

Statistical guidelines for sampling marine avian populations

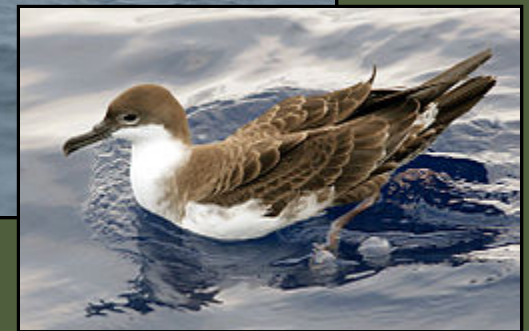
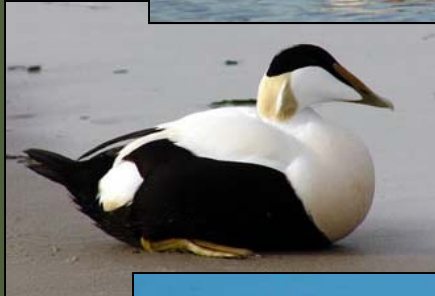
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USGS Patuxent Wildlife Research Center
NOAA National Ocean Service

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Seabirds in the Atlantic



Where are the birds?

Not a lot known about the distribution and abundances in the Atlantic

- Difficult to survey
- Rough conditions
- Patchily distributed
- Highly mobile



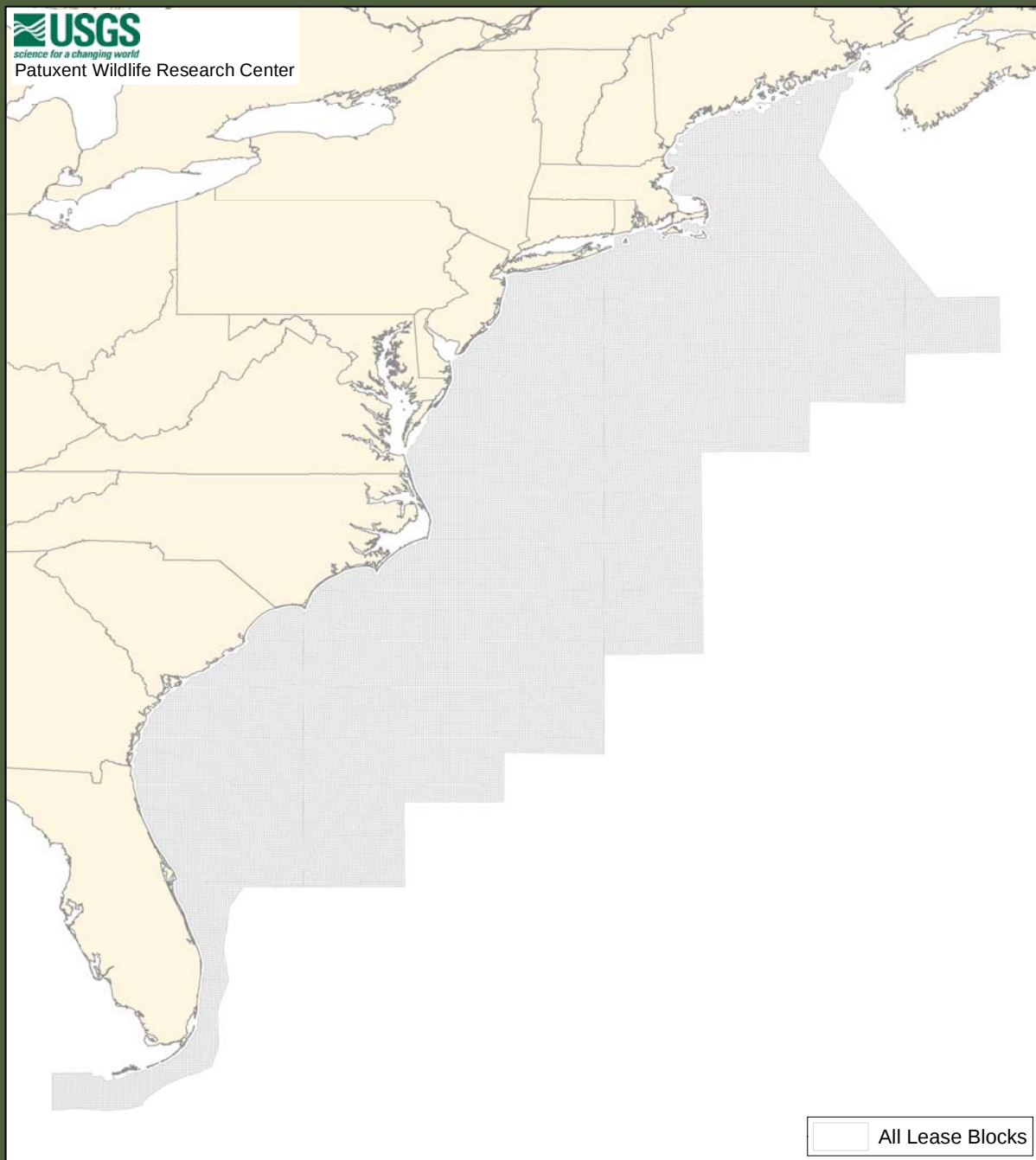
Where are the birds?

