Distribution of Short-tailed Shearwaters in the northern North pacific: a comparison between geolocator-based tracking of individuals and boat-based surveys

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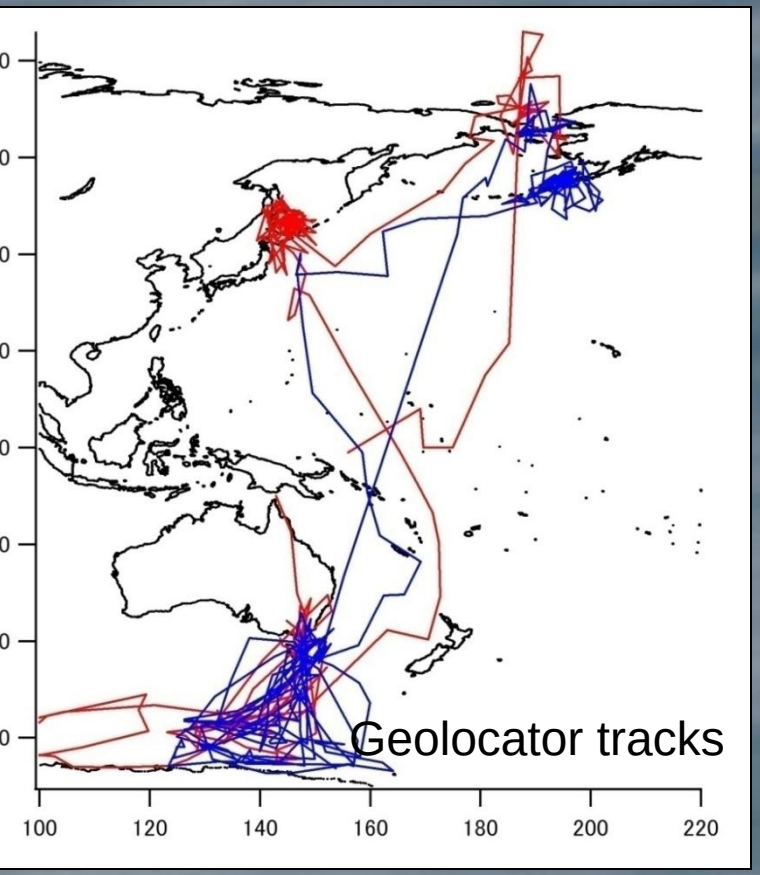
Characteristics of the data from tracking and boat survey for studies of distribution

	TRACK	BOAT
Colony/Sex/BirdID	Limited, known	Not limited (random?), unknown
Sampling range/season	Not limited or birds decide	Limited or we decide
0-bird cell	No 0-bird cell Or choose 0-bird range	Many 0-bird cell
Distance from the colony	Yes	Yes Use deviation

