BIRD-BANDING

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"OPERATION RECOVERY"—THE ATLANTIC COASTAL NETTING PROJECT

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For scores of years field observers along the Atlantic Coast have noticed that under certain weather conditions, especially during the height of the fall migration, hundreds or even thousands of individuals of migrating song birds may be found concentrated in a few acres of brush or woodland in certain coastal localities. The southern tips of coastal peninsulas, such as Cape May, New Jersey, and Kiptopeke, Virginia, tend to have the most spectacular concentrations of transient land birds; but thousands of isolated thickets among the dunes or along rocky coasts from the Maritime Provinces of Canada south to Florida and the West Indies also provide shelter for large numbers of migrants.

As early as 1930 Italian trammel nets were successfully used at the Austin Ornithological Research Station on Cape Cod, for trapping migrating land birds at localities near the Massachusetts coast. The first serious attempts to band large numbers of these birds at one of the principal concentration points, however, were in September 1951, 1952, and 1953, when Seth H. Low, John H. Buckalew, Fr. Edward Stoehr, and the late Richard D. Cole operated about 18 Japanese mist nets for one weekend each year at Cape May Point, New Jersey. The most successful of these operations was on the weekend of September 20-22, 1952, when they banded 750 birds of 43 species.

In the spring of 1955 the senior author suggested that carefully planned large-scale banding of migrants at several coastal concentration points during the same season might provide valuable information on migration—especially if birds that were once swept into the coastal area continued to follow the coast as they moved southward. A plan of operation was drawn up and temporary netting stations were set up during parts of August and September 1955 at Rockport, Plum Island, and Nantucket, Massachusetts, Middletown, Rhode Island, Cape May, New Jersey, Ocean City, Maryland, and Hog Island, Virginia. The project was named "Operation Recovery" on the admittedly remote chance that one of the netting stations might recover a bird recently banded at another station to the north. About 1,500 birds were banded during the designated period in 1955, the first autumn the project was in operation.

Table 1. *Summary of 1957 operations*

State or Province	Locality	Extreme dates	Total bandings	Total net-hrs.	Station leader
N. S.	Brier Island	Sept. 21-25	91	300	H. F. Lewis
N. B.	Grand Manan	Aug. 19-30	414	2,143	E. A. Bergstrom
Maine	Milbridge	Aug. 6-Sept. 8	394	2,449	G. H. Parks
Maine	Medomak	Aug. 23-Sept. 5	142	900	J. M. Cadbury
Maine	Castine	Sept. 1-Oct. 6	549	—	M. C. Morse, Jr.
Maine	Lisbon	Sept. 10-25	230	250	D. H. Morse
Mass.	Plum Island	Sept. 1-17	334	540	M. Gardler
Mass.	Rockport	Sept. 28-29	31	150	J. Hailman
Mass.	Gloucester	Sept. 4-29	19	50	S. F. Robbins
Mass.	Nantucket	Aug. 1-Sept. 30	2,618	1,200±	J. V. Dennis
R. I.	Middletown	Aug. 1-Sept. 30	2,144	5,323	J. Baird
R. I.	Kingston	Sept. 4-29	256	154	D. L. Kraus
N. J.	Island Beach	Sept. 6-22	2,786	8,463	E. Dickerson
N. J.	Cape May	Sept. 11-13	59	65	J. M. Cadbury
Pa.	Tinicum	Sept. 6-18	94	275	J. C. Miller
Md.	Monkton	Sept. 2-30	91	369	S. W. Simon
Md.	Grasonville	Sept. 9	20	192	R. P. Dubois
Md.	Claiborne	Sept. 3-24	227	756	W. M. Davidson
Md.	Ocean City	Sept. 7-26	868	4,464	C. S. Robbins
Va.	Chincoteague	Sept. 15-21	65	830	F. R. Scott
Va.	Kiptopeke	Sept. 24-29	156	672	E. Dickerson
N. C.	Caffeys Inlet	Sept. 14-15	25	64	H. T. Davis
Total Bandings			11,613		

In August and September 1956, 15 netting stations were in operation, ranging from Brier Island, Nova Scotia, and Grand Manan, New Brunswick, south to Claiborne and Ocean City, Maryland. About 5,400 individuals of 113 species were banded during the 1956 operation. The highest totals were: 893 at Ocean City, Maryland, by Mr. and Mrs. Richard D. Cole, Chandler S. Robbins, Stephen W. Simon, and others; 887 at Cape May, New Jersey, by Seth H. Low and others; and 599 at Island Beach, New Jersey, by Mrs. Stanley S. Dickerson and others.

Plans for the 1957 season were laid well in advance. Primary objectives of the operation this year were to investigate the effects of specific weather conditions on migration, to correlate visual observations of migration with banding records and weather conditions, and to explore the possibilities of using bird weights as an aid in interpreting migration data. It was believed that a comparative study of the weights of migrating birds would aid materially in interpreting the banding records in one or more of the following respects: (1) to indicate whether birds of a given species at any two netting stations on a certain day are samples representing a single population (*i.e.*, whether both groups originated in the same general area and were subject to the same general conditions during their flight); (2) to make it possible to recognize populations of underweight birds which may have been subjected to unusual weather conditions, or performed abnormally long flights, or migrated for two or more successive days or nights; (3) to separate actively migrating individuals from those that have not yet started migration or have completed it; and (4) to assist in the recognition of age and sex composition of populations of certain species.

Two-week periods for suggested peak coverage ranged from the latter half of August in the Maritime Provinces to the latter half of September along the south Atlantic coast of the United States. Table 1 gives a summary of the 1957 coverage, and Figure 1 shows the locations of the principal stations.

