



Modeling swordfish daytime vertical habitat in the North Pacific Ocean from pop-up archival tags

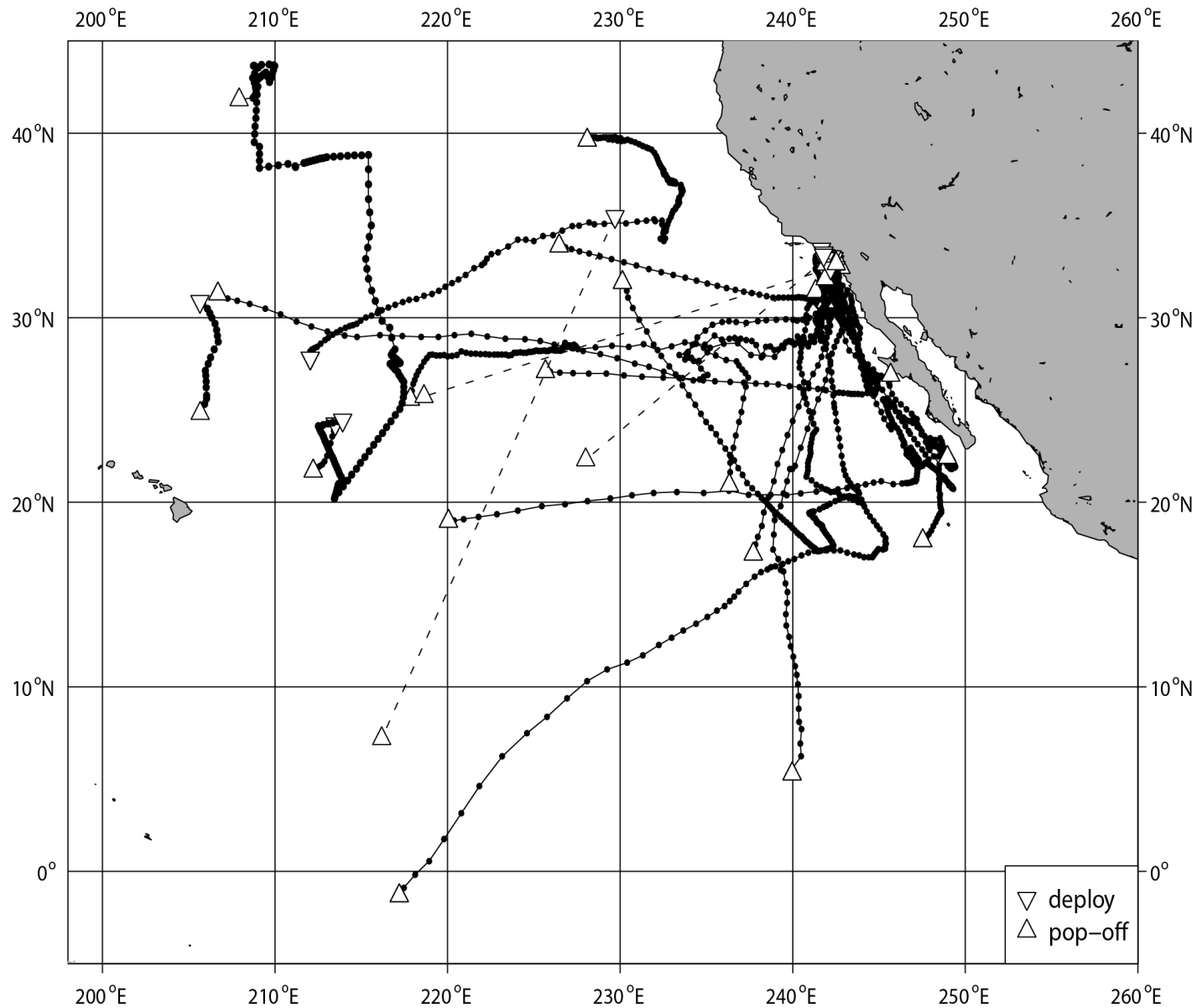
Melanie Abecassis¹,
Jeffrey Polovina², Heidi Dewar³

¹ JIMAR, University of Hawaii

² PIFSC, NOAA, Hawaii

³ SWFSC, NOAA, La Jolla

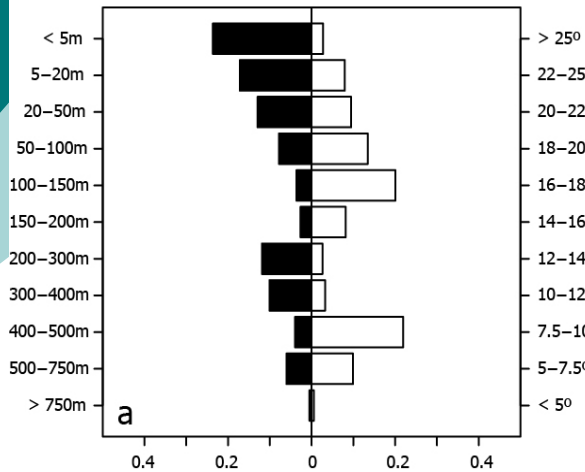
40 tags deployed
28 tags with data
5 tags recovered
23 tracks



