Repeated count surveys help standardize multi-agency estimates of American Oystercatcher abundance

A collaborative study

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Co-authors and Collaborators

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Assessing AMOY Abundance

- Numerous threats to local and regional populations
- “Management Concern” USFSW “High Concern” US Shorebird Conservation plan
- NFWF Focal Species for coastal management and conservation planning

Assessing AMOY Abundance

Data challenges:

- Multiple agencies
- Metric of interest
- Detection probability

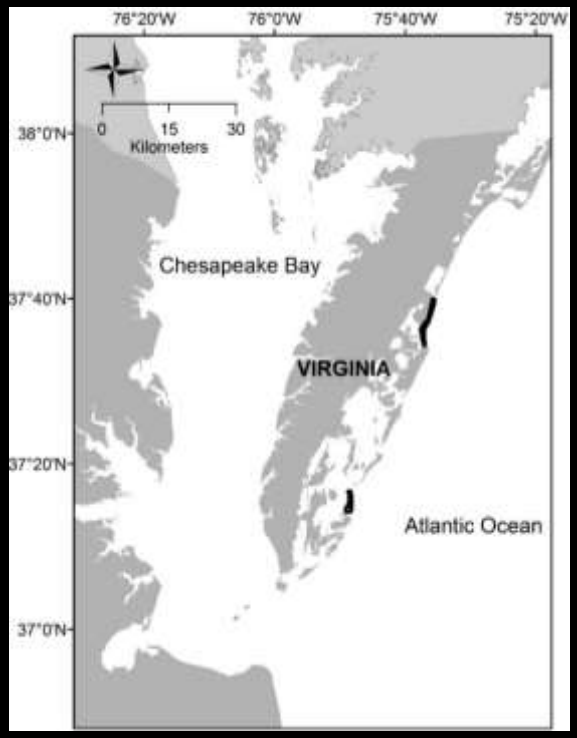
Objectives

1. Develop a standardized multi-partner survey to estimate AMOY breeding season abundance that accounts for imperfect detection

2. Validate use of approximate count metrics that do not require nest searching

Methods – Field Surveys

- 8 agencies surveyed 96 plots in North Carolina (*n* = 93) and Virginia (*n* = 3)



Methods – Field Surveys

- 8 agencies surveyed 96 plots in North Carolina (*n* = 93) and Virginia (*n* = 3)

- Counted AMOY “pairs” and “territories”

Methods – Field Surveys

- 8 agencies surveyed 96 plots in North Carolina (*n* = 90) and Virginia (*n* = 3)
- Counted AMOY "pairs" and "territories"
- Surveys were repeated on multiple occasions to allow estimation of detection probability
  - May-July, 2013
  - 219 total surveys (~2.3 surveys per plot)

Methods - Analysis

- *N*-mixture models (Royle 2004; Lyons et al. 2012)

- Covariates on ABUNDANCE:
  - Plot area
  - State (NC vs VA)

