25th meeting of LDAC

Working Group 1 - Highly Migratory Stocks and Tuna RFMOs

6 November 2019, Brussels

Scientific initiatives and research projects aimed to improve the use and management of FADs / ISSF Guide of Best Practices of FADs

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Maitane Grande, Jefferson Murua, Iker Zudaire

24th meeting of LDAC

Working Group 1 - Highly Migratory Stocks and Tuna RFMOs

27 March 2019, Brussels

EU Scientific initiatives on FAD use and management

24th meeting of LDAC

Working Group 1 - Highly Migratory Stocks and Tuna RFMOs

27 March 2019, Brussels

- Non-target species → Unwanted by-catch reduction
- Target species (small sizes)-> reduction
- Post-release survivorship (whale shark, silky shark)
- Monitoring and Management of FADs
- Fishing effort, strategy and technology to improve CPUE
- Fishery independent abundance index
- Other impacts of FAD fishing:
  - Habitat and Biodiversity
  - Biomass
  - Ecology, Biology, Behavior and Movement, including Ecological Trap.
- Minimize impact of FAD fishing

Cooperation between Industry, Managers and Scientists!!!

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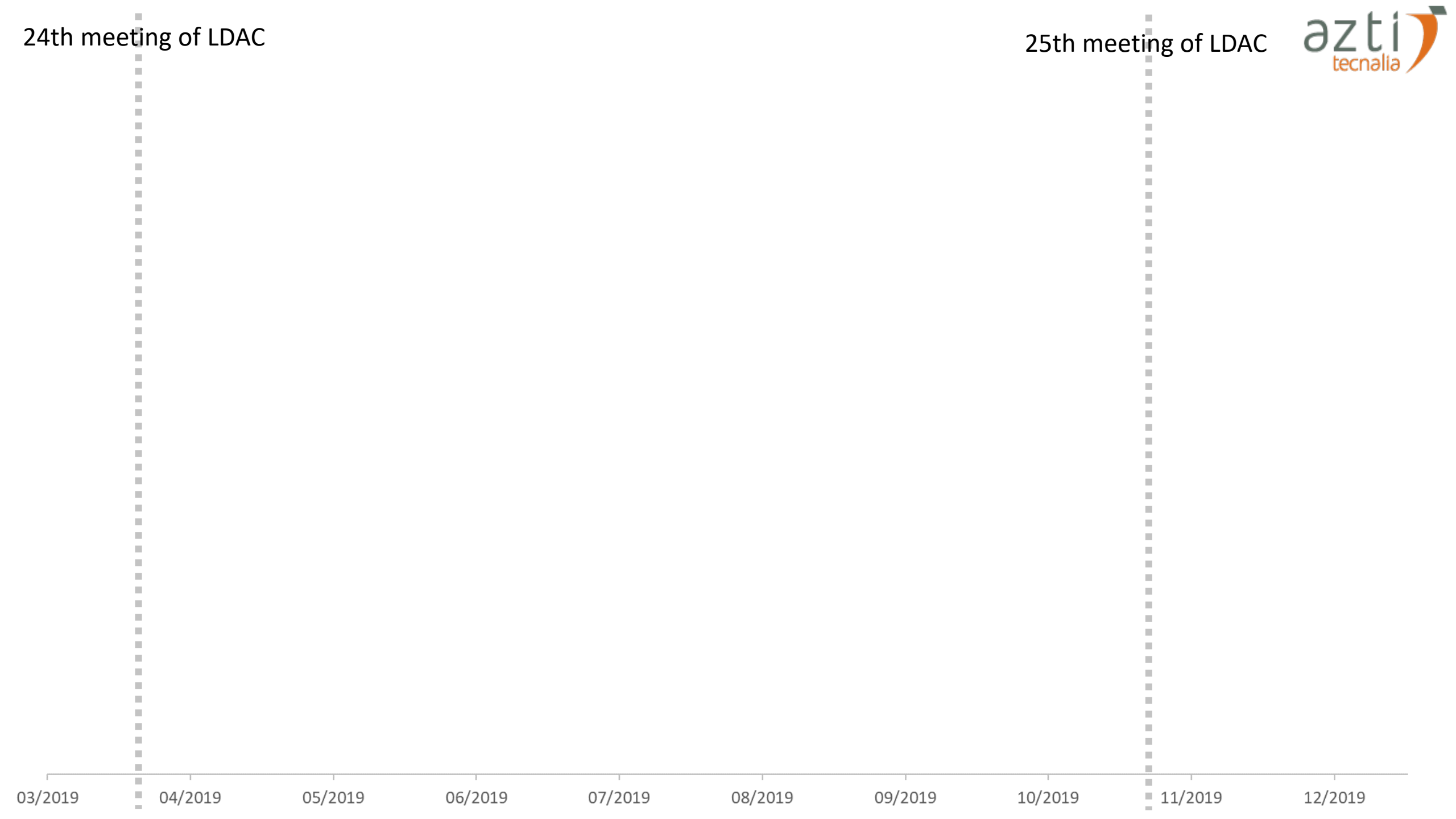
Working Group 1 - Highly Migratory Stocks and Tuna RFMOs

27 March 2019, Brussels

Some key examples:

- BIOFAD
- CECOFAD2
- RECOLAPE
- Support IOTC YFT stock assessment


24th meeting of LDAC
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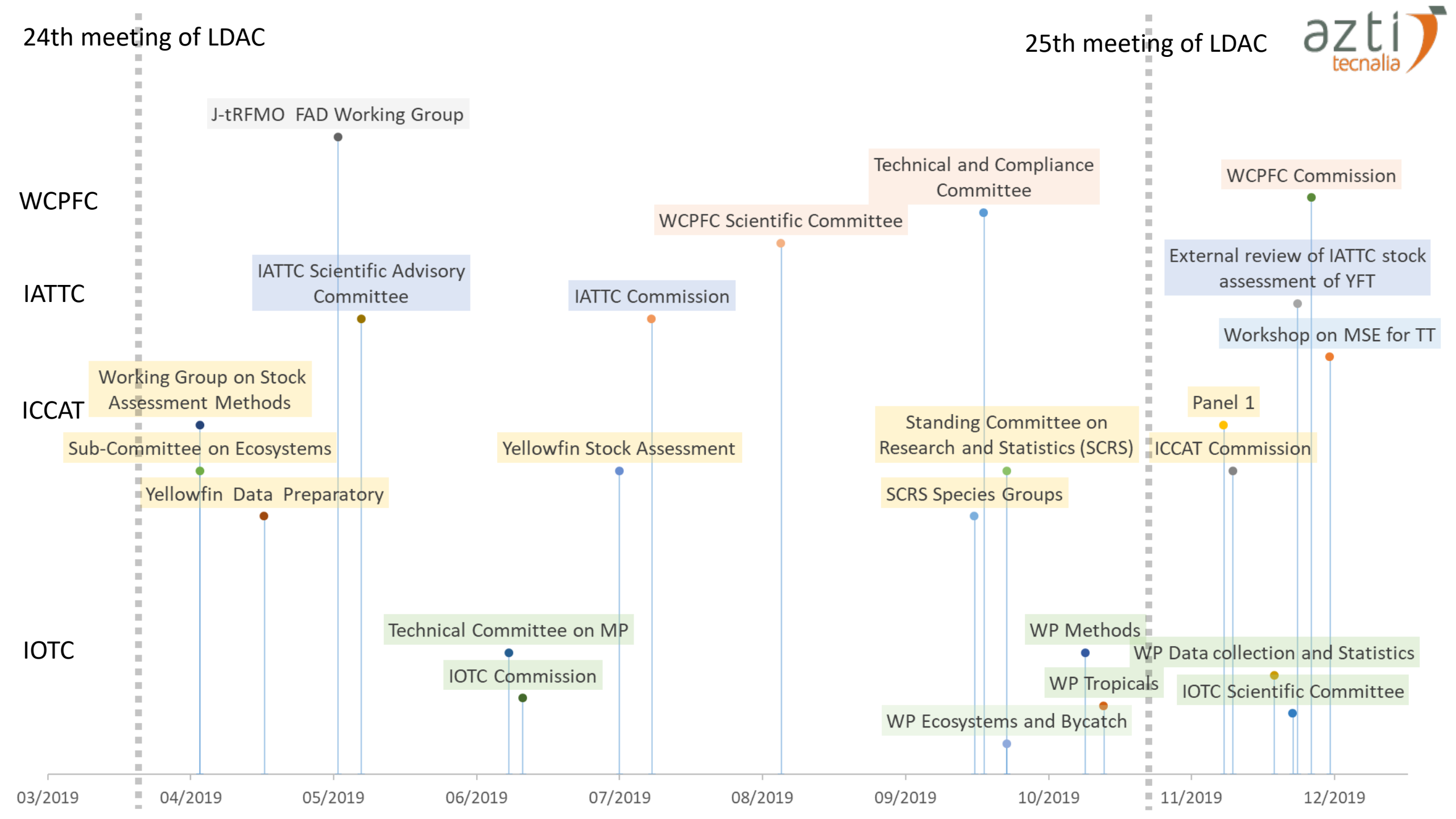
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WCPFC
IATTC
ICCAT
IOTC
J-tRFMO FAD Working Group
IATTC Scientific Advisory Committee
Working Group on Stock Assessment Methods
Sub-Committee on Ecosystems
Yellowfin Data Preparatory
IATTC Commission
Yellowfin Stock Assessment
Technical Committee on MP
IOTC Commission
WCPFC Scientific Committee
Technical and Compliance Committee
Standing Committee on Research and Statistics (SCRS)
SCRS Species Groups
WP Methods
WP Tropicals
WP Ecosystems and Bycatch
WCPFC Commission
External review of IATTC stock assessment of YFT
Workshop on MSE for TT
Panel 1
ICCAT Commission
WP Data collection and Statistics
IOTC Scientific Committee
03/2019
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Yellowfin Stock Assessment

