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ECOLOGY OF ARBOVIRUS INFECTION IN NEW JERSEY Review of a 5-Year Mist-netting Program

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Introduction

Bird banding activities have been pursued intermittently by the New Jersey State Department of Health since 1953. An intensive study of bird populations was initiated in 1960 as part of a more extensive study of the ecology of Eastern and Western encephalitis. The purpose of this report is to present an introductory review of the ornithologic aspects of this study and to present information on the size, structure, and stability of the avian populations, such as might relate to the ecology of arboviruses.

This investigation was supported in part by Public Health Service Research Grant #04392 from the National Institutes of Health, Institute of Allergy and Infectious Diseases.

Location and field layout

In the summer of 1959, trails were cut through the woods on a portion of the Atlantic County Game Preserve, a private club in Estell Manor, Atlantic County, New Jersey. This area became known as Study Area A. The trails formed a cross, with a north-south trail crossing an east-west trail. Twenty-one small clearings were cut across the trails at 200 foot intervals. The clearings were used as mist-net sites.

As a response to the conjecture that net-shyness might reduce recaptures, additional trails were cut parallel to the original trails, thus forming a double cross. In addition, alternate clearings were cut between the original net sites along all trails; in this manner, 84 sites were available for use. Mist nets were erected at 21 sites at a time, and net sites were changed every three days.

Expansion of the project in 1961 led to the preparation of three additional study areas: Study Area B in the Brigantine National Wildlife Refuge near Oceanville, Atlantic County, New Jersey, Study Area C at the Forked River Game Farm in Ocean County, New Jersey, and Study Area D in the Great Swamp National Wildlife Refuge in Morris County, New Jersey. In these areas a single cross was cut through the woods with a total of sixteen net sites at 200 foot intervals. The sixteen net sites in the woods at each study area were designated as sylvan net sites. These were augmented by four additional net sites situated near buildings; the latter sites became known as peri-domiciliary net sites.

Also in 1961, Study Area A was altered to conform to the plan of the other areas, with sixteen sylvan net sites and four peri-domiciliary net sites. From 1960 through 1963, 16 sylvan net sites were operated along a different section of the double cross on alternate weeks as a concession to the net-shyness theory. This practice was discontinued in 1964 because records of the four study areas indicated no perceptible effect of alternating net sites.

Study Areas A, B, and C were a mixed pine barrens coastal plain forest stand and Study Area D was a swamp forest.

A 12-meter type A mist net of 36 mm mesh was erected on two eight-to-ten foot bamboo poles at each net site. The bamboo poles were tied to stakes driven into the ground, or to trees, or tree stumps.

Operating procedures

The study areas were operated by public health veterinarians assigned or attached to the Bureau of Veterinary Public Health, and by veterinary students under the supervision of those veterinarians.

On normal operating days the nets were opened shortly after dawn. The operator visited each net at regular intervals. The time between visits was varied according to weather conditions and rate of capture so as to reduce the chance of mortality. A visit to all net sites in a study area was called a round. During each round, birds were removed from the nets and processed, repairs were made to the nets, and the net sites were cleared of grass and other high growth.

Processing of birds included identification, sexing by plumage where possible, banding, and drawing a blood specimen by jugular venipuncture (Kerlin, 1964; Kerlin and Sussman, 1963), following which the birds were released.

A 3x5 file card was prepared for each bird which repeated or returned. This file card records the species, band size, band number, date and place of capture, specimen number of blood sample, and occasionally other pertinent information.

TABLE 1. PERIODS OF OPERATION

Year	Study Area A		Study Area B		Study Area C		Study Area D	
	From	To	From	To	From	To	From	To
1960	Apr.	Sep.	—	—	—	—	—	—
1961	Apr.	Dec.	Jun.	Dec.	May	Dec.	May	Dec.
1962	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.	Jun.	Dec.
1963	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.
1964	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.

After a preliminary operating period in 1959, the project was operated on a regular schedule starting in 1960. The study areas were operated for periods during all seasons of the year, and throughout the year starting in the spring of 1962 and in 1963, and 1964 (table 1). A total of 1,543 operating days are covered by this report.

Captures

During the five-year period 1960 through 1964, a total of 25,238 captures of 120 species were made. Birds were subjected to venipuncture at the time of capture and at the time of each repeat or return. In all, 20,362 birds were banded during the course of this program.

The majority of birds were not recaptured (repeats and/or returns), as might be expected, for many birds were in-transit migrants. Nevertheless recaptures were made 4,876 times, 19% of the total captured. These recaptures were of 2,877 individuals or 14% of the total banded. Individuals of some species were recaptured

TABLE 2. NUMBER OF DAYS NETS WERE OPERATED

Year	Study Area	Study Area	Study Area	Study Area	Four
	A	B	C	D	Study Areas
1960	42	—	—	—	42
1961	67	69	69	61	266
1962	79	83	53	82	297
1963	139	150	83	126	498
1964	104	121	111	104	440
Five Years	431	423	316	373	1,543

frequently. For example, 3 Wood Thrushes (*Hylocichla mustelina*) were captured 13 times, and 2 Blackcapped Chickadees (*Parus atricapillus*) were recaptured 11 times. This is especially remarkable for at each time blood specimens were taken by venipuncture. These data lend support to the hypothesis that recapture rates are not altered by venipuncture when careful attention is given to proper techniques.

Summaries of the number of days of netting, total numbers captured and recaptured are shown in tables 2 and 3.

