A Review of Scientific Data on Bycatch in FAD Tuna Fisheries

Thirtieth Session
Rome, Italy

9-13 July 2012

INTERNATIONAL SEAFOOD SUSTAINABILITY FOUNDATION

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The Biology of tuna at FADs

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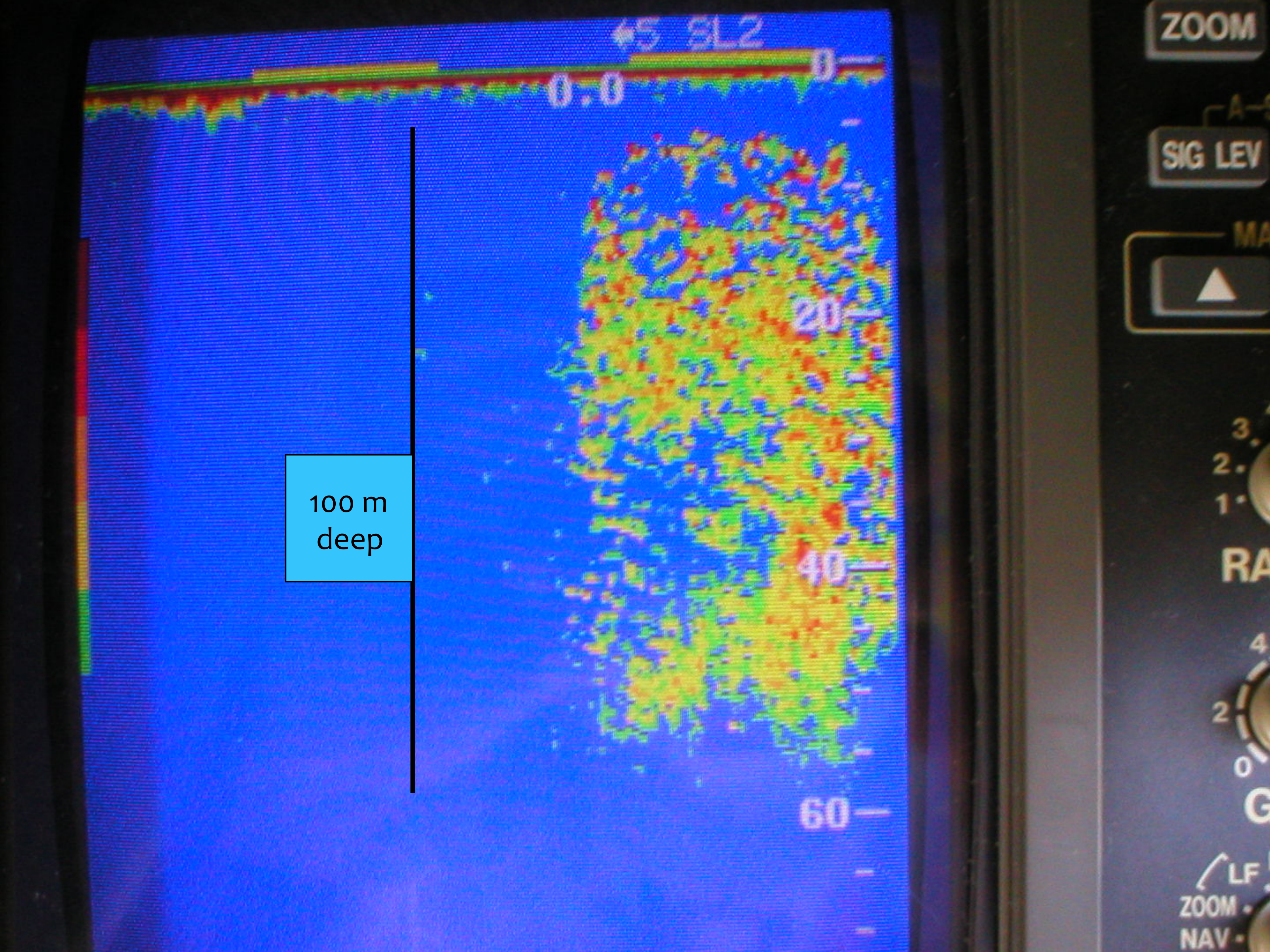
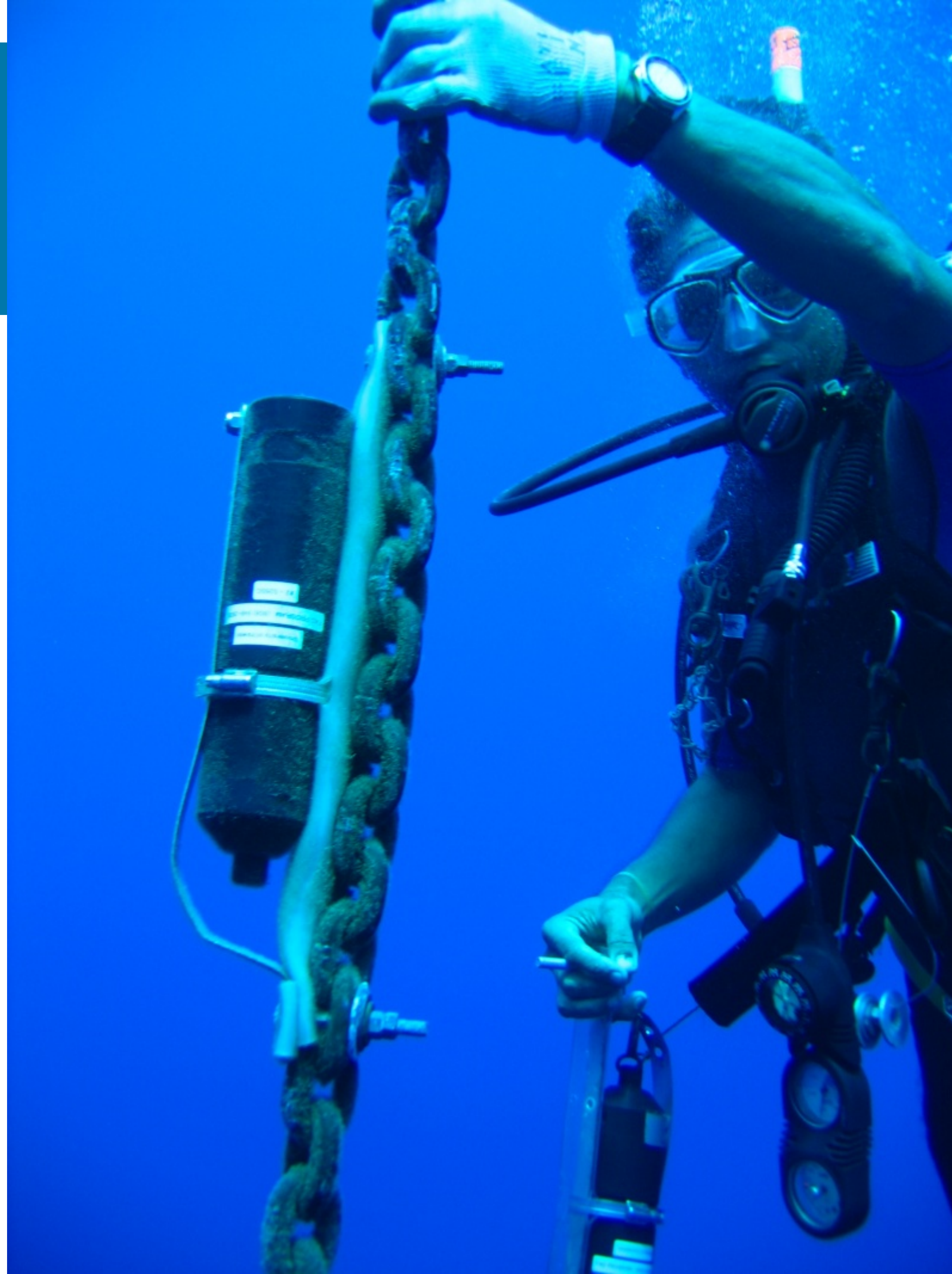
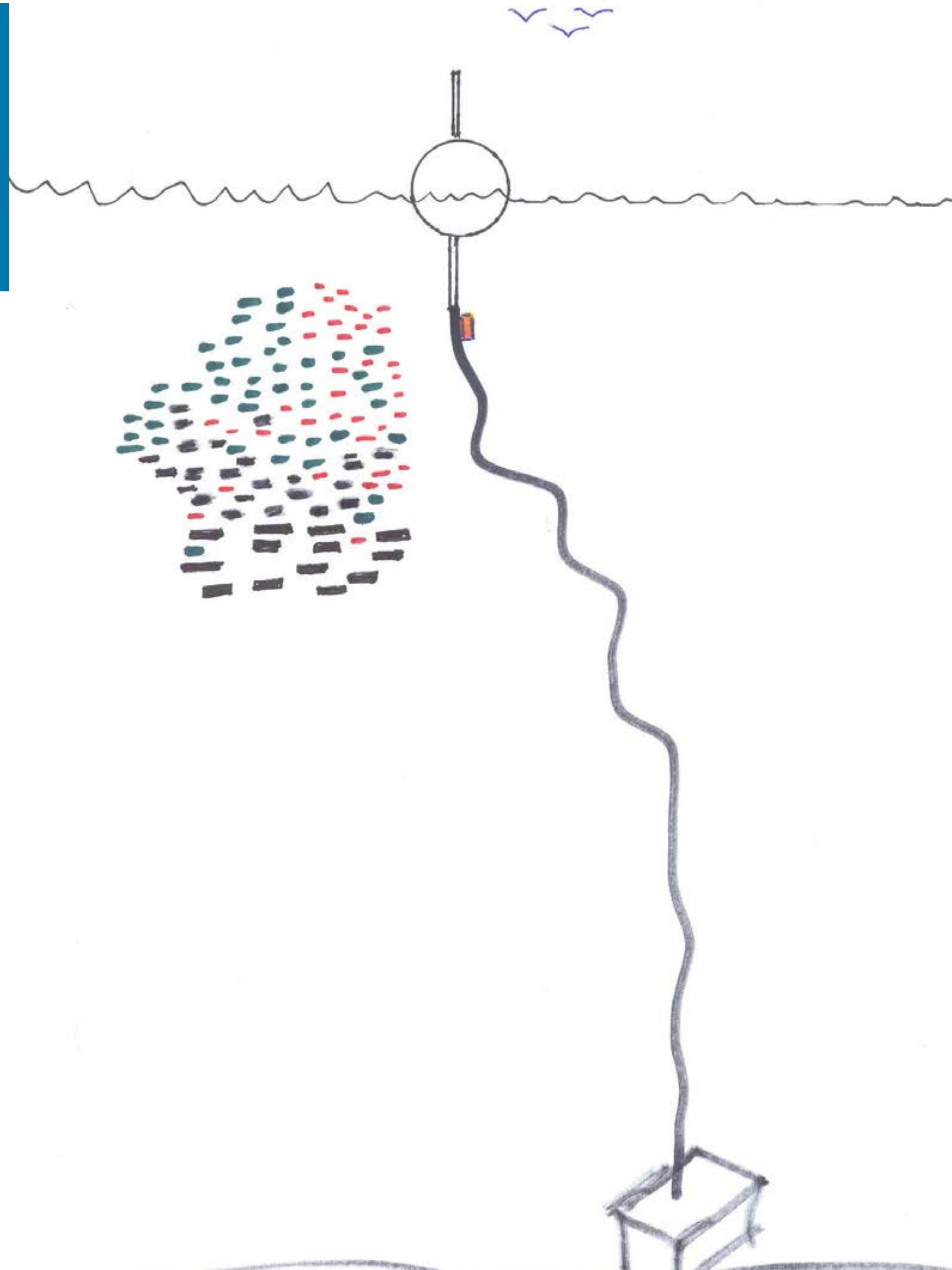
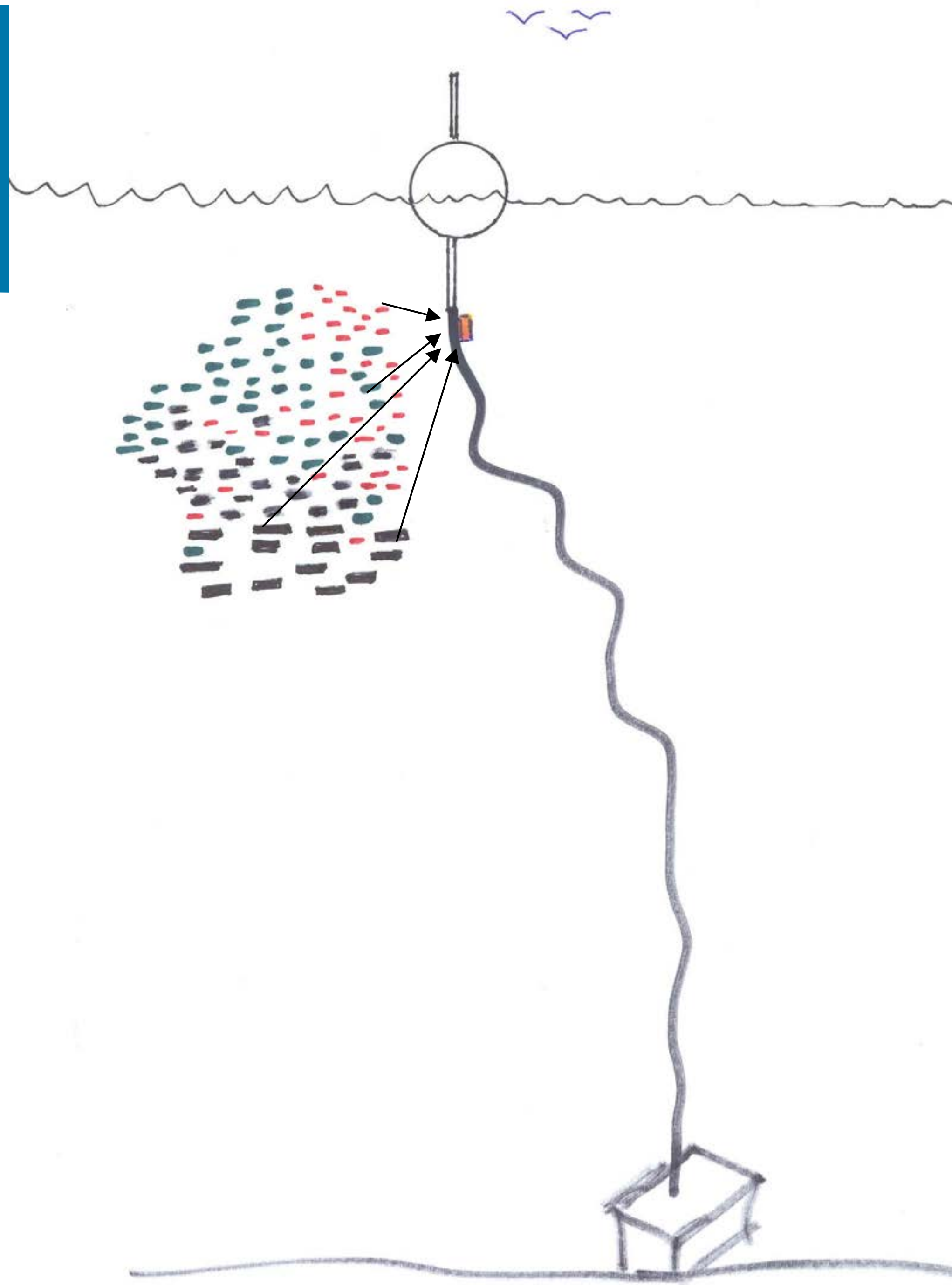