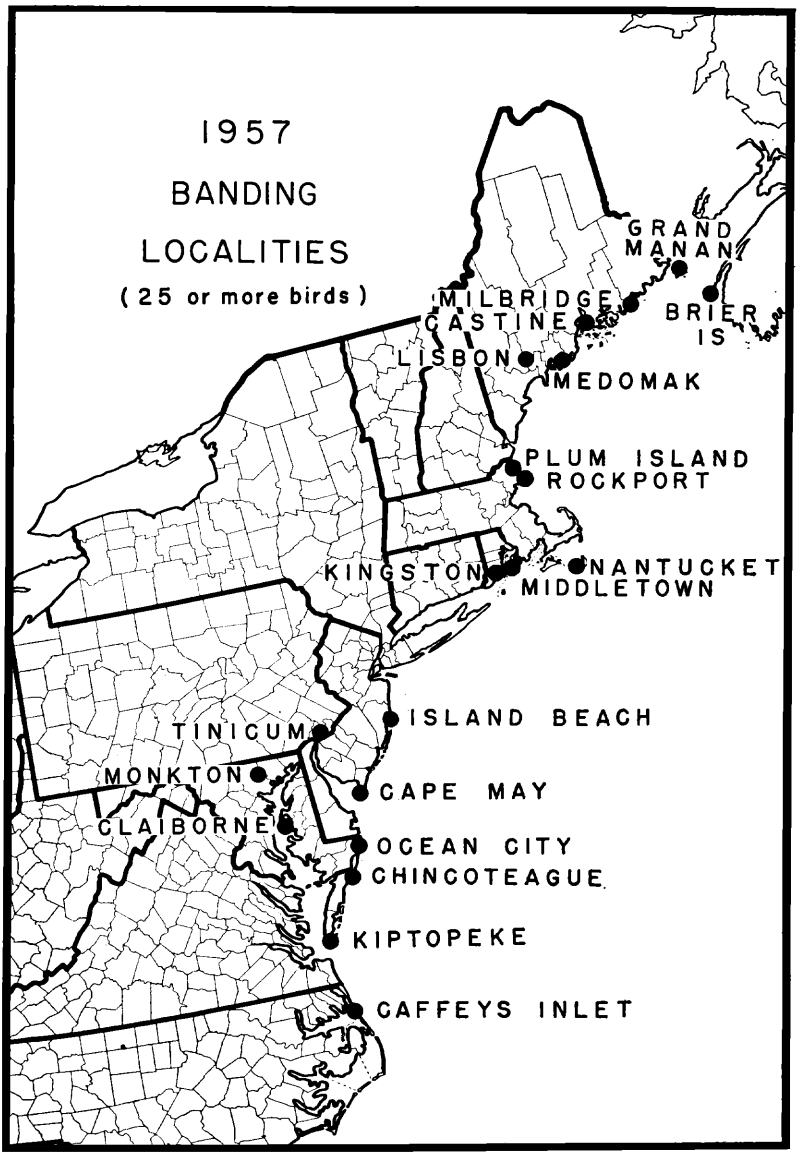

Fig. 1. Coastal netting stations, fall of 1957.

Except for a relatively small undetermined number of birds taken in conventional traps at the Nantucket station, all the above birds were taken in Japanese mist nets. Daily reports on birds caught in traps were also received from Mrs. Joseph Cardinali of Jamesburg, N. J. (32 birds, Sept. 7-22), and Caroline Van Heeswyk of Cape May Point, N. J. (148 birds, Aug. 1—Sept. 11). George M. Seeley of Long Branch, N. J., made available his record of birds seen on almost daily field trips during the period September 5-29.

The authors wish to thank all of the banders and observers who have participated in Operation Recovery during its first three years, and especially the station leaders, all of whom have been most cooperative in supplying information for use in this report. Our very special thanks are extended to Mrs. Stanley S. Dickerson, who planned, supervised, and summarized the large-scale operations at Island Beach as well as conducting the Kiptopeke bandings and assisting at Newport. Although it is not customary to acknowledge the contributions of an editor, it is appropriate to point out here that E. Alexander Bergstrom has taken a lively interest in this project since its inception; in addition to devoting vacations to operating the Grand Manan station he has made valuable suggestions regarding the planning of the study and the preparation of this report.

STATION SUMMARIES

A brief description of station locations and operations is in order. Although the majority of netting was done within sound of the surf, there were two stations along the shore of Chesapeake Bay, as well as three at inland locations. The non-coastal stations contributed valuable information on the timing of flights with the passage of cold fronts.

No two stations had the same habitat conditions. The composition of the vegetation, especially as it relates to food supply during the netting period, is an important factor in determining the length of time that individual birds remain in the vicinity of a netting station. The height of the canopy and the relative amount of undergrowth help determine the relative efficiency of the nets in taking the various species present. Species that are normally treetop feeders are easily netted at a location such as Island Beach where the average height of the vegetation is about 6 feet, but the same species are taken less frequently at stations such as Milbridge and Medomak where there is a high canopy.

All stations used Japanese mist nets of three-quarter-inch mesh, except for two nets of 1¼-inch mesh at Ocean City. The nets were of either silk or nylon, of variable length and vertical extension, but were mostly between 30 and 40 feet in length and between 3 and 6 feet in vertical spread. Except as otherwise stated, nets were strung with the top trammel about 5 to 7 feet above the ground. Some operators left their nets set 24 hours a day, some furled them up at night, and some removed them at night. Since extremely few birds entered the nets after dark, only daylight hours of operation are included in the net-hour totals. For comparative purposes the principal species banded at each station and the day or days when the largest numbers were banded are also included.

BRIER ISLAND, Digby County, Nova Scotia. 44°17′ N, 66°21′ W. North Point, about 200 yards from the ocean at the mouth of the Bay of Fundy. Principal vegetation white spruce and alder, with the tallest trees about 20 ft. in height. Natural food supply considered average. Maximum of 7 nets operated for 5 days, September 21-25. In many cases birds were driven into the nets. Principal species: 40 Slate-colored Juncos* (maximum of 13 on Sept. 22), 11 Blackpoll Warblers (5 on Sept. 25), 7 Myrtle Warblers (6 on Sept. 25). Dr. Harrison F. Lewis, assisted by John Comer, Wickerson Lent, and Willet J. Mills.

GRAND MANAN, Charlotte County, New Brunswick. 44°40′ N, 66°48′ W. Long Pond near "The Anchorage" resort about 2 miles southwest of Grand Harbour, 1/10 to ¼ mile from the Atlantic Ocean. Principal vegetation, alder, mostly 5 ft. to 8 ft. in height; secondarily meadow-sweet, then mixed deciduous scrub (some in a belt by itself, some bordering mature spruce that reached a height of 50 ft. or more). Natural food supply considered average for this habitat. Maximum of 18 nets operated 12 days, August 19-30 (but furled most of Aug. 26-27 because of rain). Principal species: 52 White-throated Sparrows (maximum of 9 on Aug. 21), 44 Traill's Flycatchers (9 on Aug. 22), 36 Red-eyed Vireos (8 on Aug. 20 and 29). E. Alexander Bergstrom.

MILBRIDGE, Washington County, Maine. 44°28′28″ N, 67°51′47″ W. Three miles due south of Milbridge, 50 ft. from Atlantic Ocean. Mixed habitat, including scrub growth and mature forest. Principal trees and shrubs were spruce, fir, tamarack, mountain ash, hardhack, blueberry, raspberry and bayberry. Food supply poor. No cones on the conifers and no berries on mountain ash. "On the first day of the migratory wave almost every berry disappeared from the other bushes." Maximum of 7 nets operated 34 days during daylight hours, August 6 through September 8. Five nets set at ground level, 2 in trees 18 ft. above ground. Principal species: 135 Swainson's Thrushes (45 on Sept. 2), 52 Myrtle Warblers (6 each on Sept. 2 and Sept. 5), 42 White-throated Sparrows (16 on Sept. 2). Mr. and Mrs. G. Hapgood Parks.

