



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

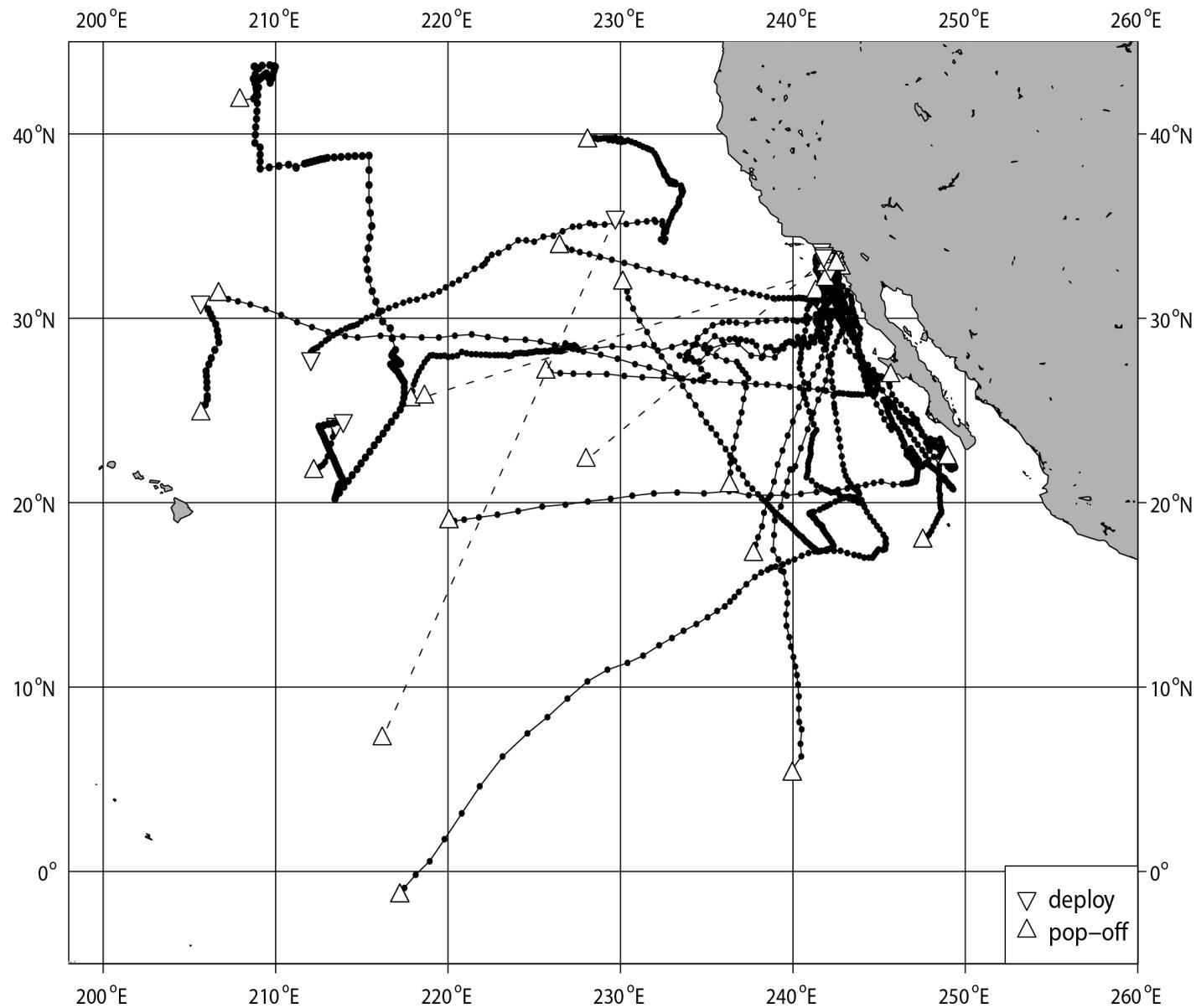
Melanie Abecassis¹,
Jeffrey Polovina², Heidi Dewar³