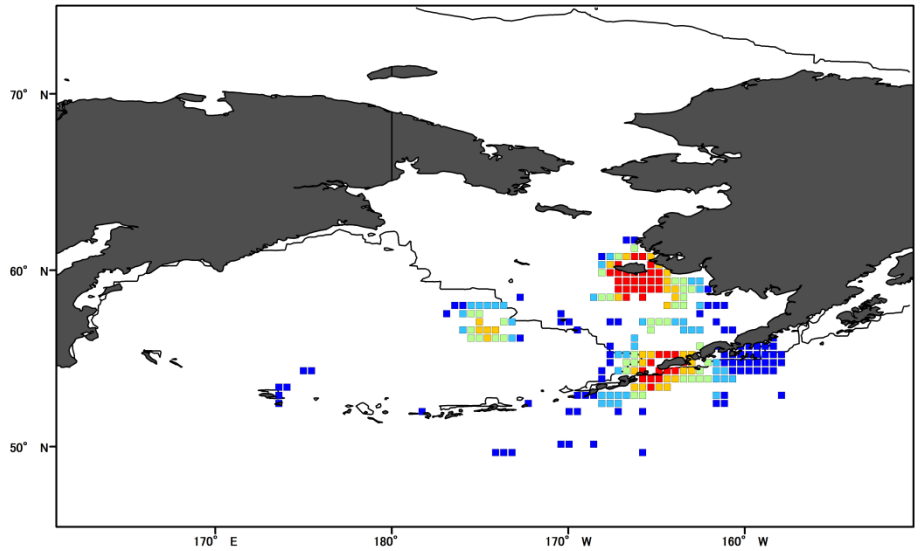


Geolocator tracks

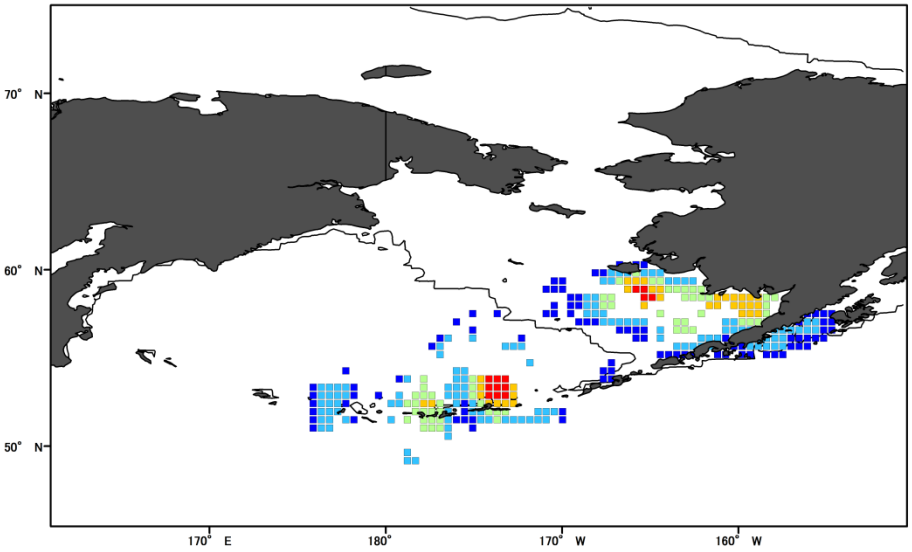
B. Nishizawa

July 50x50km

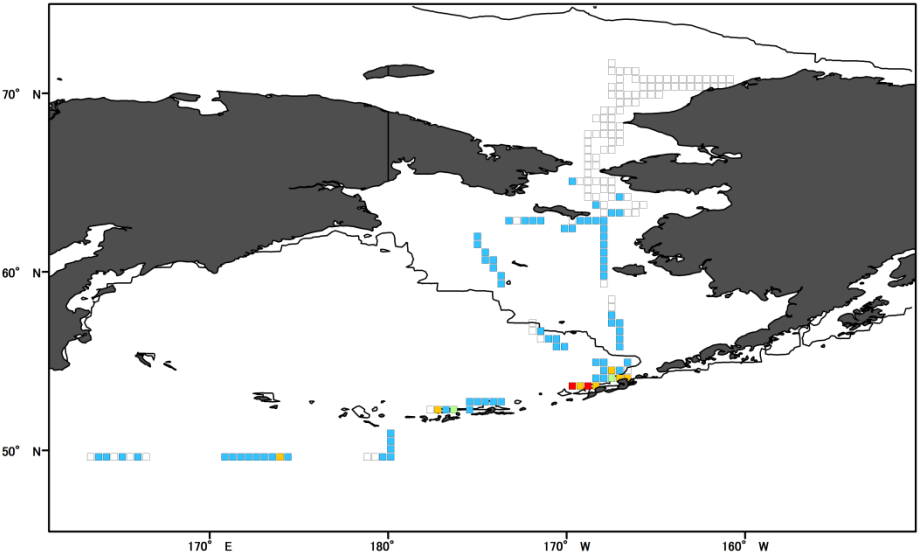
TRACK 2010 (Kernel density)



TRACK 2011 (kernel density)