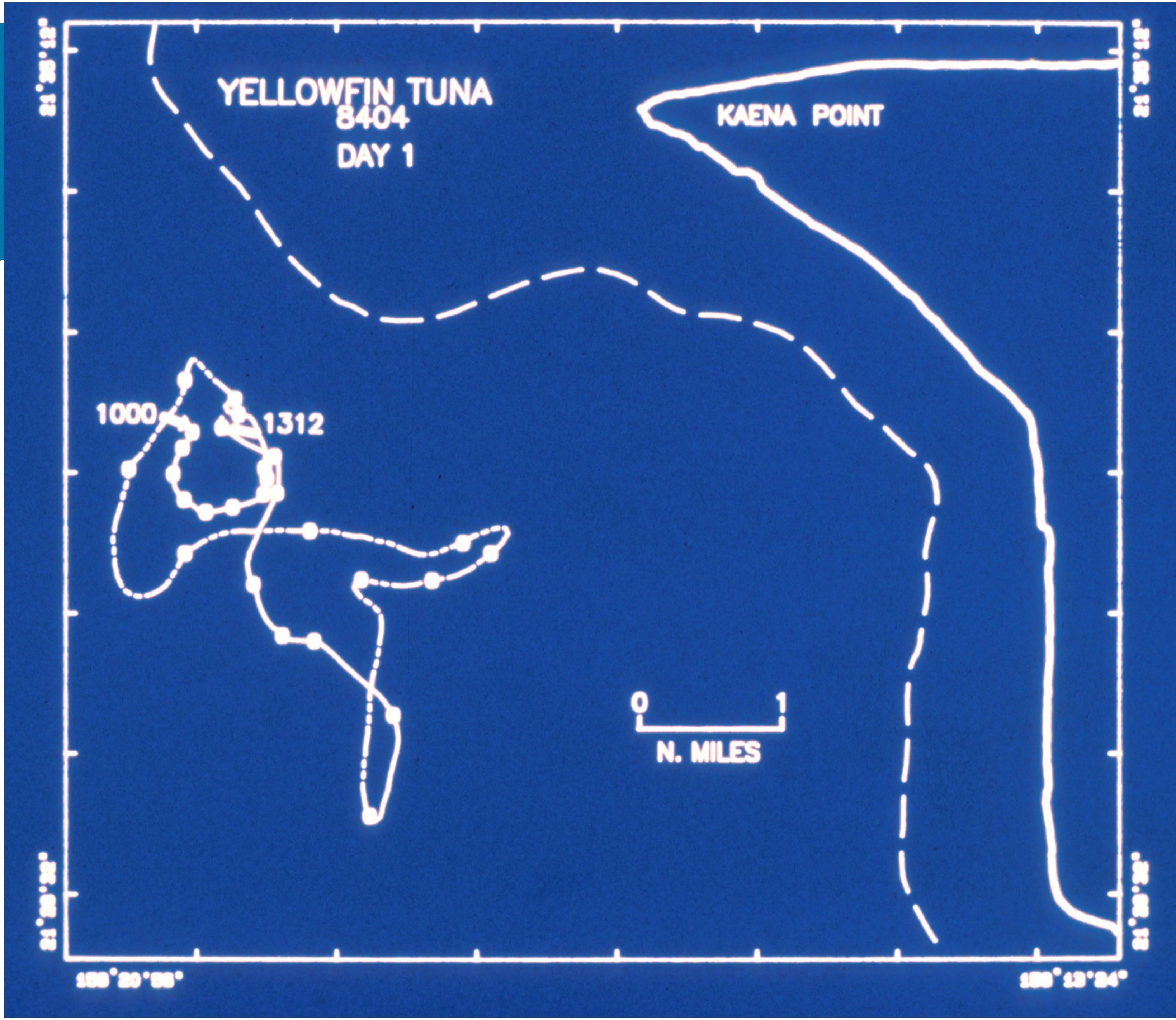
100 m deep
0.0
20
40
60
ZOOM
SIG LEV


HA 345 XF

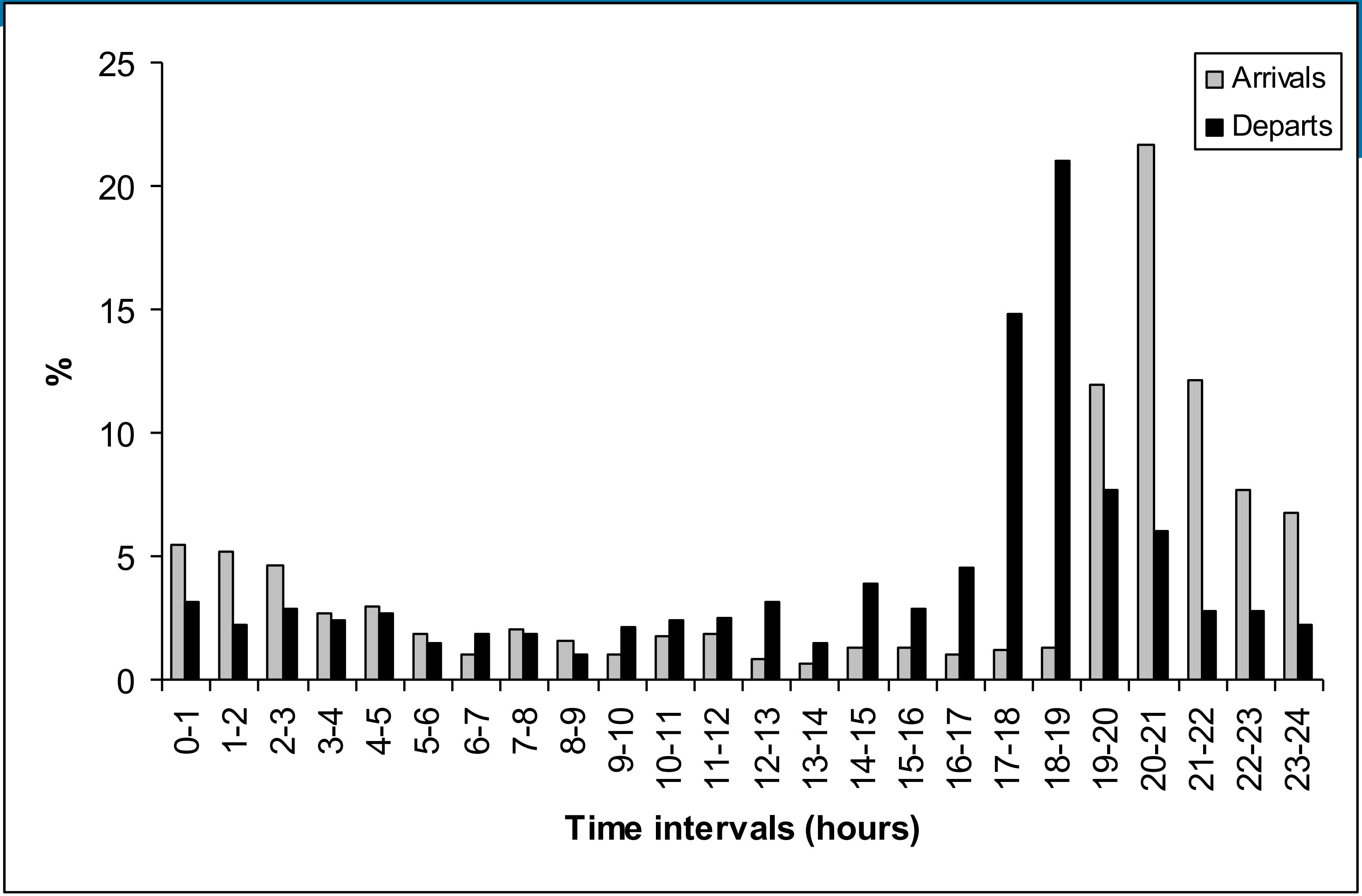


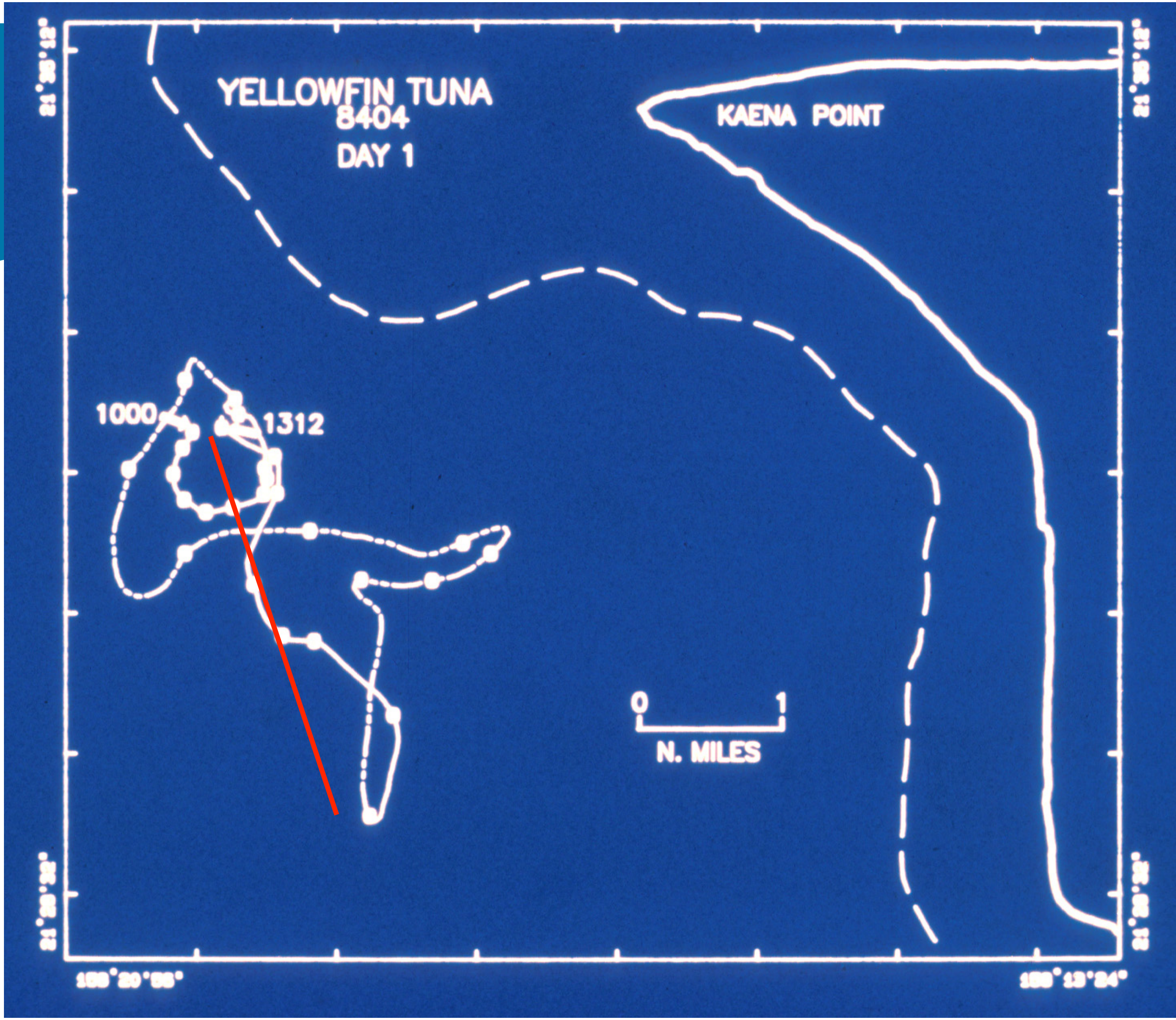




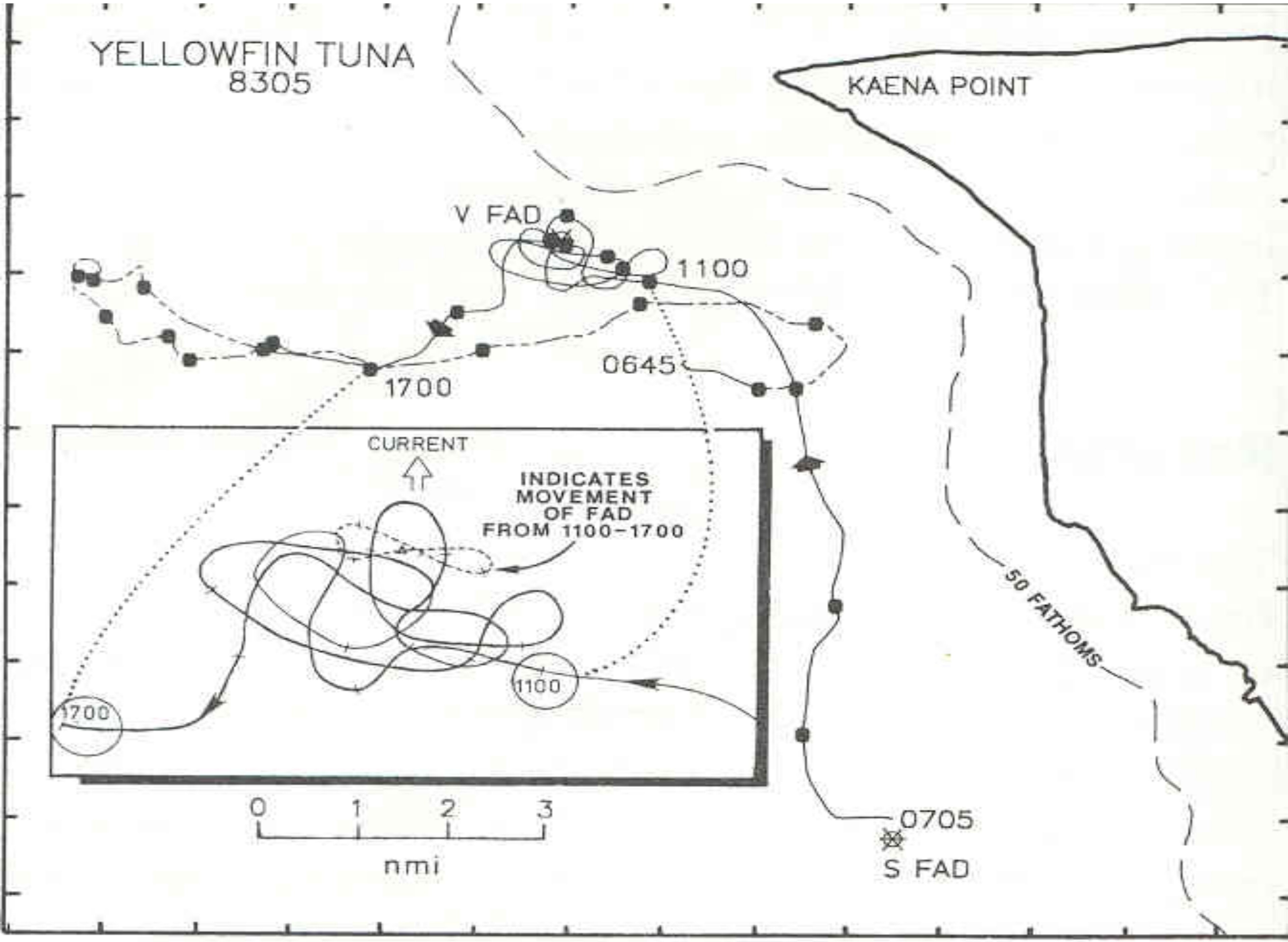

YELLOWFIN TUNA
8404
DAY 1
KAENA POINT
1000
1312
0
1
N. MILES

ANALYSIS OF FINE SCALE BEHAVIOR – Arrival and departure times of yellowfin tuna at Hawaiian FADs





YELLOWFIN TUNA
8404
DAY 1
KAENA POINT
1000
1312
0
1
N. MILES



YELLOWFIN TUNA
8305
KAENA POINT
V FAD
1100
0645
1700
CURRENT
INDICATES
MOVEMENT
OF FAD
FROM 1100-1700
1100
1700
50 FATHOMS
0 1 2 3
nmi
0705
S FAD

Tag Sp. Size

91 YFT 59 cm

52 YFT 63 cm

102 YFT 55 cm

104 YFT 58 cm

98 YFT 60 cm

Schooling Behavior (at R FAD)

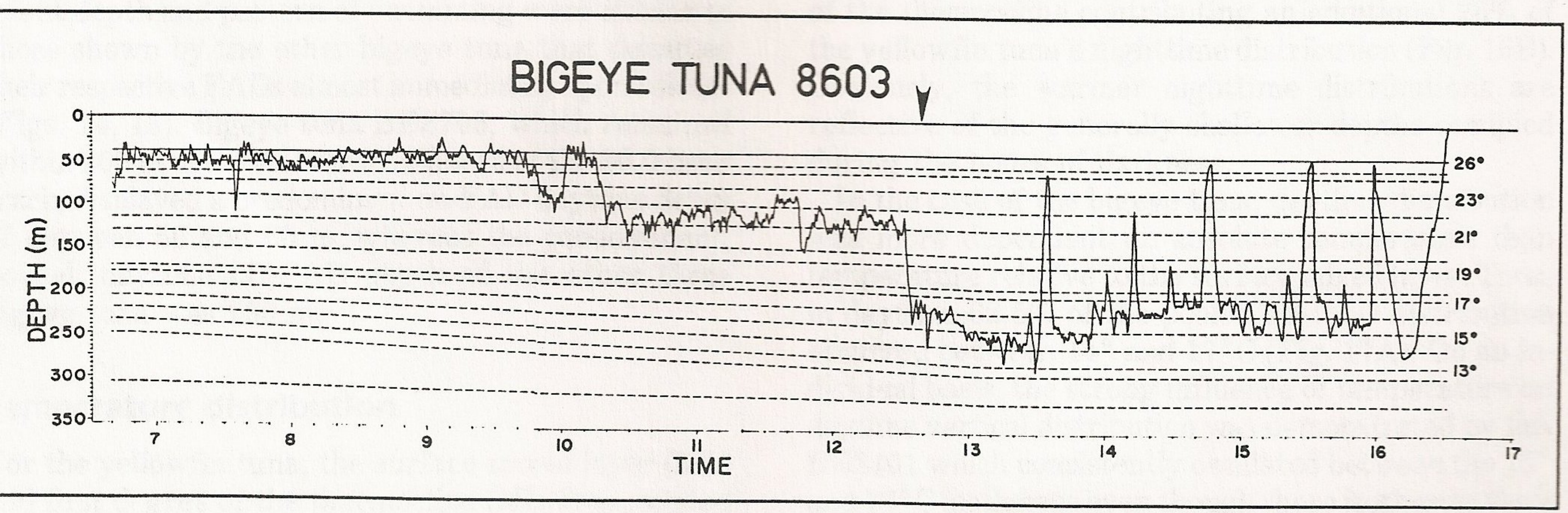
56 SKJ 53 cm

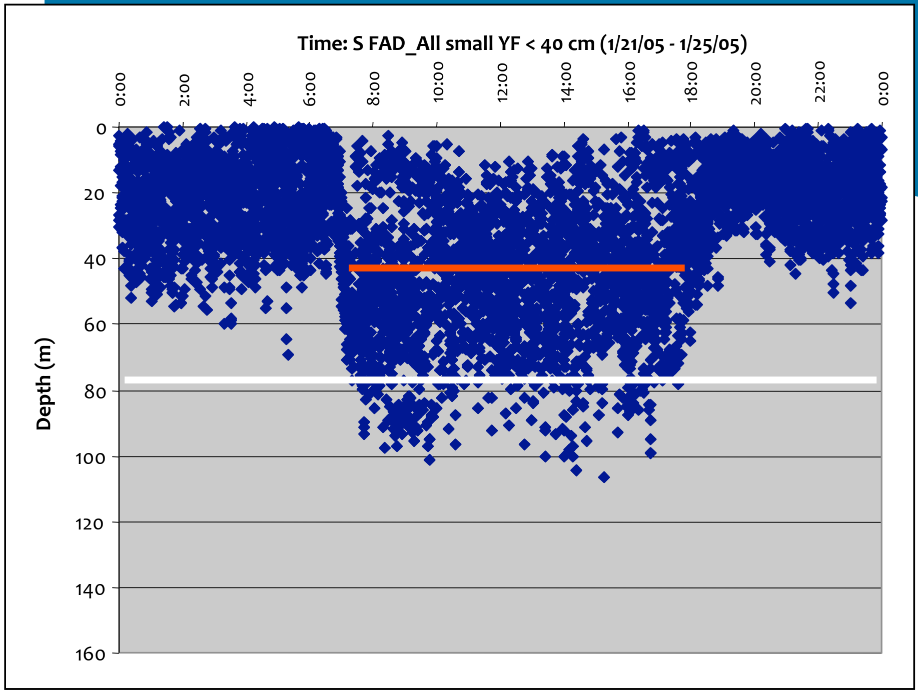
58 SKJ 58 cm

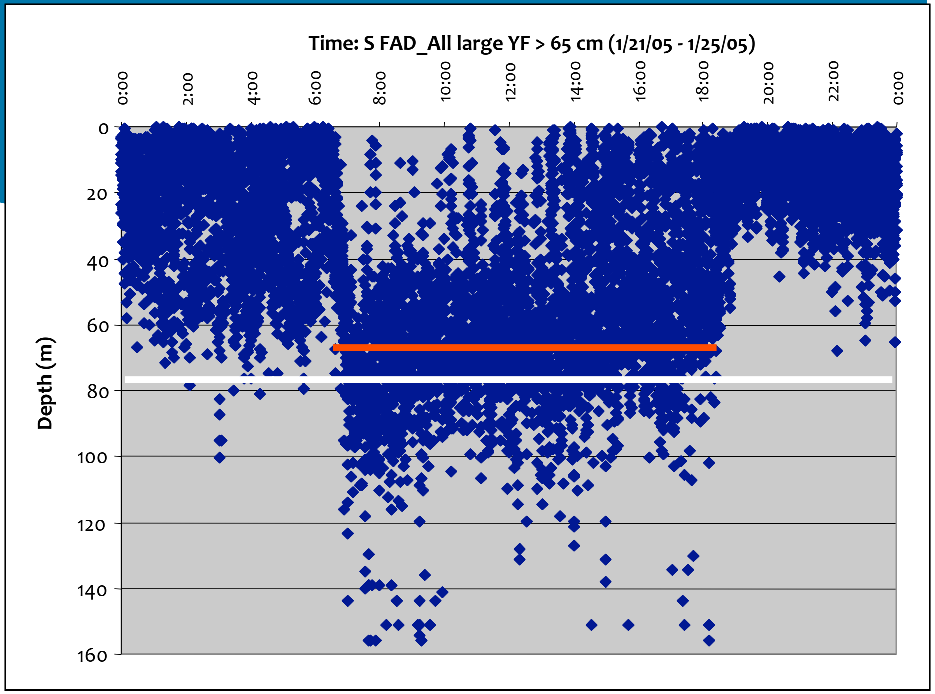
	5 oct am	5 oct pm	5 oct pm	6 oct am	6 oct am	6 oct pm	8 oct pm	8 oct pm	9 oct am	10 oct am	11 oct am	11 oct pm	12 oct am	12 oct am	13 oct pm	14 oct pm	14 oct pm	15 oct am	19 oct pm	20 oct am	21 oct am	21 oct pm	21 oct pm	22 oct am	22 oct am	23 oct pm
91	7:46																		20:12	2:27	10:59					
52	7:47												1:09	4:49							10:56	22:24	22:28			
102	7:53												0:41	4:48							10:52	20:04	21:20	1:24		18:19
104	7:48					12:27																				
98	7:48										10:40															
97	7:51					18:52																				
99		21:55											1:15	4:46							11:00	20:53	22:00	0:01	2:50	
56	⇨	22:09	22:17	2:08	3:20																					
58	⇨			4:15				22:20		5:41			0:38	5:06	17:47											
107							20:27	22:24	3:59				0:40	5:23		18:44	23:12	2:35								
113												19:22	0:57	4:44							10:56					
106		20:50			5:50	20:07																	18:22			

