

Difference of fish behavior associated with drifting FADs by species and oceanographic conditions – possibility of selective catch by purse seine fishery

Takayuki Matsumoto¹, Keisuke Satoh¹, Yasuko Semba¹, Tatsuki Oshima² and Mikio Toyonaga²

1 National Research Institute of Far Seas Fisheries, Fisheries Research Agency (NRIFSF)

2 Marine Fisheries Research and Development Department Center of Fisheries Research Agency (JAMARC)



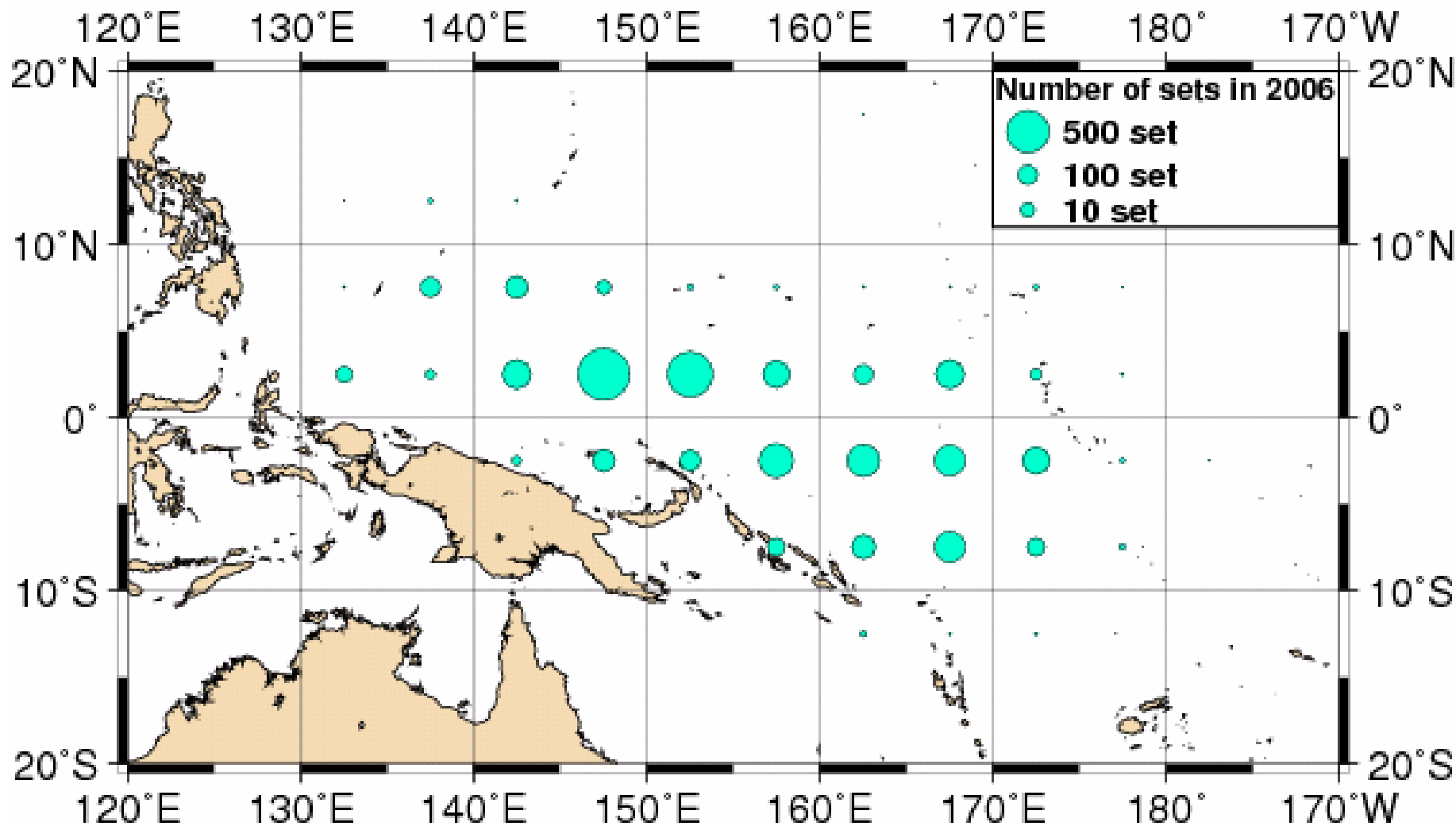
Contents

- Backgrounds
 - Distribution of operation and bigeye catch by Japanese purse seine fishery
 - Behavioral study using acoustic telemetry
 - Comparison of fish behavior under different oceanographic conditions
 - Catch rate of bigeye tuna by purse seine under several conditions
 - Future outlook
-

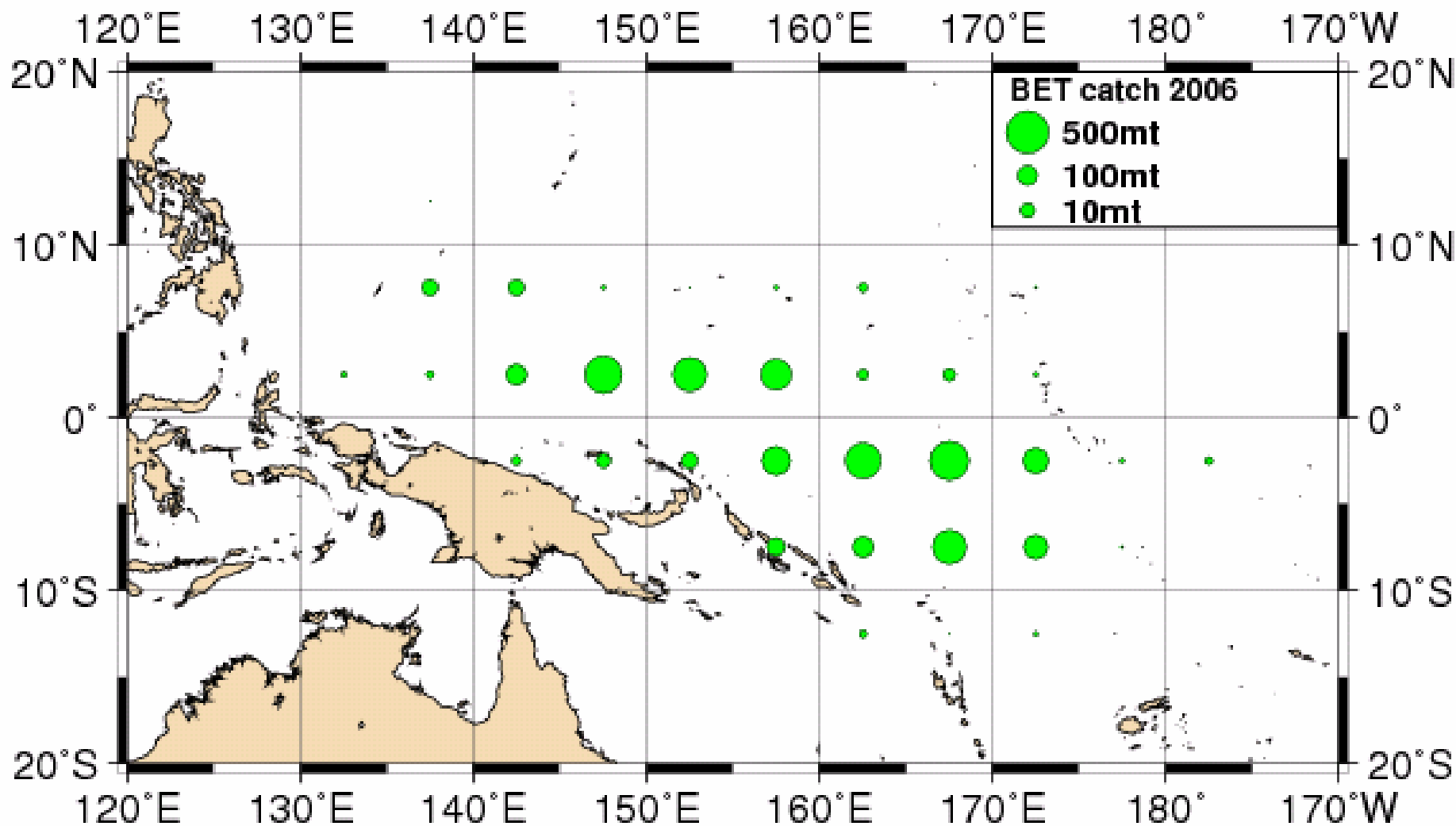
Backgrounds

- Many small yellowfin and **bigeye** tunas are caught by purse seine fishery operating around floating objects including **FADs**, which may have bad effects on the stocks.
- We conducted research of monitoring fish behavior around FADs using ID pinger to get information for the selective catch by purse seine fishery.
- Catch rate of bigeye tuna by purse seine fishing gear and operation type was analyzed and considered

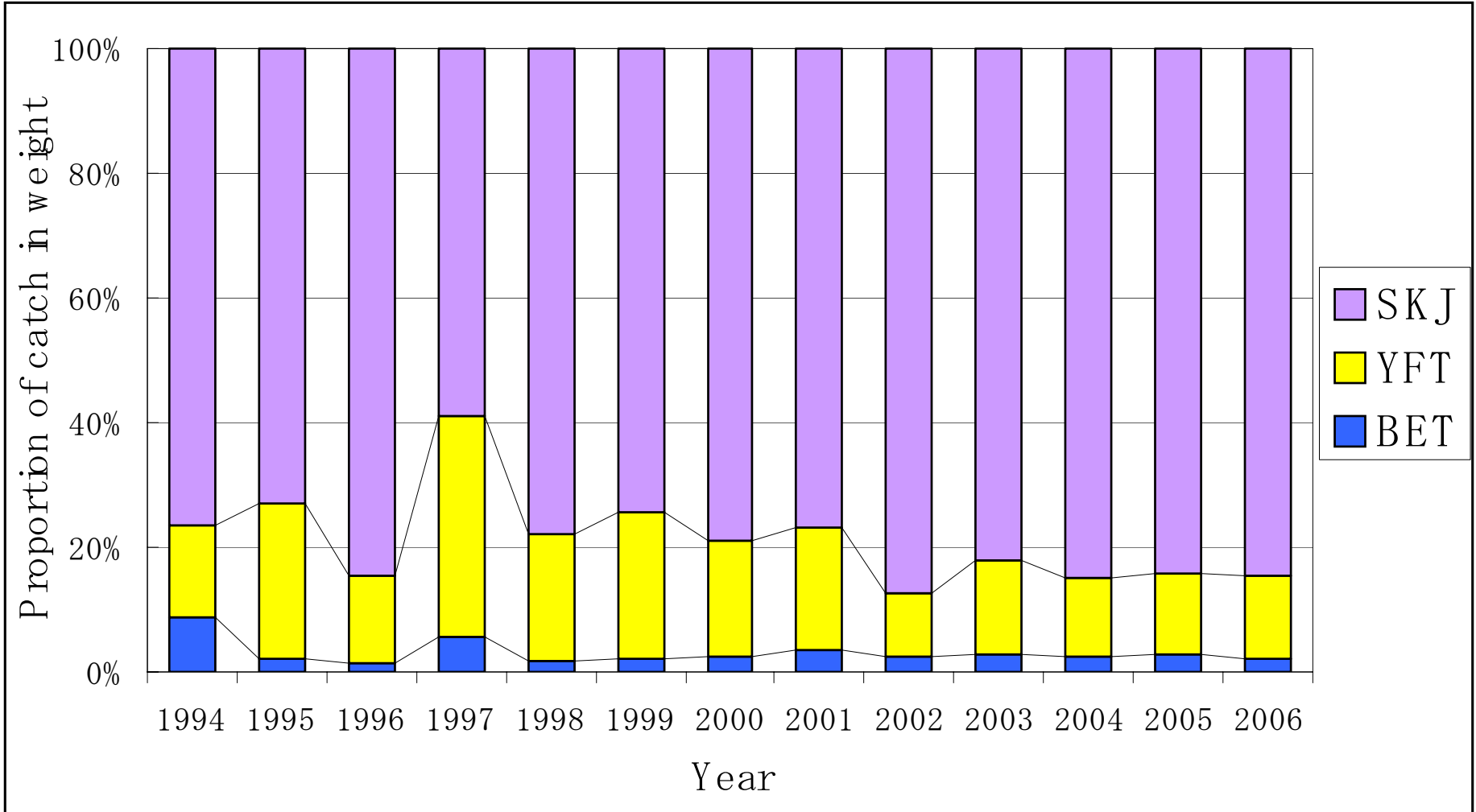
Distribution of Japanese purse seine operations



Catch of bigeye tuna by purse seine



Species composition of catch (based on logbook, tropical area)



