Comisión Interamericana del Atún Tropical
Inter-American Tropical Tuna Commission

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RELATIONSHIP BETWEEN THE CHARACTERISTICS OF PURSE-SEINE VESSELS AND FISHING MORTALITY (PROJECT J.2.a): PROGRESS REPORT

Jon Lopez, Cleridy E. Lennert-Cody, Mark N. Maunder and Ernesto Altamirano

SAC-10-10

10th Meeting of the Scientific Advisory Committee San Diego, California USA, 13-17 May 2019

Background

- Purse-seine fleet **effort continuous to increase** in the eastern Pacific Ocean (EPO), which requires more stringent management measures.

- However **extending the closures** of the fishery is difficult.

- **Additional measures** have been tried as alternatives in the past.
  - Catch limits by set type in 2017, and limiting the number of active FADs per vessel in 2018.

- Nevertheless, the current tuna conservation measures (Resolution C-17-02) may not be as effective as desired, and **new and different measures may be required**.

- As such, the staff has recently received a growing number of requests for further analyses of **alternative management measures**.

- Also, using vessel well volume as the measure of fleet capacity is somewhat simplistic, and a **more precise measure of capacity** needs to be quantified.

- Therefore, a full-time researcher was hired in early 2018 for two years to address six related questions that were grouped into **one project (J.2.a)**.

Background - Tasks

- Project J.2.a responds to a series of management-related research requests recently made to the IATTC staff:

1. Eval**ADs.**
2. Inve**c.** of the WG-FADs).
3. Eva**deployments**
4. Inve**take into** consideration **ndation 13,** Document IAT
5. Inve**t capacity** (SAC-08 Reco
6. Eva**areas,** individual vess**Document** IATTC-92-04c

Task\Month	Year 1 (March 2018-February 2019)												Year 2 (March 2019-February 2020)											
	M 1	A 2	M 3	J 4	J 5	A 6	S 7	O 8	N 9	D 10	J 11	F 12	M 13	A 14	M 15	J 16	J 17	A 18	S 19	O 20	N 21	D 22	J 23	F 24
1	Evaluate resolu-tions					Modify data collection forms					Prepare buoy dataset				Train-ing	Assess new FAD forms and data								
2					Prepare dataset						De-velop algo-rithm					Refine algorithm							Final algo-rithm	
3	Done																							
4					Prepare dataset								Quantify relationship between various indicators and *F*										Develop manage-ment pro-posals	
5																								
6				Prepare dataset		Modelling												Additional modelling and operationalization						
Others							Establish collaborations; Environmental task force terms of reference						Implement Environmental task force											

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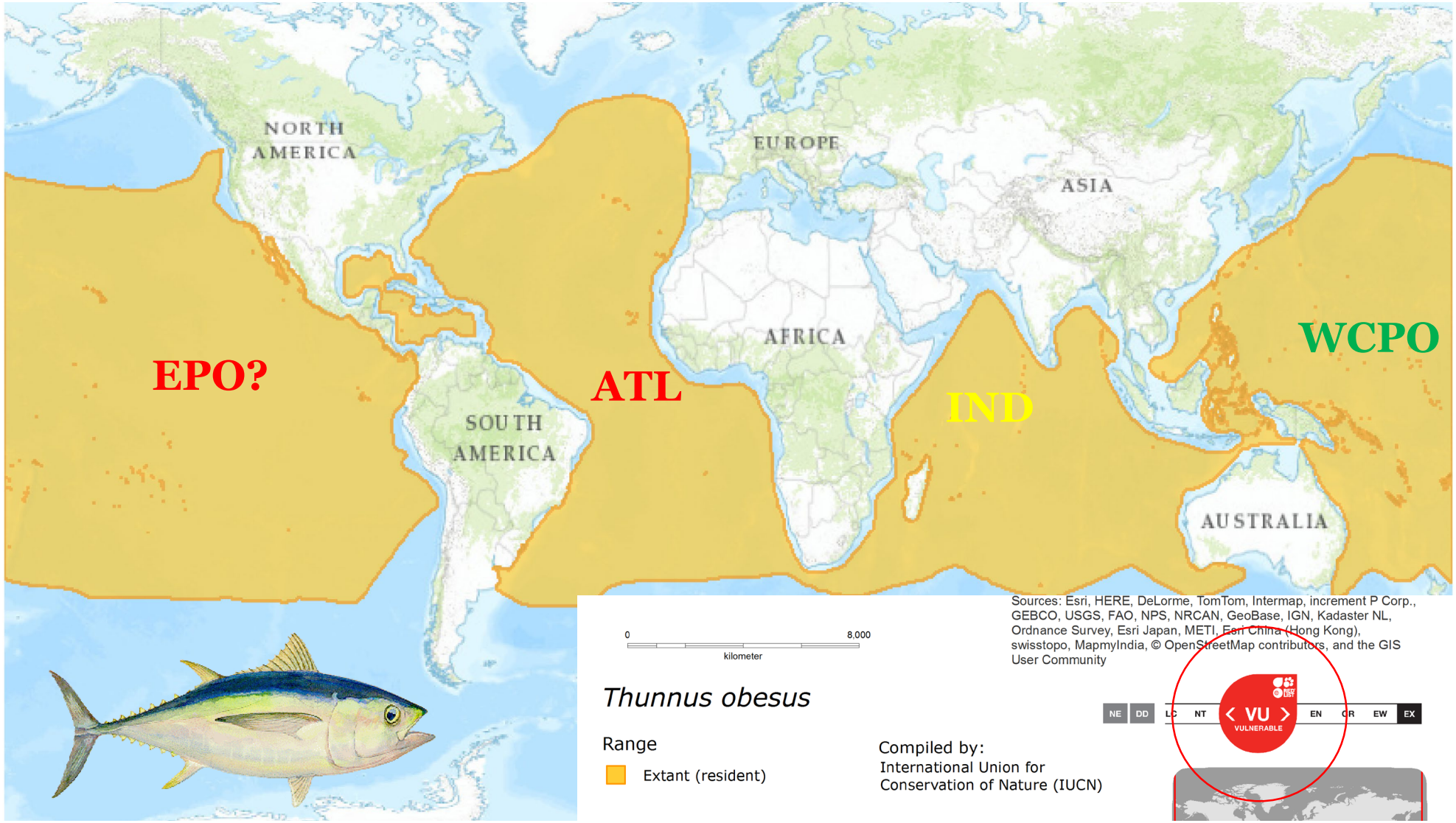
DEVELOPING ALTERNATIVE CONSERVATION MEASURES FOR BIGEYE TUNA IN THE EASTERN PACIFIC OCEAN: A DYNAMIC OCEAN MANAGEMENT APPROACH

Jon Lopez, Cleridy E. Lennert-Cody, Mark N. Maunder, Haikun Xu, Stephanie Brodie, Michael Jacox, Jason Hartog