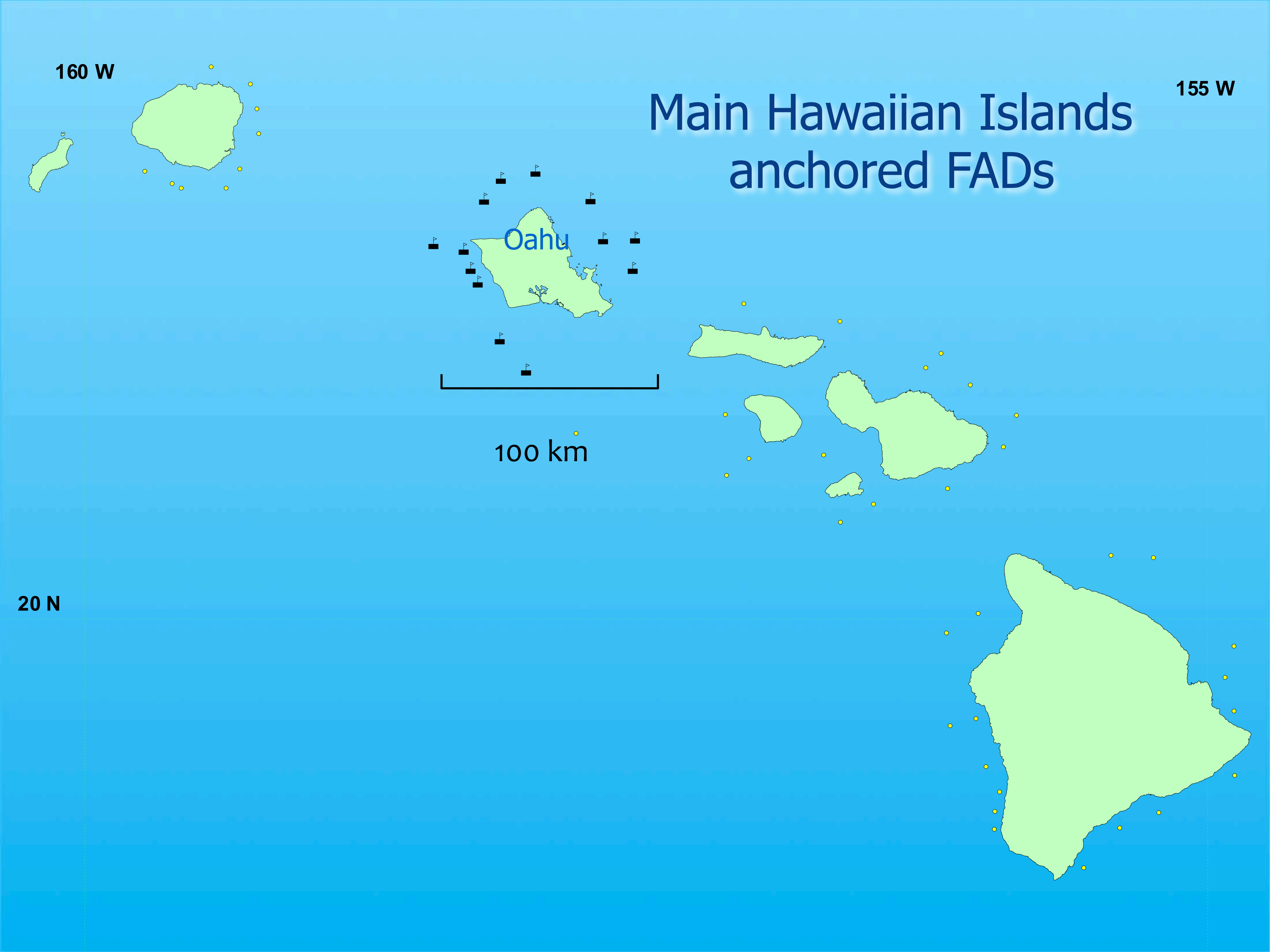
Time of Arrival

Time of Departure


BIGEYE TUNA 8603
DEPTH (m)
0
50
100
150
200
250
300
350
7
8
9
10
11
12
13
14
15
16
17
TIME
26°
23°
21°
19°
17°
15°
13°

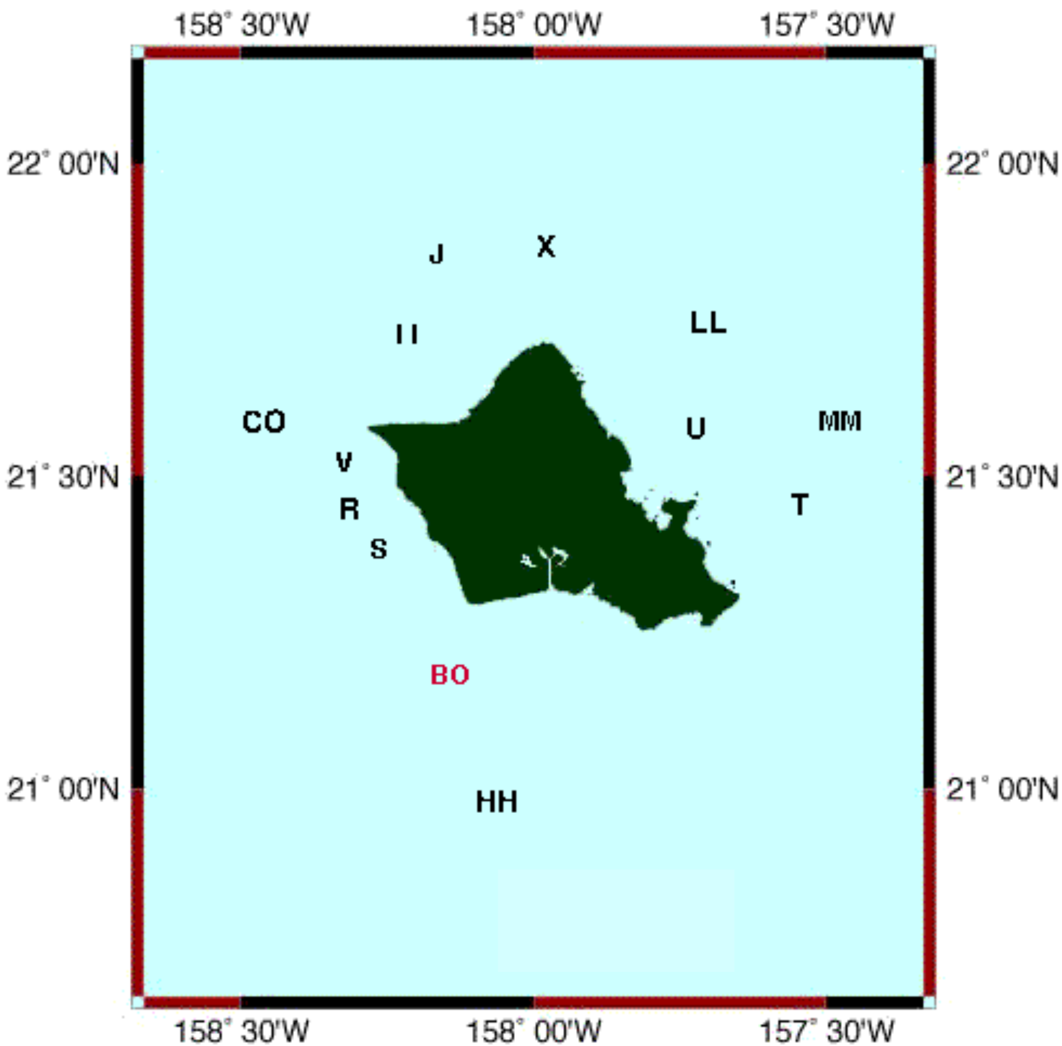

Time: S FAD_All small YF < 40 cm (1/21/05 - 1/25/05)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Depth (m)
0
20
40
60
80
100
120
140
160


Time: S FAD_All large YF > 65 cm (1/21/05 - 1/25/05)
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
Depth (m)
0
20
40
60
80
100
120
140
160

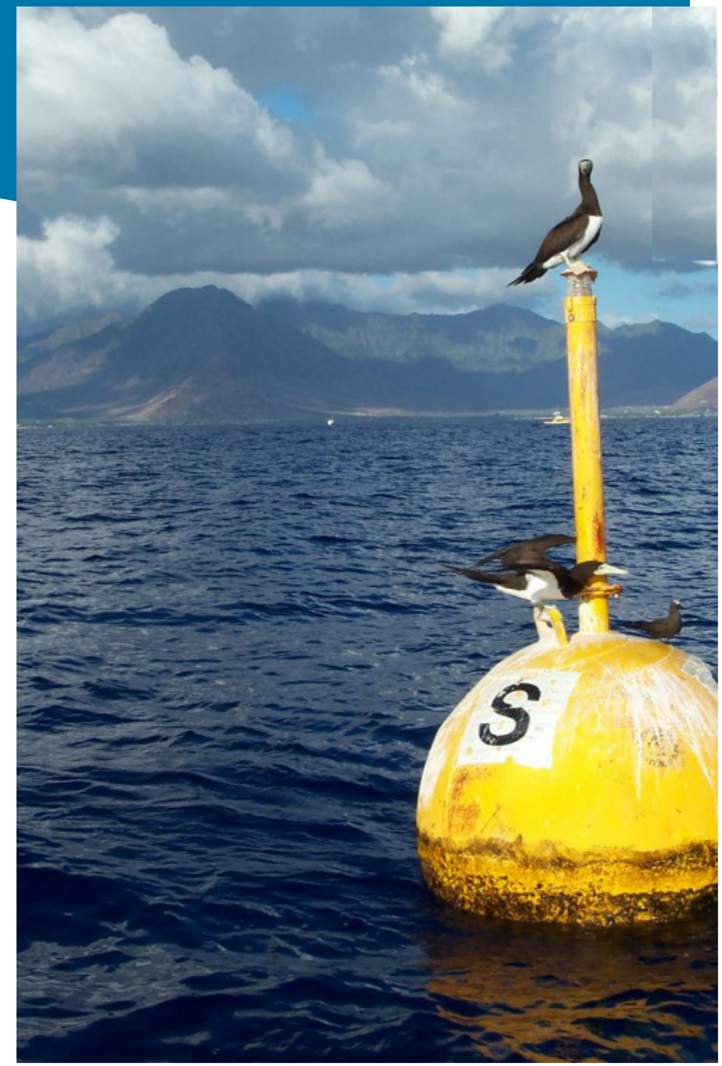


Main Hawaiian Islands anchored FADs
160 W
155 W
20 N
Oahu
100 km

Oahu FADs (13)

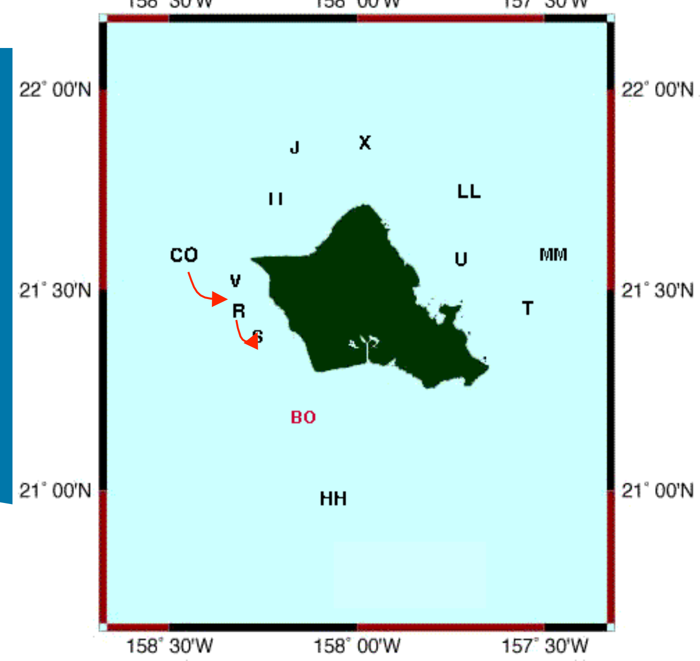


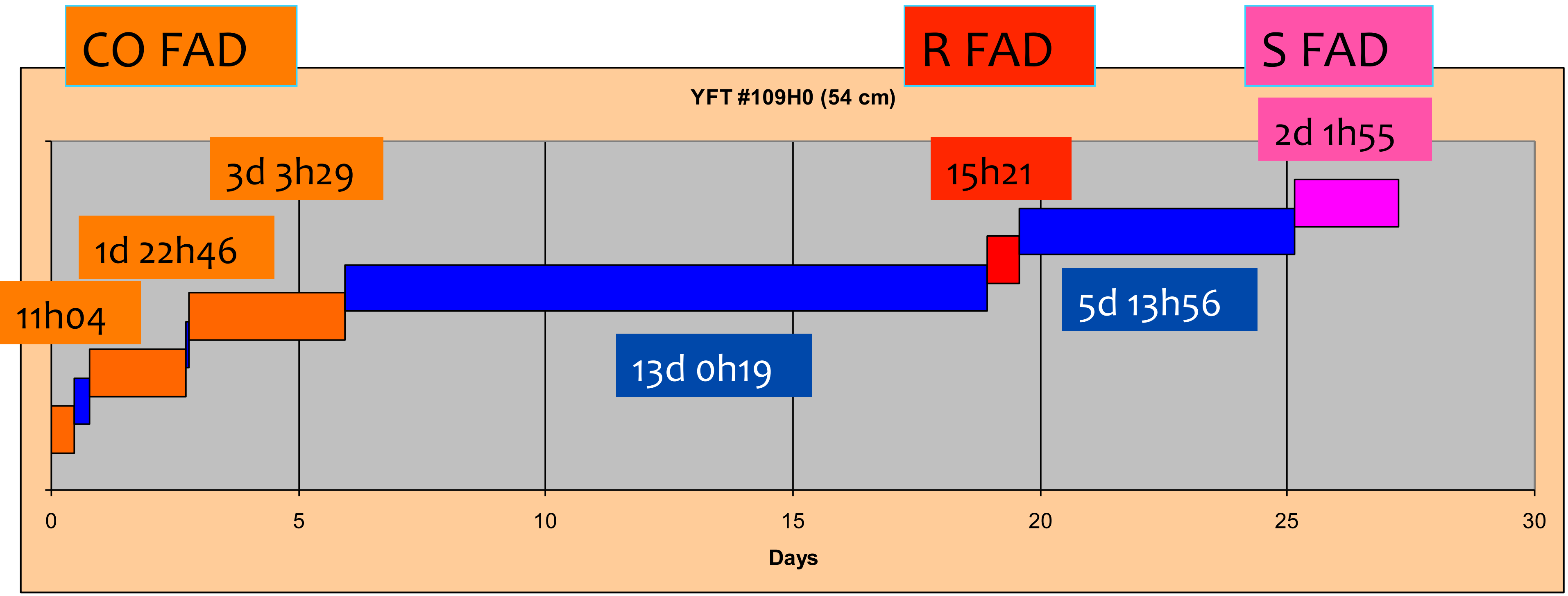
158° 30'W
158° 00'W
157° 30'W
22° 00'N
21° 30'N
21° 00'N
J
X
II
LL
CO
U
MM
V
R
S
T
BO
HH