Wind development

Off shore wind power
garnering lots of interest

- Many states have implemented a 20% renewable energy by 2020 mandate
- Public perception of oil spills is poor





U.S. Bureau of Ocean and Energy Management (BOEM)

- 5km x 5km lease blocks
- Along the Outer Continental Shelf of the Atlantic Ocean

Objectives

Develop a framework for assessing:

- 1) which lease blocks are “hot spots” and “cold spots”
- 2) the required surveying effort to guide BOEM and industry in determining wind turbine placement

What is a hot/cold spot?

Hot spot = A lease block with an average species specific abundance that is **three** times the mean of the region

Cold spot = A lease block with an average species specific abundance that is **one third** the mean of the region

The Atlantic Seabird Compendium

- >250,000 seabird observations from U.S. Atlantic waters
- Collected from 1978 through 2011
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We used:

- 32 scientific data sets – 28 ship-based, 4 aerial
- Transects were standardized to 4.63km
- 44,176 survey transects representing 463 species

Two part approach

- 1) Determine the best statistical distribution to model the count data for each species in each season
- 2) Use the best fitting distribution to produce power analyses

The rest of the talk

- 1) Describe the broad two part approach
- 2) Integrate an example using Northern Gannets



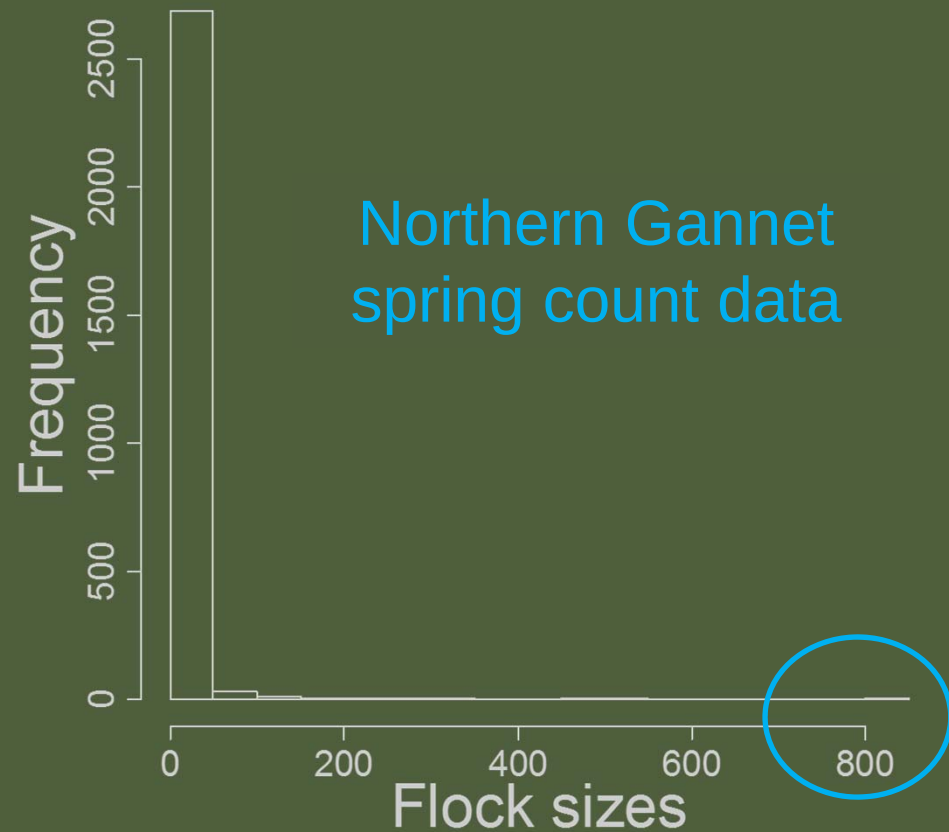
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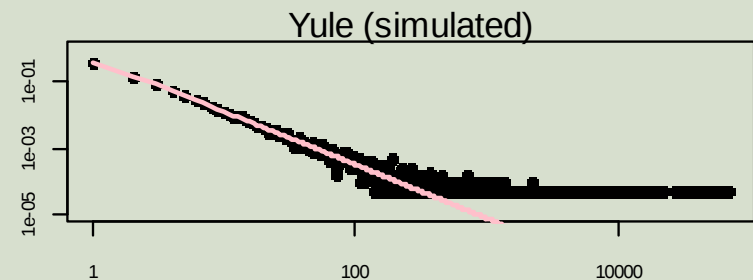
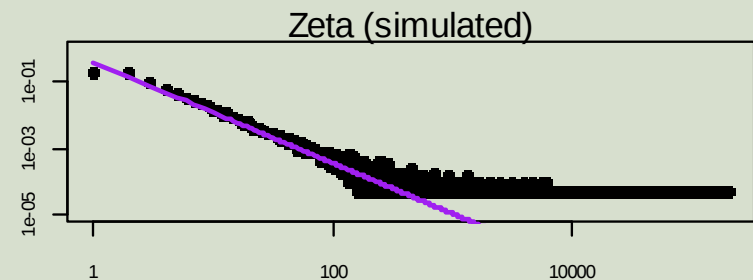
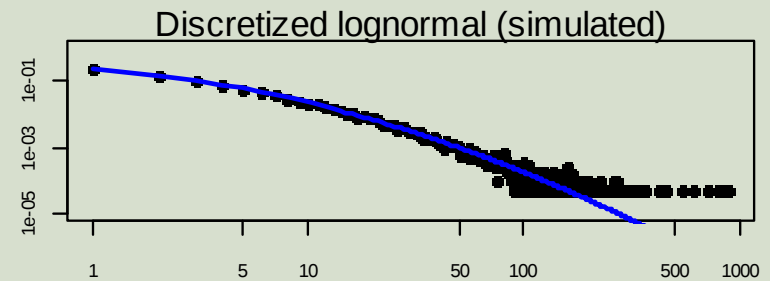
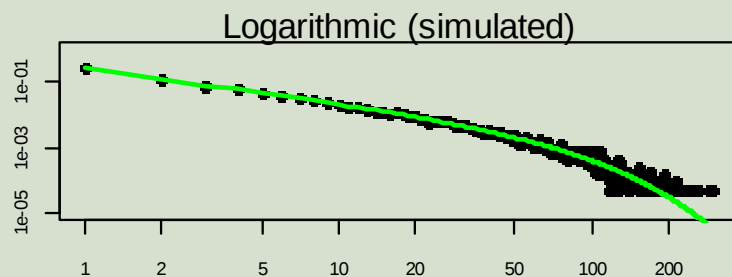
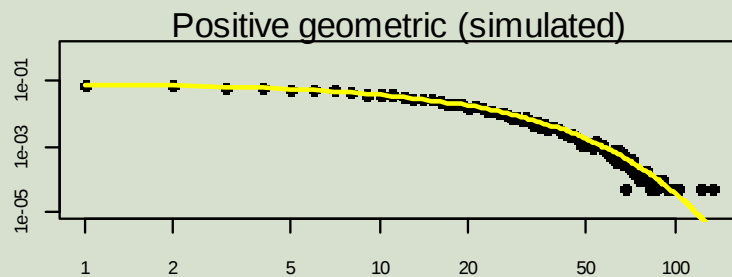
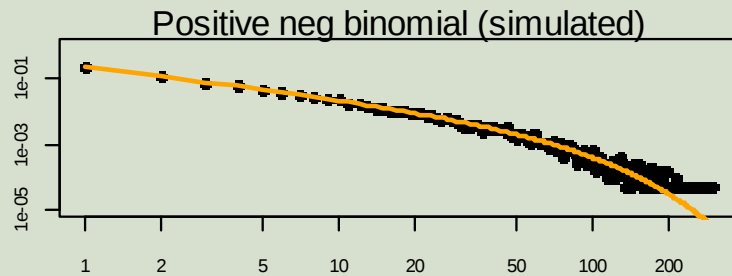
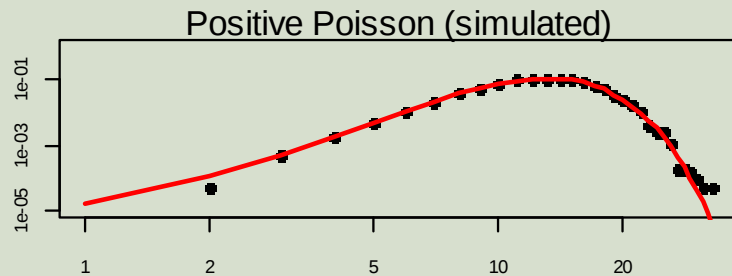
Part 1: Model the data