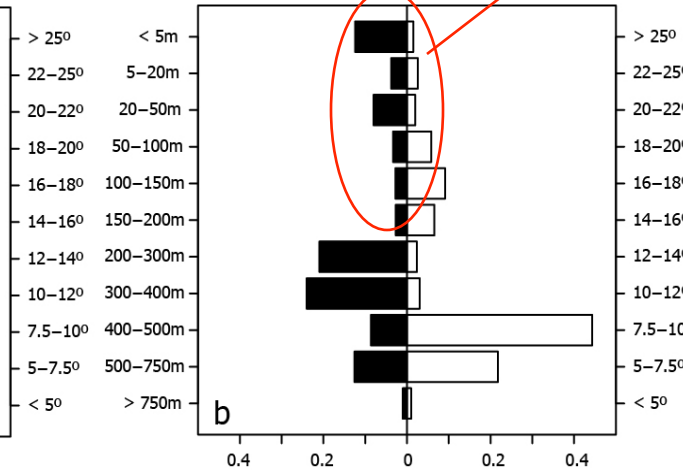
Distributions

daytime basking

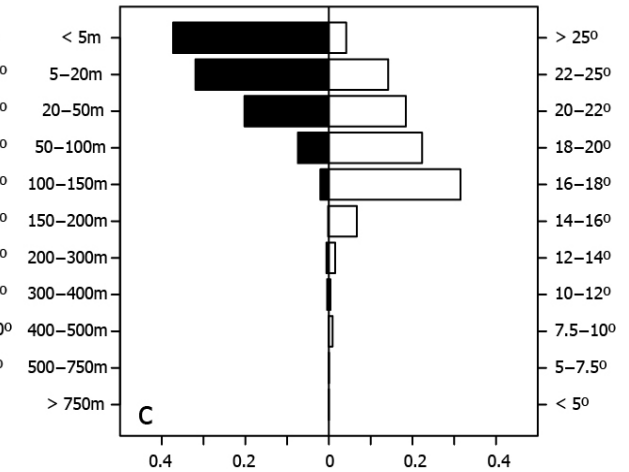
26 tags pooled together



daytime – 20 tags

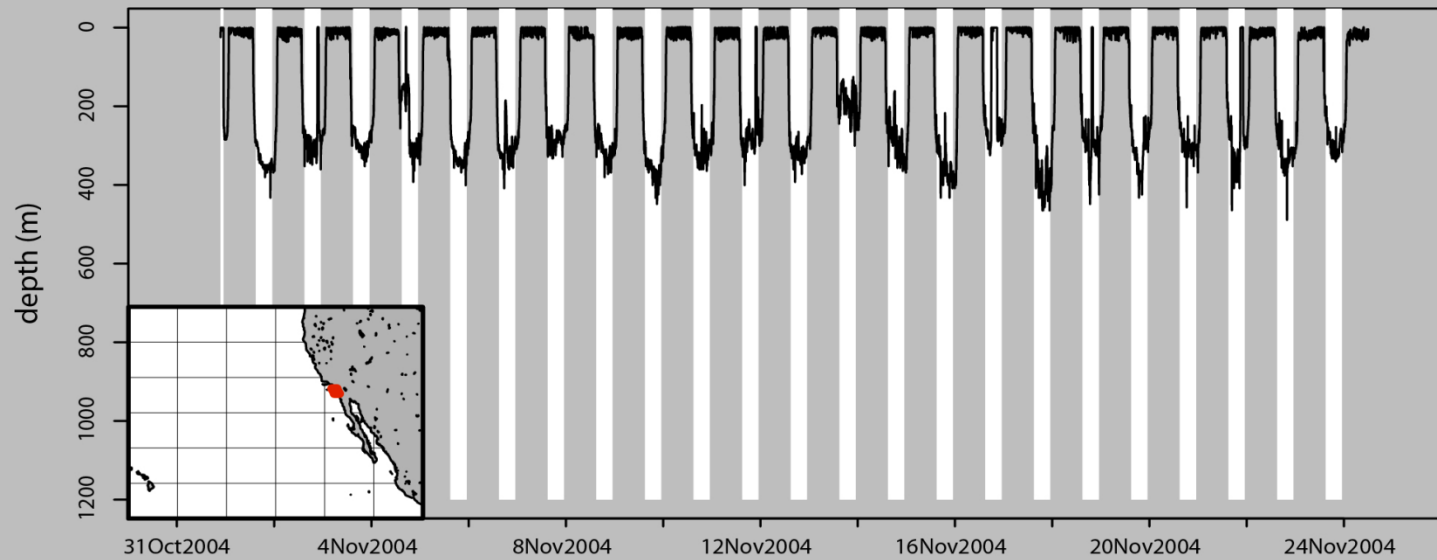