CASTINE, Hancock County, Maine. 44°23′ N, 68°50′ W. Near mouth of Penobscot River. Seven nets operated 20 days during the period September 2 to October 6. Principal species: 123 Slate-colored Juncos (63 on Oct. 4), 116 White-throated Sparrows (34 each on Oct. 5 and 6), 79 Song Sparrows (38 on Oct. 5). Minot C. Morse, Jr.

MEDOMAK, Lincoln County, Maine. 43°56′ N, 69°24′ W. One mile south of Medomak, ¼ mile from Muscongus Bay. Spruce forest, scrub growth, hedgerow, orchard, and meadow. Principal trees, red and white spruce, red oak, choke cherry, arbor vitae, and apple. Average height of forest canopy, 75 ft. Food supply good. Birds feeding on choke cherries, geometrid larvae, spiders, etc. Maximum of 6 nets

* See Appendix I for scientific names.

operated 8 days, August 23 to September 5. Principal species: 41 Song Sparrows (22 on Aug. 24), 19 Myrtle Warblers (11 on Sept. 5), 13 Swainson's Thrushes (4 on Sept. 1 and Sept. 4). Joseph M. Cadbury.

LISBON, Androscoggin County, Maine. 44°04′ N, 70°05′ W. Webster Corner, 2 miles northeast of Lisbon and 20 miles from the Atlantic Ocean. Hedgerow consisting chiefly of choke cherry, apple, meadow-sweet, and elm, with an average height of 5 to 10 ft. and a maximum of 75 ft. Birds fed principally on choke cherries, but also on apples and various unidentified insects. Native food supply unusually good while it lasted. Maximum of 3 nets operated 23 days during the period September 11 to October 13. Principal species: 78 Swainson's Thrushes (22 on Sept. 17), 26 Myrtle Warblers (7 on Sept. 17), 22 White-throated Sparrows (6 on Sept. 16). Douglass H. Morse.

PLUM ISLAND, Essex County, Massachusetts. 42°45′ N, 70°47′ W. Maximum of 6 nets operated 11 days during the period September 1-17 (daily Sept. 9-17 except for the 14th). Principal species: 106 Catbirds (32 on Sept. 1), 35 White-throated Sparrows (12 on Sept. 15), 30 Myrtle Warblers (16 on Sept. 15). Murray L. Gardler, assisted by Pat Anderson and Dave Freeland.

ROCKPORT, Essex County, Massachusetts. 42°38′11″ N, 70°35′42″ W. Lands End. Habitat varied in height and composition—mostly deciduous. Four nets run on afternoon of September 28, 8 nets run all day Sept. 29. Principal species: 21 White-throated Sparrows, 19 Swainson's Thrushes, 16 Robins. Jack P. Hailman and Carl W. Helms, assisted by Robert Barth, Peter Mott, and students.

GLOUCESTER, Essex County, Massachusetts. 42°35′ N, 70°39′ W. Eastern Point. Maximum of 2 nets operated 4 days, Sept. 4, 5, 9, and 29. Mrs. Sarah F. Robbins.

NANTUCKET ISLAND, Nantucket County, Massachusetts. 41°16′ N, 70°09′ W. Principal netting station at the Mothballs, 3 miles southwest of Nantucket, and 300 yards from the ocean. Simultaneous banding conducted at several locations on the island on a few days. Banding sites frequently shifted to take advantage of weather conditions. Poor days for warblers, vireos, thrushes, etc., were spent banding at localities that furnished such species as cowbirds, bobolinks, etc. Principal vegetation at the Mothballs was pine and bayberry with an average height of 10 ft. and a maximum of 30 ft. Bayberries and midges are estimated to have provided about 95% of the bird food, and the supply of these two items was rated as unusually good. Maximum of 15 nets (usually 5 or 6) operated 75 days during the period August 1 to October 29, but only the August and September bandings are included in the current summary. Principal species: 383 Song Sparrows (53 on Sept. 14), 293 Savannah Sparrows (123 on Sept. 6), 161 Catbirds (13 on Sept. 14), 159 Redwinged Blackbirds (44 on Aug. 19), 158 Brown-headed Cowbirds (28 on Aug. 17), 143 Bay-breasted Warblers (51 on Aug. 28), 139 White-throated Sparrows (30 each on Sept. 19

and 29), 133 Cape May Warblers (18 on Sept. 19, 17 on Aug. 22). John V. Dennis, assisted by Dr. Lee Jay Whittles, Mrs. Roy E. Larsen, and Mrs. Clinton Andrews.

MIDDLETOWN (Norman Bird Sanctuary), Newport County, Rhode Island. 41°30′ N, 71°20′ W. This netting station is located on the southeastern corner of Aquidneck Island and is bounded on the east by the Sakonnet River and on the south by the Atlantic Ocean. Two major netting areas one-half mile apart were used: (1) An area of three acres covered by 10-ft.-high shrubs and small trees (arrowwood, blueberry, black cherry, poison ivy, grape, and greenbrier). This thicket is bounded on two sides by open fields, on another by a salt marsh and on the remaining side by a reservoir. (2) The area most heavily netted lies on the east side of an extensive wooded area. The woods are dominated by red maple and tupelo, the average height of which is 30 to 40 ft. Associated species are red cedar, white oak, European oak, and beech, with an understory of spicebush, sweet pepperbush, blueberry, alder, and extensive thickets of greenbrier. Along the eastern edge of the woods is a series of abandoned fields which have developed into extensive thickets of arrowwood, blueberry, bayberry, black cherry, red cedar, and sapling red maples and tupelos. Eight nets average were set within the woods proper, most at ground level but several within the treetop canopy. Ten or more nets were operated along the edge of the woods and in the overgrown fields. Principal species: 563 Catbirds (44 on Aug. 18, 29 on Sept. 25), 174 Robins (20 on Sept. 21), 162 Song Sparrows (12 on Aug. 10). James Baird, assisted part time by Mrs. James Baird, R. Udall, and Mr. and Mrs. Stanley S. Dickerson.

KINGSTON, Washington County, Rhode Island. 41°2-′ N, 71°3-′ W. One or two nets operated daily, Sept. 4-14, 18-21, 28-29. Principal species: 147 Catbirds (19 on Sept. 5), 23 Black-capped Chickadees (4 each on Sept. 4, 6, and 8), 16 Red-eyed Vireos (6 each on Sept. 4 and 5). D. L. Kraus.

