ISSF & the Common Oceans ABNJ Tuna Project

A journey toward sustainable tuna fisheries

International Workshop on Mitigating Environmental Impacts of Tropical Tuna Purse Seine Fisheries

12-13 March, 2019 | FAO HQ, Rome, Italy

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

Introduction

In 2009, acclaimed scientists, leaders in industry, and environmental champions launched the International Seafood Sustainability Foundation (ISSF) based on shared concerns about the future of tuna fisheries and a desire to do something about it — together.

Introduction

SCIENCE IS OUR GUIDE.

- Science, not politics or profit, drives the ISSF.
- More than 70 percent of our budget goes toward original, collaborative research by leading marine scientists across a wide range of fields.
- Our research leads to policies and practices that promote better fishery management.

THROUGH ISSF, MANY VOICES SPEAK.

- Our success depends on the diversity of our stakeholders: scientists, NGOs, governments, and foundations, as well as fishing, processing, retail, and food-service companies.
- Working together, our stakeholders develop science-based policies and practices that get proven results.
- ISSF is unique in uniting a long-term vision of conservation with a businesslike concern for accountability and results.

Introduction

WE SIDE WITH THE FACTS, NOT THE FUNDERS.

- Support from conservation-oriented foundations balances the support we receive from industry.
- Scientific institutions, NGOs, and fishing companies provide in-kind support as well as financial backing.
- All of our sponsors respect our independence. No supporting organization controls our policies, our practices, or the findings of our research.

WE CLEAR THE WAY FOR COLLABORATION.

- ISSF values the interests and expertise of all of our stakeholders: scientists, NGOs, governments, and foundations, as well as fishing, processing, retail, and food-service companies.
- When our stakeholders disagree, we help them find common ground.

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

5

Our Work

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Industry Commitment | Bycatch Mitigation | FADs & FAD Management | Fighting Illegal Fishing | Harvest Strategies

Bycatch Mitigation

Finding ways to reduce or eliminate tuna fishing's negative impacts on "non-target" species and the marine ecosystem – that's been an ISSF objective from the beginning. ISSF has researched bycatch-mitigation approaches across different fisheries and gear types, and shared our findings and recommendations with industry and tuna RFMOs. We've disseminated many best practices already, and new projects to discover even better ways to protect marine species and environments are underway.

ISSF-led Skippers Workshops in 30+ locations with 3,000+ participants

Our Work

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Industry Commitment | Bycatch Mitigation | FADs & FAD Management | Fighting Illegal Fishing | Harvest Strategies

FADs & FAD Management

Since ISSF's founding, fish aggregating devices (FADs) have been a major research topic. FAD fishing catches about 40% of tuna worldwide, and certain FAD structures can trap sharks and other marine animals, impacting bycatch rates in tuna fisheries, and pollute the ocean when they are lost or discarded. To help make FAD fishing more sustainable, ISSF examines and addresses the issue from scientific, RFMO policymaking, and industry perspectives.

ISSF provides non-entangling FAD guides for fishers in 7 languages.

Bycatch Mitigation

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

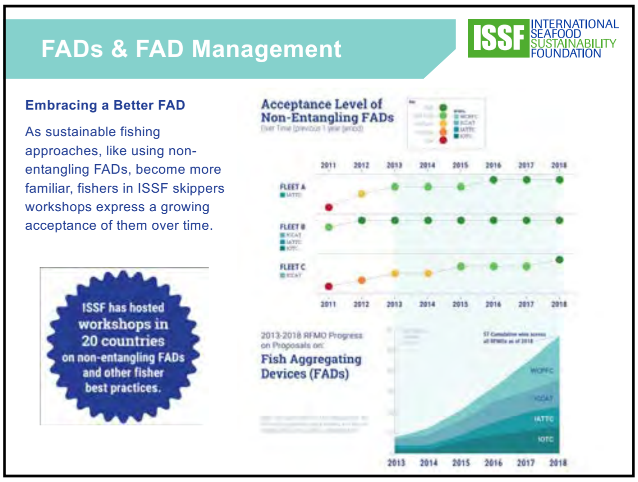
Industry Commitment | Bycatch Mitigation | FADs & FAD Management | Fighting Illegal Fishing | Harvest Strategies

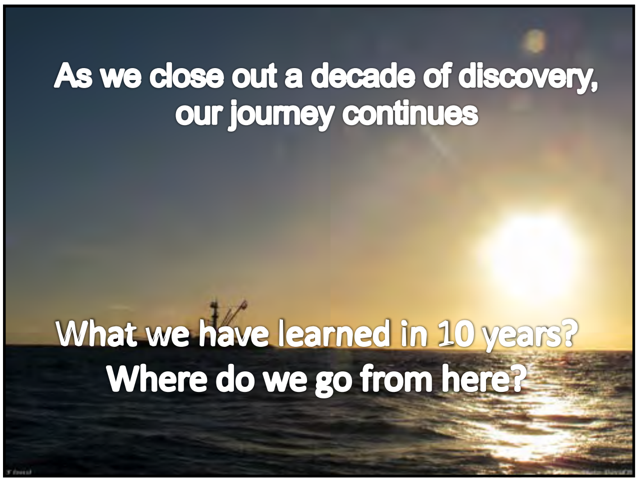
If all ISSF measures and recommendations are fully implemented, bycatch rates will be cut in half.

In addition to Skippers Workshops & videos, ISSF offers bycatch-mitigation guide-books for purse-seine and longline fishers in 10 languages.

Nearly 2,000 SKIPPERS reached to date

Enough to place 1+ ISSF-trained skipper on **EVERY large purse seine vessel** operating today


FADs & FAD Management
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Embracing a Better FAD
As sustainable fishing approaches, like using non-entangling FADs, become more familiar, fishers in ISSF skippers workshops express a growing acceptance of them over time.
ISSF has hosted workshops in 20 countries on non-entangling FADs and other fisher best practices.
Acceptance Level of Non-Entangling FADs
2011 2012 2013 2014 2015 2016 2017 2018
FLEET A
FLEET B
FLEET C
2013-2018 RFMO Progress on Proposals on:
Fish Aggregating Devices (FADs)
WCPFC
ICCAT
IATTC
IOTC


As we close out a decade of discovery, our journey continues
What we have learned in 10 years?
Where do we go from here?


ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
www.iss-foundation.org Email: info@iss-foundation.org
Thank You!
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
gef
Food and Agriculture Organization of the United Nations
COMMON OCEANS

Common Oceans ABNJ Tuna Project: A partnership for sustainability

Food and Agriculture Organization of the United Nations

Alejandro Anganuzzi
Project Coordinator
Common Oceans ABNJ Tuna Project

Global sustainable fisheries management and biodiversity conservation in the Areas Beyond National Jurisdiction Program

Four projects:

- Sustainable Management of Tuna Fisheries and Biodiversity Conservation in the ABNJ "Tuna Project"
- Sustainable Fisheries Management & Biodiversity Conservation of Deep-sea Ecosystems in the ABNJ "Deep Seas Project"
- Ocean Partnerships for Sustainable Fisheries and Biodiversity Conservation – Models for Innovation and Reform "OPP
- Strengthening Global Capacity to effectively manage ABNJ "Capacity Project"

The Common Oceans ABNJ Tuna Project

Sustainable Management of Tuna Fisheries and Biodiversity Conservation in the ABNJ:

- **To promote efficient and sustainable management of fisheries resources and biodiversity conservation in the ABNJ, in accordance with the global targets agreed in international for a.**
- **Supported by the Global Environmental Facility, with a grant of USD 27 million over five years and over USD 150 million of co-financing from the partners.**
- **More than 20 partners including all RFMOs, IGO, NGOs and private sector organizations.**
- **Since January 2014 until December 2019**

A global network of partners

Partners

CCSBT Commission for the Conservation of Southern Bluefin Tuna
IATTC Inter-American Tropical Tuna Commission
WCPFC Western & Central Pacific Fisheries Commission
ICCAT International Commission for the Conservation of Atlantic Tuna
IOTC Indian Ocean Tuna Commission
WWF World Wide Fund For Nature
ISSF International Seafood Sustainability Foundation
ISSA International Seafood Sustainability Association
ACAP Agreement on the Conservation of Albatrosses and Petrels
BLI BirdLife International
FFA Pacific Islands Forum Fisheries Agency
NOAA National Oceanic & Atmospheric Administration
Government of **Ghana**
Government of **Fiji**
OSPESCA Organización del Sector Pesquero y Acuícola del Istmo Centroamericano
SPC Secretariat of the Pacific Community
FTBOA Fiji Tuna Boat Owners Association
EU European Union
OPAGAC Organización de Productores de Atún Congelado

Main Project areas of work

C.1 Sustainable management
- Support to t-RFMO's adoption of harvest strategies.
- Support science-management dialogues.
- Support preparation of EAF plans at RFMO level

C.2 Strengthening MCS and compliance
- Capacity building and global networking for MCS officers.
- Compliance improvement in t-RFMO members.
- Port State measures template legislation
- Electronic monitoring on board vessels
- Best practices in MCS and market controls

C.3 Reducing ecosystem impacts
- Improved shark management across the Pacific.
- Bycatch reduction in purse seiners.
- Global FAD issues.
- Mortality reduction of seabirds in longliners.
- Global Information Portal on bycatch.

Food and Agriculture Organization of the United Nations

COMMON OCEANS

What has been unique about the ABNJ Tuna Project

A rare opportunity to facilitate **global collaboration between RFMOs**, exchanging technical experiences on similar subjects
- Management Strategy Evaluation
- Bycatch Mitigation
- Ecosystem Approach
- Compliance

Unique opportunity to work directly with:
- **CSO and private sector partners**: WWF; ISSF; Birdlife International, ACAP, MSC
- Other **intergovernmental organizations**: SPC, FFA, OSPESCA
- **Governments** of Fiji, Ghana US, EU

Bycatch issues in center stage

COMMON OCEANS

Coming to a future second phase (2020-2024)

Success brought an **invitation to a second phase**

Inclusive partnerships to continue

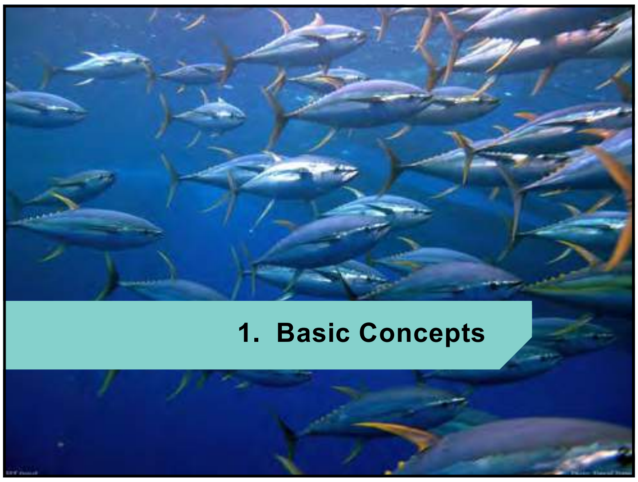
Work to continue on reducing impacts on the environment, including:
- **Bycatch reduction**
- **Better FADs: non-entangling, biodegradable**
- **Support to FAD management**

COMMON OCEANS

Objectives

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Go over **Basic Concepts** so that they do not need to be repeated in every talk
- Summarize the **Approach** used in bycatch mitigation
- **Acknowledge** sponsors, scientists and fleets
- Introduce the sessions and other **Workshop** details



Terms

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

FAD (Fish Aggregating Device)

- There are several types of floating objects that can aggregate tunas: Man-made FADs, natural logs, algae, dead whales, vessels, washing machines…
- In this workshop we call all of these either **FADs or Floating Objects (FOB)**

Bycatch

- This term means different things to different people.
- In this workshop, Bycatch means the catch of everything other than skipjack, bigeye or yellowfin tuna, **regardless of whether it is kept or discarded** (alive or dead).

Bycatch Rate

- We use this term to mean **total tons of Bycatch, divided by total tons of (SKJ+BET+YFT).**

Bycatch Ratios

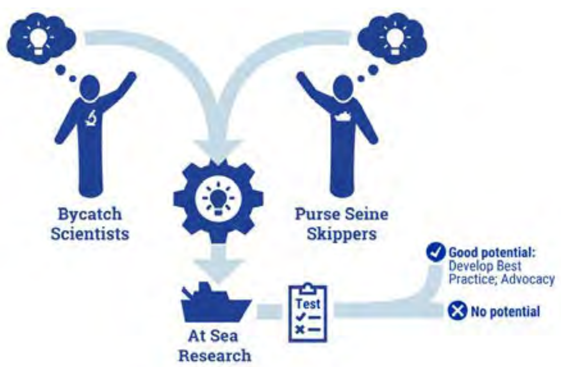
Bycatch-to-catch ratios (non-target / SKJ+YFT+BET)

- Generally small
- Decreased slightly over the past 10 years
- Highest in the Atlantic mostly because minor tuna species are caught and utilized

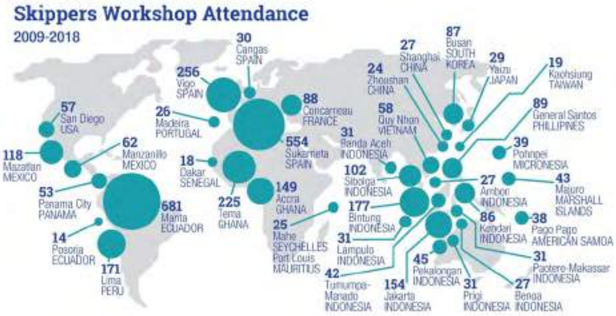
EPO	DOL	2008	0.1%
	DOL	2017	0.1%
	FAD	2008	1.1%
	FAD	2017	1.0%
	FSC	2008	0.2%
	FSC	2017	0.1%
WCPO	FAD	2008	1.0%
	FAD	2017	0.8%
	FSC	2008	0.3%
	FSC	2017	0.3%
AO	FAD	2010	13.8%
	FAD	2016	10.5%
	FSC	2010	3.4%
	FSC	2016	2.2%
IO	FAD	2008	4.0%
	FAD	2017	1.7%
	FSC	2008	0.4%
	FSC	2017	0.9%