Test eight statistical distributions:

- Poisson
- Negative binomial
- Geometric
- Logarithmic
- Discretized lognormal
- Zeta decay
- Yule
- Zeta (power law)



Examples of the distributions



Part 1: Results

	Spring	Summer	Fall	Winter	Total
Number species with >500 observations	12	10	15	11	48

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Part 1: Results

	Spring	Summer	Fall	Winter	Total
Number species with >500 observations	12	10	15	11	48
Discretized lognormal	7 (4*)	4 (3*)	8 (3*)	8 (2*)	27 (12*)
Yule	1*	3*	1*	1	1 (5*)
Negative binomial Logarithmic Zeta decay			3*		0 (3*)

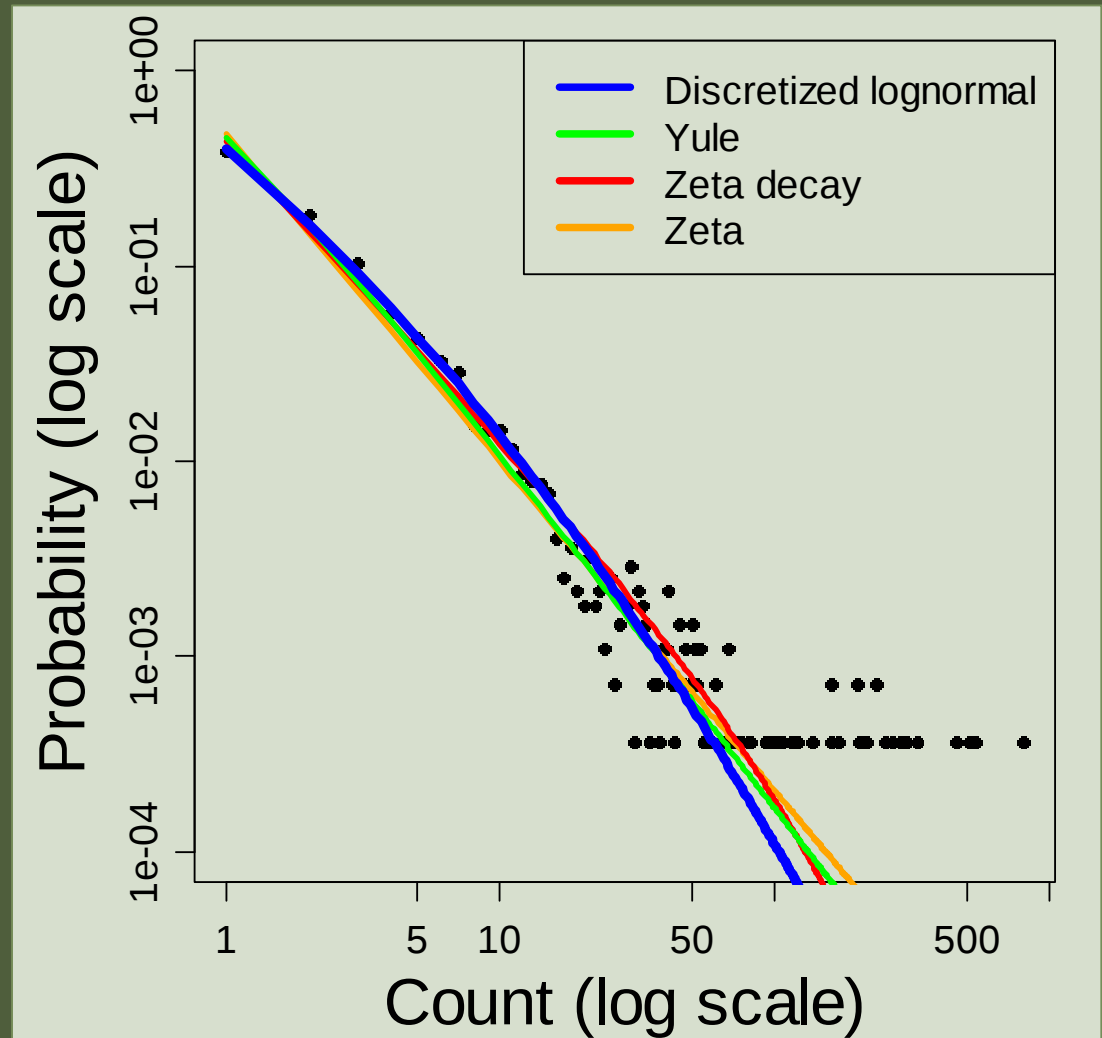
*Not significantly better for $\alpha = 0.05$

Part 1: Results

Northern Gannet

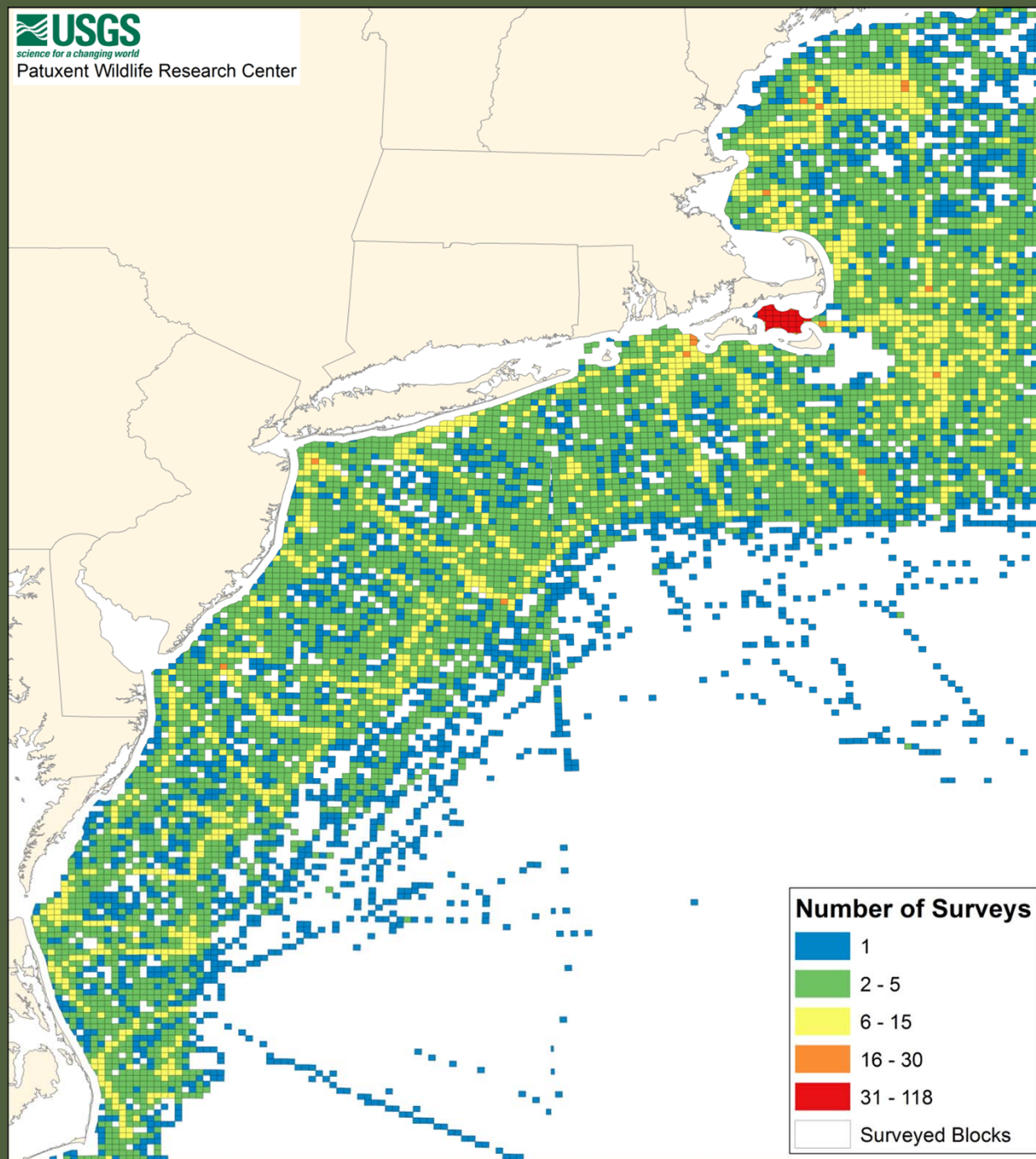
Discretized lognormal
top distribution for fall
and spring