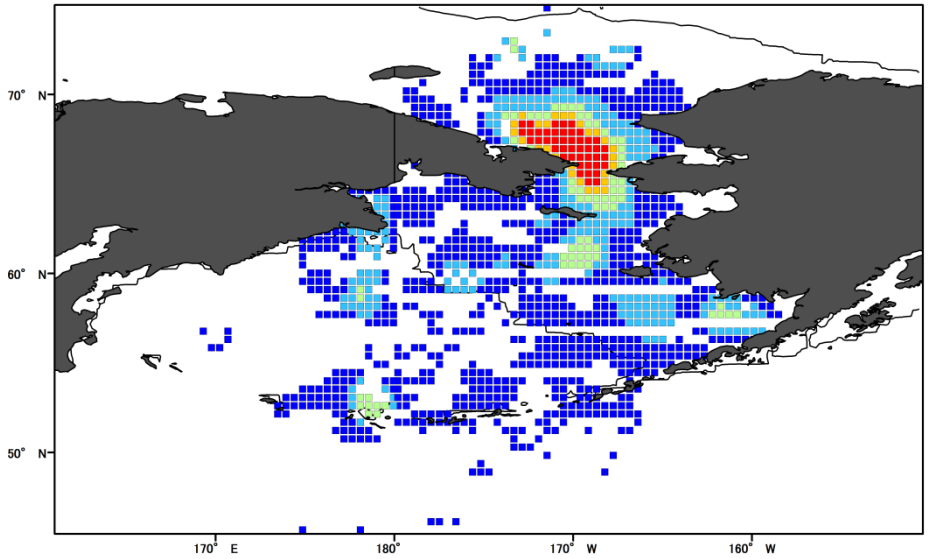


BOAT 2013 (Oshoro) (density)

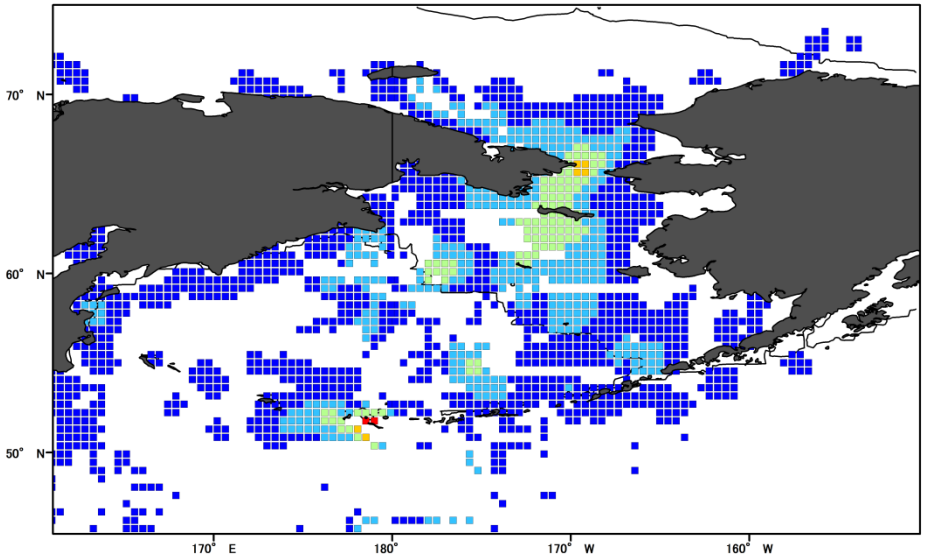


Sep. 50x50km

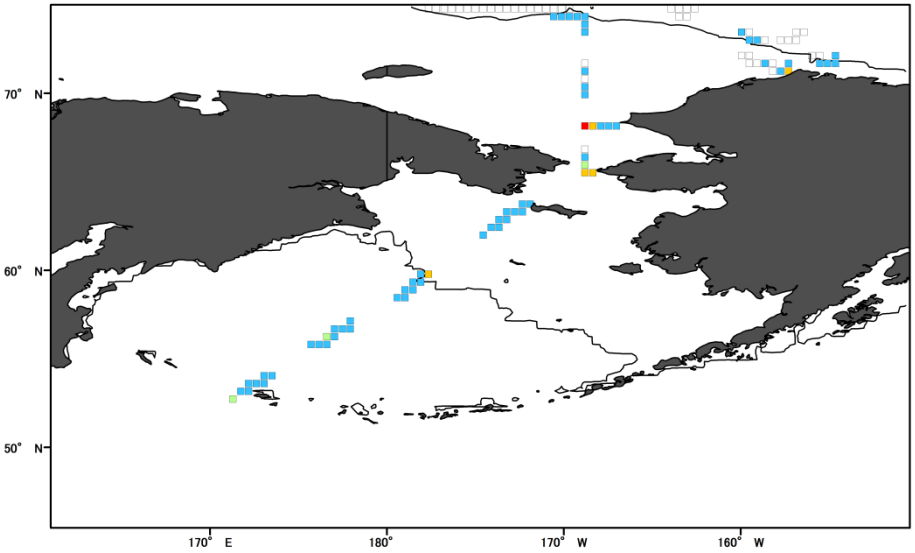
TRACK 2010 (Kernel density)



TRACK 2011 (Kernel density)



BOAT 2012 (Mirai) (density)



Does habitat models differ between the type of data?