2. Our Approach

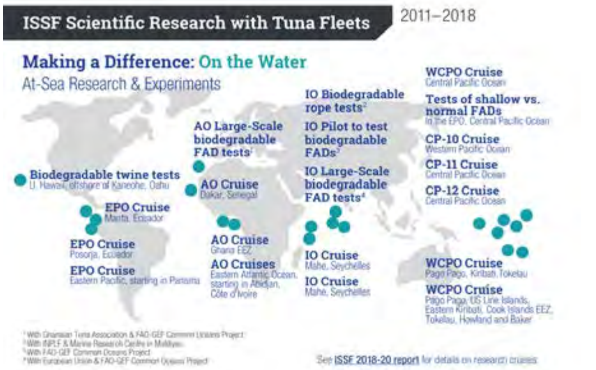
General Principle



Skippers Workshops



At-Sea Research



At-Sea Trials

Hierarchical steps

Ideas for tests are designed by the time at which the measure takes place within the fishing operation:

1. **Passive mitigation** – before the vessels are at the FAD
   e.g., non-entangling FADs; acoustic species discrimination
2. **Avoid catching bycatch** – before setting when the vessel is at the FAD, *e.g., attraction of sharks away from FADs before setting, acoustic discrimination of species before setting*
3. **Release bycatch from the net**
   e.g., release sharks and small bigeye and/or yellowfin tuna out of the net
4. **Release bycatch from the deck**
   e.g., release animals alive from the deck

At-Sea Research Activities

	Passive Mitigation	Avoid before setting	Release from net	Release from deck
1. 2011 EPO Cruise on the F/V YOLANDA L	✓	✓		✓
2. 2011 IO Cruise on the MV MAYA'S DUGONG	✓	✓		
3. 2012 EPO Cruise on the F/V VIA SIMOUN				✓
4. 2012 IO Cruise on the F/V TORRE GIULIA	✓	✓	✓	✓
5. 2012 WCPO Cruise on the F/V CAPE FINISTERRE			✓	✓
6. 2013 WCPO cruise on the F/V CAPE FINESTERRE		✓	✓	✓
7. 2014 WCPO Cruise on the ALBATUN TRES	✓	✓	✓	
8. 2014 CP-10 cruise (with SPC)		✓		
9. 2015 AO cruise on the F/V CAP LOPEZ	✓			
10. 2015 Biodegradable twine tests at U. Hawaii	✓			
11. 2015-2017 tests of shallow versus normal depth FADs in the equatorial EPO	✓			
12. 2015 CP-11 cruise (with SPC)		✓		
13. 2015 AO Cruise on the SEA DRAGON	✓	✓		
14. 2016 AO Cruise on the F/V MAR DE SERGIO	✓	✓	✓	
15. 2016 EPO Cruise on the F/V LJUBICA			✓	
16. 2016 Acoustic research in Achotines, Panama (with IATTC)	✓			
17. 2016 CP-12 cruise (with SPC)		✓		
18. 2016 Biodegradable twine tests in the Maldives	✓			
19. 2017 Test of biodegradable ropes in FADs in the western Indian Ocean	✓			
20. 2018 AO Cruise on the F/V PACIFIC STAR			✓	✓
21. 2018 CP Cruise (with SPC)		✓		
22. 2018 IO Cruise on the F/V TALENDUIC			✓	✓

Bycatch Research Steering Committee

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Javier Ariz*
Diego Bernal
Richard Brill
Laurent Dagorn
Martin Hall
Kim Holland
David Itano
Bruno Leroy
Gala Moreno
Simon Nicol*
Miki Ogura*
Hiroaki Okamoto*
Tatsuki Oshima
Jacques Sacchi
Kurt Schaefer
Peter Sharples*

* Past Members

Diverse expertise

Skippers' Workshop Team

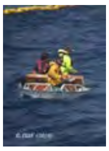
INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Laurent Dagorn
Fabien Forget
Martin Hall
David Itano
Eric Largacha
Gala Moreno
Jefferson Murua
Igor Sancristobal
Anung Widodo

At-Sea Researchers

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Shiham Adam
Rhett Bennett
Alfredo Borie
Guillermo Boyra
Patrice Dewals
Cory Eddy
John Filmalter
Fabien Forget
Dan Fuller
Kim Holland
Melanie Hutchinson
David Itano
Riyaz Jauhary
Bruno Leroy
Udane Martinez
Gala Moreno
Jeff Muir
Blanca Onue
Alex Salgado
Igor Sancristobal
Kurt Schaefer
Beth Vanden Heuvel



Teams

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Jeff Muir: **8 cruises**

Fabien Forget: **8 cruises**

JD Filmalter: **6 cruises**

Our Funders

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

gef

Food and Agriculture Organization of the United Nations

COMMON OCEANS

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

GORDON AND BETTY MOORE FOUNDATION

WALTON FAMILY FOUNDATION

Our Research Partners

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

azti tecnalia

IRD Institut de Recherche pour le Développement

Pacific Community Communauté du Pacifique

CIAT IATTC

University of Hawai'i

Marine Research Centre

WWF

IPNLF International Pole & Line Foundation

NRF SAIAB

The Vessels and Their Crew

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

ALBATUN TRES
CAP LOPEZ
CAPE FINISTERRE
GUTSY LADY 4
INPESCA (fleet)
LJUBICA
MAR DE SERGIO
MAYA'S DUGONG
NIRSA (fleet)
PACIFIC STAR
PACIFIC SUNRISE
SEA DRAGON
TALENDUIC
TIMARINE (fleet)
TORRE GIULIA
VIA SIMOUN
YOLANDA L

PHOTOS © ISSF 2014, 2011 Fabien Forget

Service Providers

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

ARCHIPELAGO MARINE RESEARCH

marine instruments

satlink

THALOS ADVANCED MARITIME SOLUTIONS

WILDLIFE COMPUTERS

vemco

ZUNIBAL

DOS DIGITAL OBSERVER SERVICES

itsaskorda

SIMRAD

Sessions

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Day 1 — PM
- Session 1: **Bycatch of the Tuna Purse Seine Fishery** — V. Restrepo
- Session 2: **Sharks and Rays** — L. Dagorn

Day 2 — AM
- Session 3: **Small BET and Yellowfin Tunas** — J. Murua
- Session 4: **FAD Structure Impact** — G. Moreno

Day 2 — PM
- Session 5: **FAD Management** — V. Restrepo
- Session 6: **Looking Ahead: The Next 10 Years** — L. Dagorn

EACH SESSION:
Introduction, Poll / 10 min.
Presentation / 35 min.
Discussion Panel / 45 min.

Logistics

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Facilitator: Ian Cartwright

Simultaneous Interpretation: Speak slowly; use microphone

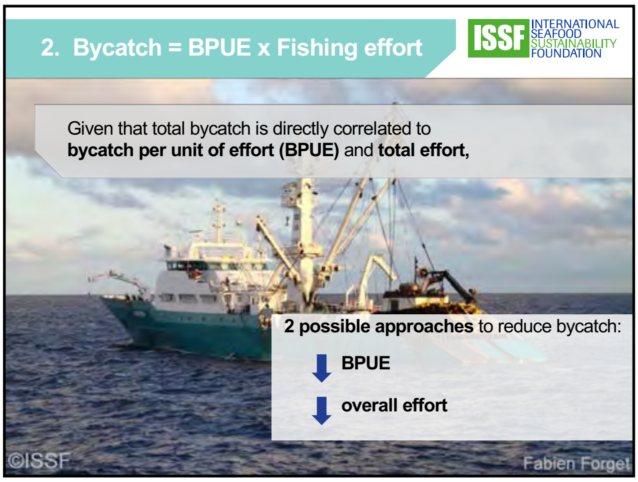
Food: On your own (FAO cafeterias). Be prompt!

Next: Poll training!

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

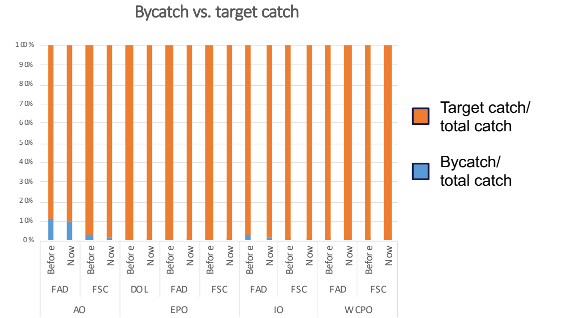
Bycatch of the tuna purse seine fishery

1. Perception of bycatch issues 10 years ago and now
2. Bycatch = BPUE x Fishing effort
3. Total bycatch and bycatch by species group
4. Bycatch composition
5. Other tropical tuna fishing gears
6. Observers programs globally
7. Electronic monitoring
8. Retention and utilization
9. Skippers' Workshop results



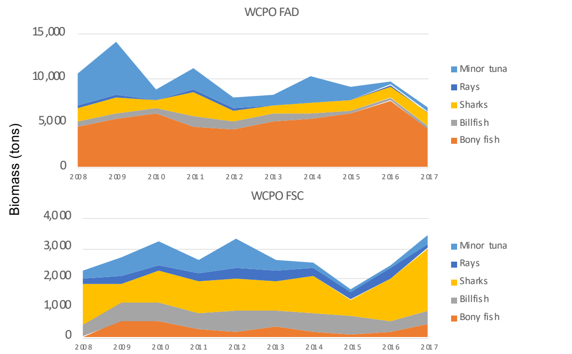
3. Bycatch vs. Target Catch

Total catch composition: Bycatch vs. target tuna catch



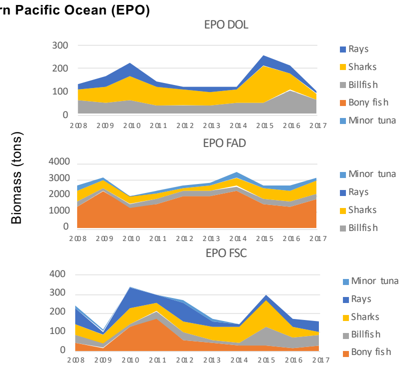
4. Bycatch by Species Group

Western and Central Pacific Ocean (WCPO)



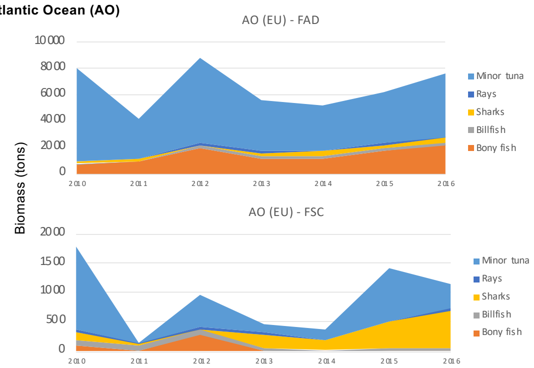
4. Bycatch by Species Group

Eastern Pacific Ocean (EPO)



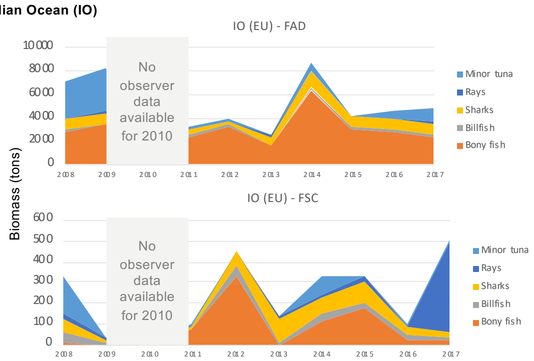
4. Bycatch by Species Group

Atlantic Ocean (AO)



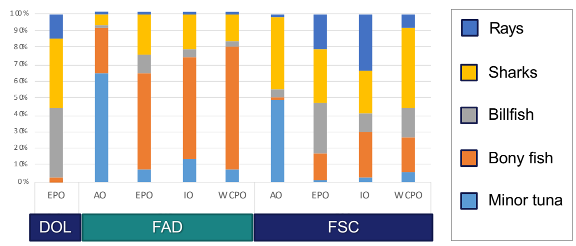
4. Bycatch by Species Group

Indian Ocean (IO)



4. Bycatch by Species Group

ALL OCEANS — Current bycatch by species group and set type



5. Other Gears

5. Other Gears

Indian Ocean (2014–2016)

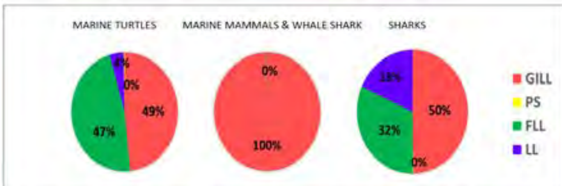


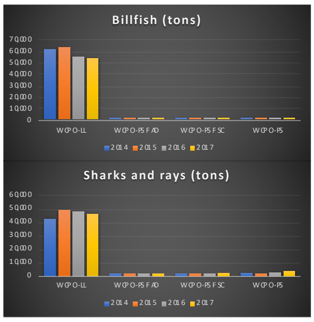
Figure 1: Contribution of fresh-tuna longline (green), deep-freezing longline (blue), gillnet and driftnet (red), and purse seine (yellow) to the total bycatch estimated for marine turtles (in number, left), marine mammals (in number, middle), and sharks (in weight, right), for the period 2014-16.

