

Behavior of target and non-target species when encircled by tuna purse seine gear



INTERNATIONAL SEAFOOD
SUSTAINABILITY FOUNDATION



Western Pacific Regional
Fishery Management Council

ECOSYSTEM-BASED MANAGEMENT OF FISHERIES
IN THE U.S. PACIFIC ISLANDS

**TRIMARINE**

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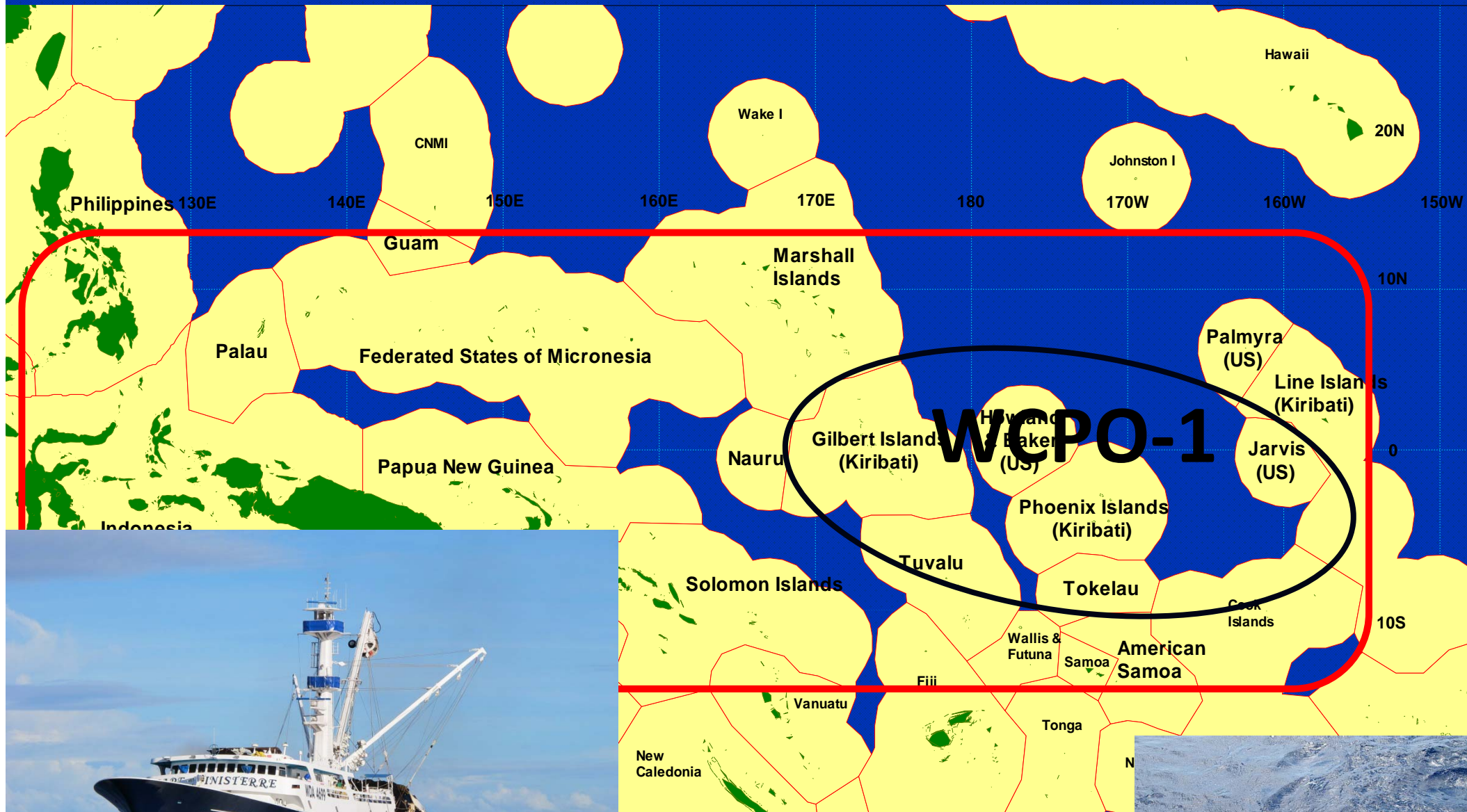
Bruno Leroy

ISSF Research Cruise WCPO-1

ISSF #Bycatch Project WCPO Objectives

1. UNDERWATER VISUAL CENSUS AT FADS
2. ESTIMATION OF CATCH AND BYCATCH
3. NATURAL BEHAVIOR OF TUNA AND BYCATCH IN THE NET
4. VERTICAL AND HORIZONTAL BEHAVIOR OF TUNA AND BYCATCH SPECIES ON FAD AGGREGATIONS
5. TARGETING SKIPJACK AFTER DAWN – WHILE AVOIDING BIGEYE AND BYCATCH
6. INITIAL RELEASE OF FISH FROM THE NET BY TOWING THE FAD
7. BEST PRACTICES FOR THE HANDLING AND LIVE RELEASE OF WHALE SHARKS AND MANTA RAYS
8. CONDITION AND POST-RELEASE SURVIVAL OF SHARKS

