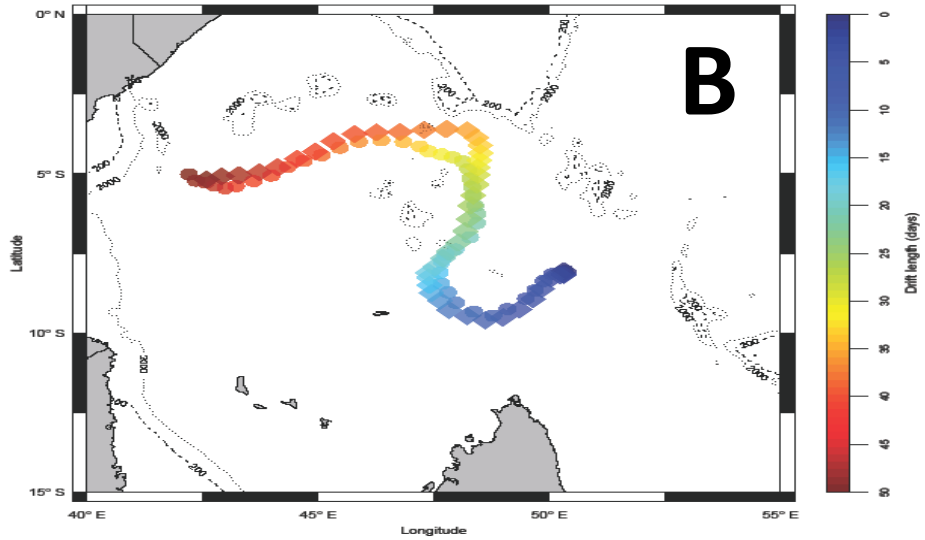




FAD PAIRS DRIFT COMPARISON

Variability in the patterns was observed

A. pairs following totally different drift,
B. pairs following partly similar drifts,
C. pairs following same patterns

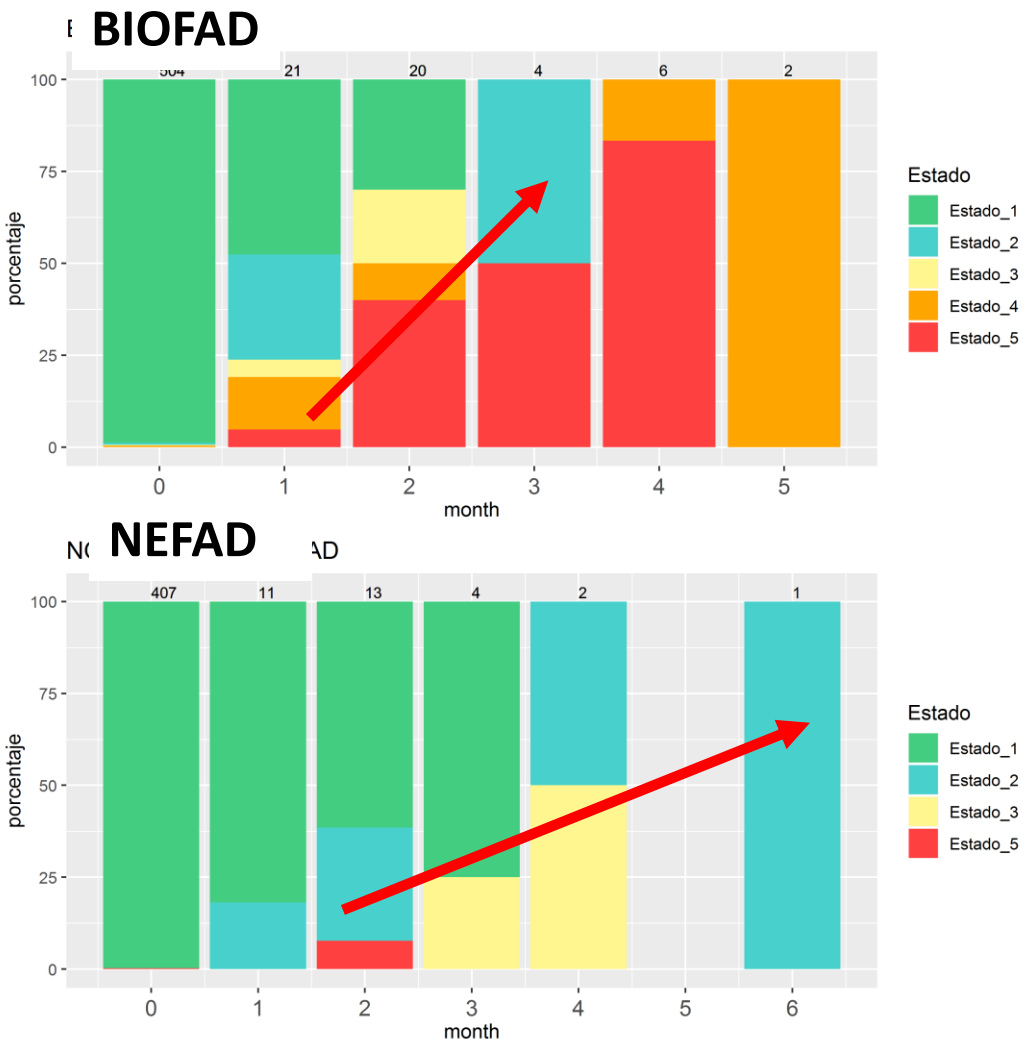


COTTON CANVAS DEGRADATION