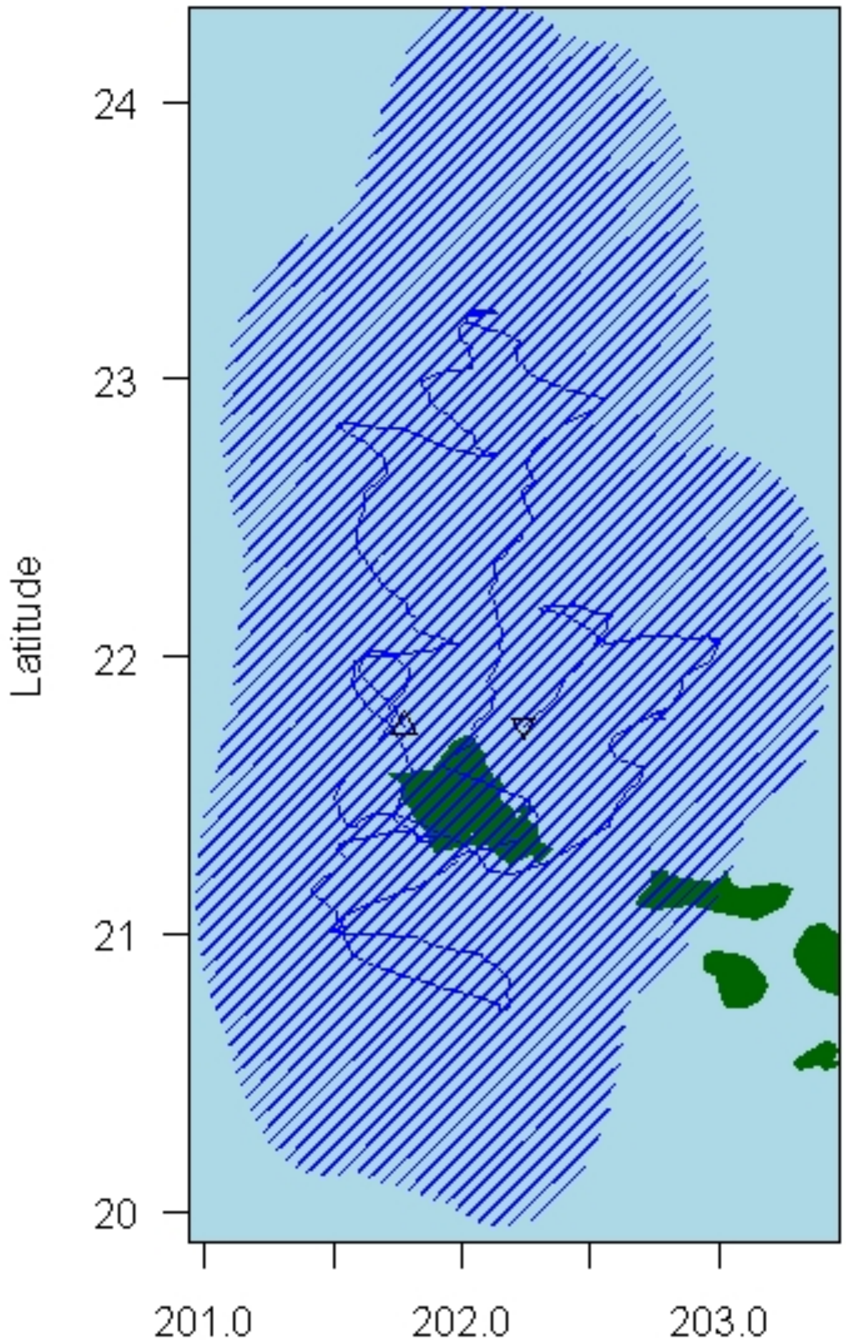


S

Movements of fish #109H0 (54 cm YF)

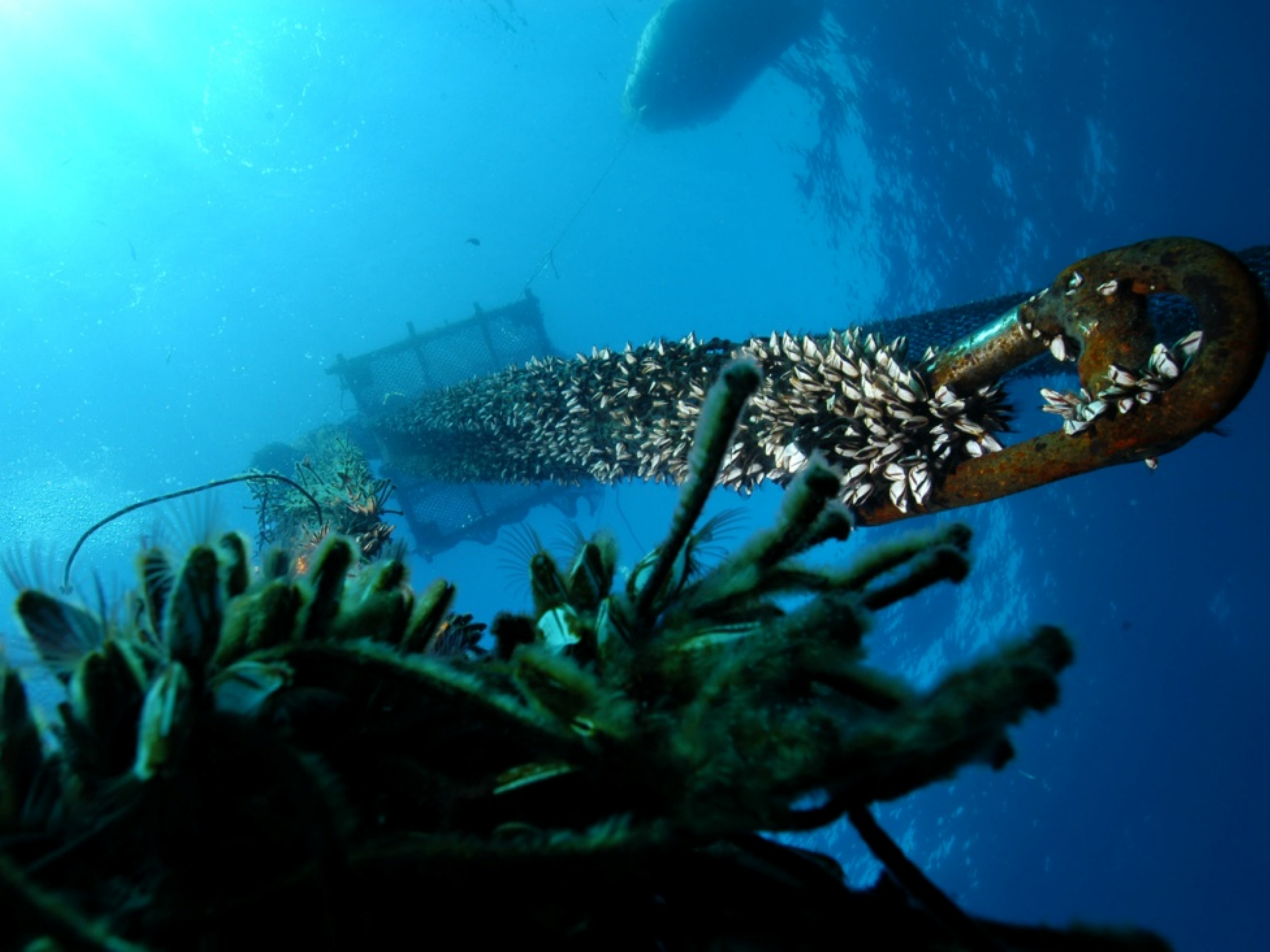






24
23
22
21
20
Latitude
201.0
202.0
203.0


BA
919




FKJR

Why fish around FADs?

- Reduces search time
- Fewer ‘skunk’ sets

Impacts on tuna stocks

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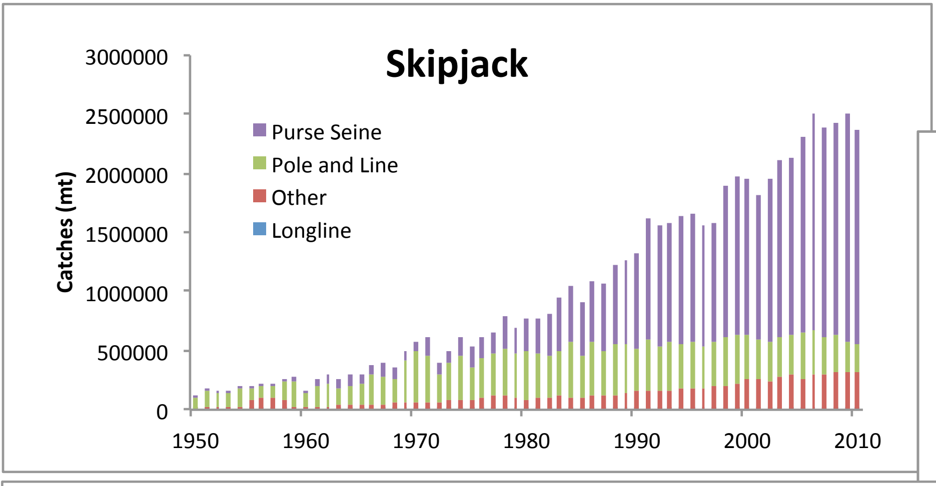
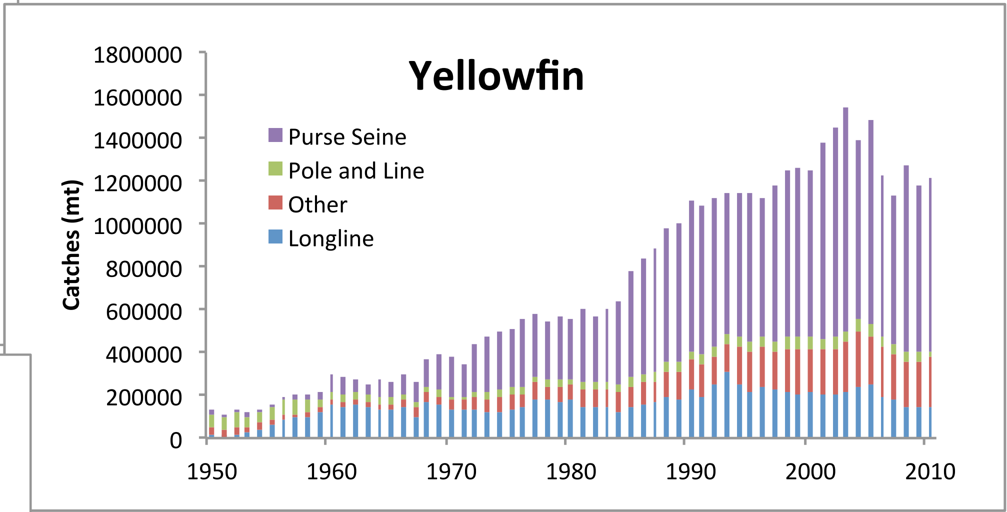
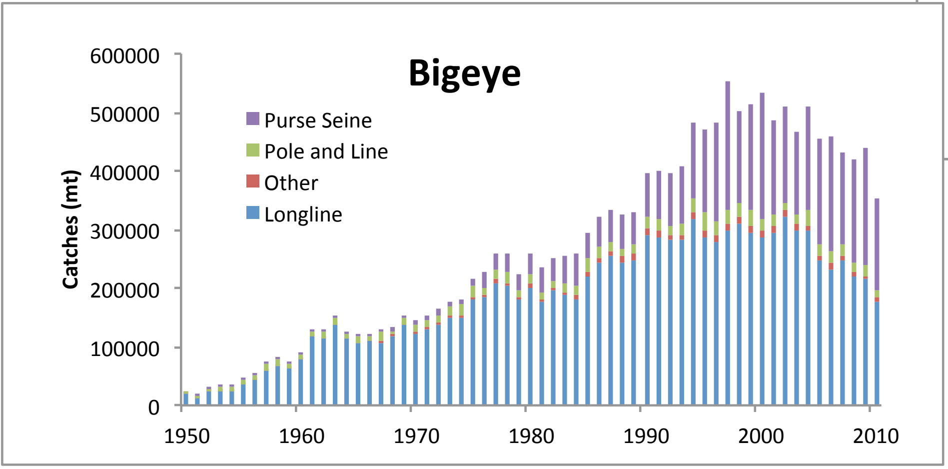
Impacts on Tuna Stocks

Note: Current statistics do not make it possible to distinguish catches made with anchored FADs, drifting FADs or natural logs The term “floating objects” is used.