ISLAND BEACH, Ocean County, New Jersey. 39°46′ to 39°54′ N, 74°05′ W. Island Beach State Park, a 10-mile barrier beach one-half mile wide separating Barnegat Bay from the ocean. Scrub growth averaging about 6 ft. in height (maximum about 12 ft.), consisting mostly of American holly, bayberry, red cedar, wild cherry, greenbrier, poison ivy, blueberry, hudsonia, and Virginia creeper. Maximum of 60 nets operated 17 days, Sept. 6-22. Simultaneous netting conducted at an average of about 6 locations; 13 netting lanes, all running east-west, and mostly on the bay side of the peninsula, were used from time to time. Principal species: 819 Catbirds (126 on Sept. 12, 116 on Sept. 20), 267 American Redstarts (100 on Sept. 9), 159 Yellowthroats (30 on Sept. 7), 126 Rufous-sided Towhees (15 on Sept. 15), 105 Red-eyed Vireos (37 on Sept. 9). Mrs. Stanley S. Dickerson, assisted by the following banders: Mr. Stanley S. Dickerson, Bennett K. Matlack, Mrs. Frank Townsend, William Pepper, Miss Mary Pepper, Frank Frazier, Sr., Frank Frazier, Jr., John Given, Dr. Richard Riesz, John C. Miller, E. Alexander Bergstrom, and James Baird.

CAPE MAY, Cape May Co., New Jersey. 38°56′14″ N, 74°57′10″W. Woods north of Lake Lily, Cape May Point. Mature pine, 25 to 35 ft. tall, with dense deciduous understory of shrubs, saplings, and vines. Maximum of ten nets operated in evening and early morning, Sept. 11-13, along old wood road and survey lines. Principal species: 20 Catbirds (9 on Sept. 13), 13 Veeries (5 on Sept. 12). Joseph M. Cadbury, assisted by Chandler S. Robbins and Allen J. Duvall.

TINICUM, Philadelphia, Pennsylvania. 39°5-′ N, 75°1-′ W. 300 yards from the Delaware River in black willow woods with elderberries, spotted touch-me-nots and pokeberries. Five nets operated 11 days during the period Sept. 6-18 (daily except Sept. 7 and 12). Principal species: 31 Catbirds (9 on Sept. 13), 11 Ovenbirds (5 on Sept. 9), 11 American Redstarts (7 on Sept. 9). John C. Miller.

MONKTON, Baltimore County, Maryland. 39°36′ N, 76°36′ W. Blue Mount Nursery, 3 miles northeast of Monkton, and 25 miles northwest of upper Chesapeake Bay. Netting site in scrub growth consisting primarily of tulip poplar, scrub pine, spice bush, and Japanese honeysuckle; tallest trees 25 ft. high. Food supply, especially berries, considered good. Maximum of 4 nets operated 14 days in September (daily, Sept. 22-30 except Sept. 26). Principal species: 15 Swainson's Thrushes (5 on Sept. 23), 11 Magnolia Warblers (3 on Sept. 24), 8 Ovenbirds (2 each on Sept. 20, 24, and 25). Stephen W. Simon.

GRASONVILLE, Queen Annes County, Maryland. 38°58′ N, 76°14′ W. Kent Narrows, 6 miles east of the Chesapeake Bay Bridge. Shrubs bordering brackish tidal marsh. Four nets operated 4 days; no birds captured except on Sept. 9. Mr. and Mrs. Richard P. Dubois.

CLAIBORNE, Talbot County, Maryland. 38°50′ N, 76°18′ W. Wade Point Farm, 1 mile southwest of Claiborne, on bluff overlooking the east shore of Chesapeake Bay, an airline distance of 65 miles from the ocean. Principal vegetation, sea-myrtle, with an average height of 8 ft. Food supply good. Maximum of 4 nets operated daily, Sept. 3-24. Principal species: 37 American Redstarts (18 on Sept. 18), 29 Catbirds (5 on Sept. 20), 19 Mockingbirds (5 on Sept. 5). W. M. Davidson.

OCEAN CITY, Worcester County, Maryland. 38°24′25″ N, 75°03′45″ W. West of Atlantic Avenue in real estate development known as Ocean Bay City, 5½ miles north of the Ocean City bridge. Loblolly pine stand and shrub swamp adjacent to tidal marsh. Mature pines 40 to 60 ft. tall, young or stunted pines averaging about 20 ft. Scattered mature black gum trees and dense understory of American holly, black gum, greenbrier, magnolia, muscadine grape, Japanese honeysuckle, bayberry, and other berry-bearing shrubs. Excellent berry supply and plentiful crop of mosquitoes. Maximum of 36 nets operated 16 days (Sept. 7-8, 13-26). Except for two double-deckers reaching from ground level to 10 ft., all nets were 1 to 7 ft. above ground. Principal species: 126 Swainson's Thrushes (50 on Sept. 24, 49 on Sept. 25), 92 American Redstarts (22 on Sept. 24, 21 on Sept. 25), 70 Gray-cheeked Thrushes (37 on Sept. 25, 28 on Sept. 24), 54 Catbirds (9 each on Sept. 14 and 25). Chandler S. Robbins, assisted by Mr. and Mrs. A. J. Fletcher, Mrs. E. W. Goodpasture, and Mrs. R. S. Stauffer.

CHINCOTEAGUE, Accomack County, Virginia. 37°54′30″ N, 75°21′15″ W. Chincoteague National Wildlife Refuge, Assateague Island, 0.5 mile southeast of Chincoteague. Loblolly pine woods with open canopy, 400 yards from Chincoteague Bay and 0.5 mile back from the ocean. Tallest trees 35 ft., average 25 ft. Chief understory species were laurel and greenbrier; food supply considered average. Maximum of 12 nets operated 7 days, Sept. 15-21. Principal species: 12 Pine Warblers (11 on Sept. 18), 12 Rufous-sided Towhees (4 on Sept. 16), 8 Northern Waterthrushes (5 on Sept. 18). Bander, Frederic R. Scott; observers, C. C. Steirly, J. M. Valentine, R. J. Watson.

KIPTOPEKE, Northampton County, Virginia. 37°07′ N, 75°58′ W. Naval Air Force Station at mouth of Chesapeake Bay. Loblolly pines, 30 ft. tall, with understory of bayberry, poison ivy, and greenbrier. Food supply considered poor to average. Maximum of 14 nets operated 6 days, Sept. 24-29. Principal species: 58 Swainson's Thrushes (18 on Sept. 25), 41 Gray-cheeked Thrushes (18 on Sept. 25), 9 American Redstarts (4 on Sept. 28). Mrs. Stanley S. Dickerson.

CAFFEYS INLET, Currituck County, North Carolina. 36°11′ N, 75°48′ W. Near old Caffeys Inlet Coast Guard Station, Duck beach, 8 miles northwest of Kitty Hawk. Shore of Currituck Sound, one-half mile from Atlantic Ocean. Native food supply poor. Four nets operated on September 14-15, some along sandy beach, some in yaupon and myrtle thickets. Principal species: 6 Semipalmated Sandpipers, 4 Catbirds. Harry T. Davis, assisted by J. W. E. Joyner and John Thompson.