Summary of sample size and type of dependent variables For habitat modeling

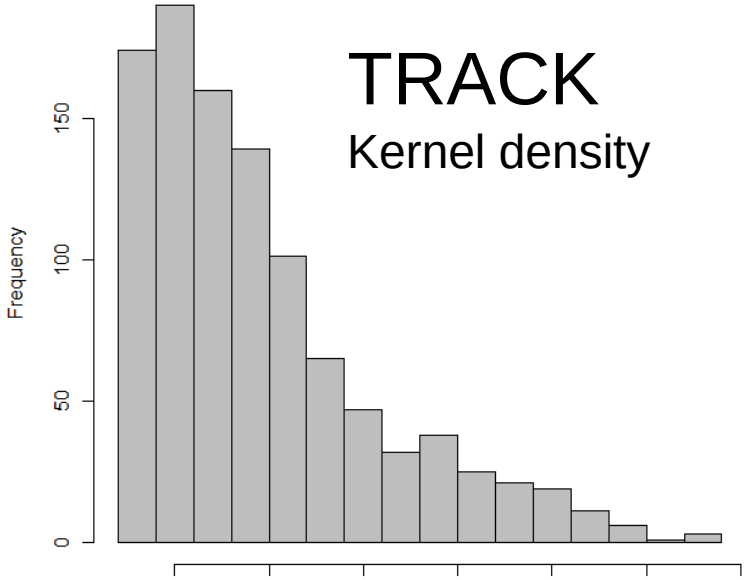
Methods	Period	Sample size	Density1	Density2
TRACK	2010 JUL	19birds x31days	Kernel density	
TRACK	2011JUL	27birds x31days	Kernel density	
TRACK	2010SEP	19birds x30days	Kernel density	
TRACK	2011SEP	27birds x30days	Kernel density	
BOAT(Oshoro)	2013JUL	16280birds	Density Exclude 0	0/1
BOAT(Mirai)	2012SEP	18135birds	Density Exclude 0	0/1

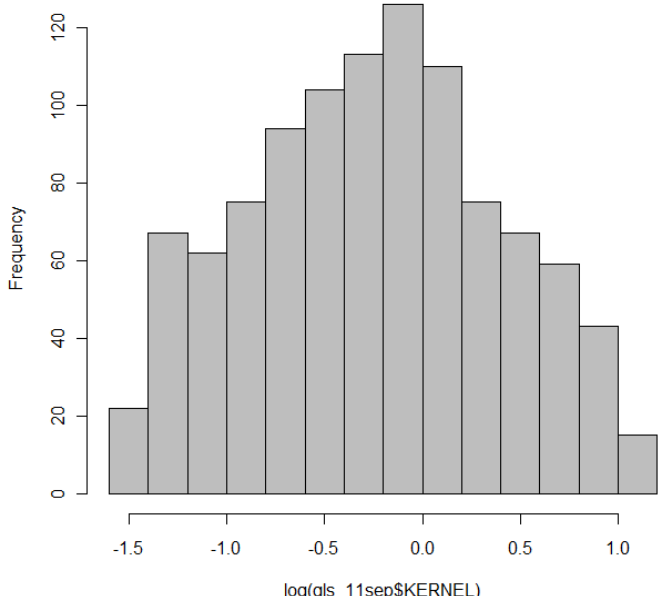
Distribution of bird's density
The number of 50x50km cells