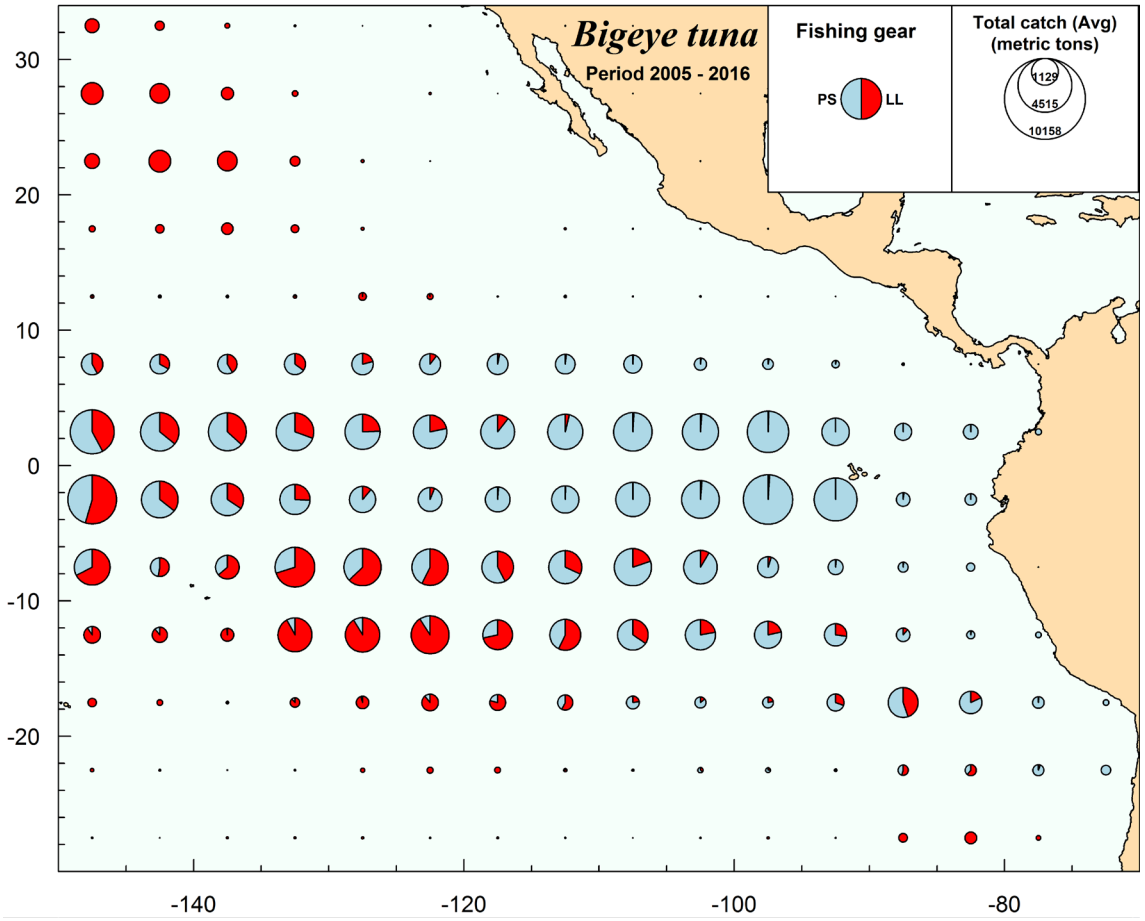
SAC-10-INF-D

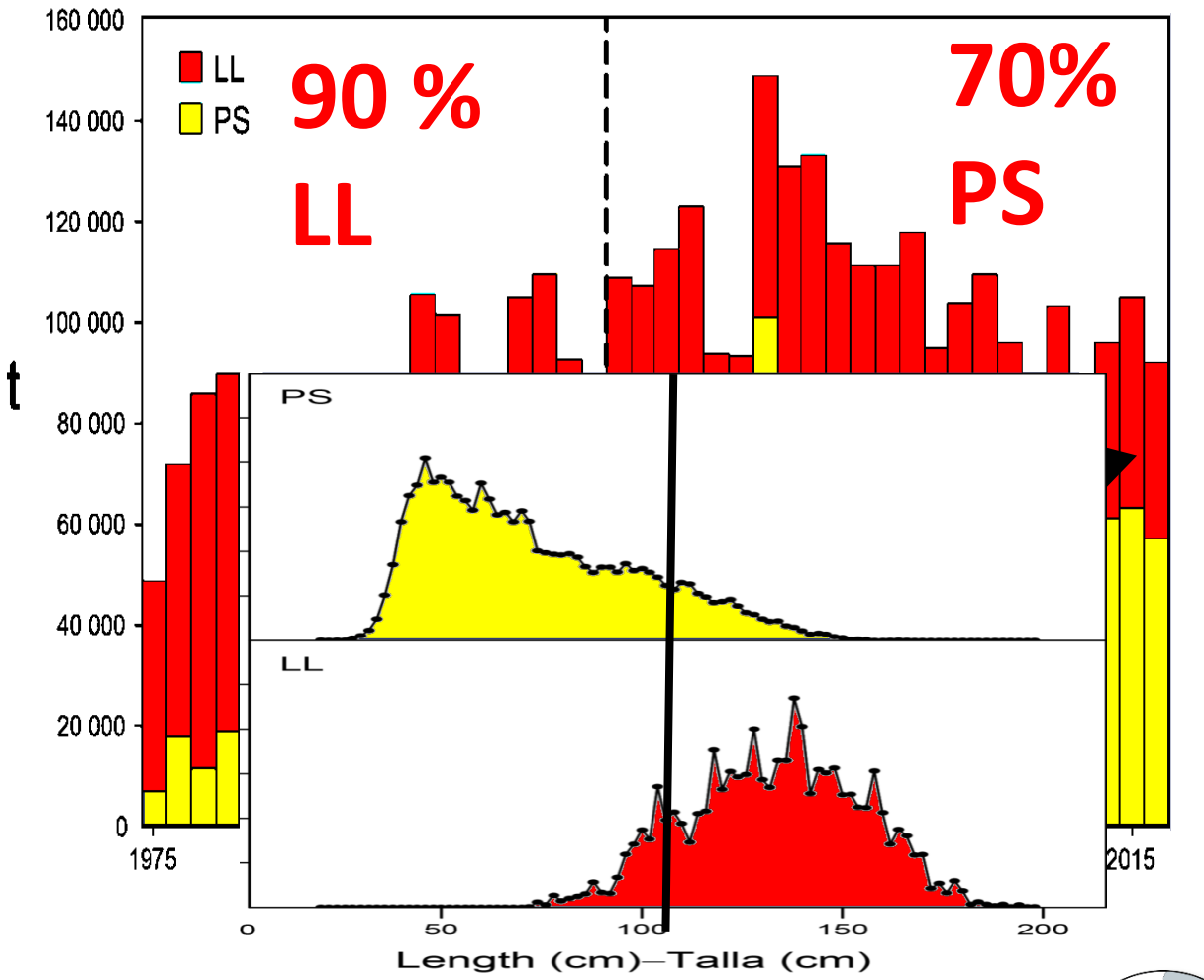
10th Meeting of the Scientific Advisory Committee San Diego, California USA, 13-17 May 2019

Background


NORTH AMERICA
EUROPE
ASIA
AFRICA
SOUTH AMERICA
AUSTRALIA
EPO?
ATL
IND
WCPO
0
8,000
kilometer
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Thunnus obesus
Range
Extant (resident)
Compiled by:
International Union for Conservation of Nature (IUCN)
NE DD LC NT VU VULNERABLE EN CR EW EX

Background


Bigeye tuna
Period 2005 - 2016
Fishing gear
PS
LL
Total catch (Avg)
(metric tons)
1129
4515
10158
30
20
10
0
-10
-20
-140
-120
-100
-80


LL
PS
90 %
LL
70%
PS
t
160 000
140 000
120 000
100 000
80 000
60 000
40 000
20 000
0
1975
2015
PS
LL
0
50
100
150
200
Length (cm)—Talla (cm)

Background

Conservation measures in force

- Res. 17-02 [plan for 2018-2020]
- 72 days closure
- 30 days additional closure (Oct-Nov)

Staff proposal to maintain/reduce F:

- Limit the **number of sets** (FOB+Una)
- Project $\mathbf{F_{mort}}$
  - Operational characteristics vs F
  - Automatic set classification
  - **BET DOM**

Little is known on BET preferred habitat in the EPO.