night-time – 22 tags



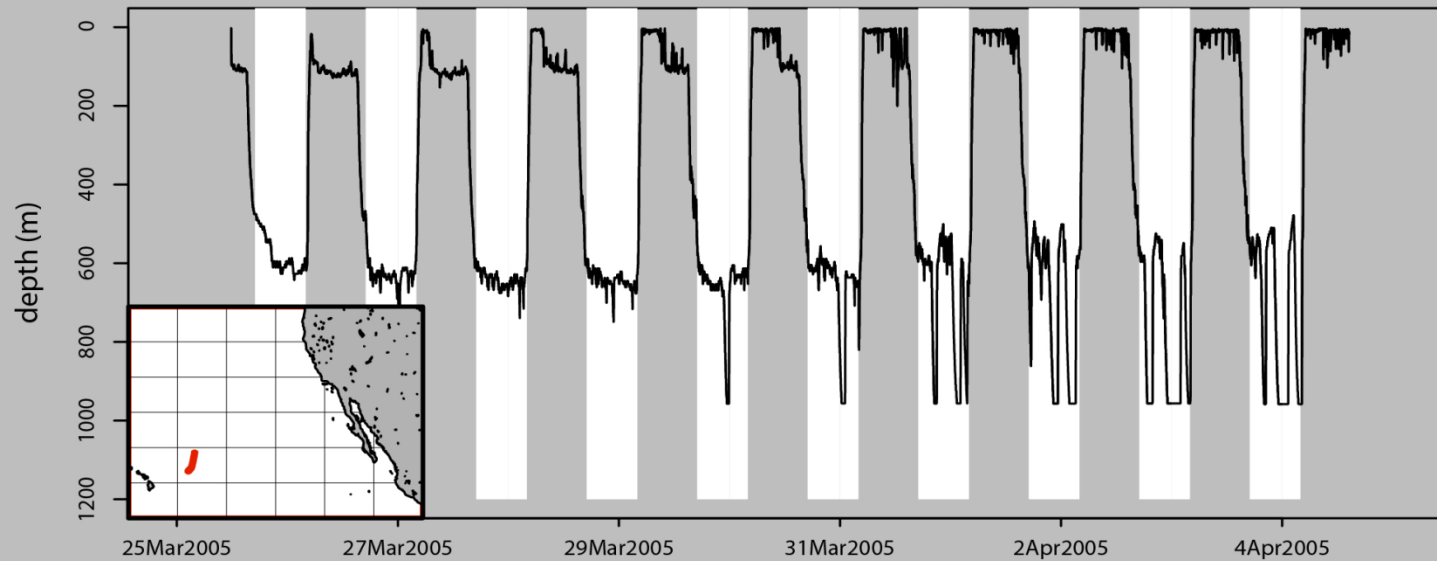
a.

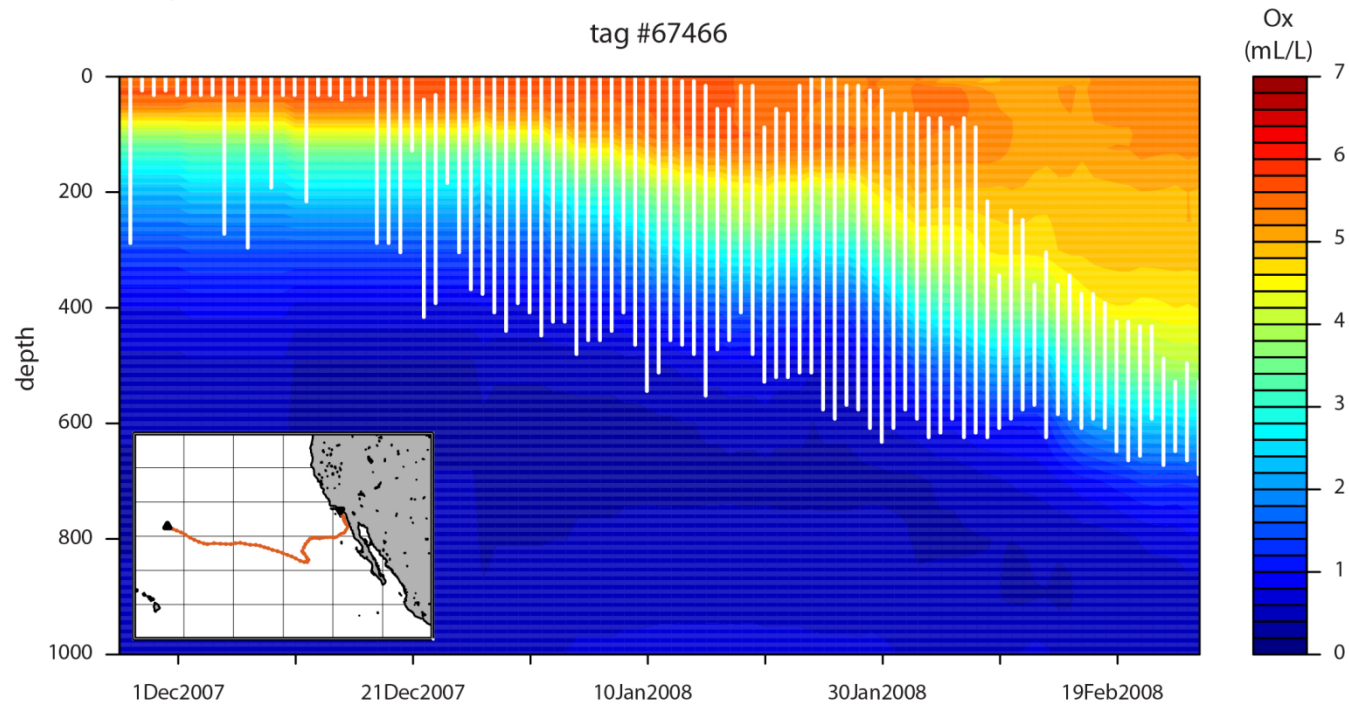
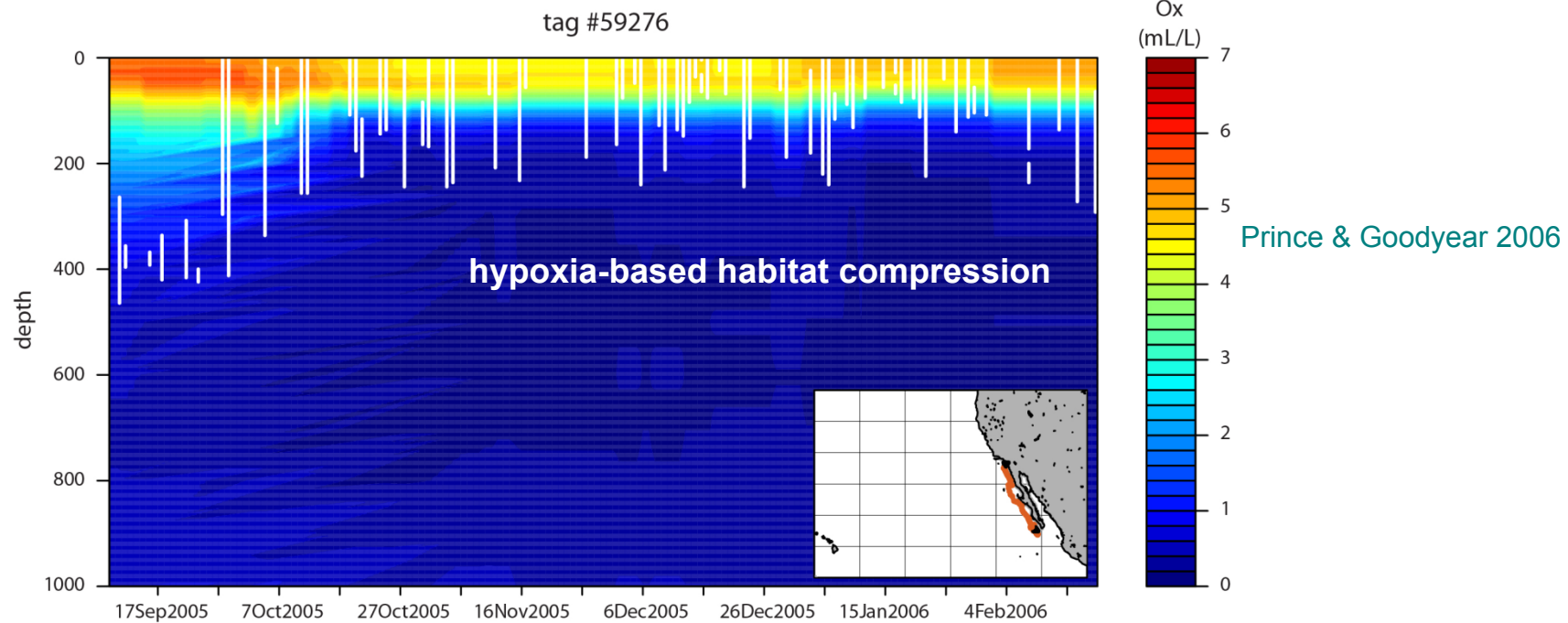
tag #8832