Total catch in WCPFC area

Data: WCPFC Yearbook

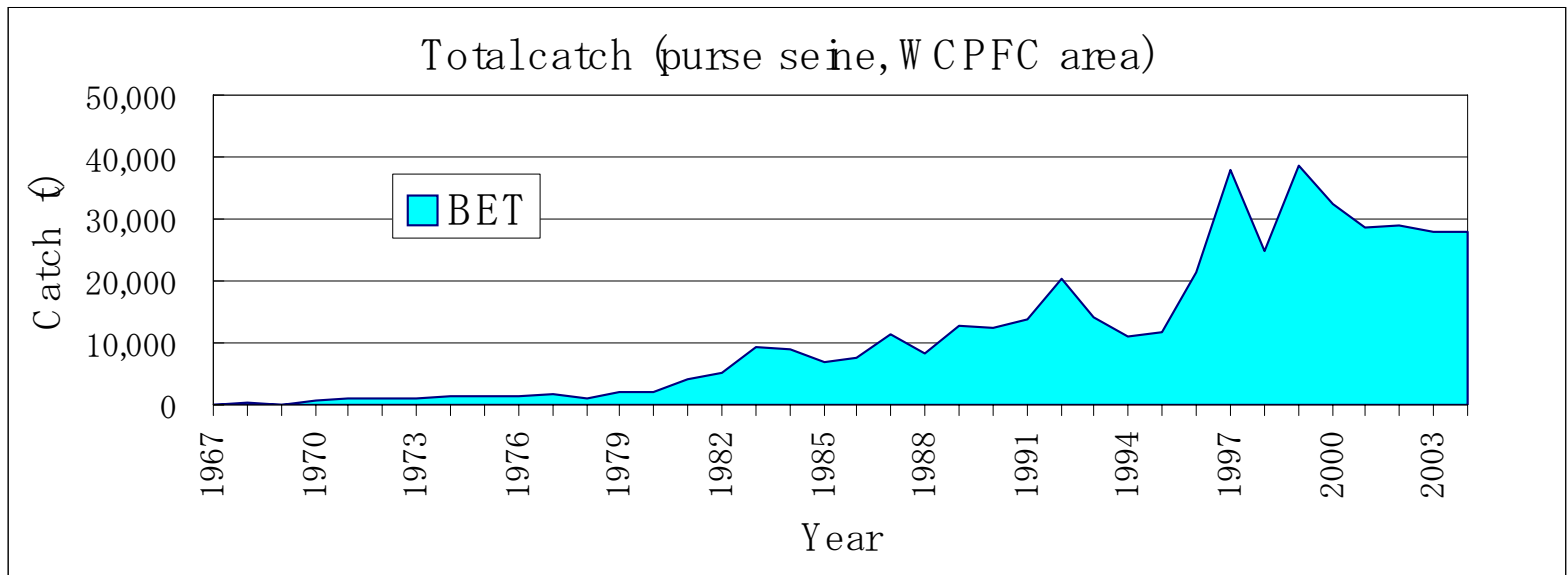
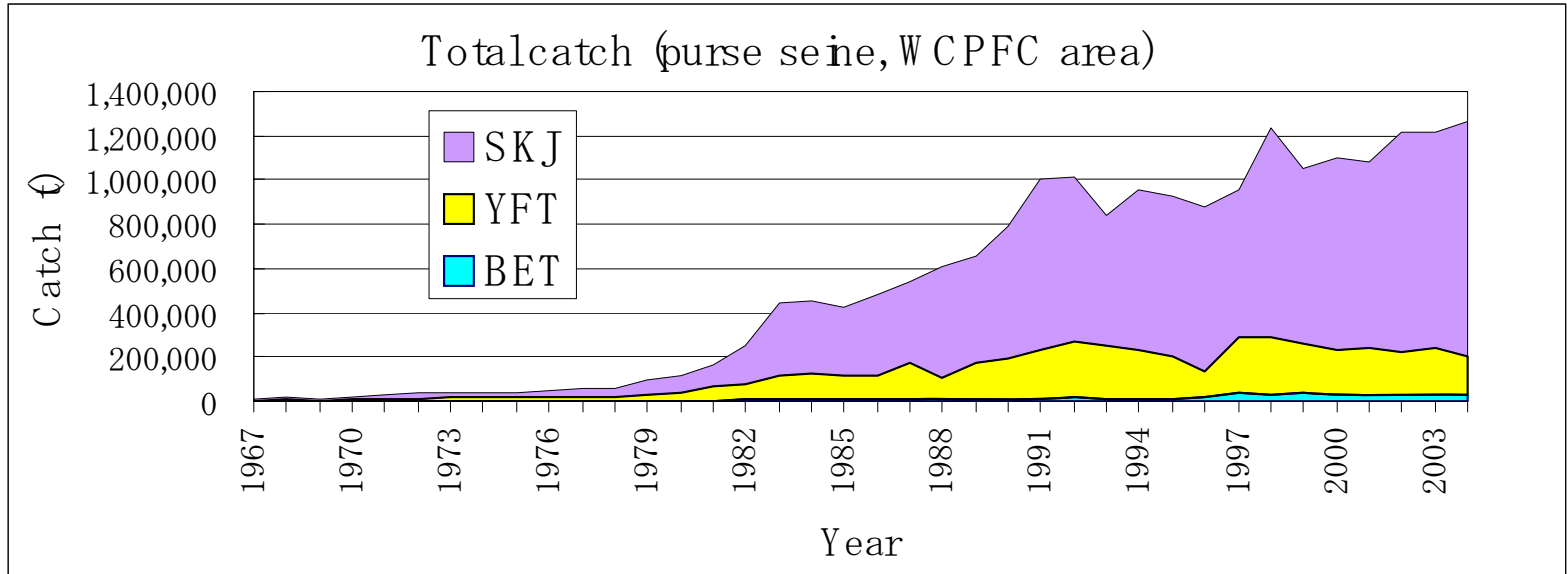
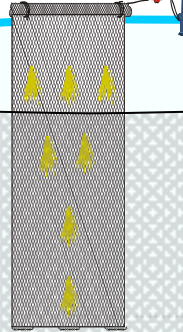


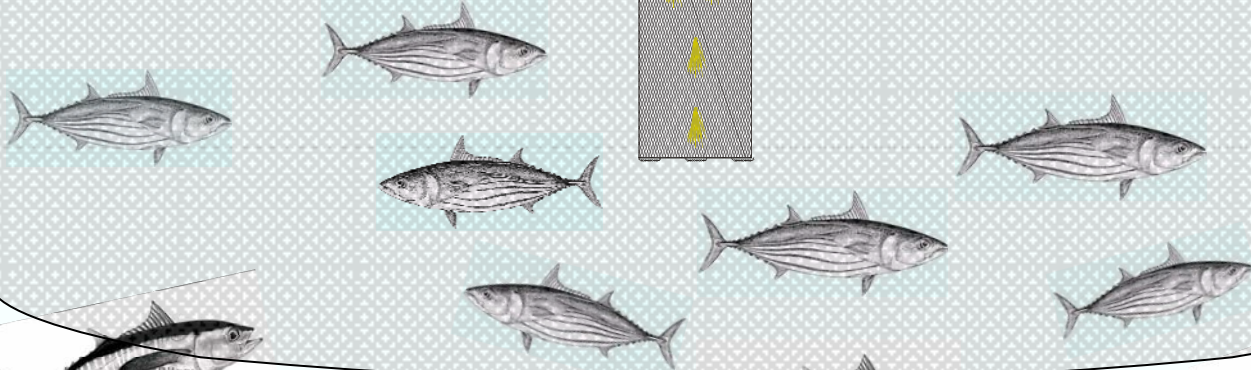
Image of tuna association with FAD (virtual)



FAD
(drifting)



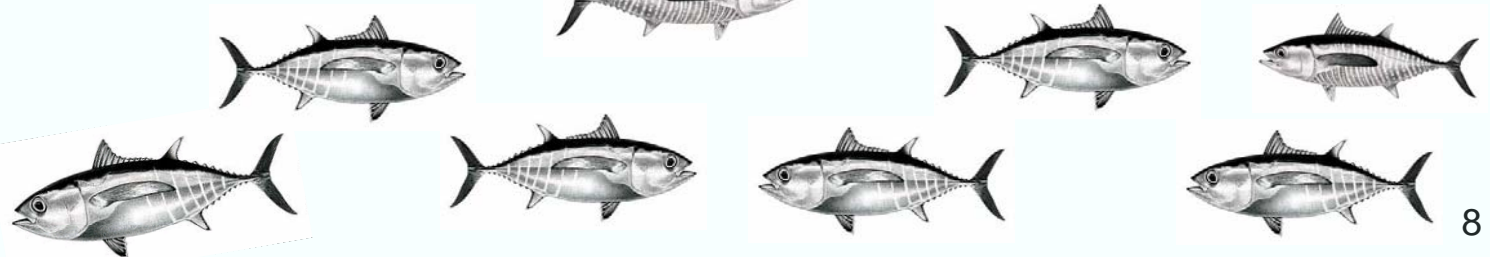
Skipjack



Yellowfin

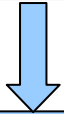


Bigeye

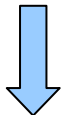


Behavioral study around drifting FAD (2001, 2003, 2005)

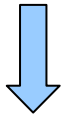
Capture of the fish
(jigging or trolling)



Deployment of ID
pinger (coded
transmitter)



Release



Monitor the behavior
around FADs



ID pinger



Two successful tracking in 2005

No.1 FAD6: BET, YFT

No.2 FAD8: BET, YFT, SKJ

Biotelemetry system



R/V *Shoyo-maru*

Hydrophone

Wind direction

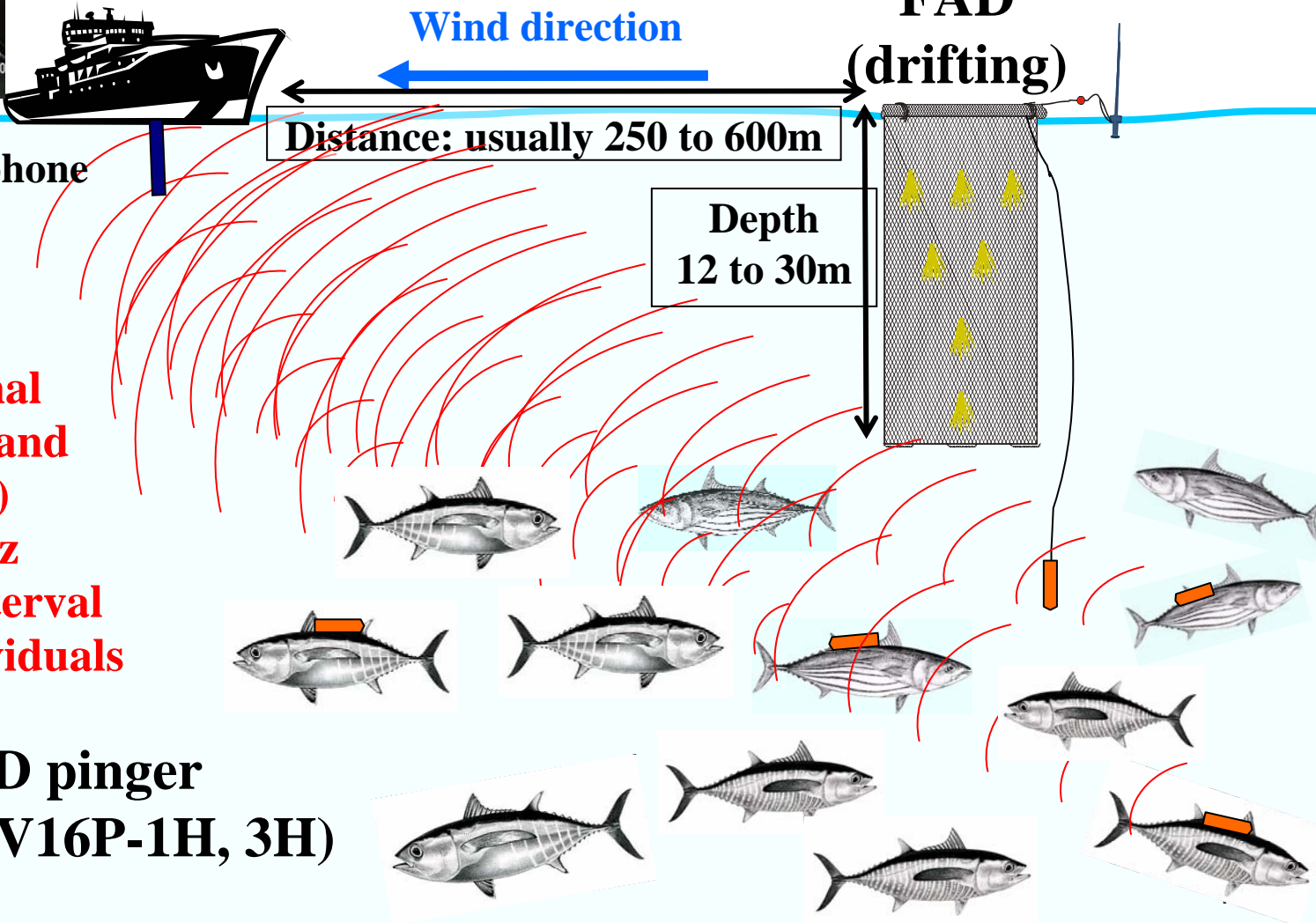
Distance: usually 250 to 600m

**FAD
(drifting)**

**Depth
12 to 30m**

**Sonic signal
(ID, depth and
position)
51-60kHz
20-69 sec. interval
Up to 56 individuals**

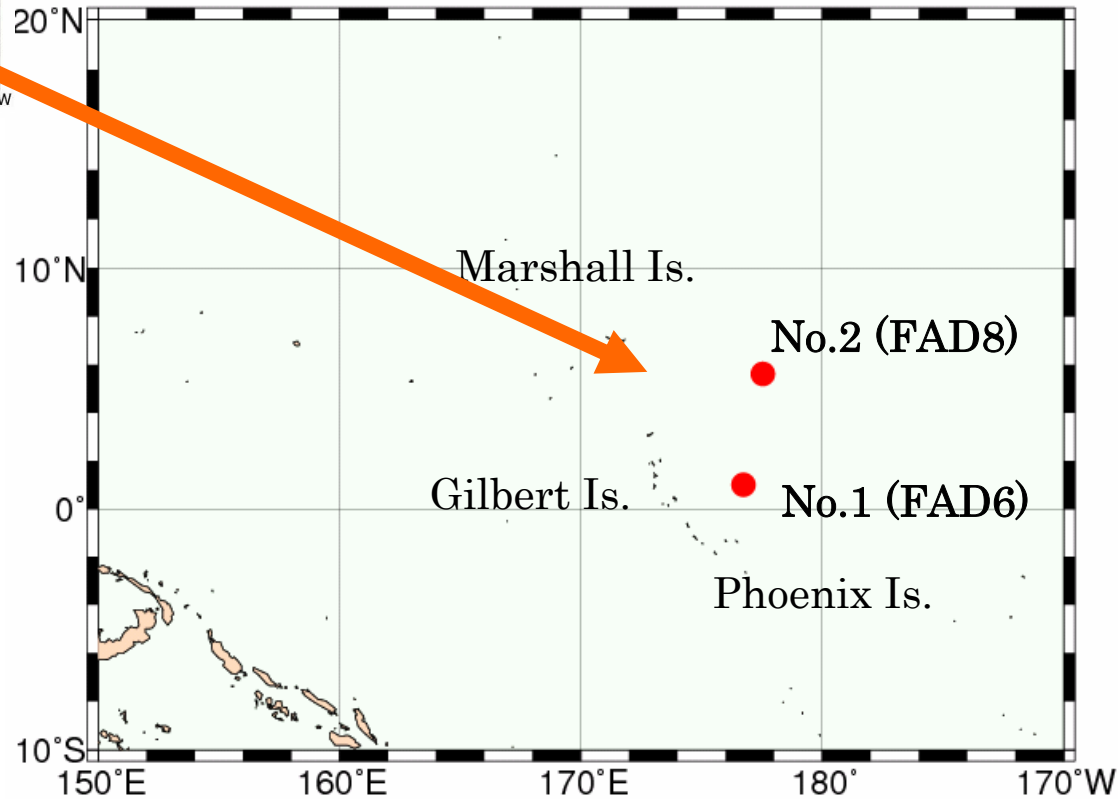
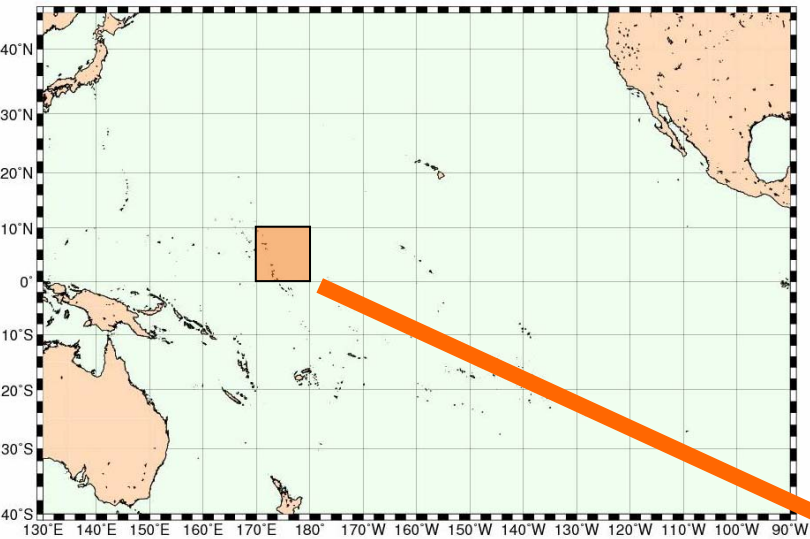
**Fish with ID pinger
(VEMCO V16P-1H, 3H)**