RECORD KEEPING

In addition to the routine banding records, all station operators were requested to record the exact time at which each bird was handled, to report the number of net-hours of operation each day, and to keep notes on weather conditions. Additional records kept at the discretion of the individual operators (as time permitted) included the direction from which birds entered the nets; the height at which they entered; the direction of observed diurnal migration; notes on age and sex characters; the molt stage; parasites collected or seen; and the food available or which was actually noted being consumed. At five stations, Nantucket, Middletown, Kingston, Island Beach, and Ocean City, weights and wing measurements (chord) were taken on a high proportion of the birds trapped.

Daily lists of birds observed but not trapped were recorded at some stations; but since all stations were understaffed, no participants could be spared for full-time studies of bird populations in and near the trapping sites or for continuous observations on arrivals and departures of migrants or for recording birds passing by overhead during the day or at night. It is hoped that in subsequent years the banding operations at many stations can be supplemented by systematic field observations.

At the larger netting stations, where two or more banders were tending nets and where each was using his own bands, each bander was asked: (1) to make available in advance a complete list of the band numbers he expected to use or had used in past years; and (2)

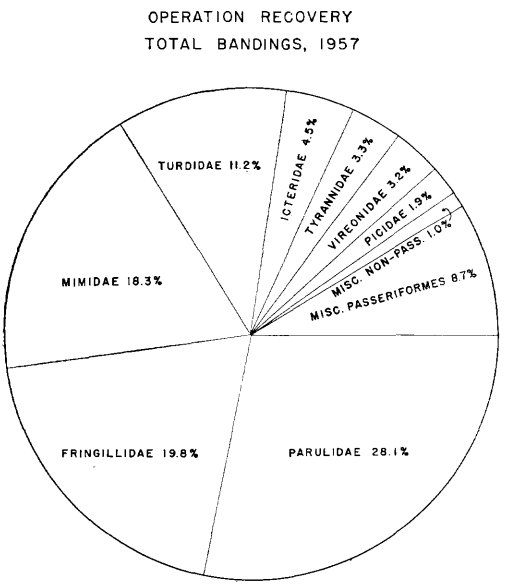

Fig. 2. Summary of total bandings by families, 1957.

to turn in to the station leader *each day* his complete banding record for the day, including all repeats and returns handled, as well as an accounting of every new band, and a summary giving totals by species. By keeping field records on a clip board and using carbon paper to prepare a duplicate copy, little extra time or effort is required to follow this procedure.

PARASITES

At the Middletown, R. I., station during 1956, 22 specimens of 3 species of flies (Hippoboscidae—*Ornithomyia fringillina, Ornithoica vicina,* and *Lynchia americana)* were collected from 16 species of birds. At the same place in 1957, 70 flies of 2 species *(Ornithomyia fringillina* and *Ornithoica vicina)* were collected from 17 species of birds. Additionally, the number and hosts of flies seen but not captured were noted. All information and specimens were sent to Dr. Joseph C. Becquaert at the University of Houston, Houston, Texas.

SUMMARY OF 1957 BANDINGS

The 1957 bandings totaled 11,613 individuals of 130 species.

Figure 2 summarizes the 1957 Operation Recovery bandings by families. The wood warbler family (Parulidae), with 3,254 individuals banded, comprised 28.1 percent of the total, and the Parulidae and Fringillidae (19.8%) combined accounted for nearly half of the individuals banded. Other families represented, in order of decreasing abundance, included: Mimidae, 18.3%; Turdidae, 11.2%; Icteridae, 4.5%; Tyrannidae, 3.3%; Vireonidae, 3.2%; Picidae, 1.9%; Bombycillidae, 1.3%; and Paridae, 1.2%. The remaining 7.2% included

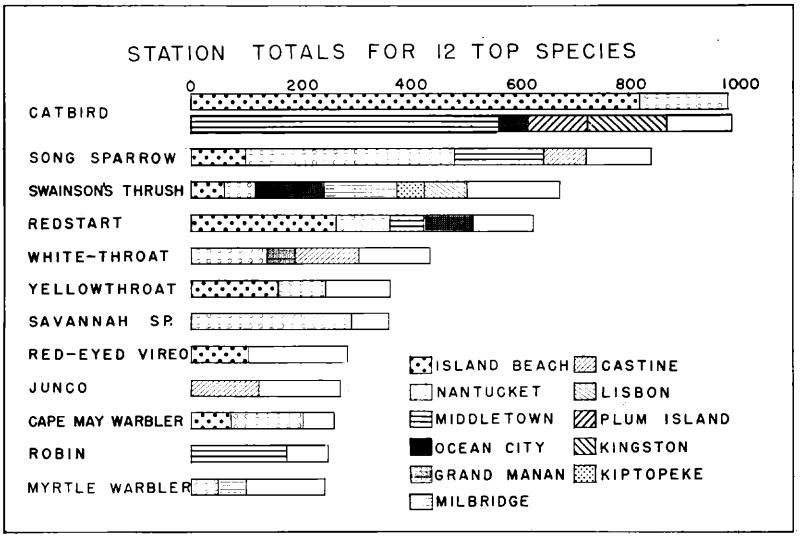

Fig. 3. Station totals for 12 top species, 1957.

the following families, in order of decreasing abundance: Certhiidae, Hirundinidae, Sittidae, Thraupidae, Troglodytidae, Cuculidae, Corvidae, Scolopacidae, Sturnidae, Sylviidae, Columbidae, Caprimulgidae, Alcedinidae, Accipitriidae, Charadriidae, and single birds of the families Ardeidae, Falconidae, Rallidae, Strigidae, and Trochilidae.

The twelve species most commonly banded were the Catbird, 1,968; Song Sparrow, 847; Swainson's Thrush, 677; American Redstart, 626; White-throated Sparrow, 440; Yellowthroat, 365; Savannah Sparrow, 363; Red-eyed Vireo, 285; Slate-colored Junco, 274; Cape May Warbler, 263; Robin, 251; and Myrtle Warbler, 246.

Figure 3 shows the comparative numbers of these 12 species banded at the major stations. Station symbols are used to show the number of individuals banded in each case where the seasonal total for a particular station exceeded 50 individuals of the species in question. It is evident from this chart that the chances of recapturing a banded bird at another station are extremely remote. Only four species were banded in numbers exceeding 500 individuals, and these same four species were the only ones for which four or more stations trapped 50 or more individuals each. Obviously, we could not expect species such as the Savannah Sparrow, Robin, Rufous-sided Towhee, or Slate-colored Junco, which were banded in quantity at only one station, to be recaptured by other participants.

This emphasizes the desirability of having all operators select trapping sites which favor the netting of certain common key species, and of timing their netting periods to conform with the speed of migration of these same species. For example, if one station were to concentrate on blackbirds, another on sparrows, a third on hawks, and a fourth on shorebirds, this would not only reduce the chances of netting each

other's birds, but would also make it impossible to compare arrival dates, peak movements, or weight records between stations, or to correlate widespread migratory movements with specific weather conditions.