Discretized lognormal
and Yule fit equally well
in winter and summer



Two part approach

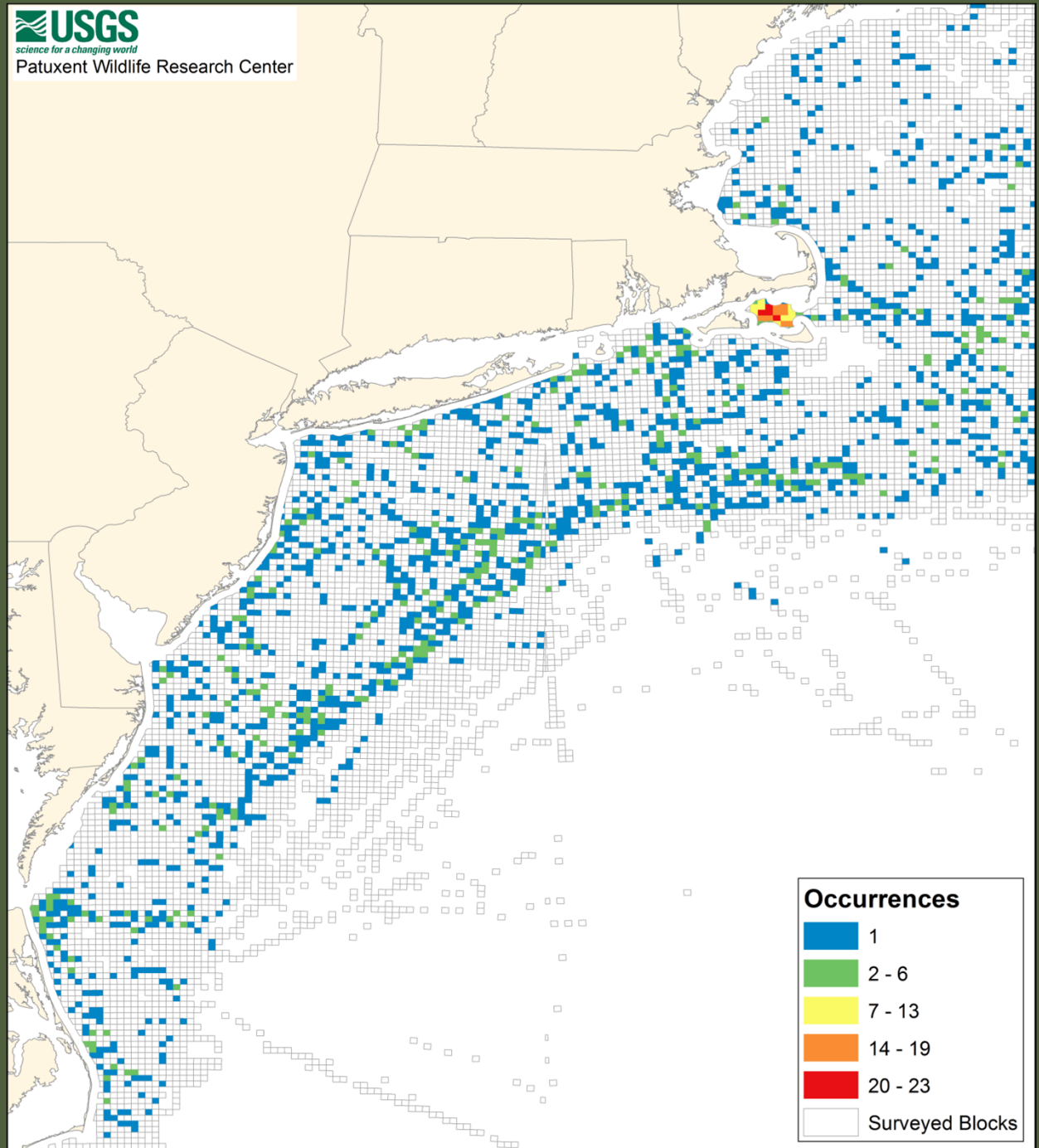
- 1) Determine the best statistical distribution to model the count data for each species in each season
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Part 2: Power analysis

