

Predictive models for domoic acid and *Pseudo-nitzschia* blooms off the Oregon coast

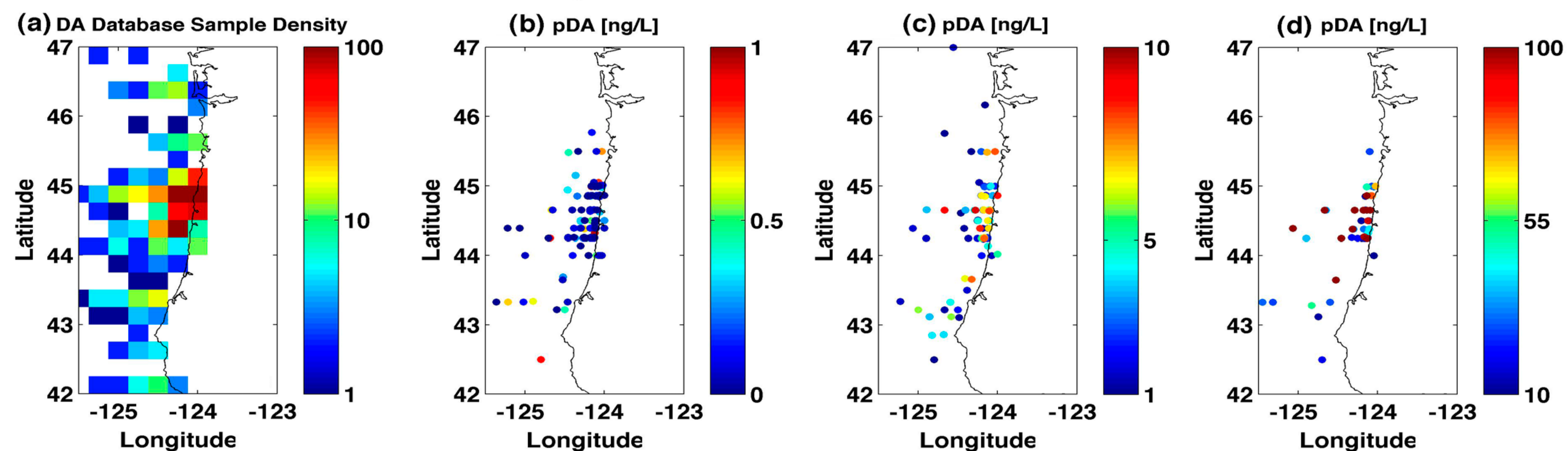
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Predictive logistic regression models are currently being developed to link two types of response variables, the presence or absence of *Pseudo-nitzschia* cells and the presence or absence of domoic acid (DA), with explanatory variables in the form of environmental parameters gathered both *in situ* and via satellite. Our goal is to determine which parameters are the best predictors and which model type is most robust. The foundation of the models is a growing database, currently containing over 1000 discrete particulate and dissolved DA samples from the Oregon and southern Washington coastline. Each sample includes whole water cell counts of *Pseudo-nitzschia*; co-located ancillary biological and physical data; and physical proxies of bloom proliferation, including upwelling intensity and USGS river outflow rates. All models will be developed and tested using the same suite of environmental parameters to allow inter-comparison of performance. Additionally, to test predictive capabilities using remotely sensed data, each model will be tested with satellite products in lieu of *in situ* data. An estimated 300-600 more samples and their ancillary data will be collected each year through at least 2012 and used to both augment the existing database and refine the models.

1. Domoic Acid Sample Database

Figure 1: Panel (a) illustrates the distribution of 1000+ samples collected from 2006-2009. Colors indicate the density of samples obtained in each square. Panels (b)-(d) show concentrations of particulate domoic acid according to location and separated by increasing orders of magnitude for clarity.



2. Model Development

Table 1: Logistic regression models of two types are currently being developed based on the five dichotomous response variables below.

Response (Dependent) Variables	Model Type
1 total number of pseudo-nitzschia cells per liter	Predicts bloom or no bloom based on concentration of <i>pseudo-nitzschia</i> cells
2 number of "medium" pseudo-nitzschia cells per liter	
3 number of "wide" pseudo-nitzschia cells per liter	
4 concentration of particulate domoic acid per liter	Predicts presence or absence of domoic acid based on concentration of toxin
5 concentration of dissolved domoic acid per liter	