The targets of tropical purse seiners

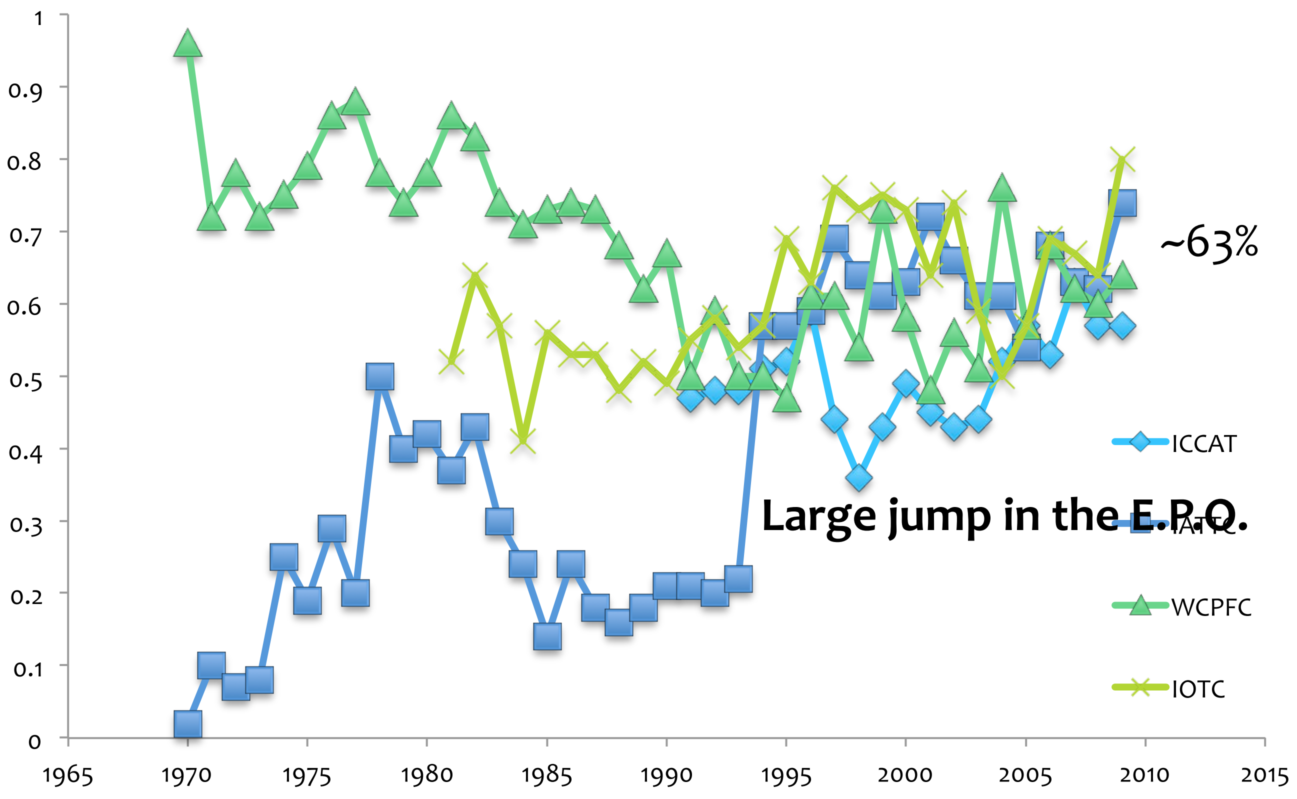




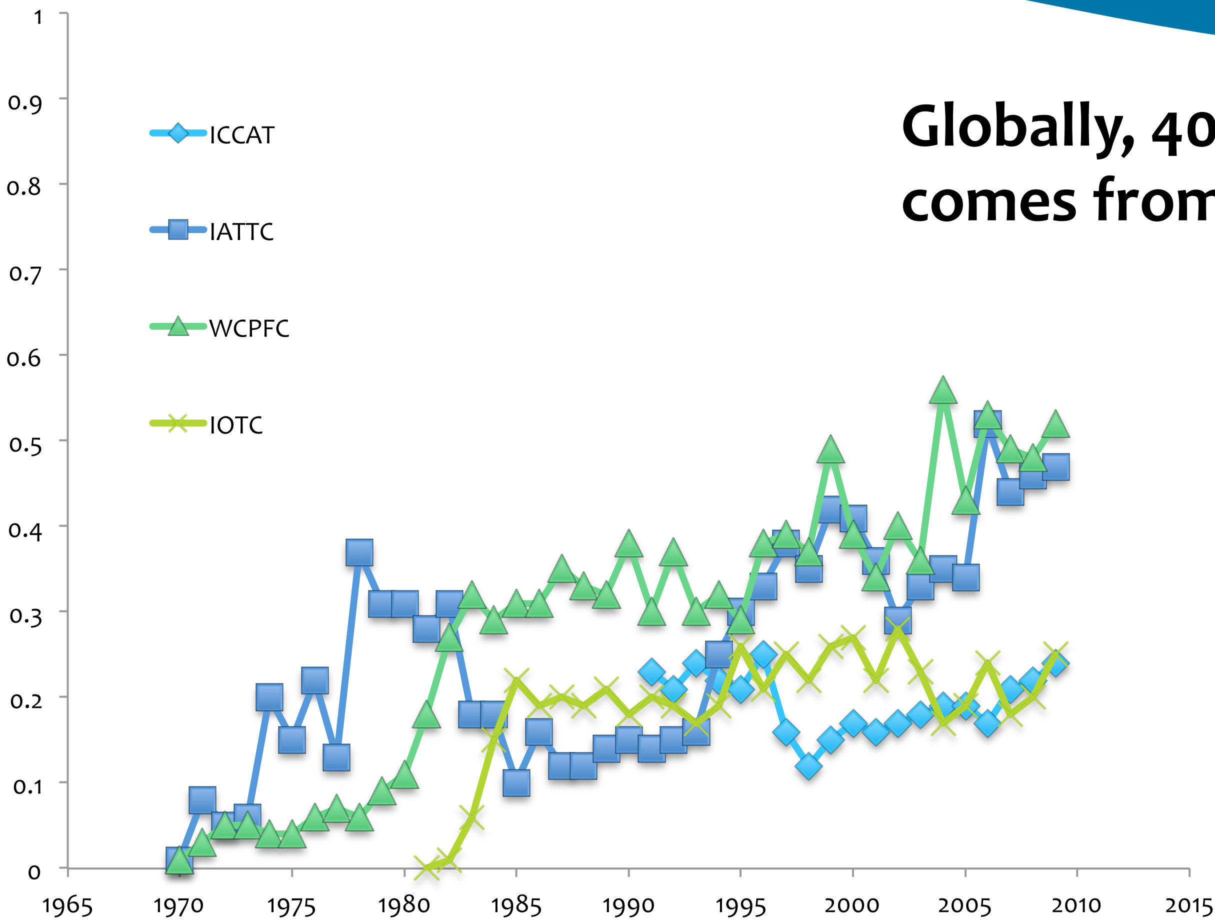


Globally, 40% of tropical tuna catch comes from floating object sets

Relative to all purse seining, floating object sets existed from the onset



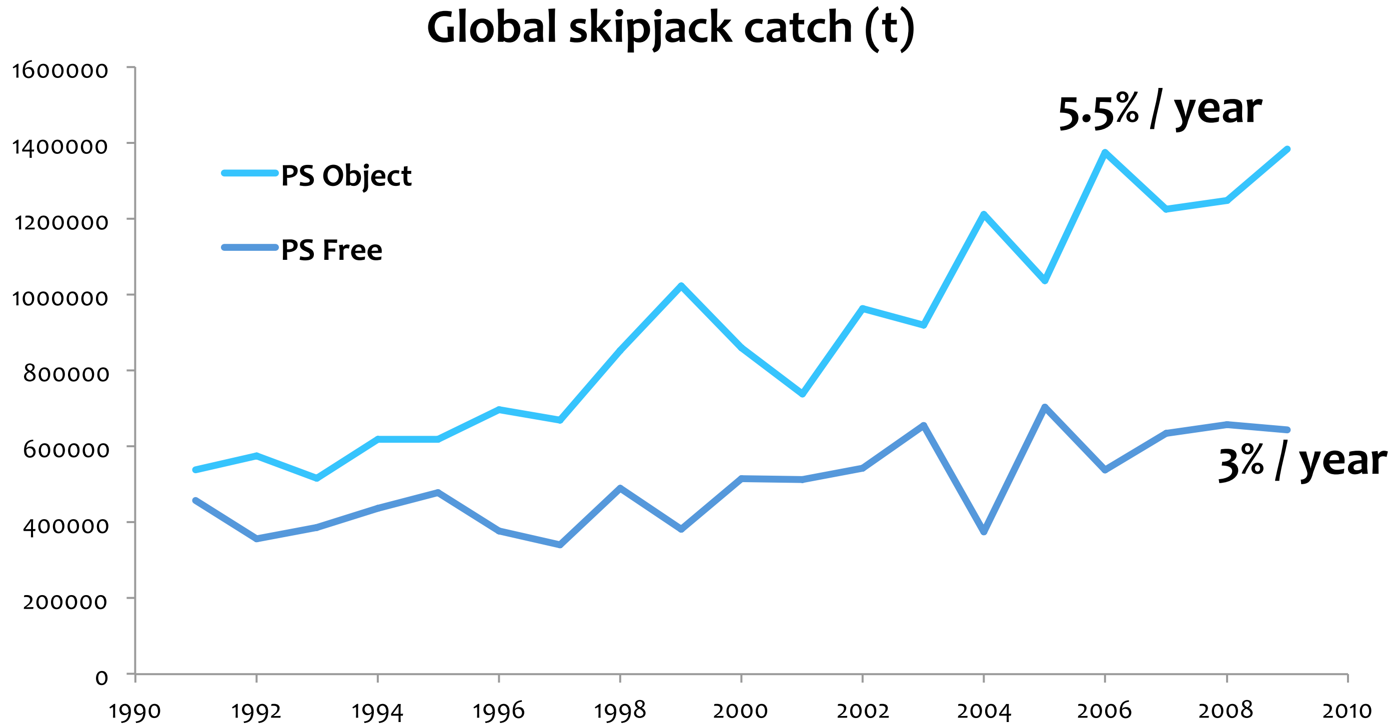
Relative to all fishing methods, catch on floating object sets has been growing



Globally, 40% of tropical tuna catch comes from floating object sets

Global skipjack catch is growing faster on object sets

Annual growth in FAD usage perhaps 2.5%/year



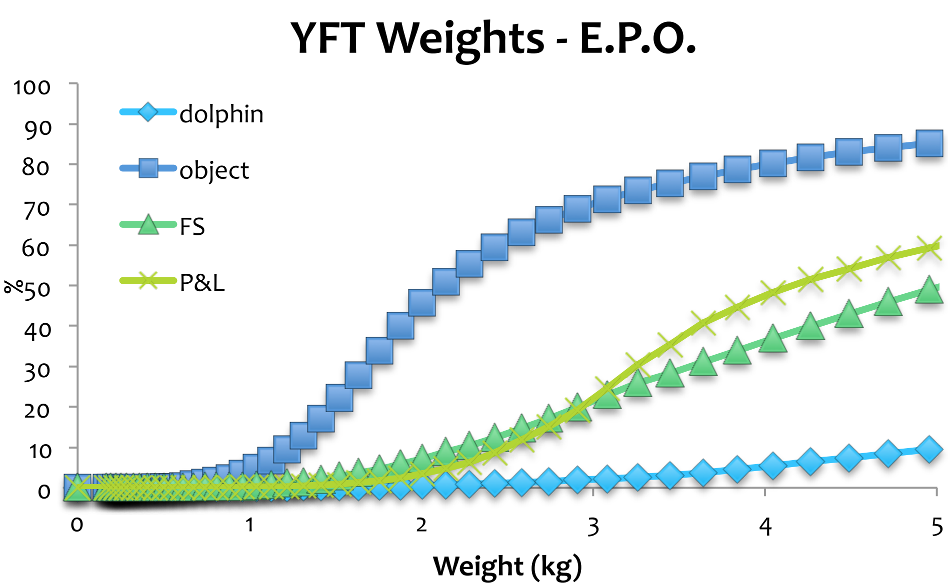
2 potential Impacts

1. Loss of potential yield (by catching small fish that have the potential to grow to a much larger size if they survive)

