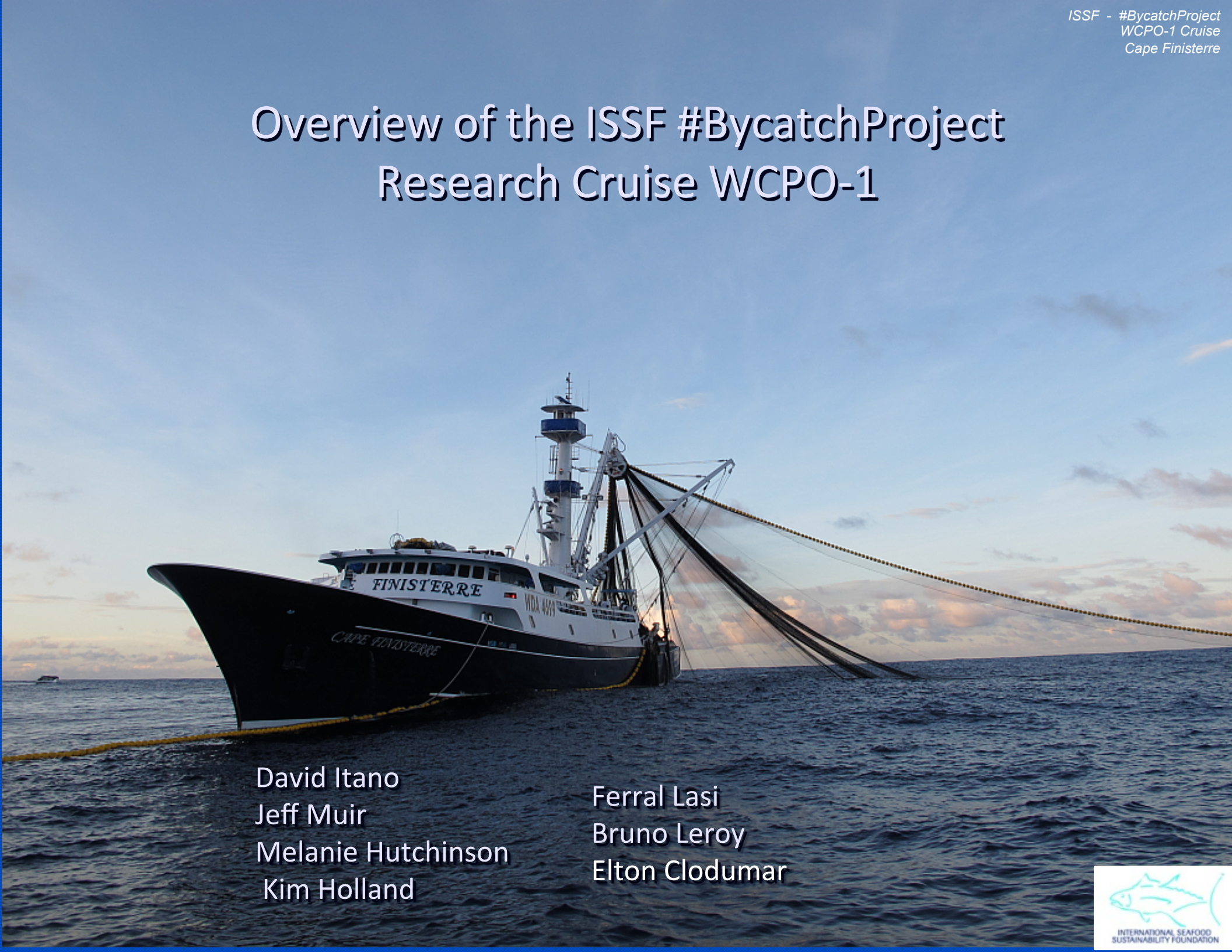
Overview of the ISSF #BycatchProject Research Cruise WCPO-1



David Itano
Jeff Muir
Melanie Hutchinson
Kim Holland

Ferral Lasi
Bruno Leroy
Elton Clodumar

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

WCPO – high diversity of purse seine fleets and vessel types

Japan

Indonesia

Chinese Taipei

Pacific Islands domestic

Korea

USA

Domestic FSM Arrangement

USA

EU

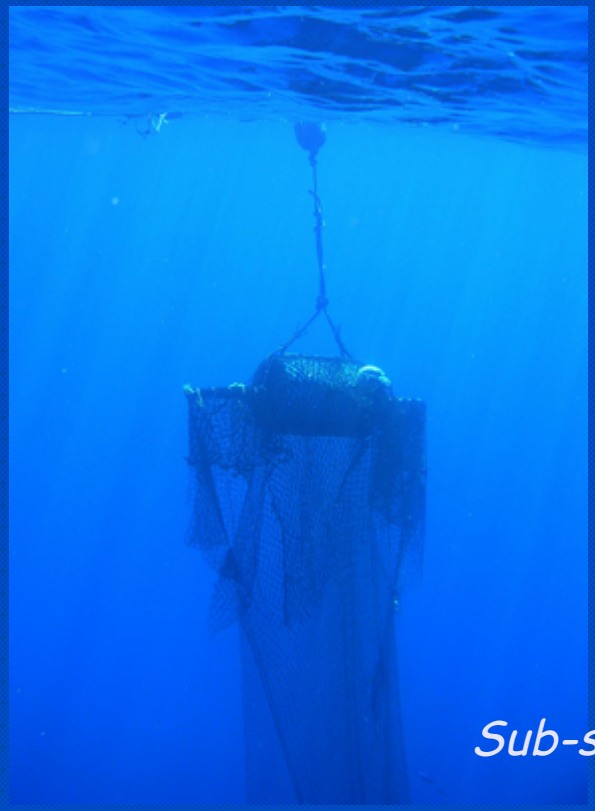
ISSF Research Cruise: WCPO-1

WCPO-1 cruise
Cape Finisterre (USA)
Tri Marine

Drifting FADs

Enhanced natural log

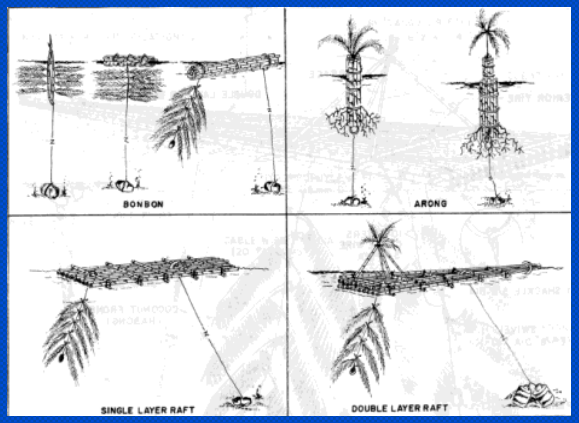
Bamboo raft



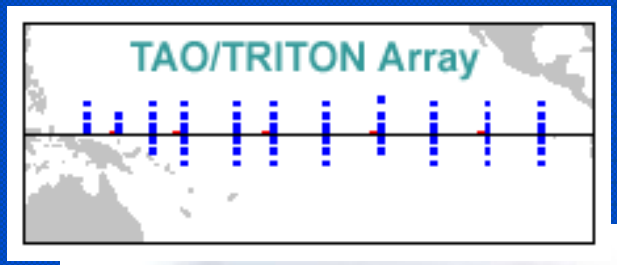
Sub-surface FAD

Purse seine floats and netting

Anchored FADs

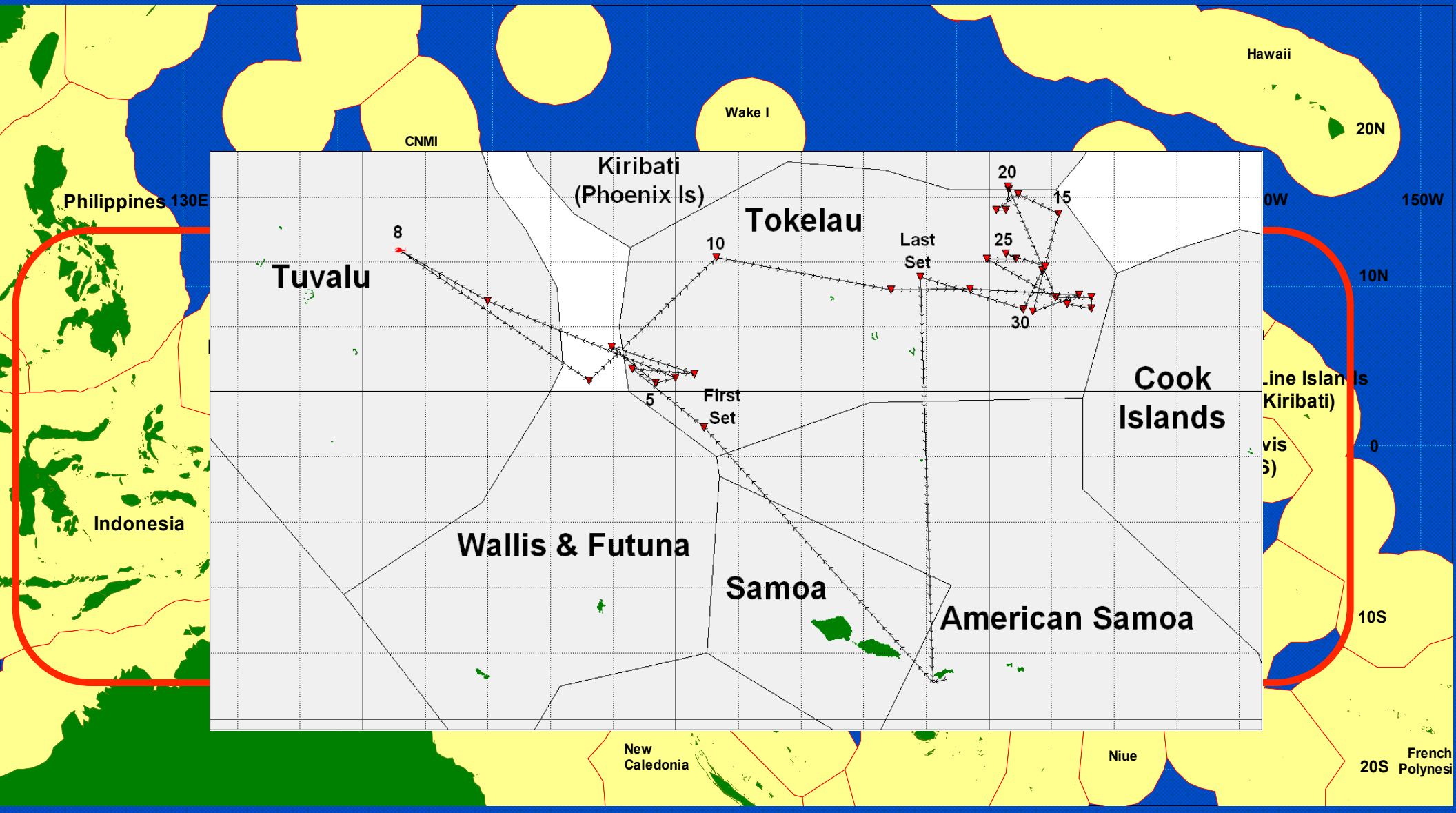


de Jesus 1982



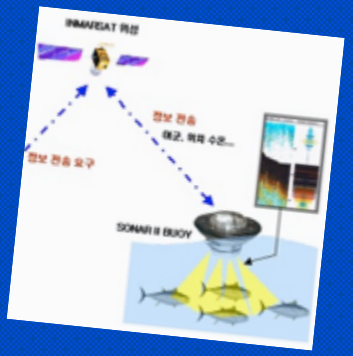
Indonesian "house FAD"

ISSF Research Cruise Track: WCPO-1

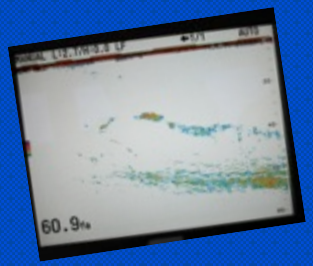


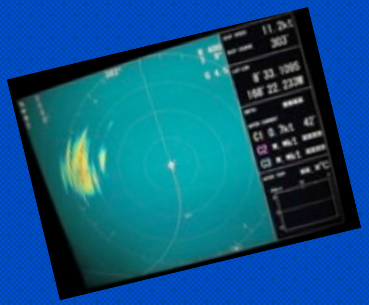
No. of days	No. Fishing / Searching days	No. of sets	Catch/set range (mt)	catch mt	Catch per set (mt)
41	34	31	6 - ~180	1246.9	40.2