Garcia, A. and Herrera, M. (2018)

5. Other Gears

Western and Central Pacific Ocean (2014–2017)

Contribution to total mortality of purse seine and longline fisheries



PS / SPC (pers. comm Feb 2019)

LL / Peatman *et al.* (2018) WCPFC-SC14-2018/ST-WP-03

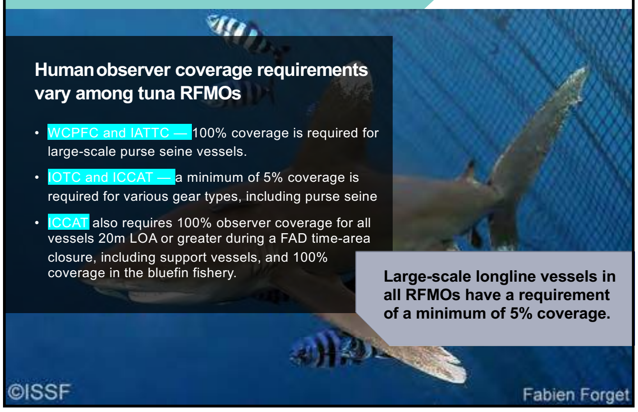
6. Observer Programs Globally

- **WCPFC ROP** — 2007
- **Forum Fisheries Agency (FFA)** — 1986
- **IATTC/AIDCP Program** — 1993
- **ICCAT Scientific Observer program** — 2010
- **ICCAT Eastern Atlantic and Mediterranean Bluefin Tuna Observer Programs** — 2010
- **ICCAT Observer Program for Bigeye and Yellowfin** — 2011
- **IOTC Regional Observer Scheme** — 2010
- **CCSBT Observer Program** — 2001

6. Observer Programs Globally

- Most programs were created as a solution to **low data reporting by crew**
- All RFMO programs have **detailed training standards** and entrance qualifications (no conflict of interest)
- **Observers functions differ** among RFMOs – **scientific role** vs dual **scientific and compliance role**.
- Observer **coverage** requirements are also different depending on ocean/region

6. Observer Programs Globally



7. Electronic Monitoring

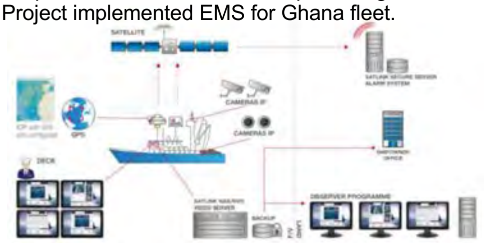
Development of Electronic Monitoring Systems (EMS) was triggered by:

- The need for an **alternative source of data** that could complement data collected by human observers (e.g. EMS can provide 24 hour coverage, monitor both decks at the same time)
- **Space problems** in small vessels
- Need to reduce **corruption** and enhance **safety**

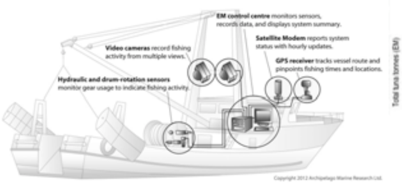
7. Electronic Monitoring

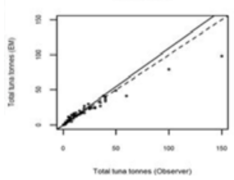
EMS: **Useful tool** to monitor many aspects of fishing operations, for scientific and/or compliance purposes. Also for vessel owner.

ISSF PS pilots in all Oceans showed promising results. ABNJ Tuna Project implemented EMS for Ghana fleet.



7. Electronic Monitoring





7. Electronic Monitoring

EMS could **complement human observers**, depending on the goals.

- One of the strengths in PS fisheries is reporting of large specimens
- There are still some weaknesses, e.g. accurate species composition (but this is also a problem for humans)

EMS could significantly **increase the coverage** of current programs.

A certain **level of human observer coverage** is still needed (e.g. biological samples, fishing activity at a fine scale).

Some RFMOs have already adopted **EMS minimum standards for PS** to harmonize the implementation of EM systems across different vendors.

8. Retention and Utilization

Full retention and subsequent utilization of non-target species is one way in which the wasteful practice of discarding fish at sea can be reduced.

Several pilot projects have been conducted to better understand the potential for bycatch utilization in tropical tuna purse seine fisheries.

IMPLEMENTATION OF PILOT PROJECTS TO EXPLORE THE MARKET VIABILITY OF FULL RETENTION OF NON-TUNA SPECIES IN PURSE SEINE FISHERIES / ISSF Technical reports 2014-12 and 2016-16

Retaining bycatch to avoid wastage of fishery resources: How important is bycatch landed by purse-seiners in Abidjan? / SCRS/2016/017

Utilization and trade of *faux-poisson* landed in Abidjan / SCRS/2016/158

8. Retention and Utilization

MAIN OUTCOMES/ RECOMMENDATIONS

- ✓ **Pilot bycatch marketing projects should continue** in additional areas, along with efforts to monitor and encourage enhanced bycatch utilization.
- ✓ **Priority: WCPO and IO**. In the AO bycatch utilization is already at high levels. In the EPO total retention for all catch has long been common practice.
- ✓ **Need to increase availability and timeliness of observer data on all aspects of bycatch and utilization**, including information on the post-harvest disposal of both bycatch and small/undersized tunas.

9. Skippers Workshops Results

- ✓ **Include fishers in the process**. They are experts and in charge of daily fishing operations. They provide feedback on activities most likely to succeed in their ocean and type of vessel.
- ✓ **Perception of bycatch issues for fishers and fleets is not fixed**, but rather evolves overtime. Provision of "sound" scientific information helps.
- ✓ **Reward for good practices that benefit fishers and companies**. Incentive of better fish prices and market options, avoid closures or prohibitions, etc. are ways to encourage skippers to adopt best bycatch mitigation practices.
- ✓ **Fishers want to catch tuna and do not like to generate bycatch**. For them it is a problem, hence they are interested in solutions, especially when they do not interfere greatly with the fishing operation.

Concluding remarks

- **Overall rates of bycatch in tropical tuna purse seine fisheries are very small**
- In the **Atlantic Ocean, bycatch rates are higher** due to minor tuna species which are targeted and marketed.
- Purse seine fisheries in all oceans are **required to carry some level of human observer coverage**, the main source of bycatch data
- **EMS can augment the data collected on bycatch.**

Concluding remarks

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- **Retention and utilization is one way of reducing discards**. Utilization is already high in the Atlantic.
- **Skippers are interested in reducing the bycatch** generated in their fisheries. Keeping them involved in the process is key.

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

Session 2

Sharks and Rays

International Workshop on Mitigating Environmental Impacts of Tropical Tuna Purse Seine Fisheries

12-13 March, 2019 | FAO HQ, Rome, Italy

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

Key Shark Species Caught by Purse Seiners

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Over 90% of shark bycatch by purse seiners is composed of **Silky Sharks** (mostly small individuals)

Key Shark Species Caught by Purse Seiners

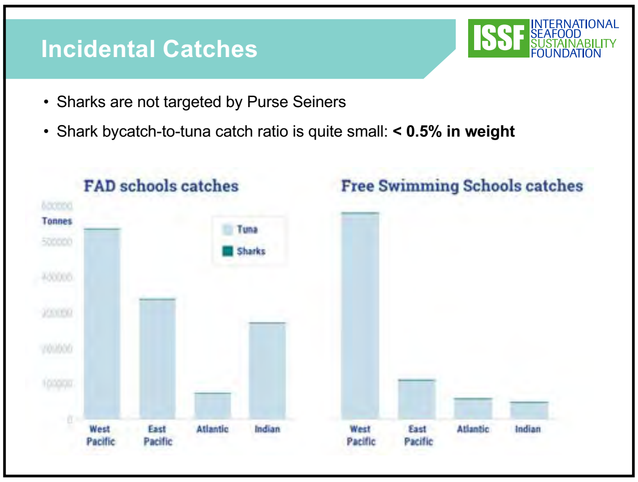
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Second main shark species caught at FADs is **Oceanic White Tip Sharks**
- Commonly **perceived as rare**
- There is a wide consensus that **populations are decreasing**

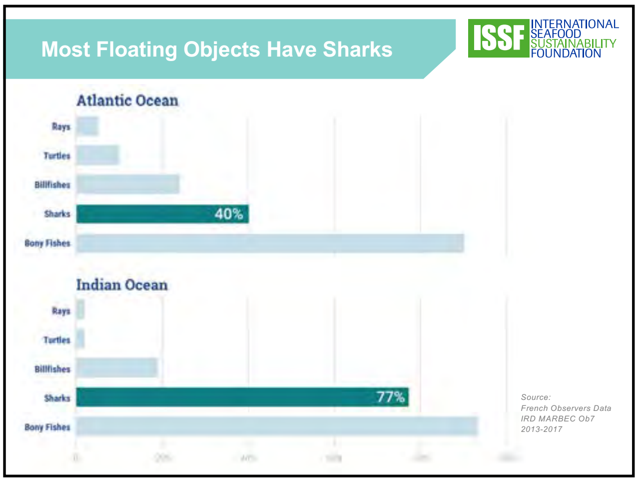
Whale Sharks & Mobulid Rays

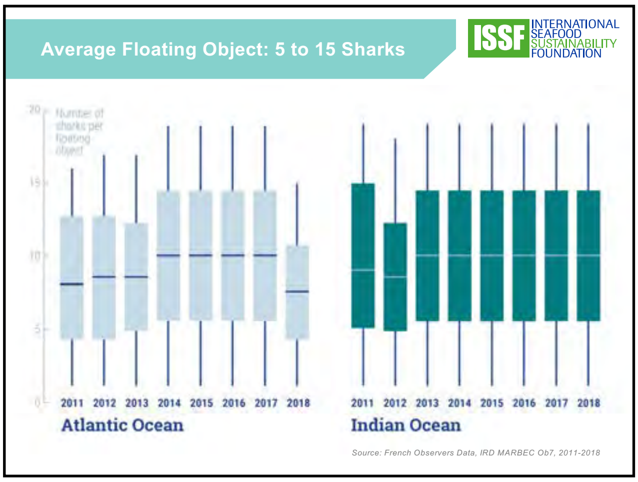
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

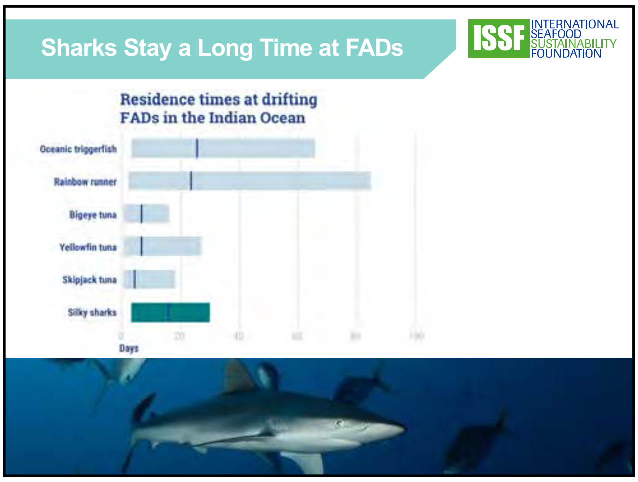
Whale sharks and **Mobulid rays** are not caught on logs or FADs, but some sets are done on tunas associated with them.

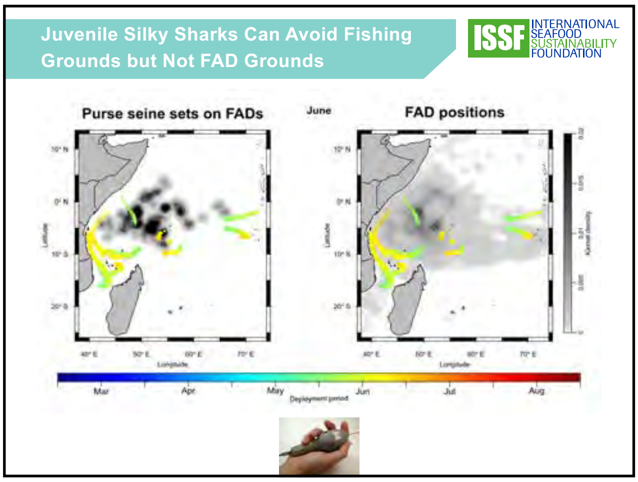

Incidental Catches
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
• Sharks are not targeted by Purse Seiners
• Shark bycatch-to-tuna catch ratio is quite small: < 0.5% in weight
FAD schools catches
Free Swimming Schools catches
Tonnes
Tuna
Sharks
West Pacific
East Pacific
Atlantic
Indian

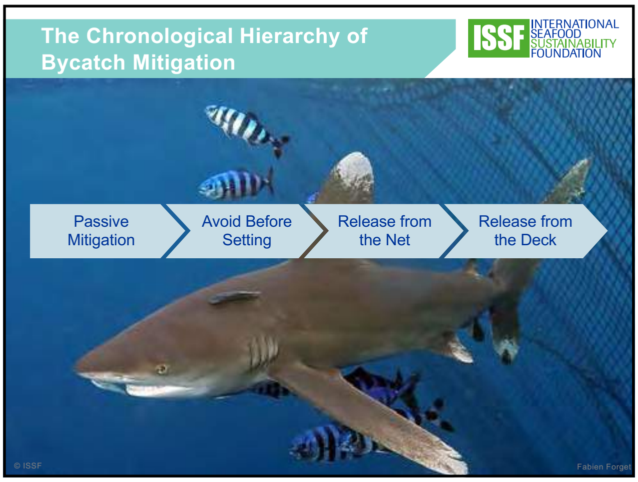

Caught by Several Gears
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Global contribution of fishing gears to catches of SILKY SHARKS
13%
35%
8%
44%
Purse Seine
Longline
Gillnet
Others
Global contribution of fishing gears to catches of WHITE TIP SHARKS
16%
51%
8%
25%
Purse Seine
Longline
Gillnet
Others
Source: FAO 2018

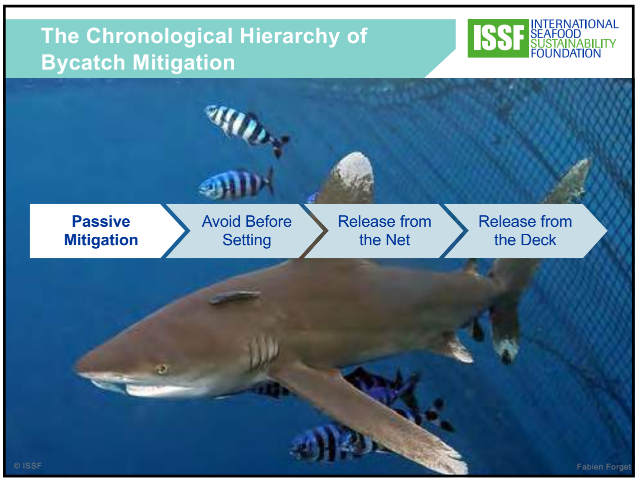

Most Floating Objects Have Sharks
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Atlantic Ocean
Rays
Turtles
Billfishes
Sharks
40%
Bony Fishes
Indian Ocean
Rays
Turtles
Billfishes
Sharks
77%
Bony Fishes
Source: French Observers Data IRD MARBEC Ob7 2013-2017


Average Floating Object: 5 to 15 Sharks
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
2011
2012
2013
2014
2015
2016
2017
2018
Atlantic Ocean
2011
2012
2013
2014
2015
2016
2017
2018
Indian Ocean
Source: French Observers Data, IRD MARBEC Ob7, 2011-2018


Sharks Stay a Long Time at FADs
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Residence times at drifting FADs in the Indian Ocean
Oceanic triggerfish
Rainbow runner
Bigeye tuna
Yellowfin tuna
Skipjack tuna
Silky sharks
Days


Juvenile Silky Sharks Can Avoid Fishing Grounds but Not FAD Grounds
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Purse seine sets on FADs
June
FAD positions
Mar
Apr
May
Jun
Jul
Aug


The Chronological Hierarchy of Bycatch Mitigation
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Passive Mitigation
Avoid Before Setting
Release from the Net
Release from the Deck
© ISSF
Fabien Forget


The Chronological Hierarchy of Bycatch Mitigation
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Passive Mitigation
Avoid Before Setting
Release from the Net
Release from the Deck
© ISSF
Fabien Forget

Sharks Like Playing… but it can be risky

Entanglement Issues

Scientists, managers, fishers:

Problem of entanglement of sharks in nets of FADs was considered negligible compared to fishery mortality

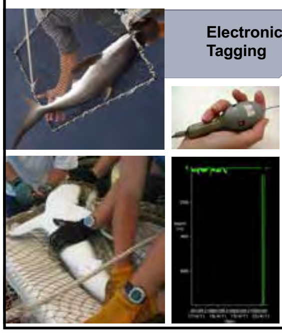
© Fabien Forget

How Did We Find It?