Figure 1. Closure area

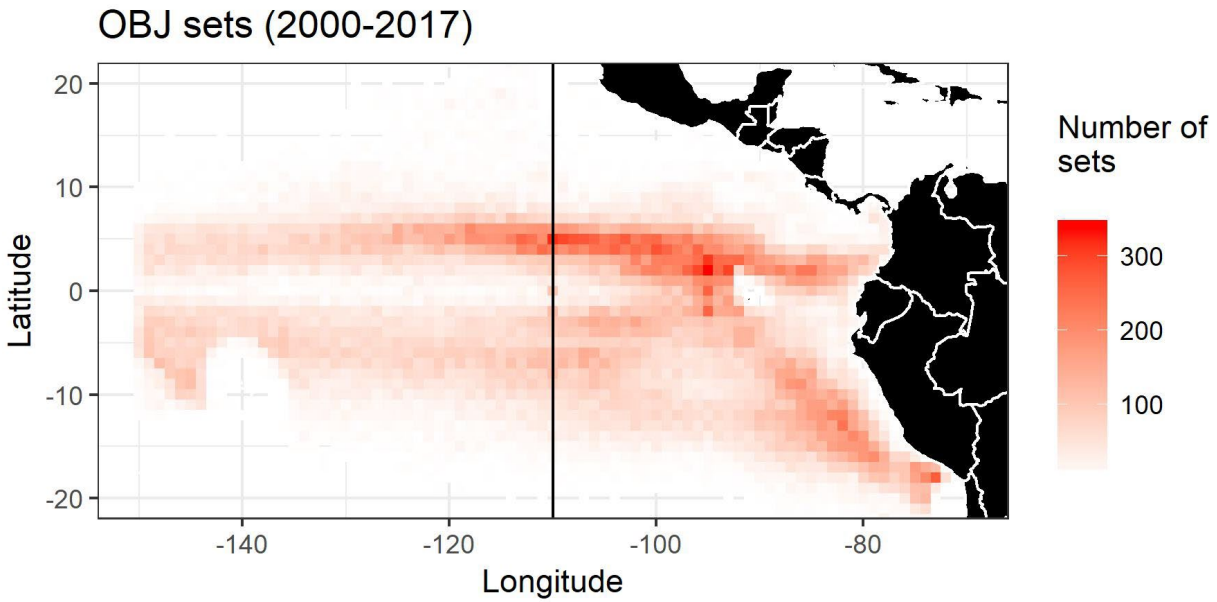
Data and methods

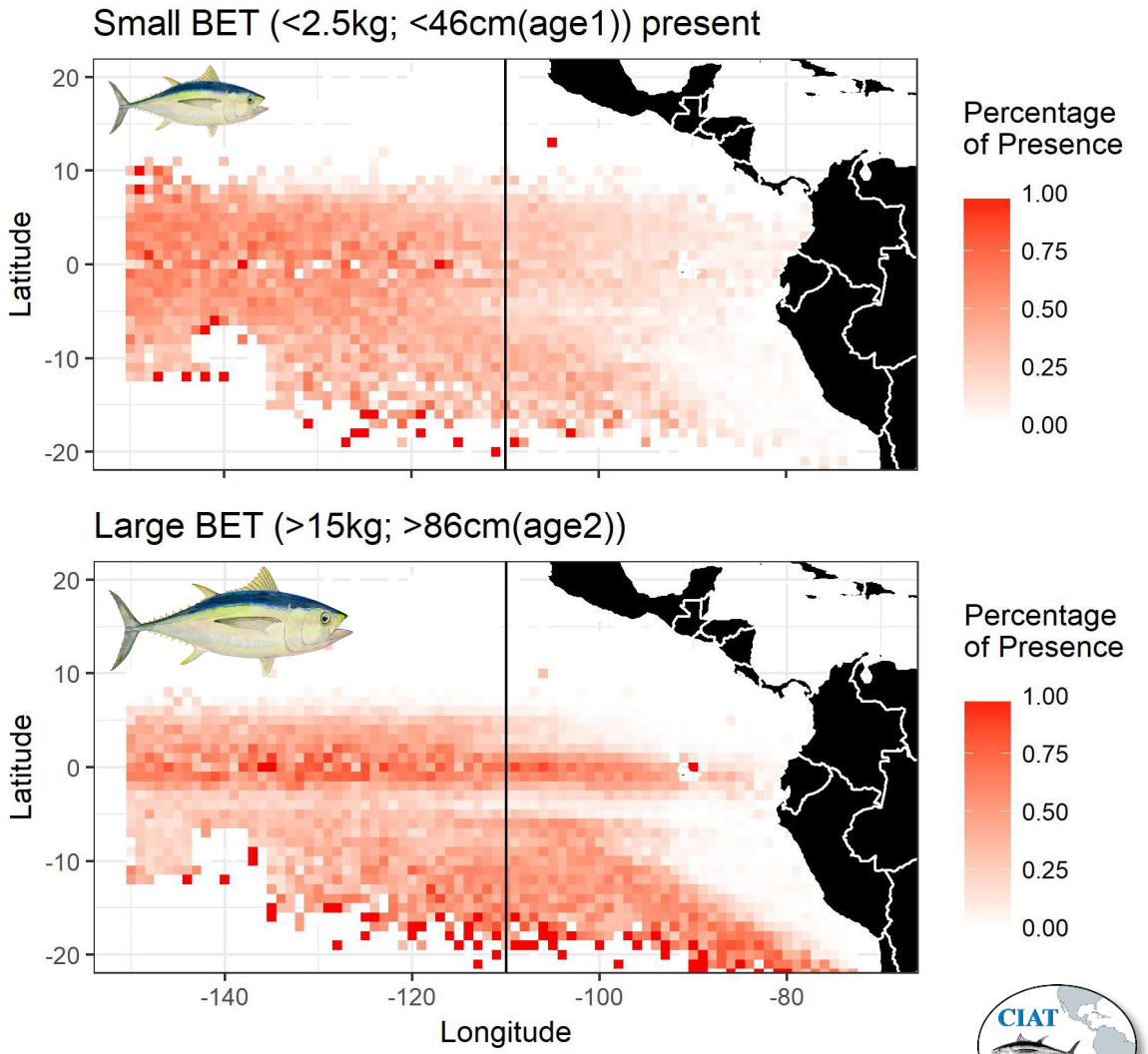
FISHERIES DEPENDENT DATA

Purse seine observer data (1995-2017)

~450,000 fishing sets

~150,000 FOB sets (~50% positives)