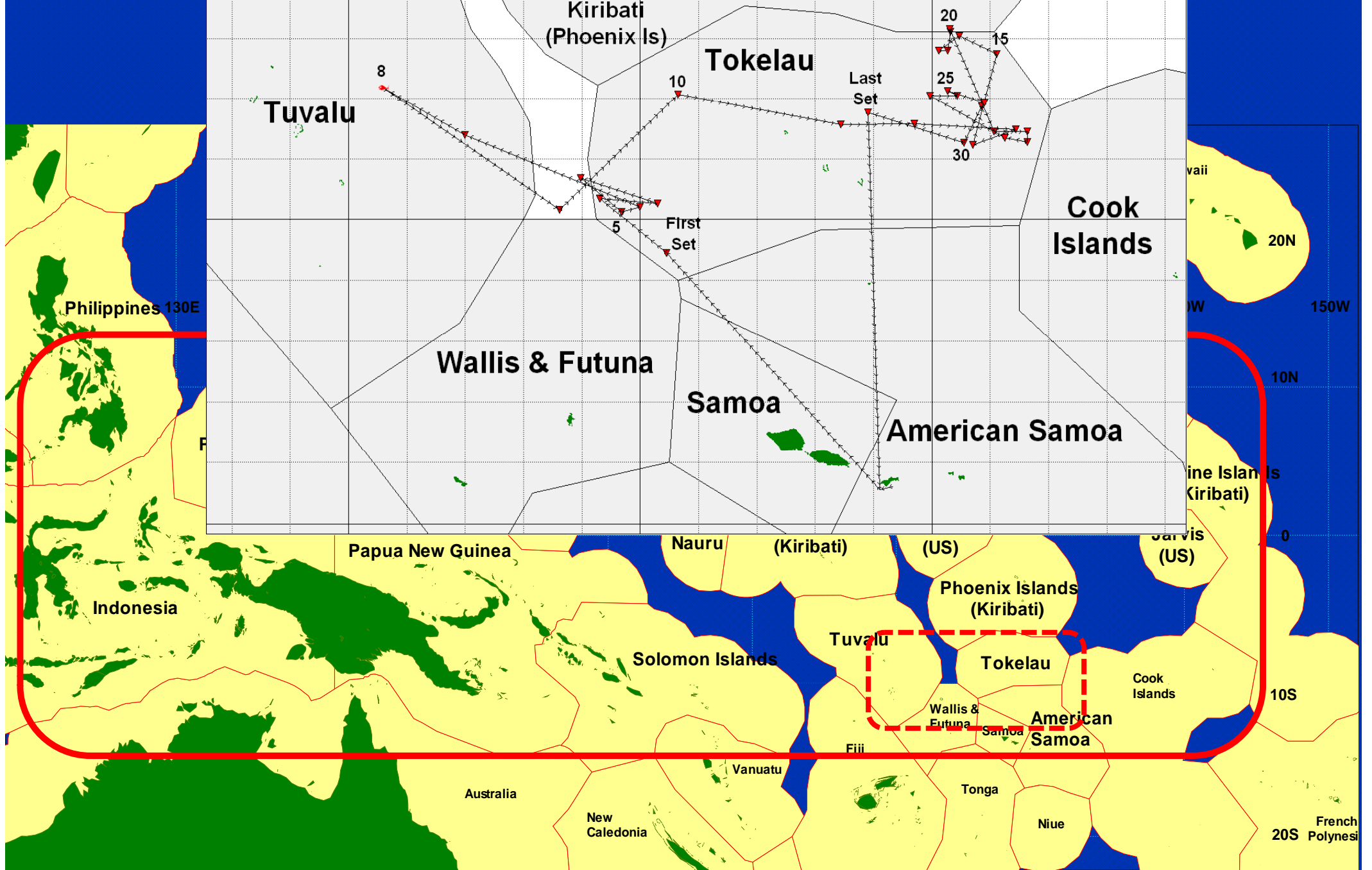
ISSF Research Cruise: WCPO-1



F/V Cape Finisterre



Drifting FADs



No. of days	No. Fishing / Searching days	No. of sets	Catch/set range (mt)	catch mt	Catch per set (mt)
41	34	31	6 - ~180	1246.9	40.2

What is “natural” behavior of associated tuna and bycatch

- Larger tuna separate themselves vertically from smaller individuals of the same species and remain deep
- Skipjack separate themselves from other tuna species
- Bycatch (Mahimahi, wahoo, billfish, silky sharks and oceanic whitetip sharks) tend to separate themselves and occupy the upper portion of the water column

Natural behavior of tuna and bycatch in the net

- Do animals exhibit natural behavior after becoming encircled?
- At what point do bycatch species and small tuna become mixed with desirable catch?
- Are there ways to exploit these behaviors to attempt to release unwanted catch in good condition?
- If release is possible, is it realistic to practically and safely employ these methods easily during commercial fishing operations?