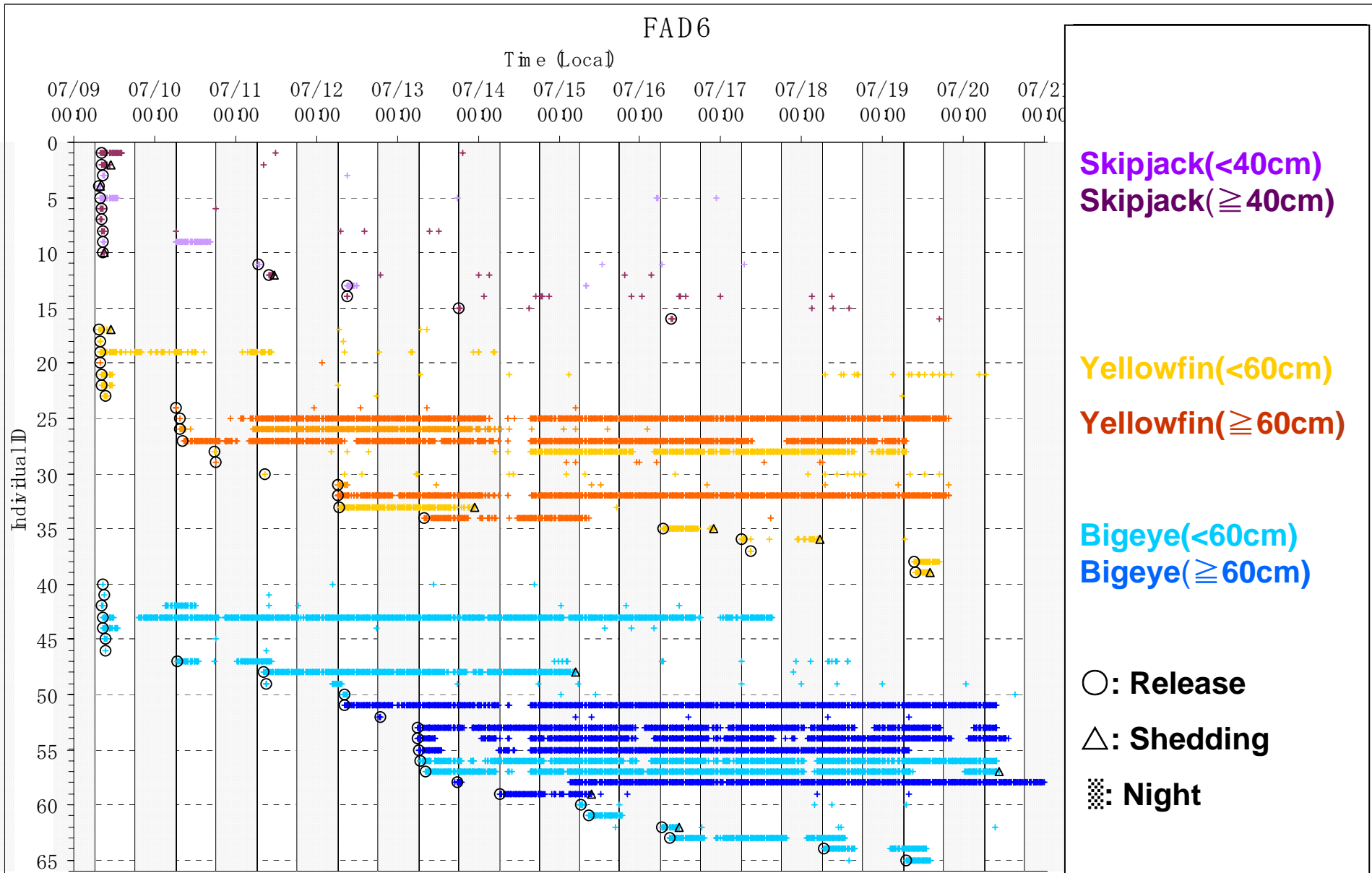
Summary of successful tracking

Track No.	FAD No.	Period of tracking	Duration of tracking (hr)	Position of initial release	Number of individuals released with ID pinger	Size of the fish (cm) (monitored for >24h)
1	FAD6	2005/7/9- 2005/7/21	283	01-04.5N 176-42.3E	SKJ 16 YFT 23 BET 26 Total 65	SKJ:38.9, YFT:35.8-93.1, BET 37.7-85.5
2	FAD8	2005/8/10- 2005/8/24	350	05-39.6N 178-05.2E	SKJ 14 YFT 20 BET 6 Total 40	SKJ:36.0-64.0, YFT:36.9-91.3, BET 40.8-47.3
Total			633 (26d 9h)		SKJ 30 YFT 43 BET 32 Total 105	SKJ:36.0-64.0, YFT:35.8-93.1, BET 37.7-85.5

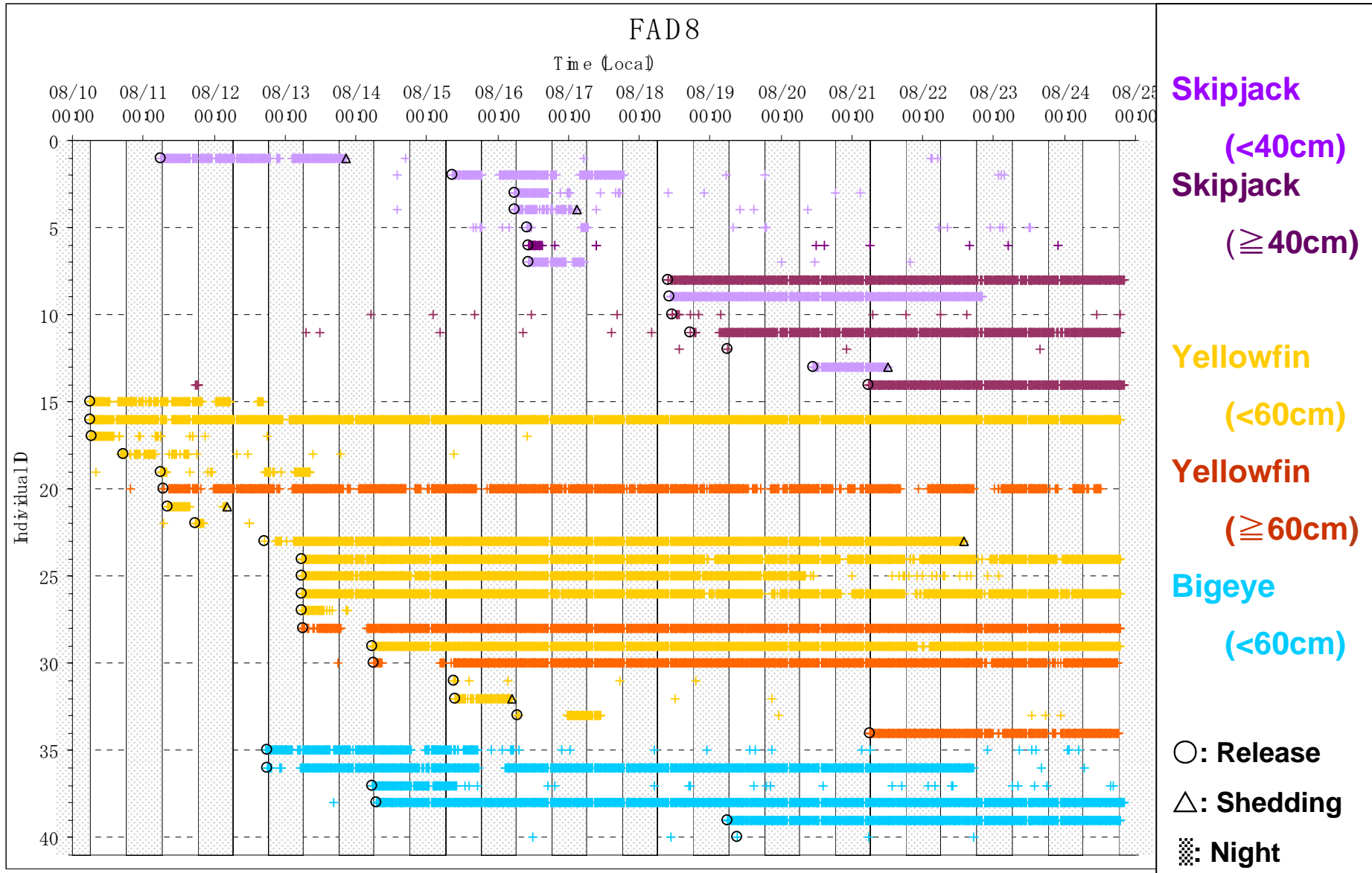
Position of this study



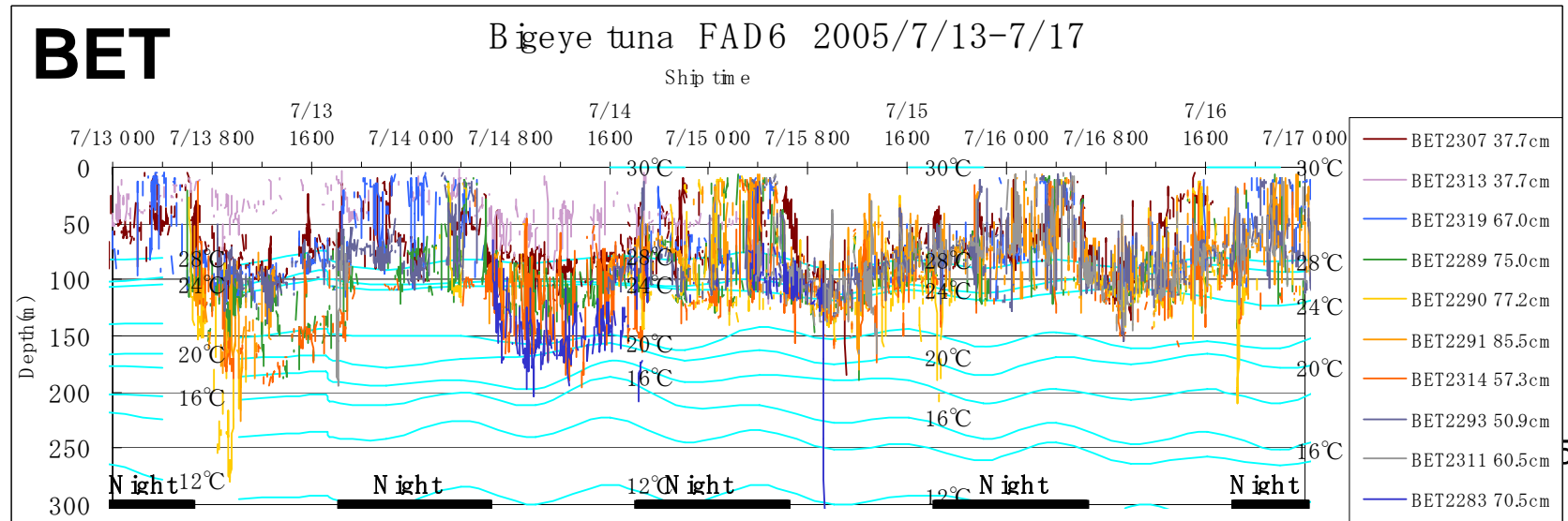
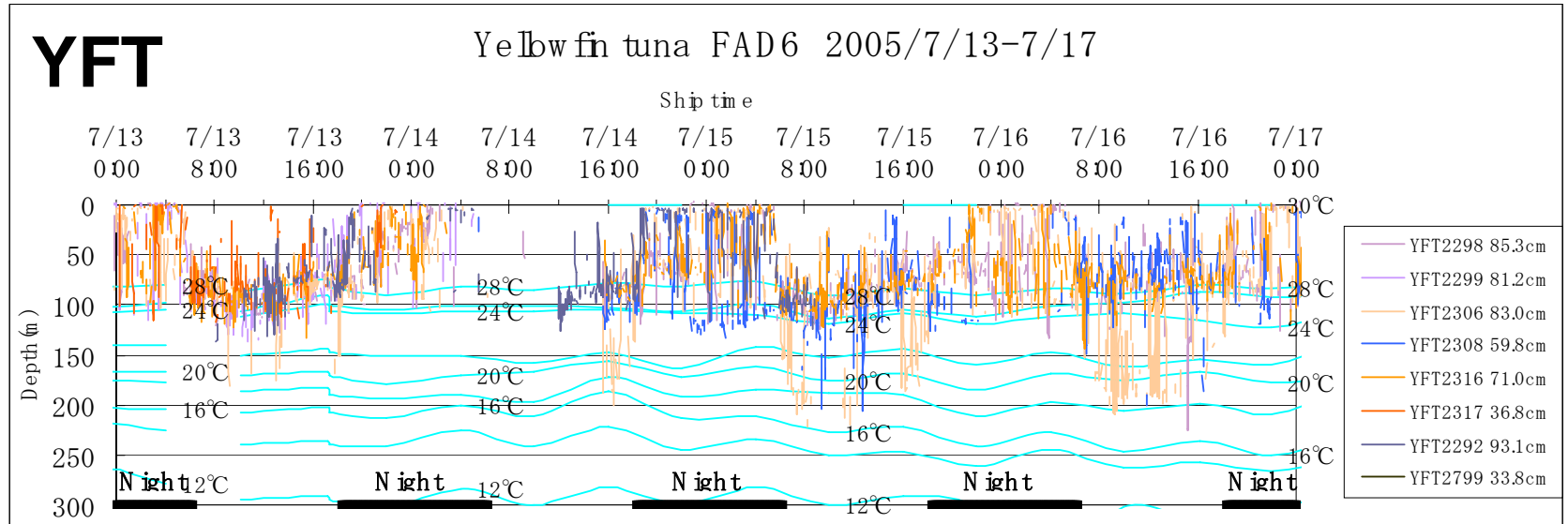
Association with FAD for each individual (1st tracking, FAD6)