Research activities



- Estimation of catch and bycatch
  - Pre-estimates (before arriving)
  - First investigation
  - Pre-set (just before letting go)
  - Onboard LF and Species Comp sampling
    - Paired "**Grab**" vs "**Spill**"
  - Automated **VIDEO** observer
    - Archipelago Marine Research
    - high definition video recording
  - Loading, unloading and identification of catch and bycatch **BY SET**



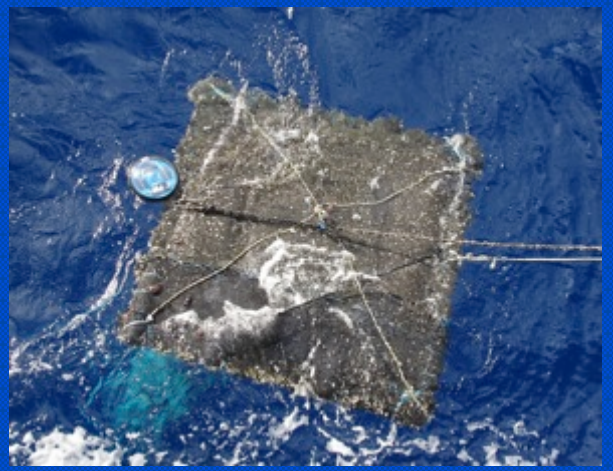


Research Activities

- Underwater Visual Census at FADs
- Natural behavior of tuna and non-target species on floating objects
- Observations of FAD design vs entangling issues

Update of information on the fishery and Recommendations for Best Practices

- FAD type and design: mesh size, float design, integrity



EB-WP-12: The post-release condition of FAD associated silky sharks (Carcharhinus falciformis) caught in tuna purse seine gear Rev 1

Hutchinson, M. et al.

- Condition and post-release survival of sharks
- Best practices for the handling and live release of whale sharks and manta rays

EB-WP-12: The post-release condition of FAD associated silky sharks (*Carcharhinus falciformis*) caught in tuna purse seine gear Rev 1

Hutchinson, M. et al.

(note: all samples were silky shark (*Carcharhinus falciformis*) except for one oceanic white tip (*C. longimanus*)

- Tag types:
  - Pop-off Archival Satellite Tags
  - Survival Satellite Tags
  - Conventional Dart Tags
- Blood analysis:
  - pH
  - Lactate
- Sampling design
  - By stage of the fishing operations:
    1. Pre-Assessments of FADs
    2. Fished inside net
    3. Entangled in net
    4. 1st Brail
    5. Later Brail

Condition and post-release survival of sharks

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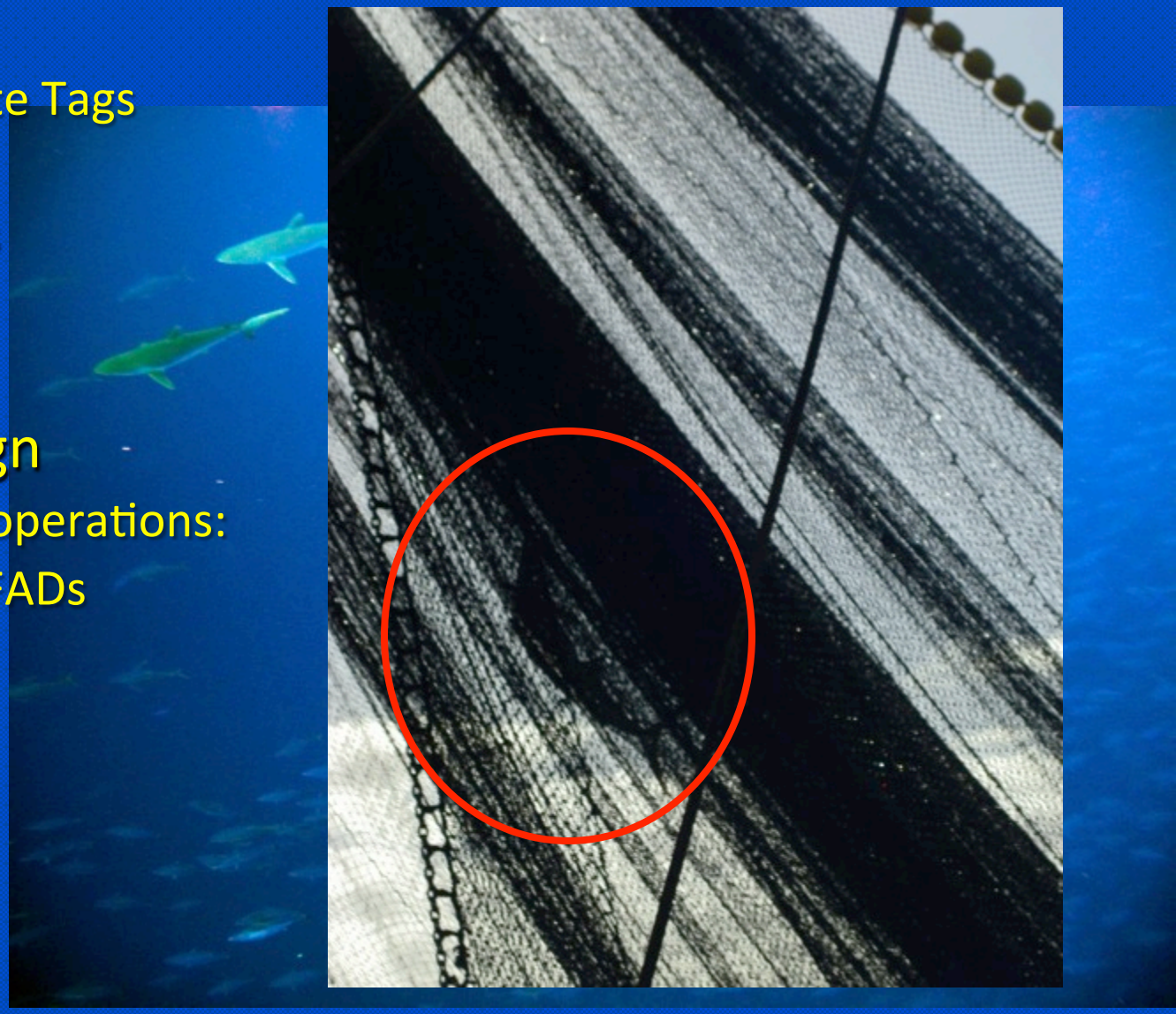

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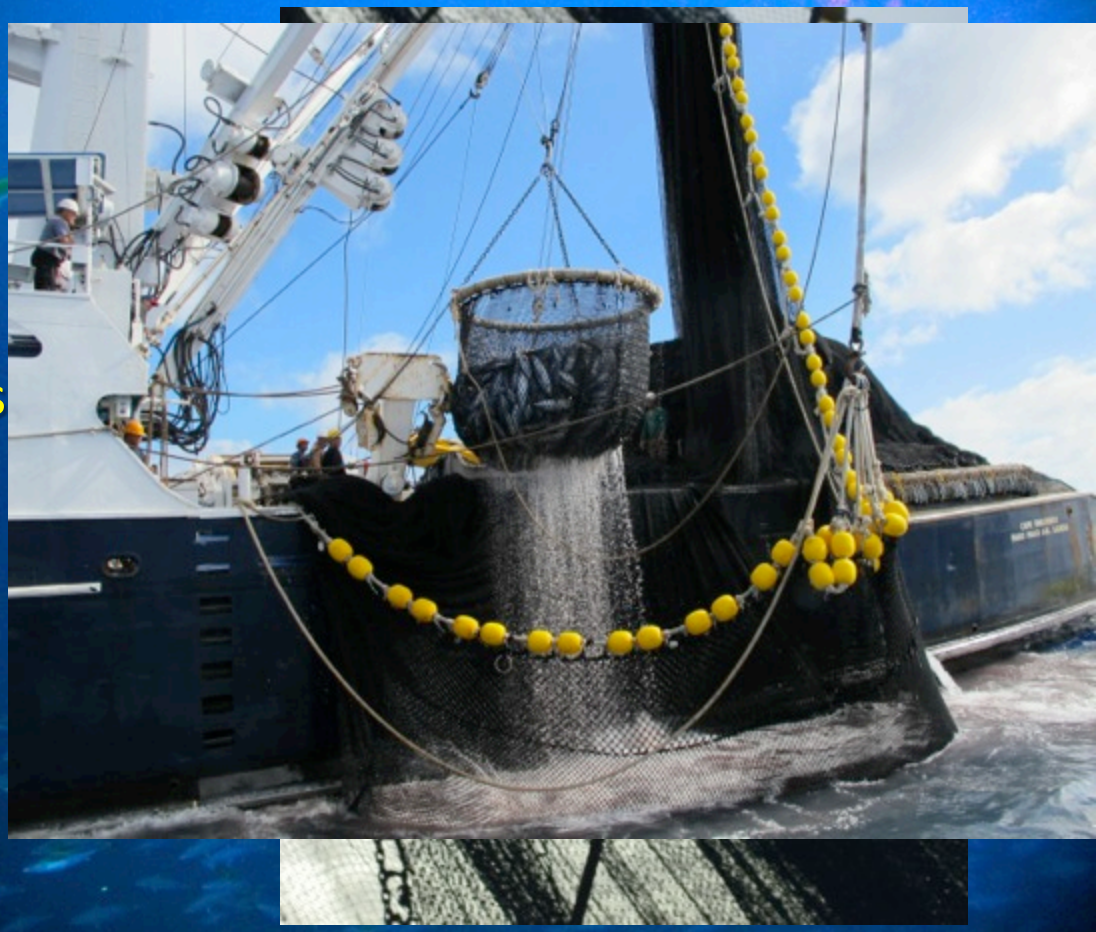

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  - By stage of the fishing operation
    1. Pre-Assessments of FADs
    2. Fished inside net
    3. Entangled in net
    4. 1st Brail
    5. **Later Brail**

Sampling Effort

Sharks tagged and/or blood chemistry by stage of fishing operation

	Pre-Assessment of FAD	Inside the Net	Entangled in the Net	First Brail	Later Brail	Total
Survival PAT	0	2	1	2	0	5
MiniPAT	3**	2	1	0	0	6
MT PAT + Blood	0	0	2	0	1†	3
SPAT + Blood	1	0	4	4	1	10
MiniPAT + Blood	0	0	5	0	0	5
Blood Only	6*	3	9	15	36	**69**
Total for each stage	10	7	22	21	38	**98**

Total sharks caught: n = 296
Satellite tags deployed: n = 29
Blood samples: n = 87
Conventional ID tags: n = 125
Acoustic tags: n = 3 (* in table)
† = OWT