Purse Seine Fishing Stages

Surrounding School and Pursing



Net Rolling



Sacking Up



Brailing

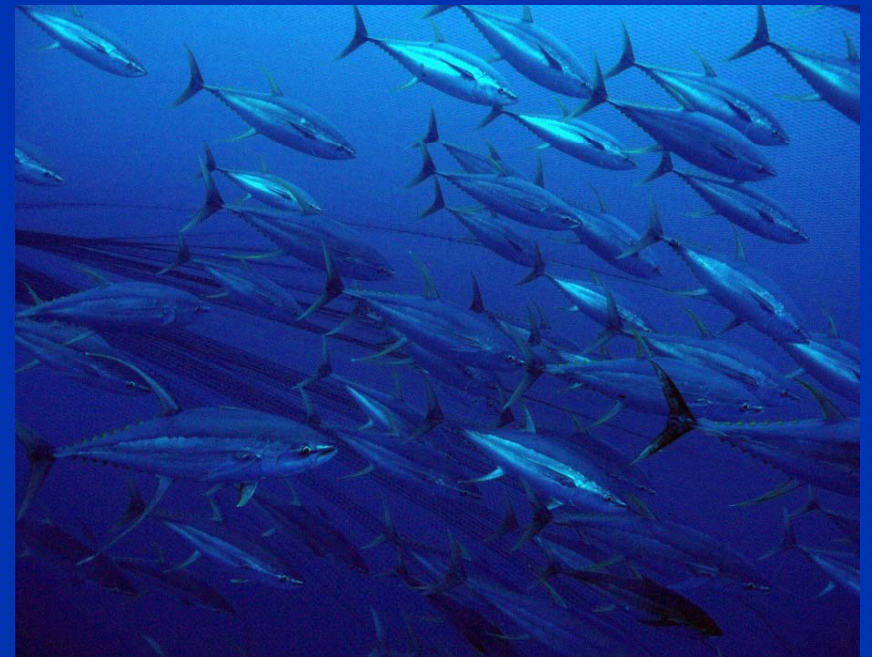
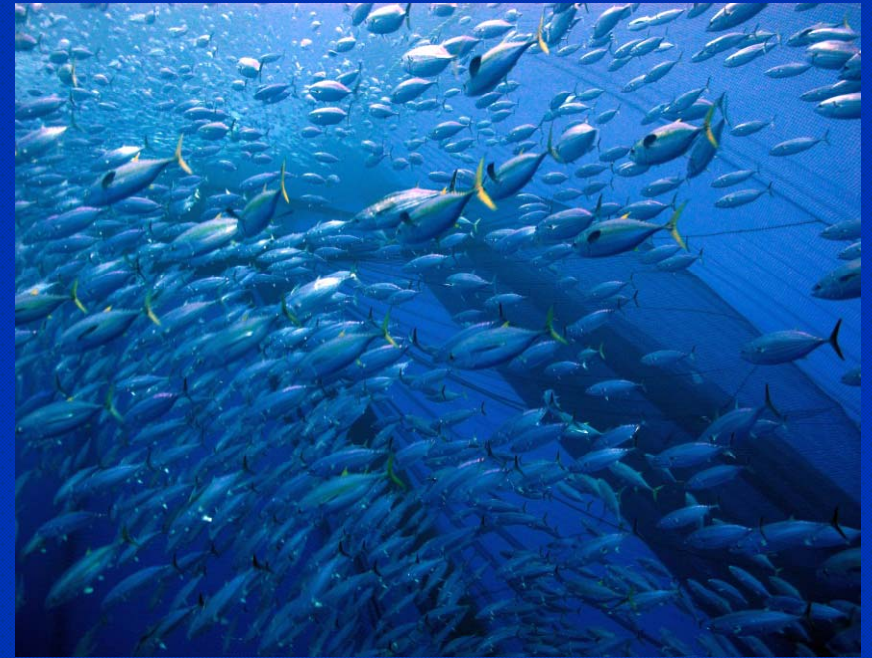


Methods

- Underwater surveys started at around 75% of net rolling completed
- Divers descended to 50m at beginning of dive, slowly ascending through the water column to observe fish behavior at all depths.
- Survey times varied, most around 30 min
- Digital still photos taken with Canon G-12 cameras
- Video captured with GoPro Hero HD2 cameras
- Divers deployed on 19/31 Sets