SCRS Species Groups

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Technical Committee on MP

WP Methods

IOTC Commission

WP Tropicals

WP Ecosystems and Bycatch

2021

03/2019 04/2019 05/2019 06/2019 07/2019 08/2019 09/2019 10/2019

2020

25th meeting of LDAC

Working Group 1 - Highly Migratory Stocks and Tuna RFMOs

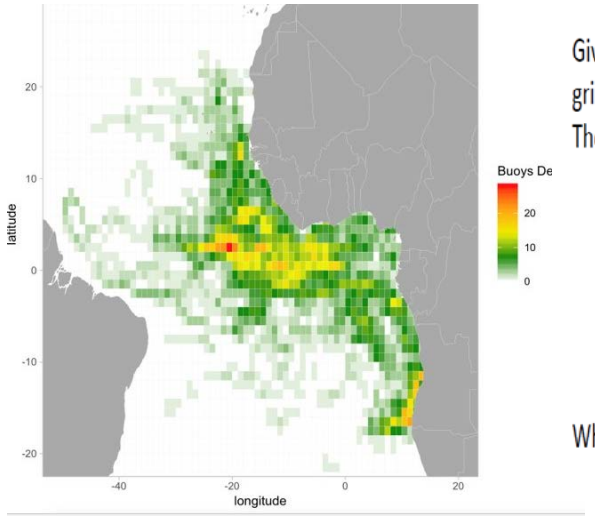
6 November 2019, Brussels

- Scientific initiatives on FAD use and management
  - Echosounder buoys for tuna biomass estimates
  - Code of Good practices (including new releasing tools)
  - BIOFAD

- ISSF Guide of Best Practices for FADmanagement

Echosounder buoys for tuna biomass estimates

Information buoy density



Given b(i,r) representing the number of different bouys counted during day *i* for 1° grid cell r.
The 1°/month density will be estimated as:

$$D(r) = \frac{\sum_{i=1}^{N} b(i,r)}{N}$$

Where N is the total number of days for a given month.

CPUE Standardization

Information of presence of tuna and biomass

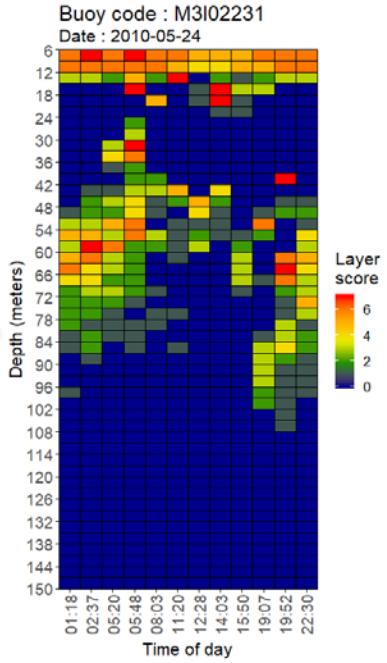
- IRD work with MI buoys and has developed algorithms to predict the presence/absence of tuna with good performance. The catch size can be also be predicted, but with lower accuracy.
- AZTI is working with Satlink and MI instrument buoys in tuna biomass estimation, applying new TS.

Alternative abundance indices

Echosounder buoys for tuna biomass estimates

IRD - Direct abundance indices from M3I buoy model

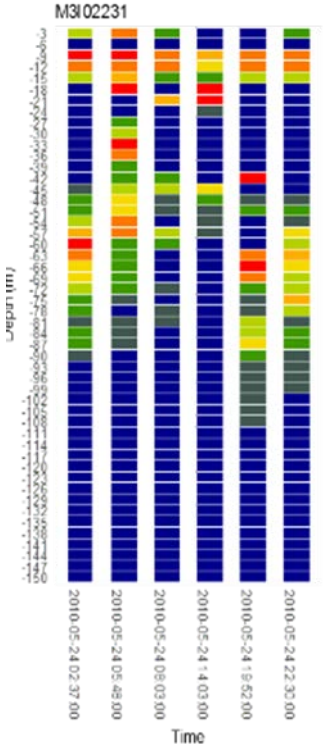
Empirical approach based on supervised learning algorithms



Acoustic data recorded over a full sampling day

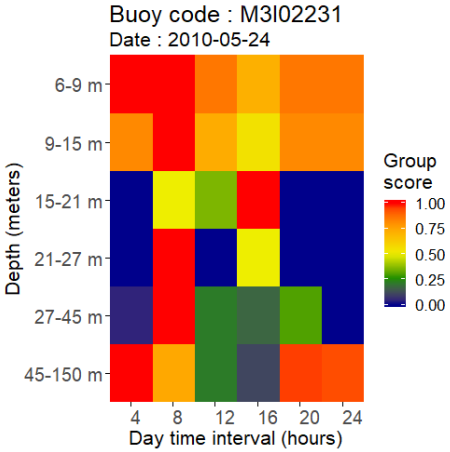
Step 1

Temporal resolution reduction : Averaging echoes over a 4 hours period over the sampling day



Step 2 :

Depth layers aggregation into groups of layers through cluster analysis (hierarchical classification with Ward method)



Daily acoustic matrix

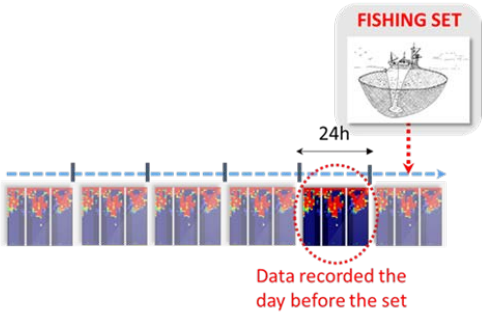
summary of acoustic information recorded on a one-day scale

Echosounder buoys for tuna biomass estimates

IRD - Direct abundance indices from M3I buoy model

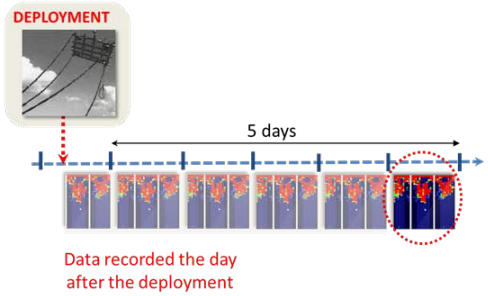
Empirical approach based on supervised learning algorithms

Tuna agregation



Acoustic samplings **recorded the day before a fishing set.**

Non-tuna aggregation



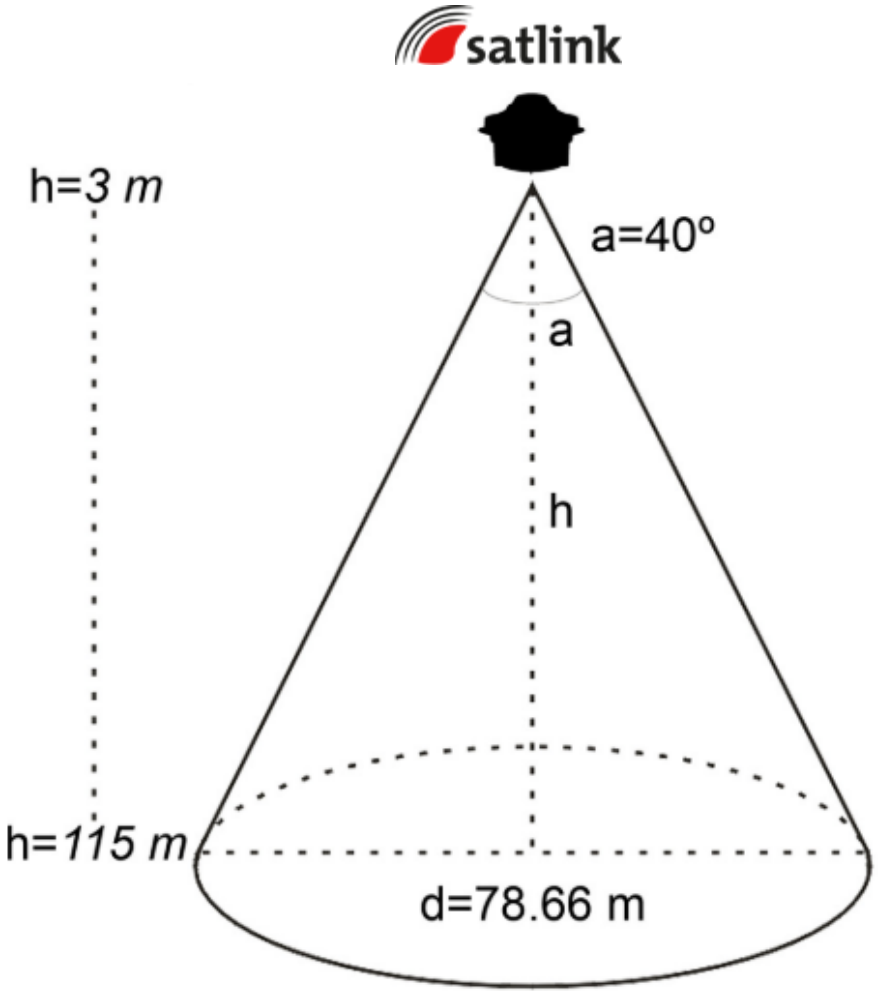
Acoustic samplings recorded **5 days after a virgin FAD deployment.**