b.

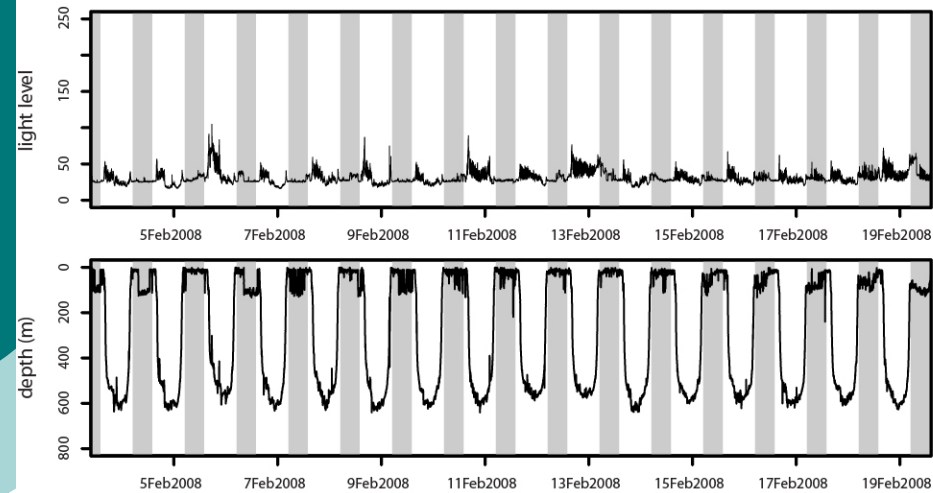
tag #49070



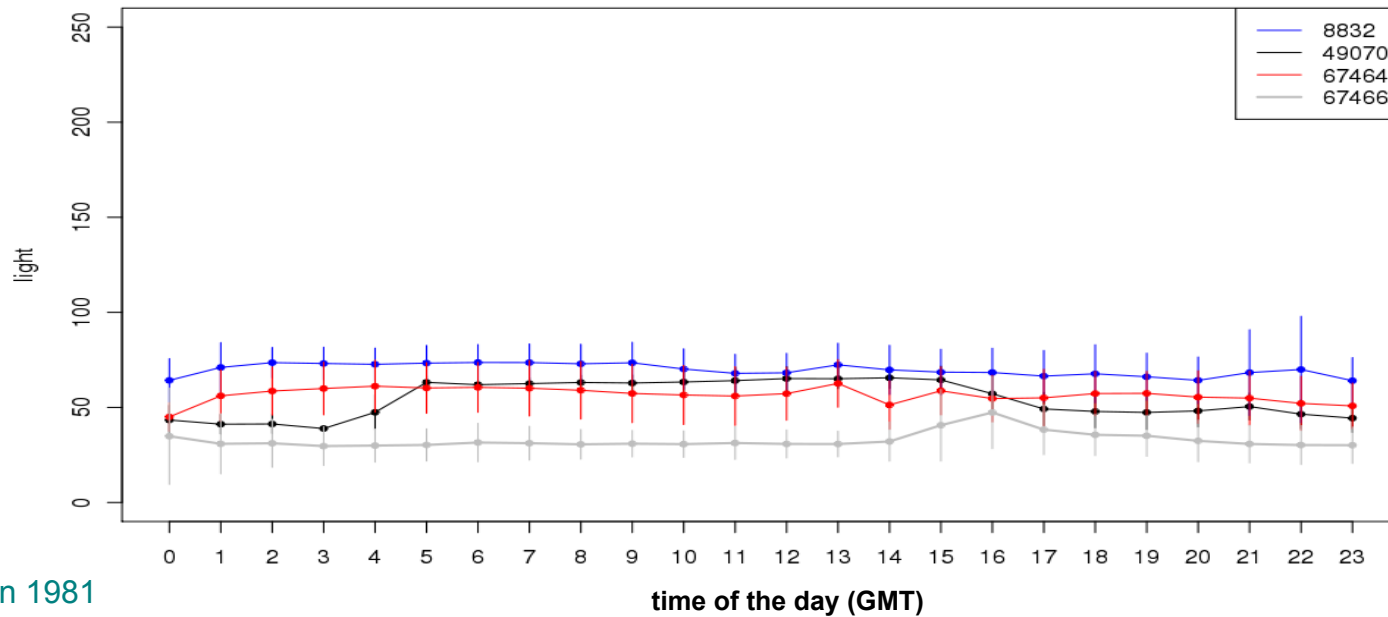
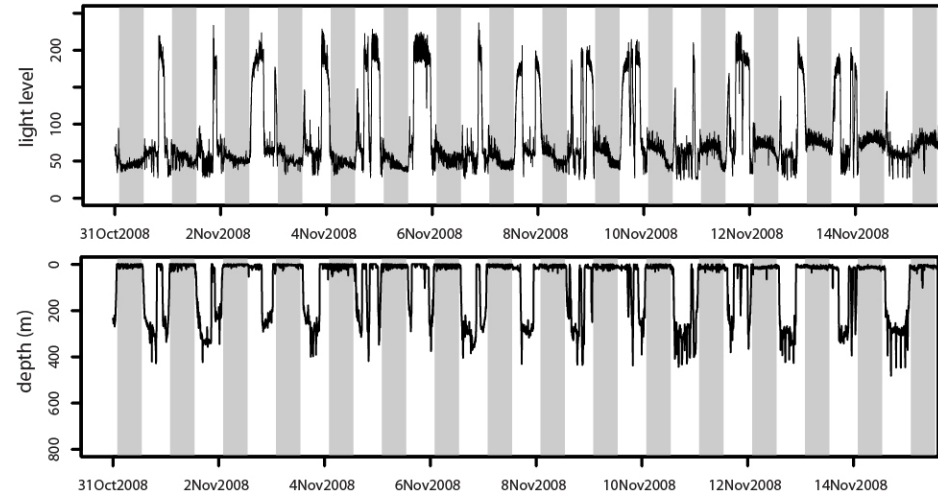


Constant isolume ?