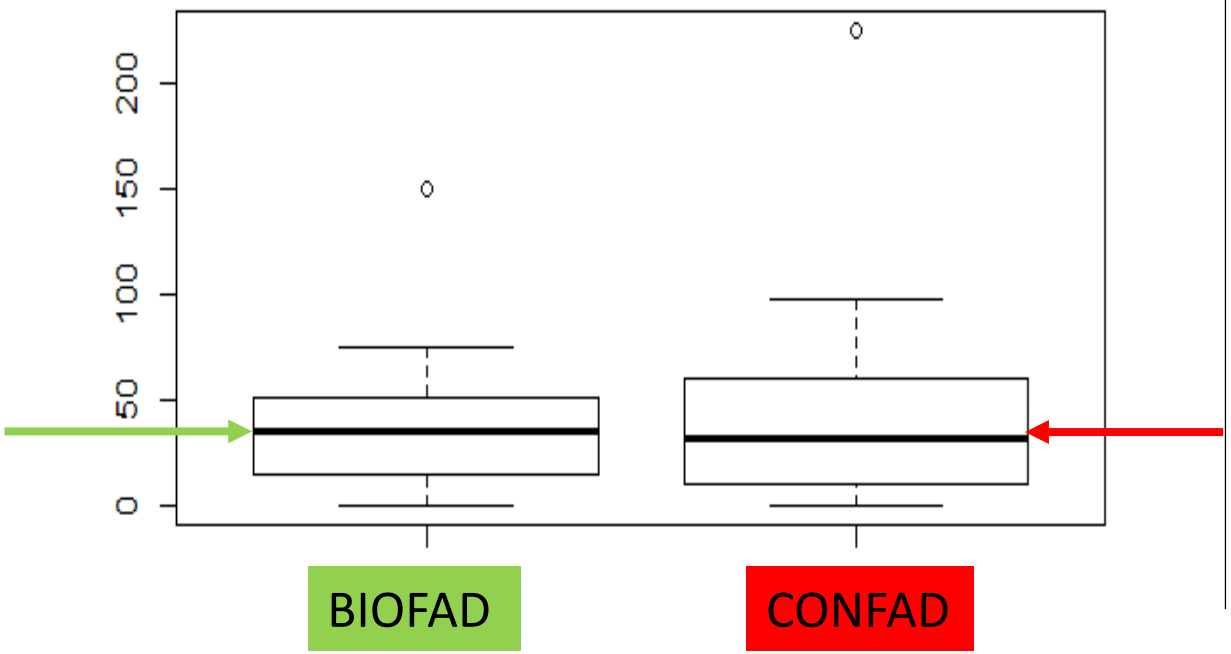
Degradation of the cotton canvas started to be significant already during the first month at sea

This degradation increased in the second and third months, when more than 50% of the observations of this material identified to be in a bad, very bad or absent states.