Log transformed distribution

TRACK

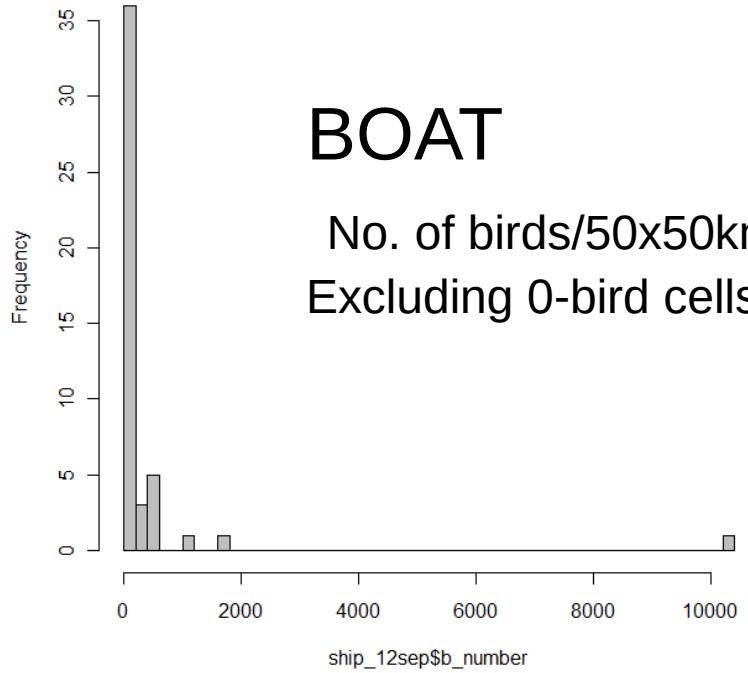
Kernel density

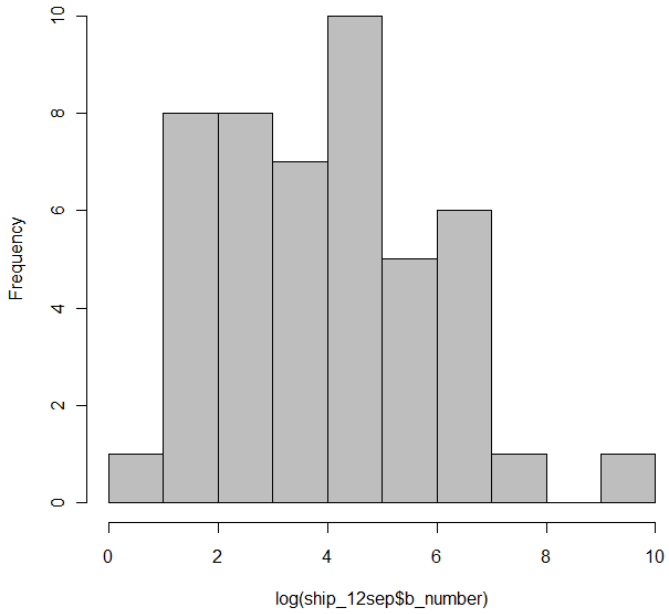




BOAT

No. of birds/50x50km
Excluding 0-bird cells

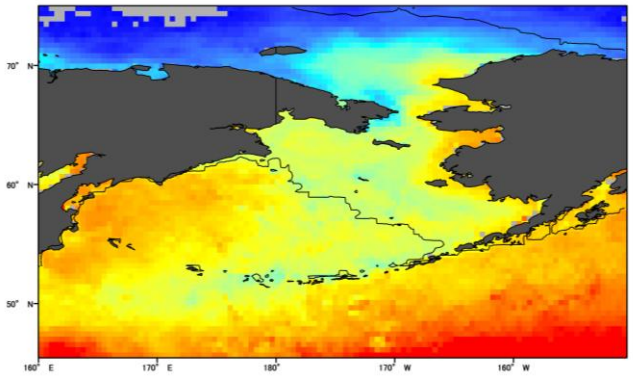




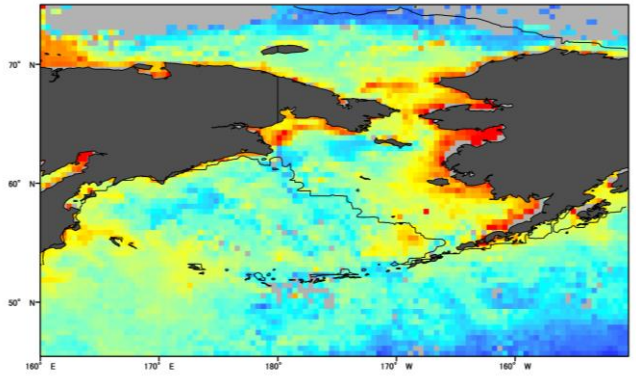
Habitat Modeling: Explanatory variables

50 x 50 km cell

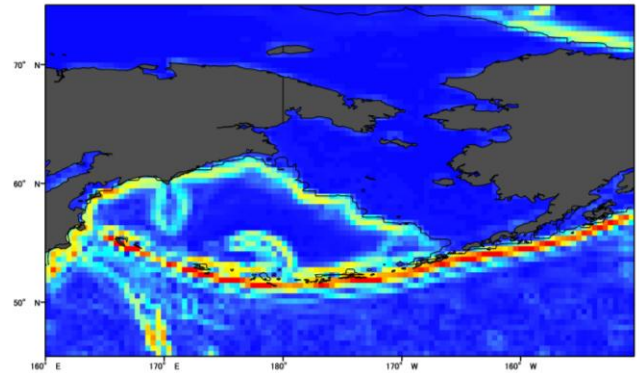
Monthly



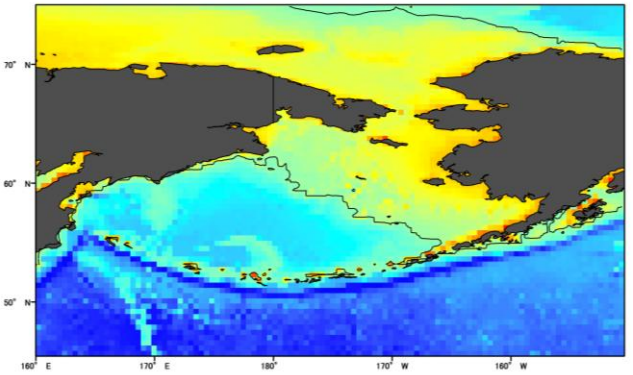
SST (^{o}C)



Chla (mg m^{-3})



Bottom slope (degree)



Depth (m)

All VIF were < 3, indicating little collinearity (Zuur et al. 2009)

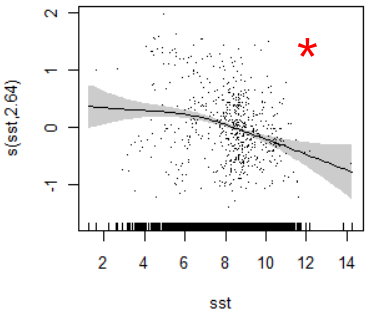
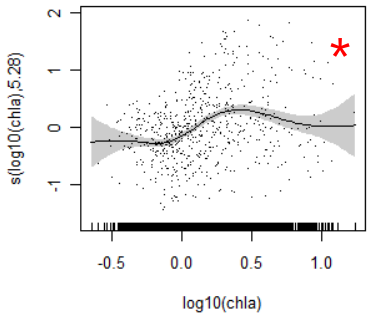