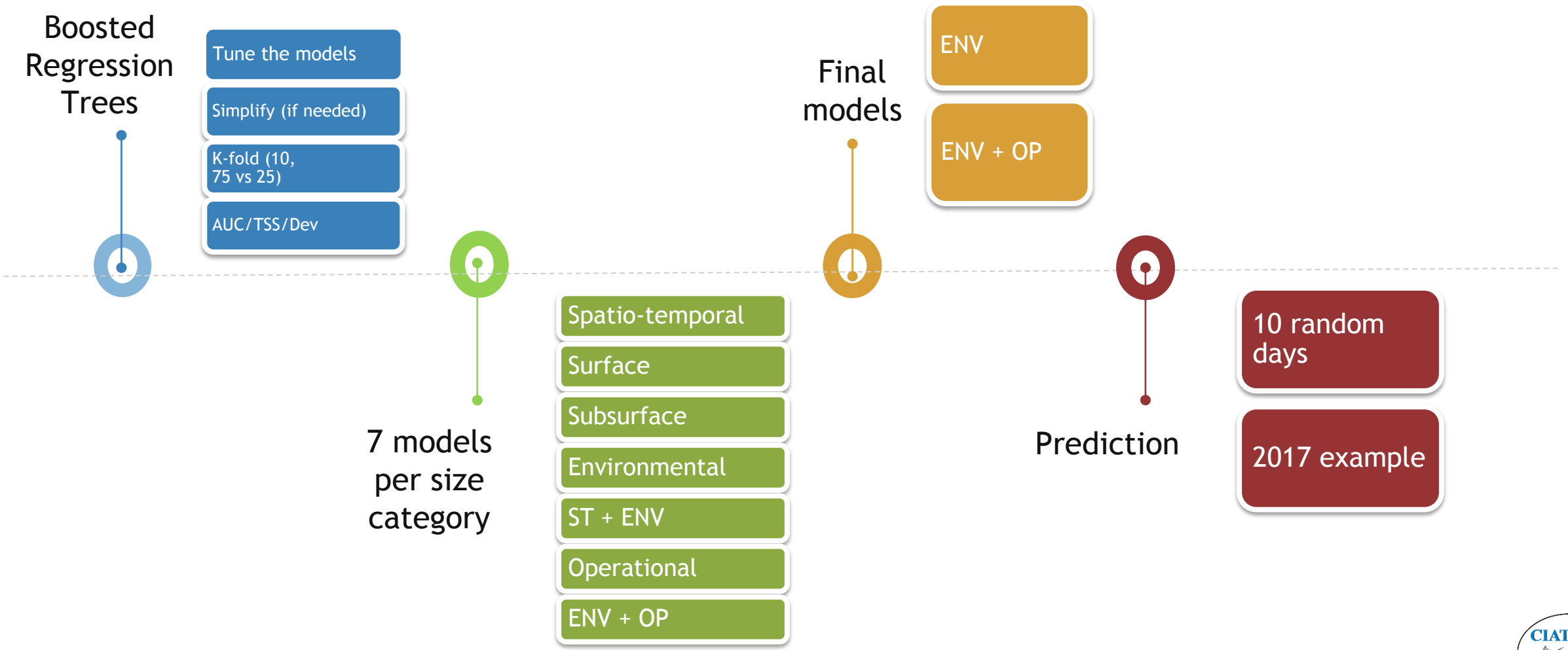




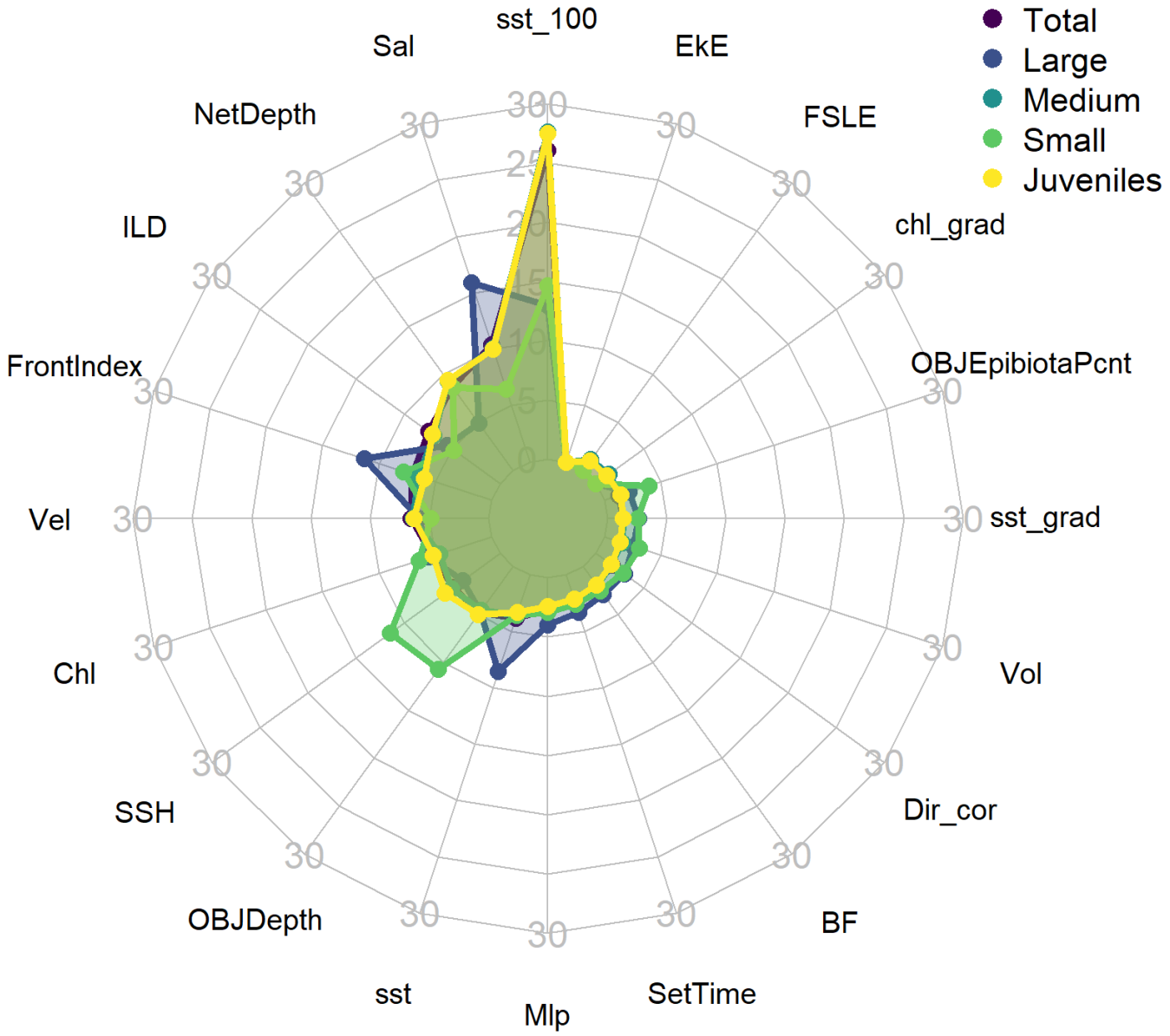
Data and methods - Variables

Spatio-temporal	Surface						Subsurface			Operational		
	Abiotic	Sp. Res	T. Res	Biotic	Sp. Res	T. Res		Sp. Res	T. Res		Sp. Res	T. Res
Latitude	SST	1/4	D	CHL	1/4	W	Temp 100m	1/4	D	Net Depth	set by set	
Longitude	Δ SST	1/4	D	Δ CHL	1/4	W	ILD	1/4	D	OBJ Depth	set by set	
Day of the year	Salinity	1/4	D	Oxygen	1/4	W	BF	1/4	D	Set time	set by set	
	SSH	1/4	D				MLD	1/4	D	OBJ epibio	set by set	
	VOL	1/4	D									
	Speed	1/4	D									
	Heading	1/4	D									
	EkE	1/4	D									
	FSLE	1/25	D									
	Front index	1/4	W									

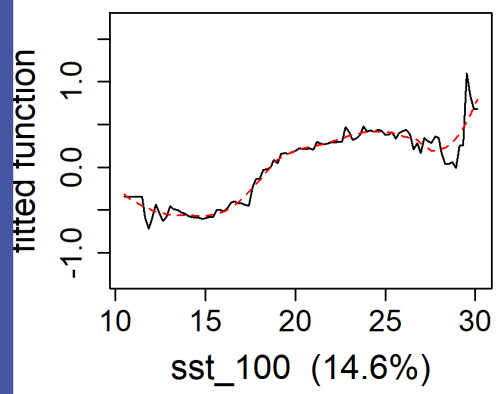
