NORTH ATLANTIC LANDSCAPE CONSERVATION COOPERATIVE GRANT
2012 PROGRESS REPORT

Quarter: (circle one)   2013 1st   2013 2nd   (2013 3rd)   2013 4th

Grant Number and Title: NALCC 2011 (11) Mapping Marine Birds NW Atlantic: Phase 1

Grant Receipt/Organization: NCSU

Grant Project Leader: Gardner

Were planned goals/objectives achieved last quarter? Yes

NALCC Conservation Need Addressed:

Progress Achieved: (For each Goal/Objective, list Planned and Actual Accomplishments)

1. Develop models for estimation of sea bird distributions, particularly in regards to potential areas of aggregation
   Planned Goal – Determine new ideas for modeling and assess their convergence and goodness of fit, and create predictive maps for different species
   Accomplished – We formulated and fit a double-hurdle model to separate and give better interpretation to the different components of the count data: zero counts, typical counts, and extreme counts. Since the likelihood can be evaluated separately in the double-hurdle model, computation time is faster. We changed the temporal random effects in the model from a quadratic function to a Fourier basis function over time.

2. Determine statistically appropriate models for assessing risk
   Planned Goal – Determine appropriate model diagnostic tools to compare different models.
   Accomplished – We created risk maps using the double-hurdle model described above. We decided to compare models using the DIC statistic. For a particular seabird, we compare models with and without an extreme-count component, with and without spatial random effects, with and without temporal random effects, and models with varying sets of biophysical covariates.
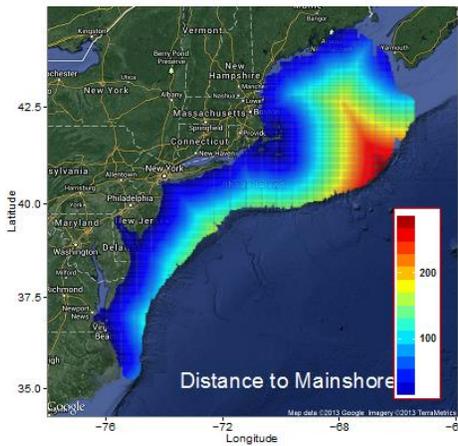
Summary of Progress: (Provide a paragraph describing progress, work to come, and timelines)

We decided to fit the double-hurdle model in which the count data is separated into zero-counts, typical-counts, and extreme counts. The likelihood is such that the three components can be computed and updated separately, making computation faster than a pure mixture model. The assumption in our hurdle model is that different mechanisms are generating the zero counts and the non-zero counts. This differs from the assumption in a generic zero-inflated model, where the distribution contains excess zeros in addition to true zeros. Our double-hurdle model probability distribution is shown below.
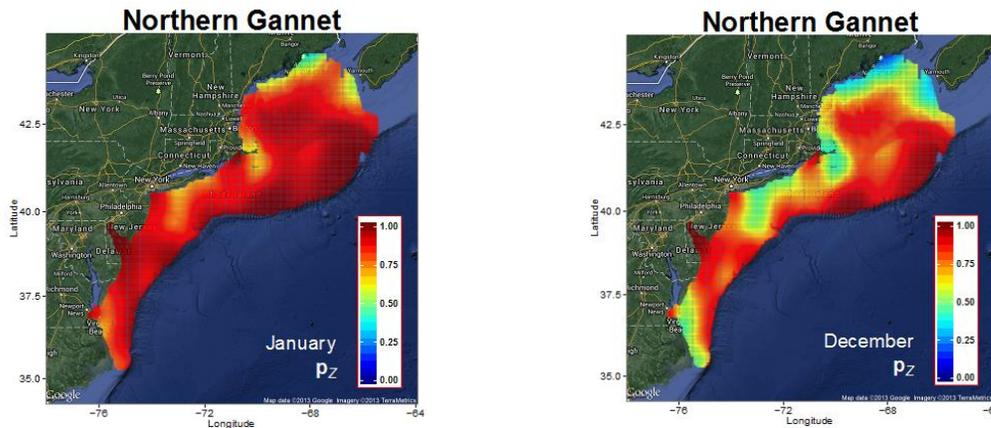
$$P(y|\theta) = \begin{cases} 1 & \text{if } y = 0, \\ f(y|\theta) \sim NB(m, r) & \text{if } 1 \leq y < \mu, \\ g(y|\theta) \sim GPD(\mu, \sigma, \xi) & \text{if } y \geq \mu, \end{cases}$$