¹ JIMAR, University of Hawaii

² PIFSC, NOAA, Hawaii

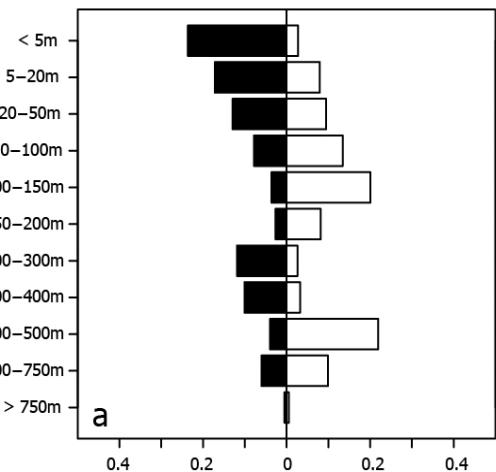
³ SWFSC, NOAA, La Jolla

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

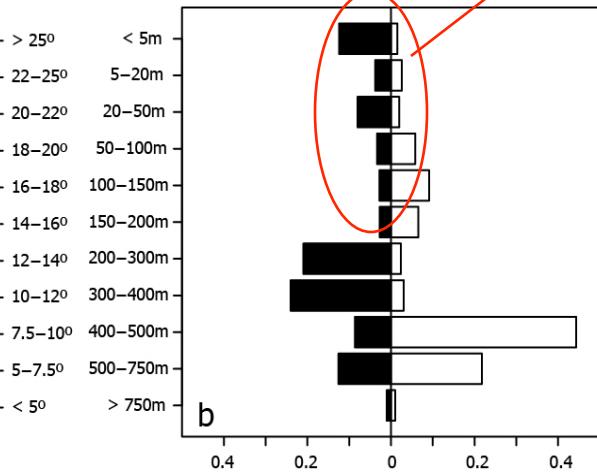