Release Condition

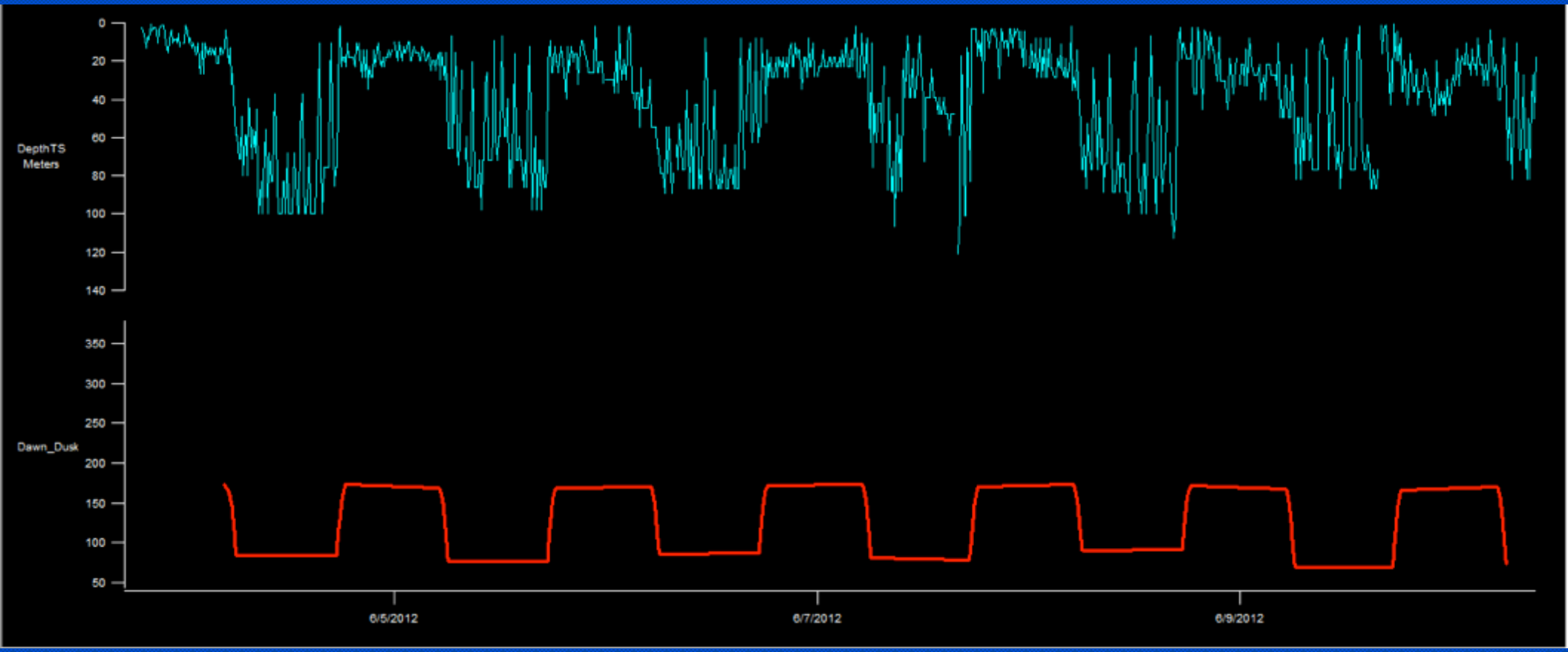
Release condition of sharks landed during each stage of fishing operations

Release Condition	Pre-Assessment of FAD	Inside the Net	Entangled in the Net	First Brail	Later Brail	Spill	Wet Deck
Excellent (4)	**90%**	**86%**	**65%**	**0**	**0**	**0**	**0**
Good (3)	10%	0	14%	3%	4%	0	0
Fair (2)	0	14%	8%	17%	6%	0	0
Poor (1)	0	0	3%	23%	12%	0	40%
Dead (0)	**0**	**0**	**8%**	**47%**	**70%**	**100%**	**40%**
Unkown	0	0	3%	10%	7%	0	20%
Total	10	7	37	30	203	4	5

Excellent (4): Shark swims away quickly without any visible signs of physical trauma
Good (3): Swims well but may appear slower or disoriented
Fair (2): Swimming appears labored with visible signs of trauma
Poor (1): Is able to right itself and makes efforts to swim
Dead (0): Sinks upside down

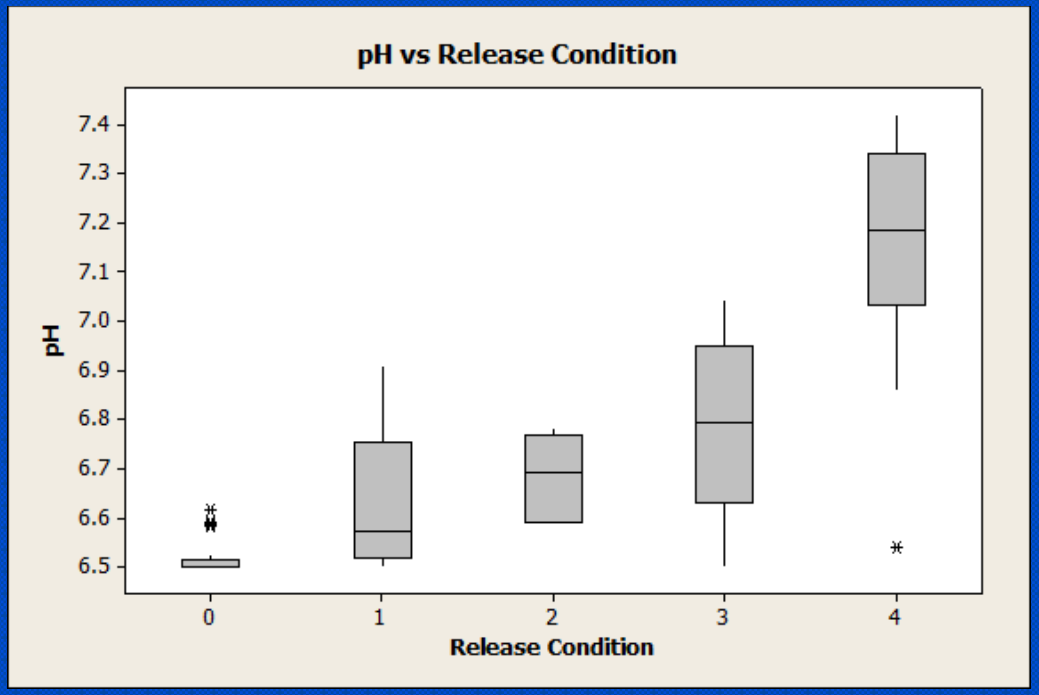
Silky sharks n = 295
Oceanic whitetip n = 1

6 Day Depth Time Series (silky shark)

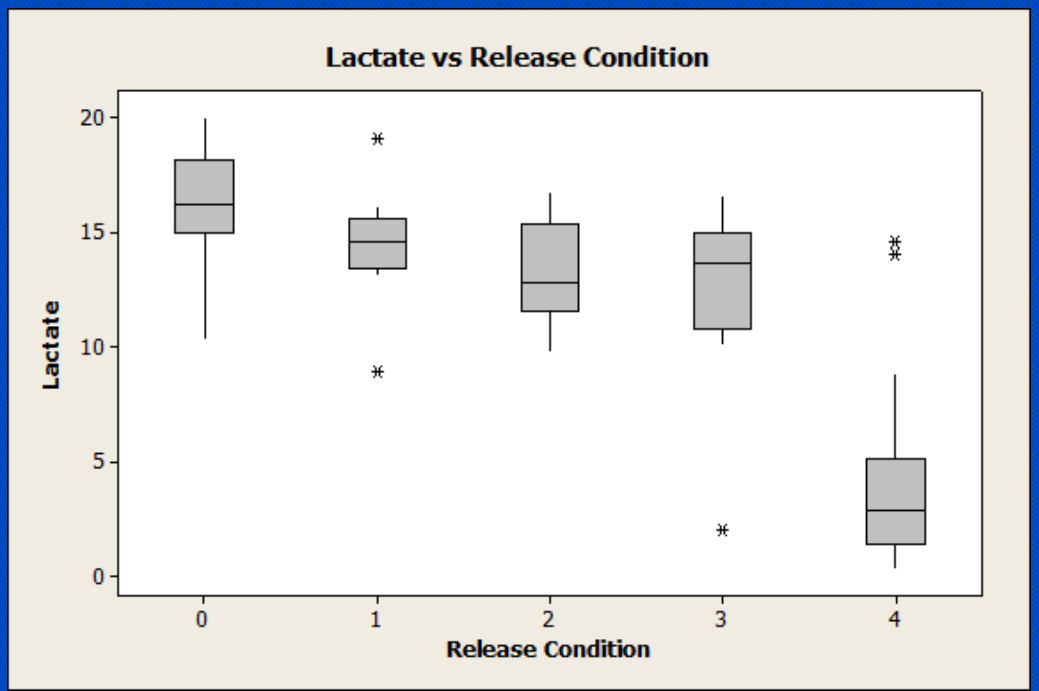


- Diel periodicity - deeper dives at night and shallow during the day.
- Animals stay between 0 – 100 m.

Blood Chemistry – pH and Lactate levels by Release Condition

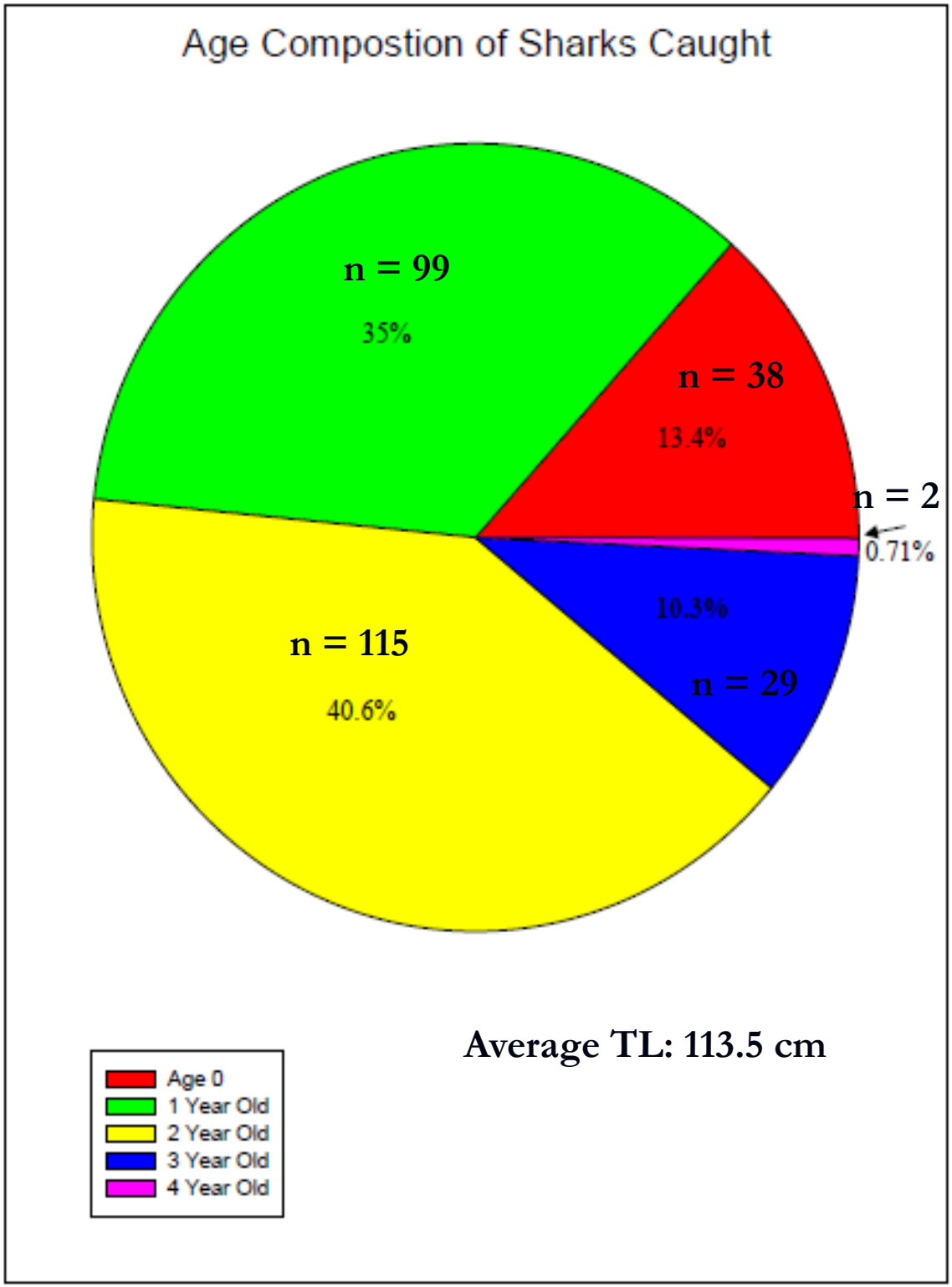


Release condition: 0 = Dead, 4 = Excellent



Age at maturity: 6-10 years
Size at maturity: 200-250 cm TL
Litter size: 1-16
Parturition: May – July

