WETLANDS, Vol. 24, No. 4, December 2004, pp. 837–847

INFLUENCE OF LAND USE ON THE INTEGRITY OF MARSH BIRD COMMUNITIES OF CHESAPEAKE BAY, USA

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Abstract: The landscape within the Chesapeake Bay watershed has been and continues to be impacted by human modifications. Understanding if such anthropogenic disturbances influence organisms that are dependent upon estuarine wetlands remains unclear. We developed an index of marsh bird community integrity (IMBCI) to evaluate marsh bird communities and wetland condition. During the 2002 and 2003 summers, we detected 30 bird species at 219 point count locations distributed among 96 wetlands. IMBCI scores for each wetland were used to determine whether wetland habitat characteristics and urban/suburban development, agriculture, and forest at three different spatial scales (watershed, 1000-m buffer, and 500-m buffer) influenced marsh bird community integrity. We found no relationship between IMBCI scores and wetland habitat characteristics, implying that marsh bird community integrity is not related to any single plant community. Nonparametric changepoint analysis indicated that marsh bird community integrity was significantly reduced when the amount of urban/suburban development within 500 m and 1000 m of the marsh exceeded 14% and 25%, respectively. There was no effect of urban/suburban development on IMBCI scores at the watershed scale. The results of our study demonstrate that marsh bird community integrity shows a threshold response to urban/suburban development at local scales. IMBCI scores, combined with the identification of a land-use threshold, can be easy to interpret and may help communicate complex ecological data to natural resource managers and conservation planners.

Key Words: threshold response, specialist, generalist, index of marsh bird community integrity, estuarine wetlands, Chesapeake Bay

INTRODUCTION

Virtually half of the world's population resides within 200 km of a coastline (Cohen et al. 1997). Between 1960 and 1990, the population of U.S. coastal areas increased by 41%, with the Chesapeake Bay watershed having the fastest growing population in North America (Culliton et al. 1990). Accompanying these population increases are numerous anthropogenic landscape modifications, including expansion of urban/suburban development. The cumulative result of these pressures is that the world's coastal ecosystems, including the Chesapeake Bay estuary, have become degraded (Nordstrom and Roman 1996, Edgar et al. 2000).

The increase in anthropogenic stressors in coastal areas makes it imperative to devise sound methods for assessing estuarine integrity and provide direction for future conservation efforts. Methods have already been developed for measuring the integrity of many components of estuarine systems, such as water quality, sediment quality, and the benthic community (Weisberg et al. 1997, Schimmel et al. 1999, Dauer et al. 2000). Methods for assessing estuarine wetland integrity, however, remain elusive largely due to dynamic environmental conditions, such as fluctuations in tidal cycles, salinity, and dissolved oxygen levels. Additionally, marsh ecosystems are particularly challenging to assess because they are vulnerable to a suite of landscape variables originating from surrounding areas and/or entire watersheds (Pennings et al. 2002).

One approach that could provide insight on estuarine wetland condition may be an index capable of measuring wetland community integrity. Thus far, most indices have focused on benthic and fish communities in freshwater (Angermeier and Karr 1986, Weisberg et al. 1997), marine (Dauer et al. 2000), and wetland ecosystems (Burton et al. 1999). The success of this technique in aquatic ecosystems has led to its expansion for use in other ecosystems. For example, avian indices have now been developed for forests