Identifying Stopover Sites for Migrating Passerine Birds in the Lower Chesapeake Bay Region

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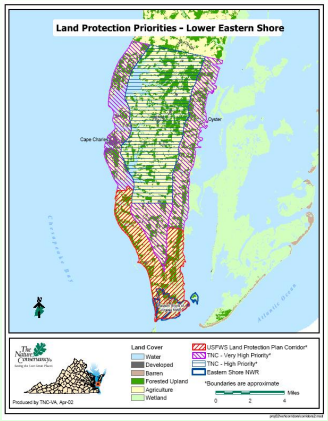
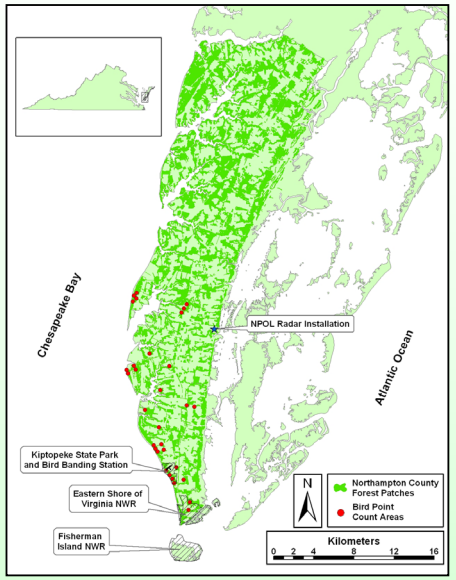
Identification and conservation of important stopover sites for migrating birds is a priority for the Atlantic Coast Joint Venture and other habitat conservation initiatives. The U.S. Fish & Wildlife Service and The Nature Conservancy, along with State and local partners, are developing conservation plans focused on migration stopover sites and habitats on the lower Delmarva Peninsula, a known concentration area for birds during the fall migration. Limited resources and recent, increased pressures to develop the area require an effective, information-based prioritization scheme to focus conservation efforts.



Radar Methods

We analyzed data from the Wakefield, VA, weather surveillance radar (NEXRAD/WSR-88D station AKQ) for the fall migration seasons of 2003 and 2004. We used a two-step process to screen radar imagery captured 0.5-2.0 hr after sunset: 1) we assessed base reflectivity imagery for weather contamination within 110 km of the radar station, and 2) for each weather-free night, we recorded the direction and speed of the main vector of target movement from radial velocity imagery. We compared target speeds and direction to winds aloft measured at 925 mb (appx. 1000 m AGL) and accepted for analysis data for nights with target speeds ≥ wind speed + 10 knots.

We used the National Climatic Data Center NEXRAD Data Exporter (http://www.ncdc.noaa.gov/oa/radar/jnx/) to translate radar reflectivity data to an ESRI ASCII Grid format, imported into ArcGIS a single sweep collected 30-40 min after sunset for each night, and reclassified data to a positive scale. We selected a random sample of 9 valid nights/yr (n = 18) during the peak period of passage for long-distance migrants (1 September – 15 October). We excluded the area within 15 km of the radar to eliminate ground clutter, and sectioned each data layer into 18 5-km rings radiating from 15 to 105 km from the radar. We summed raster cells within each distance ring to obtain a 2-yr cumulative "exodus" (reflectivity) value. We reclassified the 2-yr cumulative values within each ring to a quantile scale with 5% breaks to create a standardized relative scale of exodus intensity across the analysis area. Similar methods will be applied to the NPOL data, when they are ready for analysis.



We are using radar (NPOL and NEXRAD/WSR-88D at Wakefield, VA) to identify and prioritize daytime stopover sites in the Lower Chesapeake Bay Region, used by landbirds that migrate at night.

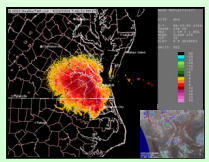
Radar can detect birds as they emerge from daytime stopover sites to resume their migration.

•Migratory "exodus" from daytime stopover sites occurs during the first 1-3 hours after sunset.

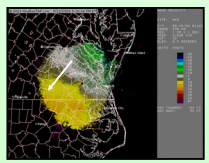
• Radar can provide nearly continuous observations of migratory exodus, but patterns that tie birds to the landscape are obscured about an hour after sunset.

• Radar observations from many nights across the migration season can be used to identify sites and habitats used consistently by migrants.