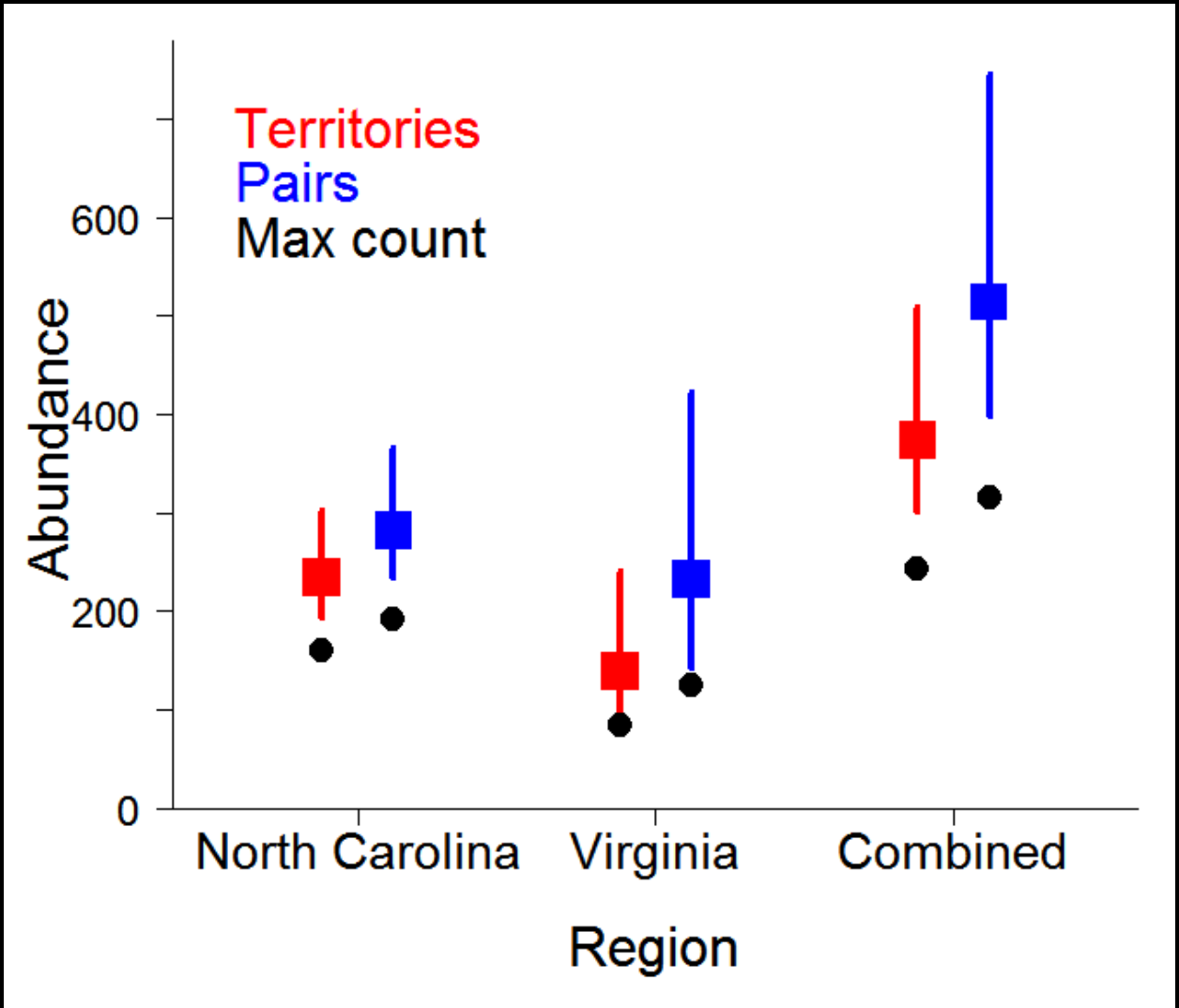
- Covariates on DETECTION :
  - Day-of-year (quadratic)
  - Tide stage
  - Plot location (barrier island vs. coastal bay)