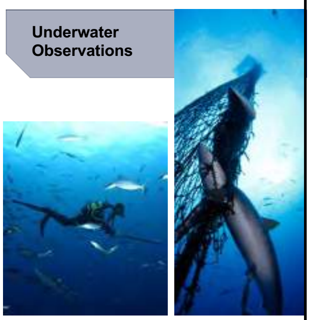
Two independent methods have shown the extent of the issue in the Indian Ocean.

Filmalter et al. 2013 Frontiers in Evol & Env

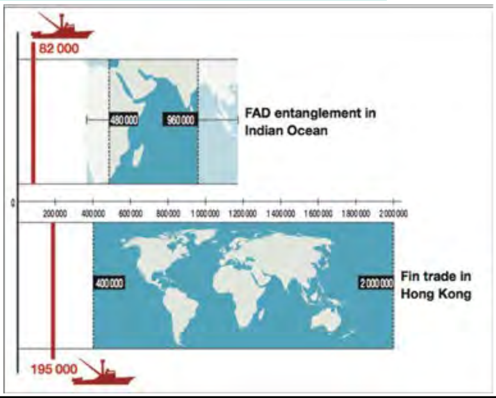
Electronic Tagging

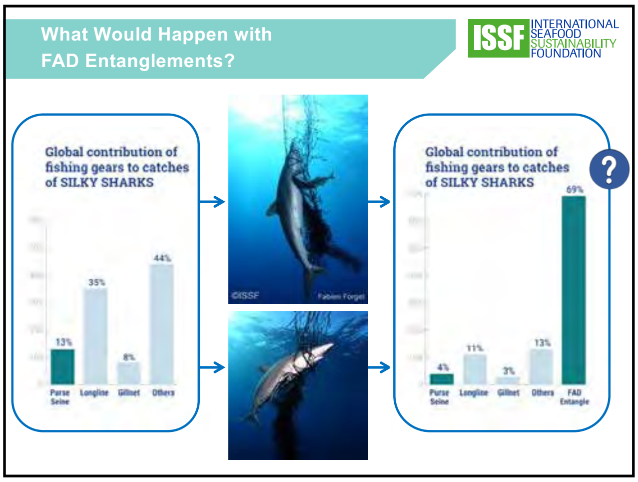


Underwater Observations

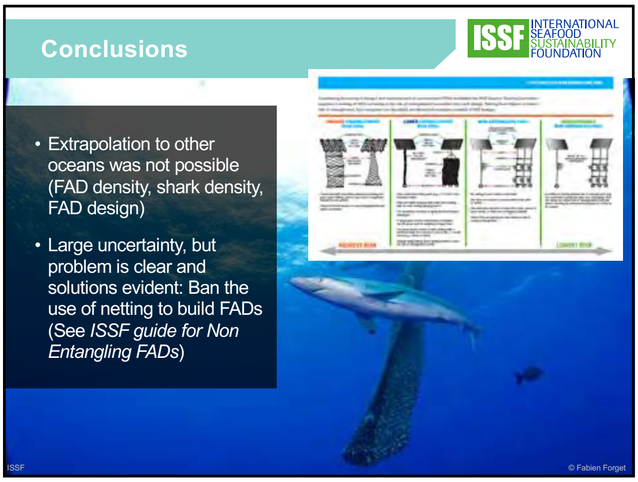


Modeling

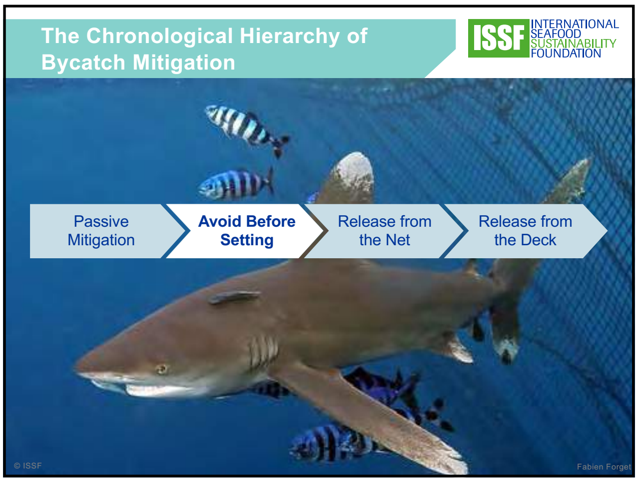




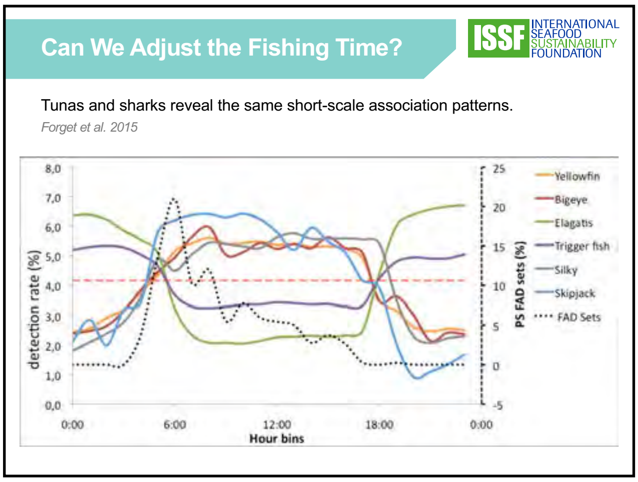
What Would Happen with FAD Entanglements?
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Global contribution of fishing gears to catches of SILKY SHARKS
13%
35%
8%
44%
Purse Seine
Longline
Gillnet
Others
©ISSF
Fabien Forget
Global contribution of fishing gears to catches of SILKY SHARKS
?
4%
11%
3%
13%
69%
Purse Seine
Longline
Gillnet
Others
FAD Entangle



Conclusions
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
• Extrapolation to other oceans was not possible (FAD density, shark density, FAD design)
• Large uncertainty, but problem is clear and solutions evident: Ban the use of netting to build FADs (See ISSF guide for Non Entangling FADs)
ISSF
© Fabien Forget



The Chronological Hierarchy of Bycatch Mitigation
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Passive Mitigation
Avoid Before Setting
Release from the Net
Release from the Deck
© ISSF
Fabien Forget

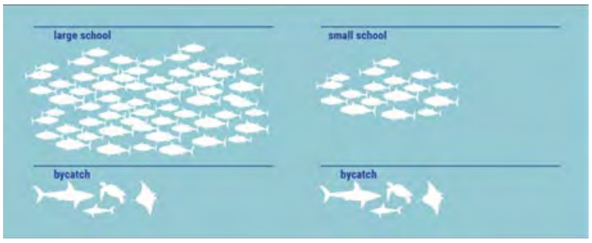


Can We Adjust the Fishing Time?
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Tunas and sharks reveal the same short-scale association patterns.
Forget et al. 2015
detection rate (%)
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
0:00
6:00
12:00
18:00
0:00
Hour bins
PS FAD sets (%)
25
20
15
10
5
0
-5
Yellowfin
Bigeye
Elagatis
Trigger fish
Silky
Skipjack
FAD Sets

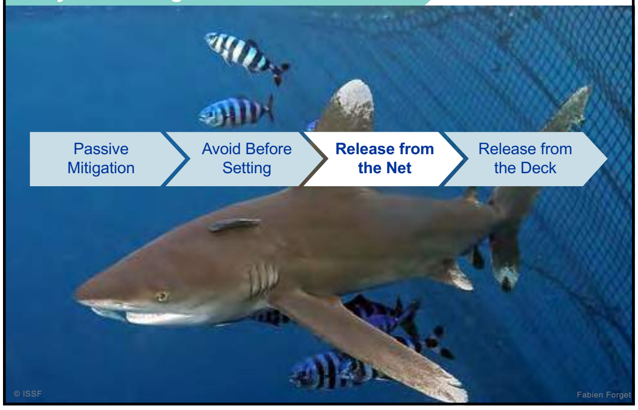
Target Large Schools

Avoiding sets on schools of tuna less than 10 tons would reduce the amount of bycatch of silky sharks by **21-41%** depending on the ocean.

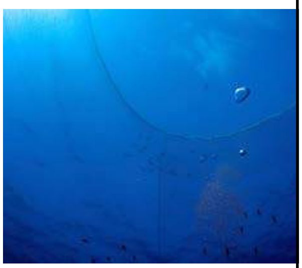
Dagorn et al. 2012



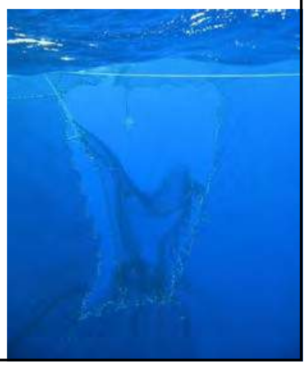
The Chronological Hierarchy of Bycatch Mitigation



Sharks Aggregate in a Particular Area of the Net



Create a Window in the Net

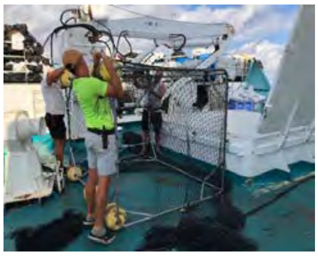


Let the Sharks Swim Out…

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Shark Trap

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION



Fishing for Sharks

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Fish and Release

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

15-35% of sharks present in the net can be caught and released.

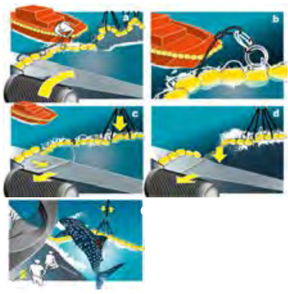
Fish-and-Release Success

15–35% of sharks present in the net can be caught and released (depending on shark fishing experience) with **97% survival rate**

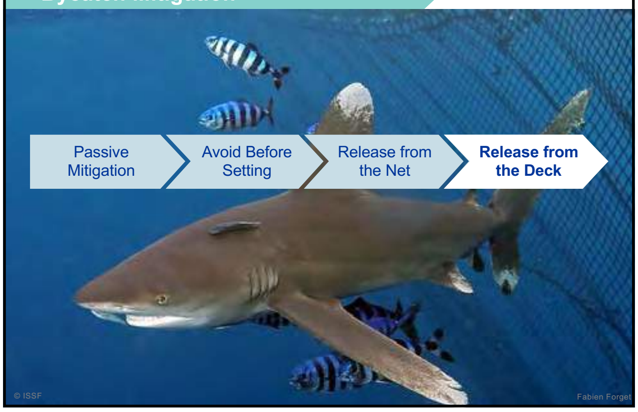
Whale Sharks

12 whale sharks encircled in tuna purse seine nets and released using "best practice," when possible (ISSF + IRD/AZTI projects) — **NO MORTALITY**

Escalle et al. 2016



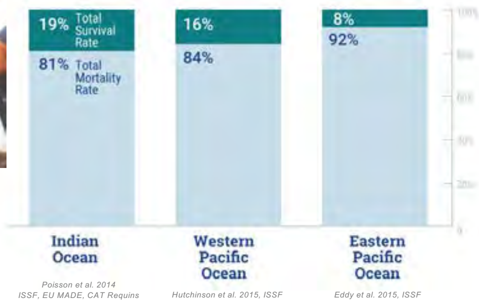
The Chronological Hierarchy of Bycatch Mitigation



70% of Sharks Arrive Dead on the Deck… but 30% Arrive Alive

Post-Release Survival of Silky Sharks

Studies in three oceans, onboard different purse seiners, have shown that about **50% of sharks released can survive**

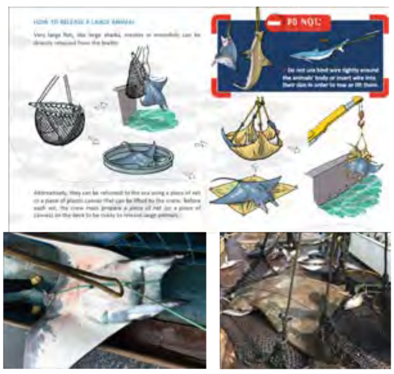


Protecting Sharks

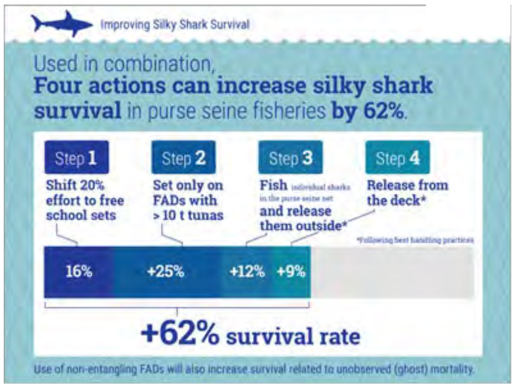
Mobulid Rays

Chilean Devil Ray
ISSF Atlantic
6 tagged rays
5 mortalities
17% survival

Spintail Devil Ray
Francis & Jones 2017
7 tagged rays
4 mortalities
43% survival



Improvements Achieved So Far




INTERNATIONAL
SEAFOOD
SUSTAINABILITY
FOUNDATION
www.iss-foundation.org
Email: info@iss-foundation.org
Thank You!
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
gef
Food and Agriculture Organization of the United Nations
COMMON OCEANS

Session 3

Small Bigeye & Yellowfin Tunas

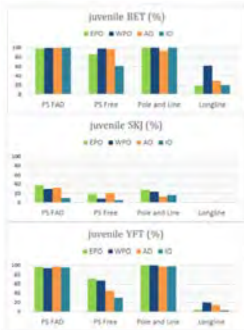
International Workshop on Mitigating Environmental Impacts of Tropical Tuna Purse Seine Fisheries

12-13 March, 2019 | FAO HQ, Rome, Italy

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

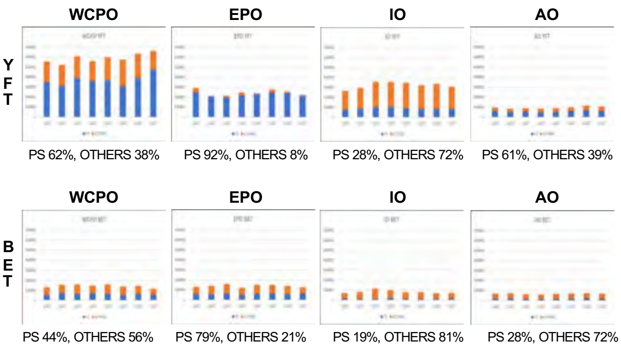
What are "Small Tunas"?