Distributions

26 tags pooled together

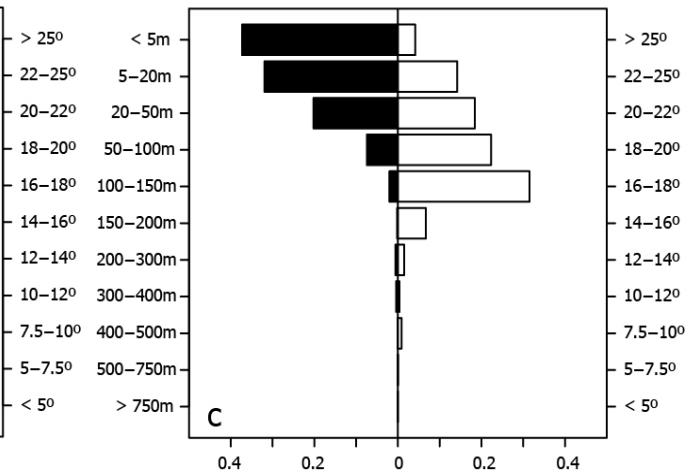


daytime – 20 tags



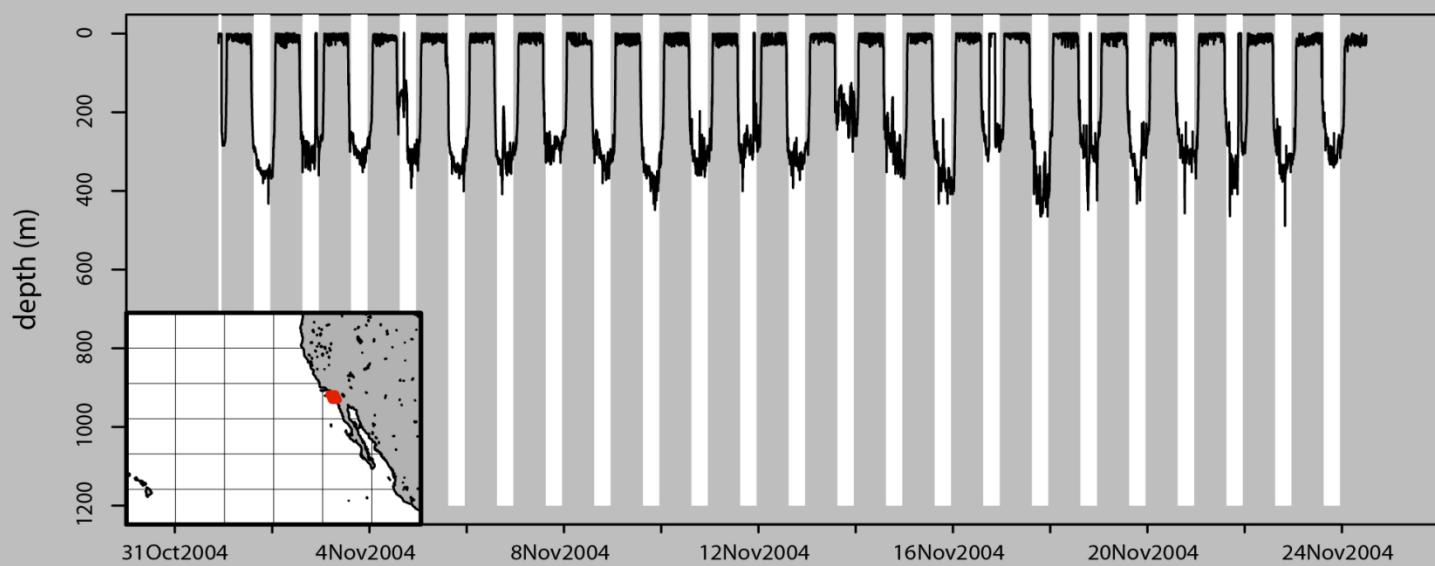
daytime basking

night-time – 22 tags



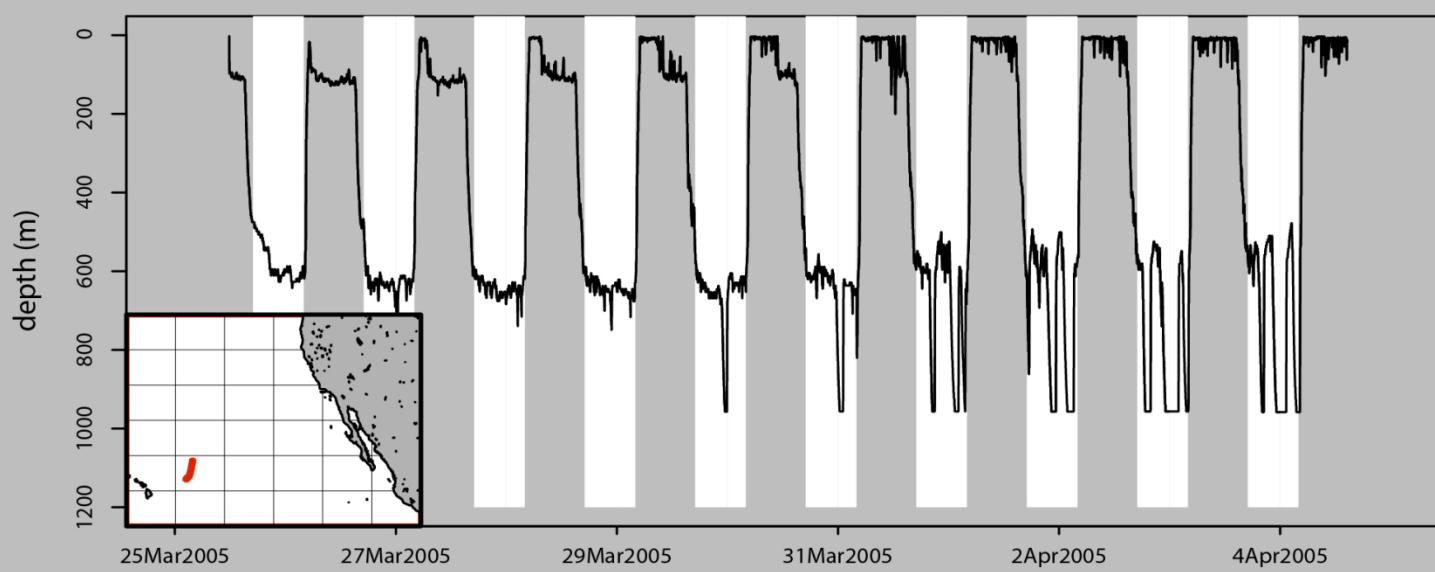
a.

