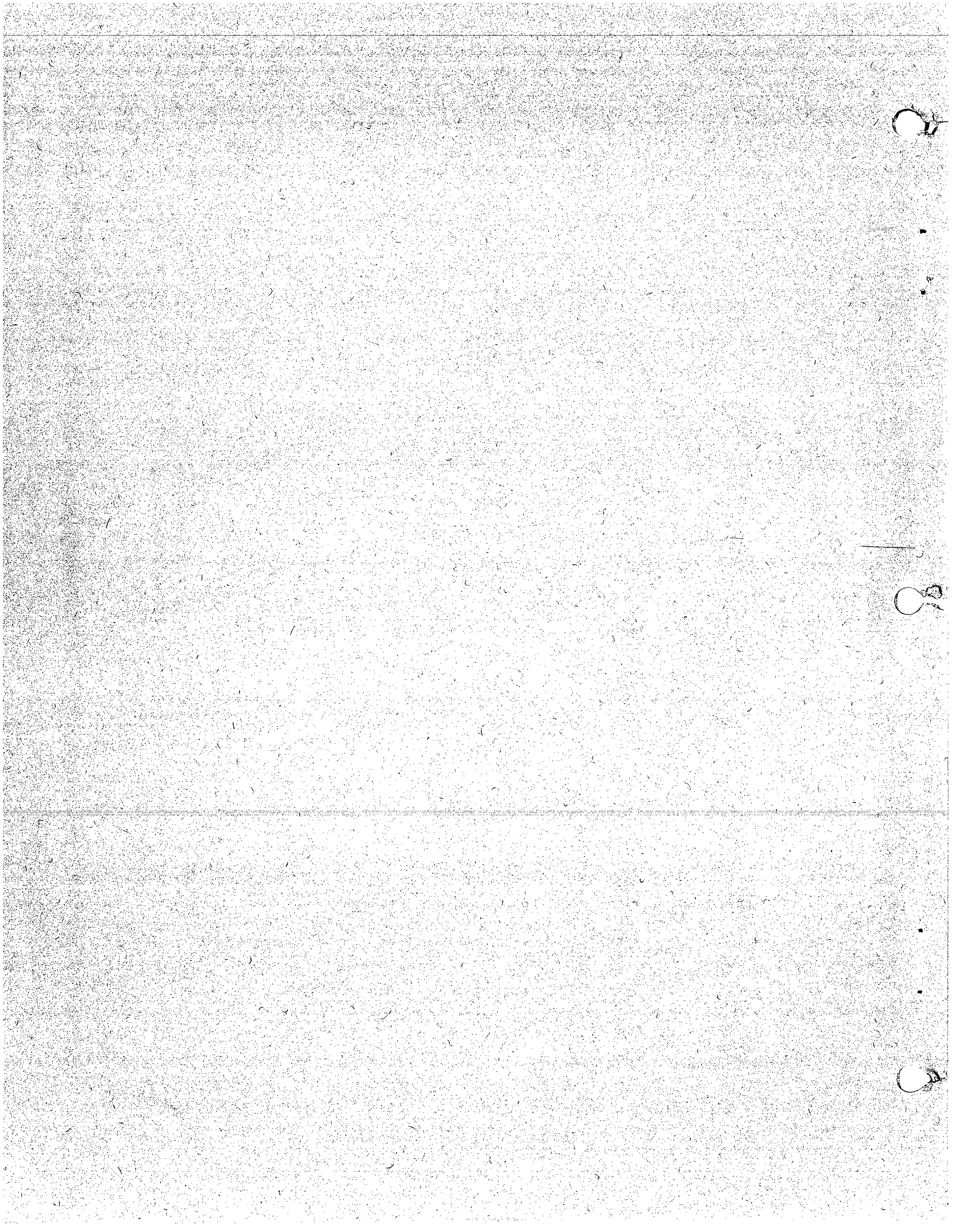


**An Analysis of
Avian Breeding Habitats
in Hudson River Tidal Marshes**

Final Report

June 1987



AN ANALYSIS OF AVIAN BREEDING HABITATS
IN HUDSON RIVER TIDAL MARSHES

Final Report

Prepared under contract with

The Hudson River Foundation
for Science and Environmental Research, Inc.
122 East 42nd Street, Suite 1901
New York, NY 10168
HRF Grant No. 024/85B/031

Prepared by

Bryan L. Swift
New York State Department of Environmental Conservation
Division of Fish and Wildlife
Wildlife Resources Center
Delmar, NY 12054

June 1987

PREFACE

The research contained in this report has been financed in part through a research grant from the Hudson River Foundation for Science and Environmental Research, Inc., a New York not-for-profit corporation with its office located in New York City. The views expressed herein do not necessarily reflect the beliefs or opinions of the Foundation, which assumes no responsibility or liability for the contents or use of the information herein.