Part 2: Power analysis for Northern gannets in the spring

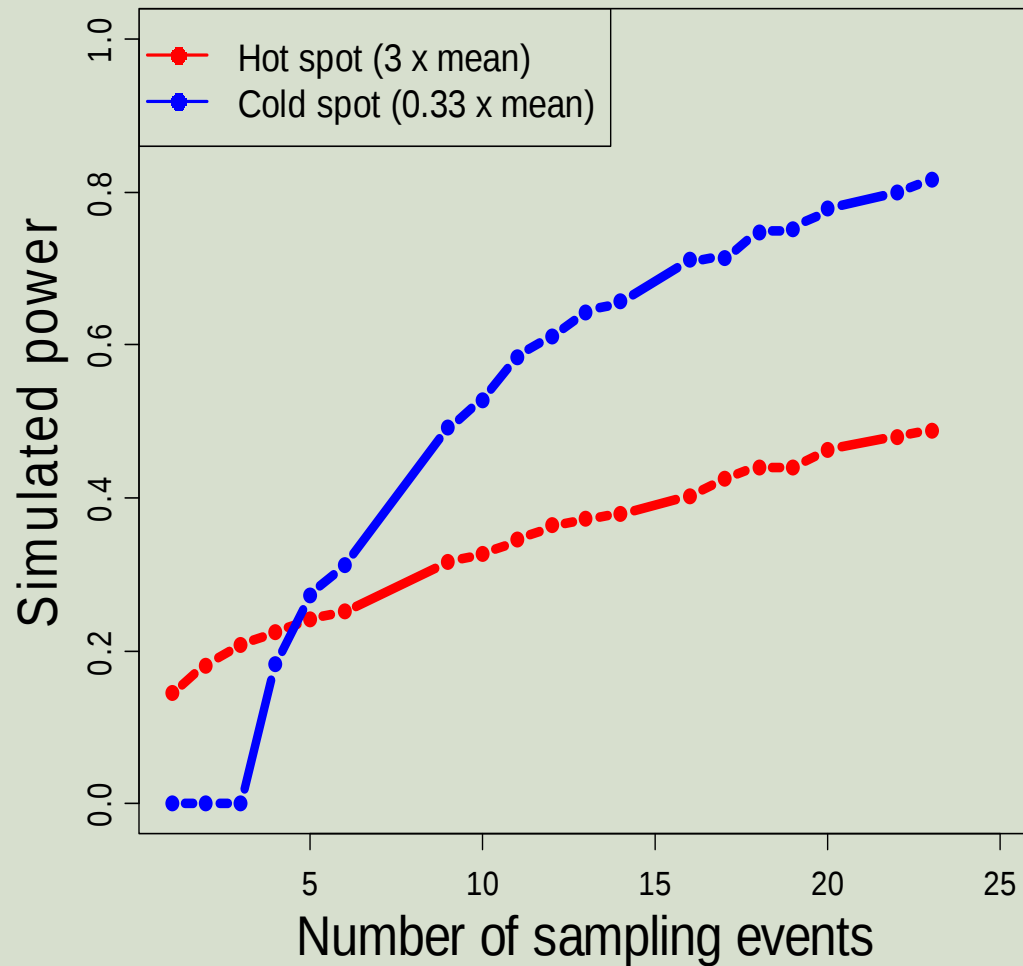
*Focusing only on
lease blocks
where individuals
were observed