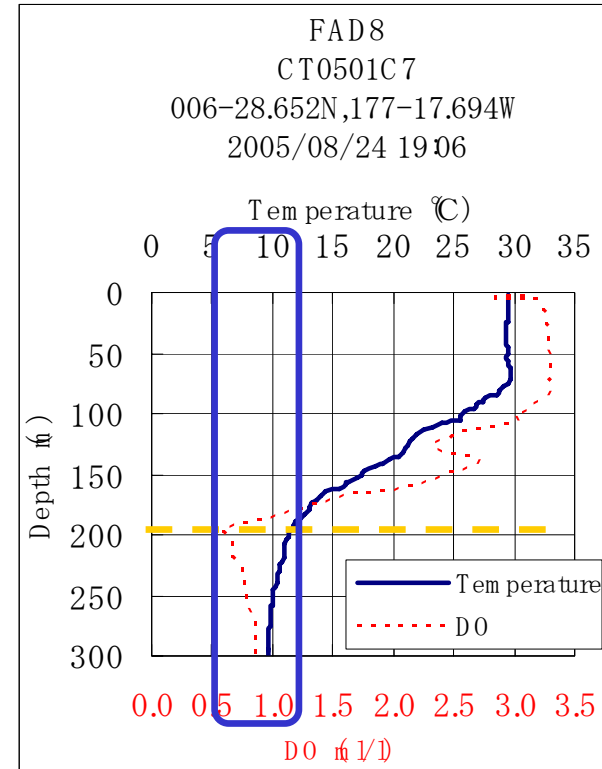
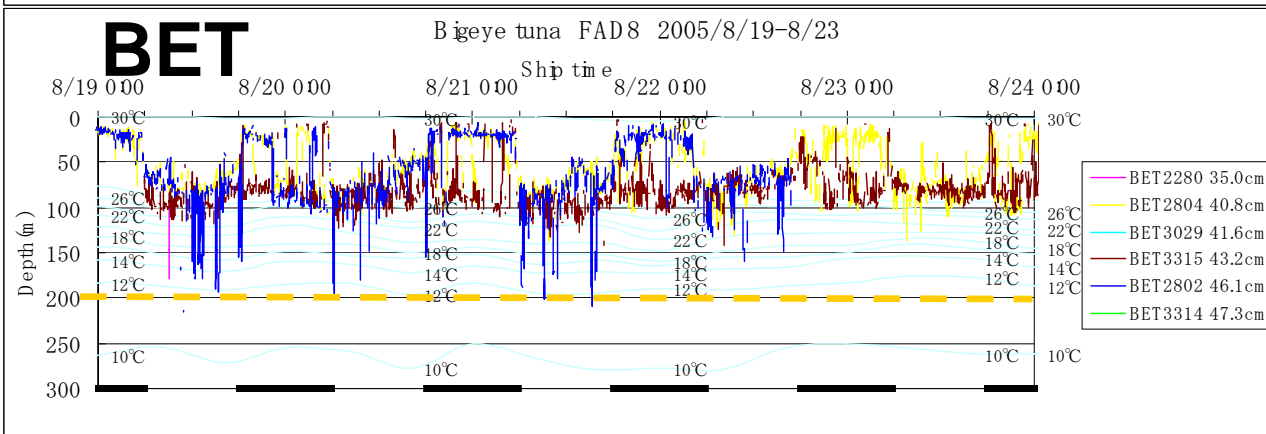
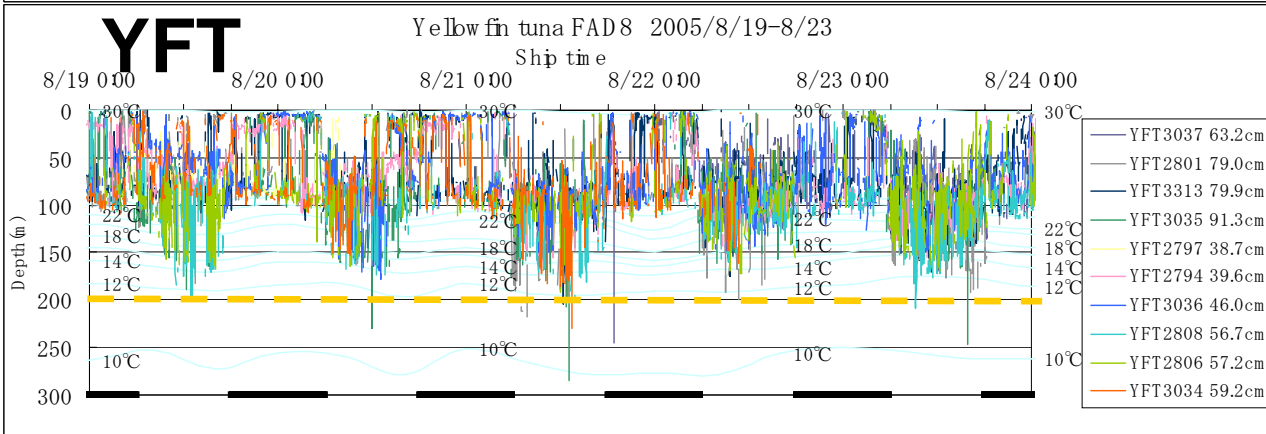
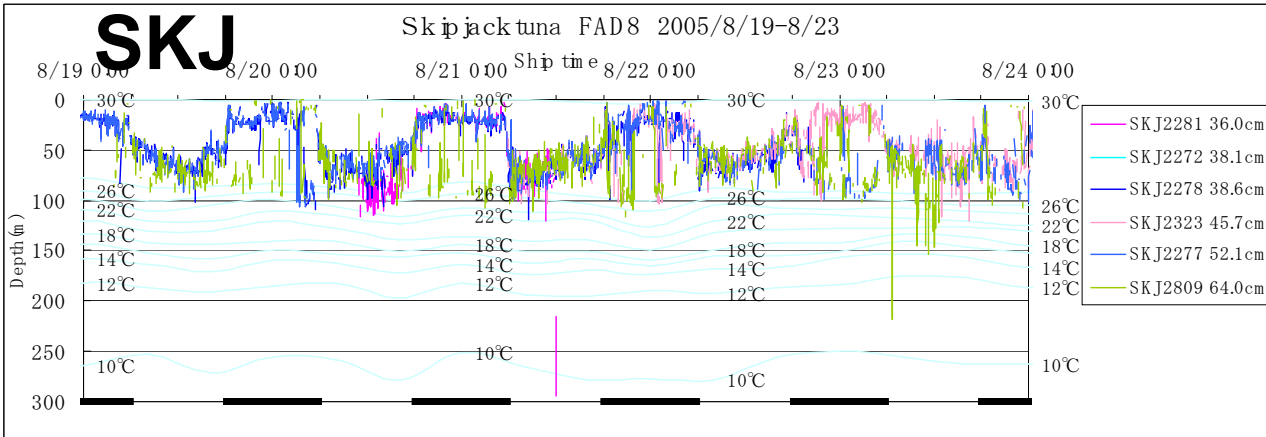
Association with FAD for each individual (2nd tracking, FAD8)



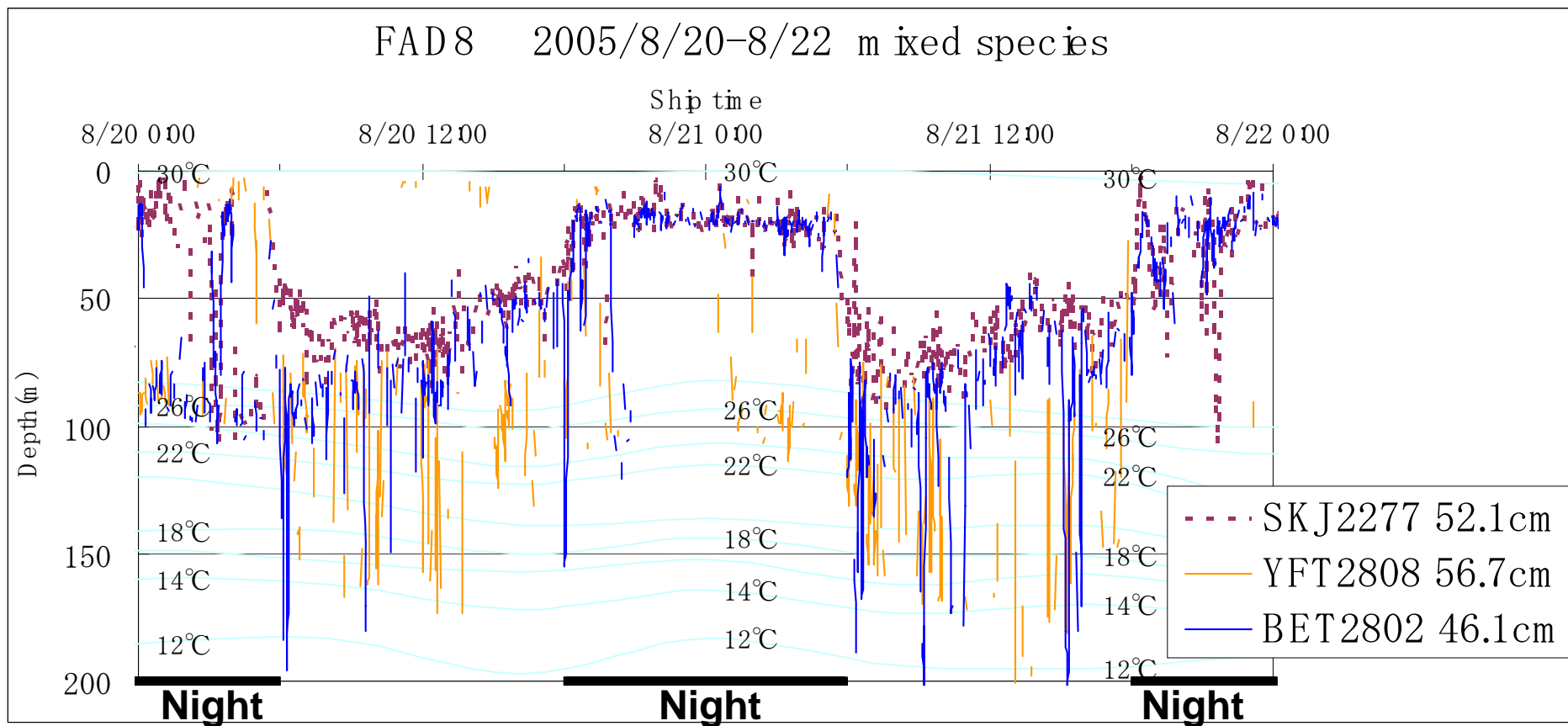
Time series swimming depth (1st tracking, FAD6)



Time series swimming depth (2nd tracking, FAD8)

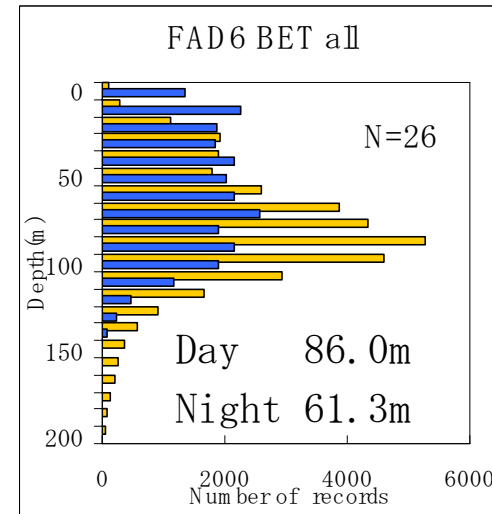
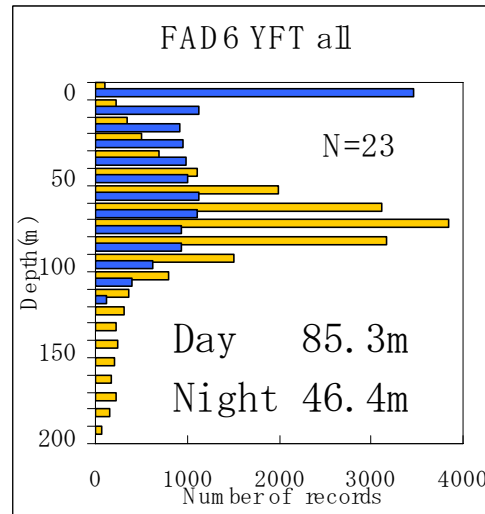
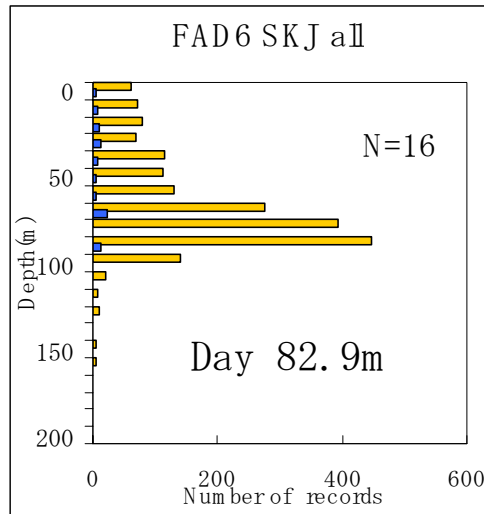


Comparison of vertical behavior between species (2005 2nd tracking)

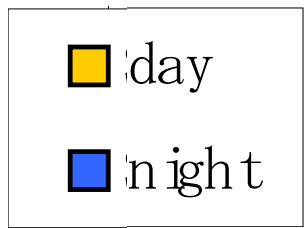


Frequency distribution of swimming depth for each tracking and species

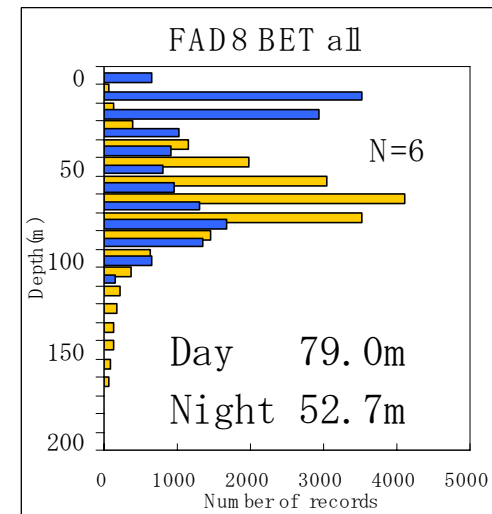
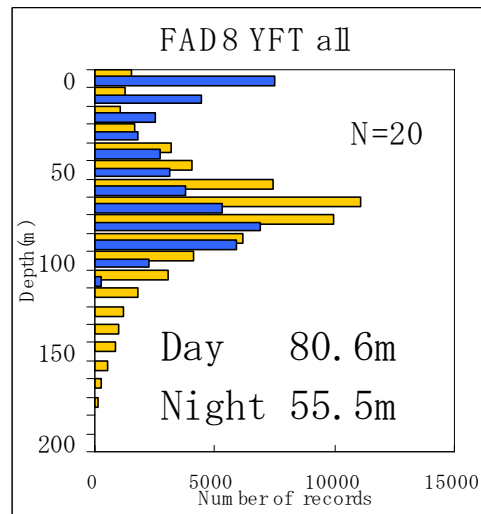
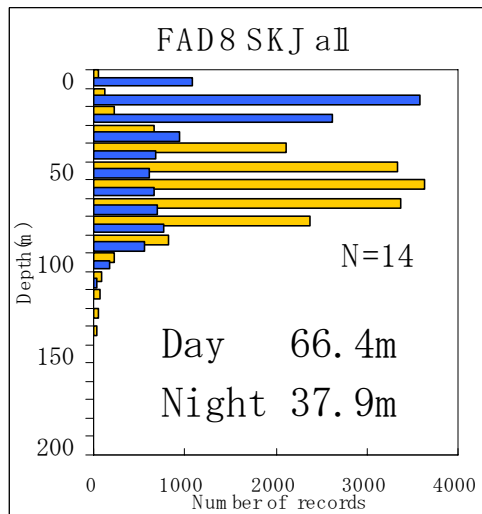
1st tracking