- Commercially speaking, undesirably small tuna sizes are individuals below 3 pounds/ 1.4 kg. Biologically, most YFT and BET below 1 m length are juvenile/immature.
- Most gears catch to some degree juvenile YFT and BET.
- PS catches on FADs for target species are: SKJ (70%), YFT (20%) and BET (10%).
- Discarding of undesirable sizes of SKJ, YFT and BET tuna is not permitted by most RFMOs and other organizations (e.g. ISSF Measure 3.3).
- Different from "minor tunas" which are species such as the *Auxis* group (bullet and frigate tunas) and the *Euthynnus* group (Pacific black skipjack and little tunny). In some fisheries these species are targeted and commercialized.



Source: Restrepo et al. 2017

YFT & BET Catch by Ocean and Gear 2010–2017

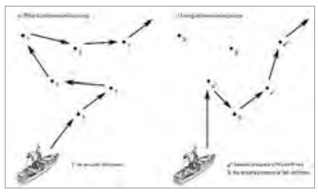


Quality Stock Evaluations Require Good Data

- Key to reliable stock evaluations need quality scientific data (e.g. observer data, buoy data, fishing technology, etc.).
- MSY is notoriously difficult to estimate as models are highly sensitive to assumptions.
- Precise knowledge on biological characteristics of each stock are essential → Improving last 10 years.
- Reliable CPUEs accounting for "technological creep" and fishing strategies → Rapid evolution, complex.

Itano et al. 2005

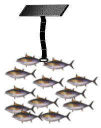
Artificial intelligence ID systems (EMS, smartphones…)?

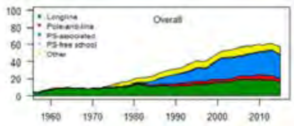


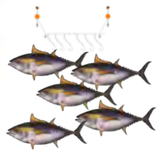
Source: Lopez et al. 2014

Overfishing & Loss of Yield Per Recruit

A stock can be overfished by catching to many juveniles, too many adults or a combination of both.



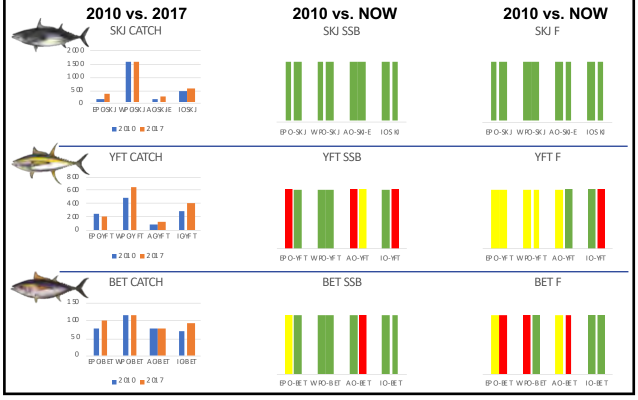




Estimates of reduction in spawning potential due to fishing WCPO bigeye by various gears / *Source: McKechnie et al., 2017*

Potential yield results from differences in catch sizes. Having the right equilibrium of gears to catch small vs. large fish is often a **political management decision** rather than scientific.

Tropical Tuna Stock Status



Small YFT/BET Mitigation Activities

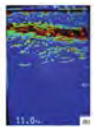
- Acoustic selectivity to address undesired tuna mortality in FADs
- Tuna behaviour around the FAD and in the net (spatial and temporal separation)
- Effect of FAD depth on BET aggregation
- Fishery-independent indexes of abundance

Predicting Tuna Composition at FADs

With current PS acoustics (sonars, echo-sounders) it is difficult to distinguish tuna species at FADs.

Table 2. Predicted and actual weight (t) by species, and bigeye and yellowfin combined, along with the percent difference (% Dif) for the eight catch prediction experiments.

	Skipjack			Bigeye			Yellowfin			Bigeye and yellowfin		
Set	Predicted	Captured	% Dif	Predicted	Captured	% Dif	Predicted	Captured	% Dif	Predicted	Captured	% Dif
1	35.0	50.9	37.0	18.0	6.2	96.3	22.0	14.2	44.1	40.0	20.5	64.1
2	45.0	55.1	20.2	7.0	5.9	17.1	11.0	13.4	19.1	18.0	19.3	7.0
3	13.0	16.4	23.1	5.0	1.0	133.3	2.0	4.6	78.8	7.0	5.6	22.2
4	93.0	115.1	21.2	33.0	13.8	82.1	34.0	18.0	61.5	67.0	31.8	71.3
5	8.0	14.5	57.8	30.0	11.7	87.8	20.0	12.8	43.9	50.0	24.5	68.5
6	90.0	166.9	59.5	35.0	6.6	136.5	37.0	8.9	122.4	72.0	15.5	129.1
7	65.0	110.9	52.2	35.0	3.0	174.4	30.0	29.9	0.3	66.0	31.9	68.1
8	25.0	56.3	77.0	9.0	3.3	118.6	12.0	13.7	13.2	21.0	16.0	27.0
x̄ % difference			43.5			106.3			47.9			57.2

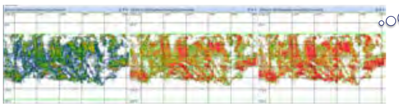


Source: Fuller and Schaefer, 2014

Acoustic Discrimination

BET?
SKJ?
YFT?

Selective fishing to address undesired tuna catches

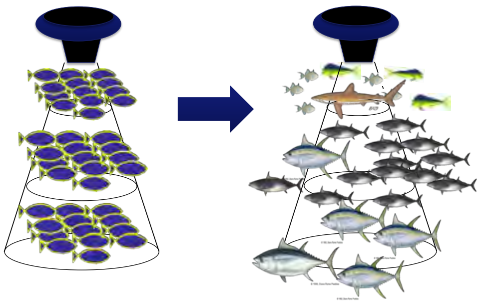


99%
SKJ

Technology to Address Undesired Tuna Mortality

ROUGH BIOMASS ESTIMATES

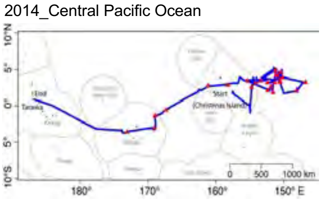
BIOLOGICALLY RELEVANT MEASURES



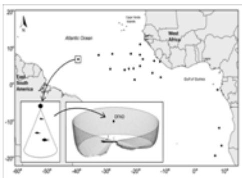
Research Towards Tuna Species Discrimination

Research cruises on-board purse seiners

2014_Central Pacific Ocean



2016_ Atlantic Ocean



Research Towards Tuna Species Discrimination

2016_Ex-situ measurements of YFT Target Strength

Target Strength measurements based on theoretical models

Source: Boyra et al. 2018

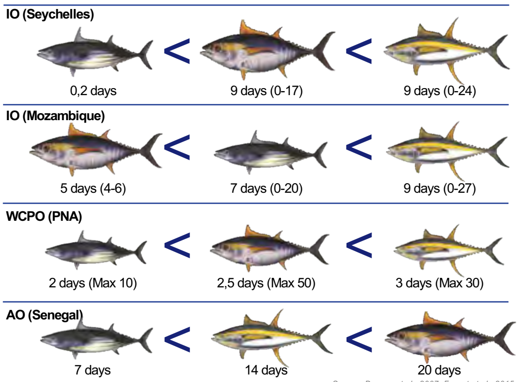
Acoustics: State of Knowledge & Technology

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Frequency response is promising for discrimination between tunas.
- Obtained TS for BET and SKJ, which is fundamental knowledge needed to scale acoustic measurements into biomass, and can be integrated in acoustic tools used by fishers.
- Buoy manufacturers have started introducing 2 contrasting frequencies in their buoys.
- Future work: improve TS-size frequencies for YFT, develop refined discrimination algorithms, make knowledge available to fishers and technology manufacturers.

Tuna Residency at Dfads

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION



Source: Dagorn et al., 2007; Forget et al., 2015

SKJ SHORT RESIDENCY TIMES

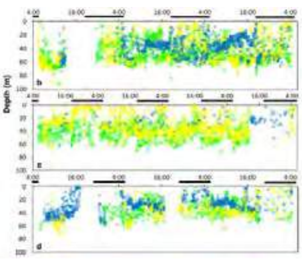
YFT STAYS AT FAD LONGER

Tuna Diel Behavior at FADs

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

When associated with dFADs swimming depths of SKJ, BET and YFT (e.g. 0-100 m) day-night movements are shallower than the effective fishing depths of most PS nets (e.g. 120-160 m)

EPO 2011 Research Cruise



SKJ ◯
YFT ◯
BET ◯

Source: Schaefer and Fuller, 2013

Catching SKJ Away From the FAD

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- There is variability in movements of SKJ and YFT, with temporary formations of species-specific subgroups.
- Targeting mono-specific SKJ schools when they move away from the FAD does not seem feasible to reduce fishing of small YFT /BET.

EPO 2011 Research Cruise

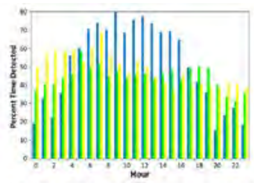


Fig. 3 Percent of time all skipjack (blue), bigeye (green), and yellowfin (yellow) tunas were within detection range of the VR2W

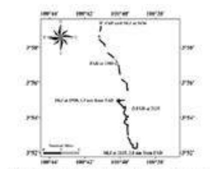
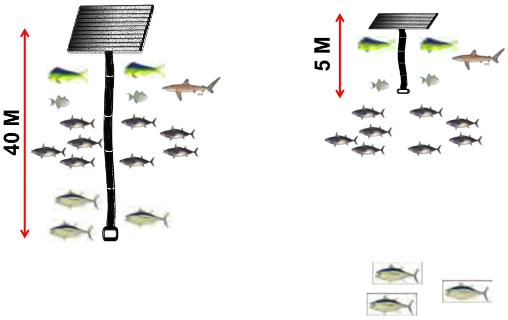


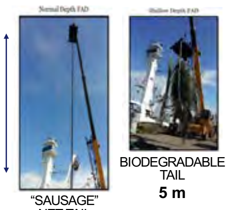
Fig. 5 A 5-h track (black broken line) of a 51-cm skipjack tuna (SKJ), with a continuous ultrasonic transmitter, as it moved relative to the position of the FAD (black circles), at which it was released during experiment 7

Source: Schaefer and Fuller, 2013

Effect of FAD Depth on Catch Composition



Effect of FAD Depth on Catch Composition

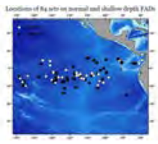


"SAUSAGE" NET TAIL
37–45 m

BIODEGRADABLE TAIL
5 m

Summary of 84 sets by 11 NIRSA vessels on normal and shallow depth FADs

	Normal	Shallow
Number of sets (% FADs)	49 (33 %)	35 (23 %)
Range in set dates	7/16/2015 - 11/06/2017	7/19/2015 - 10/13/2017
Range in set locations	15 S - 6 N, 91 W - 148 W	10 S - 5 N, 81 W - 149 W
Average (range) SKJ catch (t)	9.8 (1 - 117)	13.0 (0 - 144)
Average (range) BET catch (t)	6.6 (0 - 134)	6.7 (0 - 35)
Average (range) YFT catch (t)	1.2 (0 - 20)	2.9 (0 - 13)
Average (range) total tuna catch (t)	17.6 (0 - 140)	22.6 (0 - 151)
Average (range) proportion of BET	0.25 (0 - 0.96)	0.26 (0 - 0.83)



1st Experiment:
50 FADs each

2nd Experiment:
100 FADs each

Source: Schaefer et al. 2016, 2018 IATTC, NIRSA, ISSF

Tuna Behavior: Distribution in the PS Net

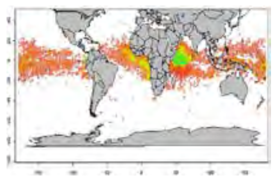
Atlantic Ocean TTV Research Cruise

VIDEO:
WCPO ISSF Trimarine Research Cruise

Source: Itano et al., 2012, 2017

Tuna Fishery-Independent Indices of Abundance

- Currently no method exists for obtaining direct, fisheries-independent estimates of tuna populations.
- Electronic tags provide information on associative patterns over the course of several months.
- Fishers use FADs with echo-sounder buoys with information on presence and abundance of tunas. (+100,000 per year).
- If we know FAD densities and associative behaviors of each species, we can translate real-time information of associated populations into total population estimates.