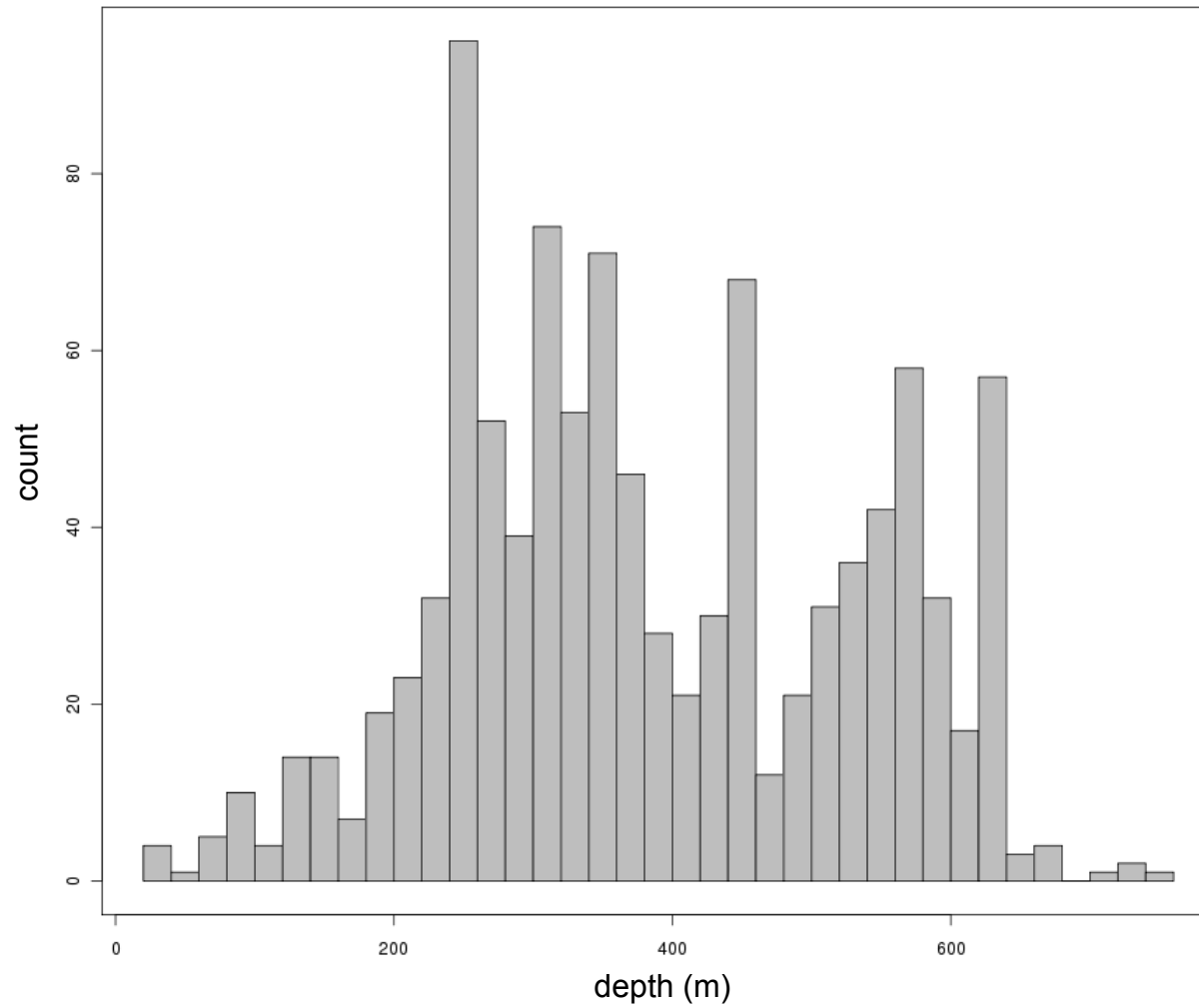
tag #67466



tag #75939



Daytime mean depth (basking events removed)



Mean : 386 m

Median : 360 m

Generalized Additive Model (GAM)

Family: gaussian
Link function: identity

Formula:
 $\text{mdt} \sim \text{s}(\log(\text{chl}), k = 15) + \text{s}(\text{ox400}, k = 15) + \text{s}(\text{ox400}, \text{T400}, k = 25)$

Parametric coefficients:

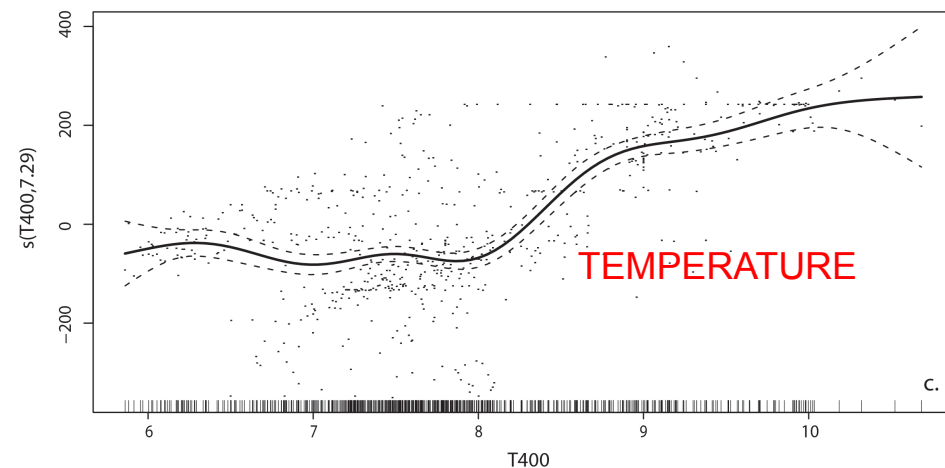
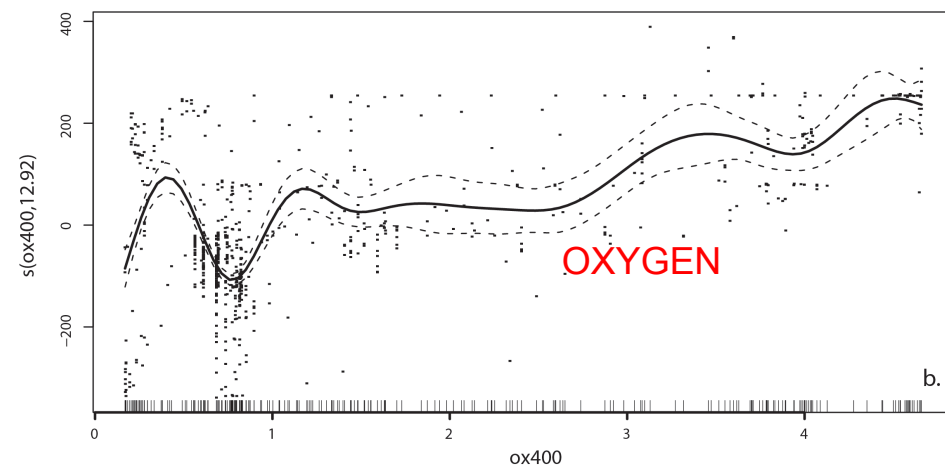
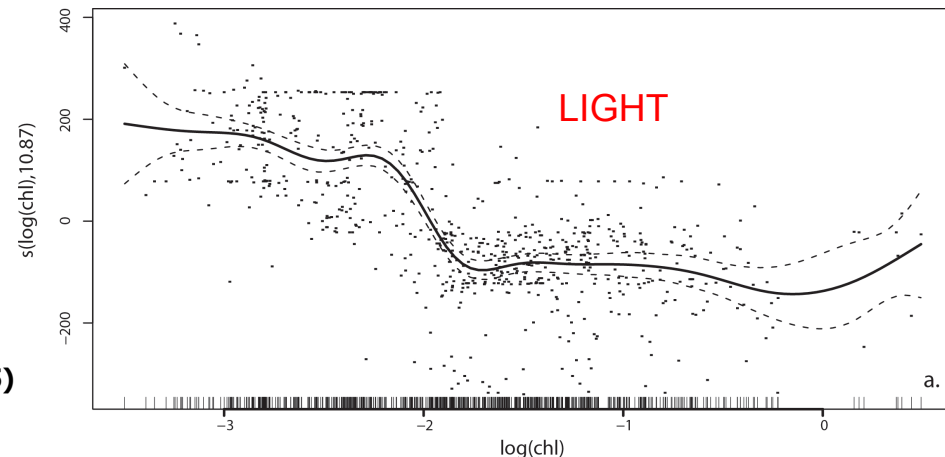
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	380.197	2.836	134.1	<2e-16***