Vertical Stratification by Size - Tuna

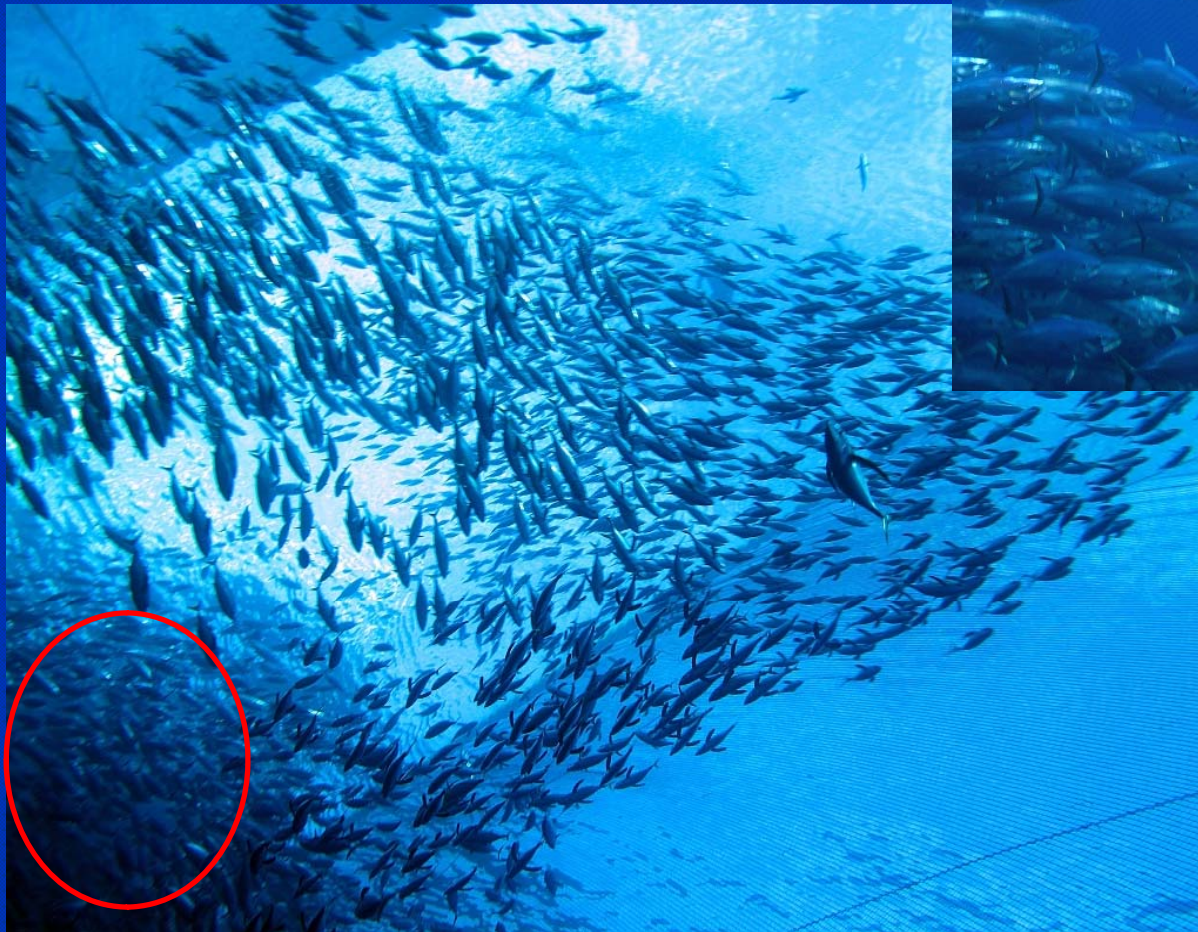
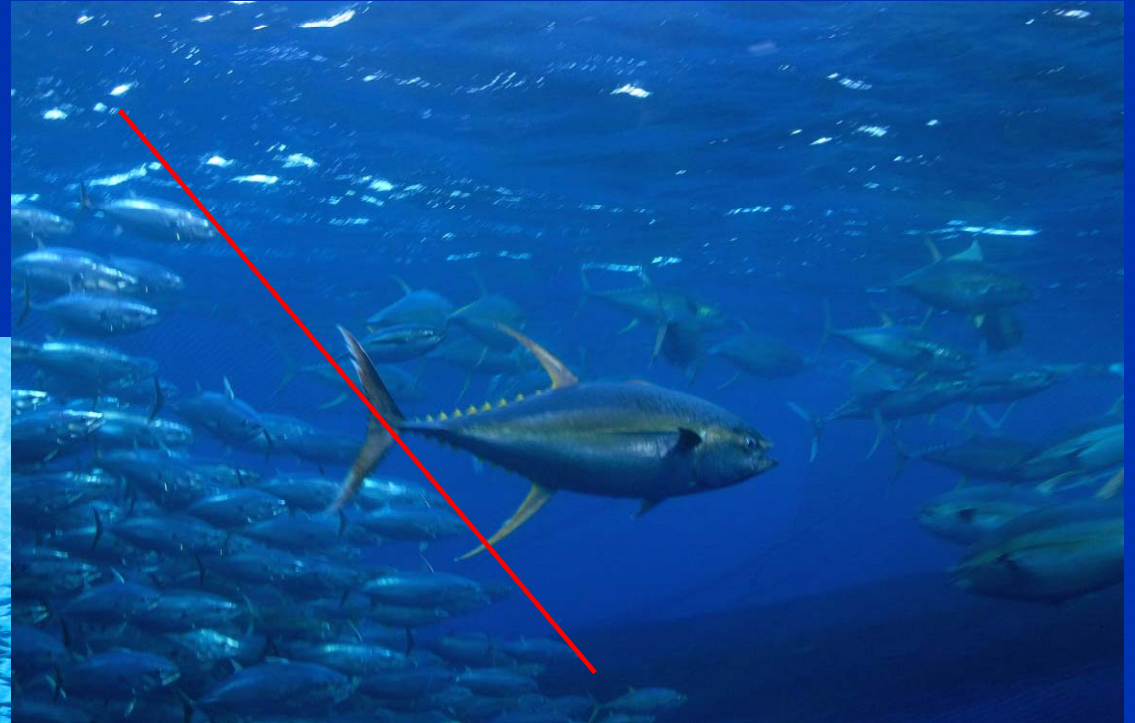


