

Predictive spatial modeling of seasonal bottlenose dolphin (*Tursiops truncatus*) distributions in the Mississippi Sound



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Introduction

- Seasonal spatial patterns of dolphin occurrence are linked to a variety of factors (e.g., temp, salinity, distribution of prey, etc.)
- Spatial distribution models (SDMs) allow for prediction of species occurrence as a function of environmental variants
- We used maximum entropy to create seasonal SDMs of dolphin occurrence using sighting locations and maps of environmental conditions that may affect their distribution



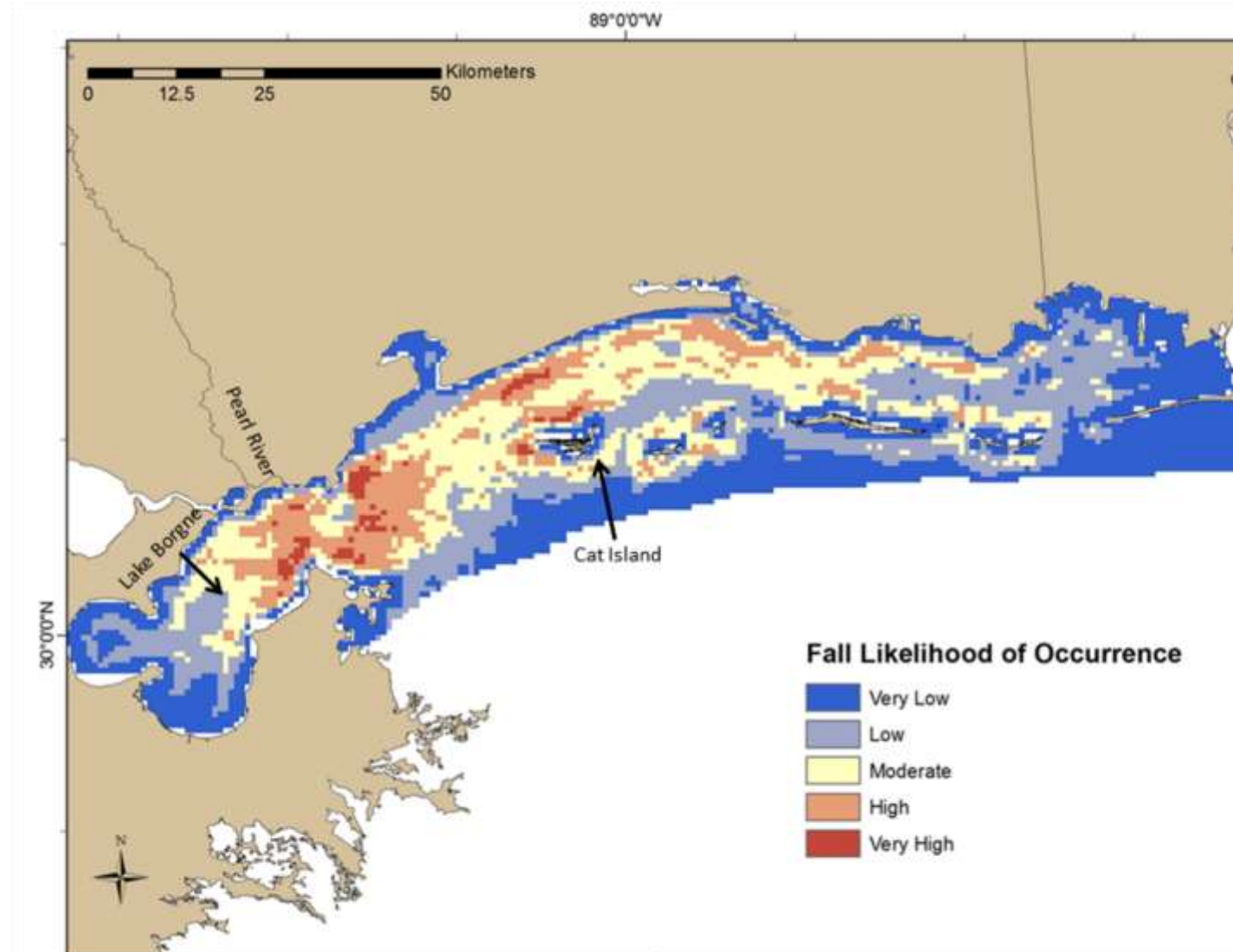
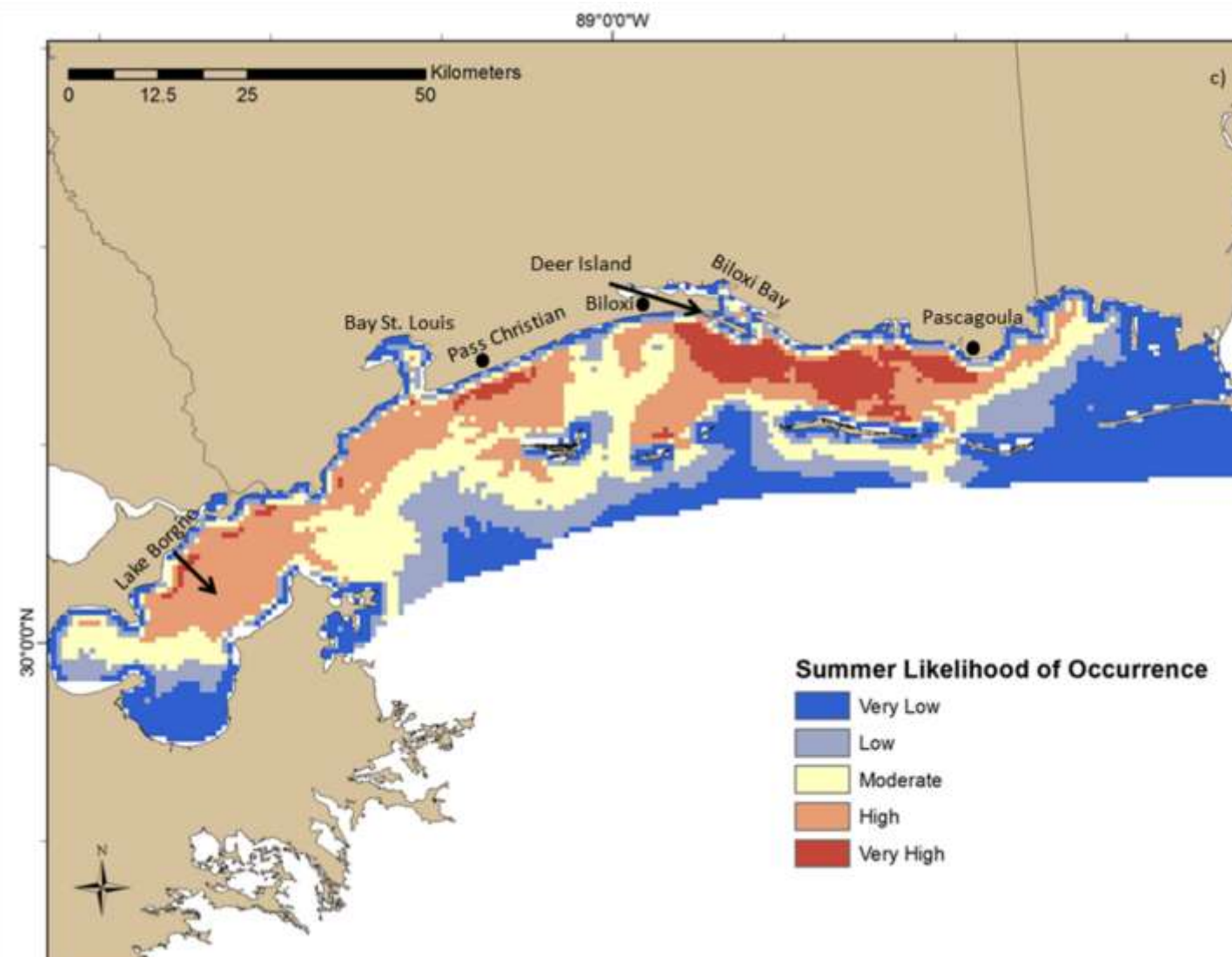
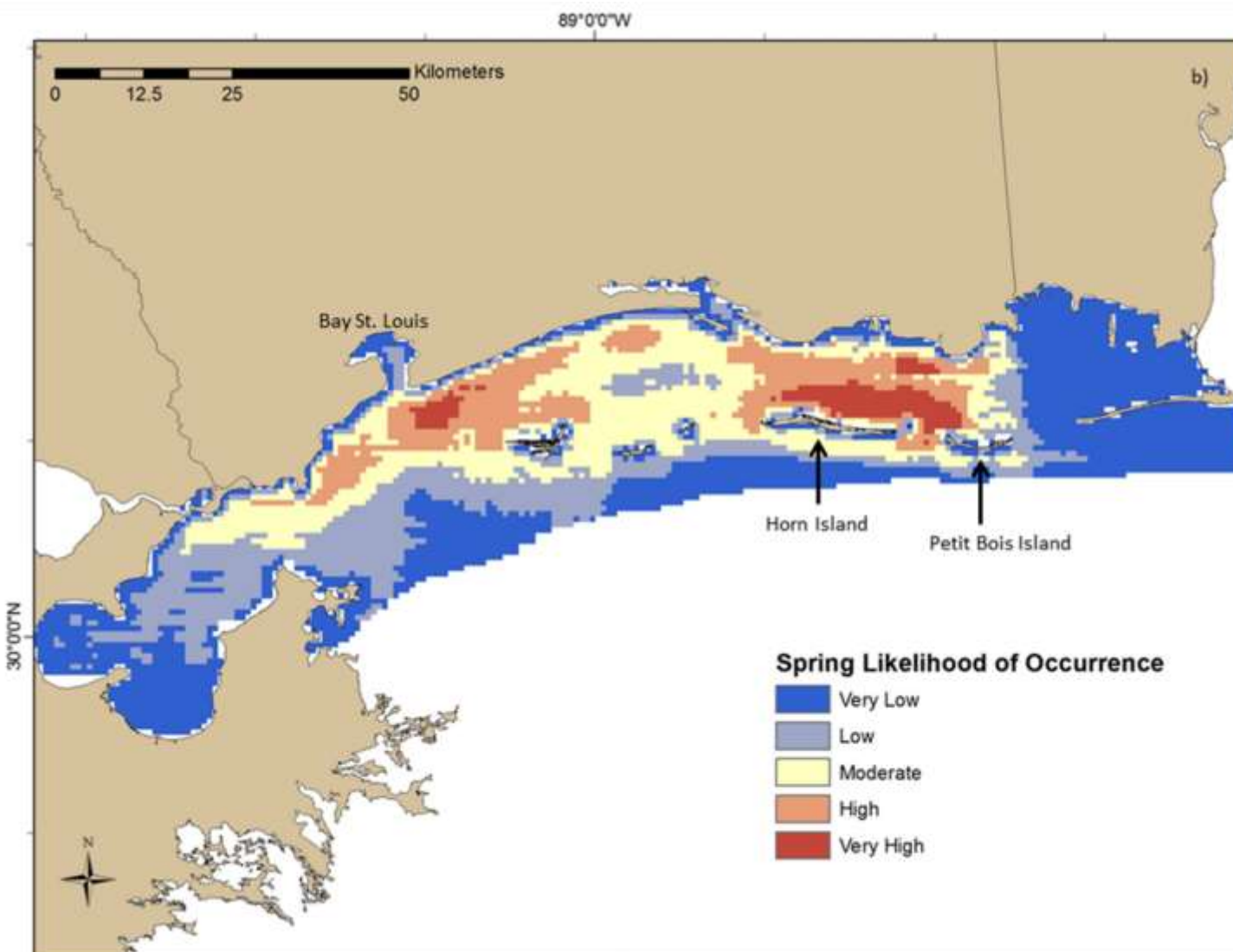
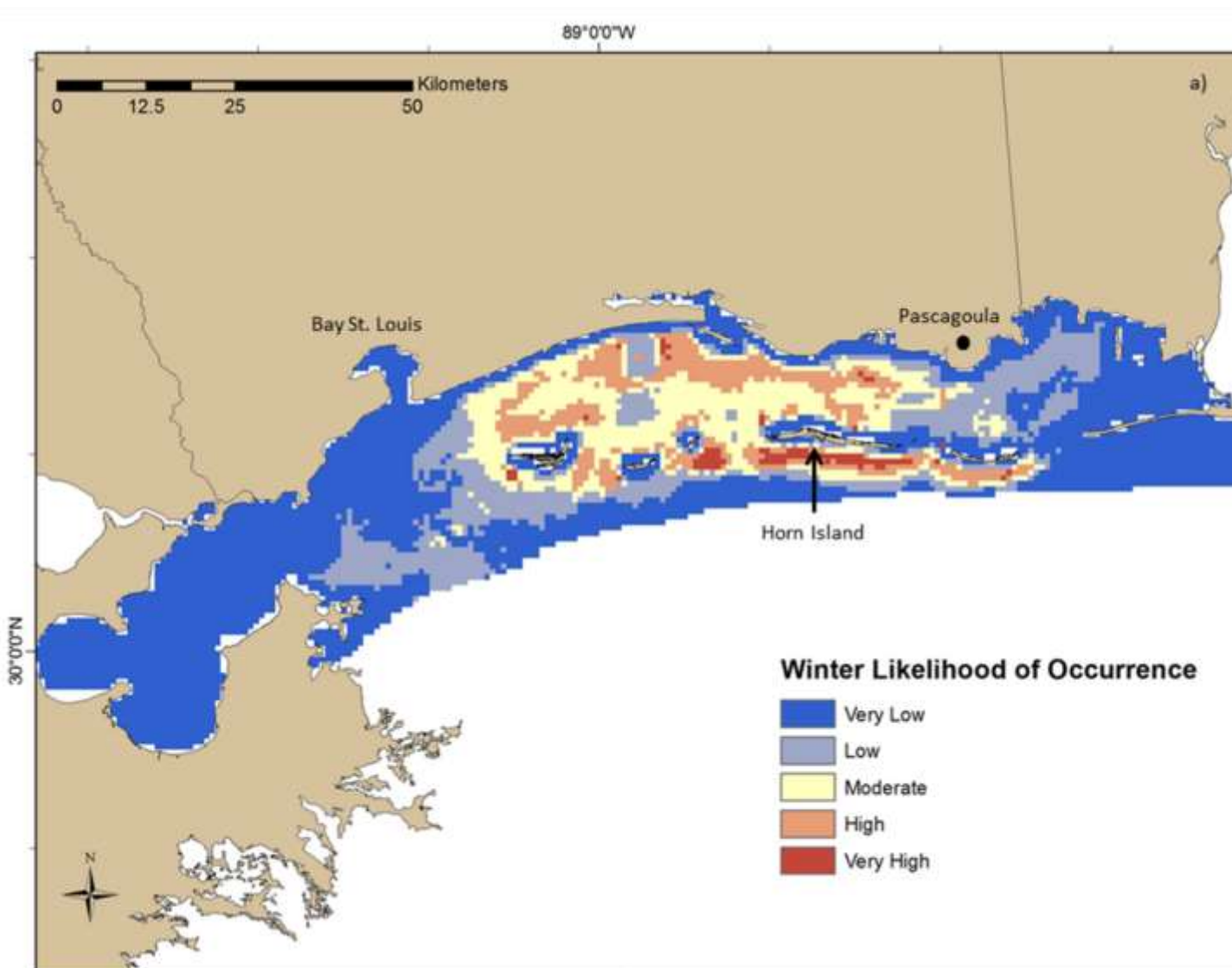
Methods