In addition to the twelve species in Figure 3, the following were banded in numbers of 150 or more (arranged in order of decreasing abundance): Rufous-sided Towhee, Redwinged Blackbird, Bay-breasted Warbler, Northern Waterthrush, Yellow-breasted Chat, Blackpoll Warbler, Brown-headed Cowbird, and Ovenbird. Between 100 and 149 individuals of the following species were banded (in order of decreasing abundance): Cedar Waxwing, Black-and-white Warbler, Brown Thrasher, Magnolia Warbler, Yellow Warbler, Veery, Baltimore Oriole, Black-capped Chickadee, and Purple Finch.

DIRECT RECOVERIES

The 1955 and 1956 Operation Recovery bandings yielded only two recovery records during the same fall migration period or the subsequent winter.

The two recoveries were both of warblers banded at Nantucket, Mass., by John V. Dennis (Table 2 and Fig. 4).

Table 2. *Direct recoveries of birds banded in 1955 and 1956*

Species	Band number	Banding date	Recovery date	Recovery locality	Elapsed time (days)
Myrtle Warbler	57-81987	Oct. 20, 1955	Feb. 12, 1956	Wingate, Maryland	115
Cape May Warbler	25-14304	Sept. 4, 1956	Oct. 25, 1956	Marcane, Oriente, Cuba	51

Partly as a result of the more intensive banding in the autumn of 1957, eleven direct recoveries were obtained from birds banded at coastal localities during August and September, and three others from stations that continued operation through October. Four of the recoveries were Catbirds, representing a direct recovery rate of one-fifth of one percent for this species. A summary of these recoveries is presented in Table 3.

Four of the recoveries, the Dickcissel, the Slate-colored Juncos, and the Louisiana Catbird, were from inland localities. It is of considerable interest that all the other recoveries came from within ten miles of tidewater. Two of these were near tributaries of Chesapeake Bay, one was on the west coast of Florida, one at the tip of the Florida Keys, and all the others were along the Atlantic coast. The Sora was shot in the same county where it had been banded. All the other recoveries listed in the table are shown in Figure 5.

The Northern Waterthrush that was banded at the Plum Island netting station in Massachusetts and recaptured in an Island Beach net five days later is of special interest. The five-day interval in itself is not remarkable; the airline distance between the two stations is only 260 miles, and it is possible that the flight was made in a single hop. Actually, Stanley Dickerson noted that the bird entered the Island Beach net from the north at 0730, so it is conceivable that it was migrating when captured. The chief interest in this recovery is that it

has demonstrated that some species of transients *can* be netted at two or more coastal points if enough stations are operating at the right time. It also impresses participants with the sobering thought that failure to record time of day, repeat records (even those on the day of banding), and weights could result in the loss of extremely interesting data if the bird were recaptured at another station the same or the following day.

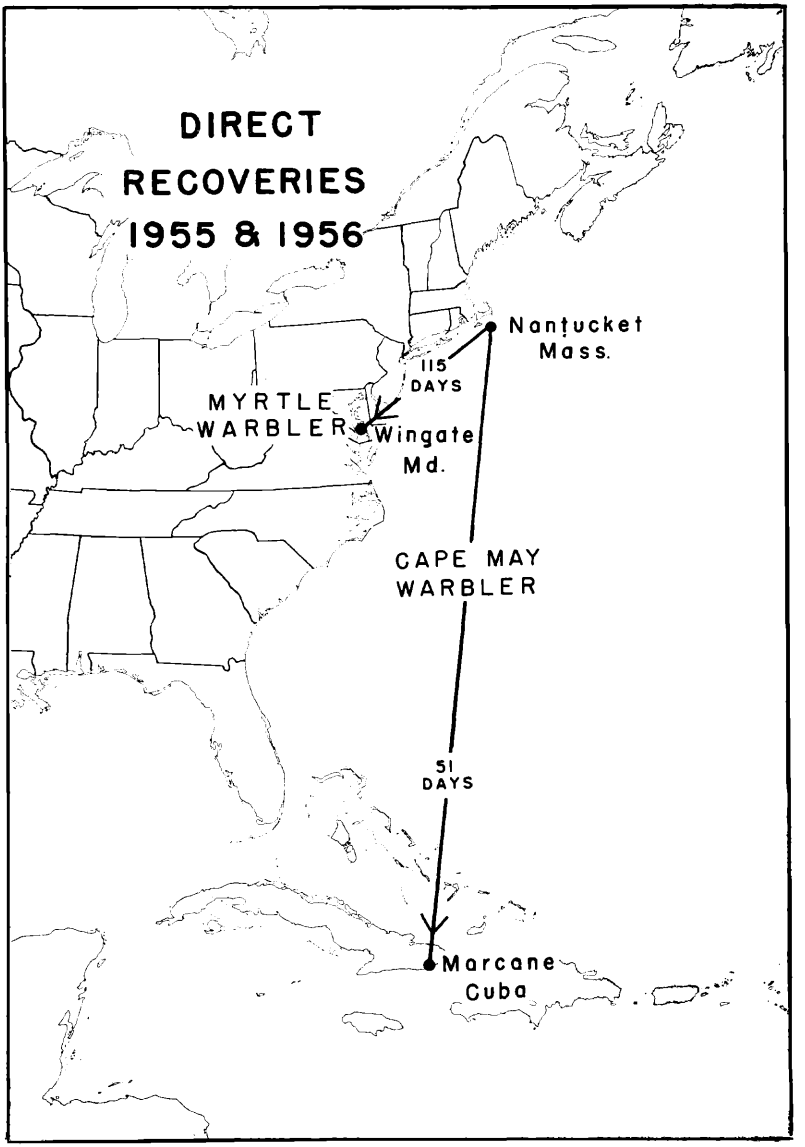

Fig. 4. Direct recoveries, 1955 and 1956.