TABLE 3. NUMBER OF BIRDS BANDED AND RECAPTURED
(RETURNS AND REPEATS)

Year	Study Area A		Study Area B		Study Area C		Study Area D		Four Study Areas	
	Band.	Recap.	Band.	Recap.	Band.	Recap.	Band.	Recap.	Band.	Recap.
1960	193	53	—	—	—	—	—	—	193	53
1961	1,034	194	1,520	392	1,141	197	713	105	4,408	888
1962	1,368	270	1,553	379	842	228	1,997	474	5,760	1,351
1963	1,442	303	1,853	552	830	190	2,264	642	6,389	1,687
1964	1,121	243	893	238	781	151	1,065	265	3,860	897
Five Years	5,158	1,063	5,819	1,561	3,594	766	6,039	1,486	20,610	4,876

Summer bird populations

For the purposes of a rough comparison of some of the data from this program with those elsewhere, we have presented a summary of the data from June, July, and August. These months were selected so as to indicate something of the breeding bird population. We recognize that some July and August records are of migrants, and of course, summer records include young of the year. Nevertheless, some indication of the success of the program in sampling breeding populations can be gained from the data of these three summer months (table 4).

TABLE 4. NUMBER OF BIRDS BANDED AND RECAPTURED IN
JUNE, JULY AND AUGUST

Year	Study Area A		Study Area B		Study Area C		Study Area D		Four Study Areas	
	Band.	Recap.	Band.	Recap.	Band.	Recap.	Band.	Recap.	Band.	Recap.
1960	125	34	—	—	—	—	—	—	125	34
1961	685	139	976	290	767	124	576	85	3,004	638
1962	670	163	763	272	815	213	1,622	307	3,870	955
1963	652	150	788	328	637	154	1,343	404	3,420	1,041
1964	568	157	386	142	415	89	740	155	2,109	543
Five Years	2,700	643	2,913	1,032	2,634	580	4,281	956	12,528	3,211

Longevity

Longevity records are comparable to those generally reported. For example, four of the birds banded in 1959 were still returning in 1964. These were a Brown Thrasher (*Toxostoma rufum*), a Wood Thrush, an Ovenbird (*Seiurus aurocapillus*) and a Rufous-sided Towhee (*Pipilo erythrophthalmus*).

Foreign retraps

We have recorded 39 foreign retraps. Most of these are recoveries of our birds elsewhere (table 5). Surprisingly, 14 foreign retraps are of birds banded at one of our locations and recovered at another of our study areas. We anticipate further discussion of these data in a subsequent paper.

TABLE 5. FOREIGN RETRAPs

Common Name	Banded and Recaptured at Different Stations Operated by this Study Group	Banded by this Study Group and Later Recaptured by Other Persons	Banded by Other Persons and later Recaptured by this Study Group
Hairy Woodpecker	1	2	—
Downy Woodpecker	1	—	—
Tree Swallow	—	1	—
Blue Jay	1	1	—
Carolina Chickadee	1	—	—
Catbird	4	—	—
Brown Thrasher	—	1	—
Robin	2	9	—
Wood Thrush	—	—	1
Gray-cheeked Thrush	3	1	—
Starling	—	1	—
Ovenbird	—	1	—
House Sparrow	—	1	—
Common Grackle	—	2	—
Evening Grosbeak	—	—	1
Rufous-sided Towhee	—	2	—
Swamp Sparrow	—	1	—
Song Sparrow	1	—	—
TOTAL	14	23	2

Two of the robins banded at Study Area D during the summer of 1962 were recovered during that winter in Texas. Two other robins banded at Study Area D during the summer of 1963 were winter recaptures in Louisiana.

Returns

As one would expect, our return records are of permanent residents, summer residents, and winter residents (table 6). However, individuals of two species not known as breeding birds in New Jersey, nor known to winter in the state, have been recaptured as returns. These species are Swainson's Thrush (*Hylocichla ustulata*) and Gray-cheeked Thrush (*Hylocichla minima*). These may represent returns of passage migrants. However, these and related records will be discussed in a subsequent paper.

TABLE 6. RETURNS 1963 AND 1964

SPECIES	NUMBER OF PREVIOUS RETURNS														
	1963	0	1964	1963	1	1964	1963	2	1964	1963	3	1964	4	1963	5
Yellow Warbler	1														
Myrtle Warbler	2														
Pine Warbler	3	1													
Prairie Warbler	8	6		2	1		2	1			1				
Ovebird	2														
Yellowthroat			1												
Yellow-breasted Chat	1														
Hooded Warbler															
Canada Warbler		1													
House Sparrow	7	3		2	2										
Redwinged Blackbird	1	3													
Common Grackle	1														
Brown-headed Cowbird	3			1											
Scarlet Tanager	6														
Cardinal	8		1	5	1										
American Goldfinch		9													
Rufous-sided Towhee	18	18		5	7		1	1							
Slate-colored Junco	5	9		2											
Chipping Sparrow	1	1													
White-throated Sparrow	3	3		1											
Swamp Sparrow	3														
Song Sparrow	6	3		1			1				1				

Results of the program

Data regarding arbovirus activity detected in birds captured in this program will be presented elsewhere. In addition the data permit estimates of breeding bird populations, following generally the procedures of Stamm, et al. The data also furnish information on a variety of population parameters such as stability and turnover in the breeding population, territorial size and consistency, migratory movements (seasonal, daily), stopover duration during migration, and the like, as well as the usual information obtained from foreign retraps. Furthermore, we may assess the effect of this program on the avian populations by comparing these data with those of other programs, such as Operation Recovery, or breeding bird studies such as described by Stamm, et al. (1960), or Swinebroad (1964).

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