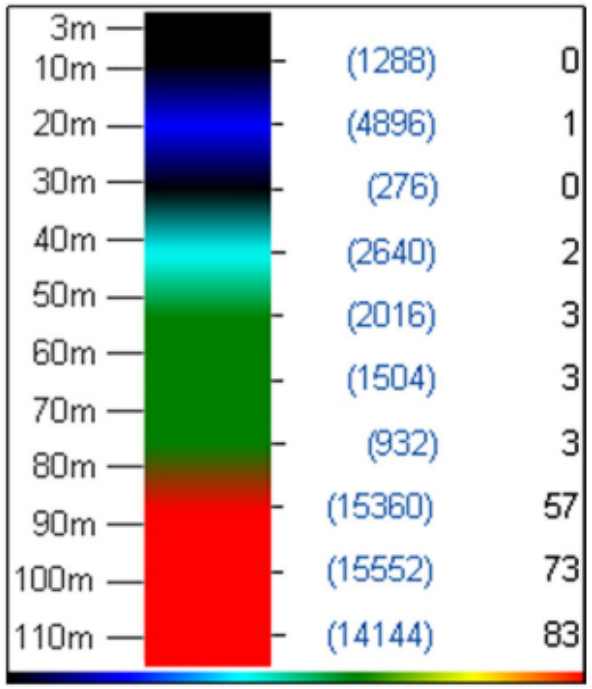
Acoustic samplings recorded **the day before DFADs visits without sets.**

Good performance in **detection of the presence and absence of tuna aggregation** under DFADs: 75 and 85 % of correctly predicted for Atlantic and Indian respectively

Echosounder buoys for tuna biomass estimates

AZTI - Direct abundance indices from Satlink buoys





Echosounder buoys for tuna biomass estimates

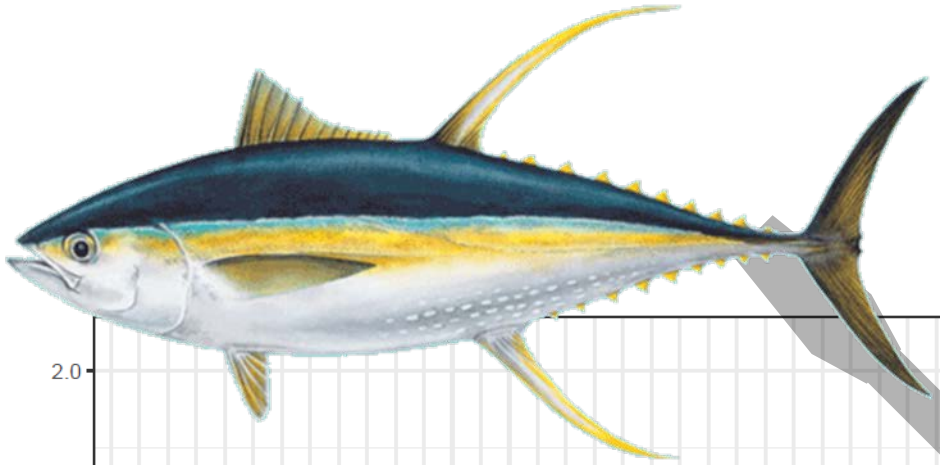
AZTI - Direct abundance indices from Satlink buoys

- Current echosounder buoys provide a **single acoustic value** without discriminating species or size composition of the fish underneath the FAD.

- Therefore, these data have been **crossed with fishery data** (species composition and average size) to obtain abundance indices for each of the three tropical tuna stocks.

- The database of acoustic information [January 2010 to December 2018] comprises around **25 million of records** (11 and 14 for the IO and AO respectively)

Echosounder buoys for tuna biomass estimates



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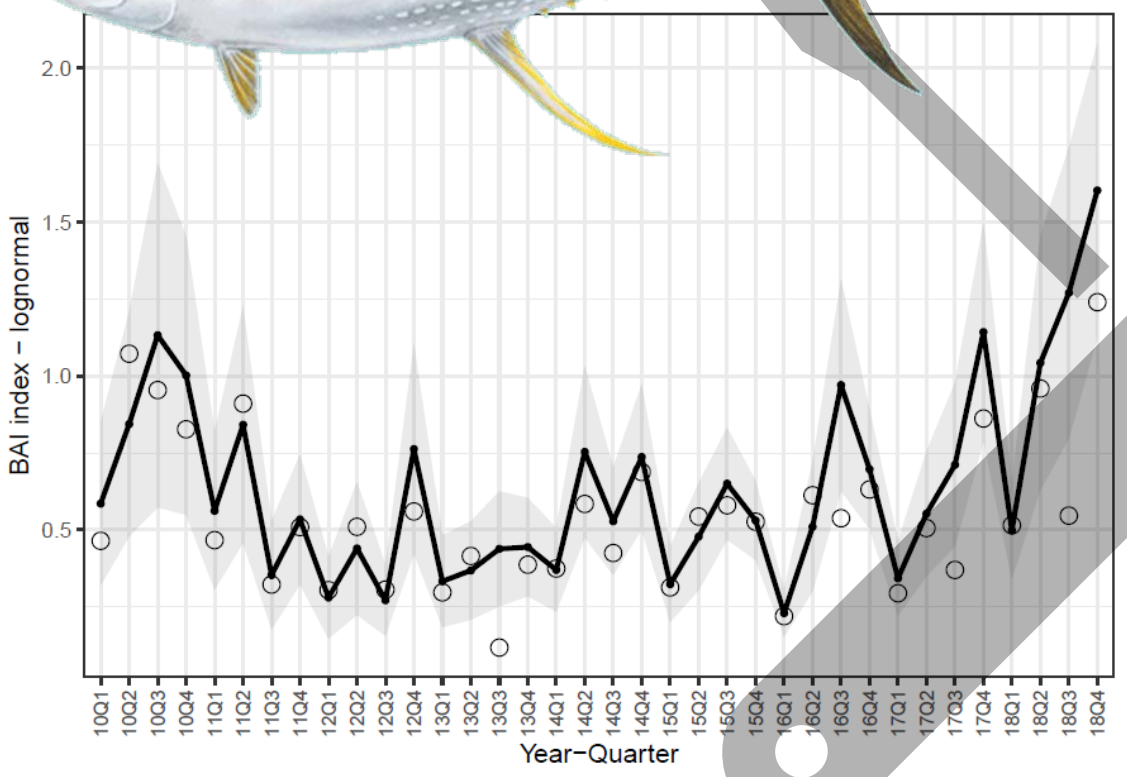
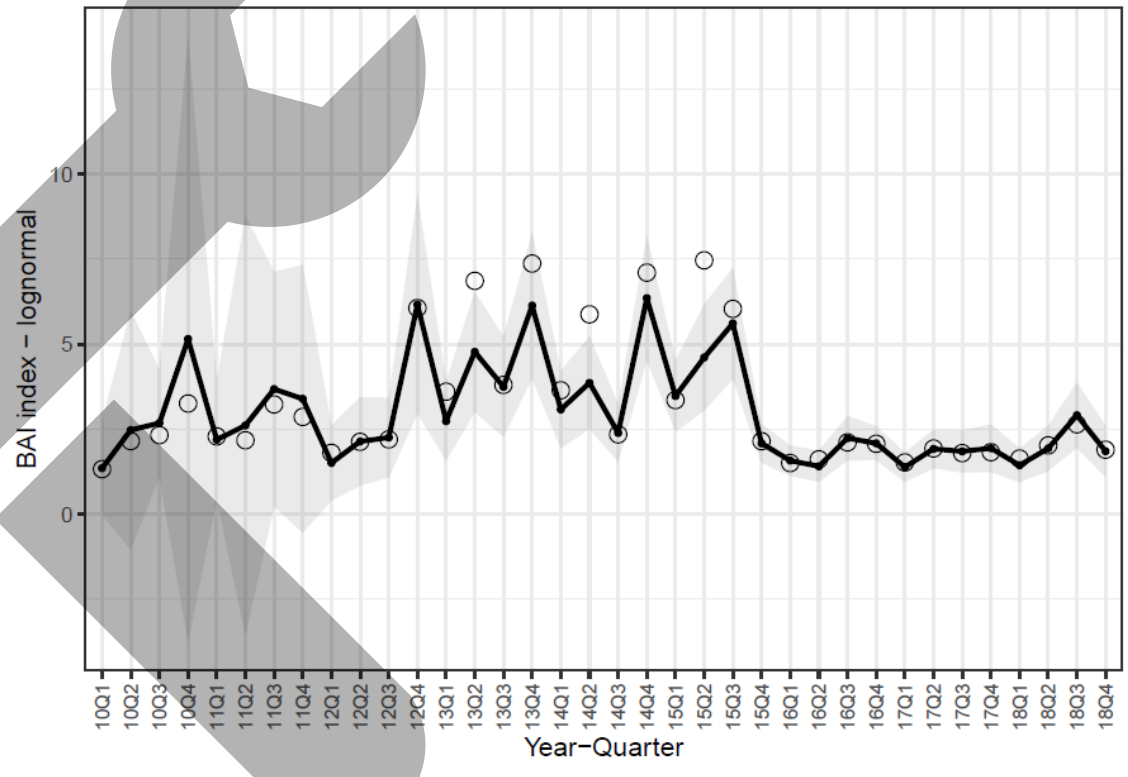
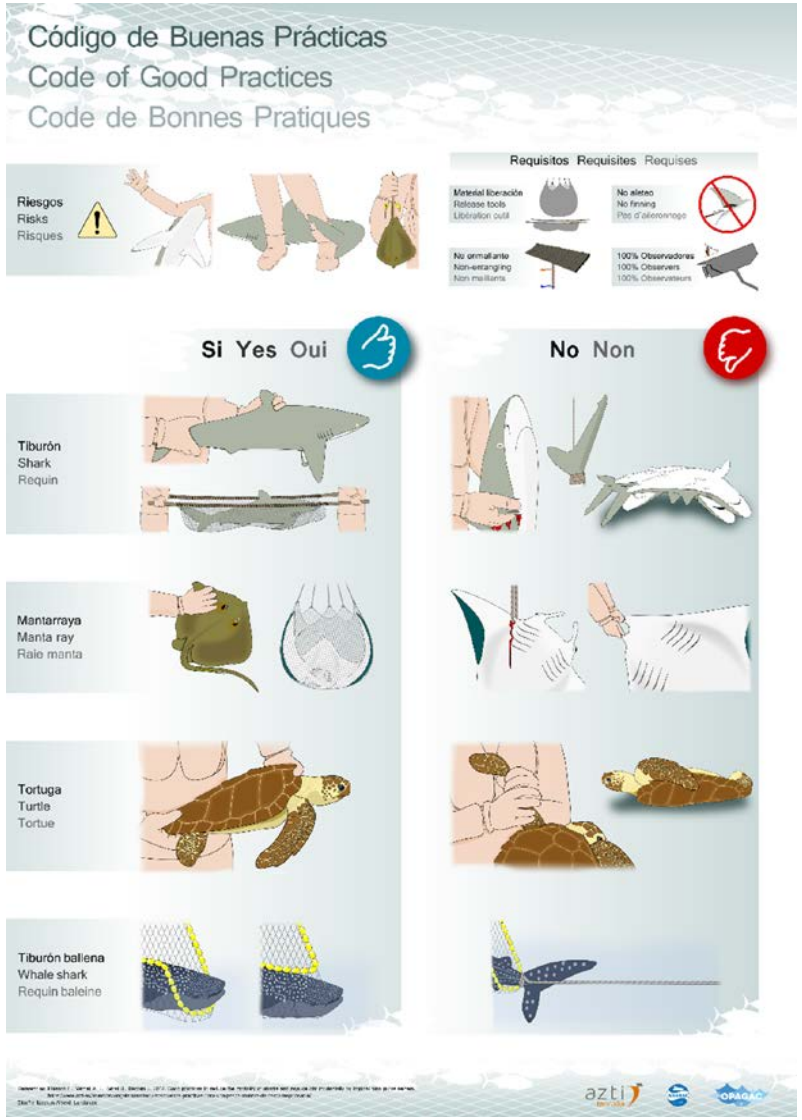


