

The following supplement accompanies the article

Habitat selection of a coastal shark species estimated from an autonomous underwater vehicle

D. E. Haulsee*, M. W. Breece, D. C. Miller, B. M. Wetherbee, D. A. Fox, M. J. Oliver

*Corresponding author: dhaulsee@udel.edu

Marine Ecology Progress Series 528: 277–288 (2015)

Table S1. Model type, no. of sharks tagged, and nominal pulse rates (s) of VEMCO transmitters used in the 2007–2012 sand tiger shark *Carcharias taurus* tagging projects carried out by Delaware State University, University of Rhode Island, University of Massachusetts and the Massachusetts Division of Marine Fisheries.

Transmitter model	No. of sharks	Nominal delay (s)
V16-6H	185	50–130 or 70–150
V16-4L	54	30–90 or 45–135
V16-5H (external)	25	40–80
VMT-1x	20	70–150
V16T-4L	8	45–135

Table S2. Results of the Kolmogorov-Smirnov (KS) Test of similar distributions comparing the environmental conditions in the top 5 m of the water column where a shark was detected against the conditions in the top 5 m of the water column measured by autonomous underwater vehicle (AUV) during the entire mission.

Environmental Variable	Two-sided KS Test			the CDF of x lies above that of y		the CDF of x lies below that of y	
	Value at D_{max}	D_{max}	Significance	D_{max}	Significance	D_{max}	Significance
Temperature (°C)	18.99	0.16	0.667	0.16	0.348	0.13	0.514
Chlorophyll ($\mu\text{g L}^{-1}$)	3.03	0.20	0.392	0.20	0.198	0.08	0.749
Salinity (psu)	31.81	0.34	0.015	0.34	0.007	0.11	0.628
Oxygen (% Saturation)	86.18	0.16	0.641	0.16	0.332	0.08	0.754
CDOM (ppb)	7.80	0.31	0.039	0.06	0.847	0.31	0.019

In a KS test, the D_{max} values are the largest vertical distance between points on the CDFs of utilized and available environmental variables. The value of the environmental variable associated with each D_{max} is presented. Randomization resampled significance values <0.05 indicate a Type 1 error was likely not committed. Bold indicates significance at $p < 0.05$

Table S3. Results of the Kolmogorov-Smirnov (KS) Test of similar distributions comparing the environmental conditions in the bottom 5 m of the water column where a shark was detected against the conditions in the bottom 5 m of the water column measured by autonomous underwater vehicle (AUV) during the entire mission.

Environmental Variable	Two-sided KS Test			the CDF of x lies above that of y		the CDF of x lies below that of y	
	Value at D_{max}	D_{max}	Significance	D_{max}	Significance	D_{max}	Significance
Temperature (°C)	18.18	0.15	0.700	0.10	0.678	0.15	0.360
Chlorophyll ($\mu\text{g L}^{-1}$)	3.07	0.20	0.360	0.20	0.181	0.19	0.222
Salinity (psu)	32.05	0.39	0.003	0.39	0.002	0.01	0.994
Oxygen (% Saturation)	85.47	0.24	0.179	0.24	0.090	0.09	0.718
CDOM (ppb)	8.95	0.31	0.034	0.03	0.958	0.31	0.017

In a KS test, the D_{max} values are the largest vertical distance between points on the CDFs of utilized and available environmental variables. The value of the environmental variable associated with each D_{max} is presented. Randomization resampled significance values <0.05 indicate a Type 1 error was likely not committed. Bold indicates significance at $p < 0.05$