Part 2: Northern gannet results

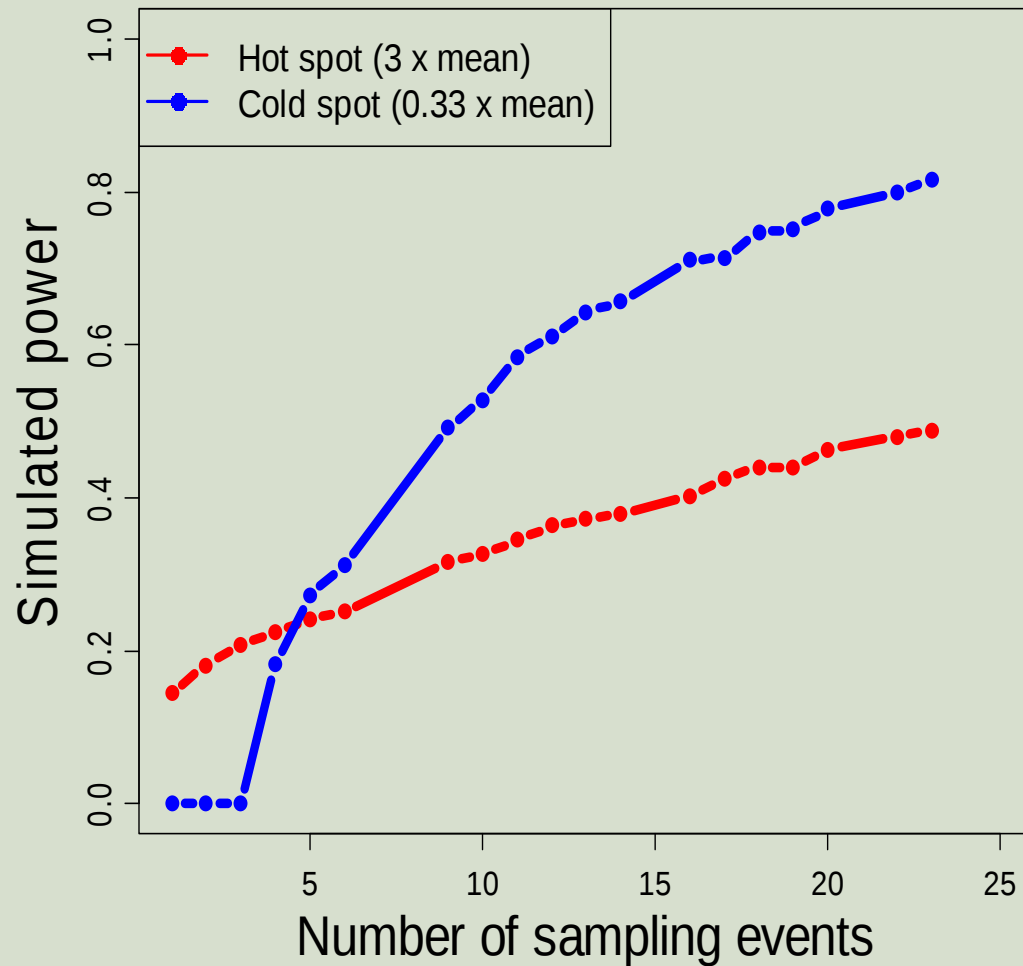
Reference mean = 6.9
individuals per lease
block conditional on
presence

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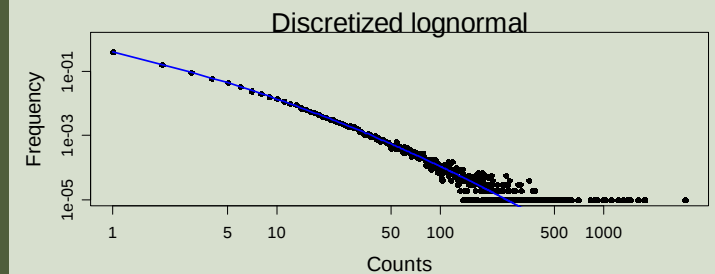


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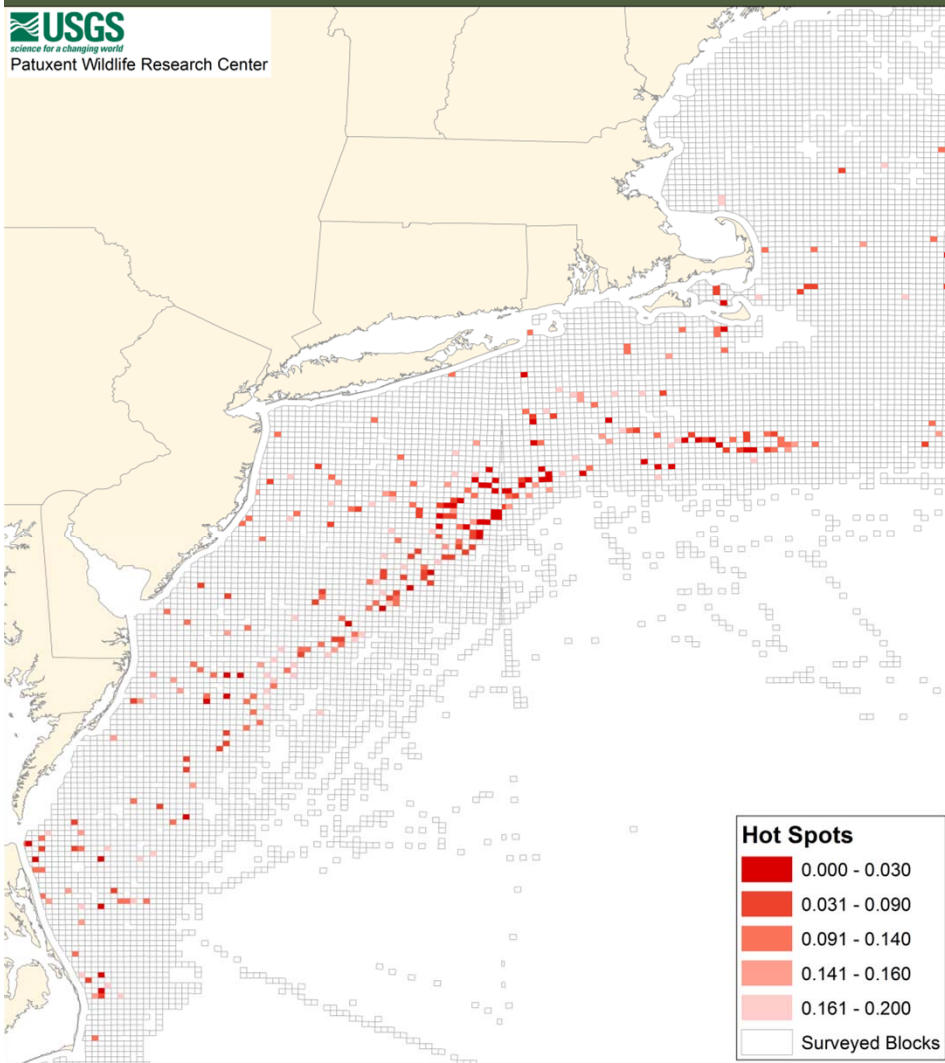


