

Wood Duck Populations on the SRS: Indicators of Changing Environments

Climate change over the next 100 years is predicted to reshape environments on a global scale. Scientists are increasingly concerned about future impacts of changing climates on ecosystems and their components, including various wildlife species. Knowledge of wildlife population dynamics and their responses under varying environmental conditions is needed to evaluate the potential consequences of shifting environments while continuing to manage wildlife resources. Consequently, data from long-term population studies will be critical in the search to understand how well wildlife species might adapt to unfolding climate changes.

Although basic changes in day length provide important cues for many birds to prepare for breeding, they also rely on environmental signs to indicate the onset of favorable breeding conditions. Annual changes in temperature and rainfall patterns can cause shifts in the timing of food resource availability. Successful breeding therefore is highly dependent upon the flexibility of birds to time their reproduction adequately with their critical food supplies. Thus, the environmental uncertainty associated with rapid climate change leads scientists to question whether reproduction of birds will become mismatched with their foods.



The wood duck (*Aix sponsa*) is the only waterfowl species that commonly nests on the 78,000 ha U.S. Department of Energy's Savannah River Site (SRS) in west-central South Carolina, and because females of the species readily use artificial cavities, they are ideal for nesting studies. Since 1973, researchers from the Savannah River Ecology Laboratory have used a nest-box program to study breeding wood ducks. In southern areas of the wood duck's range, including the SRS, nesting can carry on for more than twice as long as in northern areas, often continuing five months or longer. However, breeding season onset and length, and population productivity can be highly variable depending on annual environmental conditions.

Relating climate to wetland conditions and wood duck productivity

Wood ducks rank among the top four duck species harvested in the United States and are particularly important to hunters in the Southeast. Among the difficult challenges that managers of waterfowl populations have faced has been the development of adequate techniques to monitor changes in wood duck population numbers or productivity at large geographic scales. Annual variation in wetland conditions has been used successfully to index population sizes and productivity for other waterfowl species, and the relationships have been used to suggest the potential effects under various global warming scenarios.

To begin to address this issue, precipitation and evaporation data from a local National Weather Service station and long-term water level data from nine SRS wetlands were used to develop a predictive model of wetland hydrologic conditions on SRS. Examination of these long-term wetland hydrologic patterns on the SRS suggests the influences of prominent climatological cycles (Figure 1). An apparent 10-year cycle is likely related to the location of the "Bermuda high" in the subtropical Atlantic. When this pressure system shifts westward into the Southeast, the area experiences extremely dry conditions, but wetter conditions prevail when it is located well off the southeastern Atlantic coast. Episodes of the El Niño-Southern Oscillation (ENSO) in the tropical Pacific also modify wetland conditions on the SRS. Occurrences of the ENSO are linked to above normal precipitation in the Southeast.

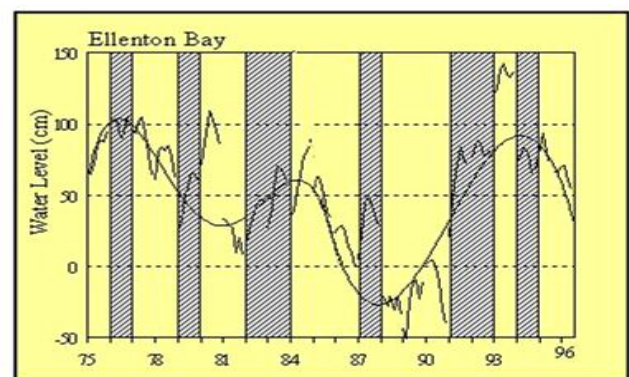


Figure 1. Long-term water levels at Ellenton Bay on the SRS. Cross-hatched regions indicate El Niño-Southern Oscillation activity. Curve illustrates the general long-term pattern.

Productivity of wood ducks using nest boxes on the SRS was related to annual indices of wetland conditions (Figure 2). In wet years, more ducklings were produced by each female in the breeding population than in dry years. Higher production in wet years was attributed in part to longer breeding seasons which allowed more females in the population to produce two broods. More female wood ducks first nested as yearlings in wet years than in dry years and nest predation rates tended to be lower in wet years than in dry years, which further contributed to greater productivity in wet years. Expansion of this methodology to larger geographic regions could provide resource managers with predictive information that is not currently available for wood duck populations.