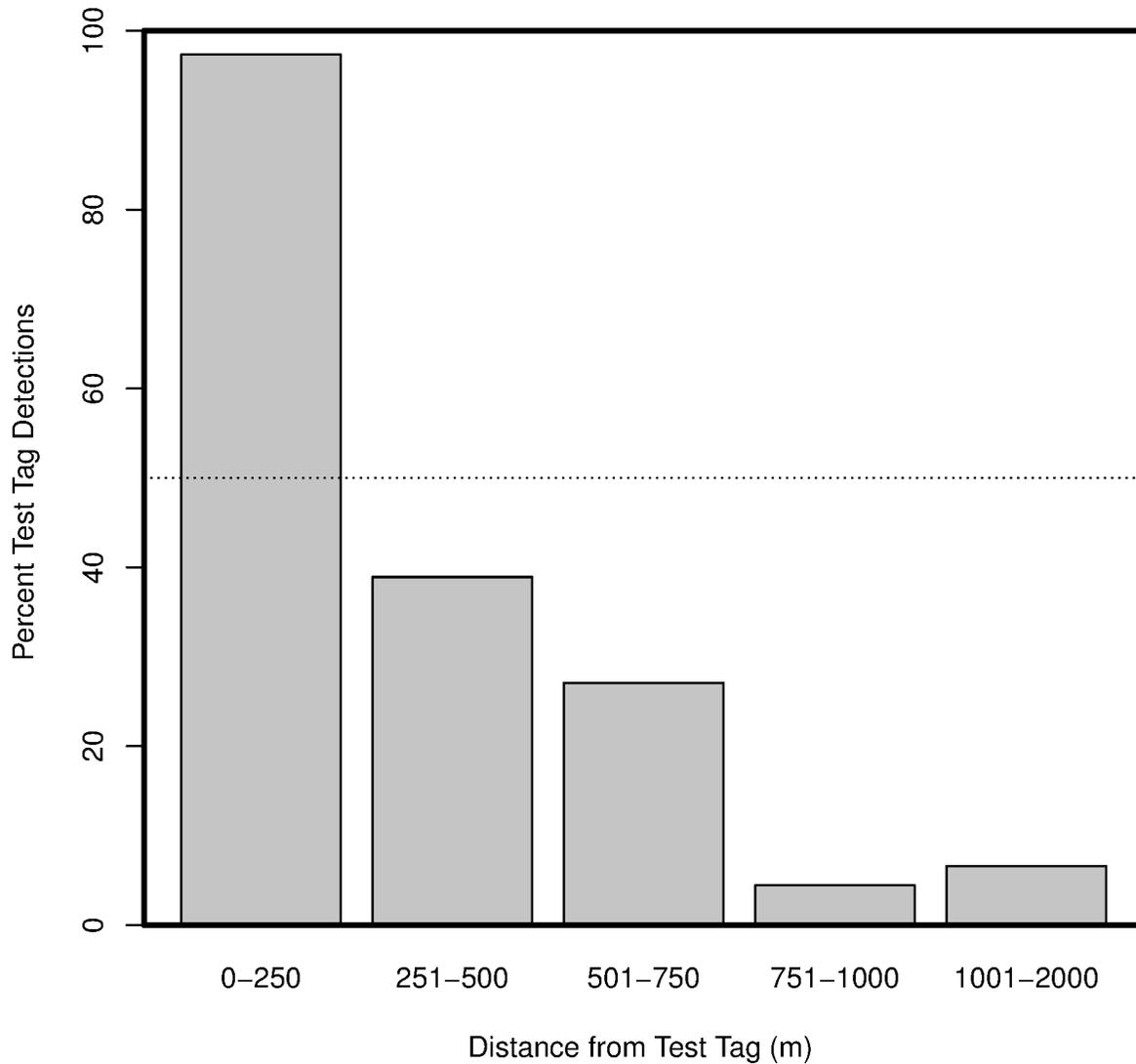


Fig. S1. Barplot of percent of test tag transmissions detected by two VEMCO VR2C acoustic receivers integrated into a Slocum Glider autonomous underwater vehicle (AUV), at various distance bins away from tags. Dashed line is at 50% test tags detected. The receivers in the AUV are 97% effective at 250 m or less from tag, but the percentage of tag transmissions detected decreases rapidly at distance further than 250 m.