Data and methods – Statistical modelling

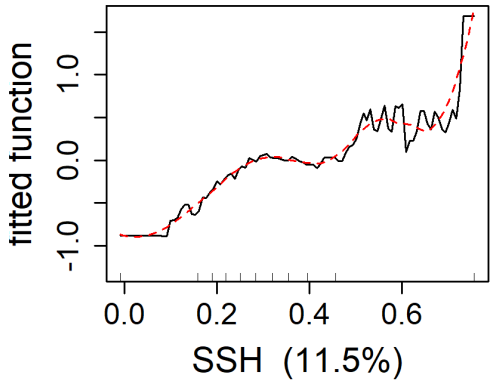


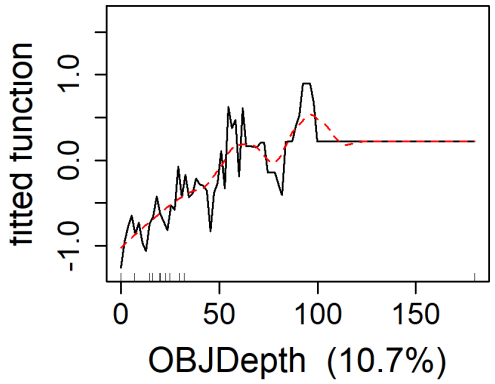
Results – Variable Importance by size category

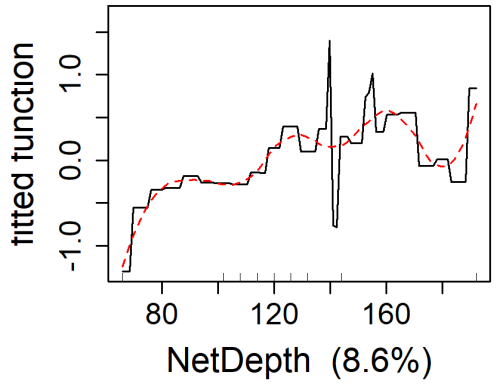


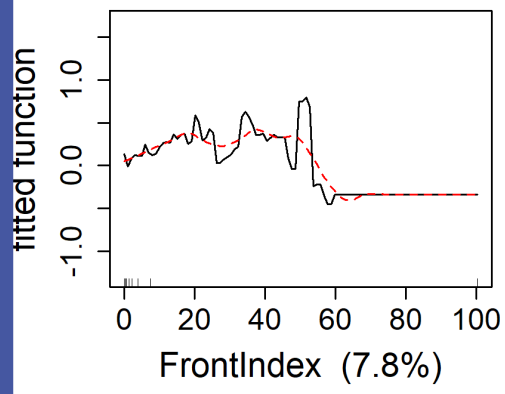
Results – Partial dependence plots – SMALL BET

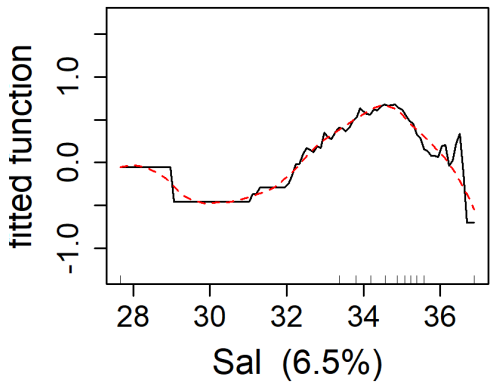


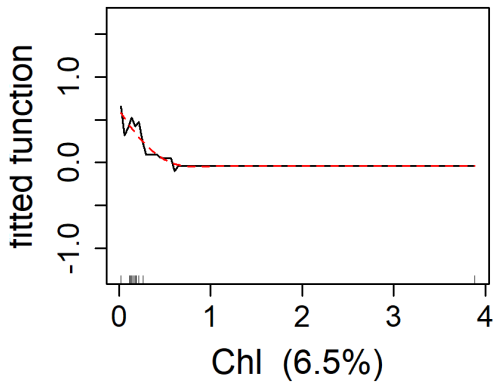




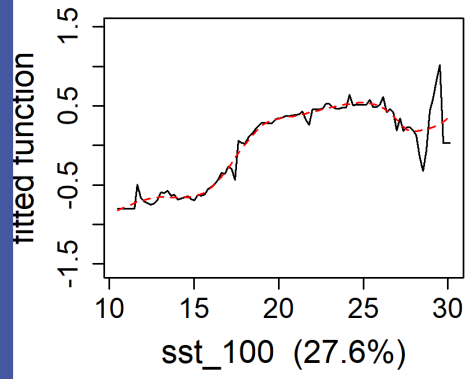


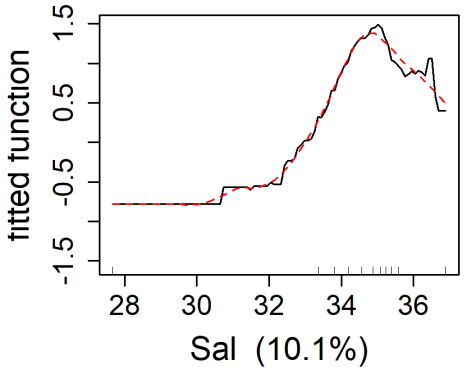


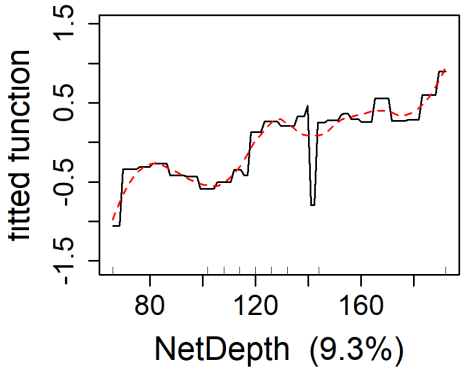


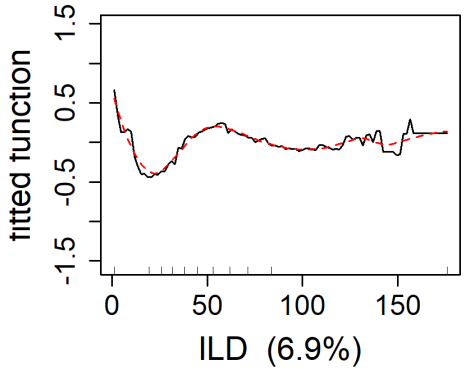


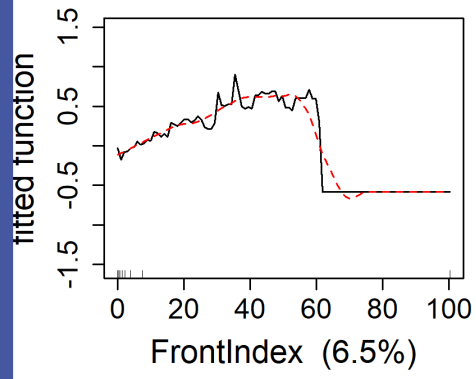
Results – Partial dependence plots – MEDIUM BET