Methods – Validation of Counts

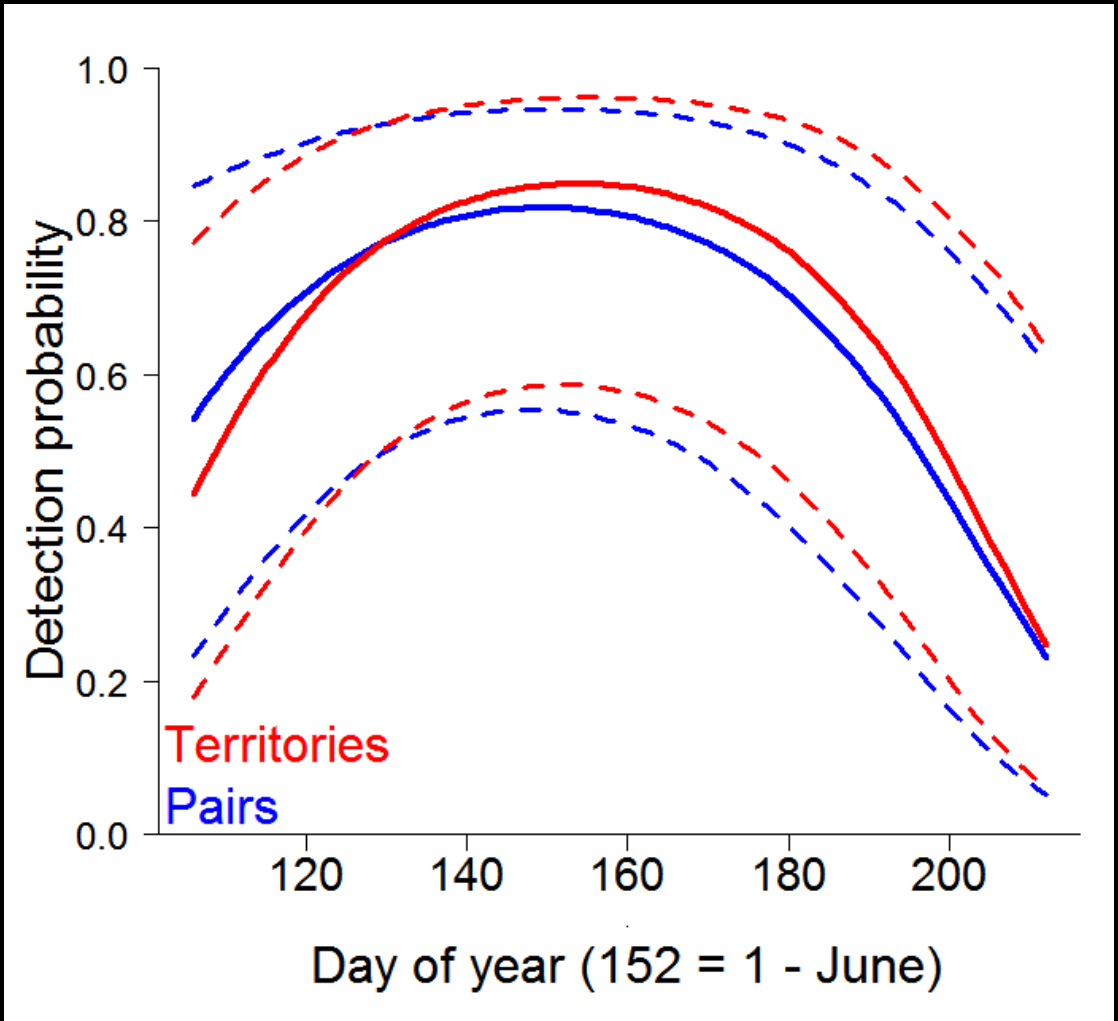
- Intensive nest searching at 13 plots to determine number of breeding pairs (2 - 5 visits per week)

- Compare to estimated:
  - "Pairs"
  - "Territories"
  - (1 - 6 visits per season)