Several covariates we have made changes to are the temporal random effects and the distance-to-shore (DTS) variable. We noticed that predicted values during one calendar year seem to follow smoothly from January to December, but the transition between December and January of the following year is abrupt. We determined this was because of the quadratic function used to model the month effect, but we have resolved this using a Fourier basis expansion shown below. We have also recalculated DTS using the haversine formula for the distance between geographic longitudes and latitudes of the observed point and the nearest shore, instead of using Euclidean distance with Cartesian coordinates. We also included the Nova Scotia shoreline.

$$\mathbf{X}\beta = \beta_0 + \beta_1 SST + \beta_2 BATH + \beta_3 CHL + \beta_4 DTS + \beta_5 \sin(\frac{\pi}{6}MON) + \beta_6 \cos(\frac{\pi}{6}MON)$$
$$+ \beta_7 \sin(\frac{\pi}{3}MON) + \beta_8 \cos(\frac{\pi}{3}MON) + \beta_9 \sin(\frac{\pi}{2}MON) + \beta_{10} \cos(\frac{\pi}{2}MON)$$

Using the new double-hurdle model, we created risk maps for the Common Eider, Greater Shearwater, Northern Gannet, Long-tailed Duck, Wilson's Storm Petrel, Herring Gull, Great Black-backed Gull, and Surf Scoter. We presented results in an NALCC webinar as well as in the Joint Statistical Meetings and the Institute of Mathematical Statistics Conference in Montreal, Canada.

Difficulties Encountered:
- There are some convergence issues with count distributions that include very extreme counts, such as the Common Eider, which contain count values up to 50,000.
- The threshold value for extreme counts is chosen using some ad-hoc procedures. We may need to make the

choice more consistent and objective using some type of automatic selection.
- For some situations, the calculation of DIC does not work because of possibly non-symmetric or multi-modal posterior distributions. We are looking into possible misspecification of priors or a convergence issue with some regression coefficients or negative binomial parameters.
- Predicted values follow smoothly from January to December, but transitions abruptly between December and January. Like explained above, we have resolved this using a Fourier basis function.

Activities Anticipated Next Quarter:
- Place a prior on the extremes threshold value and estimate it automatically
- Explore different distributions for the three components in the mixture model.
- Make sure the parameters are all converging.
- Create updated risk maps.
- Draft a paper for journal publication.

Expected End Date: 12/31/2013 (we are asking for a no-cost extension, given the time each model requires to run)

Costs:

Funds Expended to Previous to this Report: 66056.52
Amount of NALCC Funds Requested within this Report: 20653.87
Total Approved Budgeted NALCC Funds: 115,000.00

Are you within the approved budget plan?   yes

Are you within approved budget categories? yes

Signature: *Beth Gardner*

Date: 10/15/2013

NORTH ATLANTIC LANDSCAPE
CONSERVATION COOPERATIVE GRANT
2013 PROGRESS REPORT

Quarter: (circle one)   2013 1st 2013 2nd (2013 3rd)   2013 4th

Grant Program, Number and Title: Sub-award Number 2011-13: MAPPING THE DISTRIBUTION, ABUNDANCE AND RISK ASSESSMENT OF MARINE BIRDS IN THE NORTHWEST ATLANTIC: PHASE 1: SUBPROJECT – SEABIRD PREDICTIVE MONITORING INTEGRATION

Organization: CONSOLIDATED SAFETY SERVICES, INC.

Project Leader: Brian Kinlan, Ph.D.

Abstract: Please provide a short (1-2 paragraphs) abstract that addresses EACH of the following: the objectives of your project, accomplishments to date, future plans and timelines with an estimate for when the project will be completed.