Large BET and YFT below small fish



Segregation by Species -Tuna

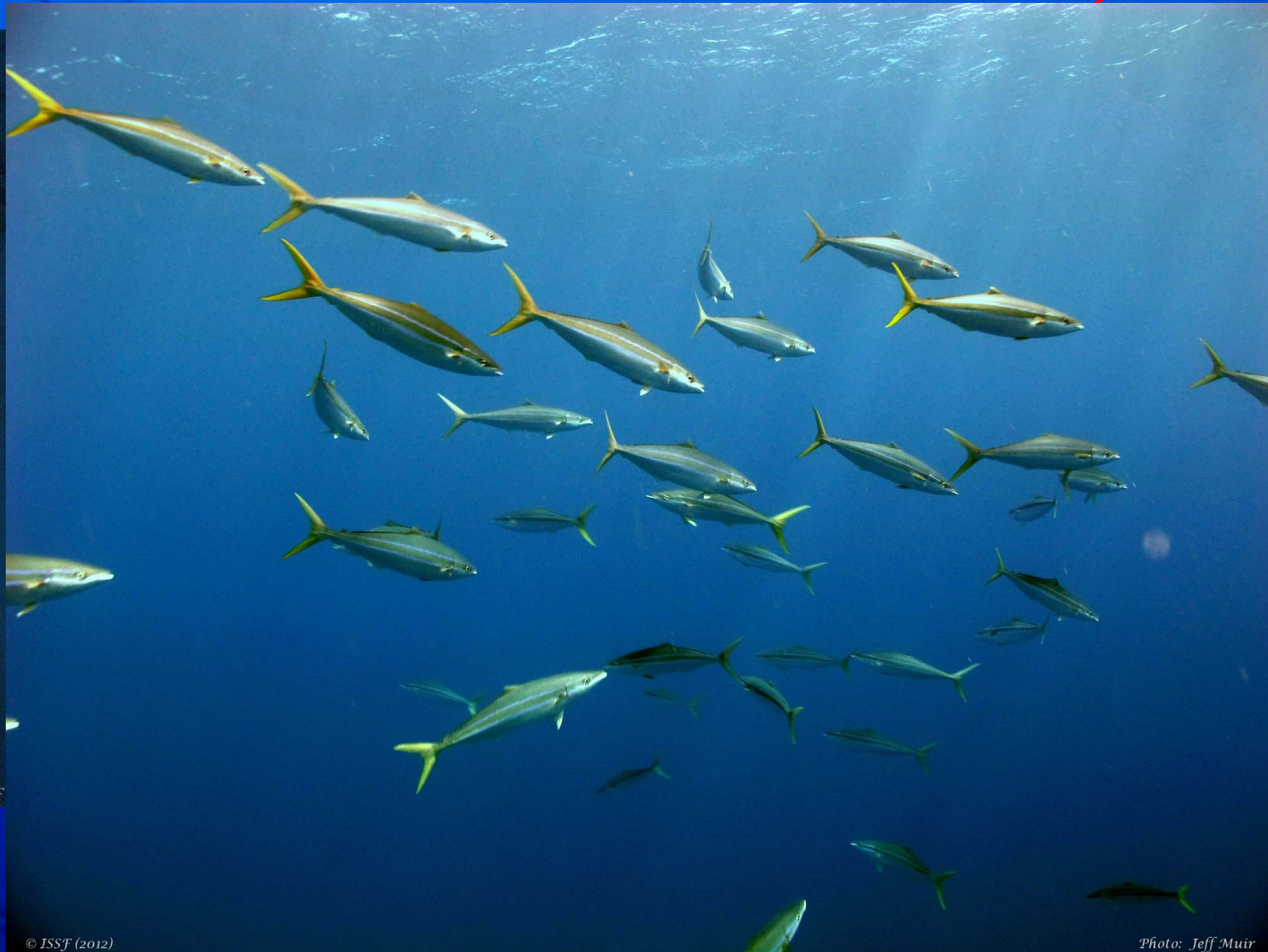
SKJ avoiding large YFT
(probably avoiding predation)