Atlantic ocean



Indian ocean

Code of Good practices in the tropical tuna purse seine fishery



The Code of Good Practices

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

2. Safe fauna **release operations (**species-specific handling procedures for sharks, mantas, rays and turtles).

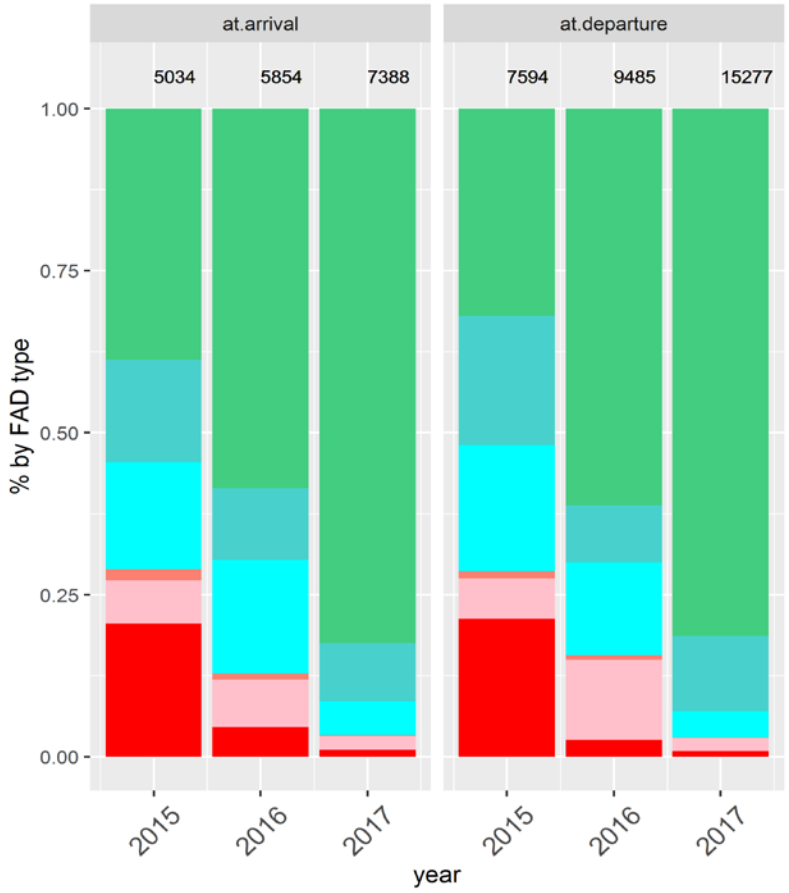
3. 100% observer coverage (EM or HO) (since 2017 gradually implemented in supply vessels)

4. Harmonization of **FAD logbooks**

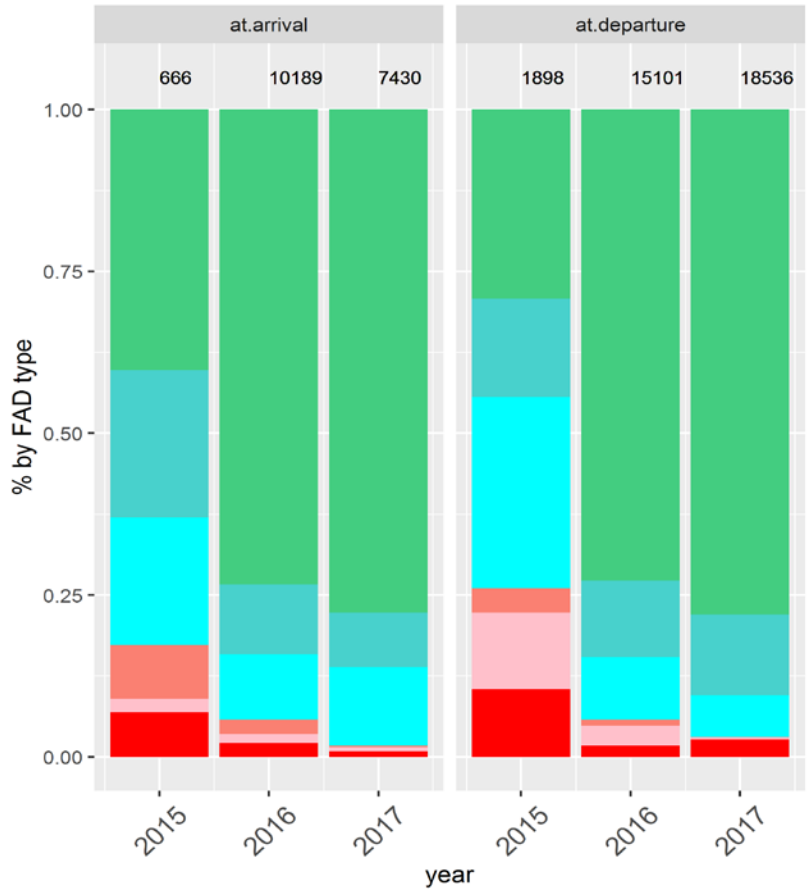
5. Training of fishing crew and scientific observers