Objectives: The goal of this project is to demonstrate an improved framework for marine bird risk assessment in the U.S. North Atlantic that integrates spatial patterns in seabird occurrence and abundance with information on species-specific vulnerability and sensitivity to potential impacts from marine offshore wind development. This sub-award supports a small amount of Dr. Kinlan's time and his travel expenses to participate in relevant workshops and meetings, and to coordinate with other sub-award PIs, to make his marine bird predictive modeling results for the New York Bight and Mid-Atlantic available to demonstrate approaches for marine bird risk assessment.

Previous work: Initial discussions among sub-award PI's took place via email and phone in the 2nd quarter of 2012. In the 3rd quarter of 2012, sub-award PI's Brian Kinlan and Beth Gardner (NC State) met in Silver Spring on July 24. They discussed recent seabird modeling results and approaches and made plans for coordinated work once the NC State Postdoc is hired this Fall. These discussions continued in the 4th quarter of 2012. On December 21, 2012, a day was spent on data analysis, data processing and project-related communication. In the 1st quarter of 2013, Dr. Kinlan traveled to attend two face-to-face project-related meetings/workshops, where he presented and discussed marine bird spatial risk assessment modeling in the mid-Atlantic. These meetings included time spent in discussions with other sub-award PI's and collaborators. In February, Kinlan participated and presented in a special session on marine spatial planning and seabirds at the Pacific Seabird Group annual meeting in Portland, OR. In March, Kinlan attended and presented at the Atlantic Marine Bird Conservation Cooperative meeting in Charleston, SC. In the 2nd quarter of 2013, Dr. Kinlan conducted project related coordination and communication via an All-Hands conference call on 5/17/2013 and one-on-one emails and phone calls with NALCC project manager Scott Schwenk, PI Dick Veit, PI Bath Gardner, PI Andrew Gilbert, and other project personnel. Kinlan also wrote an abstract for a synthesis webinar planned to be given in August for the NALCC, and worked with other PI's to synthesize project results to date and begin assembling webinar presentation.

Work that took place this quarter (2nd quarter of 2013): On July 1, 2013 Kinlan organized and led an all-hands conference call during which results from all other PI's were reported and synthesized and detailed plans were made for the NALCC webinar scheduled for August 8, 2013. Kinlan took the lead on followup from this call, developing an outline of the webinar and introductory material, as well as his own section. Final preparation of the webinar presentation, the webinar itself, and followup from the webinar (2 days of time on

August 7-8, 2013) were covered by in-kind matching labor supported by another related project (Mid-Atlantic Seabird Modeling-USGS/BOEM/NOAA). Thus, although at least 3 days were devoted to activities related to this project in this quarter, only 1 day of support is requested from WMI under this contract.

The abstract of the NALCC synthesis webinar, written by Kinlan, is provided below. The slides of the webinar are available on request.

NALCC WEBINAR ABSTRACT
Mapping the Distribution, Abundance and Risk Assessment of Marine Birds in the Northwest Atlantic Ocean: Phase I, Proof of Concept and Techniques Development
Beth Gardner(1), Brian Reich(1), Earvin Balderama(1), Andrew Gilbert(2), Kate Williams(2), Brian Kinlan (3), Robert Rankin (3), and Richard Veit (4)
1. NC State; 2. Biodiversity Research Institute; 3. NOAA-NCCOS-Biogeography Branch; 4. CUNY-Staten Island
In this seminar, we will discuss progress towards developing maps depicting the distribution, abundance and relative risk to marine birds from offshore activities (e.g., wind energy development) in the northwestern Atlantic Ocean. Our goal in this effort is to develop and demonstrate techniques to document and predict areas of frequent use and aggregations of birds and the relative risk to marine birds within these areas. The resulting map products are intended to help inform decisions about siting offshore facilities; marine spatial planning; and other uses requiring maps of seabird distributions. This NALCC project is supporting several components of map and technique development by leveraging several large, ongoing projects funded by BOEM, DOE, USGS, and NOAA and involving research groups at the Biodiversity Research Institute, NC State University, CUNY-Staten Island, the USGS Patuxent Wildlife Research Center, and the NOAA National Centers for Coastal Ocean Science-Biogeography Branch.