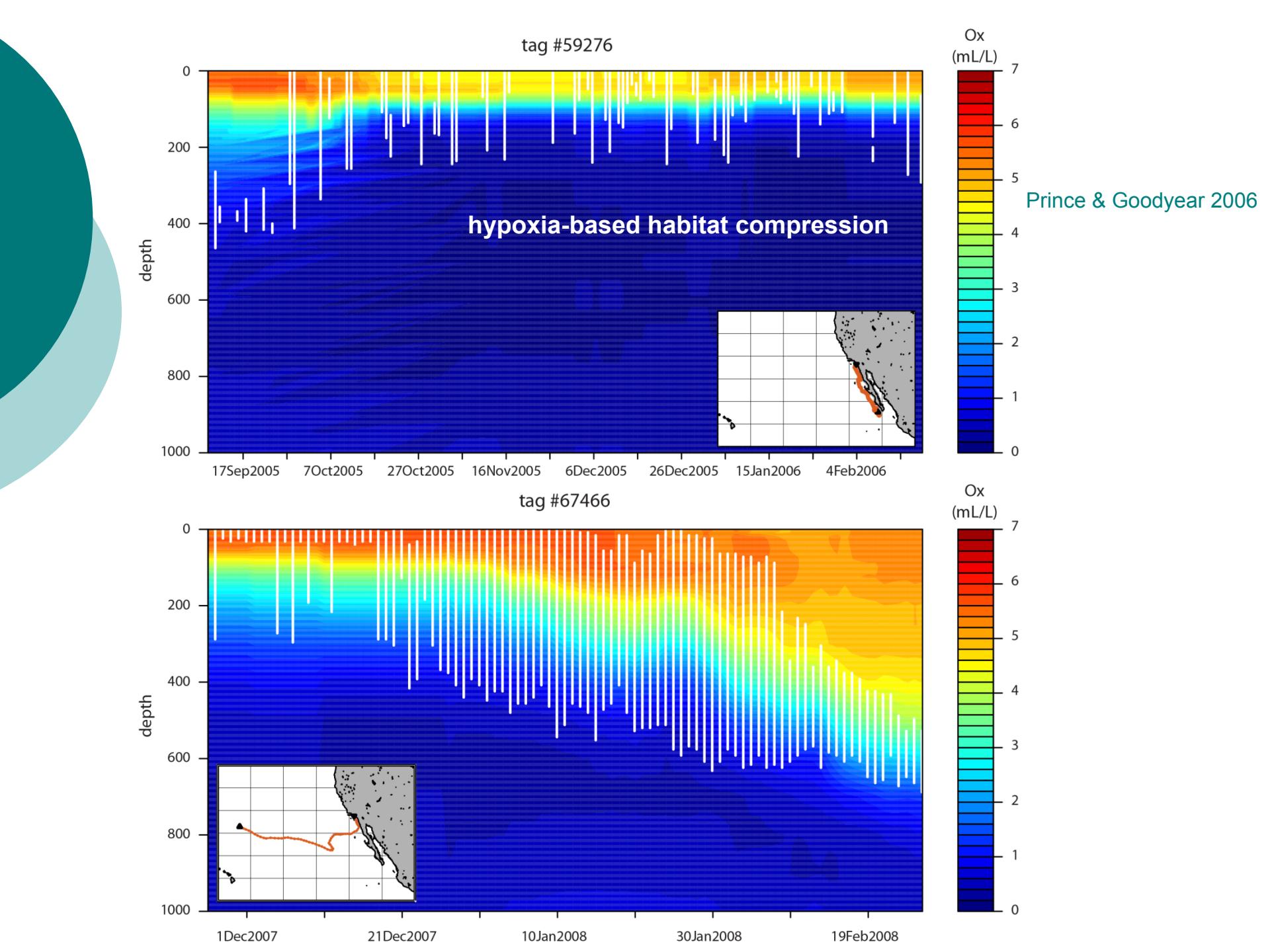
tag #8832



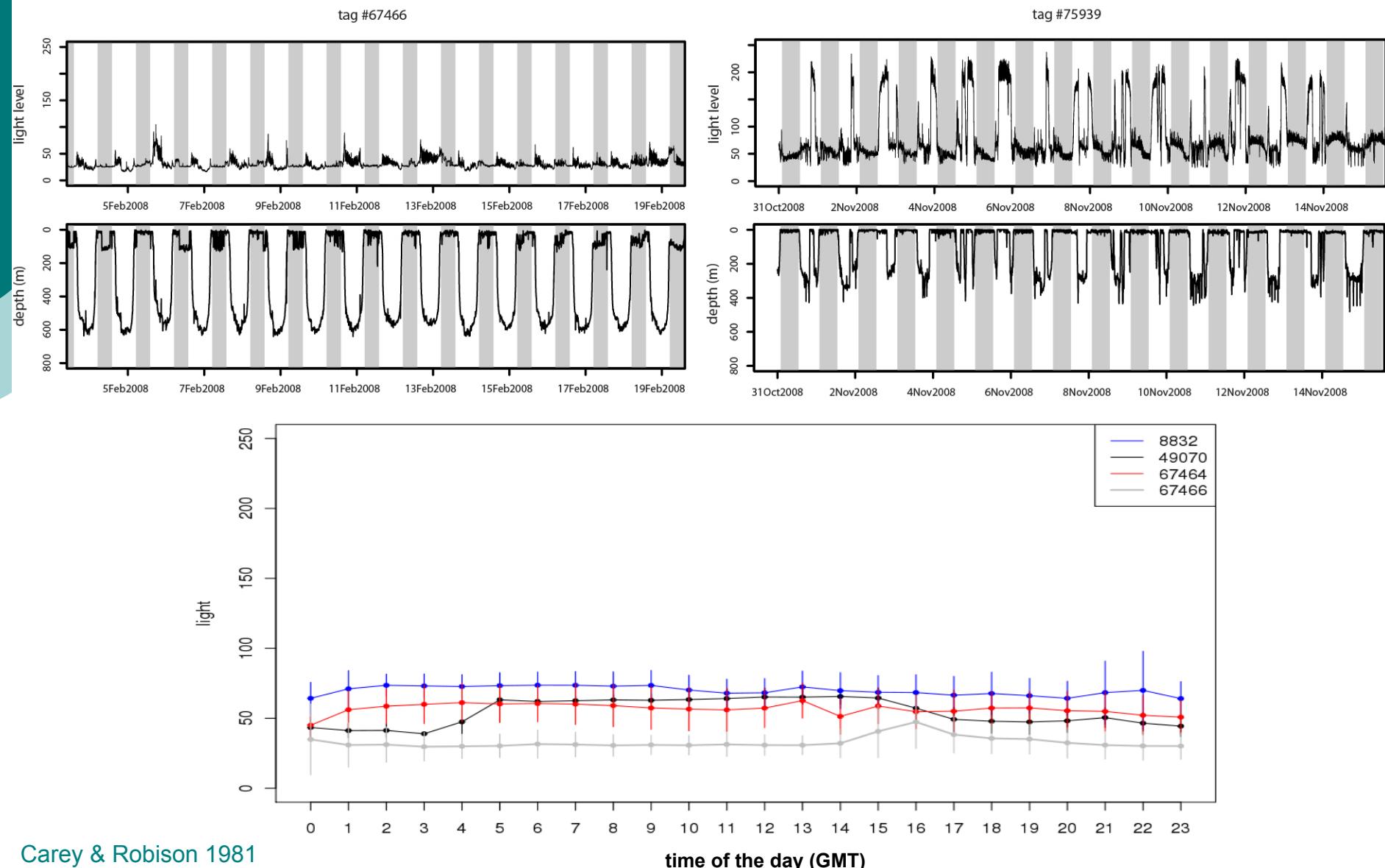
b.