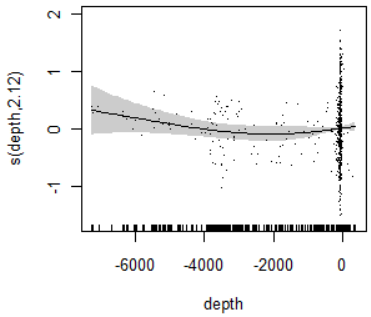
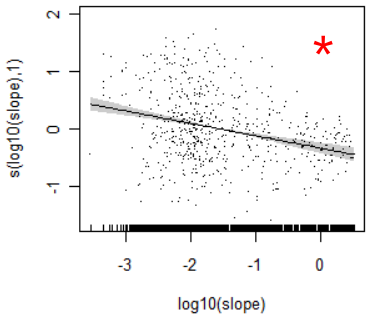
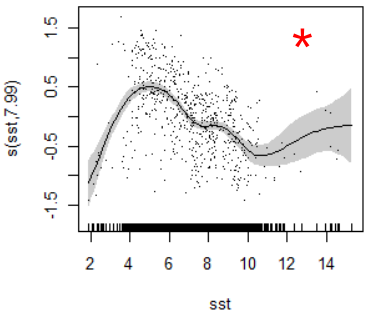
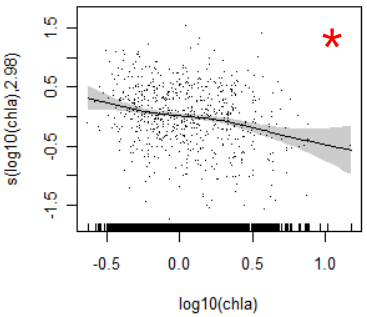
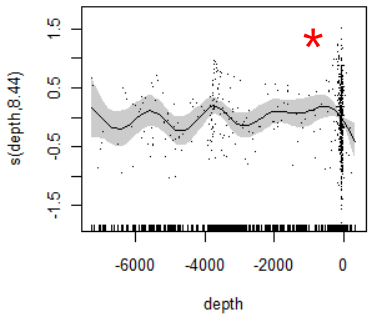
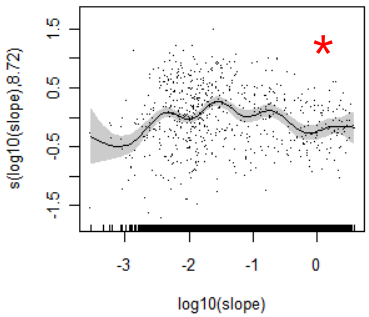
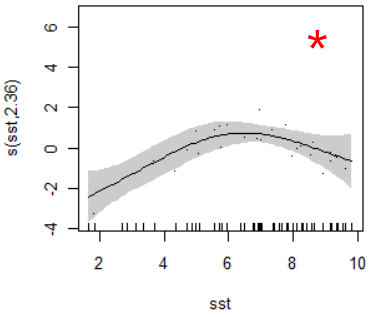
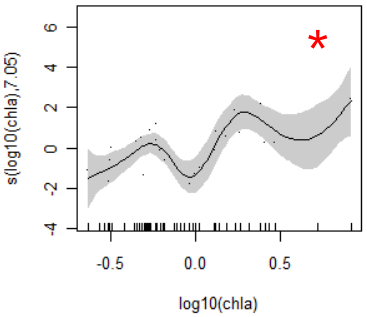
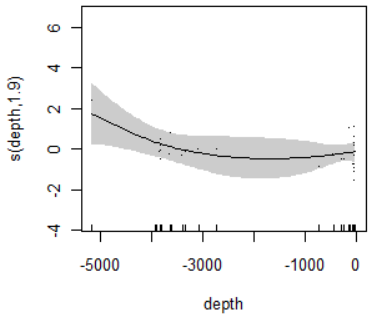
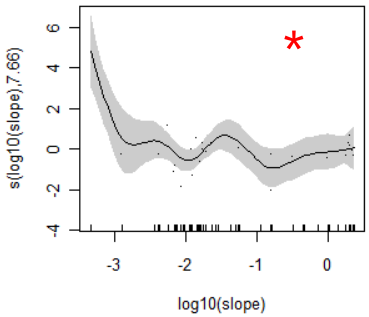
Variable	Jul. 2010	Sep. 2010	Jul. 2011	Sep. 2011	Sep. 2012	Jul. 2013
SST	1.82	1.39	1.30	1.70	2.59	1.56
Chla	1.54	1.34	1.43	1.32	1.05	1.21
Depth	2.06	1.90	1.77	2.17	2.19	1.35
Slope	2.30	1.51	1.70	1.50	1.54	2.11