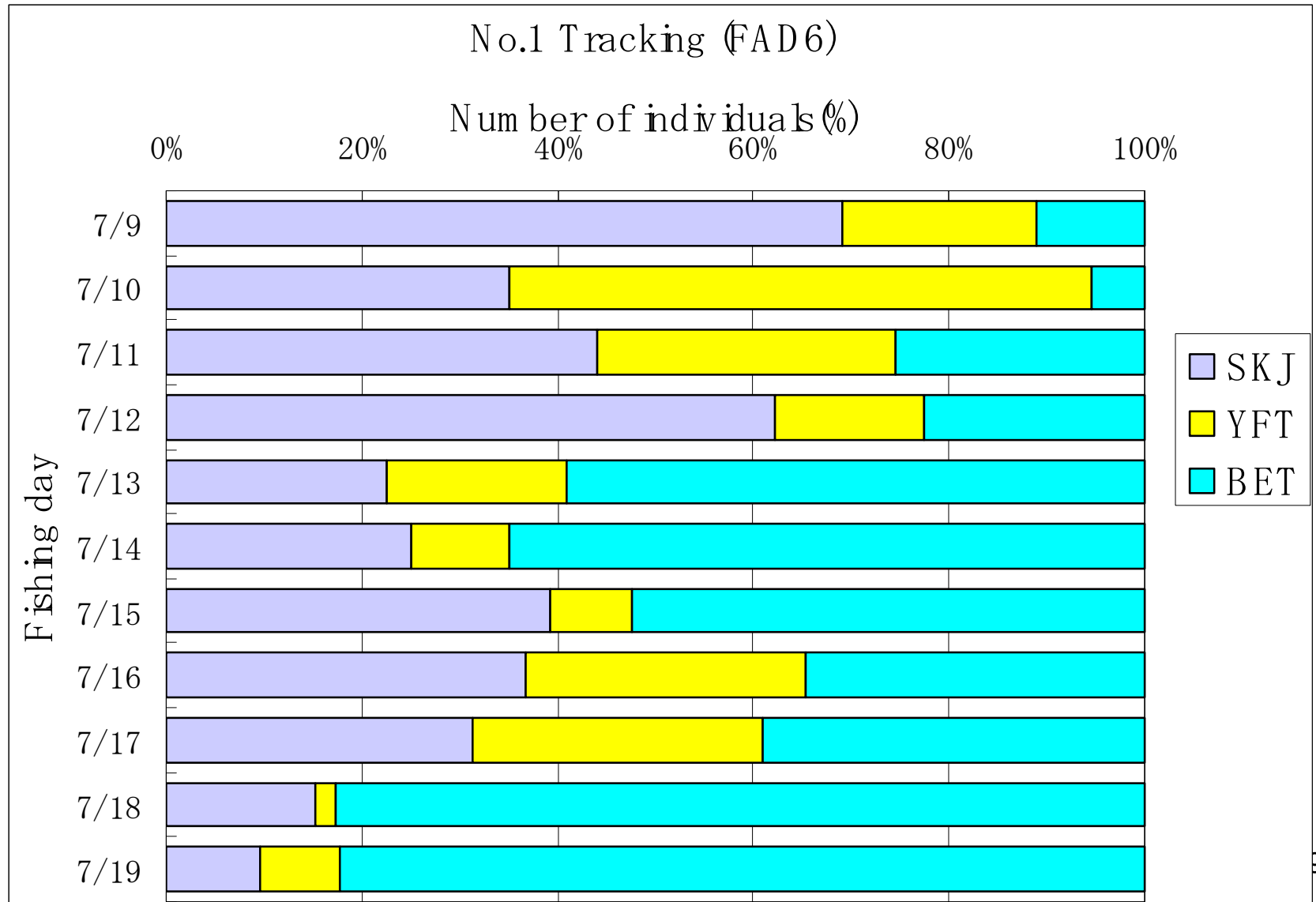
2nd tracking



Depth
(average)

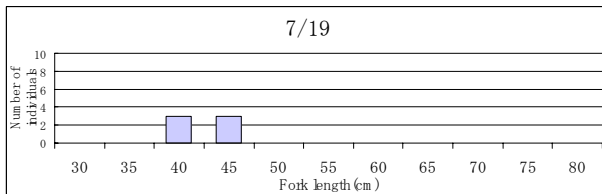
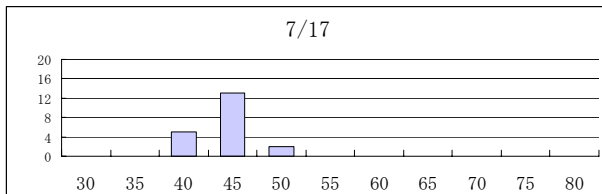
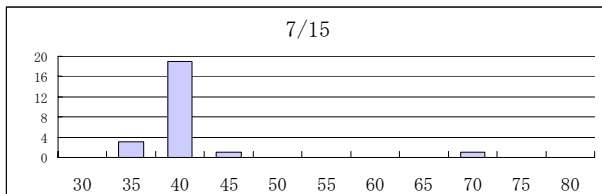
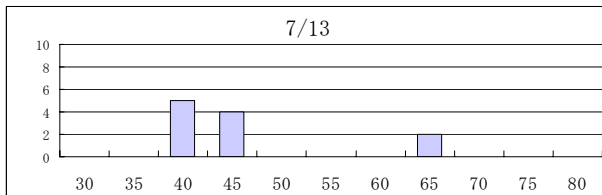
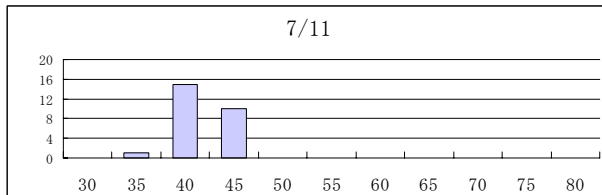
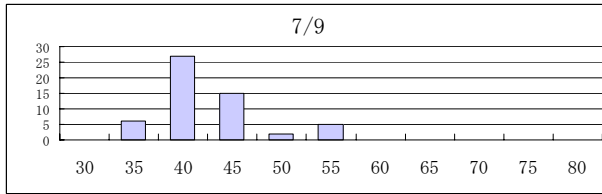


Species composition of the catch by jigging by fishing day (1st tracking)

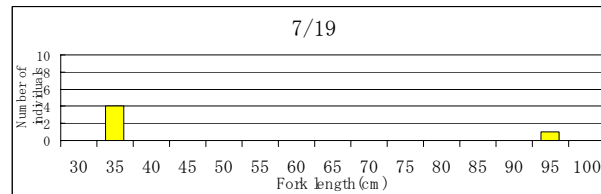
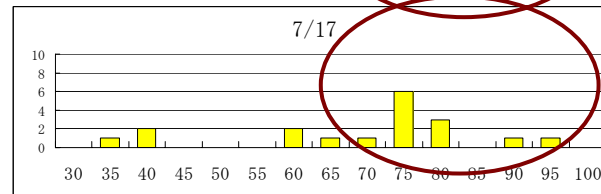
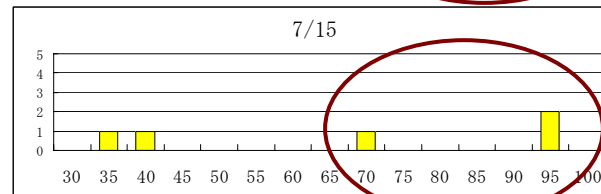
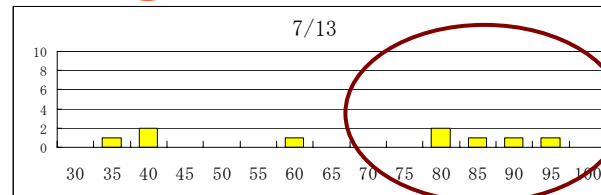
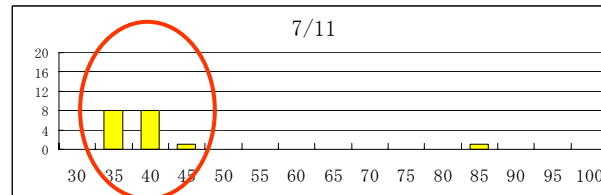
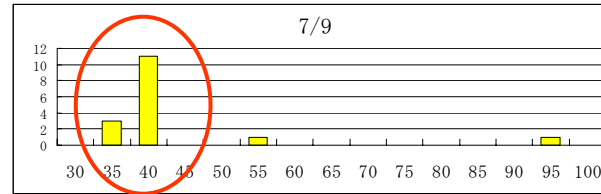


Length frequency of the catch by fishing day

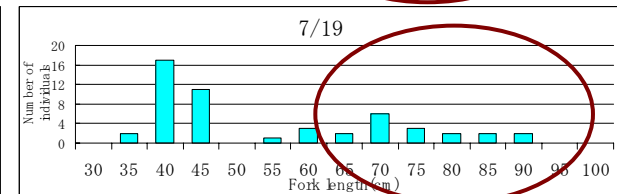
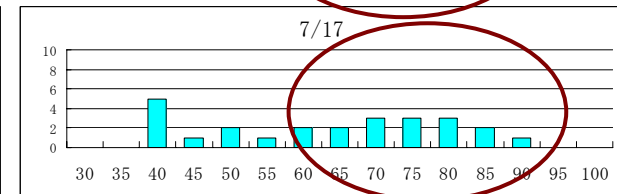
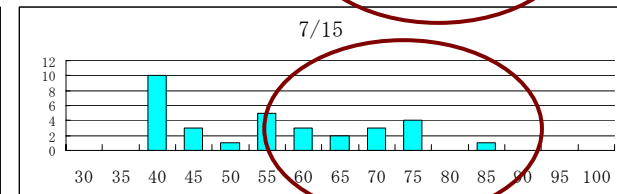
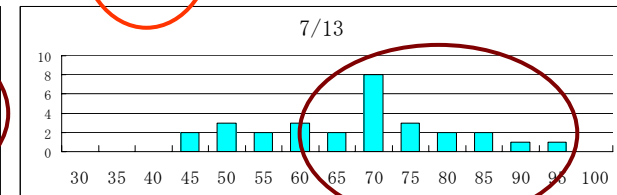
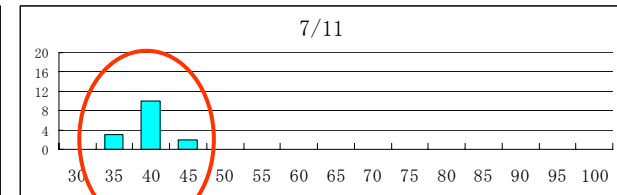
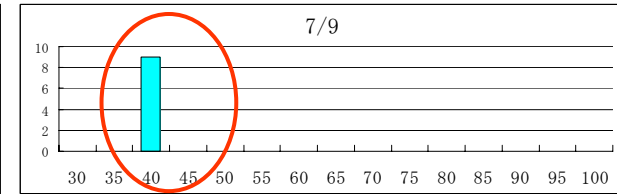
Skipjack