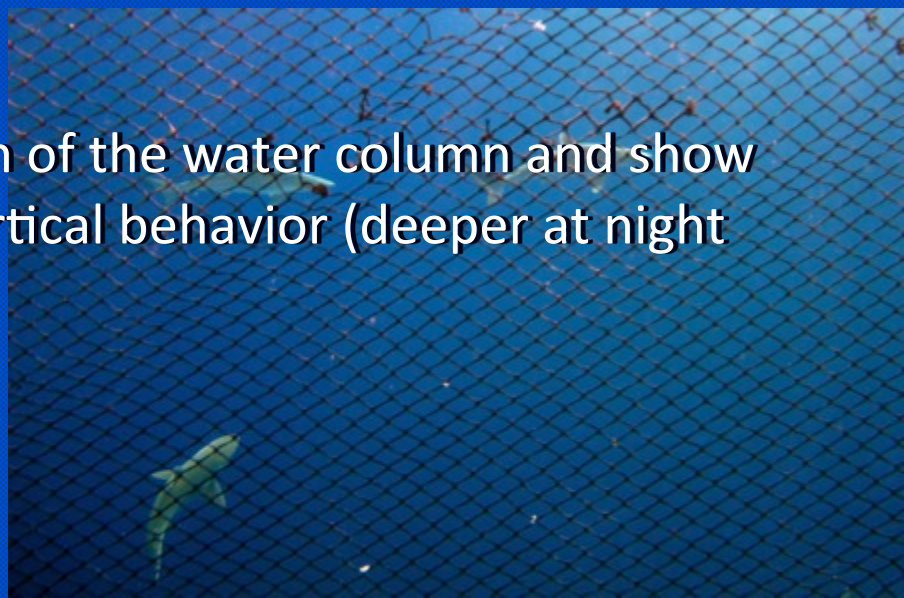
ALL sharks encountered during cruise were IMMATURE



Average TL: 113.5 cm

Key Preliminary Findings

- Animals landed and released early in the fishing operations (while still free swimming or entangled in the net) had higher post –release survival rates than animals landed during the brailing stages.
- Survival of sharks is compromised once they are confined in the sack and efforts to reduce fishery induced mortality should be focused on releasing animals before this point
- Animals released in 'Good' or 'Excellent ' condition had high survival rates
- Low pH and high lactate levels are correlated to low release condition and high post- release mortality
- FAD associated silky sharks are juveniles
- Juvenile silky sharks stay in the upper 100m of the water column and show some degree of diel periodicity to their vertical behavior (deeper at night and shallow during the day



Best practices for the handling and live release of whale sharks and manta rays

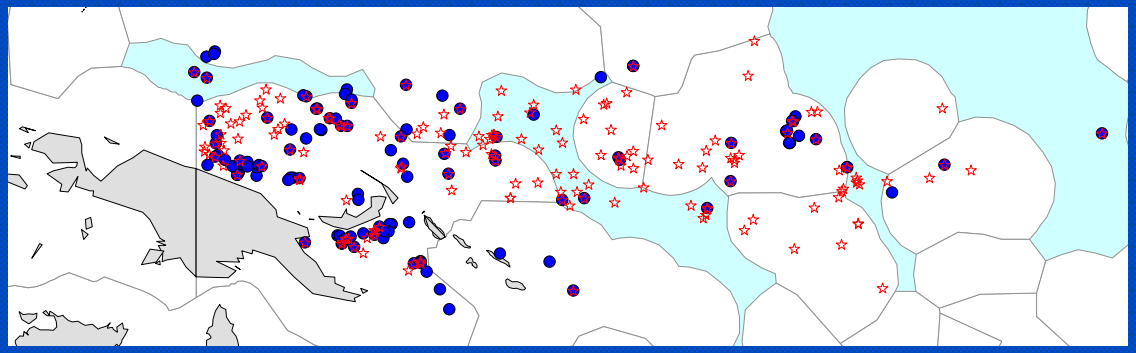
No whale sharks were encircled during the cruise but the crew described their methods and ideas for safe release of whale sharks and rays

Although no whale sharks were encircled or released, new ideas for the safe handling and release of oceanic sharks were tested

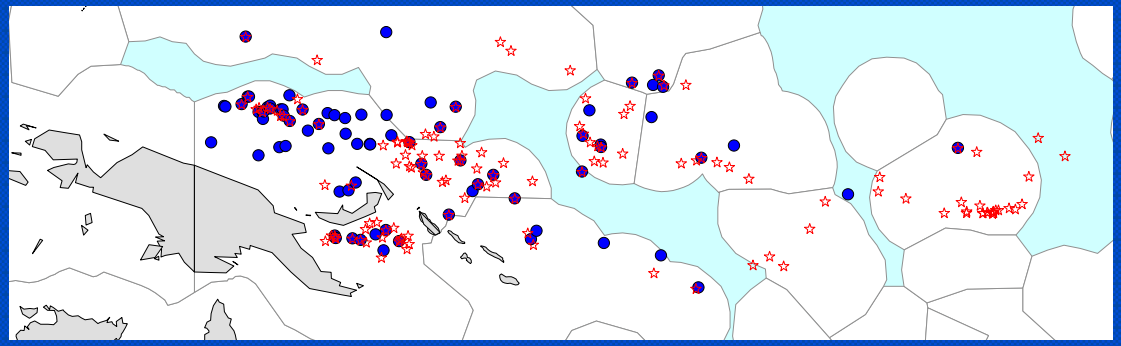
35” Sampson line sling purpose built to test whale shark release technique – coupled with tagging with Survivorship PAT tags

Whale shark issues

- Observations (red) and whale shark sets (blue)



  - 2007 – 2009



  - 2010

Recommendations from SC8

- SC8 recommends that the Scientific Services Provider conduct a study on the spatial and temporal distribution of whale shark in the WCPO based on observer data and other data sources as appropriate.

- SC8 supports the finding of the Scientific Services Provider that whale shark meets the basic criteria for consideration as a key shark species and recommends that the whale shark (*Rhincodon typus*) be defined as a key shark species of the WCPFC.

- SC8 through the Commission encourages CCMs to adopt and promote the recording of data by their longline fleets on harmonized and sufficiently detailed longline logsheets that include the key sharks species.

Development guidelines for the safe release of encircled animals, including whale sharks

(Recommendation adopted at SC8, Busan Korea, 6-15 August 2012)

- Safety of the crew is a paramount consideration.
- When releasing encircled whale sharks, the stress the animal receives should be minimized to the extent possible.
- The following possible release methods should be used as general guidelines.
- The effectiveness of the following possible release methods has not been fully evaluated. Further scientific research is necessary in order to investigate survival after the release by various release methods. Therefore, CCMs are encouraged to conduct analysis on methods used by their purse seine vessels. In addition, the WCPFC could initiate a program of satellite tag deployments by experienced observers to assess survival of encircled animals associated with various release techniques.
- The appropriate release method should be chosen in a flexible manner depending on the circumstances and condition of the particular purse seine set, e.g. the size and orientation of the encircled animal, amount of fish in the purse seine set, weather conditions and brailing operation style.

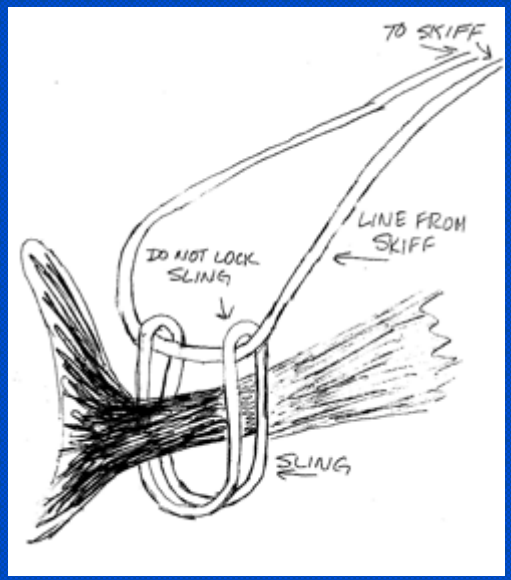
Possible release methods recommended by SC8

- Cutting the net
- Passive removal over corkline
- Horizontal towing shark with sling
- Brailing (very small individuals)

Release methods NOT recommended

- Vertical lifting by the tail
- Use of hooks, gaffs , boring of holes in the fin/body or use of sling through the gills

- Passive removal



- Sling method

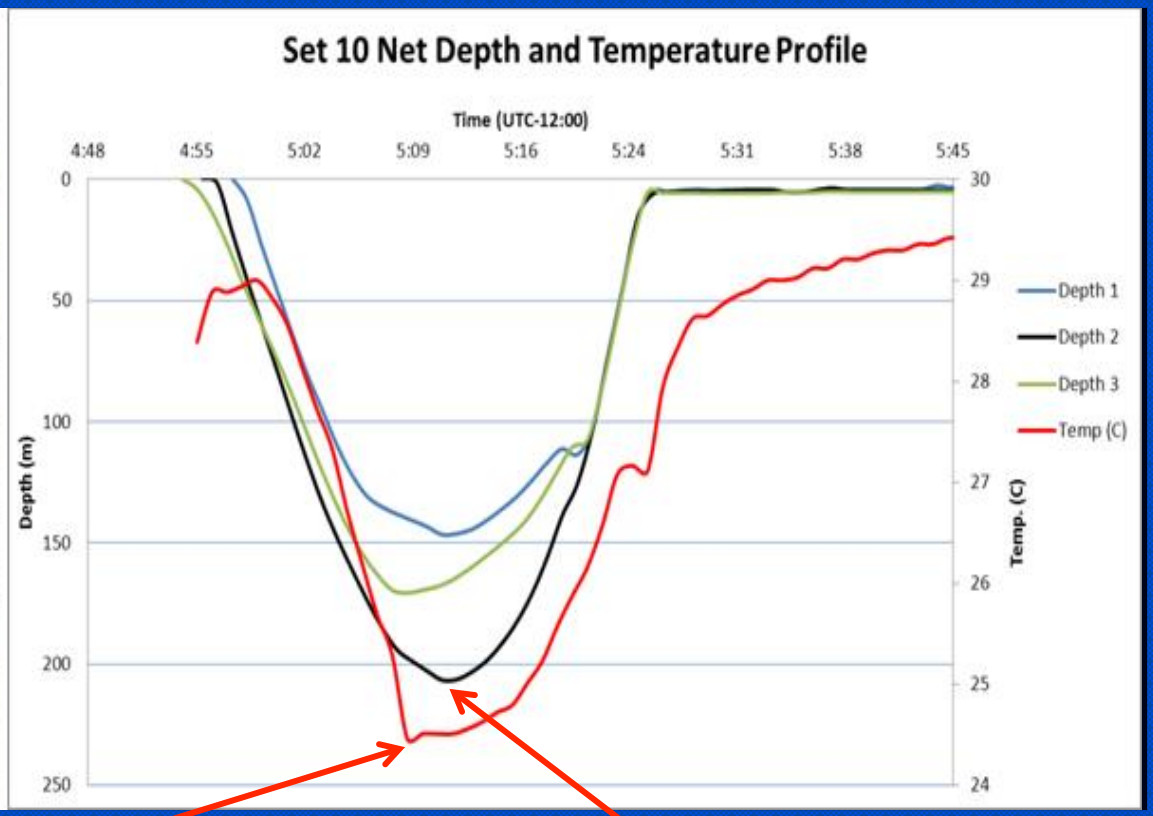
EB-WP-13: Behaviour of target and non-target species on drifting FADs and when encircled by purse seine gear

Muir, J. et al.