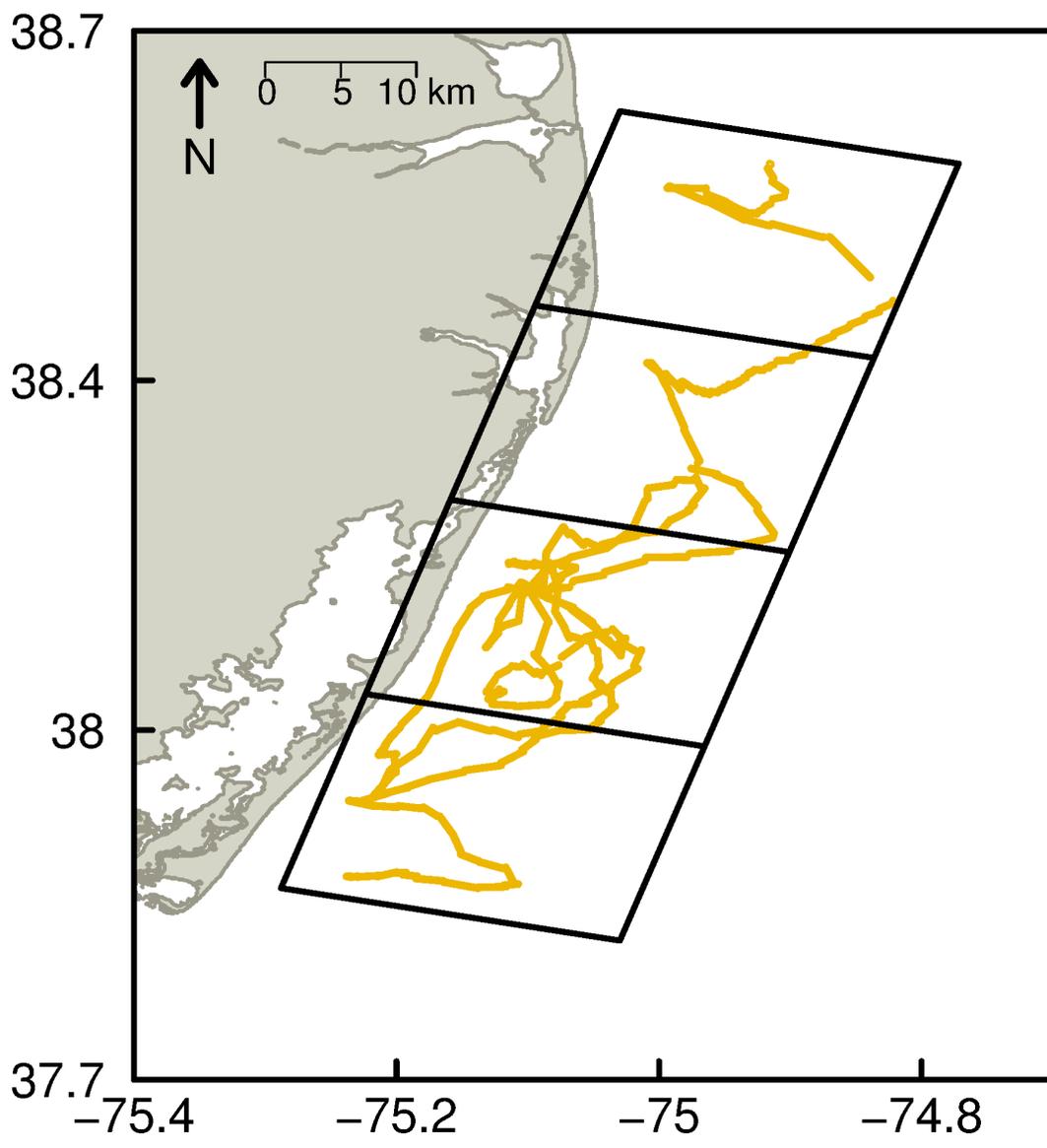


Fig. S2. Map of the Slocum Glider autonomous underwater vehicle (AUV) track (gold line) along Delaware and Maryland, USA coastline between 5–23 October 2012. The four resampling quadrats are represented by the black boxes.