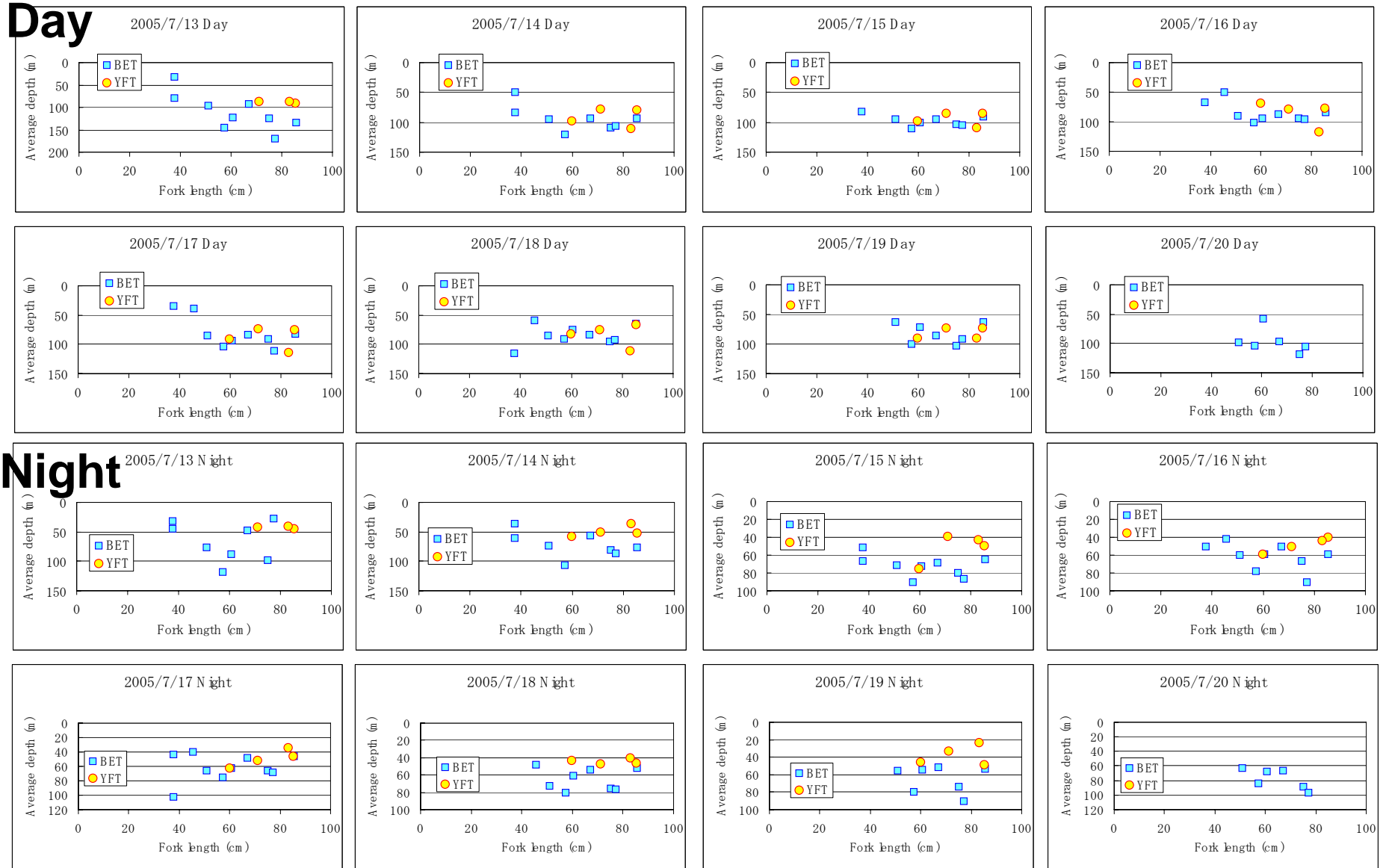
Yellowfin



Bigeye

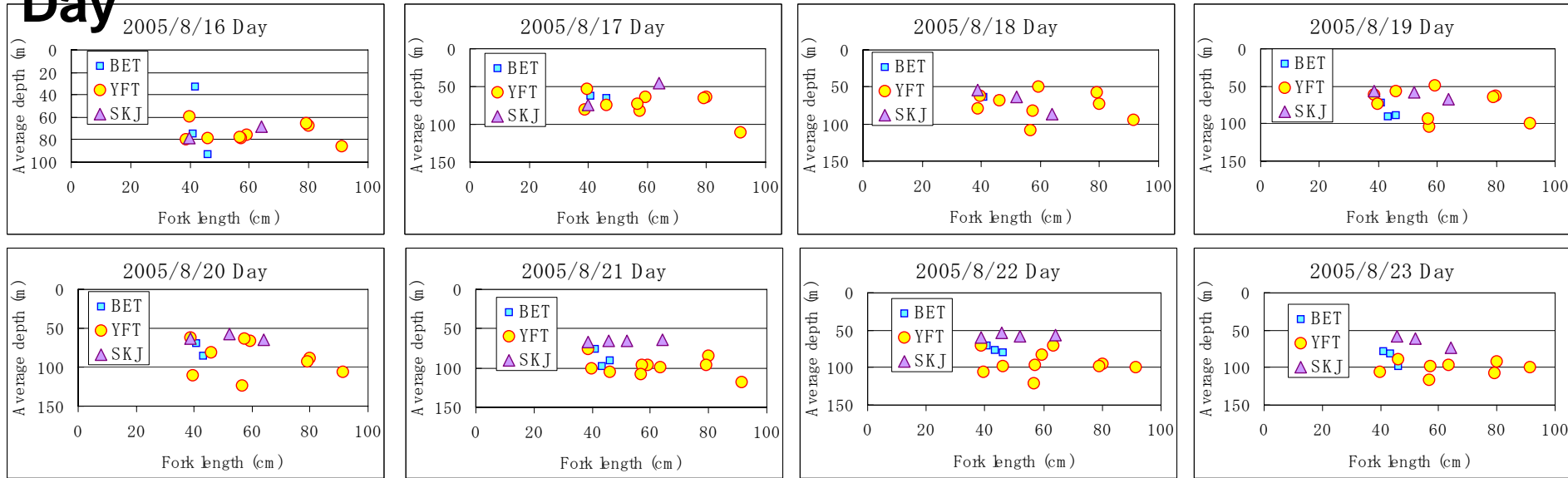


Difference of swimming depth by species and size (daily average depth, 1st tracking, FAD6)

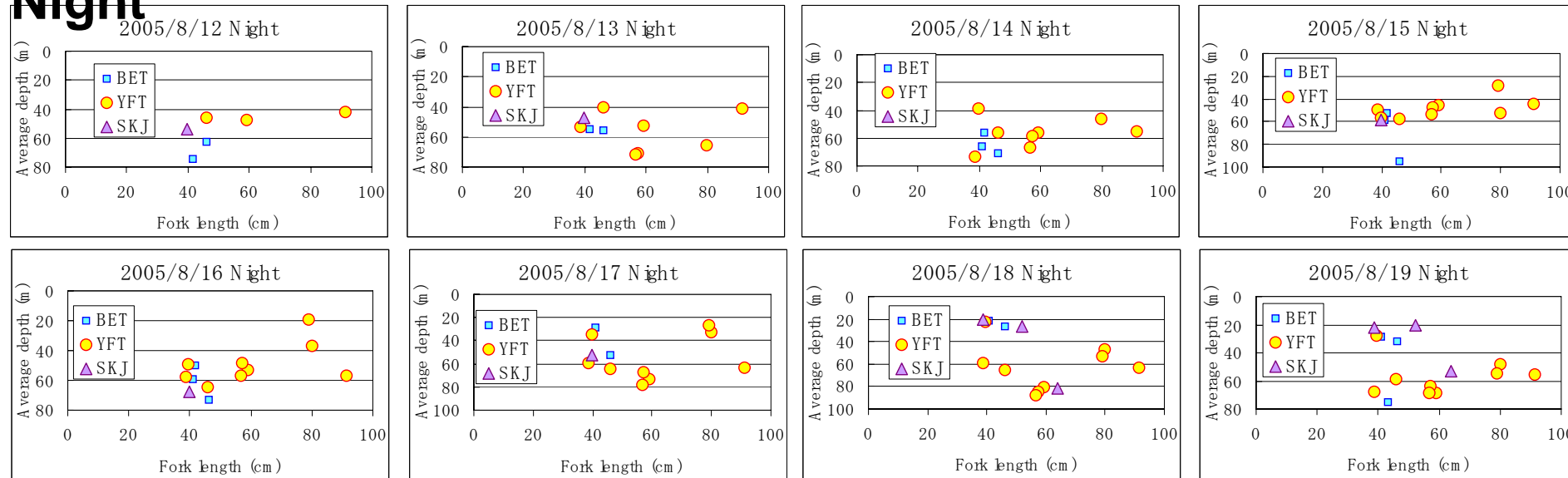


Difference of swimming depth by species and size (daily average depth, 2nd tracking, FAD8)

Day

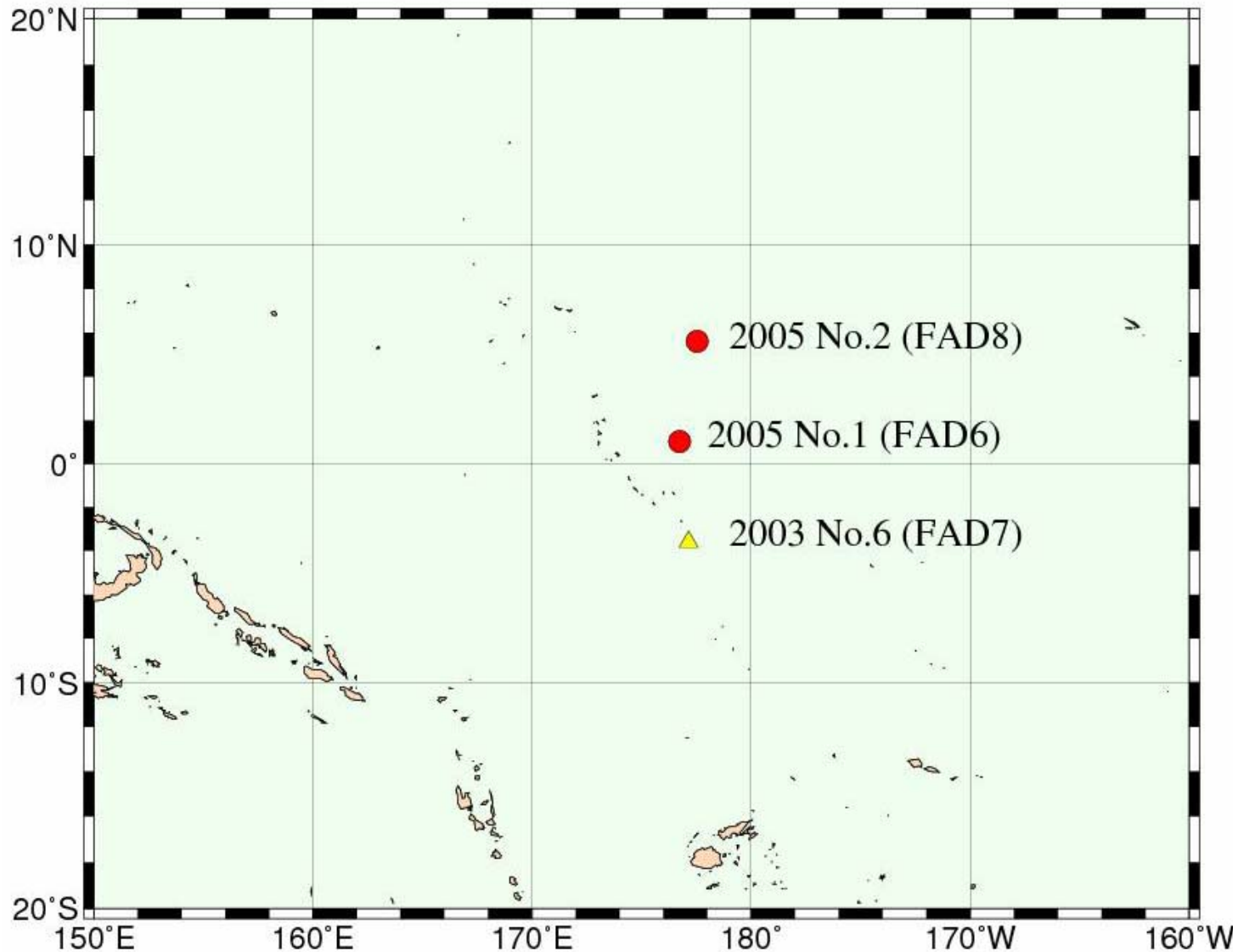


Night



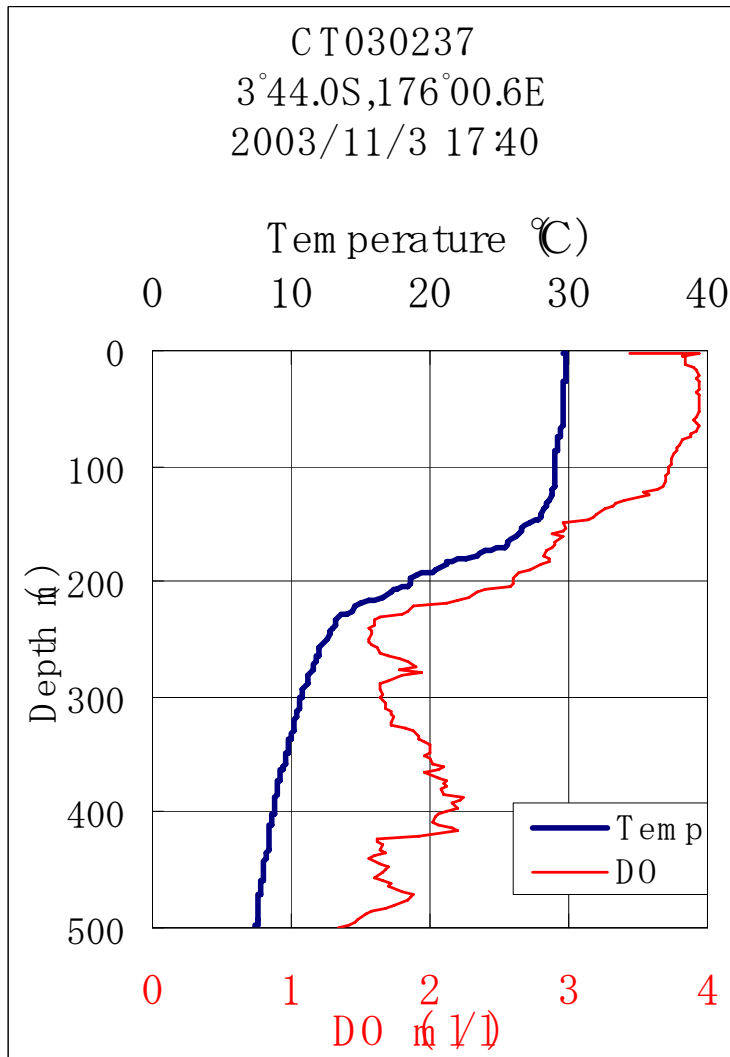
Comparison with 2003 study

Oct.-Nov. 2003, WCPFC SC1 document, Matsumoto et. al. (2005)