Approximate significance of smooth terms:

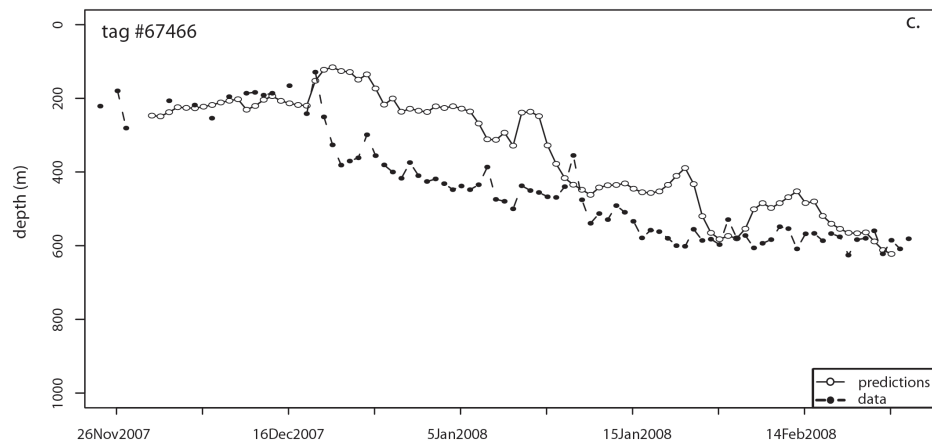
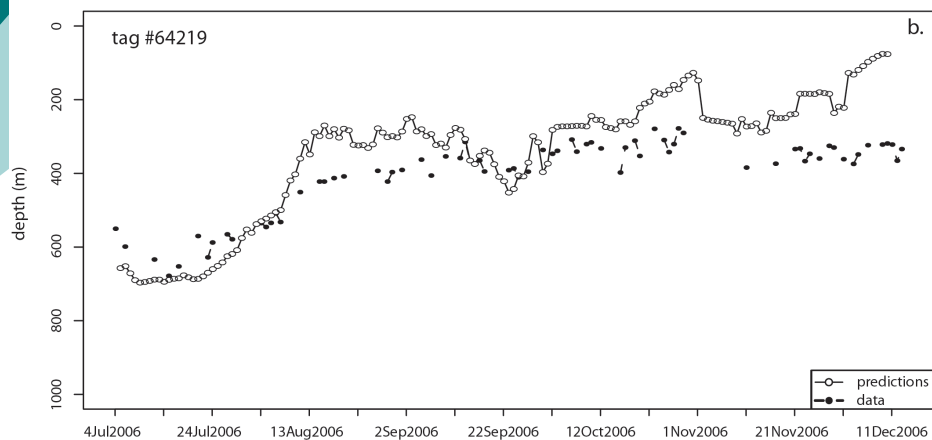
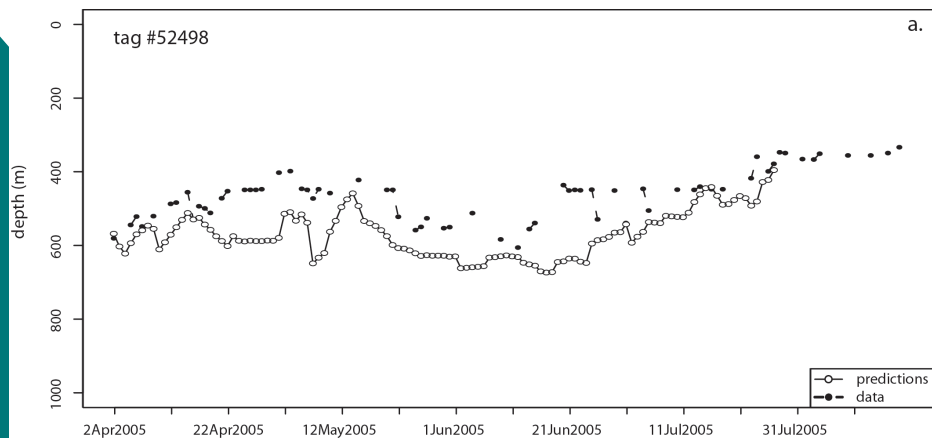
	edf	Ref.df	F	p-value
$\text{s}(\log(\text{chl}))$	11.83	12.33	13.57	< 2e-16***
$\text{s}(\text{ox400})$	10.52	11.02	4.59	9.7e-7***
$\text{s}(\text{ox400}, \text{T400})$	17.37	17.87	14.62	< 2e-16***