- Net depth monitoring
- Vertical and horizontal behavior of tuna and bycatch species on FAD Agggregations
- Targeting skipjack after dawn – while avoiding bigeye and bycatch
- Natural behavior of tuna and bycatch in the net

Net temperature/depth measurements

Example plot of set depth and temp



Min water temp 24.5 deg C

Max depth 210 m

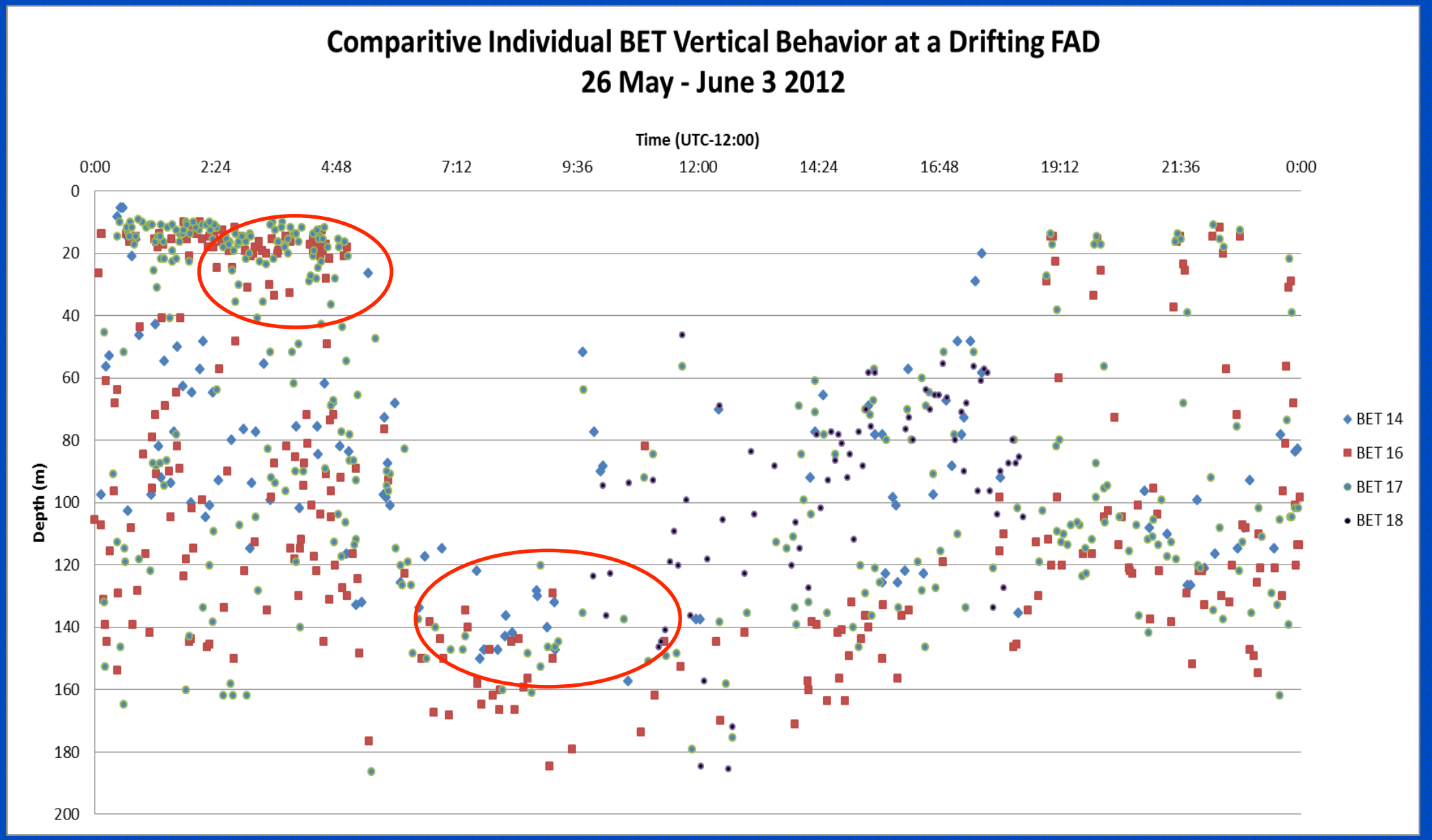
Three TDR Sensors attached to chainline at even intervals

Temperature and depth recorded at one minute intevals

Useful to verify operational depth of net for specific sets and to know net depth in relation to catch

Vertical and Horizontal behavior of tuna and bycatch species on FAD Aggregations (use of acoustic transmitter tags)

- Fidelity to FAD varied by species
- Noticeable species-specific schooling behavior
- Vertical behavior (depth of fish) consistent with other studies
- Targeting SKJ after dawn and avoiding small BET may be an option but requires more testing


Comparitive Individual BET Vertical Behavior at a Drifting FAD
26 May - June 3 2012
Time (UTC-12:00)
0:00
2:24
4:48
7:12
9:36
12:00
14:24
16:48
19:12
21:36
0:00
Depth (m)
0
20
40
60
80
100
120
140
160
180
200
BET 14
BET 16
BET 17
BET 18

Common Arrival/Departure Times (schooling behavior) - BET

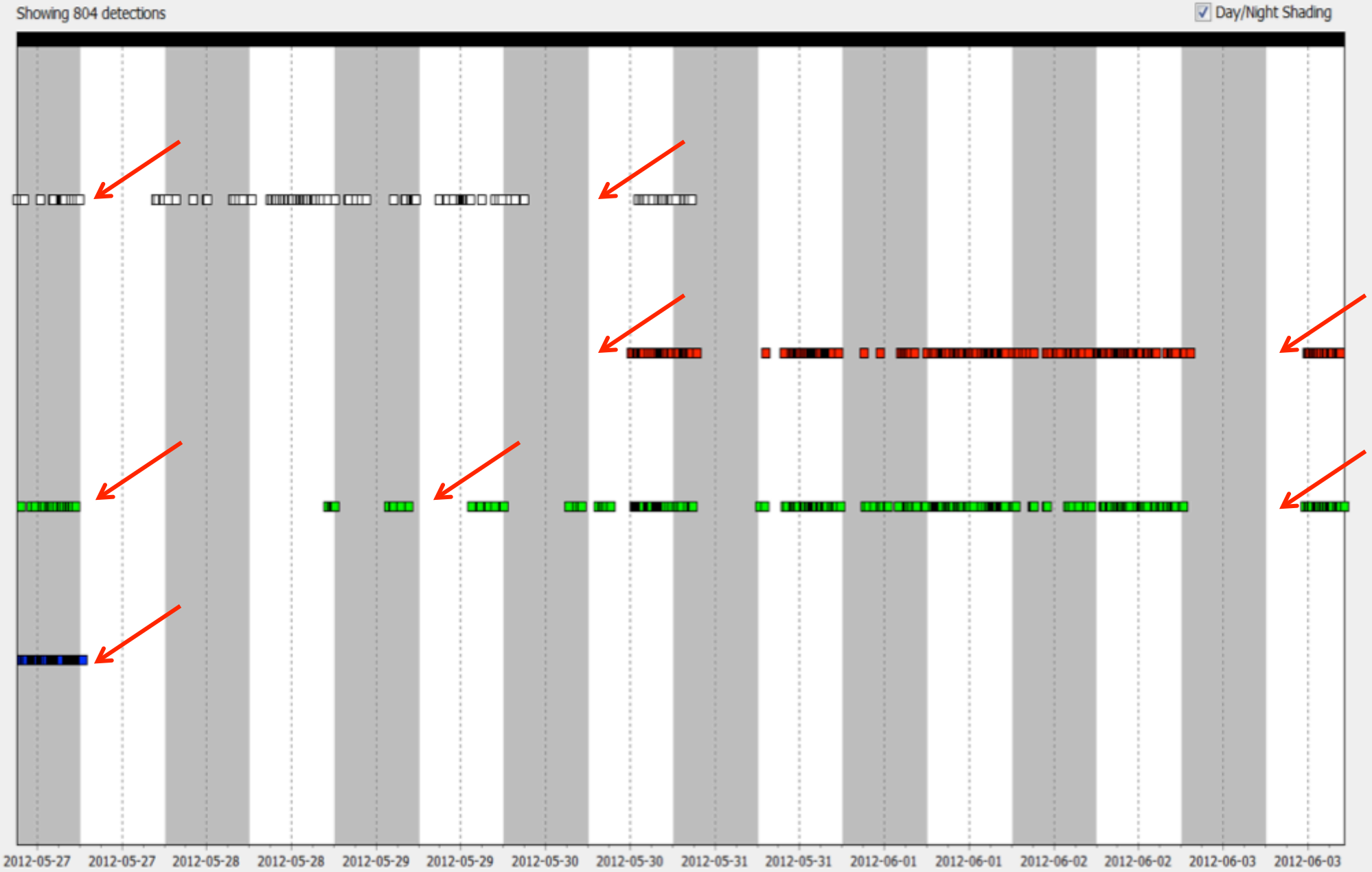


Photo: Jeff Muir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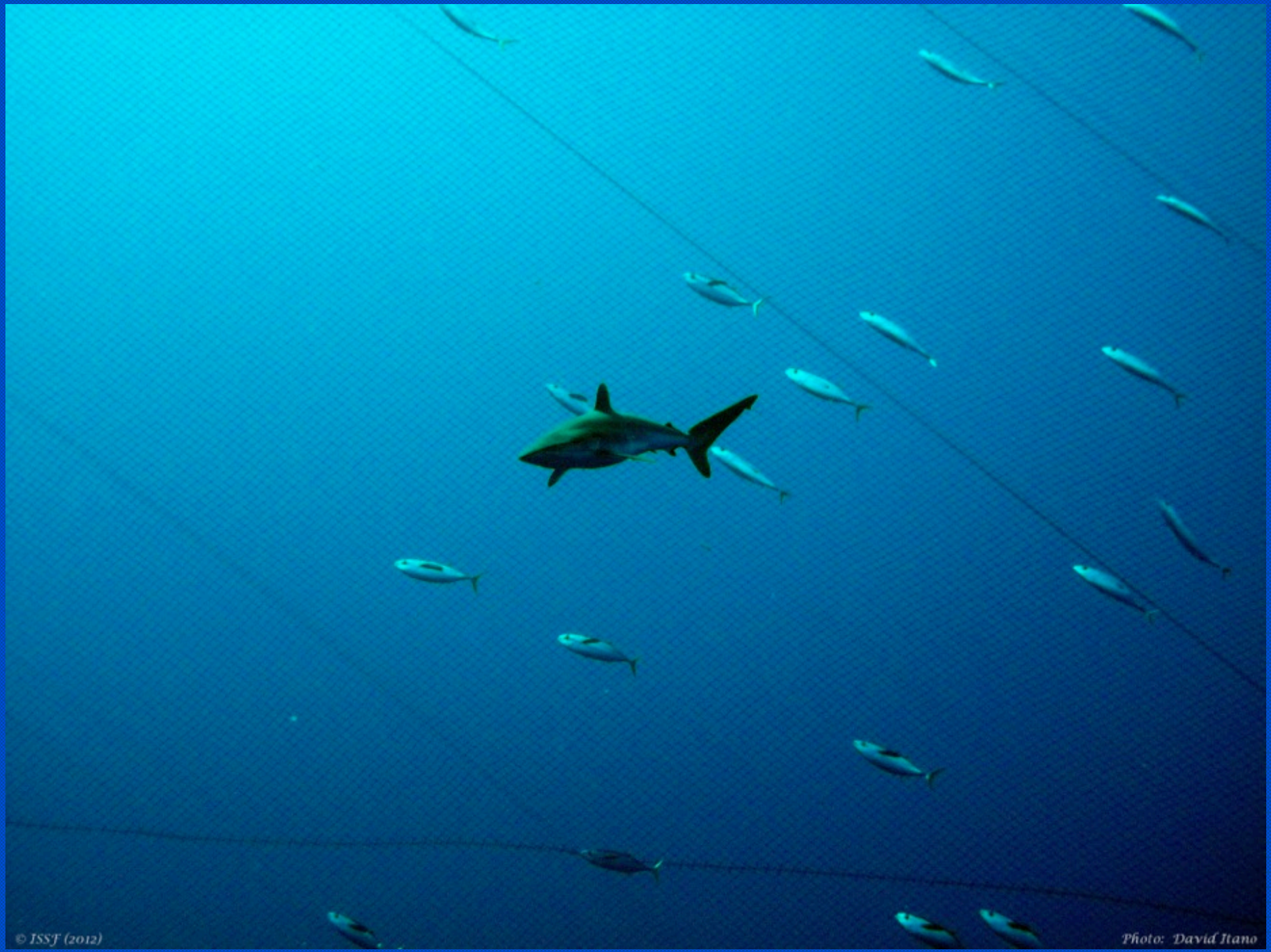
Significant Outcomes