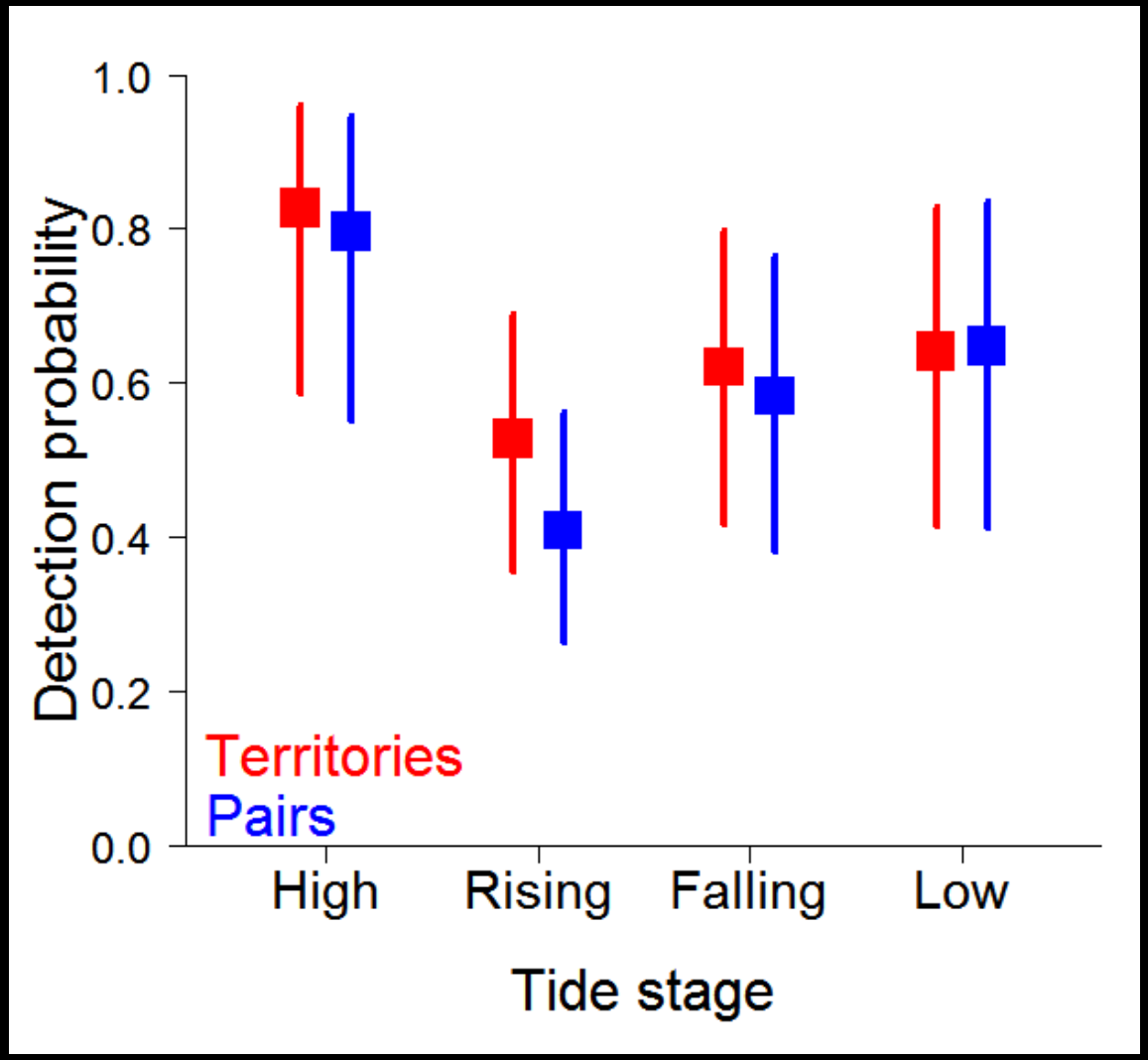
Results – Abundance



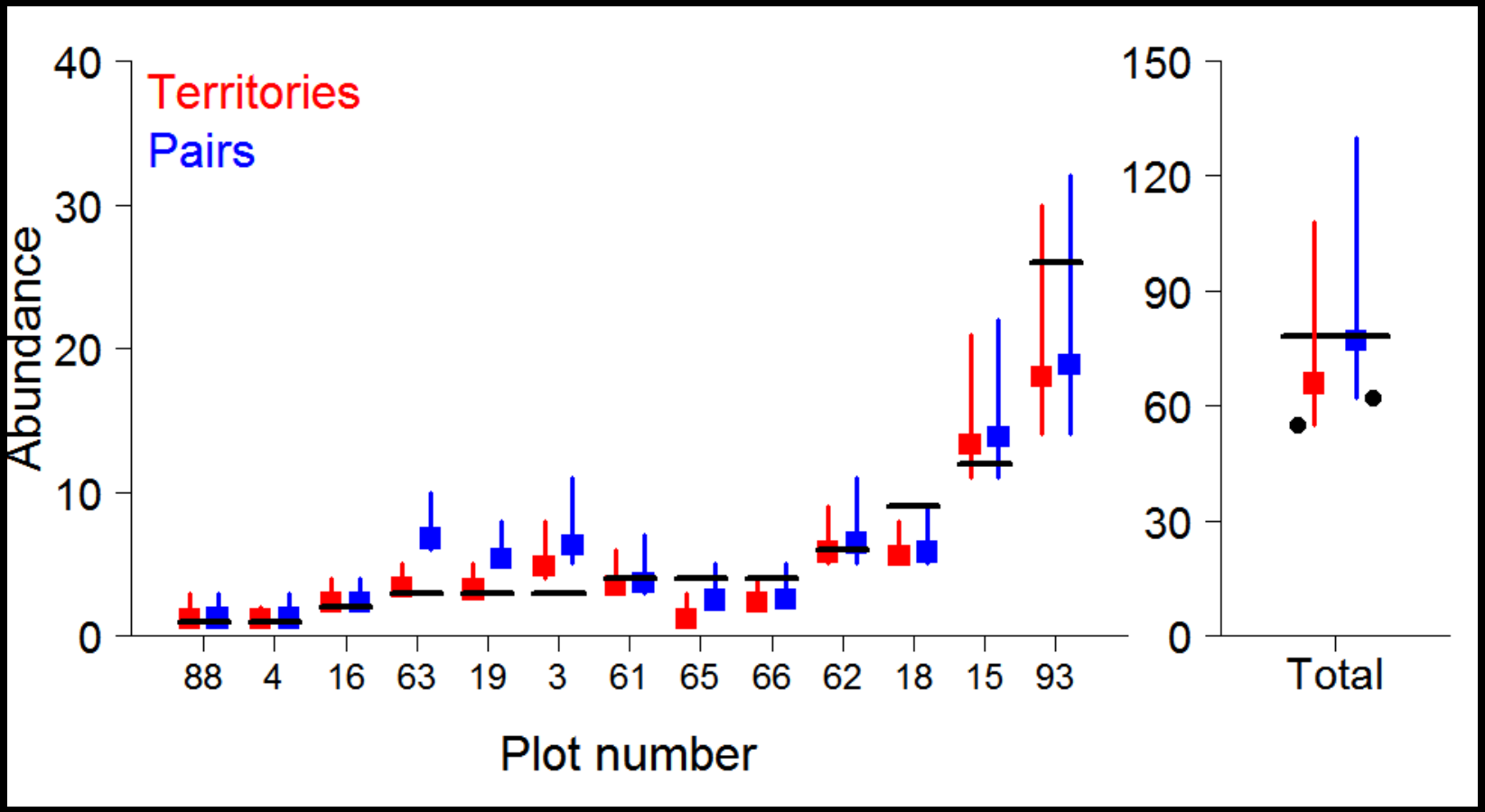
Results – Detection



Results – Detection



Results – Validation



Conclusions

- Collaboration expanded spatial coverage
  - required additional pre-season planning
- Detection probability <1.0
  - Highest during middle of season
- Standardize count metrics

Discussion

- Standardized repeated count surveys provide a method to address state- and range-side AMOY monitoring objectives
- Random sampling will be required to extrapolate results to the larger AMOY population

Acknowledgments

Numerous field technicians and volunteers from:

- Audubon North Carolina
- North Carolina Wildlife Resources Commission
- North Carolina State University
- The Nature Conservancy of Virginia—Virginia Coast Reserve
- Virginia Department of Game and Inland Fisheries
- National Park Service - Cape Hatteras National Seashore and Cape Lookout National Seashore

Extra slides: Statistical Model

ABUNDANCE

$$N_i \sim Poisson(\lambda_i)$$
$$\log(\lambda_i) = \alpha_0 + \alpha_1 S_i + \alpha_2 Log(A_i) + \varepsilon_i$$
$$\varepsilon_i \sim Normal(0, \sigma_\lambda^2)$$