tag #49070

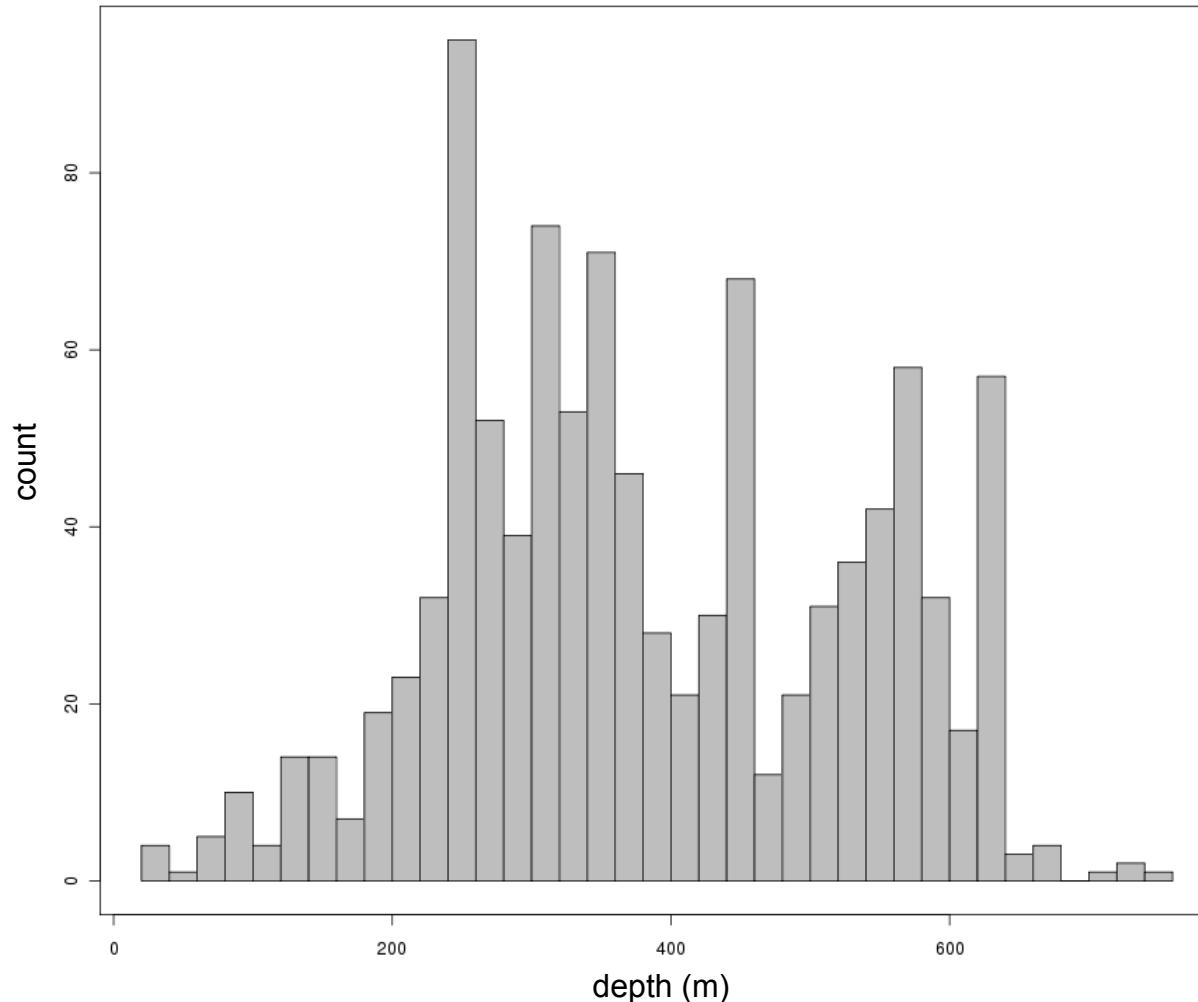




Constant isolume ?



Daytime mean depth (basking events removed)



Mean : 386 m
Median : 360 m

Generalized Additive Model (GAM)

Family: gaussian

Link function: identity

Formula:

$mdt \sim s(\log(chl), k = 15) + s(ox400, k = 15) + s(ox400, T400, k = 25)$