Table 3

Direct recoveries of birds banded in August, September, and October, 1957

Species	Band number	Banding date	Banding locality	Recovery date	Recovery locality	Elapsed time (days)
Sora	583-58208	9/8/57	Island Beach, N. J.	10/7/57	Ocean Co., N. J.	29
Catbird	56-120222	8/24/57	Middletown, R. I.	1/14/58	Bridge City, La.	143
Catbird	55-168912	9/12/57	Island Beach, N. J.	1/26/58	Ft. Lauderdale, Fla.	136
Catbird	55-168933	9/13/57	Island Beach, N. J.	1/27/58	Key West, Fla.	136
Catbird	54-179736	9/25/57	Ocean City, Md.	2/--/58	St. Petersburg, Fla.	129+
Robin	532-37732	9/10/57	Middletown, R. I.	12/19/57	Petersburg, Va.	100
Myrtle Warbler*	26-22468	9/7/57	Middletown, R. I.	10/13/57	Nantucket, Mass.	36
Bay-breasted Warbler	25-89182	8/28/57	Nantucket, Mass.	9/29/57	Boston, Mass.	32
Northern Waterthrush*	25-92774	9/2/57	Plum Island, Mass.	9/7/57	Island Beach, N. J.	5
Dickcissel**	24-189611	10/28/57	Middletown, R. I.	12/5/57	Rockaway, N. J.	38
Rufous-sided Towhee	56-120104	8/17/57	Middletown, R. I.	10/17/57	Halifax, N. S.	61
Savannah Sparrow	59-01851	9/5/57	Nantucket, Mass.	2/--/58	Merry Point, Va.	160+
Slate-colored Junco	55-71845	10/27/57	Castine, Me.	2/17/58	Jonesboro, Tenn.	113
Slate-colored Junco	55-71852	10/28/57	Castine, Me.	2/15/58	Raleigh, N. C.	110

*recaptured at another coastal netting station.
**recaptured at a feeding station.

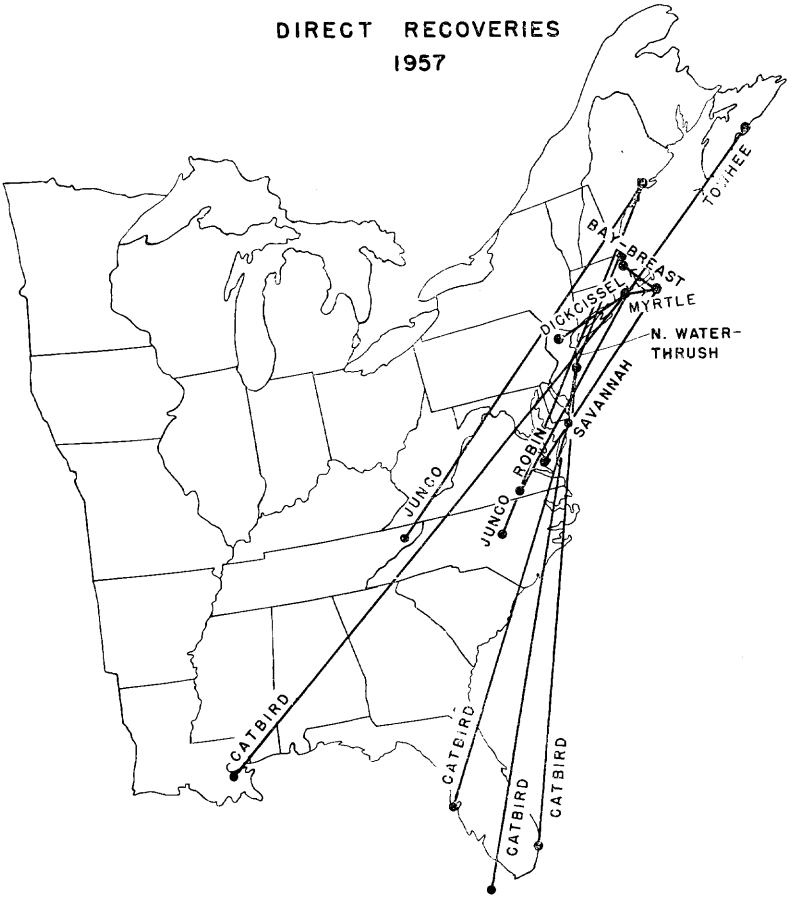

Fig. 5. Direct recoveries, 1957.

DIRECTION OF MOVEMENT

Direct Observations

As mentioned earlier most banding stations were severely handicapped by lack of adequate personnel, especially for direct observation on migration. However, with due consideration of the inadequacies of observation the following conclusions may be drawn.

In general, observed migration during daylight hours followed the contour of the coast, usually from northeast to southwest. In the case of long peninsulas, however, there was considerable doubling back by certain species. At Nantucket Island, Mass., field observations over an eight-year period have indicated that the bulk of the migrants in fall move westerly or northwesterly across the island, always departing from the island in a northwesterly or westerly direction toward the Massachusetts mainland or the island of Marthas Vineyard.

At Milbridge, Me., the White-throated Sparrow, Black-capped Chickadee, and Blue Jay were reported by G. Hapgood Parks as moving toward the southwest. At Island Beach, N. J., Baltimore Orioles and Cedar Waxwings were seen flying northward in the early morning, while Yellow-shafted Flickers flew south in the early morning, and Starlings and Common Grackles flew south in the evening.

The netting station at Ocean City, Md., was surrounded on all but the north side by treeless habitats. The nearest trees to the west or southwest were on the Isle of Wight and Saint Martin Neck, both involving a two-mile flight over Assawoman Bay. To the east of the netting area lay a bulldozed subdivision with scattered loblolly pines but no buildings; beyond this was the highway, a narrow strip of dunes, and the Atlantic Ocean. To the south-southwest, along the barrier beach, were six miles of motels, cottages, hotels, and other buildings, with only a few scattered ornamental trees; beyond this was Ocean City Inlet (0.2 miles wide), and then many miles of Assateague Island. The nearest clump of trees in this direction was 15 miles from the netting station. Heavily wooded Upper Sinepuxent Neck, one mile west of Ocean City and the northern part of Assateague Island, could be reached from Ocean City by an over-water flight of less than a quarter of a mile. Most species observed in flight were moving southward along the barrier beach a little above treetop height. Among the migrants following this pattern were: Osprey, Marsh Hawk, Peregrine Falcon, Pigeon Hawk, Sparrow Hawk, Yellow-shafted Flicker, Hairy Woodpecker, Eastern and Western Kingbirds, Tree Swallow, Bobolink, and Baltimore Oriole. When the wind was blowing from a southerly quadrant, Tree Swallows tended to fly northward over the netting station. Unfortunately, the shortage of man power made it impossible to follow the birds south of the station to determine which species crossed over to Assateague Island, and which ones flew to the mainland.

Observations on diurnal migration were made during late August and September of 1956 and 1957 at Brenton's Point, Newport, R. I. Observations were not made at the netting station in Middletown since past experience showed that diurnal migration at this southeast point of Aquidneck Island was diffuse and ill-defined. However, at Brenton's Point, the southwest point of the island, there was diurnal migration of considerable magnitude. Species which were observed actively migrating past this point included the following: Sharp-shinned Hawk, Red-tailed Hawk, Red-shouldered Hawk, Broad-winged Hawk, Osprey, Sparrow Hawk, Killdeer, Chimney Swift, Ruby-throated Hummingbird, Eastern Kingbird, Tree Swallow, Bank Swallow, warblers (spp.), Bobolink, Redwinged Blackbird and Dickcissel.