This study was one of the first by the New York State Department of Environmental Conservation (NYSDEC) to be funded by the Hudson River Foundation. The need to obtain outside funding for this work stemmed from the fact that internal funding severely limited the number of research and management programs that could be implemented, resulting in only the highest priorities being accomplished. In recent years, Federal funding has been drastically reduced, and we were forced to look for new sources of revenue just to maintain existing programs. Therefore, the NYSDEC greatly appreciates the Foundation's support of baseline ecological research described in this report.

The purpose of the research reported herein was to generate substantial new data on migratory bird habitats associated with the Hudson River estuary. The study areas represented some of the most important potential breeding habitats for wildlife in the Hudson Valley. Non-passerine marsh-nesting birds (herons, waterfowl, and rails) received special emphasis because they are closely tied to the aquatic environment, and because little was known regarding their habitat use and management needs in tidal freshwater wetlands. Results of our work represent the first major step toward developing a quantitative data base on avian breeding habitats in the Hudson River estuary. We are pleased to report that a second Hudson River Grant has been awarded to NYSDEC for follow-up research in 1987. The second year of study will test habitat models presented in this report, and help assess whether observations in 1986 reflected normal bird population levels and habitat conditions.

Any comments or questions regarding this report should be directed to the author, at the following address: New York State Department of Environmental Conservation, Division of Fish and Wildlife, Wildlife Resources Center, Delmar, NY 12054.

ACKNOWLEDGEMENTS

My sincere appreciation is extended in many directions for support of this study. The project was financed in part through research grant No. 024/85B/031 from the Hudson River Foundation for Science and Environmental Research, Inc.. Additional funding was provided by the New York State Division of Fish and Wildlife's Conservation Fund and the Hudson River National Estuarine Research Reserve.

Many Division staff, too numerous to name here, assisted with technical and administrative aspects of this project. However, special thanks go to John Ozard, for spending long hours in wet boots setting up study areas, conducting census work, and holding vicious "snappers" at bay. Thanks to Steve Orman for assistance with habitat measurements (on many hot days, with only arrow arum and pickerelweed for shade), data compilation and entry, and preparation of figures in this report. And of course, to Sue Sheridan for painstakingly typing this entire report to my unreasonable standards. Many others from the Wildlife Resources Center in Delmar assisted with nest-searching, water level measurement, and data analysis, and their efforts were greatly appreciated.

Support from the Hudson River Foundation would not have been possible without the constructive input and support from my supervisor, Larry Brown, and other staff in NYSDEC's Central and Regional offices, especially Stu Free, Joel Hermes, Art Johnsen, Bob Miller, and Ken Wich. Background information needed for development of the project proposal and interpretation of results was obtained through conversations with numerous researchers, including Bill Eddleman, Jim Glahn, Erik Kiviat, Jim Rod, and Milton Weller. Access to New York State Breeding Bird Atlas information was made possible by Janet Carroll, and the following individuals who discussed their "Atlas" work in tidal marshes with us: Dick Guthrie, William Cook, Jack Focht, E. Treacy, Steve Chorvas, Frank Murphy and Seward Highley. The Laboratory of Ornithology at Cornell University provided tape recordings of bird calls used in this study.

Special permission for access to study area lands was obtained from, or with the assistance of: Ed Brady, Coxsackie, NY (West Flats); Betsy Blair, Hudson River National Estuarine Research Reserve, Annandale, NY (Stockport Marsh, Tivoli North Bay, and Iona Marsh); Jim Rod, National Audubon Society, Garrison, NY (Constitution Marsh); and Ken Krieser, Palisades Interstate Park Commission (Iona Marsh). Thanks to John Cronin of the Hudson River Fishermen's Association for making Castle Rock Field Station in Garrison a very comfortable "home away from home" on many occasions. And finally, my regards to Rick and John at the Selkirk Thruway Station (Exit 22) for making the many miles of travel on I-87 something to look forward to.