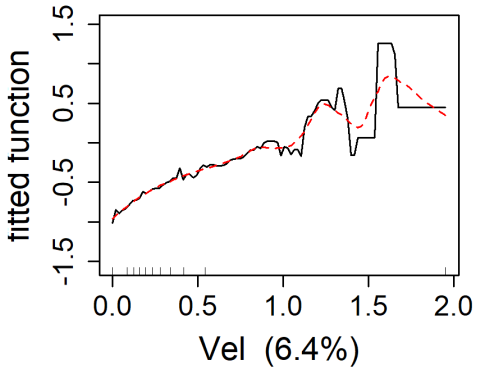


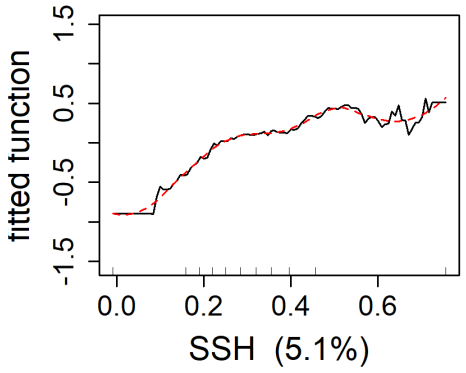




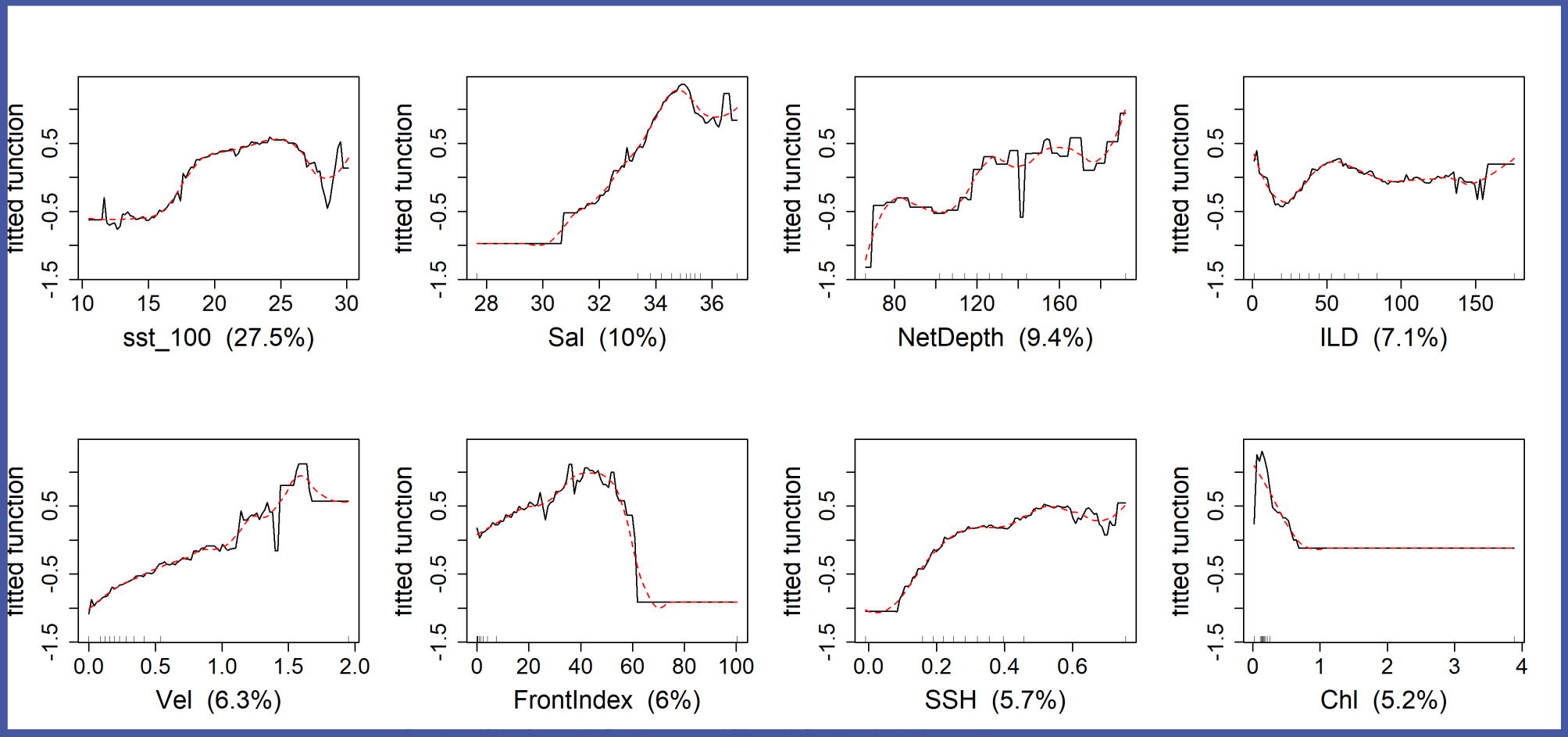




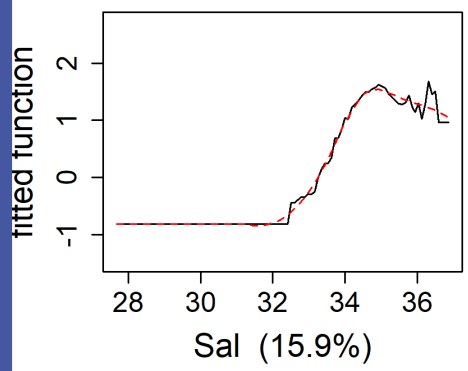


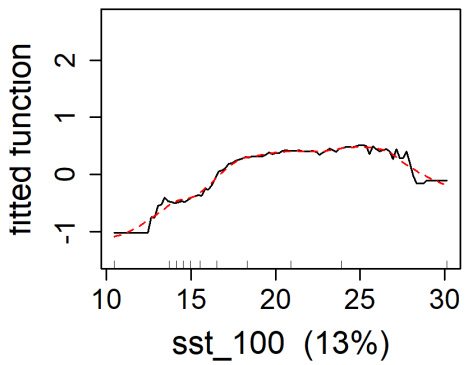


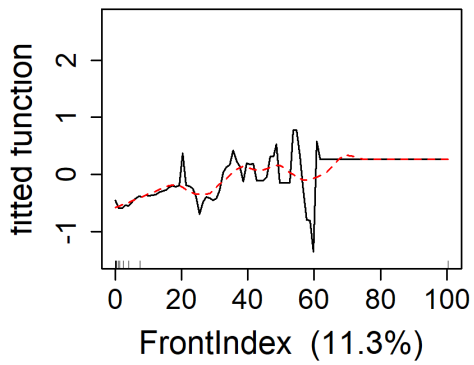
Results – Partial dependence plots – JUVENILE BET

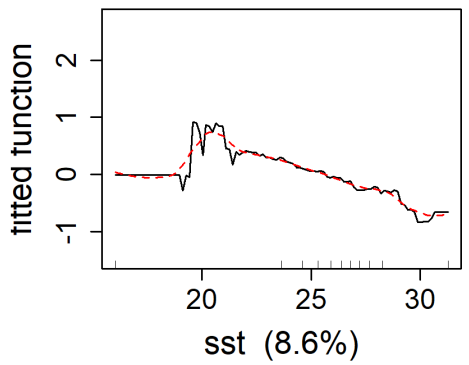


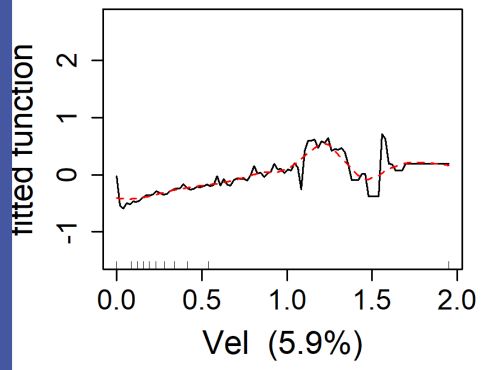
Results – Partial dependence plots – LARGE BET