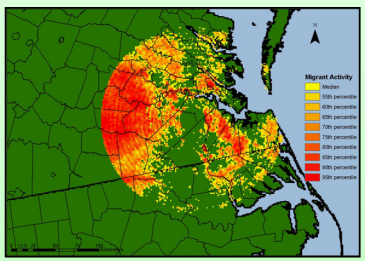
NPOL is a polarimetric Doppler radar that was installed on property owned by The Nature Conservancy at Oyster, VA, in Fall 2003. The National Aeronautics and Space Administration is determining whether this type of radar can be used to predict rainfall volume. If so, it may be integrated into the nationwide system of weather surveillance radars. When not in use for meteorological research, NASA allows the NPOL to be used to study bird migration. In Fall 2004, NPOL was operated by NASA contractors on 54 evenings between August 16 and November 15 to collect data on migrant emergence from stopover sites.



Base reflectivity image 30 min after sunset. Density of birds is measured as reflected energy. At a given distance from the radar, higher reflectivity values (reds and pinks) indicate higher densities of migrants. Reflectivity imagery is screened for contaminating weather (inset). Nights with weather appearing within 110 km of the radar are not included in analysis.

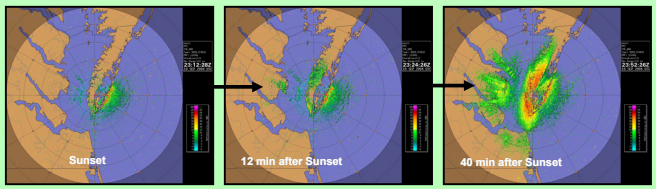


Radial velocity image 2 hr after sunset. Targets are moving in a seasonally appropriate direction at speeds of 20-30 knots. Velocities are screened against winds aloft to determine that targets are moving faster than wind speed, indicating active flight.

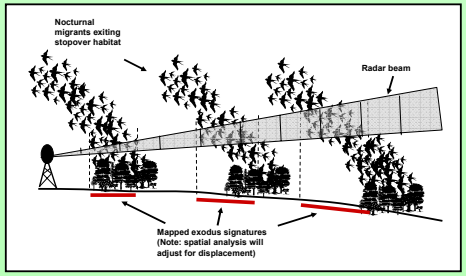


Cumulative migratory exodus patterns for southeastern Virginia. Exodus sites mapped here are those with relative reflectivity values above the median.

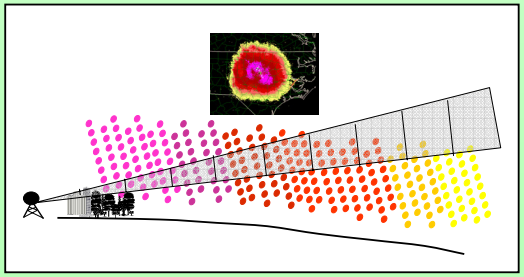
Field surveys were conducted in Fall 2004 to "ground-truth" the radar results. A capture-mark-recapture/re-sight study was conducted on Fisherman Island National Wildlife Refuge to collect data for estimation of migrant abundance and exodus; birds were also captured and banded at the long-term banding station at Kiptopeke State Park. Counts of birds were conducted repeatedly through the fall in 32 forest patches in southern Northampton County and in scrub habitats on the Eastern Shore of Virginia National Wildlife Refuge. Vegetation characteristics were sampled at the scrub points and in >400 forest patches across Northampton County. The data will be used to identify vegetation, site, and landscape characteristics associated with migrant presence and abundance, and to correlate with radar estimates of the spatial and temporal distribution and abundance of migrants emerging from stopover sites.



NPOL reflectivity (imagery from 19 Sept 2004) showing migratory exodus during the first 40 minutes after sunset. High reflectivity values over the southern barrier islands at sunset are caused by land-based "clutter" and high wave action off-shore. Some clouds can be seen just to the west of the peninsula over the Bay.



The radar beam is set at a slight angle. As distance from the radar increases, the earth curves away from the radar beam and the relative altitude of the beam increases. At higher altitudes, bird targets are observed farther away from their stopover habitat.



The increasing altitude of the radar beam and the increasing volume of the sample space create an extraneous pattern of decreasing reflectivity values with increasing distance from the radar. It is necessary to correct for this effect in order to observe true exodus patterns and compare exodus volumes.