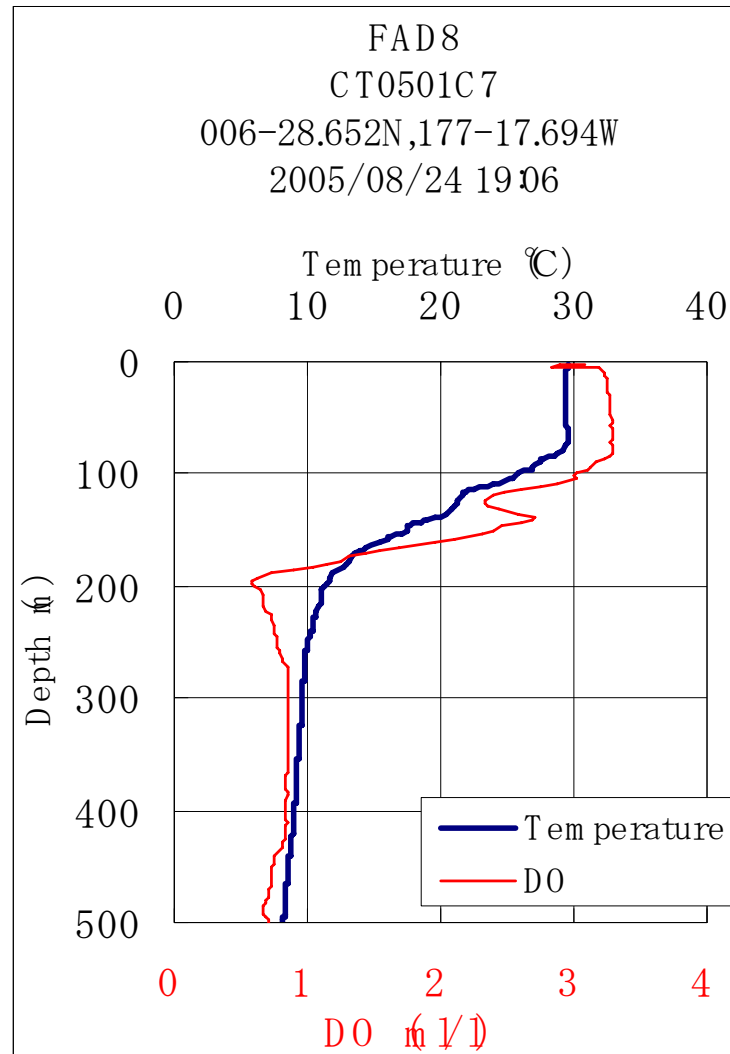


Oceanographic condition

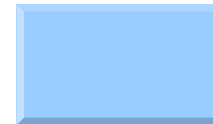
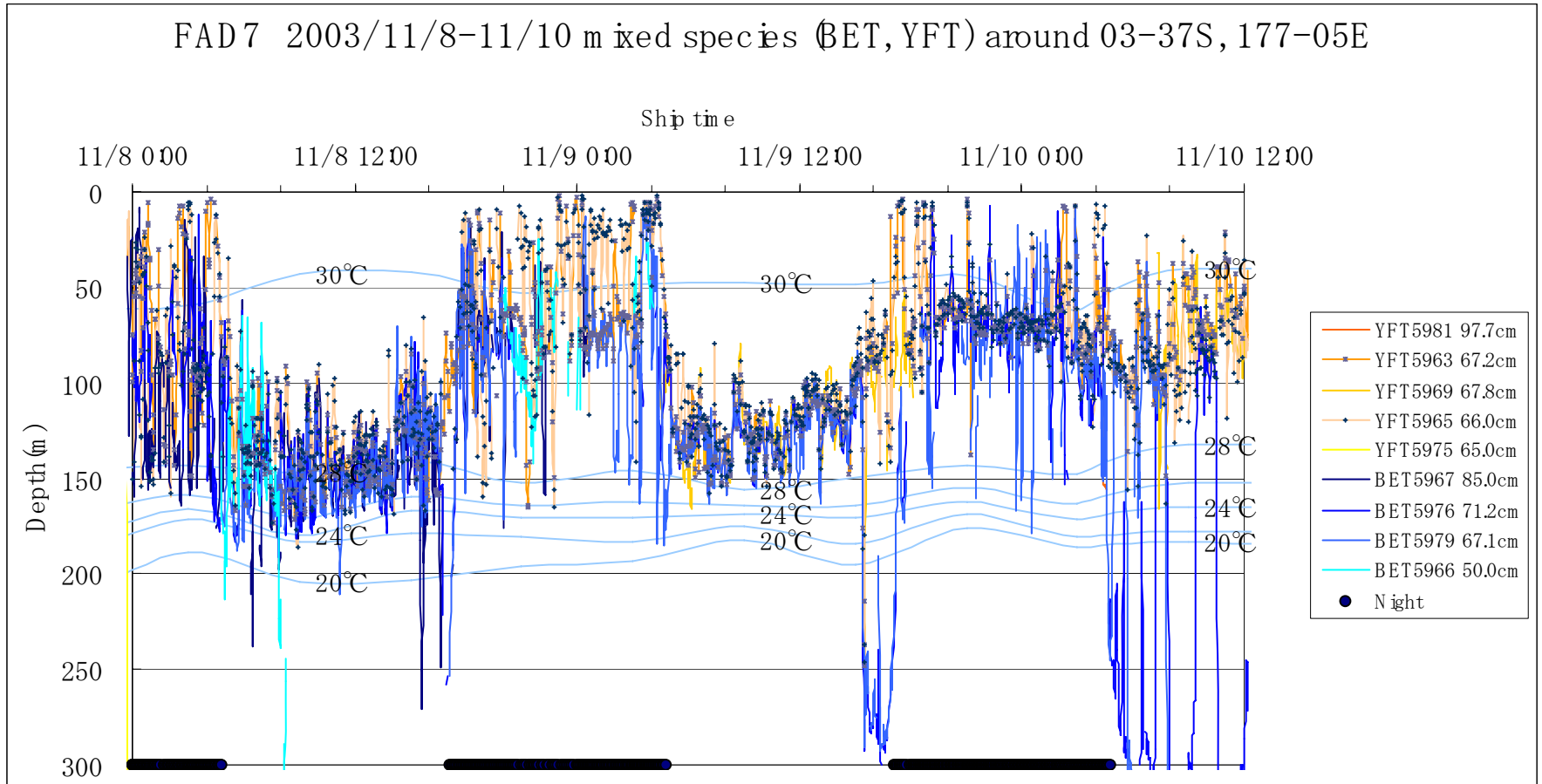
2003 study



2005 study
(2nd tracking)



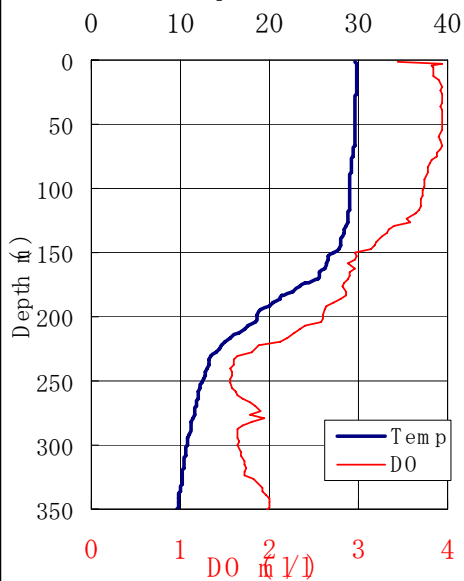
Results of 2003 study (BET and YFT only)



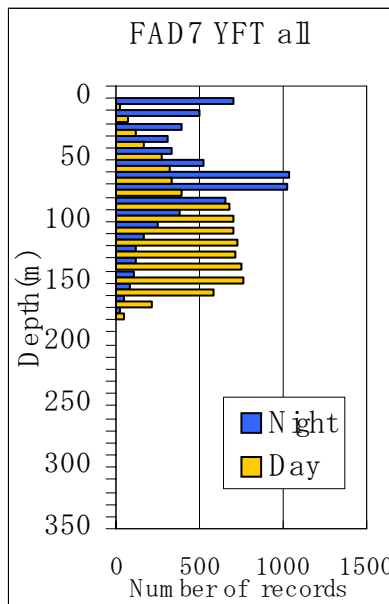
Comparison of swimming depth between tracking series

2003

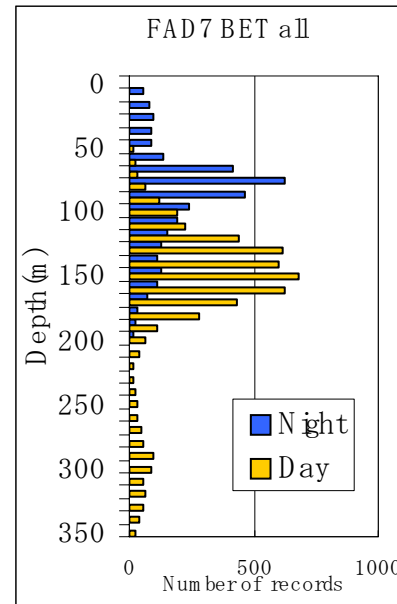
3°44.0S,176°00.6E
2003/11/3 17:40
Temperature (°C)



YFT

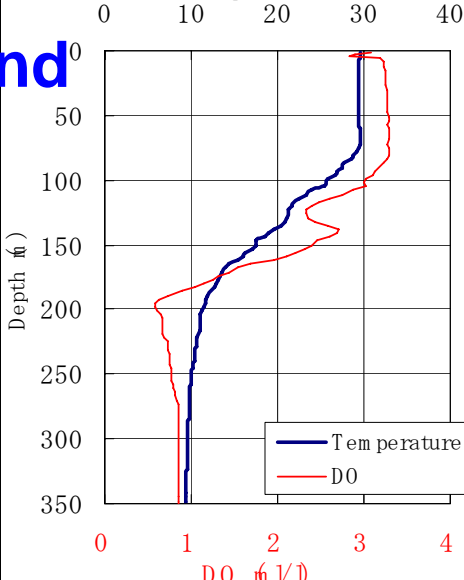


BET



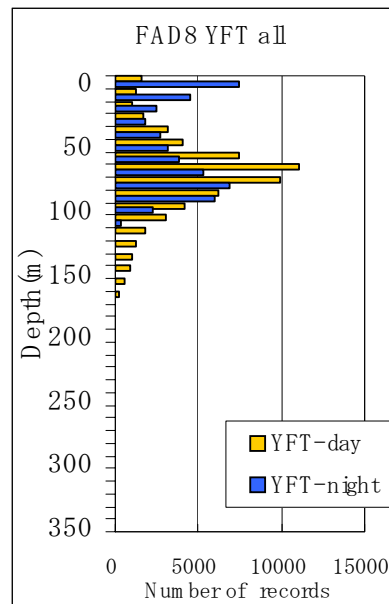
2005

006-28.652N,177-17.694W
2005/08/24 19:06
Temperature (°C)

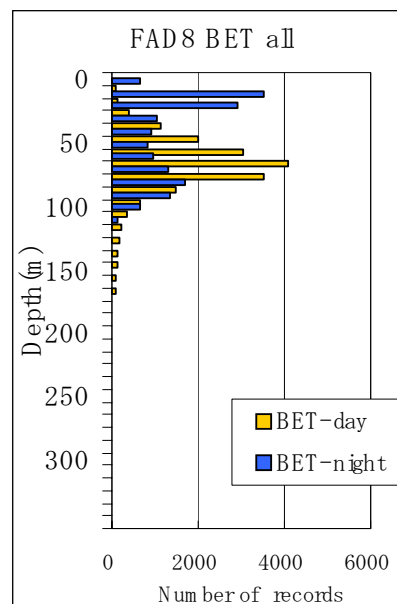


2nd

FAD8 YFT all



FAD8 BET all



The relationship between the length of underwater object of FAD and bigeye catch by purse seine

Satoh et. al. (2007) (WCPFC SC3 document)

Hypothesis: The longer the underwater object of FAD becomes, the more bigeye is caught