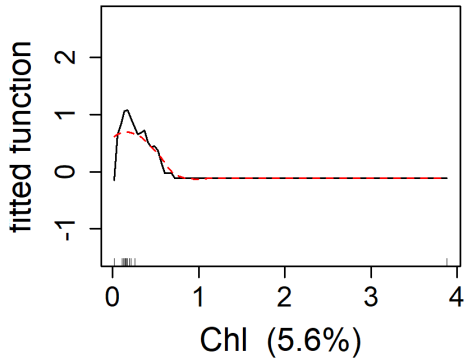


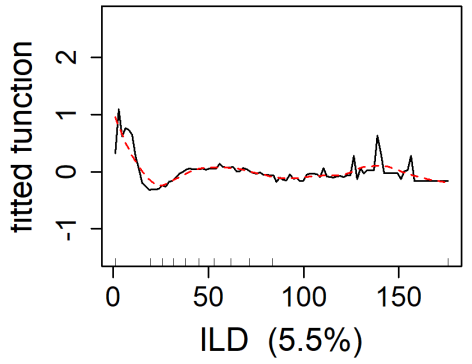




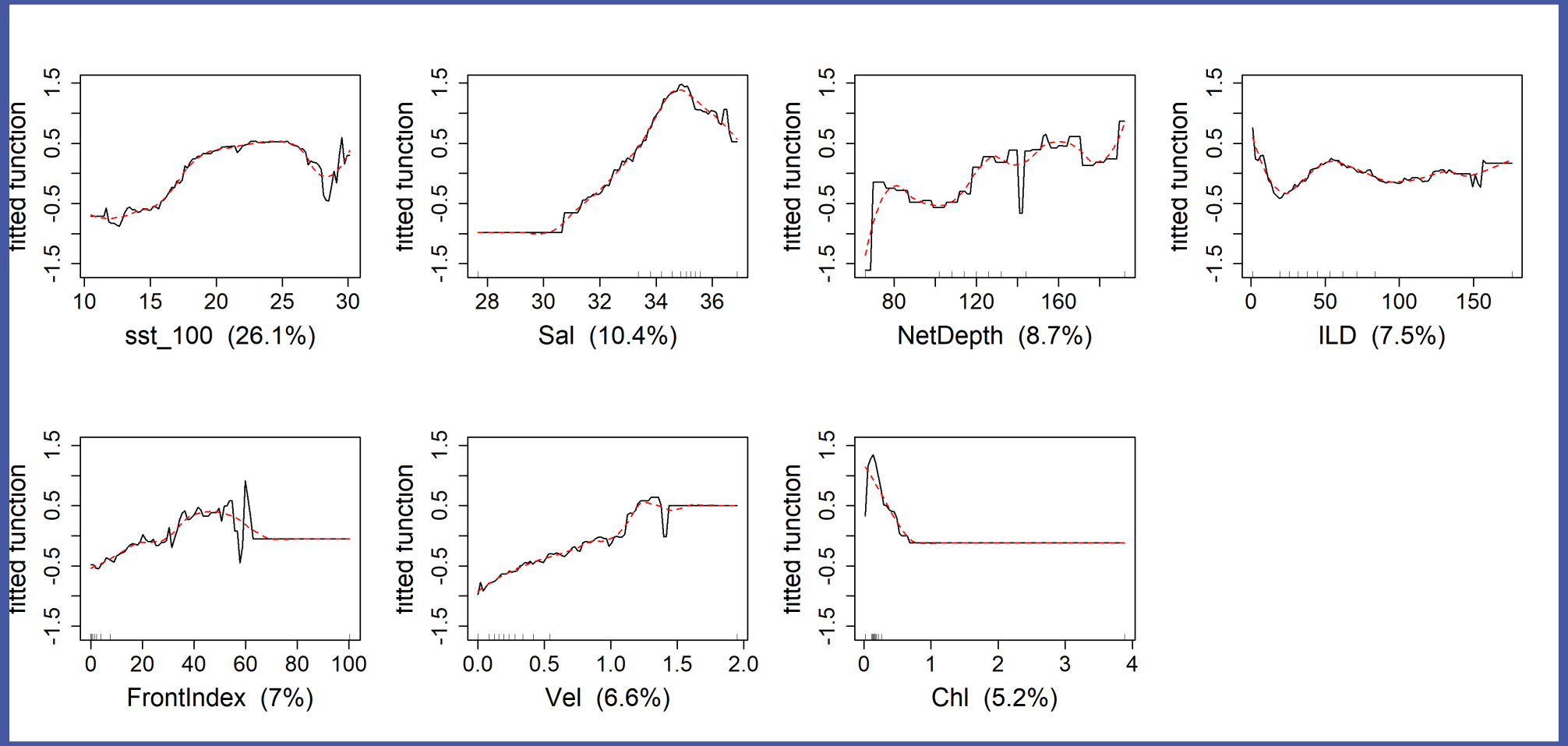






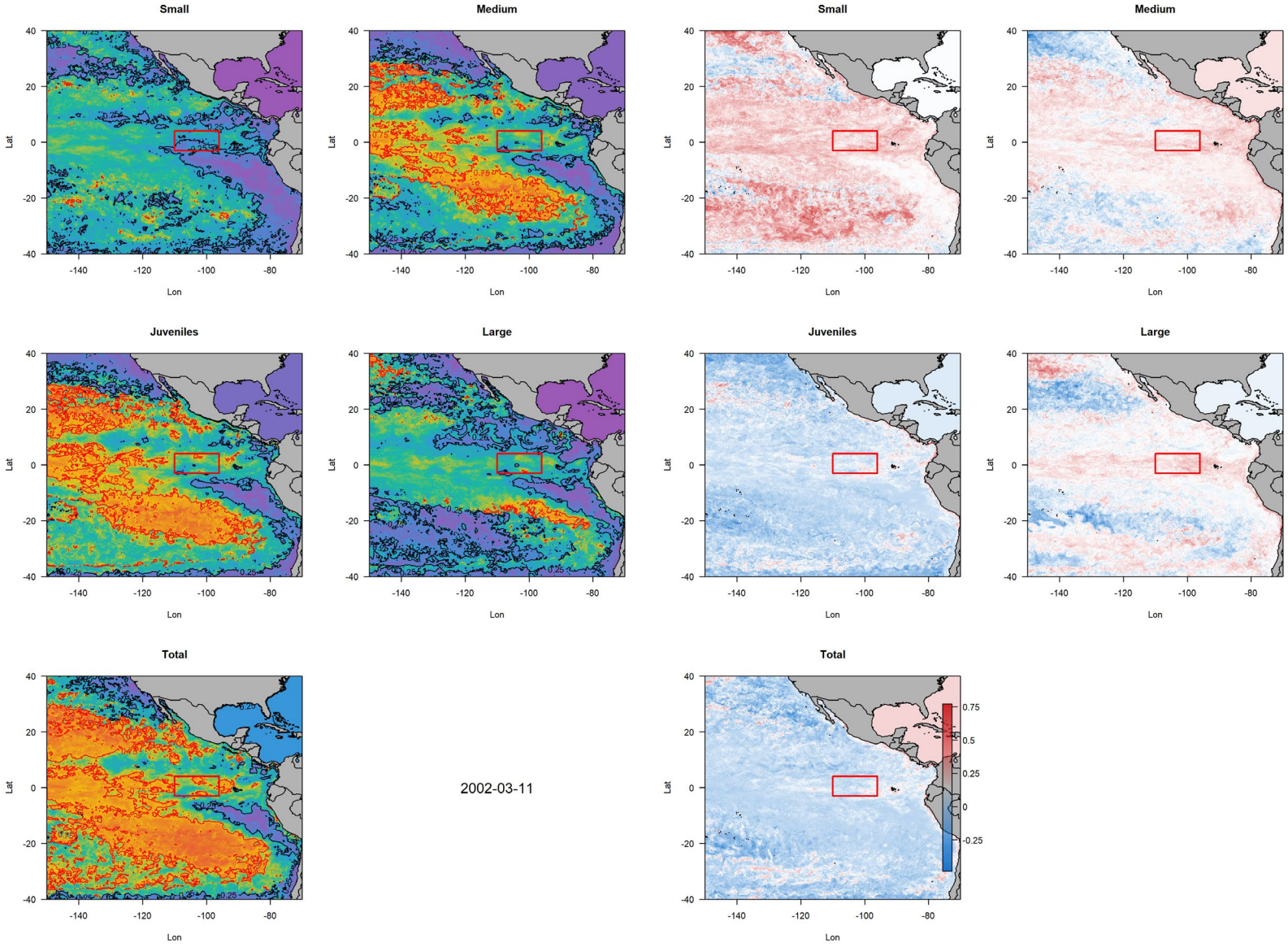


Results – Partial dependence plots – TOTAL BET

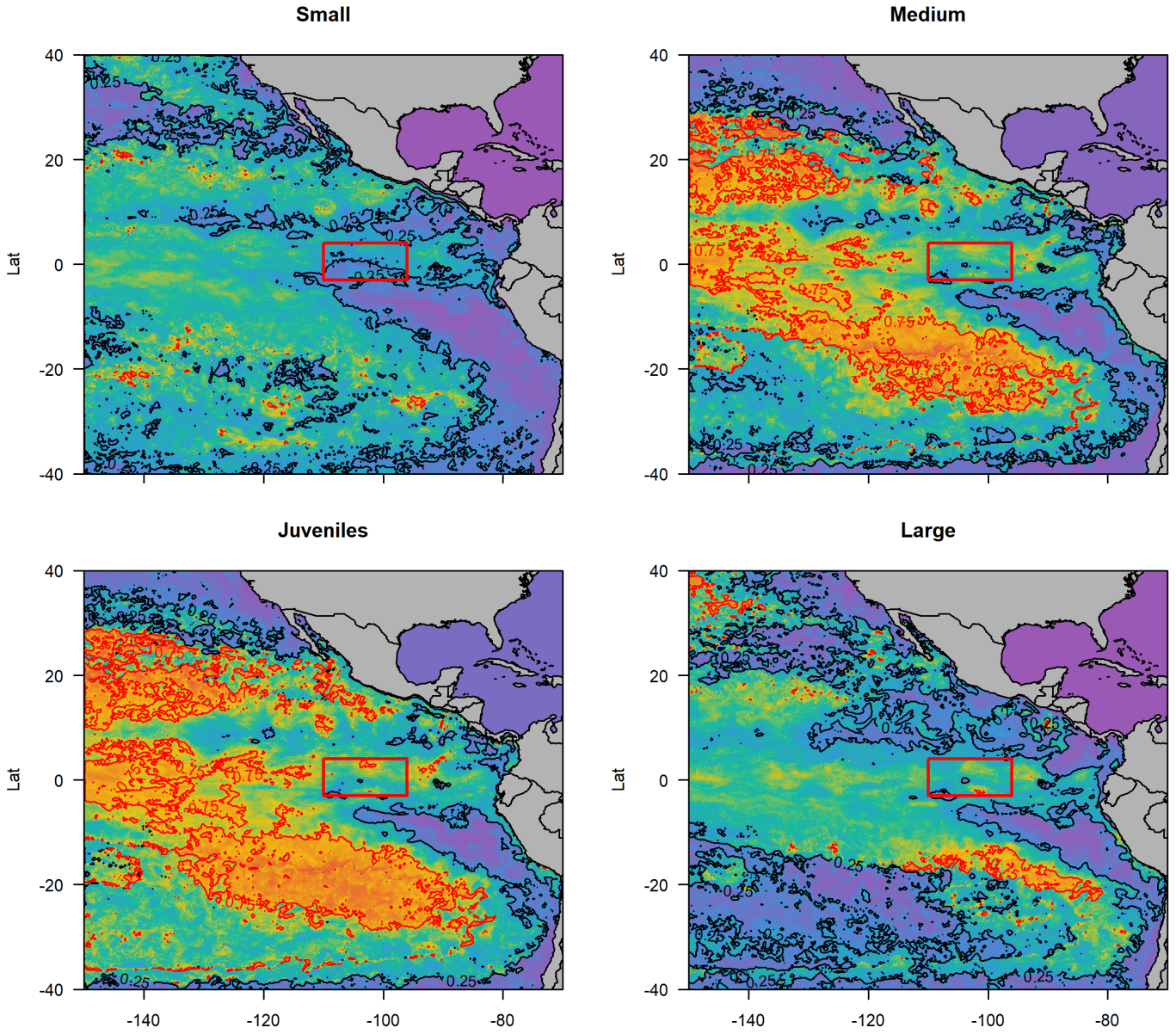


OBJEpibiotaPcnt (1.3%) chl_grad (1.2%) FSLE (1.1%)