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

Code of Good practices in the tropical tuna purse seine fishery



Atlantic ocean



Indian ocean

Non-entangling FADs

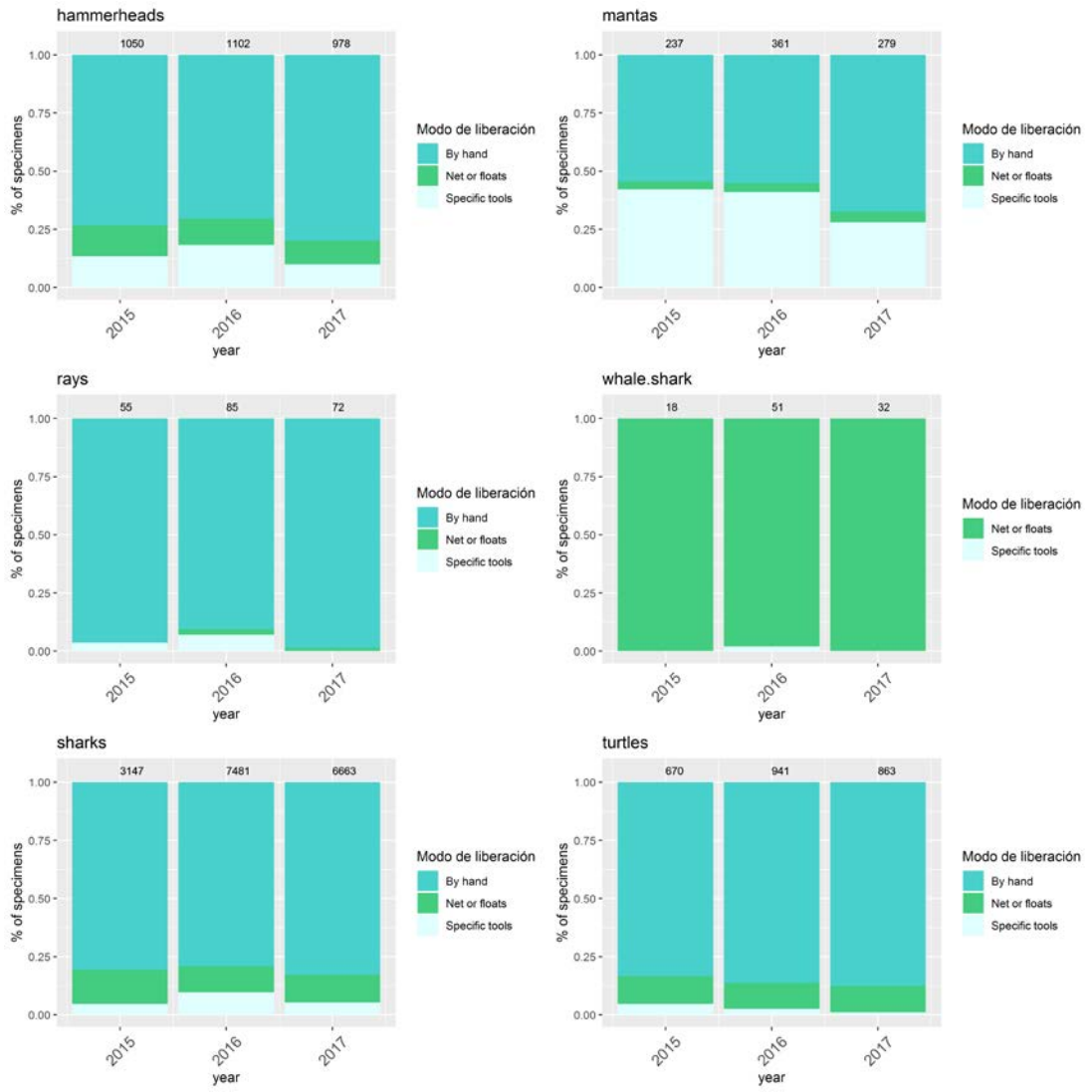
FAD Type

- 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.

Code of Good practices in the tropical tuna purse seine fishery

- The **sharks**, rays, and turtles are **mainly handled by hand from the deck**, a technique that is described in the CGP, which allows a quick release from the deck.
- Releasing by hand can suppose a **risk for the crew**.
- **Whale sharks** are released by submerging the floats or cutting the net.
- For **mantas** specific equipment is also used.
- **New initiatives** are needed to find new releasing tools

Fauna release



New initiatives: Pre-evaluating hopper efficiency for shark release

	N BRAILS	AV. BRAILING TIME (min)	SHARKS PER BRAIL	RELEASE TOP DECK (%)
WITH HOPPER	55			
WITHOUT HOPPER	239			

HOPPER TRAY

UNLOADING BRAIL INTO HOPPER,
SHARK QUICKLY RELEASED AT TOP DECK

UNLOADING BRAIL WITHOUT HOPPER

SHARK ARRIVING TO THE LOWER DECK

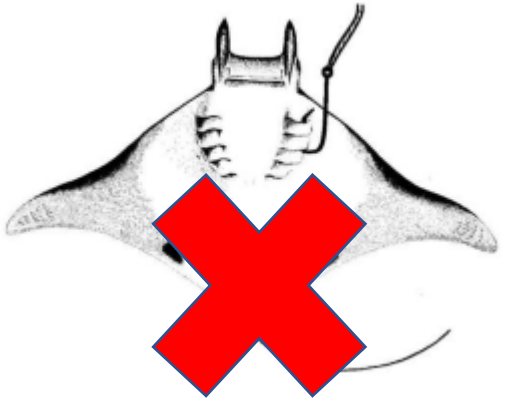
- **Release from the deck**: Using safe handling and release practices to release live sharks from the deck can increase shark survival (ISSF, 2016). Crew safety is of utmost importance, especially with larger sharks. Using a hopper will facilitate life release. This practice can save up to 20% of encircled sharks.

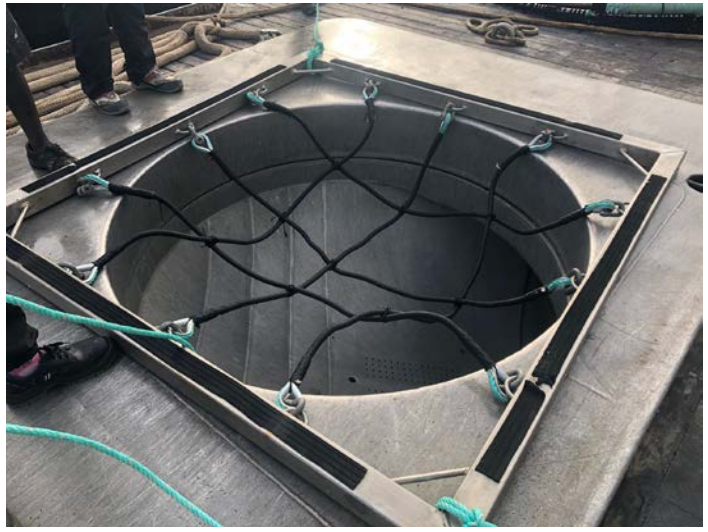
New initiatives: Improving elasmobranch (sharks & mantas) release tools

OBJECTIVE: FAST AND EASY RELEASE AVOIDING INJURY TO THE ANIMALS

PRESENTLY TRIALS IN THE ATLANTIC OCEAN WITH POSITIVE FEEDBACK FROM FISHERS

SHARK RELEASE VELCRO





MANTA RELEASE GRID

Specific contract Nº7: Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)

UNDER FRAMEWORK CONTRACT – EASME/EMFF/2016/008

Provision of scientific advice for fisheries beyond EU waters

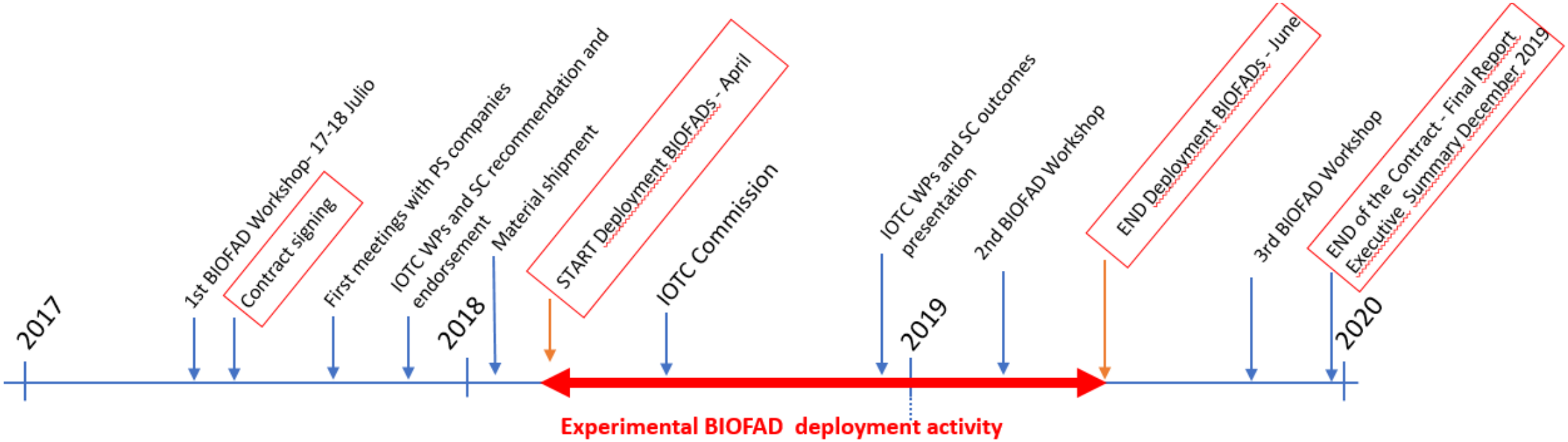
EASME
Executive Agency for SMEs

Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)

Main details:

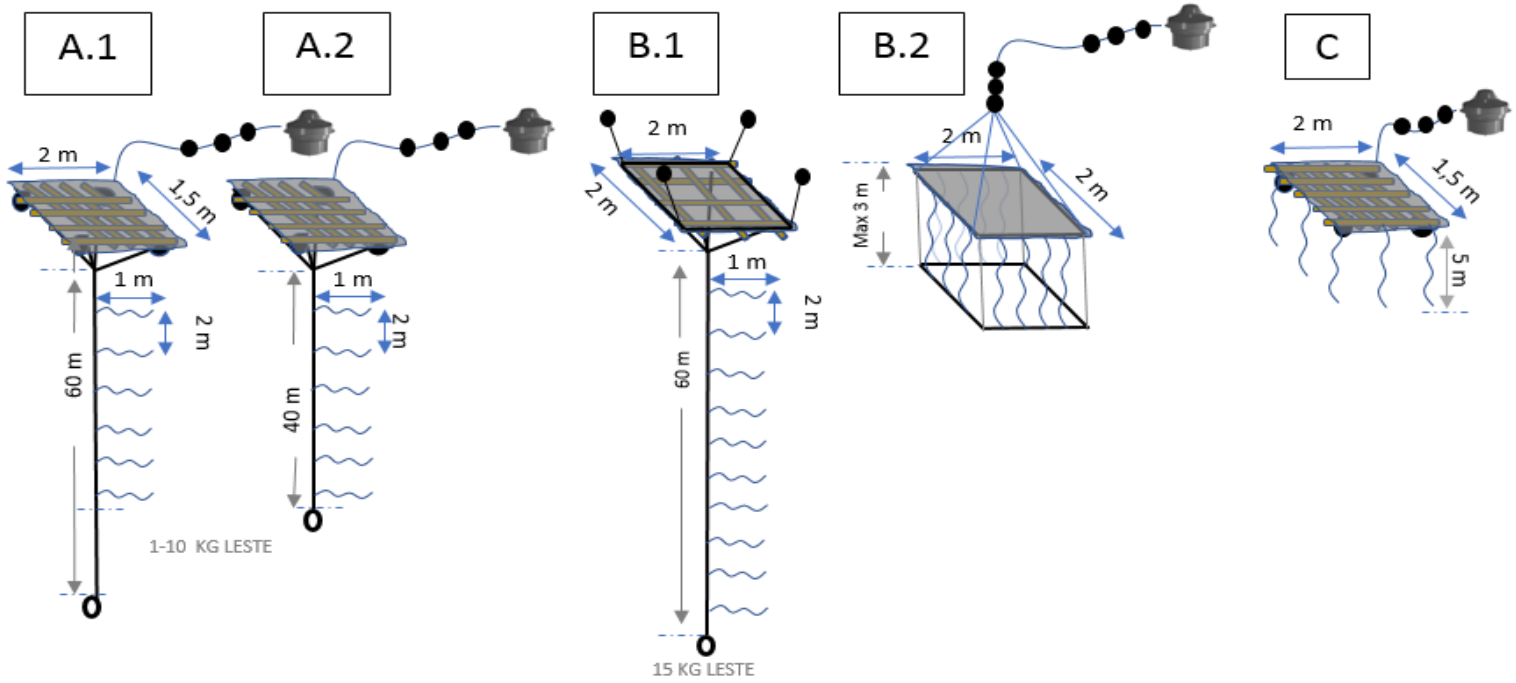
- **Consortium members**: AZTI, IRD and IEO
- **Project period**: from August 2017 – to December 2019 (28 months)
- **Study area**: Indian Ocean
- **Deployment objectives**: 1000 BIOFADs
  - ~2 BIOFADs per vessel and month (~6-8 by trimester)
  - ISSF support for biodegradable material purchase

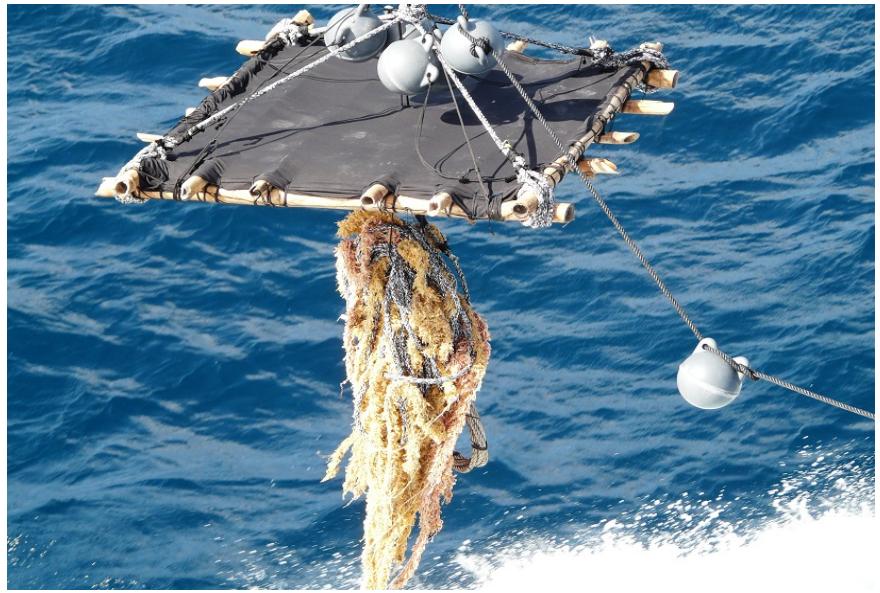
Collaborators:



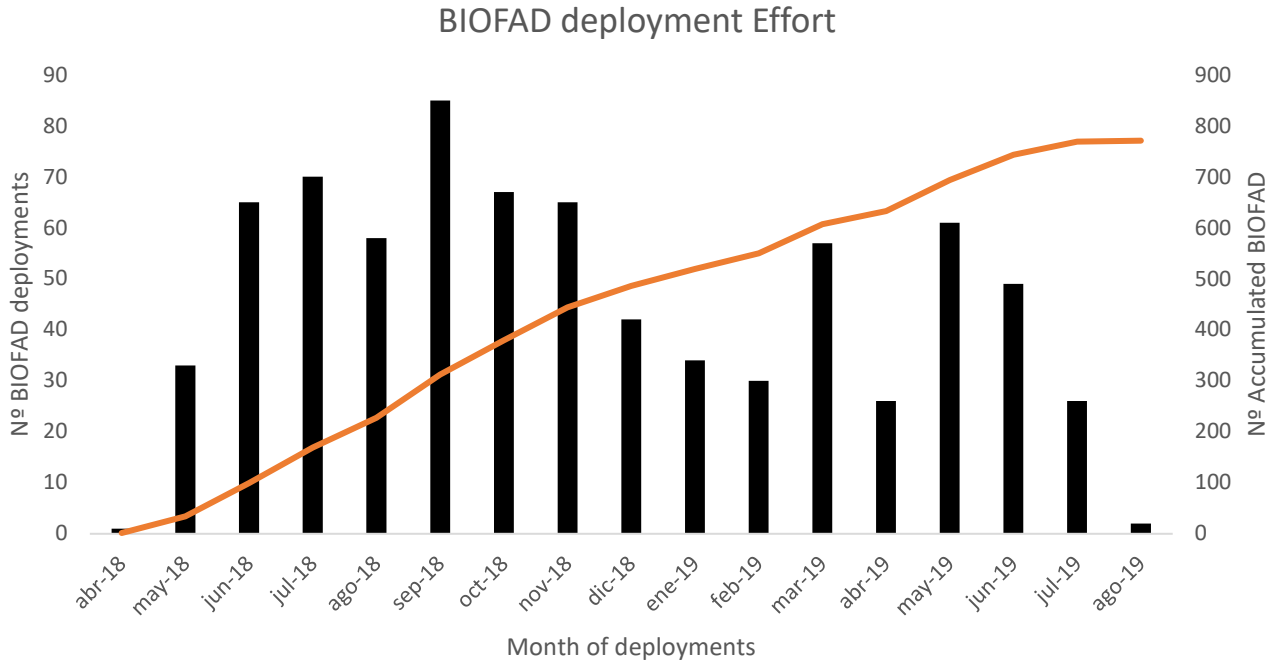
Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)