2. Reduction of spawning biomass or stock size (by catching too many fish, either adults or juveniles)

Loss of potential yield

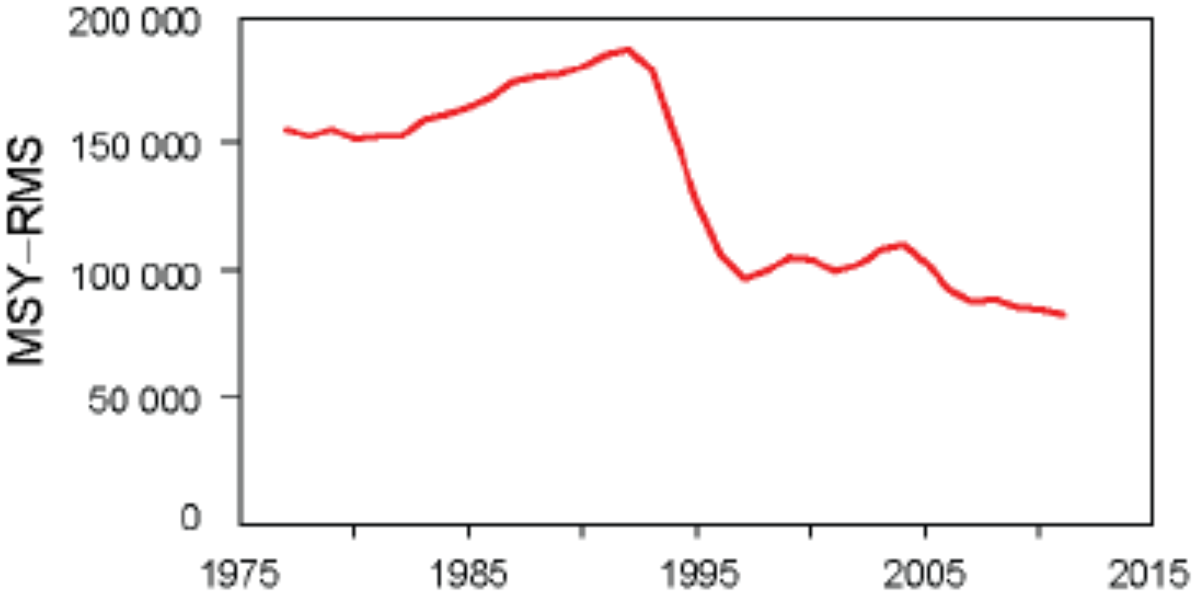
Floating object sets tend to catch smaller tunas (yellowfin and bigeye)



Set Type	**% under 5 Kg**
Dolphin	**9%**
Free School	**49%**
P&L	**59%**
Object	**85%**

Loss of potential yield

MSY for E.P.O. bigeye has decreased, coinciding with increased catch on objects



The relative mix of fishing gears has allocation implications

Overfishing

All sources of fishing mortality reduce spawning biomass, either today or later.

A stock can be overfished by taking too many juveniles or too many adults, or both.

All sources of fishing mortality need to be monitored and managed.

Overfishing

Species	Ocean	%object	F/Fmsy	B/Bmsy
BET	**EPO**	**70**	**1.05**	1.12
SKJ	EPO	64	1	>1
SKJ	AO-E	62	<1	>1
SJK	WCPO	56	0.37	2.94
BET	**WCPO**	**38**	**1.46**	1.19
YFT	WCPO	36	0.77	1.47
SKJ	IO	31	<1	2.56
BET	AO	21	0.95	1.01
BET	IO	20	<1	1
YFT	EPO	17	0.87	1
YFT	IO	17	0.84	1.61
YFT	**AO**	**13**	0.86	**0.96**
SKJ	AO-W	9	<1	>1

There is no obvious relationship with amount of floating object catch

Impacts on non target species

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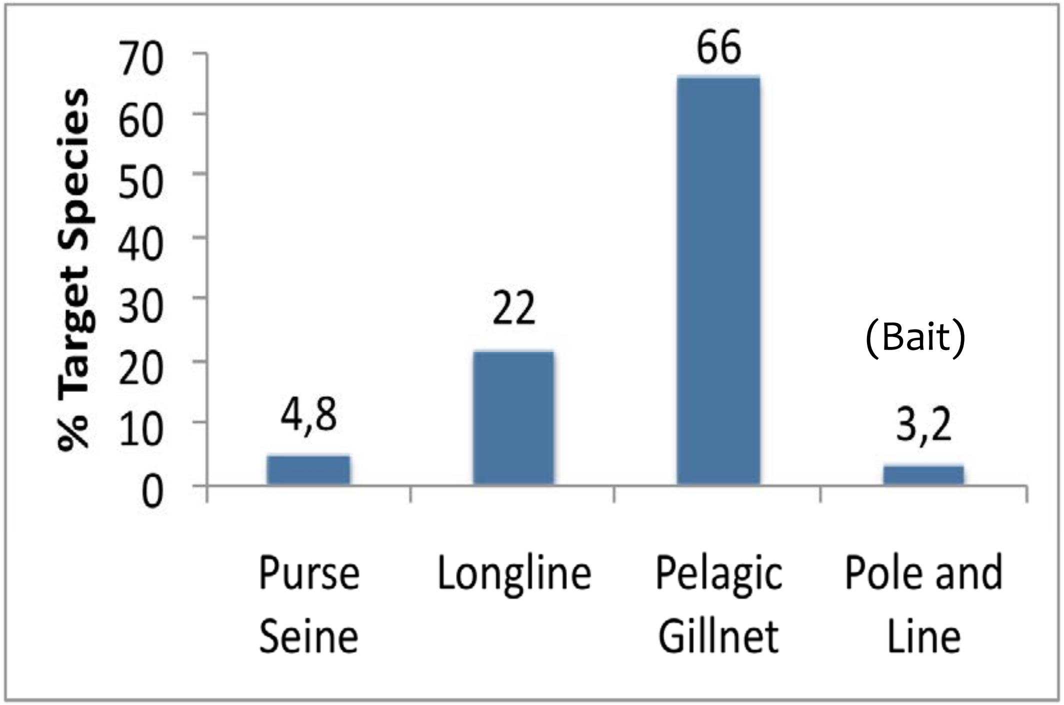
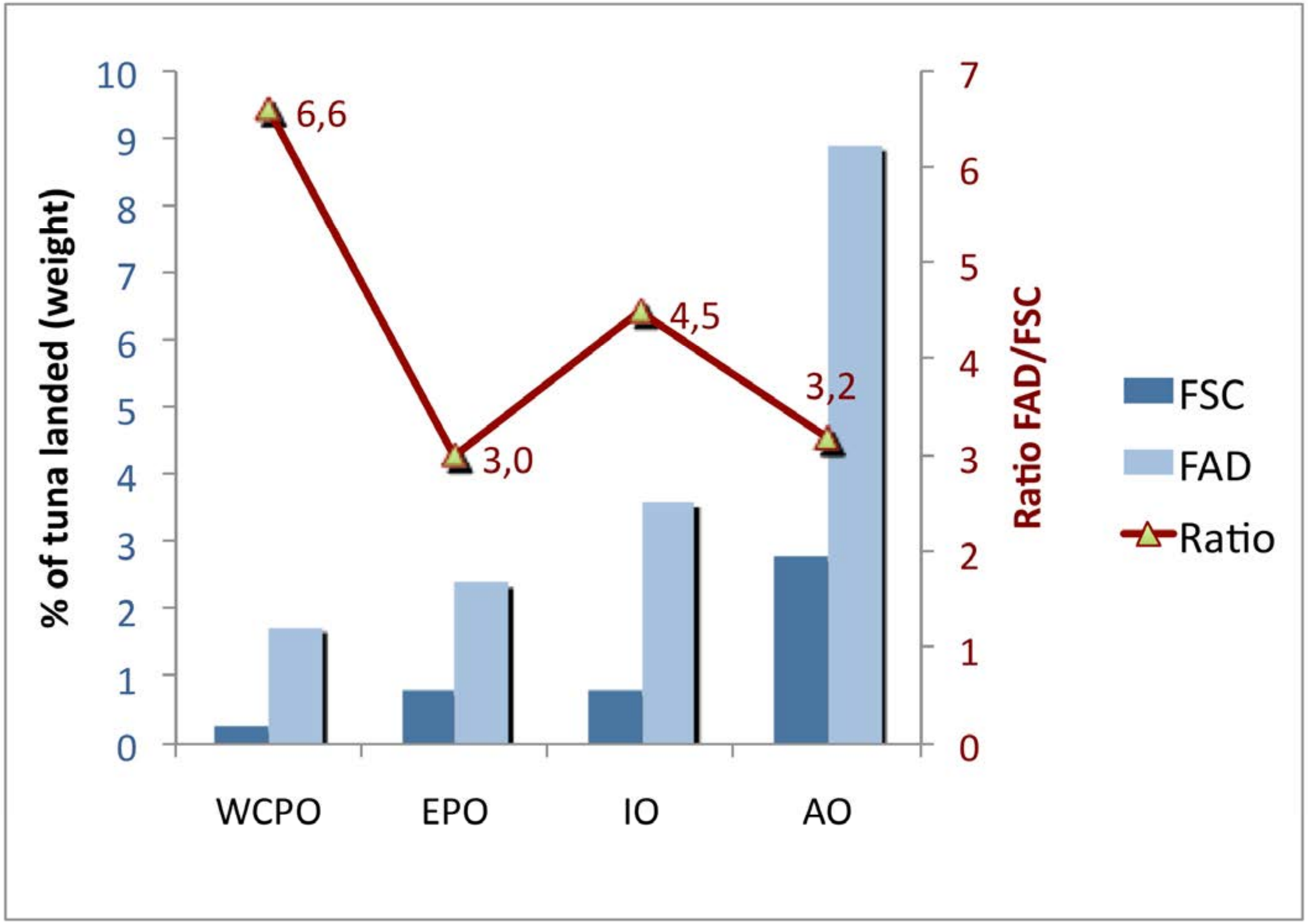
Bycatch rates: Comparison of tuna fisheries Kelleher (2005, FAO)



Bycatch of purse seiners (excluding discards of SKJ, YFT, BET) estimated from scientific observers onboard



Other Tuna & Finfish (80-95% of PS bycatch)

Fast growing, highly fertile and characterized by a high natural mortality rate → No particular ecological concern

But monitoring is necessary

Sharks (2 to 17% of PS bycatch)

Silky shark
(Carcharhinus falciformis)

Oceanic white tip
(Carcharhinus longimanus)

Around 90% of sharks caught on FADs

Slow growth, late maturation, low fecundity, and long reproductive cycles, they are amongst the least resilient of fish species to intense exploitation

Sharks (Gilman 2010)

Longline	Purse seine
Some fisheries target sharks	Pacific (1992-98): an order of magnitude lower than longline
Western and Central Pacific (mid 1990's – mid 2000's) **102 000 tons**	Western and Central Pacific (mid 1990's – mid 2000's) **2 000 tons**

Turtles (Gilman 2010)

Longline	Purse seine
10 000's to 100 000's caught each year in each ocean	5-200 caught per year per ocean, 95% released alive But some turtles entangled in netting under FADs