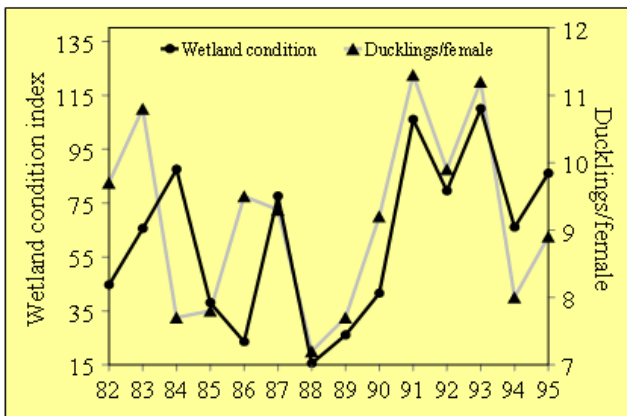


Figure 2. Wetland water condition indices (increasing values indicate wetter conditions) and wood duck ducklings produced per breeding female in the SRS population.

Long-term nesting patterns: are wood ducks laying eggs earlier?

Analysis of data from an investigation into wood duck nesting patterns on the SRS spanning twenty-three years demonstrated that the start of the breeding season gradually shifted to earlier in the year, with dates of first nests each year advancing by about a month from the early 1970s through the mid 1990s (Figure 3). Nesting that typically began in mid-February later began in mid-January, with the earliest egg-laying date ever recorded on the SRS being January 11, 1993. This shift occurred even in years that were relatively dry and during which breeding seasons might have been expected to be shorter as a result of dry conditions. In contrast, the end of the egg-laying period remained relatively unchanged, usually ending in early June (Figure 3). Mild winters allow females the ability to acquire the nutrients necessary for reproduction from the environment earlier. Apparently this has been so much the case that some females on the SRS were able to advance breeding for the entire population.

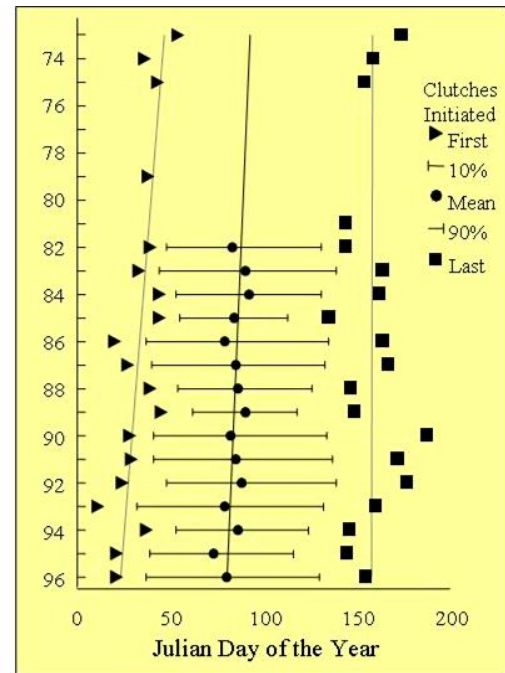


Figure 3. Annual timing of wood duck breeding on the SRS.

Patterns of earlier breeding by birds have now been recognized from long-term studies around the world. Early-season warm weather enables birds to breed earlier because their critical food supplies become available earlier. Most scientists now agree that the predicted rate of global warming associated with increased atmospheric greenhouse gases has the potential to disrupt the ability of some species to remain adequately timed with their food resources. Currently, for wood ducks on the SRS and elsewhere in the southern U.S., there are recognized advantages to nesting earlier each year, including the laying of larger clutches, increased opportunity for producing two broods in a single season, and respite from certain predators that become active later in the season. Continued rapid climate change, though, makes their future less certain. As one example of a possible negative impact, milder winters may increase overwinter survival of bird ectoparasites and become an increasing threat to nest success. Prior to 1990, hematophagous mites were not noted in nest boxes used by wood ducks on the SRS. Throughout the 1990s and coincidental with milder winters though, mites have increasingly appeared in nests, and have now been associated with nest abandonments on numerous occasions each year.

Although the challenge remains for future research to address many uncertainties still surrounding global climate change, the use of wood ducks as biological indicators of shifting environmental conditions holds great promise for unraveling some of the mystery. For further information, please contact Robert Kennamer; SREL; (803) 725-0387; rkennamer@srel.edu