Direction of the effects of the factors selected in the best model (GLM)

Methods	Period	DEP	SLOPE	SST	CHLa
TRACK	2010JUL	-*		-*	+*
TRACK	2011JUL	-*		-*	
TRACK	2010SEP		-*	-*	+*
TRACK	2011SEP	+*	-*	-*	-*
BOAT(exc.0)	2013JUL	+*	+*		
BOAT(exc.0)	2012SEP		-*	+	+*
BOAT(0/1)	2012SEP		+*	+*	-*

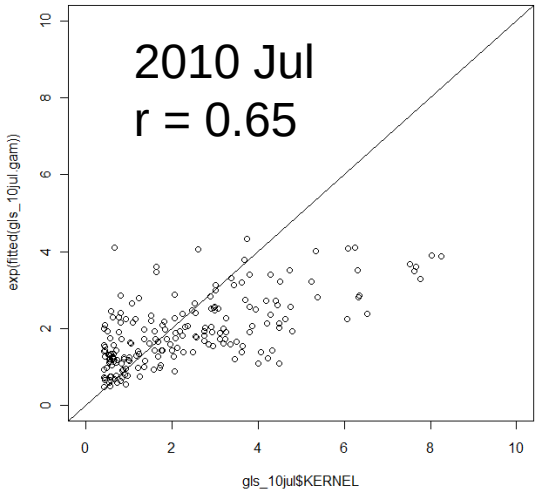
Best GAM on Sep.

* $P < 0.05$

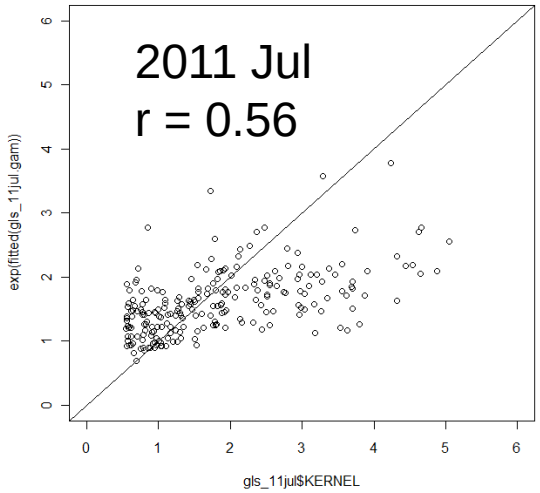
	SST	Chla	Depth	slope
TRACK 2010				
TRACK 2011				
BOAT 2012				