Small SKJ and YFT/BET of similar size avoid mixing



Segregation by Species - Bycatch



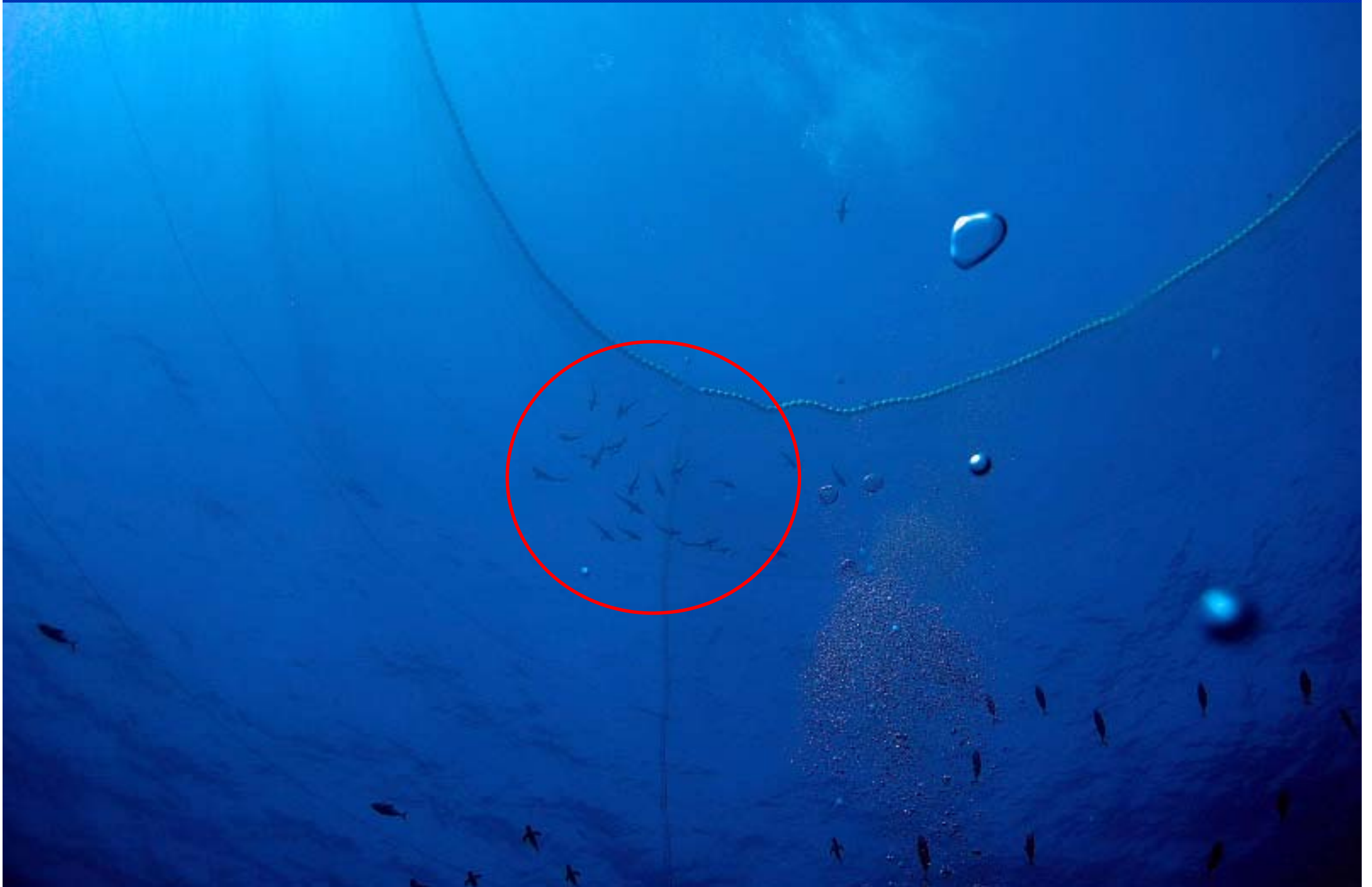