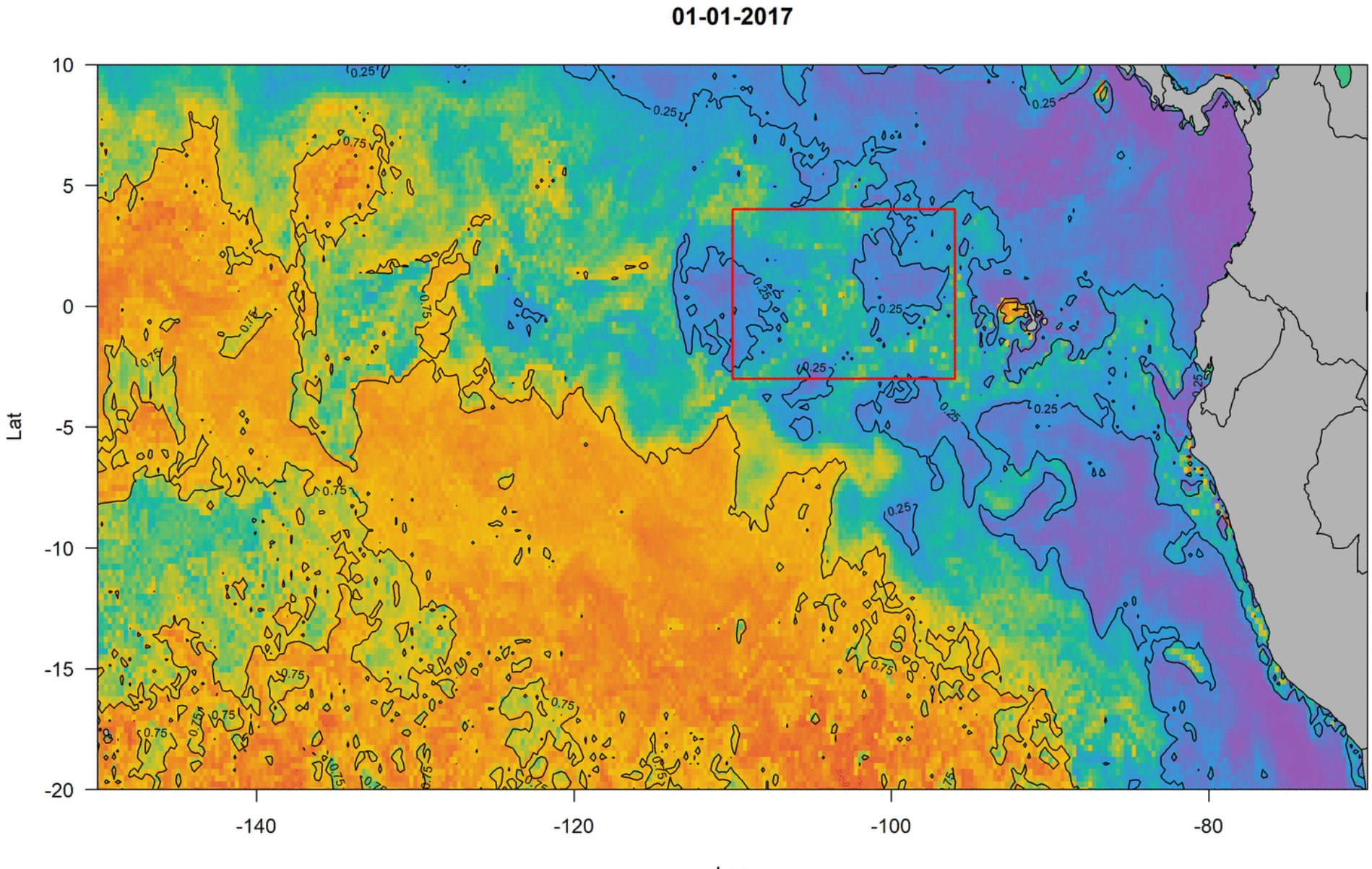
Results – Predictions by size category



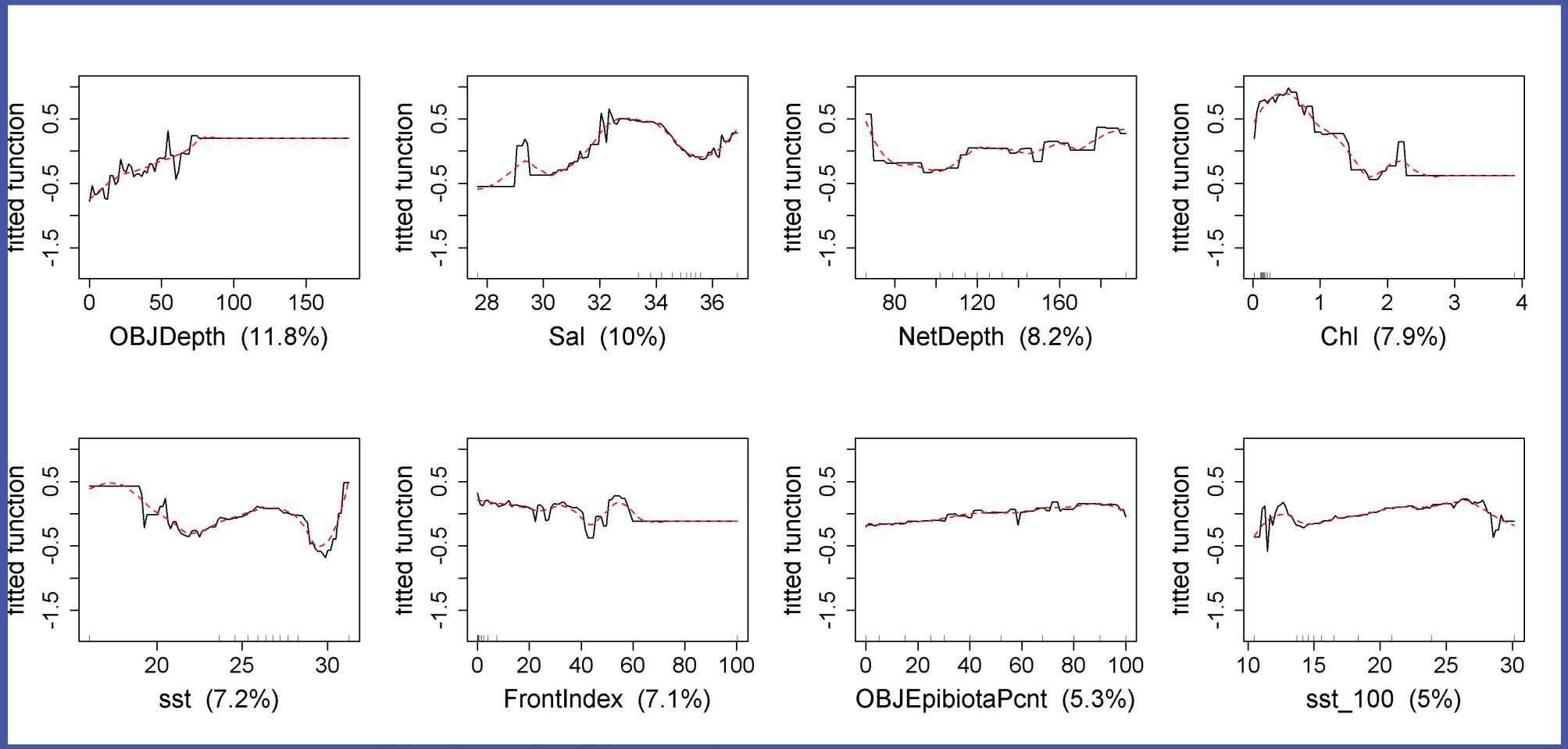
Results – Predictions by size category



Results – Seasonality



Results – Partial dependence plots – Juvenile YFT



SetTime (3.2%) Vol (3.2%)

Conclusions

- We present the basis to develop a **dynamic ocean management** tool for BET in the EPO.
- Next step would be to **make the tool operational**.
- Ideally similar models should be established for **SKJ and YFT** and weight outputs based on users preference-needs.
- **Different possibilities** exist:
  - Provide maps to the fleet in **near real time** to make fishery more selective, both catch-restricted or unrestricted.
  - **Adaptive closures** (e.g. weekly, monthly, seasonal)
- **OBJ depth and Net Depth** may have implications on juvenile BET and YFT catch rates. However, hard to extract definitive conclusions for management due to spatial correlation particularly for Net depth and OBJ epibiota (e.g. deeper nets are used in the western area).

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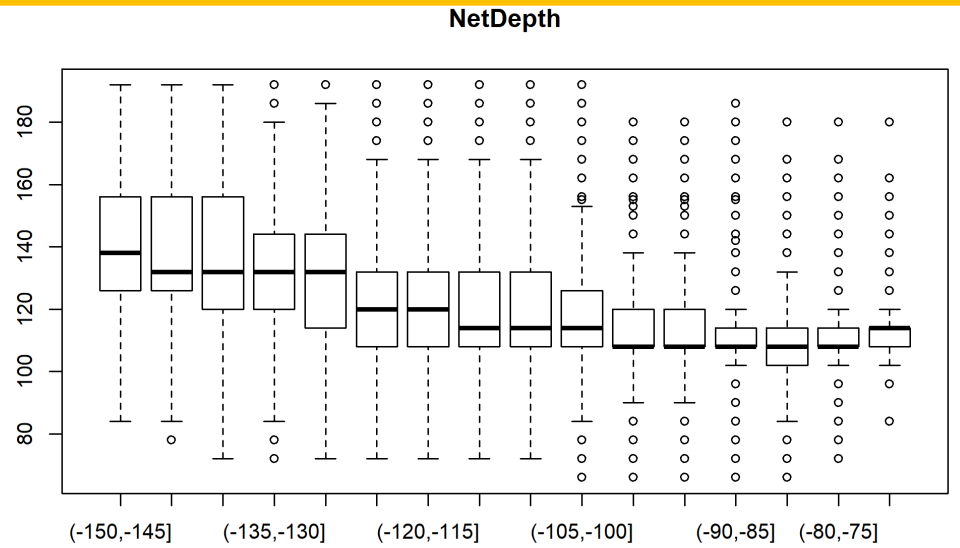
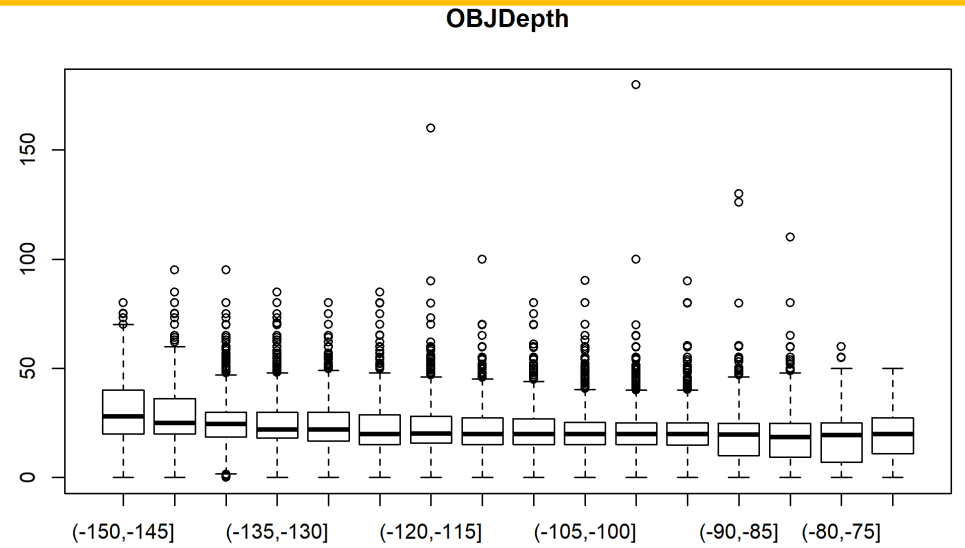
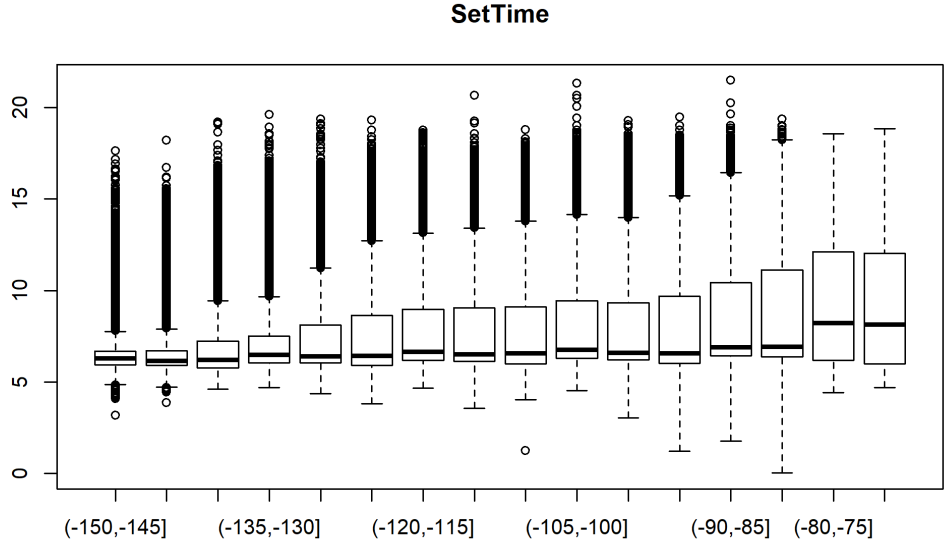
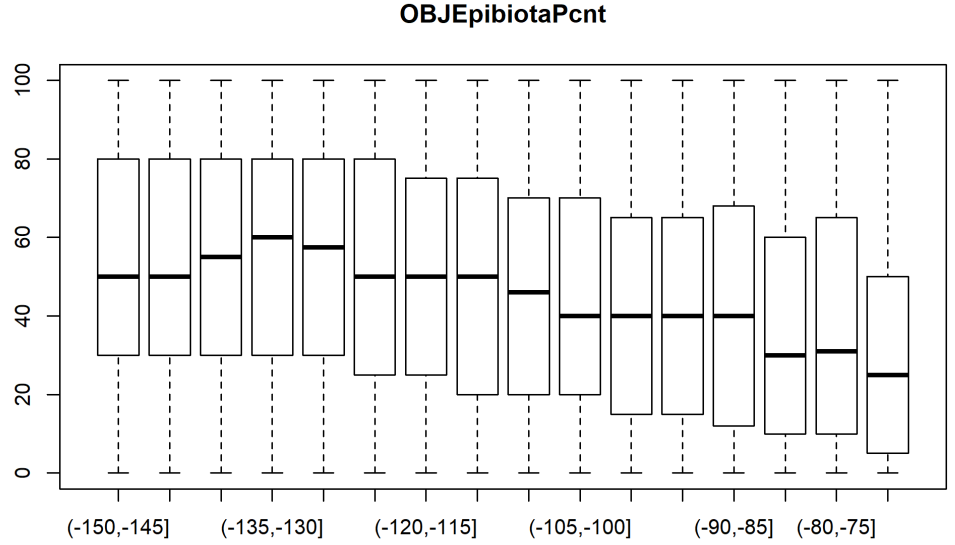
Questions

Operational vs Longitude