- Segregation and stratification in net observed consistently
  - By species
  - By size
  - Target and non-targeted
- This natural behavior may provide clues for future work in selective release of small tuna and non-target species before sack up
- Fishermen and scientists have a window into what really happens in the net… now solutions to bycatch release can be proposed and tested
- Tagging data confirms behavioral characteristics observed in the net
- Tagging data suggests SKJ targeting after dawn while avoiding bigeye may be possible – needs further experimentation
- Net depth sensors provided data as to how fishing can be modified to avoid unwanted catch by adjustments in depth


© ISSF (2012)
Photo: David Itano

Release of undersize tuna and non-target species from the net

- Initial release of fish from the net by towing the FAD
- Scooping bycatch from the top of the sack
- Experimental technique of a "skimming brail"

For Drifting FADs, these methods do not appear to be a viable solution to bycatch mitigation

Research Activities

- Release of undersize tuna and non-target species from the net
  - Scooping bycatch from the top of the sack
  - Experimental technique of a “skimming brail”

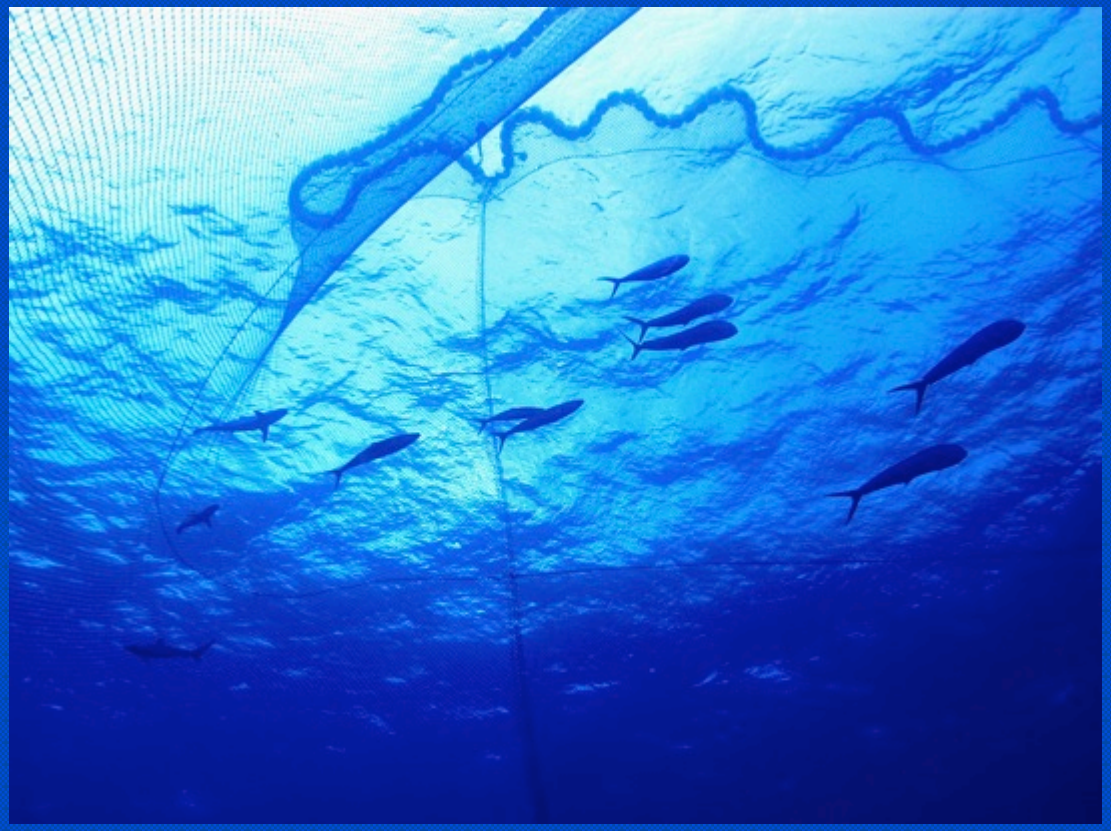
<u>For Drifting FADs, does not appear to be a viable solution to bycatch mitigation</u>

Sorting grid in the sack ?

EB-WP-14: Development and testing of a release panel for sharks and non-target finfish in purse seine gear

Itano, D. et al.

- Natural behavior of tuna and non-target species
  - Inside the net



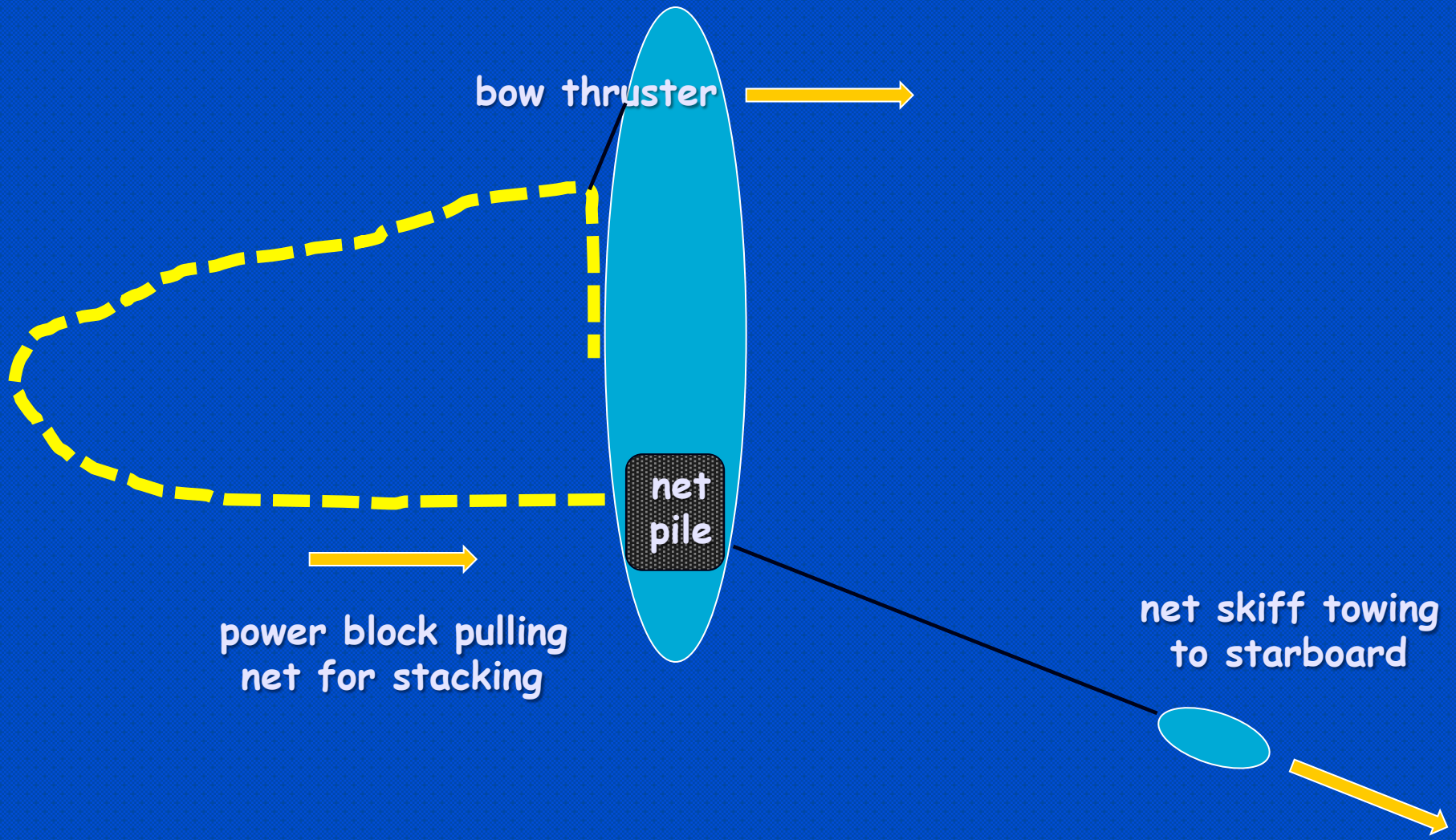
Research Activities

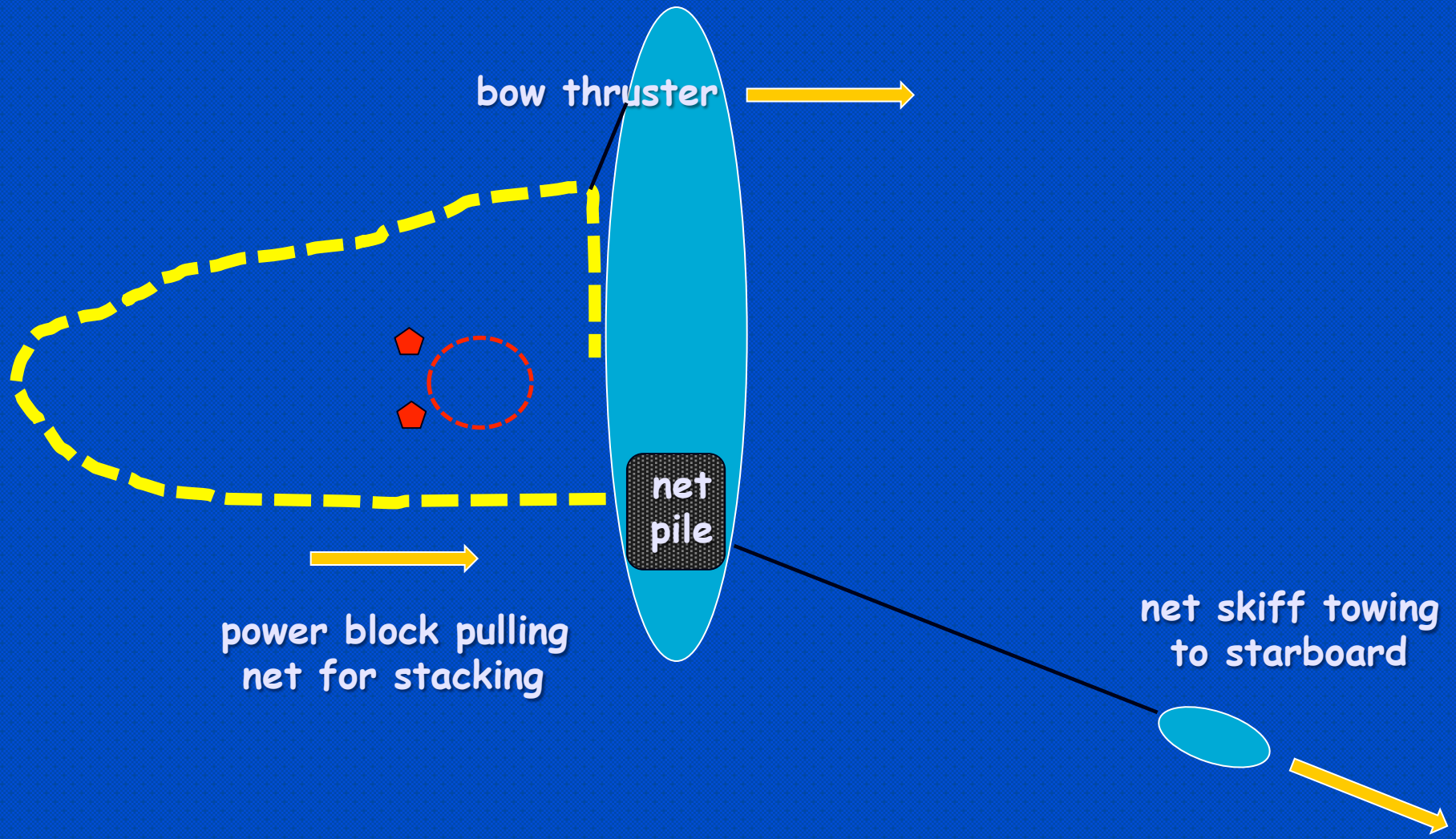
- Natural behavior of tuna and non-target species
  - Sharks and bycatch species often end up shallow and in the “Pocket”

Research Activities

- Natural behavior of tuna and non-target species
  - "Pocket" formed near the sack by skiff towing vessel away from net, the bow thruster moving to starboardand current