MATERIAL DEGRADATION



ASSOCIATED TUNA CATCH

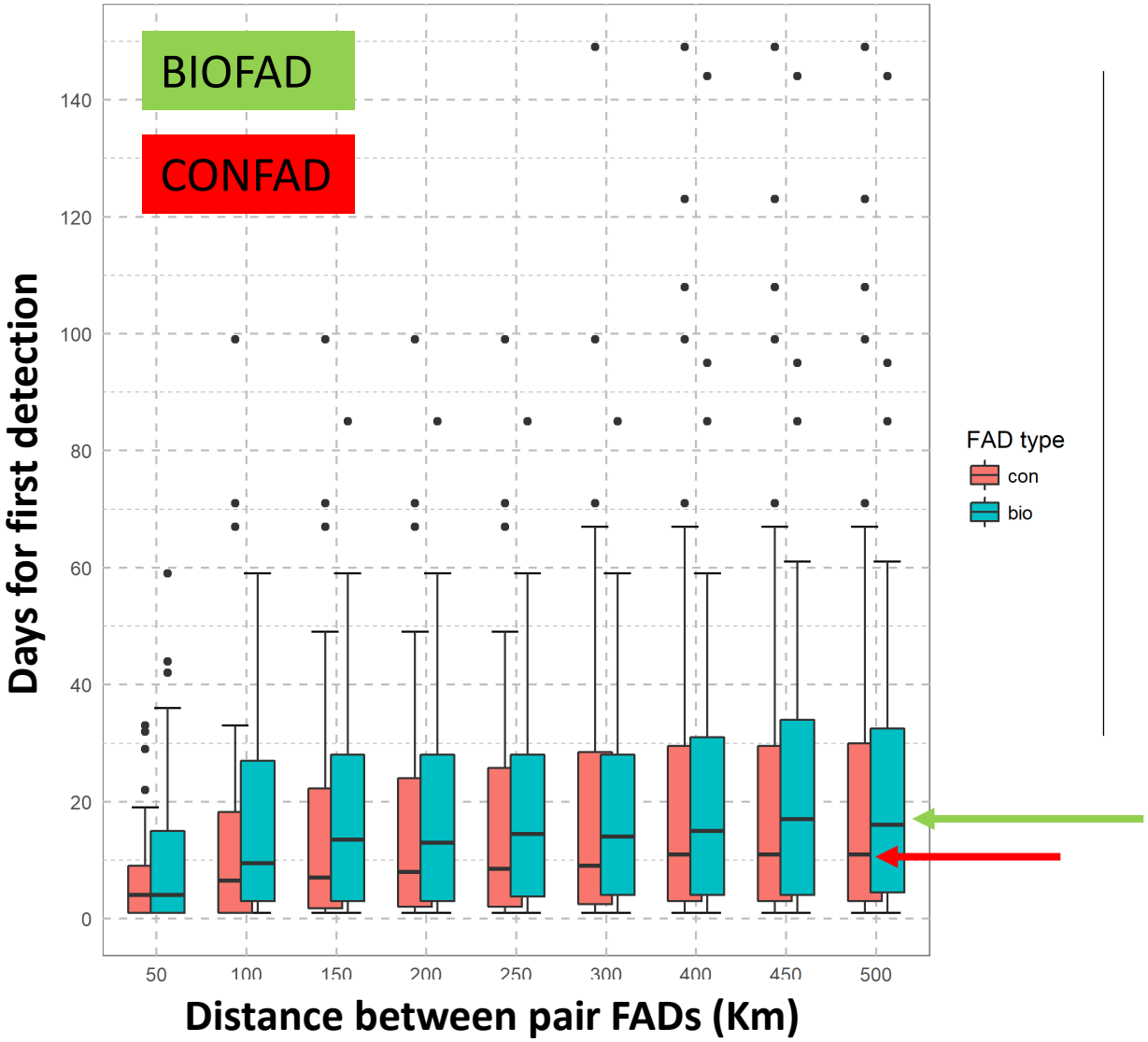


CATCH DATA BY FAD TYPE AND PROTOTYPES

No differences in catch by set by FAD types

- Low number of sets were recorded in both type of FAD

FIRST DAY OF TUNA DETECTION



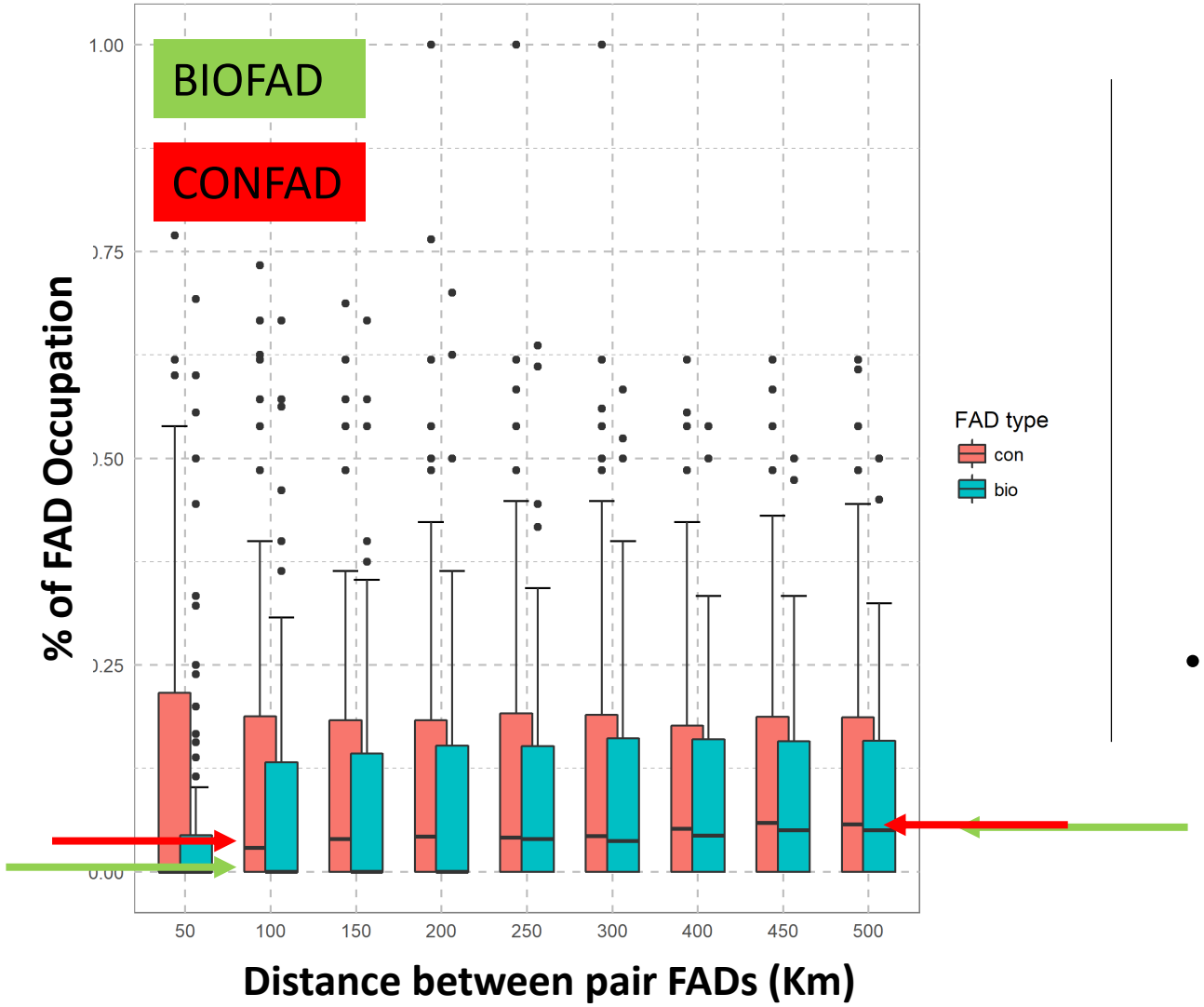
COLONIZATION TIME OF TUNA BY FAD TYPE

Faster (in days) presence of tuna was observed in NEFADs than in BIOFADs.

- This pattern was kept throughout the different range of distances between pairs.

FAD OCCUPATION

FAD OCCUPATION BY TUNA AGGREGATION BY FAD TYPE



Higher proportions of FAD occupation by tuna were observed in NEFADs when the distance between pairs is lower.