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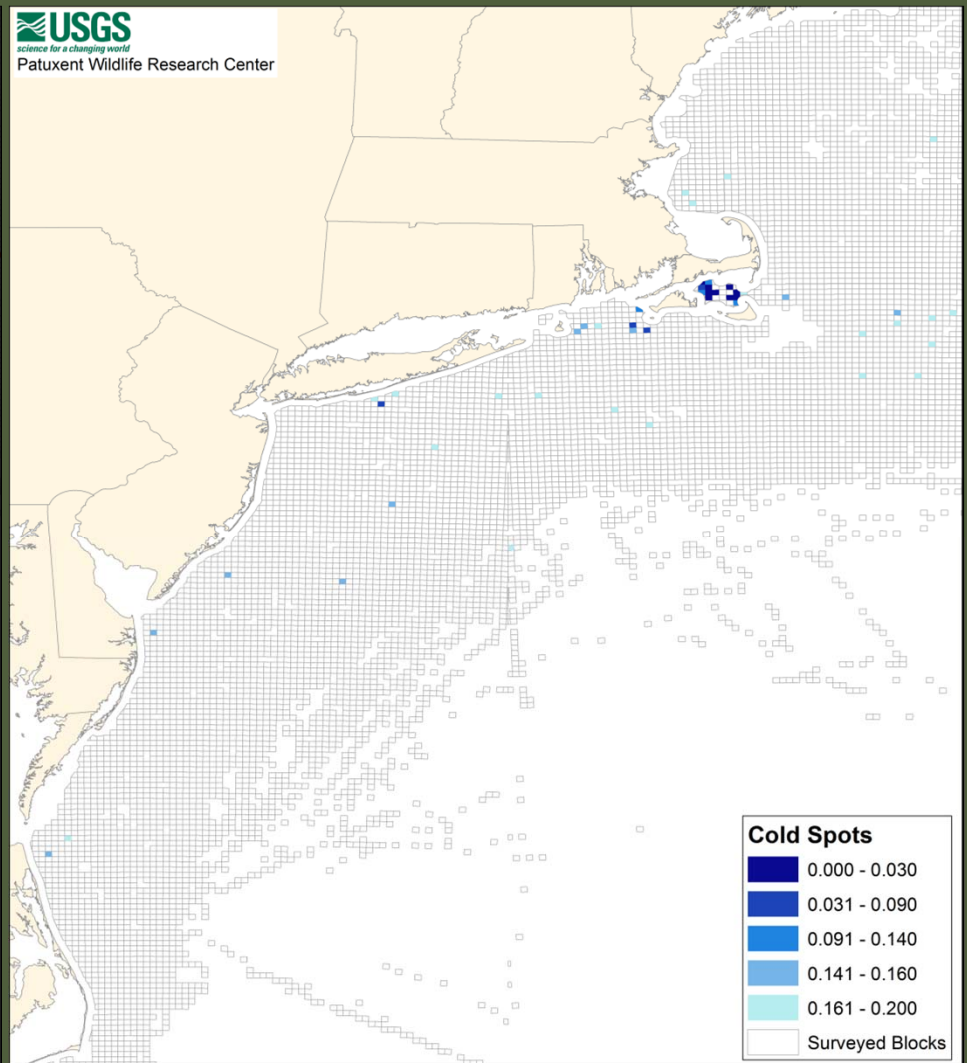


Part 2: Northern gannet results

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Summary of results

- Seabirds tend to be highly aggregated and require skewed statistical distributions to accurately describe populations
- For many species, we need a large number of surveys to detect areas with atypical abundances



Implications for wind power

- Intensive sampling in multiple seasons will be required to determine potential impacts on seabirds
- A possible approach could be to combine data on functionally similar species or species of high conservation value

Acknowledgments

- The many researchers and their crews who collected the data used in our analyses
- Emily Silverman, Diana Rypkema
- The Bureau of Ocean, Energy, Management (BOEM) for funding model development and analysis