TO TEST THE FUNCTIONALITY OF BIODEGRABLE MATERIALS FOR FADs CONTRUCTION TO REDUCE IMPACT IN THE ECOSYSTEM

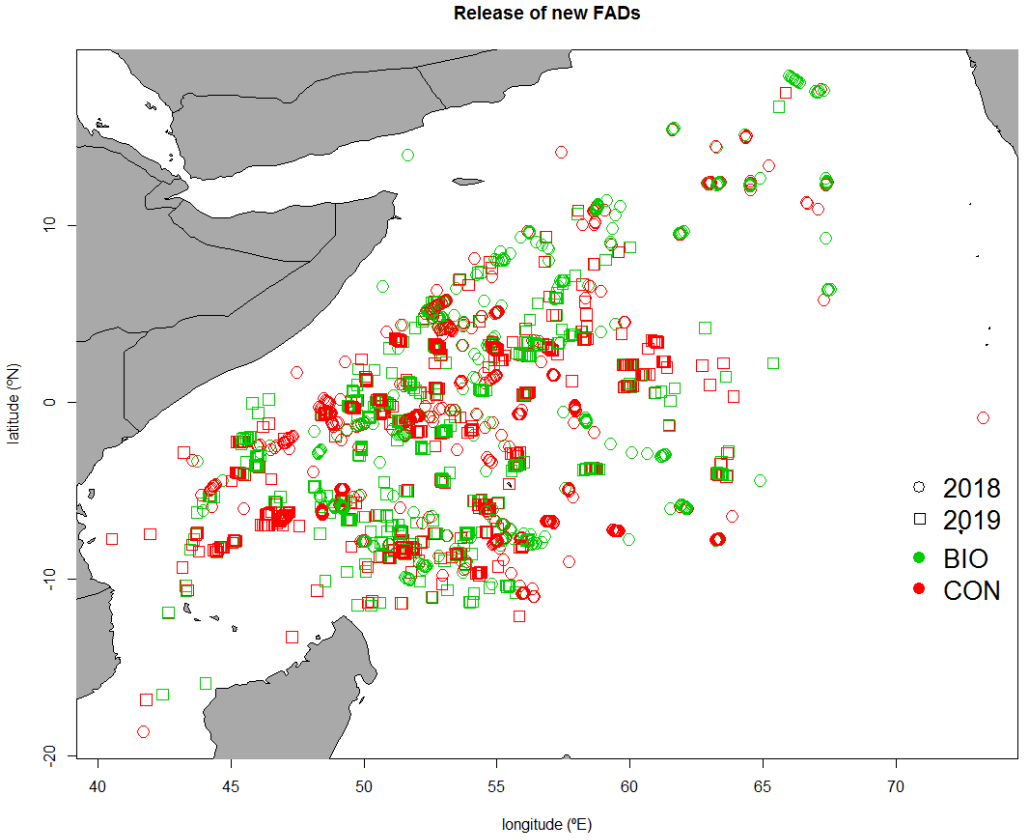




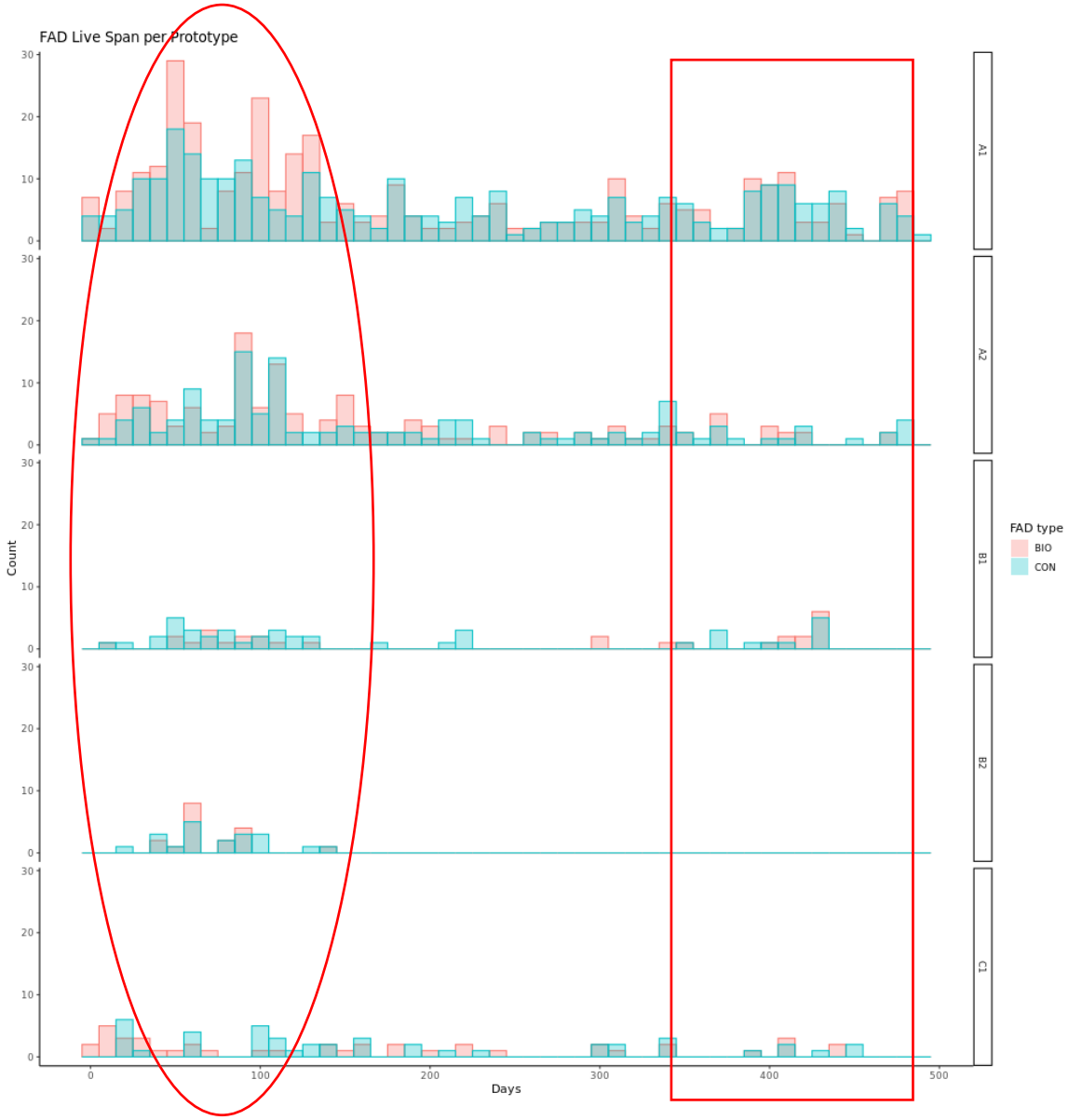
Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)



Deployments



Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)



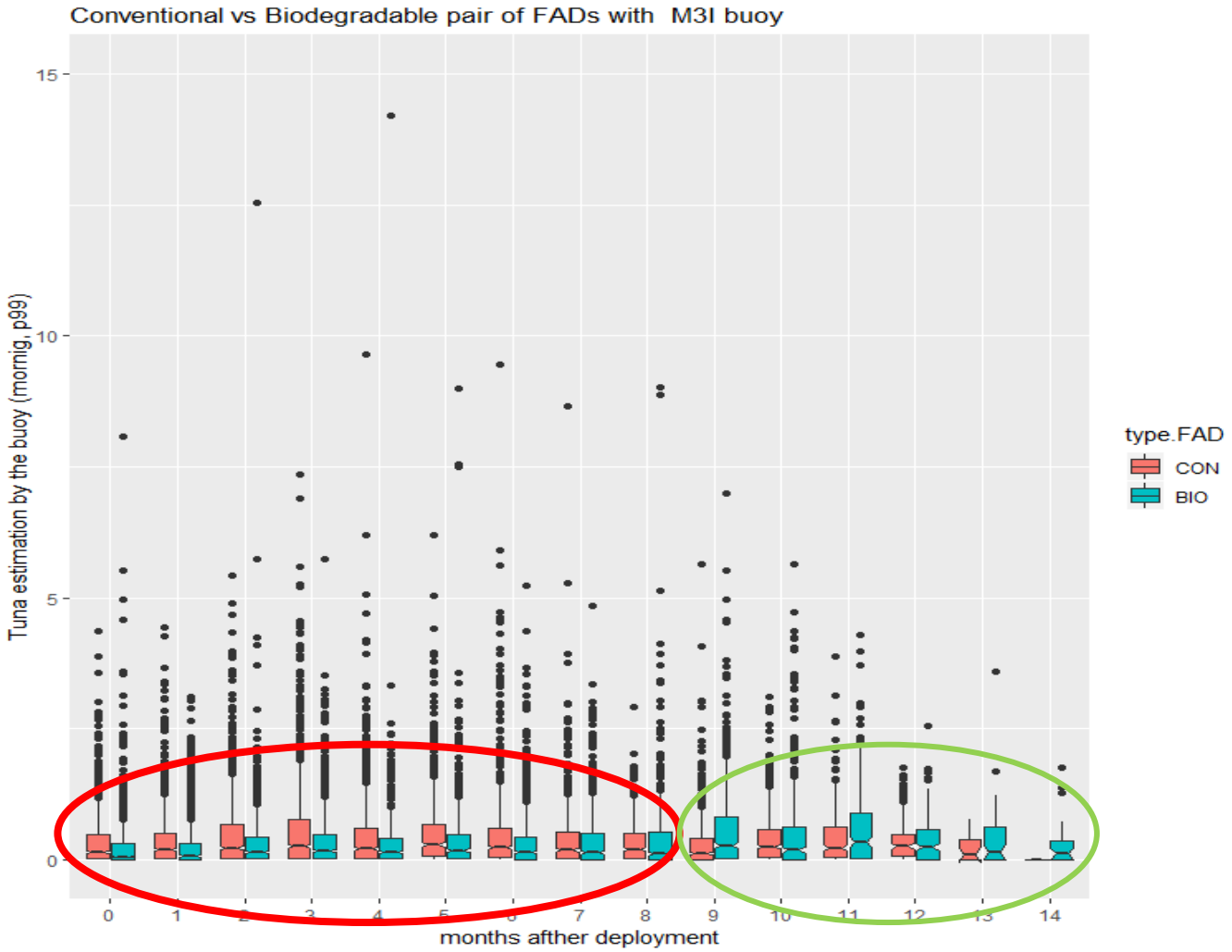
Catches

- All prototypes show lifespan longer than 1 year.
- Average catches per set of CONFAD > BIO-FADS.
- These differences are NOT signif.

	BIOFAD	CONFAD
Max (tons)	150	225
Mean (tons)	27,96	44,2
Sets	36	32
Deployments	771	736

Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)

Biomass indicators



- Overall, no difference or higher values of biomass in NEFAD were observed during the first months.
- Overall, higher values of biomass in BIOFAD were observed after the ninth month.

Testing designs and identify options to mitigate impacts of drifting FADs on the Ecosystem (BIOFAD)

Recommendations

- **Need of a BIOFAD definition** by t-RFMOs
- Acknowledging the current state of the art for biodegradable materials and availability, **different levels/categories of biodegradability of BIOFADs**, similar to ISSF classification for FAD's entanglement risk.
- **A stepwise process**, including a timeline, towards the implementation of fully biodegradable FAD:
  - As first step, **use of a minimum %** (i.e., determined by the % of total weight or surface) of biodegradable material or the **requirement of biodegradable materials for the construction of certain FAD parts**.
  - Progressively, as soon as materials are available, the **% of biodegradability should be increased** for the construction of other parts of the FADs targeting 100% biodegradability for the FAD.
- Gradual modification of current FAD design, in terms of **reductions in the amount of material** and the synthetic fraction used in their construction, at a short term.
- Fully/partly biodegradable still requires investigation: **further research on natural and synthetic materials** that meet the BIOFAD definition is required.