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
s(log(chl))	11.83	12.33	13.57	< 2e-16***
s(ox400)	10.52	11.02	4.59	9.7e-7***
s(ox400,T400)	17.37	17.87	14.62	< 2e-16***

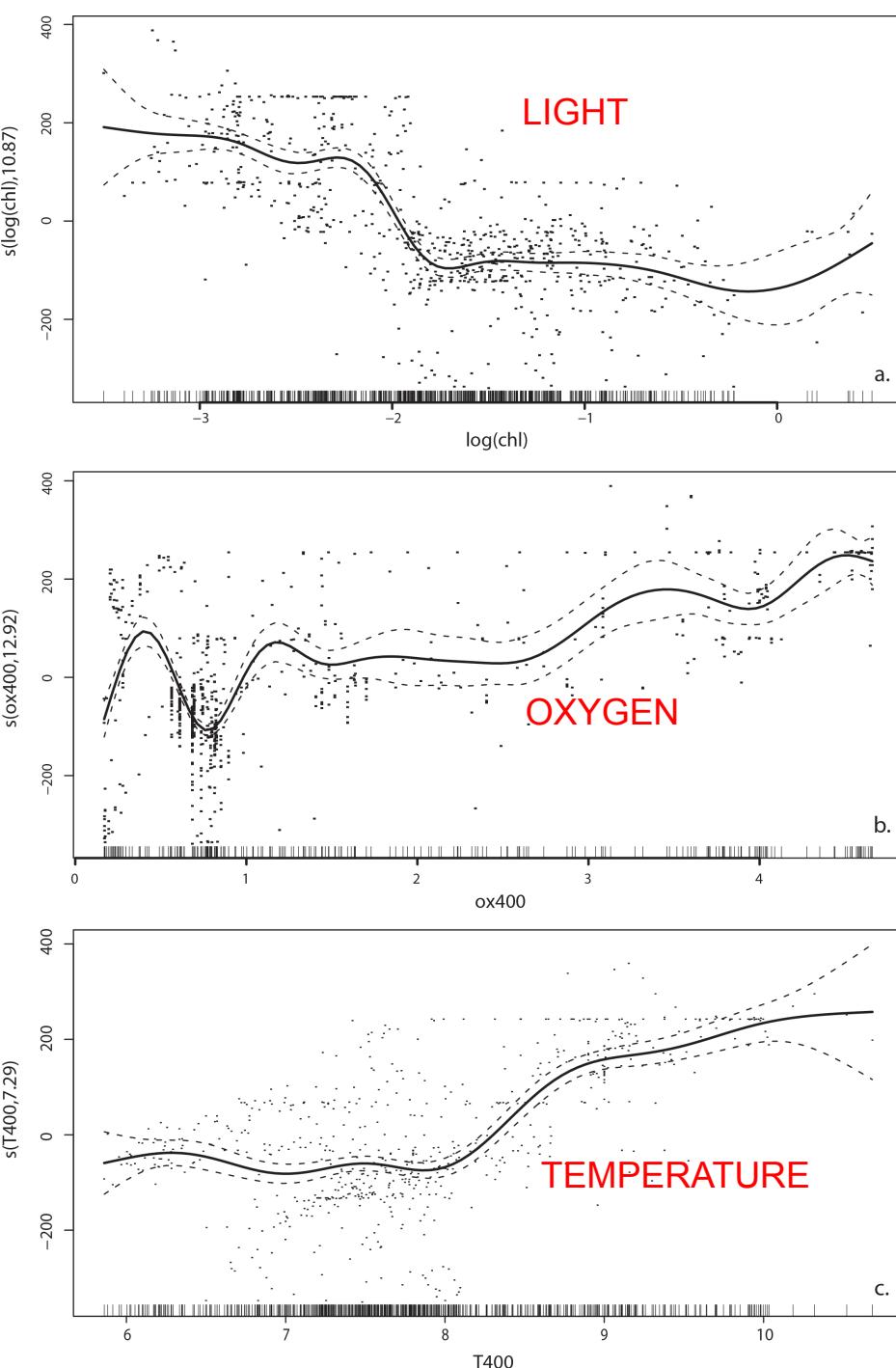
R-sq.(adj) = 0.754 Deviance explained = 76.8%