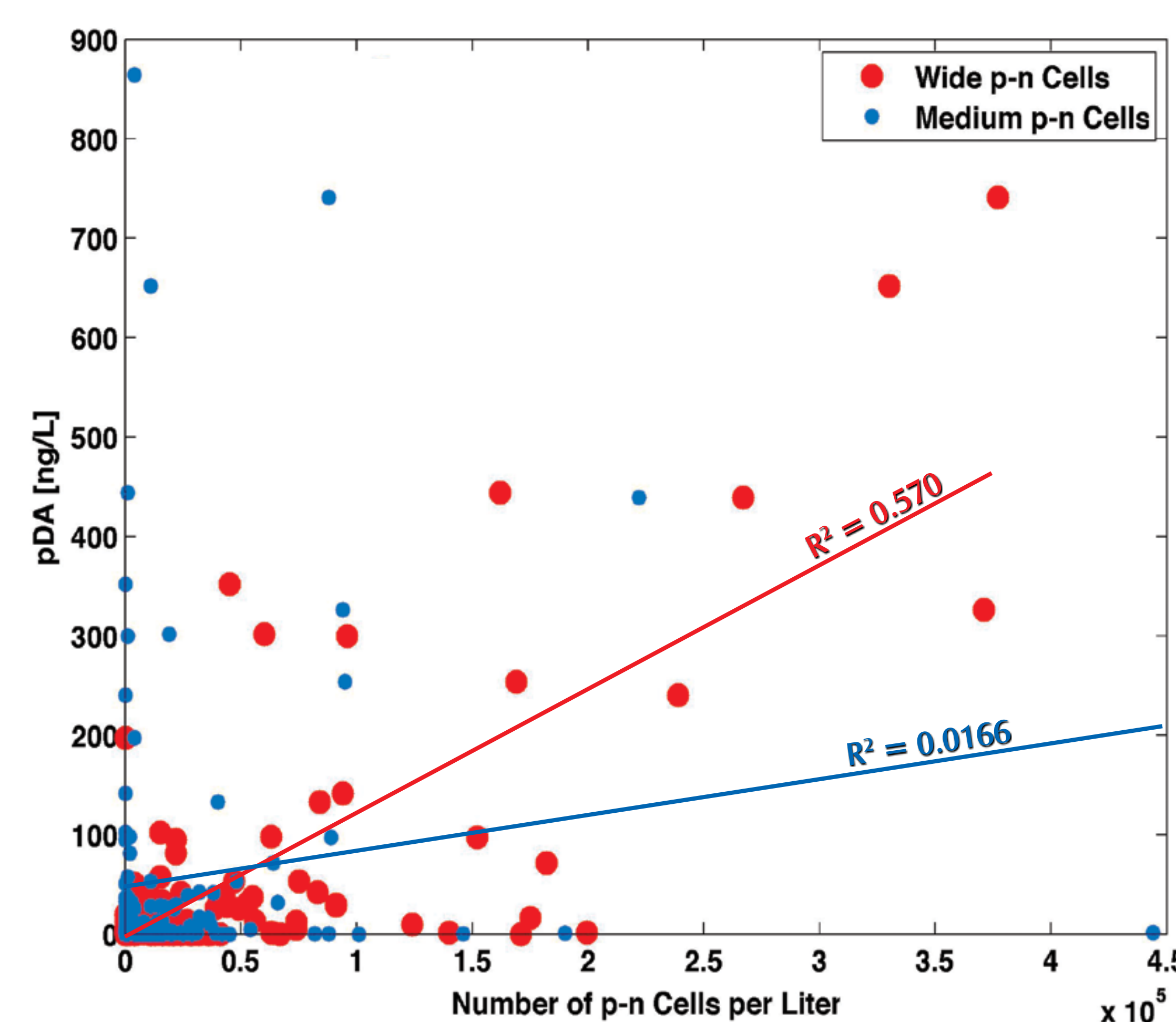


Figure 2: Species variety present in the water may be an important factor. As a result, response variable #1 in Table 1 was split into variables #2 and #3.

Explanatory (Independent) Variables	For Models Based on <i>In Situ</i> Data	For Models Based on Satellite Data
chlorophyll concentration	✓	✓
nitrate concentration	✓	
silicate concentration	✓	
ammonium concentration	✓	
phosphate concentration	✓	
temperature	✓	✓
salinity	✓	
<i>All models will include the same three river discharge and upwelling proxies:</i>		
USGS river discharge from nearest river		✓
USGS river discharge from the Columbia River		✓
upwelling index		✓

Table 2: Backwards step-wise regression will be utilized to determine which combination of these explanatory variables yields the most accurate predictive model for the five cases in Table 1. Each model will also be individually tested based on both *in situ* and satellite-derived data to compare the predictive power of each data source.

3. Data Analysis

Ultimately, each predictive model will have a refined list of explanatory variables, suggesting which are the most significant predictors for the presence/absence of domoic acid and bloom/no bloom conditions. Models will be tested on both a seasonal and annual basis to examine the effects of seasonal variability on predictive performance. Preliminary annual models based on *in situ* data suggest chlorophyll and ammonium concentration may be significant predictors for the presence of DA.