- Dolphin presence locations were obtained from line-transect sampling (2011 – 2013)
- Maps of 8 environmental variables were created to represent variables that may affect the Likelihood of dolphin occurrence (LoDO)
- The Program MaxEnt was used to create a probability distribution across the MS Sound from presence locations and predictor variables
- Model evaluation consisted of Area Under Curve (AUC) analyses
- The percent contribution of each variable and logistic response curves were generated to evaluate the influence of predictors on dolphin occurrence

The MaxEnt algorithm

$$H(\hat{\pi}) = - \sum_{x \in X} \hat{\pi}(x) \ln \hat{\pi}(x)$$

Results



Season	Total Sightings	AUC Values ^a	H LoDO ^b (km ²)	VH LoDO ^c (km ²)
Winter	174	0.910 (0.005)	326.6	50.8
Spring	105	0.844 (0.006)	463.0	133.4
Summer	102	0.820 (0.007)	816.5	241.1
Autumn	141	0.903 (0.006)	464.8	61.6
Total	522	-	-	-

^a Standard error of the mean is shown in parentheses

^b High likelihood of dolphin occurrence (H LoDO) – total area associated with a high LoDO

^c Very high likelihood of dolphin occurrence (VH LoDO) – total area associated with a very high LoDO

Variable	Percent Contribution (%)			
	Winter	Spring	Summer	Fall
Distance to Shore	20.3	21.1	32.4	25.9
Salinity	9.6	12.0	43.0	19.9
Nitrates	16.6	3.0	3.3	9.5
Depth	9.4	2.3	3.7	12.2
Temperature	11.9	23.1	2.3	5.2

Conclusions

- Dolphins display distinct seasonal shifts in LoDO among seasons:
 - LoDO was highest in deepwater habitats during the winter
 - High and very high LoDO was limited to the central MS Sound in winter and spring,
 - LoDO was high or very high throughout the MS Sound during summer
 - A distinct westward shift of LoDO was noted in fall
- The most important predictors of dolphin occurrence were distance to shore, salinity, nitrates, and depth
- Variable importance differed among seasons
- Changes in dolphin distributions appear to reflect changes in environmental conditions, which likely influence prey availability