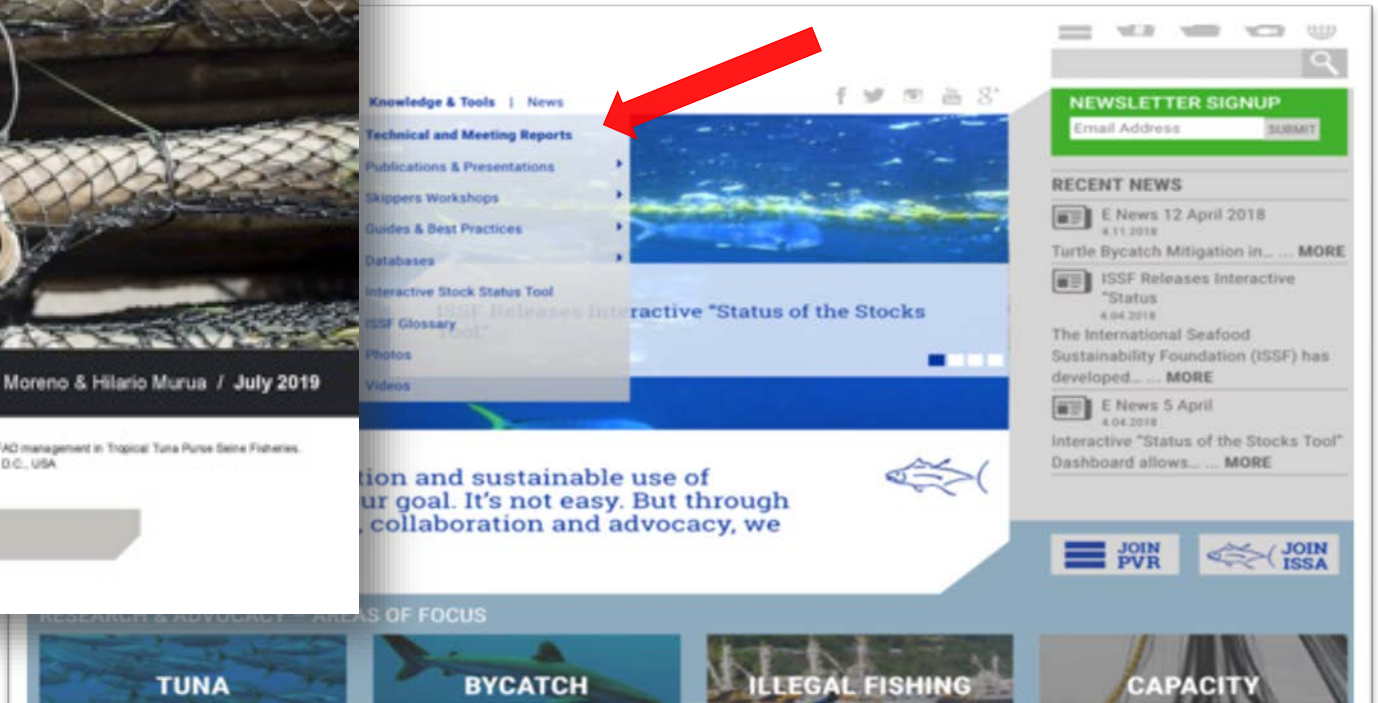
Scientific initiatives and research projects currently in place

- Non-target species → Unwanted by-catch reduction
- Target species (small sizes)-> reduction
- Post-release survivorship (whale shark, silky shark)
- Monitoring and Management of FADs
- Fishing effort, strategy and technology to improve CPUE
- Fishery independent abundance index
- Other impacts of FAD fishing:
  - Habitat and Biodiversity
  - Biomass
  - Ecology, Biology, Behavior and Movement, including Ecological Trap.
- Minimize impact of FAD fishing

ISSF Guide of Best Practices for FAD management

Materials kindly provided by Hilario Murua (ISSF)

ISSF Guide of Best Practices for FAD management



ISSF report summarizes best practices for **tropical tuna purse seine fisheries with FAD component** that aim to participate in Fishery Improvement Programs (FIPs) w/ MSC certification objective

Recommended practices linked to MSC Fishery Certification Requirements

ISSF Guide of Best Practices for FAD management

Lays out key elements of FAD management with **BEST PRACTICES**

1. Comply with **flag state and RFMO reporting requirements for fisheries statistics** by set type;
2. Voluntarily report **additional FAD buoy data** for use by RFMO science bodies;
3. Support **science-based limits** on the overall number of FADs used per vessel and/or FAD sets made;
4. Use only **non-entangling** FADs to reduce ghost fishing;
5. Mitigate other environmental impacts due to FAD loss including through the use of **biodegradable FADs and FAD recovery policies**;
6. For **silky sharks** (the main bycatch issue in FAD sets) implement further **mitigation efforts**.

ISSF Guide of Best Practices for FAD management

1. Comply with flag state and RFMO reporting requirements for fisheries statistics by set type

Recommended best practices for complying with flag state and RFMO reporting requirements by set type:

- **Logsheets**: Commit to filling out completely and accurately the logsheets required by the flag state, licensing authority, and/or RFMO for each set on a trip. The data should include catch and bycatch by set type.
- **FAD activity:** Provide data on FAD activity (deployments, visits, sets and loss) through "FAD logbooks" and data on number of active FADs through the analysis of satellite buoy daily position data provided by satellite buoy provider.
- **Observer coverage**: Commit to 100% observer coverage (either human or electronic). If electronic monitoring is used, follow best-practice minimum standards (Restrepo *et al.*, 2018).

ISSF Guide of Best Practices for FAD management

2. Voluntarily report additional FAD buoy data
for use by RFMO science bodies

Recommended best practices for voluntary report of additional FAD buoy data for use by RFMO science bodies:

- **Buoy positional and acoustic raw data**: Participate in scientific programs that require the recovery of historical data and use of FAD position data and acoustic records from the echo-sounder buoys (with a time lag, as needed for time-sensitive confidentiality) either at the RFMO level or with specialized research institutions. The recovery of historical information should receive high priority. Ideally, information on position and acoustic record for the whole track should be provided; alternatively, one position and echosounder record per day as a minimum.

ISSF Guide of Best Practices for FAD management

3. Support science-based limits on the overall number of FADs used per vessel and/or FAD sets made

Recommended best practices for science-based limits on the overall number of FADs and/or FAD sets made:

- **Limit number of FADs**: Commit to not increase the number of FADs per vessel even if the RFMO would allow for an increase. Commit to other practices that limit the number of FADs such as:
  - ⇒ Deploying only FADs with satellite tracking buoys,
  - ⇒ Not activating remotely the buoys of dormant FADs, and
  - ⇒ Allowing buoys to report at least once per day while they are in the water.
- **Time/area closures**: Support the adoption of meaningful FAD closures that will mitigate impacts of FAD fishing on target tuna stocks. From a point of view of monitoring and compliance, a complete closure would be preferred.

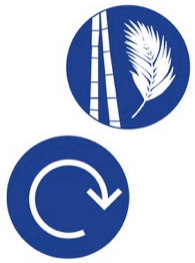
ISSF Guide of Best Practices for FAD management

4. Use only non-entangling FADs to reduce ghost fishing

Recommended best practices for using non-entangling FADs:
• **Non-entangling FADs**: Commit to using non-entangling FADs (without any netting) only. Commit to removing entangling FADs that are found in the water.

ISSF Guide of Best Practices for FAD management

5. Mitigate other environmental impacts due to FAD loss including through the use of biodegradable FADs and FAD recovery policies



Recommended best practices for mitigating environmental impacts due to FAD loss including through the use of biodegradable FADs and FAD recovery policies:

- **Biodegradable FADs**: Test biodegradable FADs, using local materials if possible. Participation in research collaborative projects to test biodegradable FADs is encouraged.
- **Limit number of FADs**: Commit to not increase the number of FADs per vessel even if the RFMO would allow for an increase. Commit to other practices that limit the number of FADs such as:
  - ⇒ Deploying only FADs with satellite tracking buoys,
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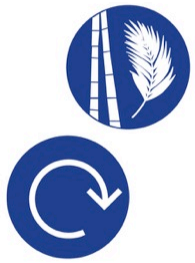
ISSF Guide of Best Practices for FAD management

5. Mitigate other environmental impacts due to FAD loss including through the use of biodegradable FADs and FAD recovery policies



Recommended best practices for mitigating environmental impacts due to FAD loss including through the use of biodegradable FADs and FAD recovery policies:

- **FAD construction and deployment:** Test whether simpler, smaller FADs effectively aggregate tunas and use them if so. Participate in research programs to determine deployment areas that are highly likely to result in stranding.
- **FAD abandonment and loss**: Promote good practices to reduce the loss and abandonment of FADs, such as:
  - ⇒ Increase storing capacity onboard purse seiners for FADs that are retrieved,
  - ⇒ Develop a program to remove a percentage of FADs from the water, relative to the number deployed,
  - ⇒ Provide FAD track data to identify areas of high incidence of stranding events and positional data on beached FADs to enable targeted recovery, and
  - ⇒ Participate in cooperative efforts to remove stranded FADs.

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6. For silky sharks, implement further mitigation efforts
(This species is the main bycatch issue in FAD sets)

Recommended best practices mitigating bycatch of silky sharks:

- **Adopt best practices to reduce shark bycatch and increase survival**: Commit to using non-entangling FADs only. Adopt a combination of practices that can reduce mortality and increase shark survival amongst the following:
  - ⇒ Making fewer FAD sets,
  - ⇒ Avoiding small sets (e.g. under 10 tons),
  - ⇒ Releasing sharks from the net, when safe and practical, and
  - ⇒ Practicing live and safe release of sharks (and rays) from the deck.


Merci
Thank you
Gracias