ABSTRACT

Field studies were conducted in 1986 to document patterns of habitat use by breeding birds, especially non-passerines, in tidal freshwater marshes along the Hudson River in New York. Data were collected on a total of 119 0.28-ha (30-m radius) plots in 6 study areas. Twenty-two bird species were identified as "probable" breeders within the marshes, with 10 species accounting for 95% of all observations. The most numerous species, in decreasing order, were marsh wren (Cistothorus palustris), red-winged blackbird (Agelaius phoeniceus), swamp sparrow (Melospiza georgiana), Virginia rail (Rallus limicola), and yellow warbler (Dendroica petechia). Only two non-passerines, Virginia rail and least bittern (Ixobrychus exilis), were found to make significant use of Hudson River tidal marshes for breeding. Nesting by sora (Porzana carolina), American bittern (Botaurus lentiginosus), or native waterfowl species was not documented during the study.

Avian census data were related to 13 habitat variables (10 cover types, 2 biogeographic aspects, and relative depth of flooding) using univariate and multivariate statistical analyses. Significant habitat relationships were detected for most species, and suggested that two relatively distinct avian communities could be defined. The occurrence of either group was determined by depth of flooding and availability of diverse nesting substrates, both of which are related to ecological succession in Hudson River tidal marshes.

Predictive models of potential breeding habitats for Virginia rail and least bittern were developed using multiple regression and discriminant analysis, and are recommended for testing through a second year of study. The distribution (i.e., presence or absence) of least bittern was closely related to relative elevation of the marsh surface, as this species favored deep flooding stands of persistent emergent vegetation. Using just 3 variables, the discriminant function correctly classified 66% of all census plots as probable or not probable breeding habitat. Similarly, a set of 4 habitat variables could be used to correctly classify 75% of marsh locations sampled as probable or not probable breeding habitat for Virginia rail. Important variables for predicting presence or absence of this species included proximity to natural uplands, presence of river bulrush-cattail cover, and presence of purple loosestrife. Habitat characteristics of estimated Virginia rail territory centers and observed nest sites were consistent with results obtained from analysis of census plot data.

CONTENTS

	page
PREFACE	ii
ACKNOWLEDGEMENTS	iii
ABSTRACT	iv
LIST OF TABLES	vi
LIST OF FIGURES	viii
INTRODUCTION	1
MATERIALS AND METHODS	
Study Areas	3
Census Methods	5
Habitat Measurements	11
Statistical Analyses	14
RESULTS	
The Avian Community	15
Non-passerine Species	15
Habitat Characteristics	24
Avian Habitat Relationships	24
DISCUSSION	
Breeding Bird Communities in Tidal Freshwater Marshes	39
Use of Hudson River Marshes by Non-passerine Birds ...	41
Predicting Avian Habitat Use	47
Review of Study Methods	49
CONCLUSIONS	52
LITERATURE CITED	54
APPENDICES	
A. Study Area Descriptions	A-1
B. Bird Species Observed in Hudson River Tidal Marshes	B-1
C. Detailed Account of Least Bittern Observations	C-1
D. Detailed Account of Virginia Rail Observations	D-1
E. Habitat Data for Hudson River Tidal Marshes	E-1
F. Multiple Regressions of Avian Breeding Habitats ...	F-1

LIST OF TABLES

	page
1. Dates and time periods of 1986 census work in six Hudson River tidal marshes	7
2. Playback sequence of tape-recorded calls used to census birds in Hudson River tidal marshes	8
3. Summary of 1986 nest-searching activities in six Hudson River tidal marshes	10
4. Definitions of cover types identified in Hudson River tidal marshes	13
5. Relative abundances ($\bar{X} \pm$ s.e. per 40 ha) of bird species nesting in six Hudson River tidal marshes in 1986	16
6. Relative abundances ($\bar{X} \pm$ s.d. per plot) of 12 bird species among groups of census plots defined by cluster analysis	17
7. Number of birds observed during four census rounds in 1986	18
8. Number of birds observed per census plot visit ($\bar{X} \pm$ s.d.) during morning (AM) and evening (PM) periods in 1986	19
9. Number of birds observed per census plot visit ($\bar{X} \pm$ s.d.) by two census workers in 1986	20
10. Summary of 1986 observations of Virginia rail in six Hudson River tidal marshes	22
11. Summary of 1986 observations of least bittern in six Hudson River tidal marshes	23
12. Summary of habitat measurements ($\bar{X} \pm$ s.d.) from avian census plots in six Hudson River tidal marshes	25
13. Relative elevations ($\bar{X} \pm$ s.d.) of selected cover types in six Hudson River tidal marshes	26
14. Simple correlations (r) between avian species' abundances and habitat variables	27
15. Relationships between least bittern distribution (presence/absence) and habitat variables determined by discriminant analyses	30
16. Classification results for two discriminant analyses of least bittern breeding habitat in Hudson River tidal marshes	31