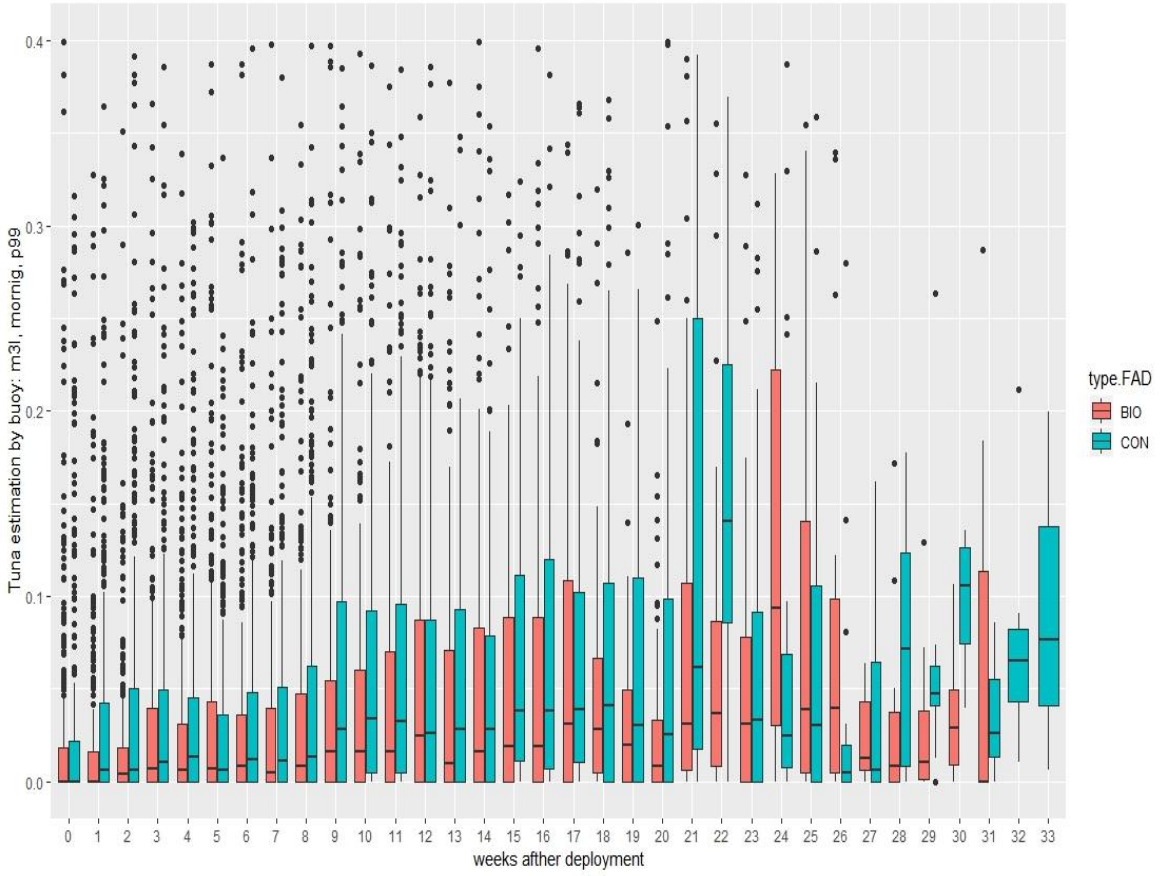
- The proportion tended to stabilise when the distance between pairs is higher than 250Km among them.

ACOUSTIC ENERGY FROM THE ECHOSOUNDERS

NEFADs were found to have higher biomass than BIOFADs

- The estimated values were relatively low for both FAD types.

BIOMASS INDICATOR



CONCLUSIONS

- Science-industry-ONGs active collaboration has been successful in implementing actions to reduce negative effects of drifting fish aggregating devices (dFADs) on marine species and ecosystems:
  - ✓ Major use of NEFADs In all Oceans,
  - ✓ Increase of safe release of fauna,
  - ✓ Testing Biodegradable FADs
- All this grounded on openness to collaborate, mutual trust, and data/knowledge sharing.

It is RECOMMENDED that this collaboration and mutual trust and data/knowledge sharing is strengthened in the future to tackle unresolved key sustainability FAD fishery questions.

Still much to do!

THANK YOU!!

QUESTIONS?