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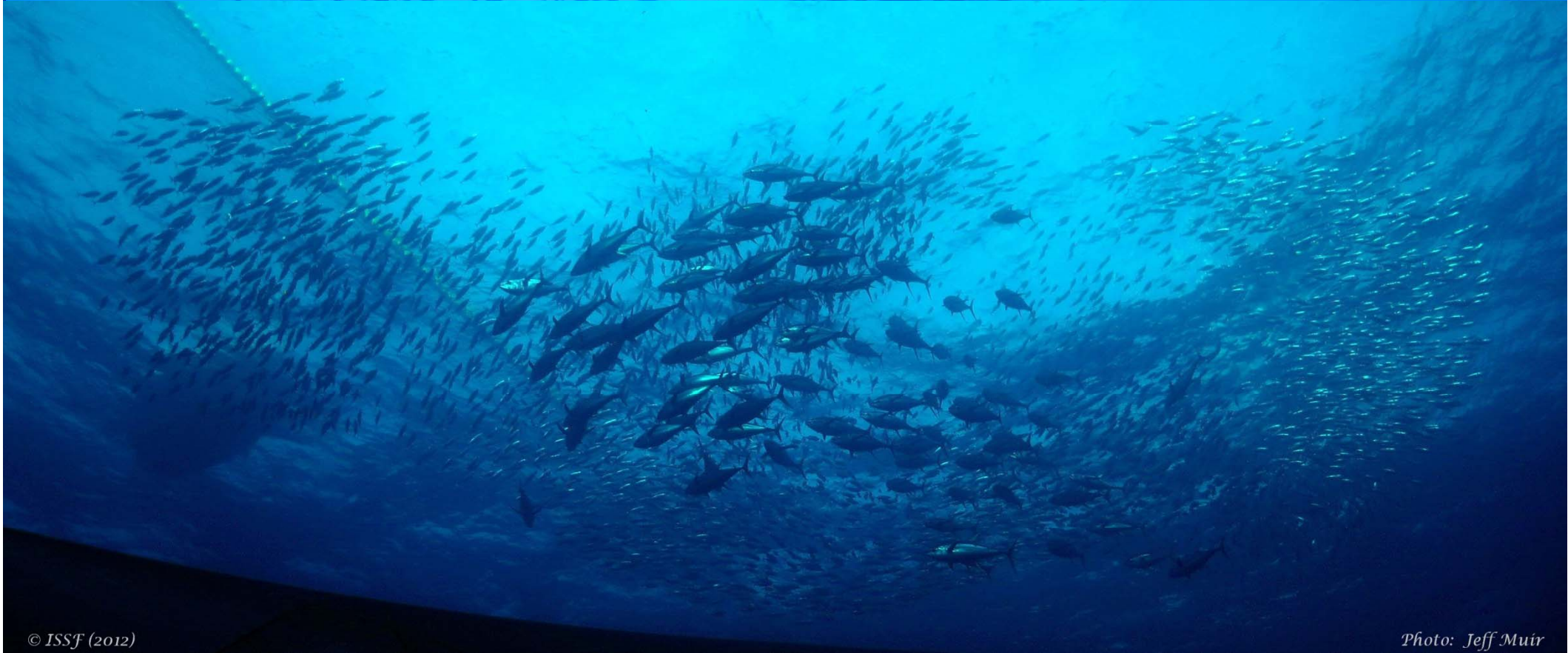
Photo: Jeff Muir