Source: Moreno et al., 2016; Capello et al., 2016

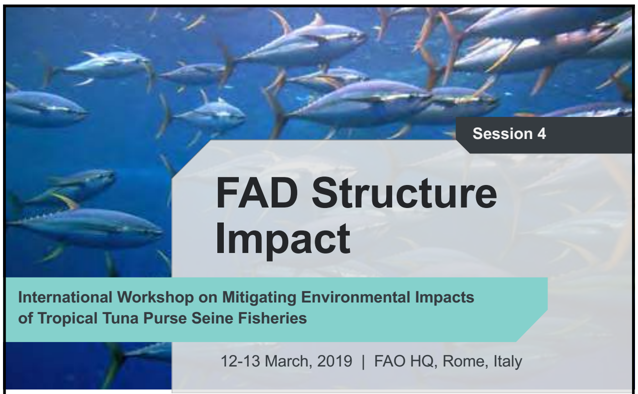
Small BET and YFT Tunas Skippers Workshop Results

- Fishing areas, rather than FAD depth, determining BET presence and the possibility of real-time closures.
- Regulations like closures or TACs have an effect on the fishing strategies of fleets.
- Difficulty discerning species composition at FADs with current acoustic technology used by fishers. Progress required to improve the species identification using multiple frequencies.
- Small-scale vessels in developing countries due to low technology and proximity to the coastline catch mostly BET and YFT of smaller sizes.

Conclusions

- Catching juvenile BET and YFT does not necessarily cause overfishing
- But catching juveniles results in loss of potential yield (lower MSY)
- RFMOs can manage these impacts through quotas and/or seasonal or time/area closures
- Better stock assessments can be achieved integrating tuna behavior and buoy data
- In the near future, acoustics work can result in tools for fishers to be more selective in targeting FADs with higher proportion of SKJ

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS



Session 4

FAD Structure Impact

International Workshop on Mitigating Environmental Impacts of Tropical Tuna Purse Seine Fisheries

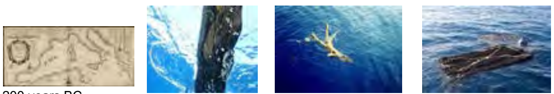
12-13 March, 2019 | FAO HQ, Rome, Italy

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION | gef | Food and Agriculture Organization of the United Nations | COMMON OCEANS

Floating Objects

Naturally ocurring components of the pelagic ecosystem

Fish Aggregating Devices: A fishing gear well known to fishers



200 years BC Mediterranean Sea

Only natural floating objects

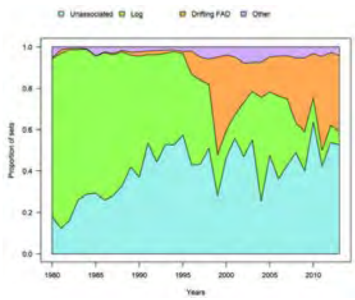
Tracking natural floating objects

Man-made floating objects

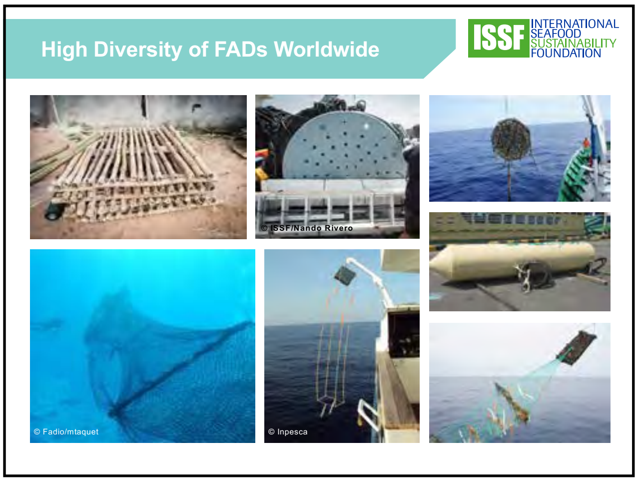
200 BC | 1900 | 1970 | 1980 | 1990

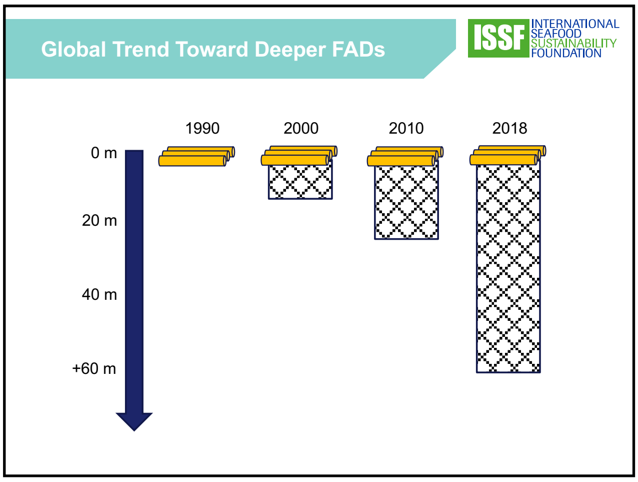
Percentage of FAD Sets vs. Natural Logs

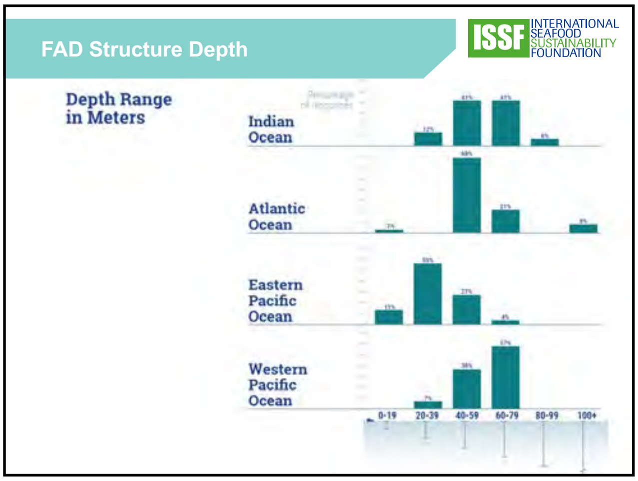
WCPO — Percentage of total sets by school type for the major PS fleets

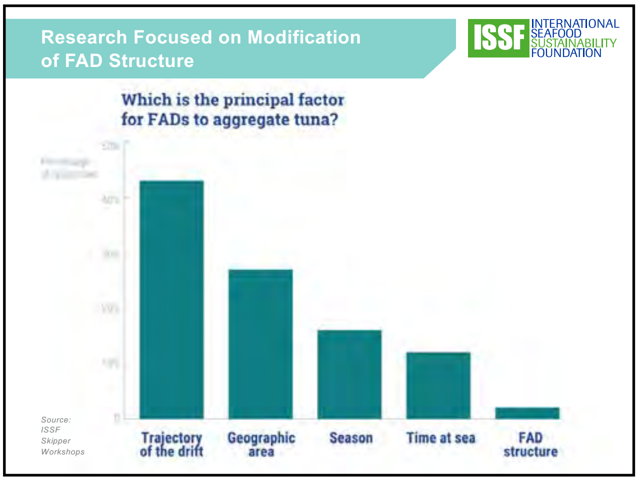


Source: Allain et al. 2016. DOI: 10.4000/books.pacific.423


High Diversity of FADs Worldwide
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
© ISSF/Nando Rivero
© Fadio/mtaquet
© Inpesca


Global Trend Toward Deeper FADs
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
1990
2000
2010
2018
0 m
20 m
40 m
+60 m


FAD Structure Depth
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Depth Range in Meters
Indian Ocean
Atlantic Ocean
Eastern Pacific Ocean
Western Pacific Ocean
0-19
20-39
40-59
60-79
80-99
100+


Research Focused on Modification of FAD Structure
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Which is the principal factor for FADs to aggregate tuna?
Source: ISSF Skipper Workshops
Trajectory of the drift
Geographic area
Season
Time at sea
FAD structure

Research Focused on Modification of FAD Structure

SCIENTIFIC KNOWLEDGE:

Experiment in the EPO to compare shallow vs. normal FADs

After 60 days monitoring the 2 types:

- ✓ No significant difference in **drift speed**
- ✓ No significant difference in **total tuna catch**
- ✓ No significant difference in **species composition**

300 FADs Each Type

5 m. depth | 37 m. depth

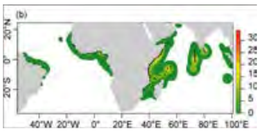
Impacts Caused by FAD Structure

Ghost Fishing: Entanglement Issues

FAD Beaching & Marine Pollution

FAD Beaching Events

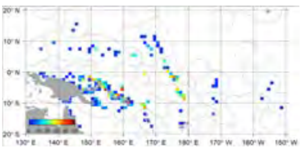
Indian & Atlantic Ocean



10% of the FADs deployed end up beaching

Maufroy et al. 2015

Western and Central Pacific



- 5% beaching
- 26% buoy 'lost', likely leading to marine pollution or unnoticed beaching

Escalle et al. 2018

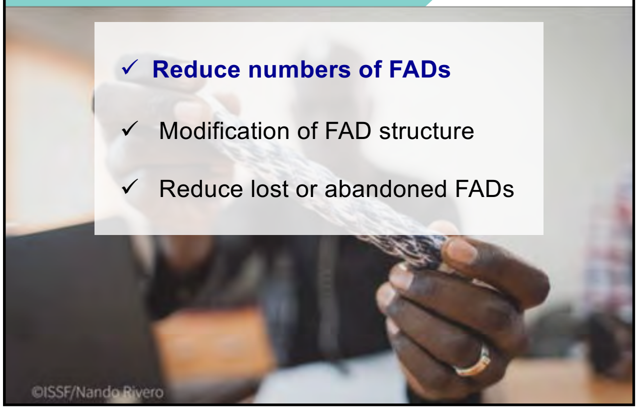
Impact of FAD Structures

- Damage of vulnerable ecosystems, such as coral reefs
- Marine pollution
- Interference with other economic activities
- Ghost fishing

Marine Pollution: Oceans Can Not "Digest" Plastics

FADs accumulate year after year

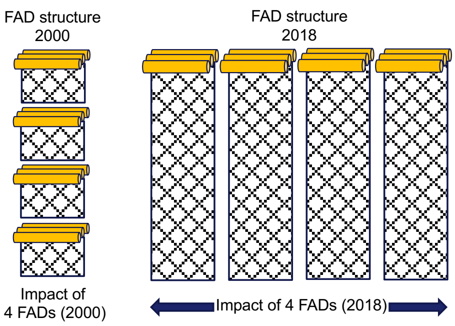
Reducing Marine Pollution by FADs



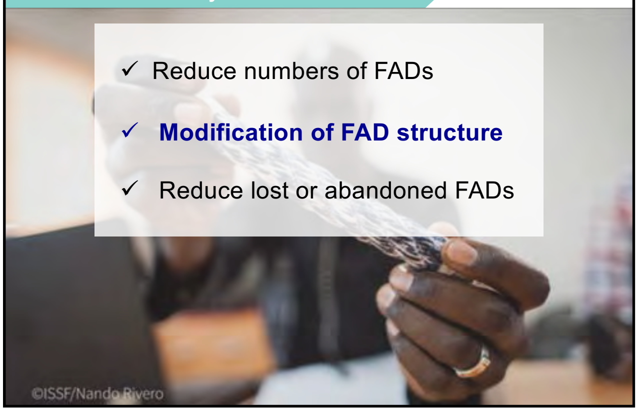
- ✓ **Reduce numbers of FADs**
- ✓ Modification of FAD structure
- ✓ Reduce lost or abandoned FADs

Reducing Marine Pollution by FADs

The impact is proportional to the **number** of FADs and their **size**



Other Actions to Reduce Marine Pollution by FADs



- ✓ Reduce numbers of FADs
- ✓ **Modification of FAD structure**
- ✓ Reduce lost or abandoned FADs

Reducing FAD Structure Impact: Modification of FAD Structure

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

OBJECTIVE

To find a biodegradable FAD that degrades after its useful lifetime for fishing.

What is the best definition for a biodegradable FAD?

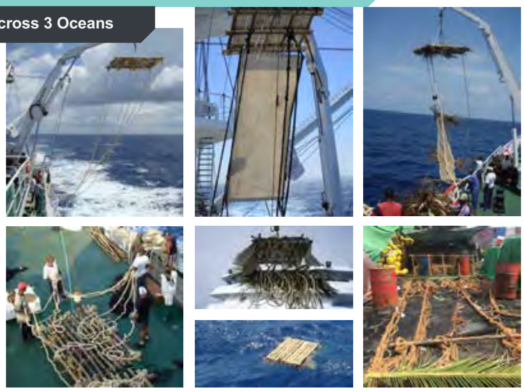
ISSF definition of a Biodegradable FAD:
a non-entangling FAD made of 100% vegetal fibers or materials.*

**This definition does not apply to buoys attached to track them.*

2007 to Present: Small-Scale At-Sea Experiments

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Across 3 Oceans



Experiments Under Controlled Conditions

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

FIRST STEP: Material Selection

- 100% natural fibers / materials
- Sustainably harvested
- Accessible & available in great quantities
- Available as close as possible to fishing grounds
- They can be processed to make ropes
- Rope diameter and material easy to handle onboard
- Cost

2016 Tests In Controlled Conditions: Maldives

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

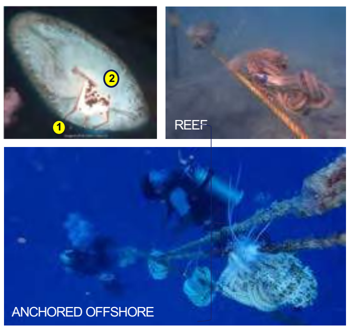
3 TYPES OF ROPE
selected:

- Raw Cotton Twisted

- Raw Cotton + Sisal

- Raw Cotton + Linen + Sisal

DEPLOYED IN MALDIVES



Results: Maldives

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Raw Cotton + Sisal > Raw Cotton Twisted >> Raw Cotton + Linen + Sisal

- Breaking strength measurements showed that mixed cotton and sisal rope was the strongest rope after one year at sea.
- 100% cotton rope was easier to handle.
- Lower cost of 100% cotton rope.
- 100% cotton rope degradation faster after one year.

