A Remote Sensing and Radio Telemetry Biosecurity Mechanism for the Poultry Industry

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Introduction

- Risk of avian influenza virus (AIV) in commercial poultry operations is increased due to interactions with wild waterfowl.
- NEXRAD radar network provides comprehensive novel data of aggregate bird distributions.
- Radio telemetry of waterfowl provides data of individual bird activity.
- Need for combining available data streams to create a multi-faceted and interactive biosecurity tool for the industry, along with other professional applications.

Objectives

1. Validate use of radar to quantify waterfowl in the airspace and at the ground with telemetry data.
2. Quantify waterfowl-poultry farm proximity as an AIV risk assessment.
3. Generate species-specific wintering waterfowl distribution maps for the mid-Atlantic and California.
4. Model changes in waterfowl distributions as a function of abiotic and biotic factors (e.g., hunting seasons, seasonal progression).

Acknowledgements

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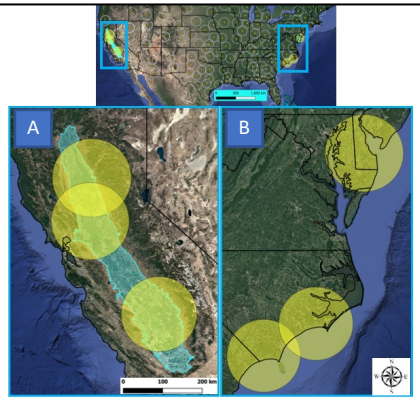
Study Area and Methods

- Regions of high poultry farm densities within the Mid-Atlantic and California Central Valley (i.e., two major waterfowl flyways).
- Winter considered Nov 1st - Mar 15th for 2019-2022.

Figure 1. NEXRAD network (top center) with CA Central Valley (A), and Mid-Atlantic (B) study areas shown.



Radar

- Six radars (3 CA, 1 DE, 2 NC)
- A single radar scan every 5-10 minutes. 24-hour/day (~144-360 scans per day).
- Create monthly summaries of radar reflectivity (i.e., bird density aloft) across scans

Radio-Telemetry

- GPS/GSM telemetry devices (Ornitela) applied to Canada Geese (N=14), Snow Geese (N=70) with locations every 15 min
- Movement rate can be used to classify activity type (i.e., flying, walking/swimming, resting).
- Quantify behavior as activity budgets, bioenergetics, net displacement, and poultry house proximity.
- Linear regression and GAM approach.

Preliminary Results

- Telemetry and radar data show similar hotspots of waterfowl distributions and create theoretical shedscape in Mid-Atlantic
- Waterfowl sometimes occur in close proximity to poultry facilities with direct interface observed
- 22.8% of points (N=45,596) considered high-risk.
- Flight is energetically costly, 3.5% of overall movement.

Figure 2. Theoretical AIV shedscape with waterfowl-poultry farm interface shown (inset). Data for both radar and telemetry combined from winters of 2019-2020 and 2020-2021

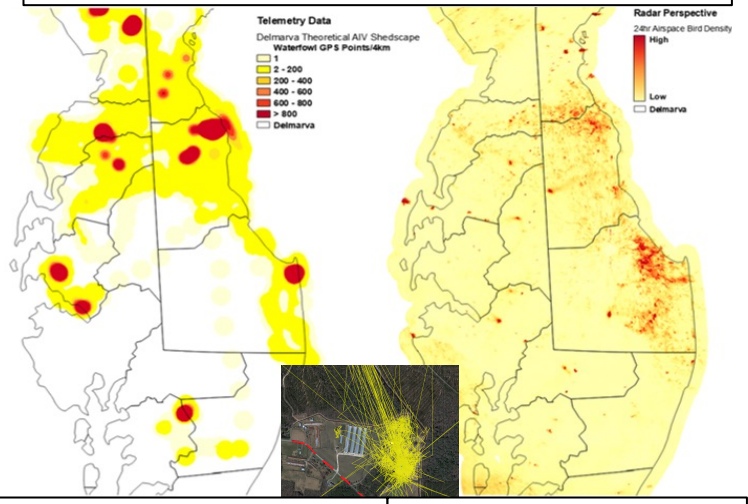


Figure 3. Activity type composition (N=200,764) of Canada Geese and Greater Snow Geese

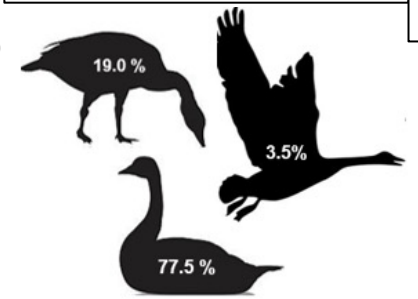


Figure 4. Waterfowl-poultry interface risk. Nearest neighbor analysis. Individual waterfowl points (N=200,764) and poultry farms (N = 6,013).