R-sq.(adj) = 0.754 **Deviance explained = 76.8%**
GCV score = 5973.1 Scale est. = 5314.7 n = 661

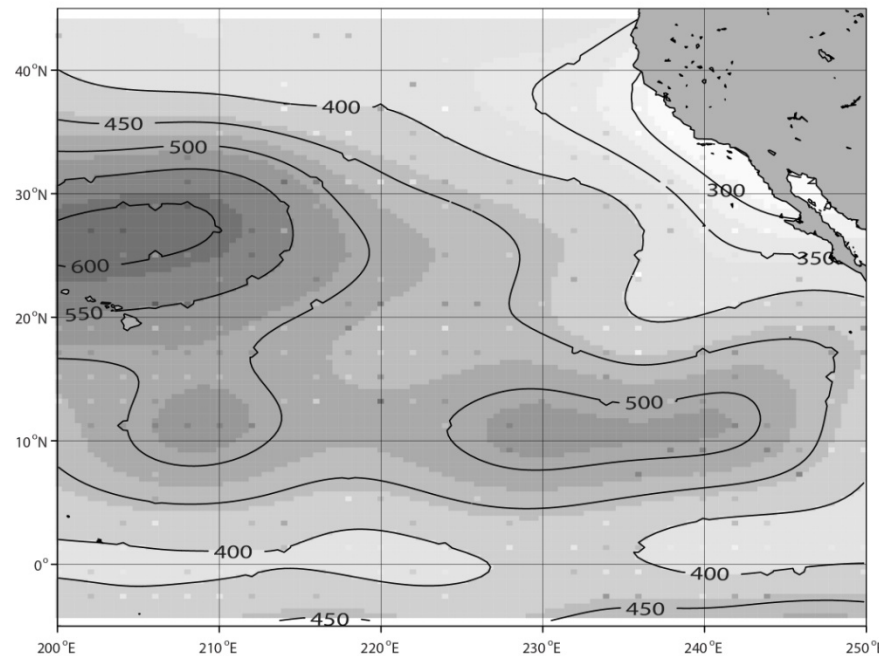
chl from MODIS-Aqua
ox400 from the World Ocean Atlas
T400 from the tags PDT data



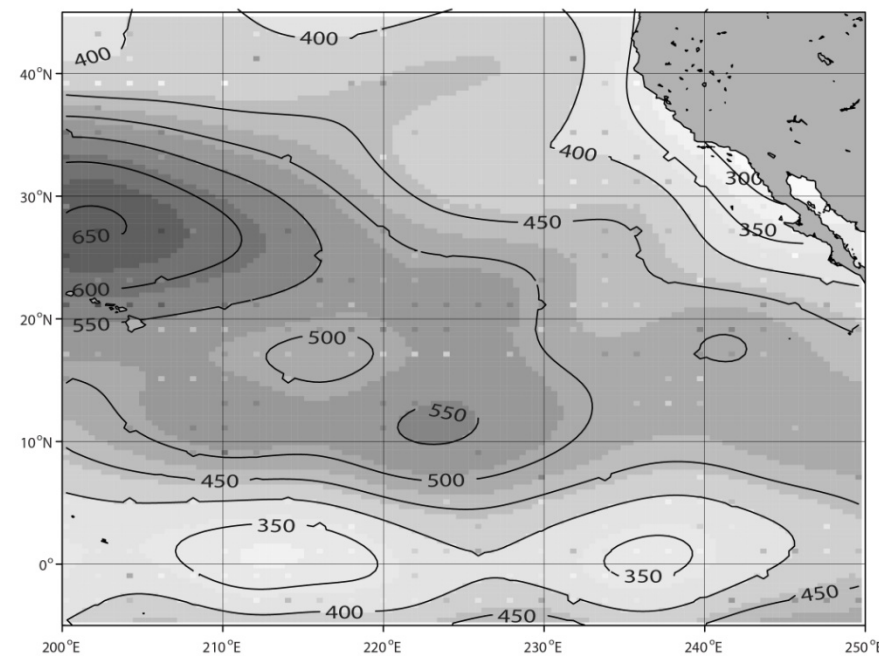
PREDICTIONS



January 2010



July 2010



Summary

- in absence of basking, swordfish seem to roughly follow an isolume : targeting of a portion of the DSL on which they prey during both day and night
- daytime mean depth = foraging at depth
- can be explained by 3 environmental factors : chl concentration as a proxy for light, temperature at depth, oxygen concentration at depth
- the combination of those 3 factors can be converted spatially to produce maps of daytime mean depth
 - **daytime DEEP longline sets targeting swordfish to reduce by-catch ??**

Acknowledgements

- Deployment of central Pacific tags : Don Hawn
- Geolocation :
 - LightTrack : Francois Royer and Beatriz Calmettes (CLS, France)
 - trackit : Anders Nielsen (SOEST, Hawaii) and Tim Lam (USC)



PFRP/JIMAR

