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## STUDYING THE DESIGN OF BIRD REFUGES ALONG THE CONNECTICUT RIVER

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FIG. 1. The Virginia Rail was a common but secretive inhabitant of the tidal marshes of the Connecticut River (photo by the author).

Bird Conservation Research, Inc. is our region's newest organization devoted to the conservation of birds. It differs from traditional bird observatories in not being primarily banding-oriented. We indeed have a substantial banding capability, but our principal focus is practical, long term research into the design and management of open space for bird life. We also provide research-based assistance to municipalities, land trusts, private landowners, and similar entities who need technical input on how to develop a viable system of preserves. With the rapidly fragmenting and suburbanizing natural landscape of southern New England, a sustained and focused effort of this sort is imperative for the continued survival of our region's

bird life.

Although we are just a year old, we have already begun the process of researching the design of refuges. This first BCR project began investigating the question, "If everything else is held constant, how big is big enough for a wildlife refuge?" It is a deceptively hard question to answer, and must be approached in stages. In a first step toward finding an answer, we looked at how bird species respond as refuge size increases. For example, can certain species only inhabit areas greater than a certain size? The habitats chosen for study were the freshwater tidal marshes of the Connecticut River—an area of great conservation interest in our region.

Not only is the Connecticut River an area of major conservation concern, it is also a well-studied system, with its birds the subject of ongoing investigations for 25 years. Additional bird studies here are particularly valuable, because they build upon what already has been studied. For example, between 1974 and 1987, Craig and Beal (1992) found that along the Connecticut River in Connecticut, marsh size, water cover, and habitat diversity all exerted important influences on the number of bird species that could nest in the river's marshes. So, to understand more completely how marsh size (i.e., refuge size) affects bird species, we studied sites in which other habitat factors were held constant, and only marsh size varied. This allowed us to critically evaluate differences in populations and species distributions without the complicating effects of other influences. Also, because we have many years of observations on how bird numbers change in this system over time, (e.g., over a 20-year period at least 23.5% of species declined and 37.3% increased; Craig 1990, 1994), it is possible to examine new data in light of long-term variation in populations. Long term data help to clarify whether trends observed are real or just artifacts of short-term, externally driven (e.g., conditions on the wintering ground) population phenomena.

Although there is great local concern for these habitats, in many instances the birds that live in them are poorly known. As most birdwatchers know, birds of tidal marshes are notoriously difficult to observe, because many (such as the Virginia Rail in Fig. 1) are very secretive. Many also have the bad habit of getting up very early, which means that investigations must begin well before first light. And, of course, wading around in soggy, cold, smelly, sometimes even dangerous tidal marshes is rather less than the most enjoyable activity for a spring morning. Despite such drawbacks, we initiated a series of bird counts at nine sites and, in the process, field tested a new bird survey protocol which is being developed U.S. Fish and Wildlife Service.

With the 1999 research season's focus on marsh size alone, we immediately discovered trends that had not previously been apparent, as well as reaffirmed general trends noted in previous years. In this new project we added series of study sites that were much smaller than those previously surveyed, so we also were able to determine the minimum viable habitat size for breeding marsh bird species.

Not surprisingly, we found that marshes of greater size held more species (Fig. 2). This is a well-known phenomenon in ecology, the "species-area effect," and one that we had documented in earlier

years. The positive relationship between habitat size and species richness has been called one of the few real laws in ecology.

New to this study were findings that three principal responses to habitat size existed: from small to large sites, there were species that 1) maintained a uniform density, 2) increased in density, and 3) did not appear until a threshold habitat size was reached. With data thus far in hand, the abundant Red-winged Blackbird appeared to be an example of 1). It occurred at all sites regardless of size and showed little trend in density between sites. An example of 2), the Swamp Sparrow also appeared at most sites, but occurred most abundantly at the largest sites. The Marsh Wren was an example of 2) and 3), being absent from small sites, and showing its greatest density at the largest sites.

An additional observation made about the breeding marsh birds was that about five hectares (12 acres) was the minimum habitat size suitable for a number of species. Sites smaller than this size can be seen to have considerably fewer species than those greater than five hectares (Fig. 2). Larger, wider-ranging species like ducks were absent from the smallest sites, as were rare species like the Sora. From observations such as these we can reasonably conclude that, for many marsh species, habitat size is positively related to habitat quality.

The observations reported here will be repeated this coming spring so that the generality of these findings can be assessed. Moreover, related upcoming investigations are being designed to clarify how refuge size is related to the long-term stability of bird populations. As we come to understand how it is that bird species respond to increasing habitat size, we can draw conclusions about what a minimum effective refuge size is for marsh birds. In other words, if a town or land trust is considering purchasing a wetland for preservation, these findings will assist in determining whether the purchase will be a significant one for preserving bird life.

#### LITERATURE CITED

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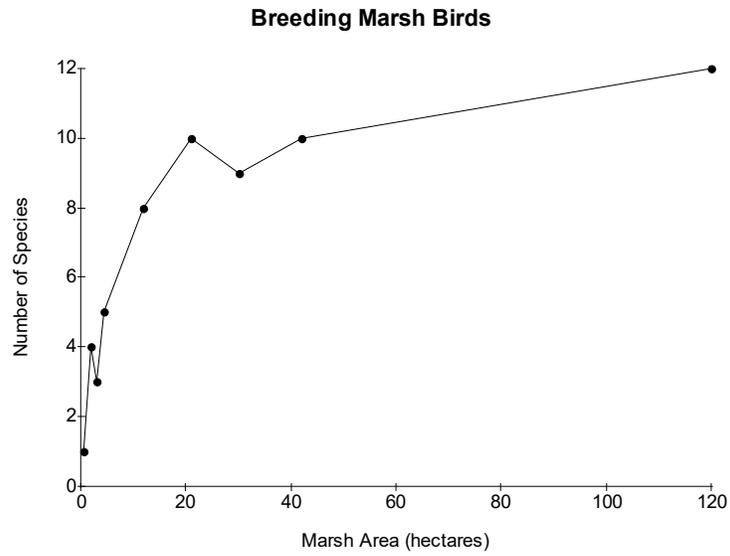


FIG. 2. The relationship between the number of breeding bird species and marsh area.