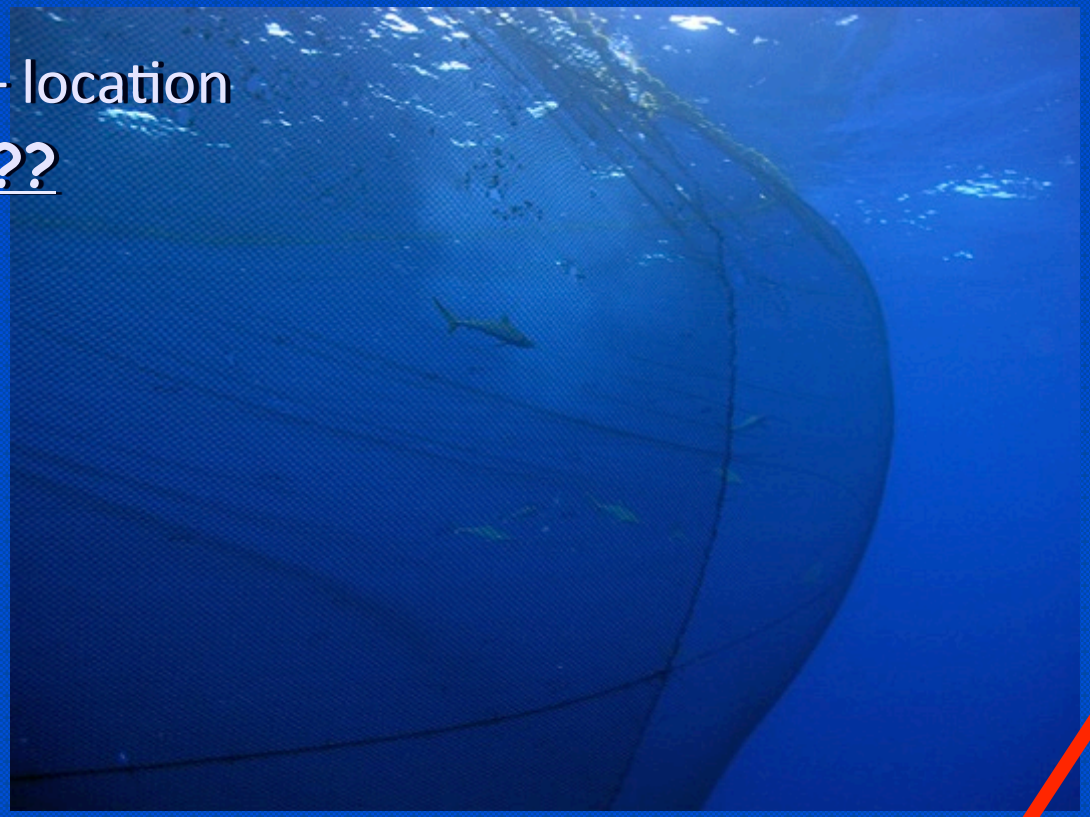
Formation of the “pocket” and release mechanism




bow thruster
net pile
power block pulling net for stacking
net skiff towing to starboard

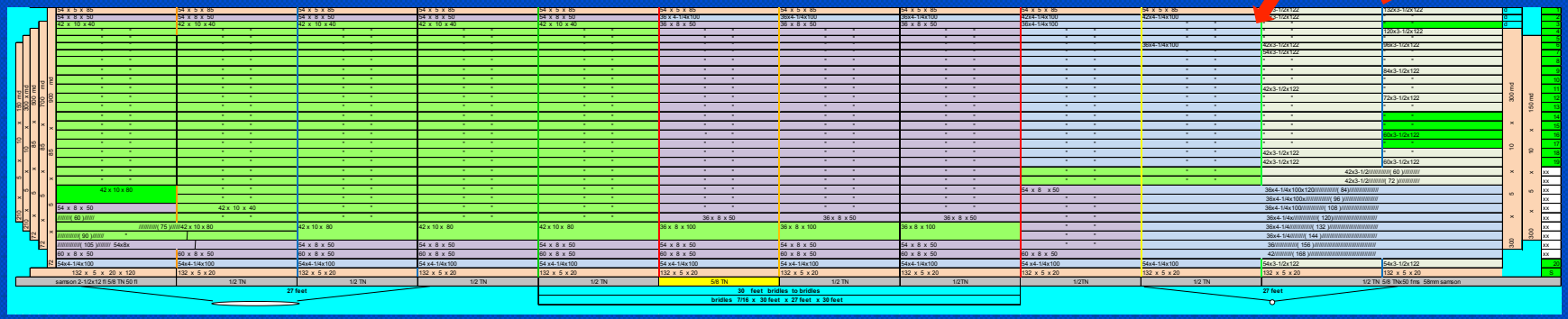
Research Activities

- Release panel – location
  - … what if ??