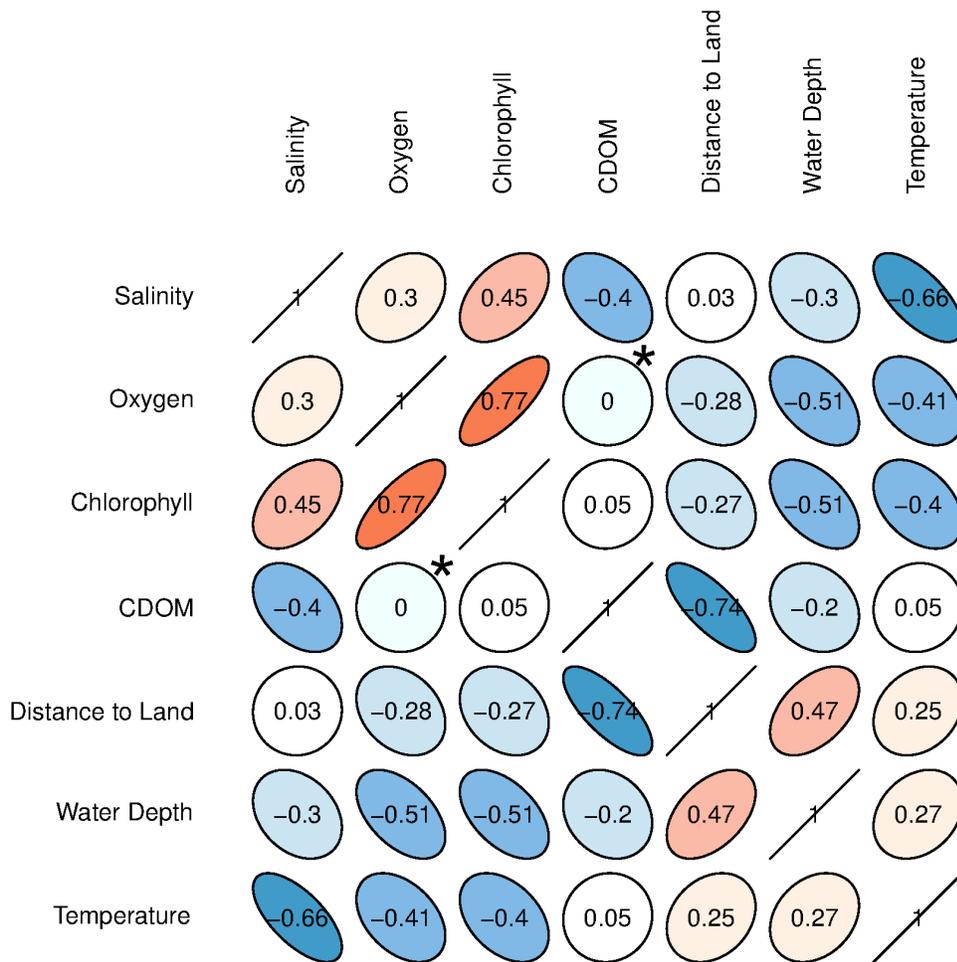


Fig. S3. Correlogram displaying the Pearson's correlation r_s value between environmental predictors measured by autonomous underwater vehicle (AUV) during mission. Warm colors represent positive relationships, while cool colors represent negative relationships. The narrower the ellipse, the stronger the correlation. All relationships are statistically significant at the $p < 0.001$ level, unless denoted by an (*), representing a non-significant relationship.