100% cotton rope was selected

Other Problems to Solve

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

1. Determine the **working lifetime** required for a FAD in the different oceans
2. Design **biodegradable FAD structures** best suited for each oceans
3. Define the **strategy to test** biodegradable FADs in real fishing conditions

Workshops Designed to Answer These Questions

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

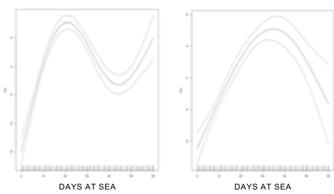
Pilot in Indian Ocean — 2017

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

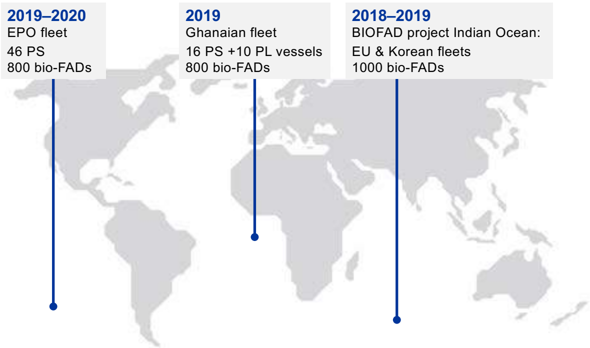
Testing 100 BIO-FADs in fishing conditions

- Raft synthetic materials
- Tail structure with cotton ropes

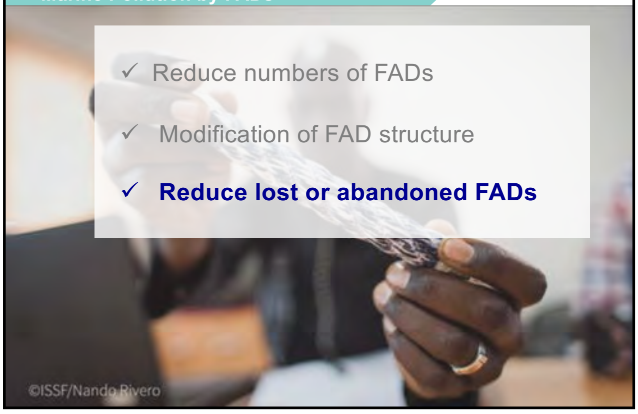
Tuna aggregated to Biodegradable FADs | Tuna aggregated to Non-Biodegradable FADs



Large-Scale Deployment of Bio-FADs



Other Actions to Reduce Marine Pollution by FADs



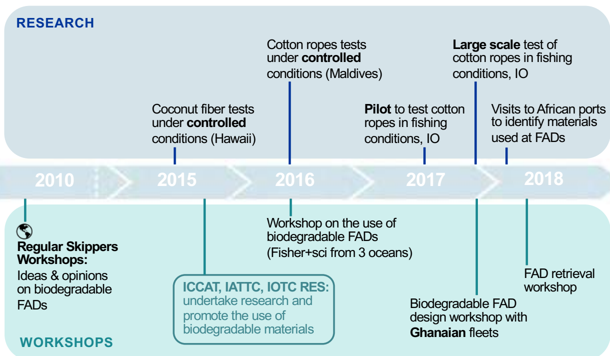
2018 FAD Retrieval Workshop

Workshop Recommendations

- **Quantify strandings:** Identify main beaching zones by establishing priority areas based on the vulnerability of the ecosystem and the degree of stranding.
- **Develop a guide** of good practices for tuna purse seiners and auxiliary vessels with the aim to reduce the loss and abandonment of FADs.
- **Study the trajectories** of FADs based on the position and time of deployment to determine the deployment areas with the highest risk of FAD loss of FADs.
- **Conduct pilot studies** at sea of FADs with navigation capacity to better understand the behavior of these FAD "drones" and the possible strategy for their use.
- In projects on FAD retrieval from the coast, determine the minimum **requirements for the vessels** that would recover FADs, as well as ensure the management of the waste on land.

Source: Moreno et al 2018

Reducing FAD Impact on the Ecosystem



Next Steps

- **Quantify FAD loss:** Identify FAD beaching and FAD retrieval priority areas
- Research to **find a biodegradable material** for the floatation
- **Tests** in the western Pacific Ocean
- Evaluate the possibility of **applying a hierarchy scheme** in the definition of biodegradable FADs according to the results of the ongoing experiments at sea and the size and weight of the FAD structure

In Summary

What does a FAD fishery that avoids impacts on the ecosystem look like?

- ✓ Uses FADs **100% made of natural fibers**/materials that are sustainably harvested
- ✓ **Reduces the size and weight** of the FAD
- ✓ **Avoids FAD deployment areas** that imply high risk of stranding
- ✓ **Reduces and control FAD lost and abandonment**, to the extent possible

What affects fishing efficiency?

FAD-related
Use of FADs, supply vessels, FAD technology

Other technology
Helicopters, bird radars, computers, satellite imagery, long-range sonar, lateral echo-sounders, navigation radars, private radio communications

Vessel-related
Vessel size, capacity and speed, freezing capacity, net depth and speed, speed of unloadings

Many of these started in the 1990s and continue to evolve. Many are not well monitored historically.

Source: ISSF 2012-10 Understanding purse seine CPUE

Key Elements of FAD Management

Development

- 2010 onwards: RFMO measures
- 2017 Global FAD Science Symposium
- ISSF 2018-05 "Best practices for PS Fisheries in transition to MSC"
- NGO "Collective Best Practices for Well-Managed FAD Fisheries"

BirdLife International | Conservation International | Fish Wise | ISSF | Monterey Bay Aquarium | The Nature Conservancy | PEW | Sustainable Fisheries Partnership | WWF

Key Elements of FAD Management

Element 1: Data Reporting

- ✓ Data on FADs (e.g. tracks, echosounder data) to science bodies and authorities w/ appropriate time lags
- ✓ Reporting catch/effort by set type and comply with RFMO and flag state requirements
- ✓ Data from supply and tender vessels

Element 2: Bycatch Mitigation

Require:
- ✓ Non-entangling FADs
- ✓ Participation in pilots with biodegradable FADs (eventually require)
- ✓ Safe handling and best release practices for sharks and rays (and additional measures for silky sharks)
- ✓ Prohibit intentional setting on whale sharks and cetaceans

Key Elements of FAD Management

Element 3: Monitoring

Require 100% observer coverage (human or electronic) on PS and supply/tender vessels

Element 4: Management - General

- ✓ Require FADs to be marked (FAO Guidelines)
- ✓ Develop science-based FAD and FAD set limits
- ✓ Retain by-catch that can be utilized except vulnerable species that need to be released following best practices.
- ✓ Require a FAD recovery policy
- ✓ Ensure management measures also apply to supply/tender vessels and list them on RFMO Records

Evolution in RFMO FAD Management

FAD Measures that were in place 10 years ago:

IATTC: Prohibit the use of supply vessels (C-99-07, still in force); 2-month total closure (C-09-01)

ICCAT: 3-month FAD closure in a specific area (Rec. 99-01), later changed to 1-month covering all set types (Rec. 04-01)

IOTC: No FAD-specific measures

WCPFC: FAD closures (2 months in EEZs and 3 months in high seas); Required Management Plans (CMM 2008-01)

All RFMOs had initiated some type of scientific or management effort to better understand the impact of FADs, especially on juvenile tunas.

Evolution in RFMO FAD Management

Where are RFMOs today?

FAD data reporting by set type required and flag State compliance assessed?

IATTC *Data required, but compliance assessment weak*
ICCAT *Data required, but flag state compliance weak*
IOTC *Data required, but compliance assessment weak*
WCPFC *Data required, but compliance assessment is not transparent*

Current RFMO Measures

Provide data on FAD use to RFMO science bodies (e.g., buoy tracks, echosounder estimates of biomass, etc.) even if not required?

IATTC	Provided voluntarily
ICCAT	✗
IOTC	✗
WCPFC	PNA members voluntarily provide to the SPC available buoy track data for vessels operating under the PNA VDS

Science-based limits on active FADs and/or FAD sets

IATTC	450-70 active FAD limit per vessel. Basis unknown
ICCAT	500 active FAD limit per vessel. Basis unknown
IOTC	350 active FAD limit per vessel. Basis unknown
WCPFC	350 active FAD limit per vessel. Basis unknown

Current RFMO Measures

Time/Area FAD closure?

IATTC	✓
ICCAT	✓
IOTC	✗
WCPFC	✓

Require the use of non-entangling FAD designs?

IATTC	✓
ICCAT	✓
IOTC	✓
WCPFC	✓

Current RFMO Measures

Promote the use of biodegradable FADs?

IATTC	✓
ICCAT	✓
IOTC	✓
WCPFC	✓

Establishes FAD recovery policy?

IATTC	✓
ICCAT	✗
IOTC	✗
WCPFC	✓

Current RFMO Measures

Safe handling and release practices for sharks, rays & turtles?

IATTC	✓
ICCAT	*For turtles*
IOTC	✓
WCPFC	✓

Other silky shark measures?

IATTC	*Retention prohibition*
ICCAT	*Retention prohibition*
IOTC	✗
WCPFC	*Retention prohibition*

Current RFMO Measures

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

Prohibit intentional setting on whale sharks & cetaceans?

- **IATTC** ✗
- **ICCAT** ✗
- **IOTC** ✓
- **WCPFC** ✓

Current RFMO Measures

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

In Summary

- Each RFMO requires several best practice elements of FAD management. (WCPFC addresses all.)
- Many measures have loopholes.
  Example: IOTC requires FADs to be non-entangling "*applied gradually from 2014*"; it does not set a date for a complete transition.
- Some measures are set to enter into force in the future.
- Compliance mechanisms are weak. It is not possible to know if measures are being implemented.

Factors that make FAD management complicated

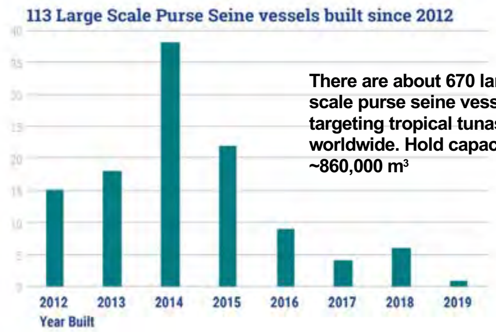
INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

In no particular order

- Management objectives are not well defined for FADs within PS, or for PS relative to other gears (especially LL). Setting science-based limits without clear objectives is hard.
- Many anti-FAD positions are not fact-based.
- Industry and governments resist change. RFMOs are consensus-based.
- Effort creep is difficult to detect. Monitoring usually lags behind innovation.
- With few exceptions, FAD data reporting is still very incomplete.
- Overcapacity is a driver for increased fishing and ineffective regulations. Reducing it is expensive and politically difficult.
- Lack of FAD ownership and marking rules result in complex fishing strategies that are difficult to monitor.

Vessel Capacity

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION



There are about 670 large-scale purse seine vessels targeting tropical tunas worldwide. Hold capacity ~860,000 m³

NOTE: Active FAD limits are per vessel so they are not really hard limits unless vessel numbers are limited as well.

How many active FADs could be allowed by RFMOs?

- Using ISSF 2018-17 "snaphsot of the number of PS vessels"
- Assuming each vessel uses its maximum
- Using the ISSF PVR and the tRFMO CLAV to assign RFMO area

RFMO	Limit/vessel	# PS Vessels	Max # active FADs
IATTC	70-450	227	70,220
ICCAT	500	79	39,500
IOTC	350	80	28,000
WCPFC	350	305	106,750
Total	>350	691	244,470

The number of FADs in the water globally is thought to be around 100,000 (Gersham et al; Scott and Lopez). But, if each LSPS vessel used the maximum allowed, the **number of FADs in the water could increase by nearly 2.5 times!**

Other alternatives for tuna management

Managing by catch quotas (TACs)

- Ineffective if not fully allocated between flags
- Real-time monitoring of PS catch by species is very difficult
- May lead to mis-reporting

Managing by seasonal closure

- A blunt instrument but it seems to work

Managing by time/area closure

- Ineffective unless they are very large

Managing fishing capacity

- I remain hopeful!

There needs to be a comprehensive package of measures tailored to the situation in each RFMO.

RFMO challenges to adopt resolutions

All RFMOs work by consensus. It takes just 1 member to block or weaken proposed actions.

- Resolutions are adopted for periods of 3-4 years and are unlikely to be revisited in the interim.
- Fleets want certainty that a problem is real and that a solution can be implemented cost-effectively while still catching tuna.
  Example: Adoption of non-entangling FADs. Lessons from other oceans or other fleets are often ignored.
  - Sometimes fleets act faster than RFMOs do, especially if they perceive some market reward such as access or price differential.
- PS fleets perceive that they are being monitored and managed much more strictly than LL fleets are (e.g. observer coverage; bycatch mitigation). PS countries are less likely to agree to measures that seem unbalanced.

Skippers Workshop Lessons

In general, PS skippers share these opinions about management:

- The number of FADs is not the only thing to be managed. Many elements assist FAD fishing such as supply vessels, helicopters and other technologies like echo-sounder buoys.
- Fishers have thoughts on the efficacy and feasibility of different types of measures and possible loopholes; they can contribute to management.
- Regulations are more closely followed when accompanied by incentives.
- Fishers perceive that there usually is not a level-playing field and that enforcement varies greatly by flag and by RFMO.

Concluding remarks

- A lack of clear objectives makes it difficult to define science-based targets.
- The PS fishery needs to be managed holistically. Too much focus on FAD sets detracts from other important issues.
- Fisheries other than PS need to be managed too. Objectives?
- Over the past decade, many NGOs have converged on what they consider are best practice elements for FAD management.