Fit of the models: Predicted (GAM) vs observed (r)

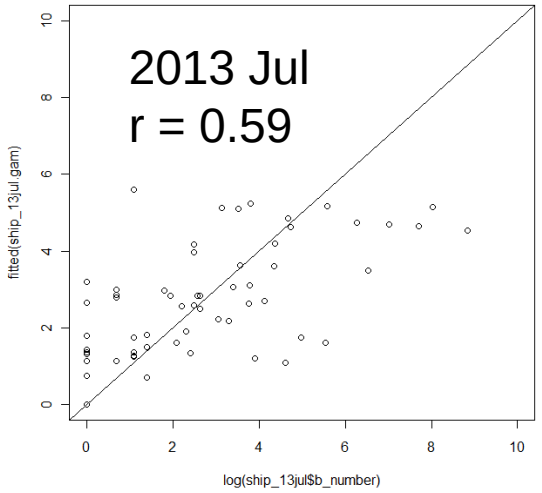
TRACK

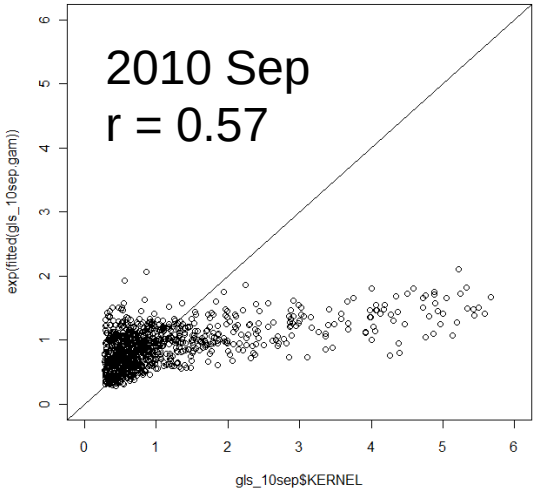


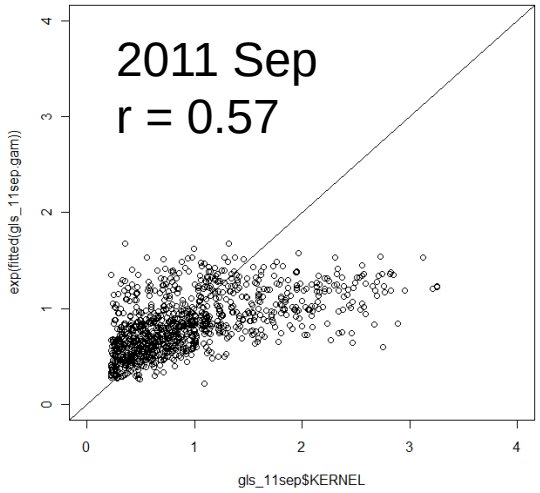
TRACK

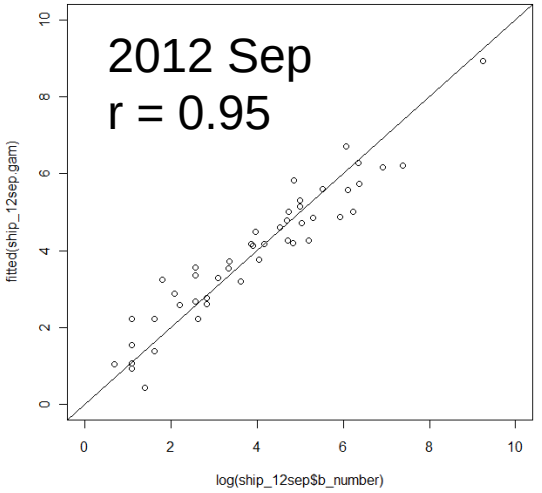


BOAT









Difficult to conclude but we learn some

- TRACK and BOAT data showed similar high-density areas at large scale and those were different between summer and autumn.
- Different habitat models were selected in July and September both for TRACK and BOAT.
- Using TRACK data, similar models were selected for the same season in the different years.
- But, for the same season, different models were selected using TRACK, BOAT (exc. 0) and BOAT (0/1).
- With GAM, fit of the models seemed to be better for the boat (exc 0-cell) than track.