GCV score = 5973.1 Scale est. = 5314.7 n = 661

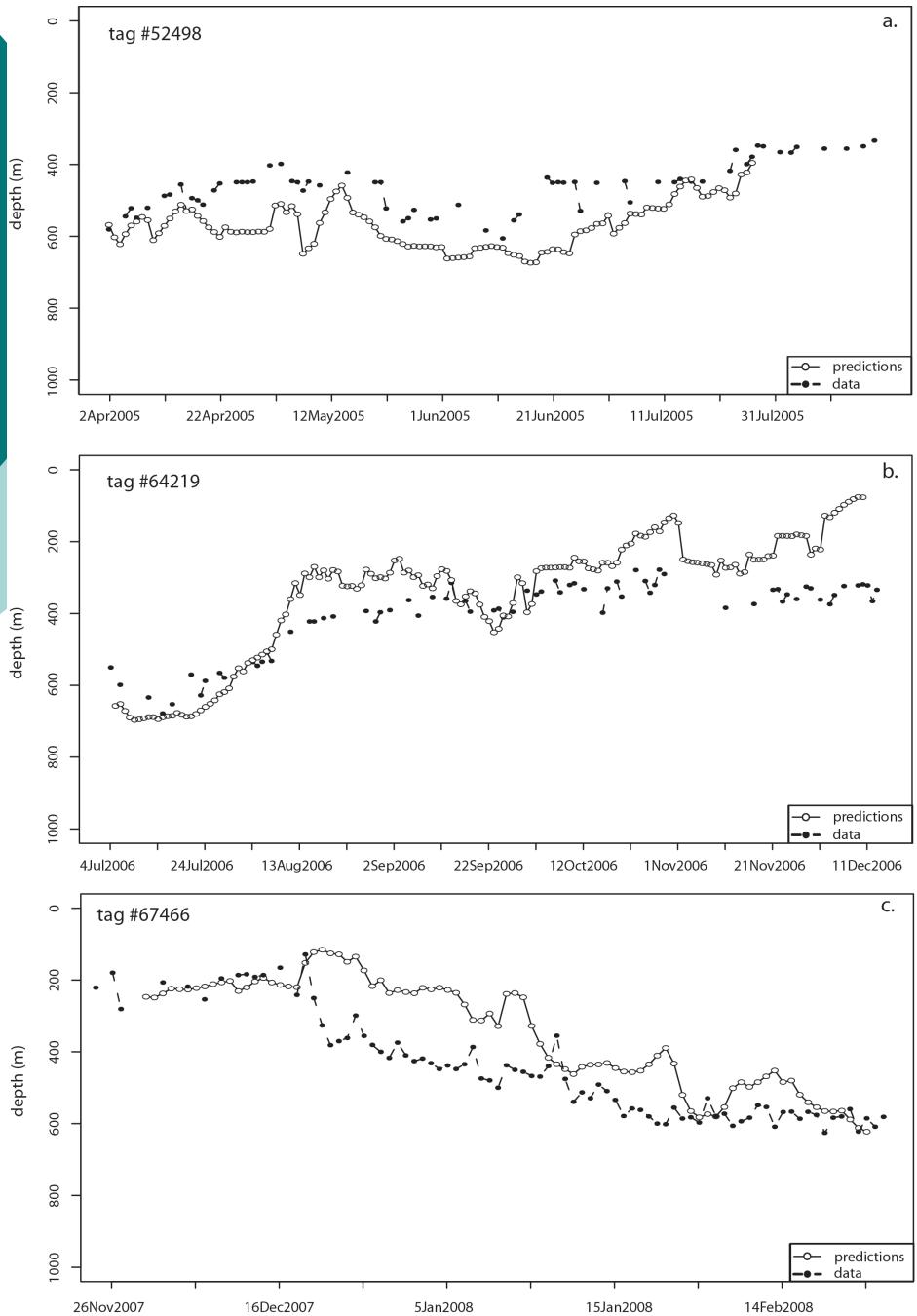
chl from MODIS-Aqua

ox400 from the World Ocean Atlas