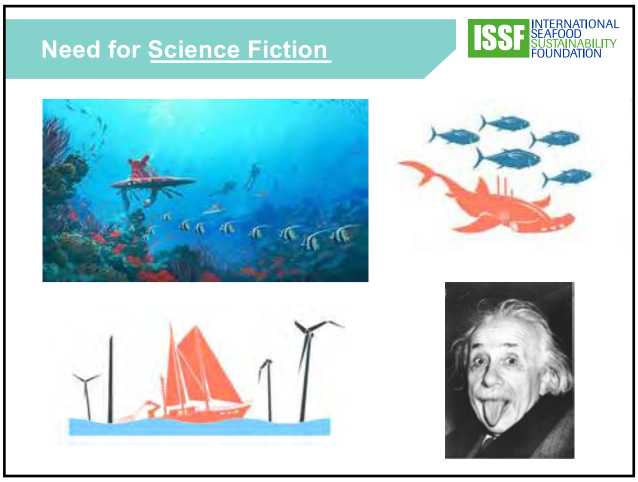
Concluding remarks

- Comparing these elements to RFMO management shows that RFMOs follow some or all of these to some extent. But there are loopholes, exemptions and weak compliance systems.
- RFMOs have made much progress in managing FADs over the past 10 years. But FAD data reporting is still sparse, with some exceptions (e.g. PNA) and the limits on active FADs warrant a careful look.
- Many factors make FAD management complicated. Holistic management of the fishery will require a comprehensive package of measures, tailored to each RFMO.
- Fleets have much to contribute in terms of finding practical and effective solutions

Session 6
Looking Ahead:
The Next 10 Years
International Workshop on Mitigating Environmental Impacts
of Tropical Tuna Purse Seine Fisheries
12-13 March, 2019 | FAO HQ, Rome, Italy
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
gef
Food and Agriculture Organization of the United Nations
COMMON OCEANS

Objectives
Sustainable fisheries | Science-based management
However, management objectives are not always well defined by tRFMOs
• All fishing gears are concerned by the sustainable exploitation of tunas
• An holistic approach is necessary to address all fisheries impacts on the stocks and the ecosystem in general
• The current presentation will focus on research needed to improve the sustainability of tropical tuna purse seine fisheries
©ISSF
Fabien Forget

Objectives for the Next 10 Years?
In Line with RFMO Objectives
• Improve data for ecosystem-based fisheries management
• Further reduce fishery-induced mortality of sharks and rays
• Further reduce fishery-induced mortality of small bigeye and yellowfin tuna
• Further reduce environmental impacts of FADs
• Improve the knowledge on the effects of FADs on the ecology of tunas and other associated species (ecological trap hypothesis)
©ISSF
Fabien Forget



Need for Science Fiction

Objectives for the Next 10 Years?

In Line with RFMO Objectives

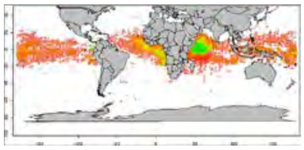
- Improve **data** for ecosystem-based fisheries management
- Further reduce fishery-induced mortality of **sharks and rays**
- Further reduce fishery-induced mortality of **small bigeye and yellowfin tuna**
- Further reduce **environmental impacts** of FADs
- Improve the knowledge on the effects of **FADs** on the ecology of tunas and other associated species (**ecological trap hypothesis**)

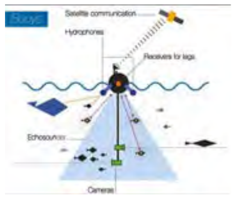
Data Collection

One challenge in moving to ecosystem-based fisheries management is the difficulty of integrating and understanding all components

- **Big data and AI**: All data accessible to scientits, analyzed with AI techniques
- **Fishing vessels** as scientific platforms (Melvin et al. 2016): Bird radars, sonars, echo-sounders, EMS, e-logs, etc.
- **FADs** as scientific platforms (Moreno et al. 2016)

The international PS fleet maintains about 100,000 FADs worldwide





Objectives for the Next 10 Years?

In Line with RFMO Objectives

- Improve **data** for ecosystem-based fisheries management
- Further reduce fishery-induced mortality of **sharks and rays**
- Further reduce fishery-induced mortality of **small bigeye and yellowfin tuna**
- Further reduce **environmental impacts** of FADs
- Improve the knowledge on the effects of **FADs** on the ecology of tunas and other associated species (**ecological trap hypothesis**)

Are sharks swimming in a safe environment?

Are there very few "entangling" FADs in the 4 oceans?

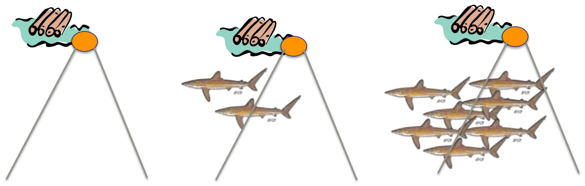
- Need independent verification
- Tag silky sharks in every ocean every year and check if entanglement events are observed

Counting the Number of Sharks

Having a few sharks or >50 sharks in the net completely changes the release issue

Innovation: Develop an electronic buoy which counts the number of sharks at FADs and sends data to PS (similar to the echo-sounder buoys)a

No shark | Few sharks | Many sharks



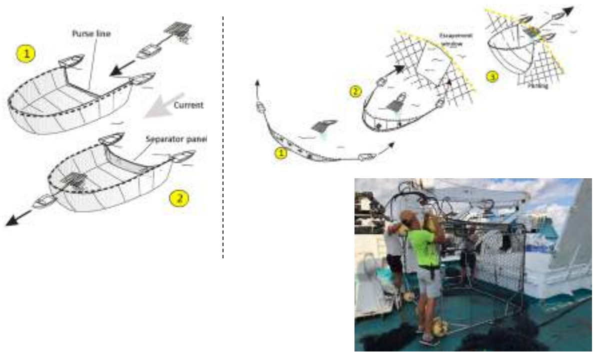
Average FAD: Few sharks but frequent

Can we attract sharks away from FADs (using bait), then set on tunas?

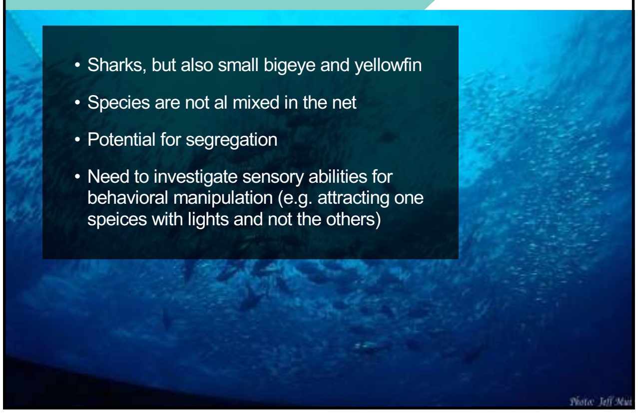
→ 50% success

Separate Sharks and Bycatch

Trap net or ring net



Behavior of Fish in the Net

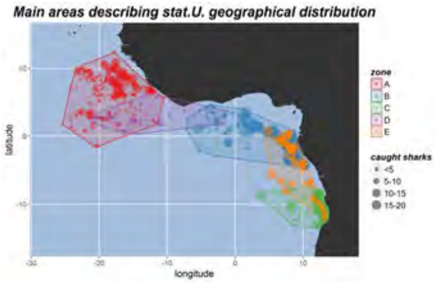


- Sharks, but also small bigeye and yellowfin
- Species are not al mixed in the net
- Potential for segregation
- Need to investigate sensory abilities for behavioral manipulation (e.g. attracting one speices with lights and not the others)

Exceptional Sets (FADs or FSC): Large number of sharks

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Identify hotspots (using observers data and tagging data)
- Real-time management (immediate communication within the fleet to inform about sets with large numbers of sharks)



Objectives for the Next 10 Years?

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

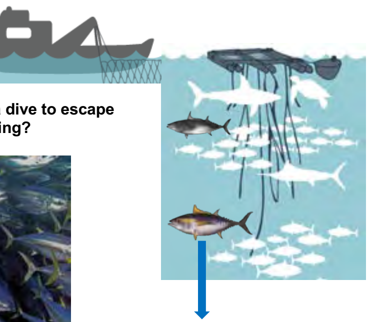
In Line with RFMO Objectives

- Improve **data** for ecosystem-based fisheries management
- Further reduce fishery-induced mortality of **sharks and rays**
- Further reduce fishery-induced mortality of **small bigeye and yellowfin tuna**
- Further reduce **environmental impacts** of FADs
- Improve the knowledge on the effects of **FADs** on the ecology of tunas and other associated species (**ecological trap hypothesis**)

Small Bigeye and Yellowfin

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

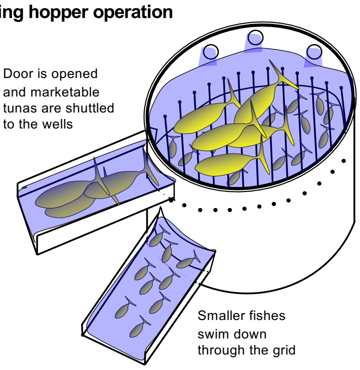
Can bigeye tuna dive to escape nets during setting?



Small Bigeye and Yellowfin

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

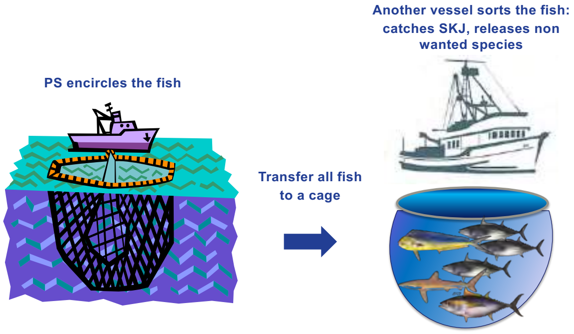
Sorting hopper operation



A New Way of Fishing?

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

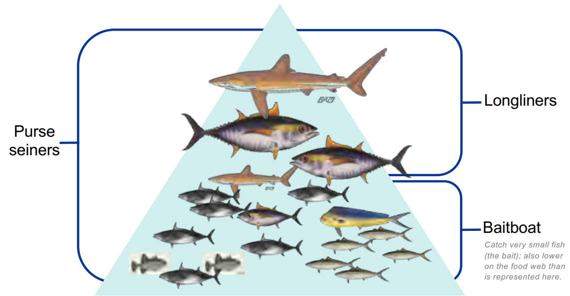
Sorting fish in the water (ex. of bluefin tuna)



Real Ecosystem-Based Fisheries?

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

- Harvest an ecosystem in an ecological sustainable way?
- Design a fishery composed of different fishing gears characterized by their size and species selectivities to achieve a balanced harvest of the ecosystem



Objectives for the Next 10 Years?

ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

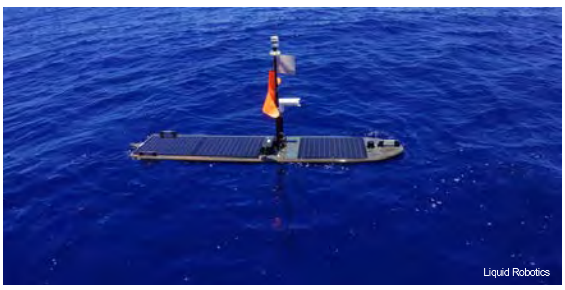
In Line with RFMO Objectives

- Improve **data** for ecosystem-based fisheries management
- Further reduce fishery-induced mortality of **sharks and rays**
- Further reduce fishery-induced mortality of **small bigeye and yellowfin tuna**
- Further reduce **environmental impacts** of FADs
- Improve the knowledge on the effects of **FADs** on the ecology of tunas and other associated species (**ecological trap hypothesis**)

FAD drone

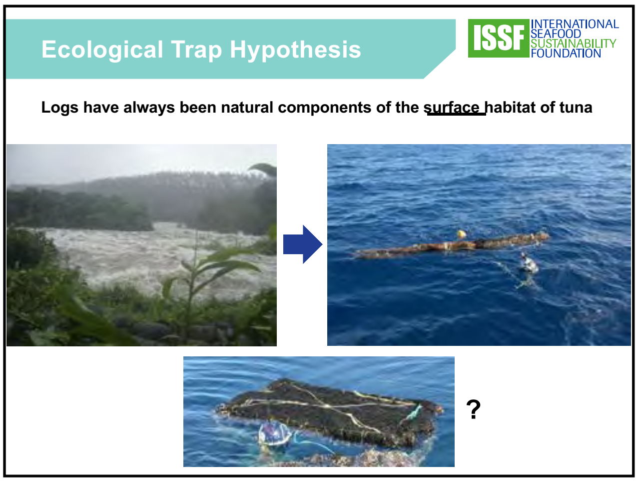
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

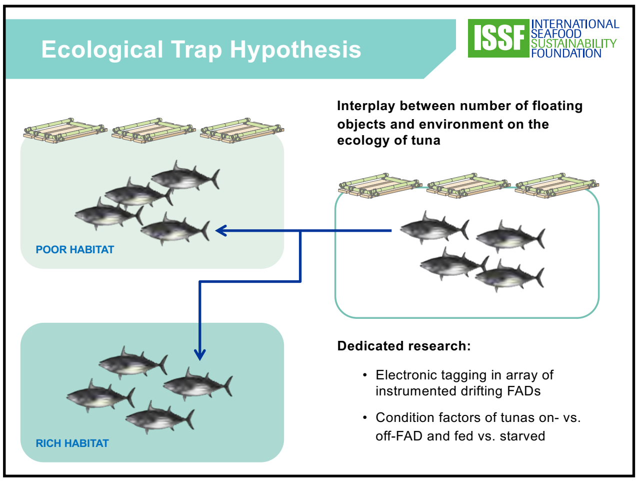
A FAD which trajectory can be controlled / modified in order to avoid coasts




Other Options to Investigate
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
• "FAD watch" programs with a database with all FAD trajectories, automatic quantification of beaching, setting alerts to sensitive areas
• Change fishing strategy with FADs. Use FADs shared by all fishers (similar to some anchored FAD arrays)
• Use anchored FADs in areas where drifts of FADs are likely to end beaching
©ISSF
Fabien Forget


Objectives for the Next 10 Years?
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
In Line with RFMO Objectives
• Improve data for ecosystem-based fisheries management
• Further reduce fishery-induced mortality of sharks and rays
• Further reduce fishery-induced mortality of small bigeye and yellowfin tuna
• Further reduce environmental impacts of FADs
• Improve the knowledge on the effects of FADs on the ecology of tunas and other associated species (ecological trap hypothesis)
©ISSF
Fabien Forget


Ecological Trap Hypothesis
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Logs have always been natural components of the surface habitat of tuna
?


Ecological Trap Hypothesis
ISSF INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION
Interplay between number of floating objects and environment on the ecology of tuna
POOR HABITAT
RICH HABITAT
Dedicated research:
• Electronic tagging in array of instrumented drifting FADs
• Condition factors of tunas on- vs. off-FAD and fed vs. starved

Conclusions

Looking back 10 years shows that there has been great progress

But there is still a lot of challenges to address to make the use of FADs more sustainable

Need for fundamental & applied research

- FADs and fishing vessels as scientific platforms
- Better knowledge on tunas, sharks and other species
- Fewer FADs, but better FADs
- New ways of fishing