Methods

FAD underwater object length: report by vessels

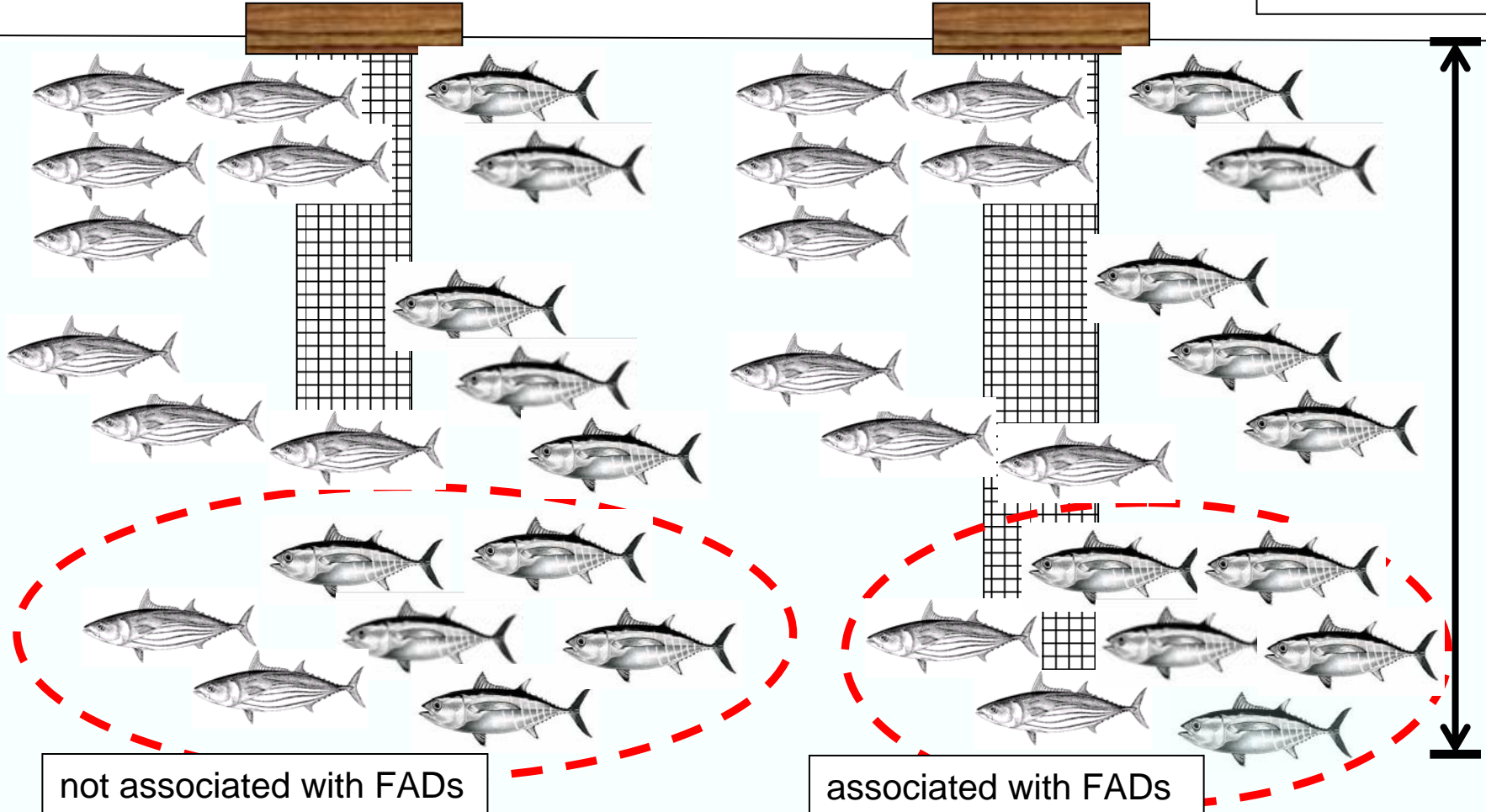
BET catch: logbook and port sampling

Short

Floating base

Long

The length of underwater structures



not associated with FADs

associated with FADs

Catch ratio of BET : **0.38** = 5/13

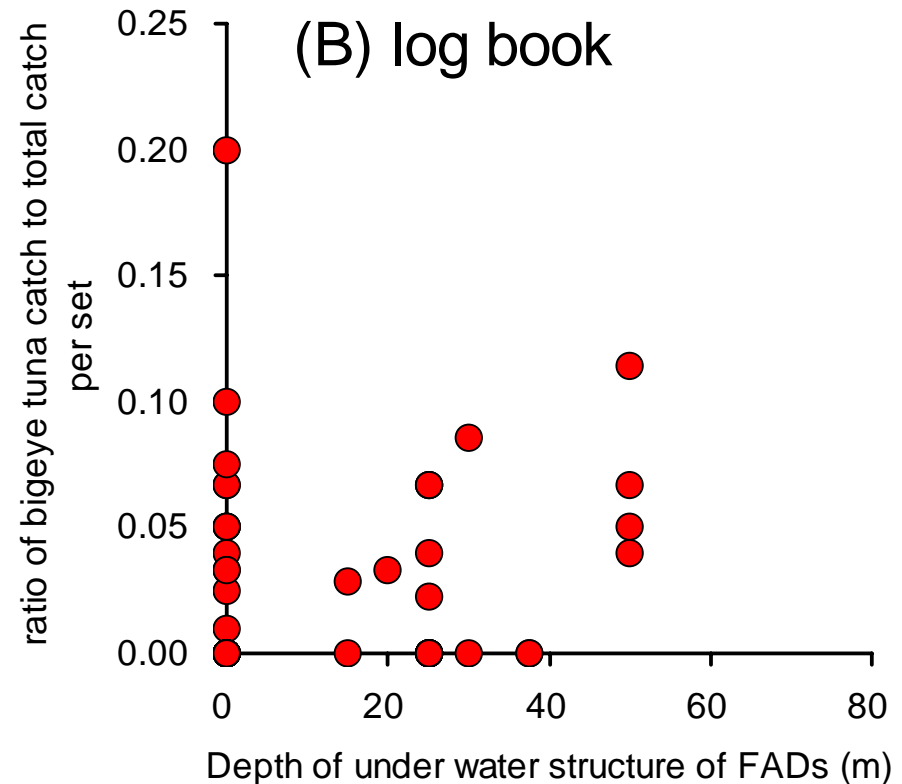
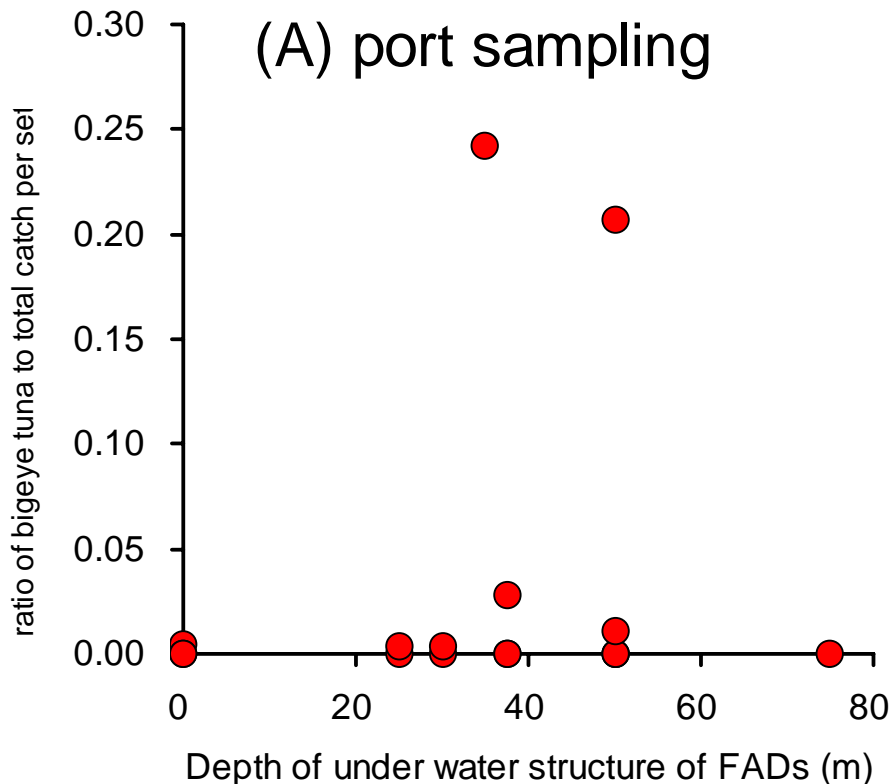
Catch : **13** = 8 (SKJ) + 5 (BET)

Catch ratio of BET : **0.50** = 10/20

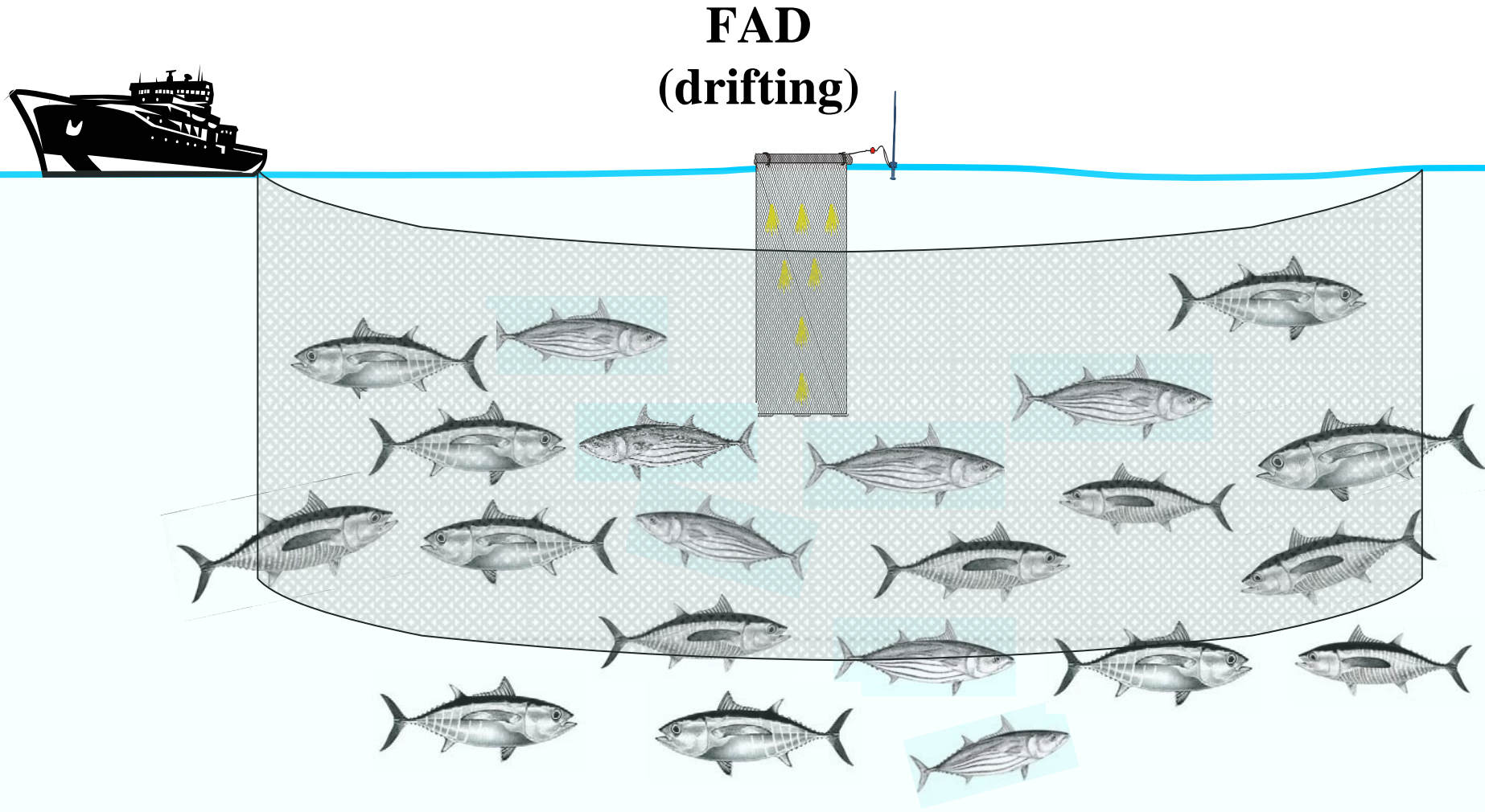
Catch : **20** = 10 (SKJ) + 10 (BET)

Results

- Significant correlations were not found
- Sample size is very small
- This study is continuing



Behavior of fish after setting of the net (**virtual**)

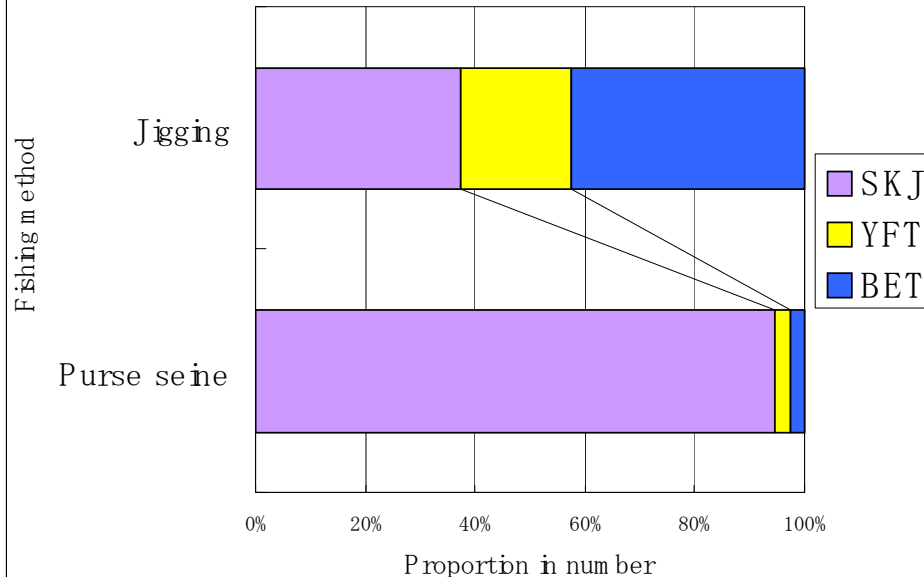


Species composition by fishing method (2005 1st tracking)

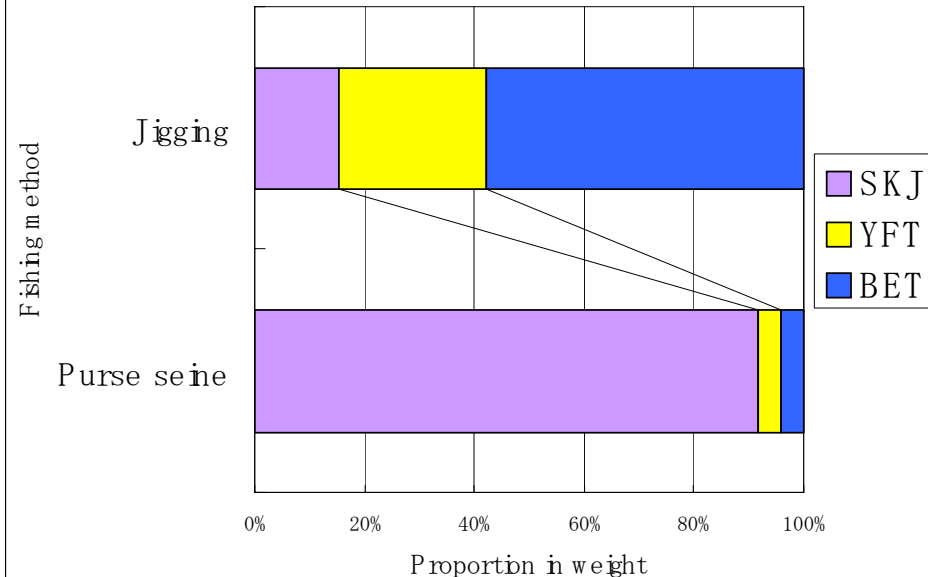
Purse seine operation and on-board sampling were conducted for the same FAD just after the tracking



2005 FAD6 species composition of the catch in number

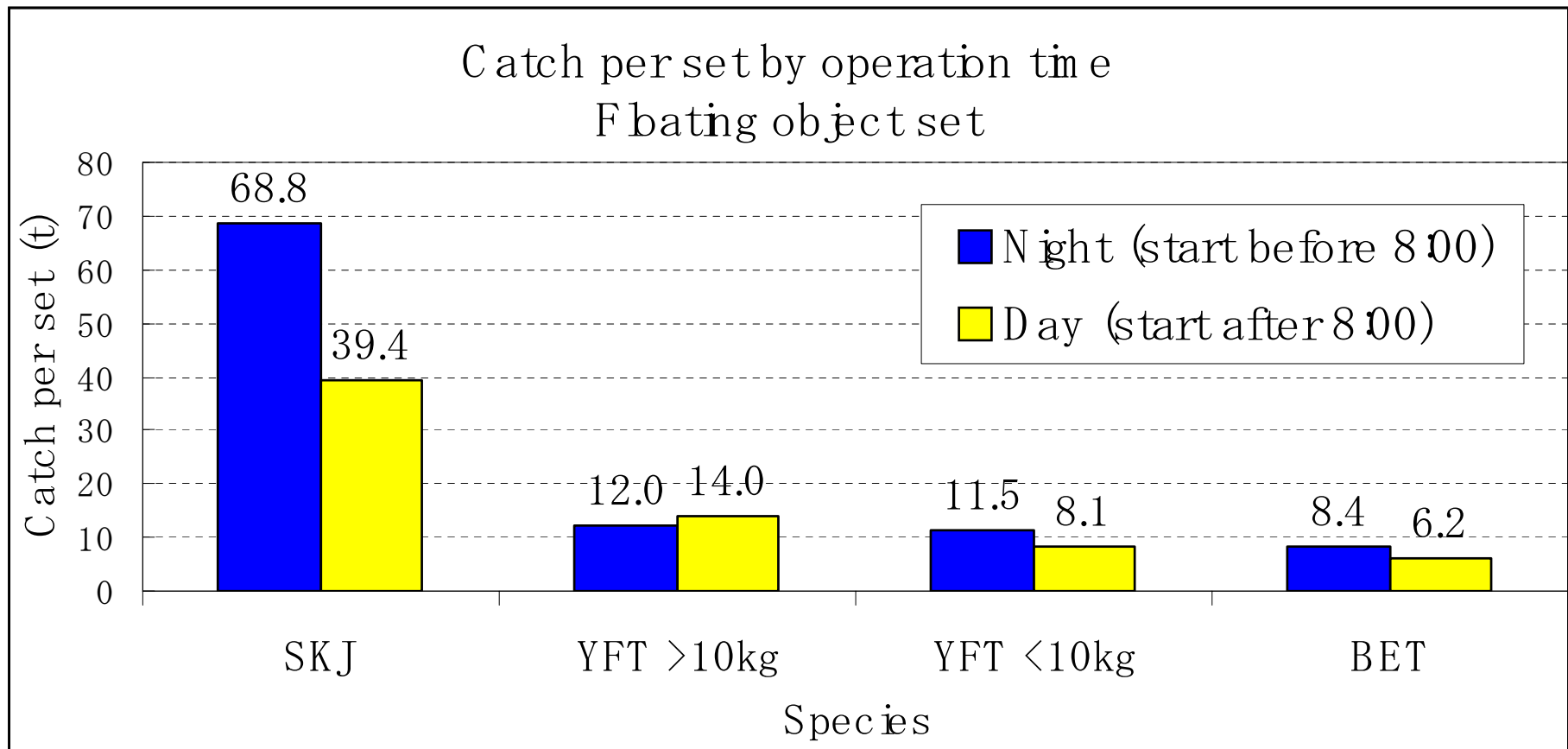


2005 FAD6 species composition of the catch in weight



Difference of catch by time of operation

Based on logbook, 1995 - May 2007



Future outlook

- Consider the design of future behavioral study
- Monitoring the behavior of each species after setting the net
- Difference of horizontal behavior among species
- Analyze and consider in detail about the effect of gear and operation type for the catch of bigeye tuna

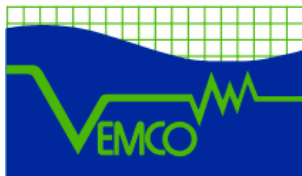
Acknowledgements



- Crew of R/V Shoyo-maru
- Staffs of Fisheries Agency of Japan



- Staffs of JAMARC
- Crew of purse seine vessel No.18 Taijin-maru



- VEMCO



- Nippon Kaiyo Co. LTD.



- PFRP