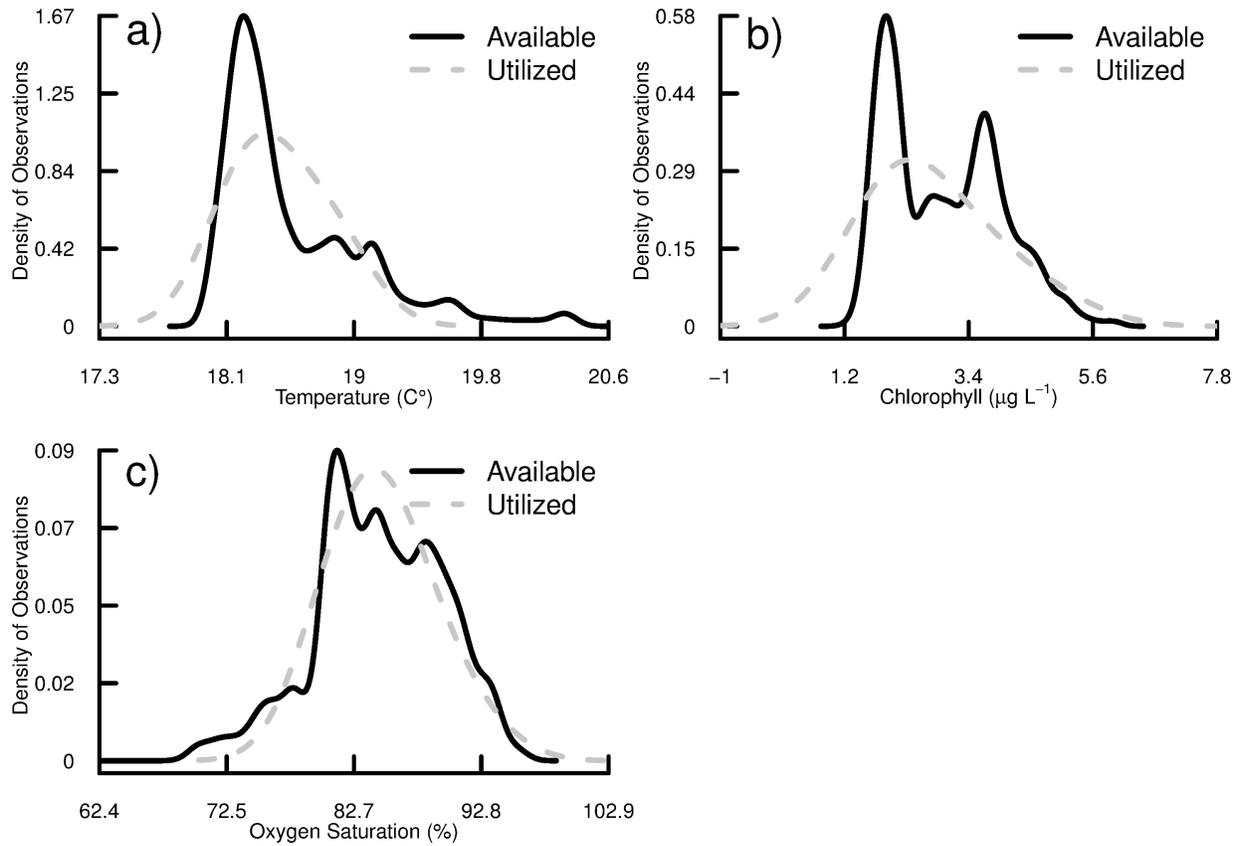


Fig. S4. Density distributions of environmental variables [temperature ($^{\circ}\text{C}$), chlorophyll a ($\mu\text{g L}^{-1}$), and oxygen saturation (%)] measured by sensors in the autonomous underwater vehicle (AUV). Available habitat (solid black line) is compared to habitat utilized (dashed gray line) by sand tiger shark. Utilized habitat are the environmental variables matched to each sand tiger shark detection point, while available habitat is all data measured by AUV during study.