Impacts on habitats and ecological consequences

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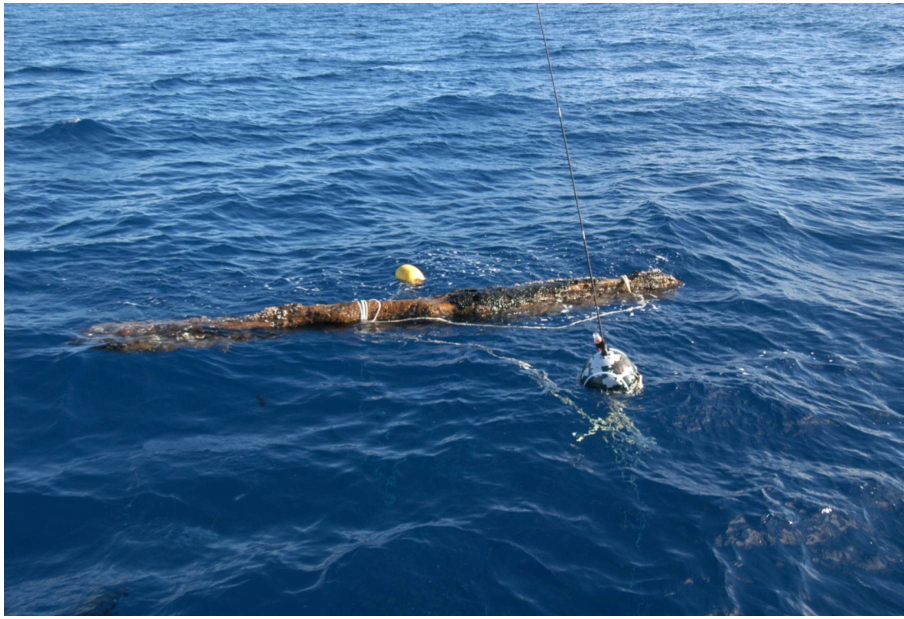
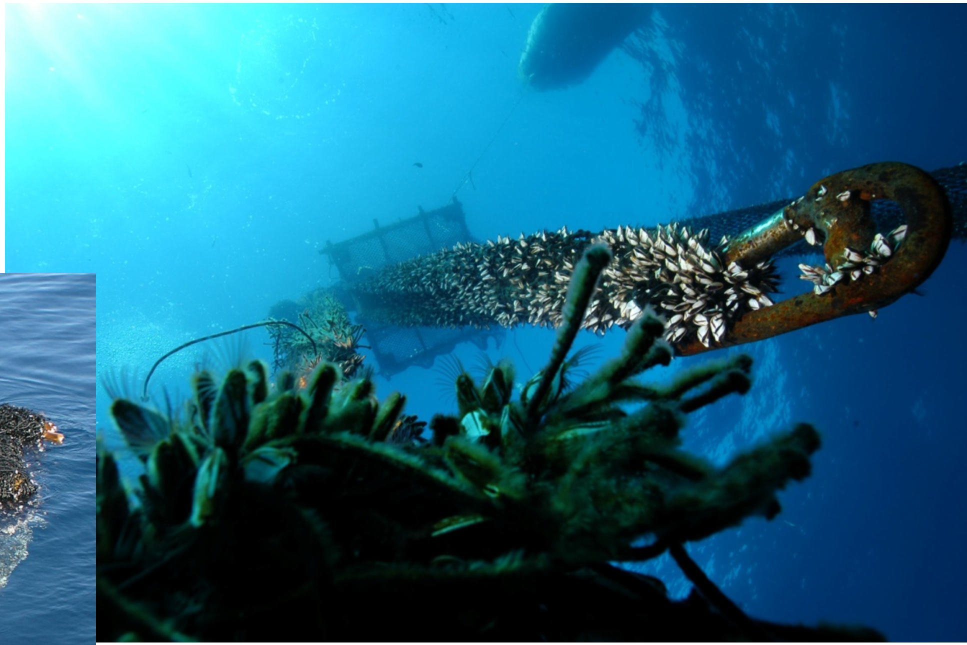
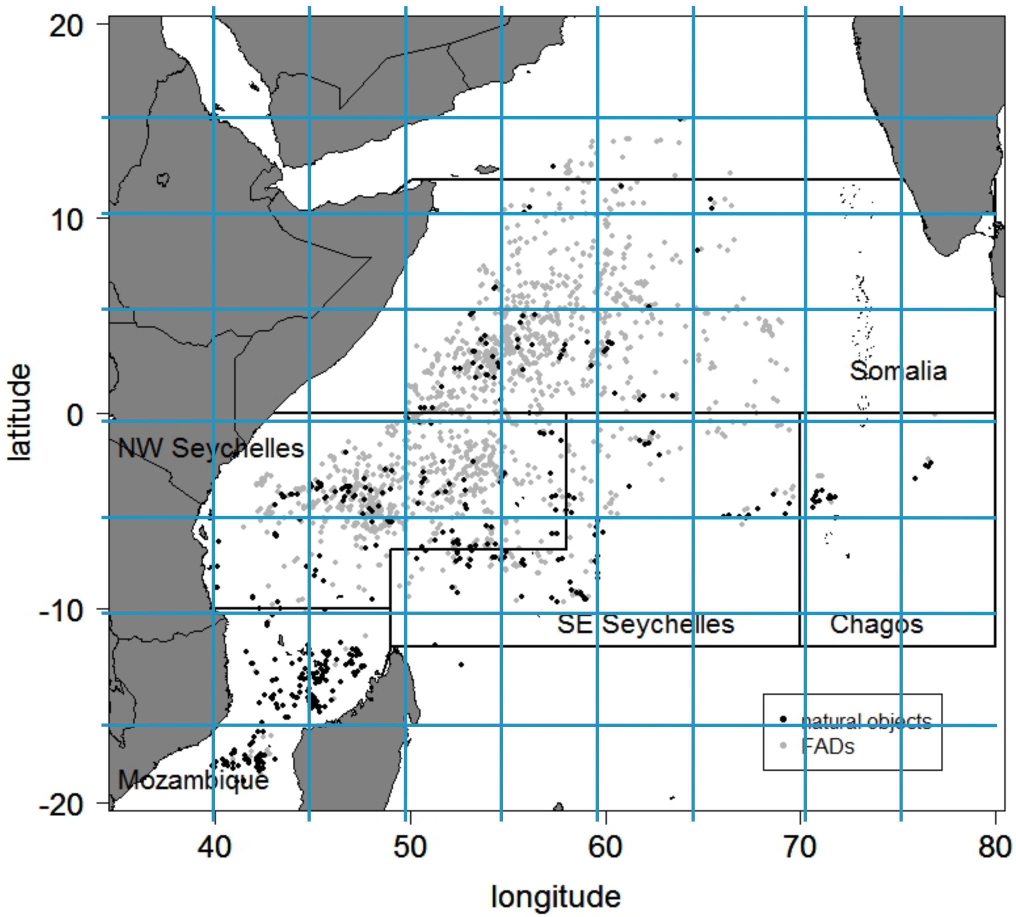
Logs have always been natural components of the « surface » habitat of tuna



Deployment of FADs:
How much do FADs change the « surface » habitat?

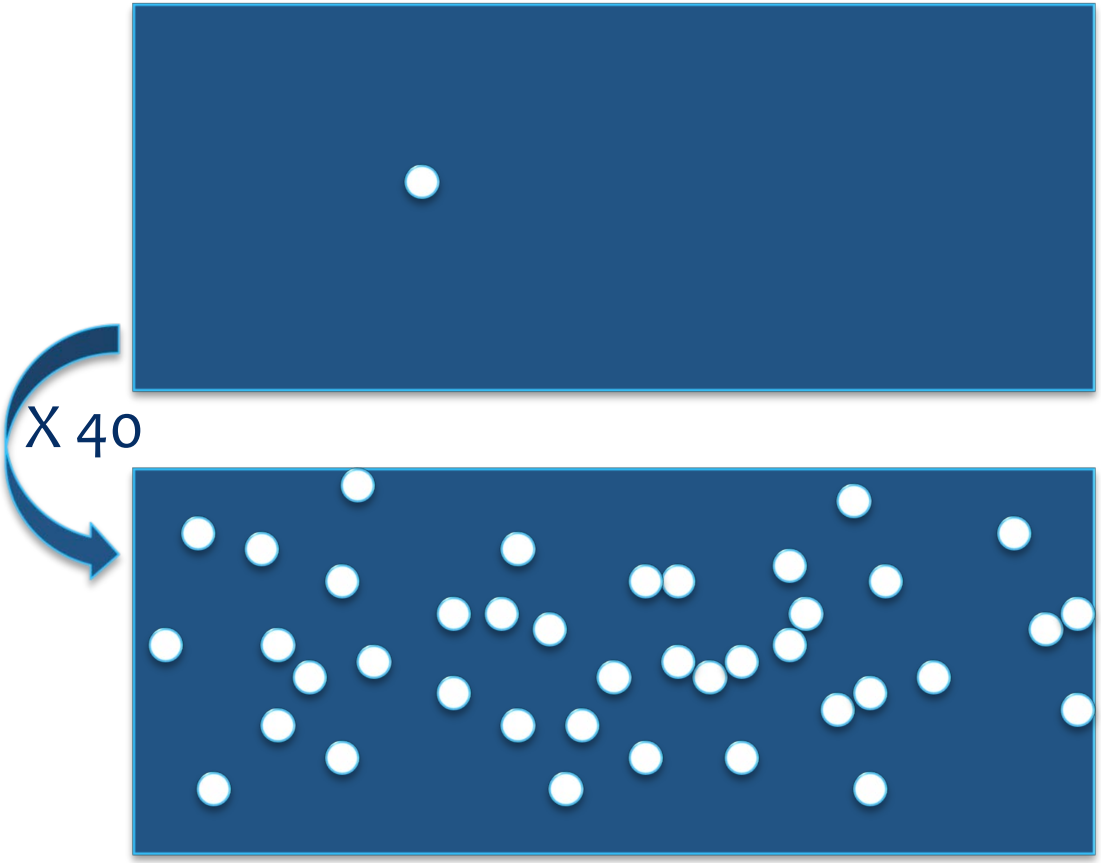


Quantifying the changes due to the deployment of FADs



- No new « floating object » area at the scale of 5°x5° quadrats
- Threshold: 2°x2° quadrats

Quantifying the changes due to the deployment of FADs

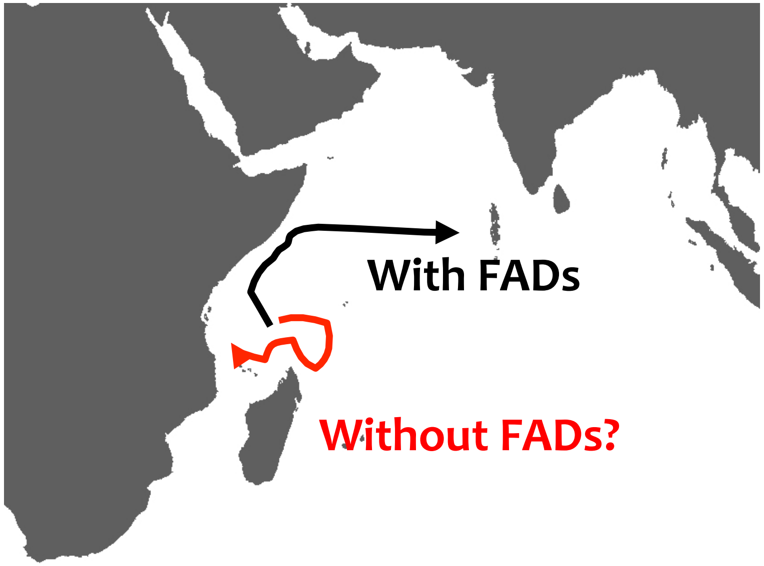


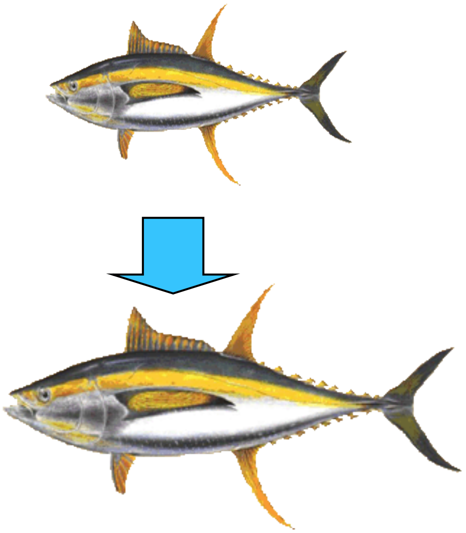
- Major changes are quantitative (increase of numbers of floating objects) : **multiplication factor 20 or 40 (2008)**

What could be the effects of these changes?
The hypothesis of the Ecological trap

Behavioural impacts

Biological impacts





Are FADs ecological traps for tuna? (Change migration patterns, modify growth, etc.) → Controversial results

In favor

- Kleiber & Hampton (1994)
- Marsac et al. (2000)
- Hallier & Gaertner (2008)
- Jaquemet et al. (2010)

Against

- Kleiber & Hampton (1994)
- Dagorn et al. (2007)
- Stehfest & Dagorn (2010)
- Schaefer & Fuller (2010)
- Robert et al. (submitted)

There are still only a few solid empirical examples of ecological traps in the published literature (Robertson & Hutton 2006).

→ Need for reference points, in order to assess the changes in behavior and biology due to the use of FADs

Management needs

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Monitoring the number of FADs and electronic buoys

FADs are a major part of the fishing effort

They must be monitored and managed like any other type of fishing effort

Reducing the fishing mortality of small bigeye and yellowfin tuna

Two main measures used by RFMOs:

- Moratorium of FAD fishing / full time-area closures
- Retention of all tunas of all sizes

Other options:

- Limiting the number of sets on floating objects
- Limiting the number of electronic buoys attached to floating objects
- Economic incentives

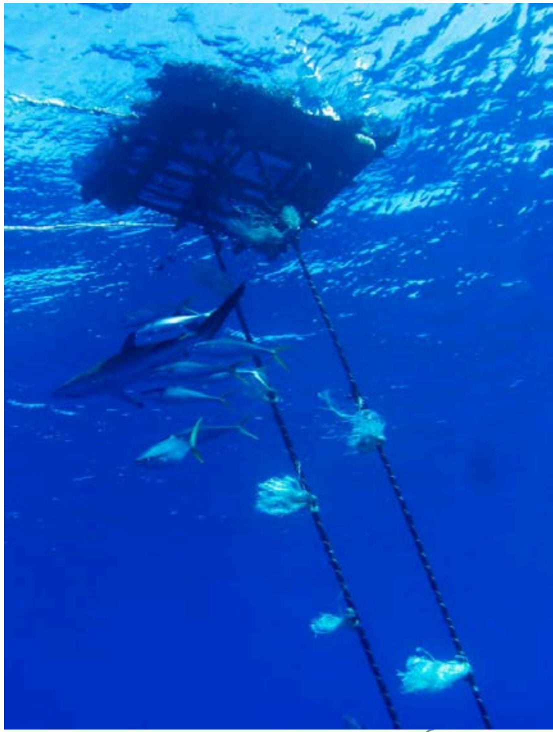
Monitor biological and behavioral indices

Collect time-series of:

1. Adult survival, reproductive success
2. Condition indices of tuna in various areas
3. Residence times of tuna at FADs
4. School sizes

Reducing the fishery-induced mortality of by-catch

Non Entangling FADs to avoid ghost fishing



Reducing the fishery-induced mortality of by-catch

Avoid small sets: by not catching tuna schools less than 10 tons, it could reduce bycatch by 25% and would affect tuna catch by 3% only

Release sharks alive: this could save up to 10-20% of sharks

New escape panel for sharks and other bycatch (see recent ISSF cruise)

Future of FADs?

There is a route towards the sustainable use of FADs IF all stakeholders consider FADs like any fishing gear that must be monitored and managed with appropriate measures