Future plans and timelines: The 4th quarter of 2013 is the final quarter of funding for this project. Approximately 10 hours of support for Kinlan's time remain. This time will be used for final wrap-up of project, including an email to other PI's summarizing accomplishments, and preparation and provision of links to downloadable reports and digital data packages containing all relevant results of Kinlan's predictive modeling work for marine birds in the NY Bight and U.S. Mid-Atlantic. This will facilitate other PI's work to incorporate Kinlan's work into their final products, as appropriate. Final email and phone communications will emphasize linking this effort to other ongoing efforts to ensure lasting and synergistic impacts. No additional travel is planned. This project is expected to be completed by December 31, 2013.

Were planned goals/objectives achieved last quarter?
YES

Progress Achieved: (For each Goal/Objective, list Planned and Actual Accomplishments)
This project has one deliverable: "Participation in project-related meetings, workshops, phone calls, and email communication". This goal was met this quarter through Kinlan's co-lead role in coordinating, preparing, and carrying out the NALCC synthesis webinar, coordinating and facilitating PI phone meetings and email exchanges, project coordination calls and emails with NALCC management (Scott Schwenk), and Kinlan's contribution of the mid-Atlantic marine bird predictive modeling results section to the webinar.

Difficulties Encountered:
NONE

Activities Anticipated Next Quarter: Final wrap-up of project, including an email to other PI's summarizing accomplishments, and preparation and provision of links to downloadable reports and digital data packages containing all relevant results of Kinlan's predictive modeling work for marine birds in the NY Bight and U.S. Mid-Atlantic. This will facilitate other PI's work to incorporate Kinlan's work into their final products, as appropriate. Final email and phone communications will emphasize linking this effort to other ongoing efforts to ensure lasting and synergistic impacts.

Expected End Date: On or before December 31, 2013

Costs:

        Total life to date expenses (include this quarter): $9,274.39

        Total Approved Budgeted Funds: $10,000.00

        Are you within the approved budget plan and categories? YES

Signature:

Date: 10/10/2013

NORTH ATLANTIC LANDSCAPE CONSERVATION COOPERATIVE GRANT
2013 PROGRESS REPORT

Quarter: (circle one)   2013 1st 2013 2nd 2013 3rd 2013 4th

Grant Program, Number and Title: 2011-14 Best Darn Bird Map

Organization: Biodiversity Research Institute

Project Leader: Andrew Gilbert

Abstract: Please provide a short (1-2 paragraphs) abstract that addresses EACH of the following: the objectives of your project, accomplishments to date, future plans and timelines with an estimate for when the project will be completed.

The Best Darn Bird Map project will pull together existing information on marine bird distribution and abundance, including modeled distributions, vessel and aerial survey information, and data from individually marked birds, and create mapping products useful for planning uses of the marine environment, including sighting alternative energy projects.

The objectives of our contribution to the BDBM are to 1) produce model data appropriate for BDBM and 2) deliver seabird model input for BDBM.

We have continued to compile the latest seabird data to date and are working with modelers at NC State and USGS database personnel to provide the latest and highest quality data for modeling. We will continue to work at least through summer 2013 so that the latest model runs can use the most up to date data.

Were planned goals/objectives achieved last quarter? Yes.

Progress Achieved: (For each Goal/Objective, list Planned and Actual Accomplishments)

1. Consult with project PI and USGS to produce model data appropriate for BDBM.

   Actual - We have continued to work to update seabird database with the latest survey data having now compiled 14+ datasets. We have continued cooperation with Beth Gardner to insure highest quality data as well as modeler Brian Kinlan from NOAA to plan for his future needs.

2. Deliver seabird model input for BDBM
   Actual – in progress with USGS help – waiting for government to reopen. Many datasets ready to upload to the Compendium.

Difficulties Encountered:
US Government shutdown has kept us from loading datasets. This will be resolved this fall we hope.

Activities Anticipated Next Quarter:

Finish compiling and adding data to the Atlantic Seabird Compendium to update the database with the latest seabird data for the Atlantic.

Expected End Date: December 2014

Costs:

Total life to date expenses (include this quarter): $8132.71

Total Approved Budgeted Funds: $9967

Are you within the approved budget plan and categories?YES

Signature:

Andrew T. Gilbert

Date: 10/15/2013