280 m from Bow oertza

Corkline length: 1719 m

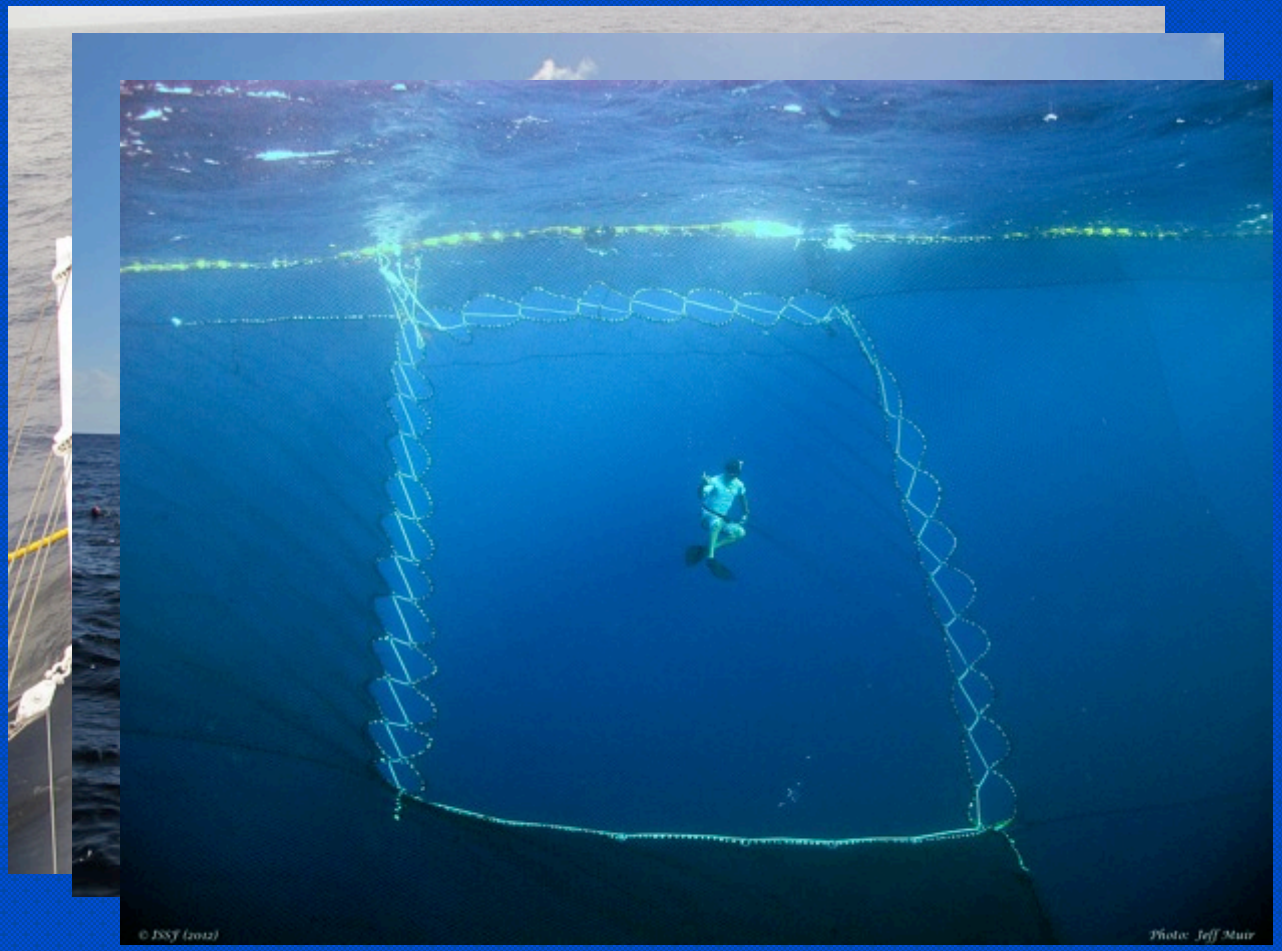


Purse seine diagram

Release panel construction and testing

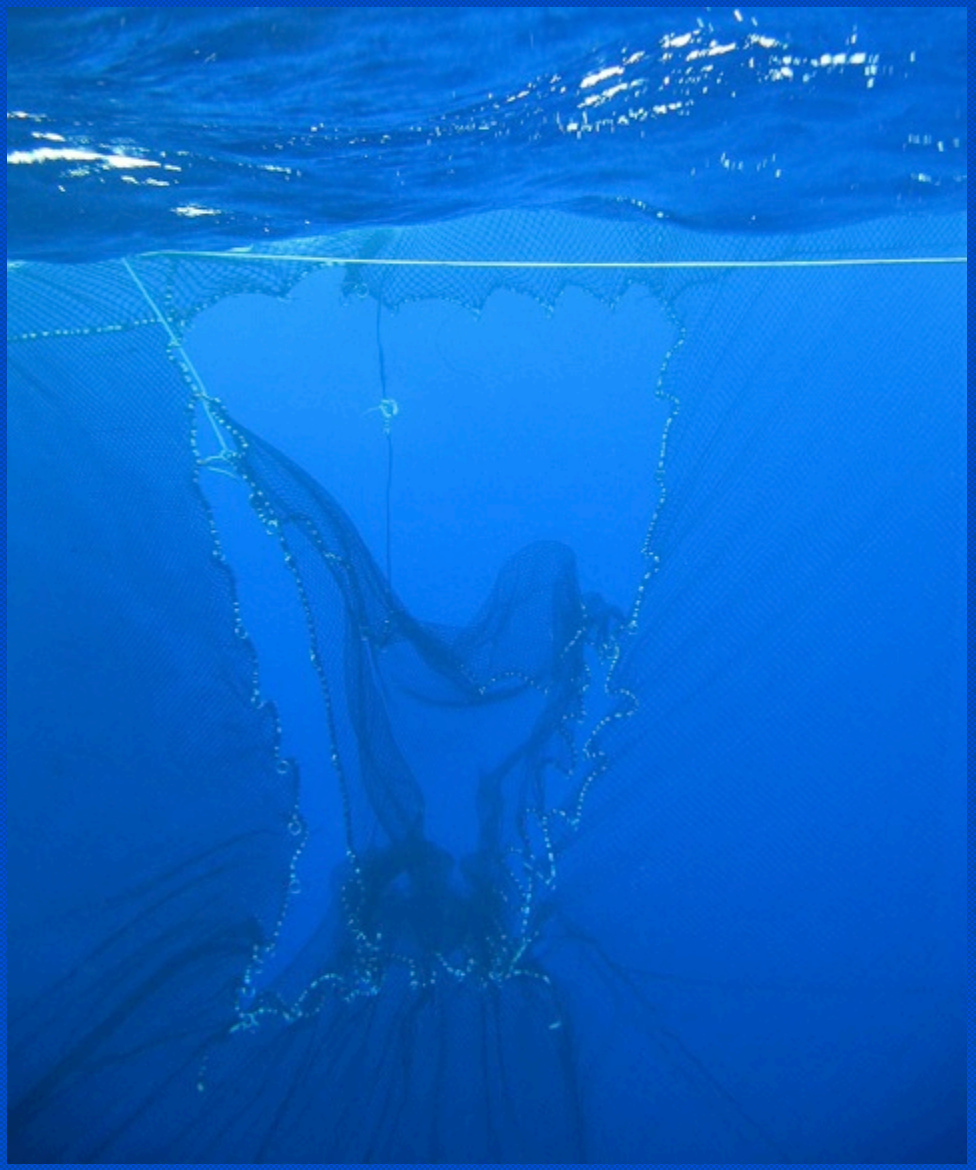
Release panel construction and testing

- Release panel – location
  - 280 m from the end of the net

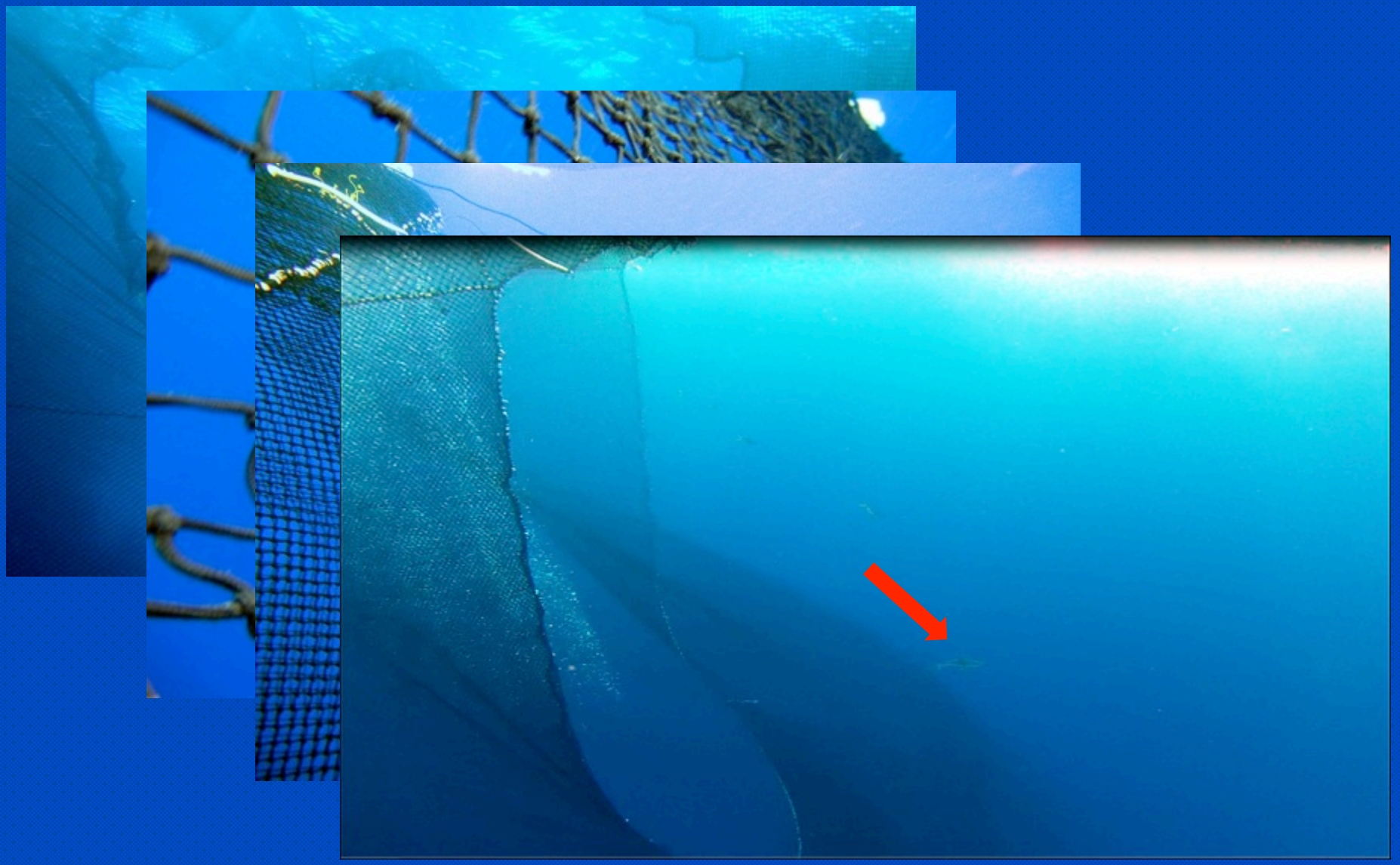


Impact of the panel on fishing operations

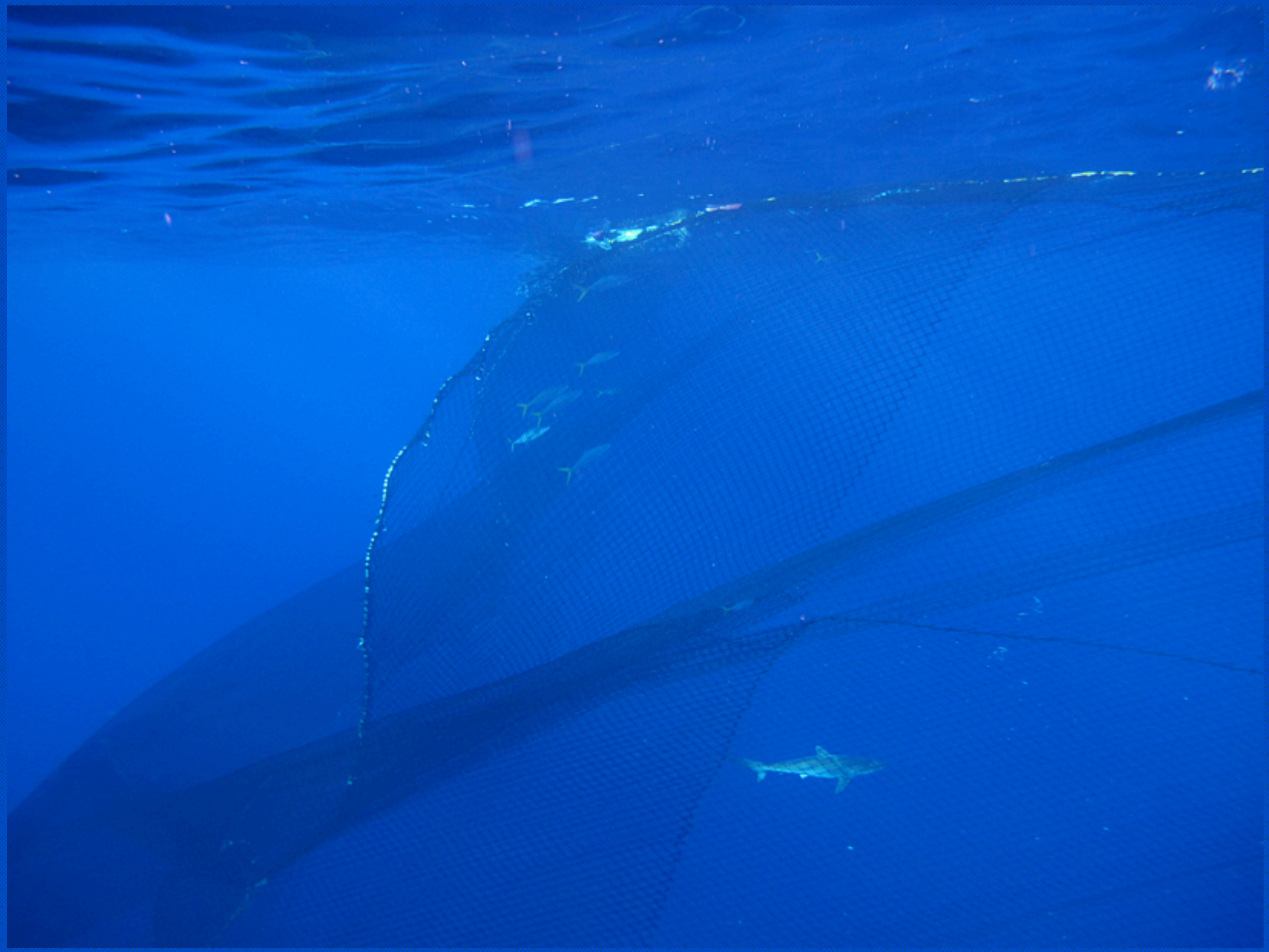
Operation of the panel



Operation of the panel



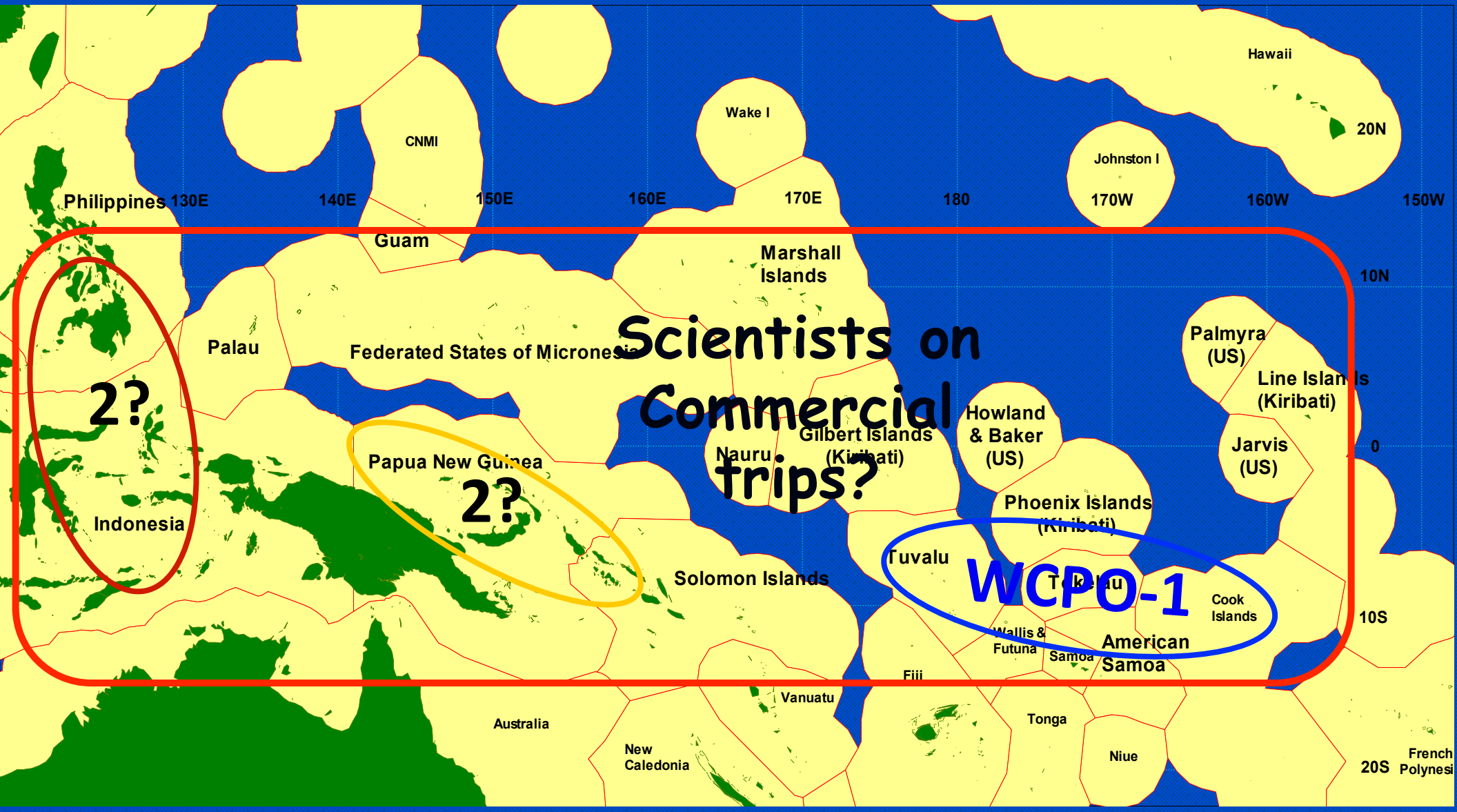
Motivations and mechanisms to leave or stay



Research Activities

- Natural behavior of tuna and non-target species
  - "Pocket" formed near the sack by skiff towing vessel away from net, the bow thruster moving to starboardand current

WCPO: Future Research Cruises ?



Recommendations arising from the research cruise

- 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. large oceanic shark) studies should be developed that utilize PSAT and survival PAT tagging technology.
  - In particular, the post release condition of whale shark needs to be verified with satellite tag technology in conjunction with careful documentation of release method
- Estimates of shark mortality reported by observers should be investigated closely as unintentional under-reporting may be occurring

Thank you

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