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Photo: Jeff Muir

Separation - Silky Shark





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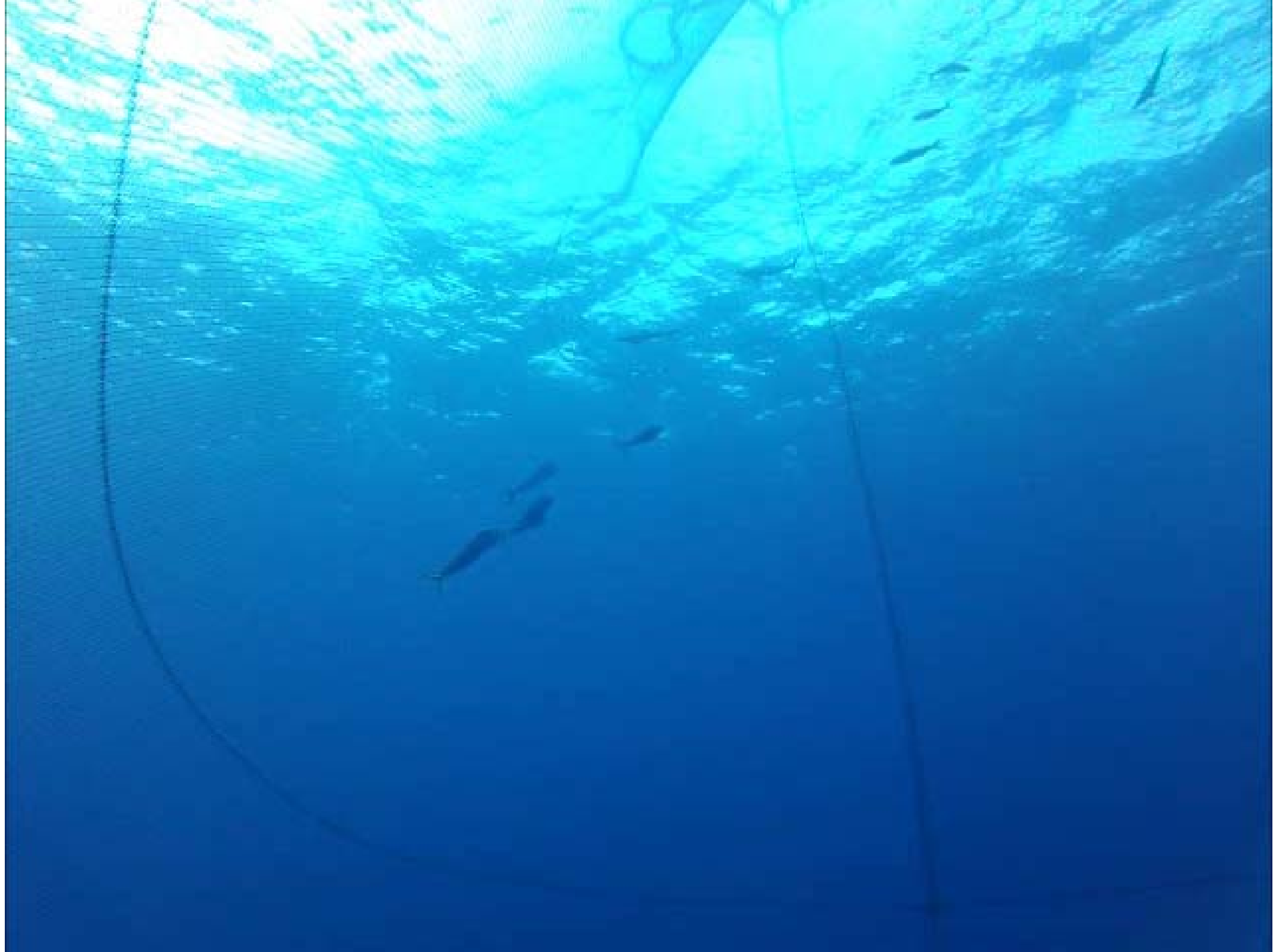
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Significant Outcomes

- Segregation and stratification in net observed consistently
 - ◆ By species
 - ◆ By size
 - ◆ Target and non-targeted
- Small tuna separate from large tuna
- Interspecific vertical separation of tuna schools
- Bycatch species separate themselves horizontally and vertically from tuna schools
- Silky sharks consistently end up in far end of net at shallow depths
- These patterns erode as sacking up point approaches

What's Next?

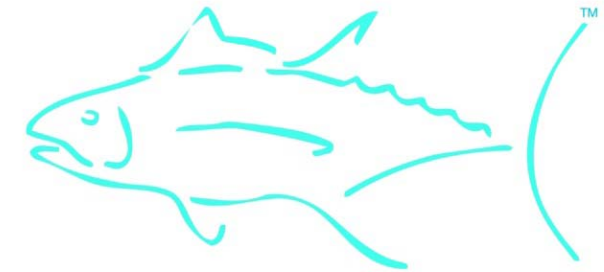
- This natural behavior may provide clues for future work in selective release of small tuna and non-target species before sack up...how can we use this knowledge to release unwanted catch?
- Sorting grids or selective release panels?
- Use of stimuli or deterrents?
- Other options to release small tuna and unwanted bycatch species?

Recommendations arising from the research cruise

- Research efforts should continue to find ways of avoiding encircling unwanted catch before the set, but...
- PS Bycatch mitigation efforts for shark and other finfish should concentrate on ways to avoid or selectively remove bycatch species before the catch is sacked up or the commencement of brailing
- Observations of size and species separation in the purse seine net suggest that selective release of bycatch and undersize tuna in good condition may be possible. Research efforts should be advanced to explore these possibilities.
- The condition and post-release survival rates of released bycatch need to be scientifically verified. Where appropriate (i.e. larger individuals) studies should be developed that utilize PSAT and survival PAT tagging technology

Acknowledgments

Captain John Crisci and the crew of the F/V
Cape Finisterre



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**TRIMARINE**

ISSF and WPRFMC

WCPFC, FFA, SPC

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Tri Marine International

Starkist Samoa

NMFS