DETECTION

$$y_{i,j} \sim Binomial(N_i, p_{i,j})$$
$$\text{logit}(p_{i,j}) = \beta_0 + \beta_1 TR_{i,j} + \beta_2 TF_{i,j} + \beta_3 TL_{i,j} + \beta_4 DOY_{i,j} + \beta_5 {DOY_{i,j}}^2 + \beta_6 PL_i + \delta_{i,j}$$
$$\delta_{i,j} \sim Normal(0, \sigma_p^2)$$

- Analyzed in a Bayesian framework using JAGS and R
- 1,000 adaptation; 20,000 burn-in; and 80,000 posterior iterations

Extra slides: Parameter Estimates

	Territories		Pairs	
	Mean	95% BCI	Mean	95% BCI
ABUNDANCE (log scale)				
α_0 (North Carolina, mean log area)	0.23	(-0.26, 0.68)	0.51	(0.08, 0.91)
log(area)	0.40	(0.05, 0.75)	0.42	(0.11, 0.74)
State - Virginia	3.20	(1.75, 4.82)	3.40	(2.07, 4.77)
σ_λ	1.17	(0.82, 1.61)	1.07	(0.77, 1.43)
DETECTION (logit scale)				
β_0 (high tide, barrier island, mid-season)	1.72	(0.35, 3.21)	1.50	(0.21, 2.88)
doy	0.08	(-0.28, 0.44)	-0.09	(-0.47, 0.25)
doy^2	-0.55	(-0.90, -0.26)	-0.46	(-0.77, -0.19)
Location - coastal bay plot	0.41	(-0.47, 1.29)	0.76	(-0.09, 1.63)
Tide - rising	-1.61	(-2.92, -0.50)	-1.88	(-3.16, -0.78)
Tide - falling	-1.21	(-2.45, -0.18)	-1.15	(-2.34, -0.09)
Tide - low	-1.12	(-2.35, -0.04)	-0.85	(-2.02, 0.26)
σ_p	1.04	(0.44, 1.72)	1.06	(0.48, 1.66)