LIST OF TABLES (Continued)

	page
17. Relationships between Virginia rail distribution (presence/absence) and habitat variables determined by discriminant analyses	32
18. Classification results for two discriminant analyses of Virginia rail breeding habitat in Hudson River tidal marshes	33
19. Multiple regression models of known and predicted least bittern breeding habitats in Hudson River tidal marshes	34
20. Multiple regression models of known and predicted Virginia rail breeding habitats in Hudson River tidal marshes	35
21. Habitat characteristics ($\bar{X} \pm$ s.d.) at 16 Virginia rail territory centers and 119 random census points in Hudson River tidal marshes	37
22. Habitat characteristics ($\bar{X} \pm$ s.d.) associated with bird species groups defined by cluster analysis	38

LIST OF FIGURES

	page
1. Locations of tidal marsh study areas along the Hudson River, New York	4
2. Map of West Flats study area, illustrating random location of census points	6
3. Hypothetical plot of a non-passerine species' occurrences, including the estimated geometric center of outermost observations	9
4. Geometry of sampling areas for vegetative cover analyses in Hudson River tidal marshes	12

INTRODUCTION

Tidal freshwater wetlands are highly productive biological communities (Weinstein 1977, Odum and Heywood 1978, Whigham et al. 1978), characterized by near freshwater conditions (average annual salinity of 0.5 ppt or below except during extended periods of drought), plant and animal communities dominated by freshwater species, and a daily lunar tidal fluctuation (Odum et al. 1984). Over 1,000 ha of tidal freshwater wetlands occur along the Hudson River between the Federal dam at Troy and Haverstraw Bay, New York (unpubl. data). The Hudson estuary is one of only a dozen areas in the northeastern United States with more than 200 ha of tidal freshwater marsh, and is the only such area in New York State (Odum et al. 1984).

The intertidal emergent marshes in the Hudson River are important potential breeding areas for a variety of migratory bird species. Collectively, marsh-nesting birds comprise a significant faunal component of the Hudson River ecosystem; they are consumers, as well as competitors, of various aquatic organisms (including insects, mollusks, crustaceans, and fish), and may serve as indicators of environmental quality. However, there have been insufficient data available on habitat use by marsh-nesting birds to effectively manage or assess the role of these species in the Hudson River estuary. Especially lacking was information on non-passerine birds, including herons and bitterns (Ardeidae), waterfowl (Anatidae), and rails (Rallidae).

For many wetland areas on the Hudson River, lists of possible breeding bird species could be developed from existing published and unpublished sources (e.g., Orth 1965, Kiviat 1978a, Drennan 1981, U.S. Dept. of Commerce and NYSDEC 1982, and knowledgeable individuals). The New York State Breeding Bird Atlas project (Carroll and Peterson 1981) has produced substantial lists of species for "blocks" that included the proposed study areas. However, the Atlas project was designed specifically to determine geographic breeding ranges of species, and provided no quantitative information on relative abundances of species or habitats used.

The importance of tidal freshwater ecosystems as breeding bird habitats has received relatively little study. Odum et al. (1984) presented a synthesis of information on avian use of tidal freshwater marshes in the eastern United States, but cited very few published sources. Estimates of breeding bird abundance have been reported for several tidal marsh communities in New Jersey (Hawkins and Leck 1977) and Maryland (Springer and Stewart 1948), but quantitative habitat data were not included in either study. Relevant studies of breeding biology and habitat use in non-tidal freshwater marshes have been reported for bitterns (Vesall 1940, Weller 1961, Kushlan 1973), waterfowl (Bellrose 1976, Ratti et al. 1982), rails (Walkinshaw 1937, 1940; Mousley 1940; Billard 1947; Horak 1970; Fredrickson 1971; Andrews 1973; Glahn 1974; Odum 1977; Strohmeyer 1977; Zimmerman 1977, 1984; Griese et al. 1980;