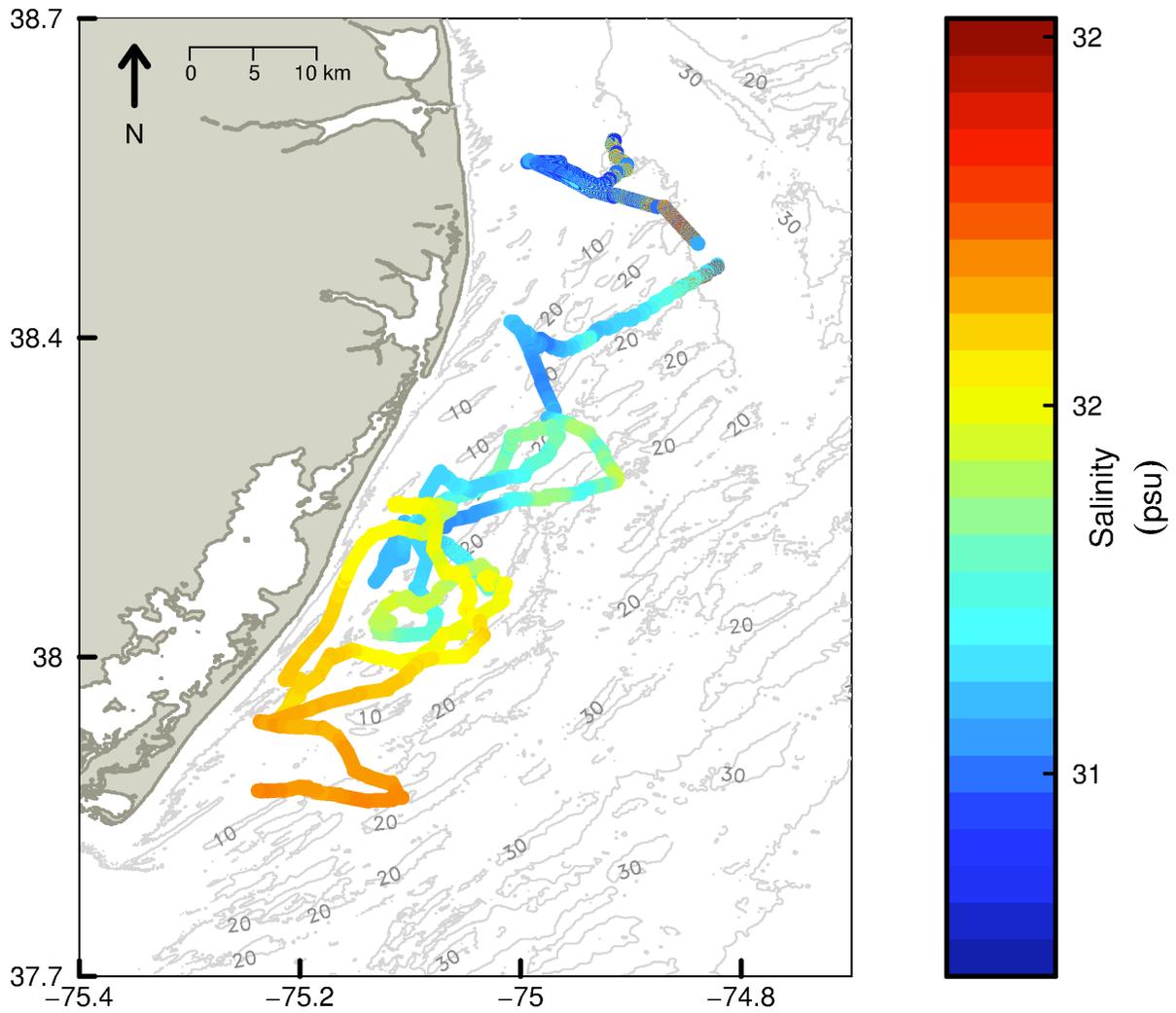


Fig. S5. Map of autonomous underwater vehicle (AUV) track between 5-23 October 2012 with AUV locations colored by surface salinity values measured by AUV. Apparent is the general increase in salinity throughout the mission.