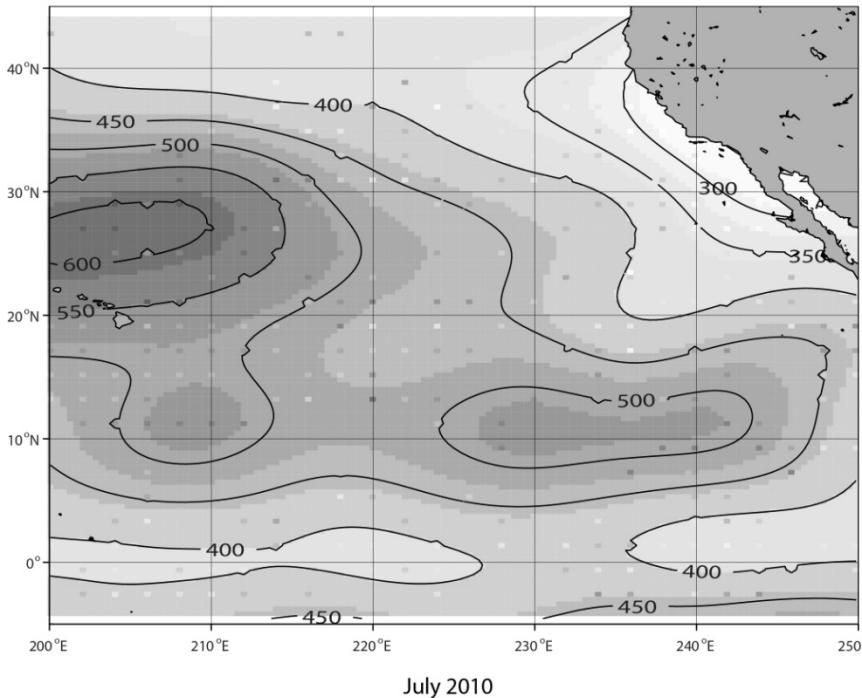
T400 from the tags PDT data



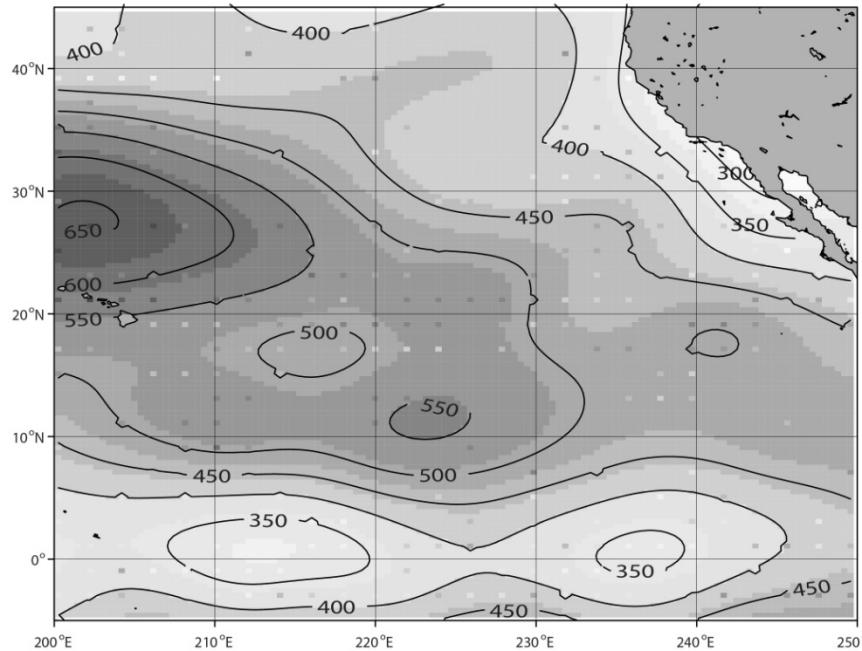
PREDICTIONS



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