Hours of Migration at Brenton's Point, Newport

The first diurnal migrants were not observed until approximately 30 minutes after sunrise even though the observer was on the scene well before the morning's first light on several occasions. In the case of the Bobolink, which migrates both by day and by night, this lack of crepuscular activity suggests that night-migrating Bobolinks do not continue their flight into the daylight hours; apparently, there is no continuity between night-flying and day-flying Bobolinks. The heaviest period of

diurnal migration activity is between 0630 and 1900 (D. S. T.). Migration of nearly all passerine species is completed by 1100.

Behavior Patterns when Confronted by an Overwater Crossing

Visual observations of diurnal migration at Brenton's Point, Newport, are typical of those that have been noted at other coastal points where overwater crossings are initiated. They are summarized here under family headings.

Hawks: The Sharp-shinned Hawk, Marsh Hawk, Osprey, and Sparrow Hawk all made direct crossings without hesitation, east to west, at varying altitudes. Buteos came to the point, circled, gained altitude, and turned northward proceeding in a flap-and-glide flight.

Shorebirds: Most shorebirds observed flew in direct flight at fairly high altitudes from the east-northeast to the west-southwest.

Swifts: Chimney Swifts made direct crossings alone, in small groups, or in the company of swallows. The altitude and directness of the crossings were dependent on the wind direction and speed.

Hummingbirds: Unhesitating southward flight. Adherence to this line of flight would carry the bird out over the open ocean on a course parallel to the eastern seaboard. However, a westerly or southwesterly redirection of flight would lead the bird back to the mainland.

Flycatchers: The Eastern Kingbird traveled in small or large flocks, seldom alone. In all instances observed the flocks were loose and straggling, with each bird engaged in straightforward flight. Upon reaching the shoreline, if the altitude was great enough at the time, the crossing was made without preliminary circling or milling about. When the birds approached the shoreline at low level, they often milled about and either dropped into the bushes, or headed out over the water in a westerly direction, gaining altitude rapidly. Regardless of the altitude at which the flocks reached the shoreline, they always continued to gain altitude for the duration of the crossing. The flight direction was west or north of west.

Swallows: The species most frequently observed crossing was the Barn Swallow. Tree and Bank Swallows were seen in considerably smaller numbers, and a Cliff Swallow was seen only once. Generally speaking, the Barn Swallows reacted in one of two ways on reaching the point: (1) Their numbers were constantly being augmented by new arrivals. When they first arrived, they fed over the low shrubs and grassy areas and gradually, in both small and large groups, took off in a southwesterly direction. This departure was sometimes preceded by a great deal of twittering and circling. The group then split up, some continuing feeding, and the remainder heading out over the water on a southwesterly course. (2) The swallows arrived at the point and without hesitation or feeding took off across the water.

The height of the swallows over the water was apparently determined by wind direction; a head wind, in this instance a westerly wind, caused them to fly low (from wave-top level to about 10 feet), while a tail wind (easterly) caused them to fly higher.

Warblers (spp.): In several instances high-flying unidentified warblers were heard chipping loudly overhead. The reactions of these individuals were all the same, in that the birds suddenly appeared

overhead, and while facing south rapidly gained altitude while their position over the point was nearly stationary. Invariably the birds turned to the north and dropped into the bushes a short distance from the point.

Icterids: The Bobolink migration followed an almost unvarying pattern. They arrived at or near the point from the north or northeast. The compact flock, varying in number from 3 to 150 birds, upon reaching the shoreline, immediately began to mill about in a straggling fashion. While milling about, they gradually turned on a northwesterly course, gaining altitude all the while. As they proceeded farther out over the water the flock again became compact and the altitude gain continued as long as the birds were visible. This routine was followed by all of the 1,480 Bobolinks seen between August 28 and September 7, 1956. Furthermore, this migration pattern was relatively uninfluenced by wind direction.

The Redwinged Blackbird migration pattern was nearly identical to that of the Bobolink in all aspects. While Bobolinks and Redwings usually migrated in separate flocks, they occasionally were found together.

Fringillids: The only fringillid noted as a diurnal migrant was the Dickcissel. Two individuals were seen. In the first instance, a lone bird came to the point, circled several times, then headed north in the direction from which it had come. In the second instance, the Dickcissel was caught up in a flock of 75 Bobolinks. These birds reacted in the usual manner and the Dickcissel stayed on the periphery of the flock calling all the while. It remained with the Bobolinks in their over-water flight.

Local Movement

Local movement at net level frequently did not conform with the direction of flight overhead. At Milbridge, Nantucket, Cape May, and Ocean City the banders were not aware that more birds entered the nets from one direction than from another. A sample of 517 records from Island Beach showed that 214 birds entered nets from the north as compared with 303 from the south. At Tinicum, along the Delaware River, birds taken in the early morning entered nets from the north; but later in the day they entered at random.

Except at Island Beach, Middletown, and Nantucket, the greatest distance between nets was 800 feet or less. Thus it was not possible in most areas to obtain information on the local movements of banded birds. At Nantucket, however, repeat records of 1 Catbird, 2 Myrtle Warblers, 1 Slate-colored Junco, and 2 White-throated Sparrows confirmed the westerly and northwesterly movement noted during field observations. The Catbird and White-throats were retaken 10 miles due west of where banded, the junco and Myrtle Warblers 2 miles to the northwest. A Cape May Warbler was retrapped 10 miles southwest of where banded. Song Sparrows, on the other hand, showed a tendency to turn up to the east of the place of banding, 5 of them being retaken a mile or more in this direction, and 1 as far as 10 miles. A House Sparrow moved 2½ miles to the northeast. Ten local recaptures of Brown-headed Cowbirds indicated random movement by this species.

The high percentage of repeat records from the intensively netted

area of about 10 acres at Ocean City indicated that once birds had arrived in the area many remained for several days or until conditions were suitable for continuing their migration. Exactly what these conditions must be could not be determined from the data at hand, although the *greatest* number of departures took place on the night of September 23-24, the first night following cold frontal passage, and the same night when the largest influx of arrivals occurred. Repeat records in prior years, when nets were operated at other locations a few miles away, did not indicate any appreciable movement of birds either to the north or to the south of the net where they were first banded.

Reverse Migration

It came as quite a surprise to the Operation Recovery participants to learn that three of the first four recoveries away from the banding localities were of birds that moved to the north or east of the banding station. The Myrtle Warbler that went eastward from Middletown, R. I., to Nantucket Island, Mass., could have been completing a normal migration that began at some point to the northwest of Middletown. But the Bay-breasted Warbler that went from Nantucket to Boston, Mass., and the Rufous-sided Towhee that flew from Middletown, R. I., to Halifax, N. S., were definitely heading *away* from their usual wintering grounds. In fact, the towhee was recovered far to the northeast of its breeding range!

This direct evidence of reverse migration, coupled with the numerous records of stragglers from the south mentioned in the section on rarities, indicates that northward movement under certain weather conditions in fall may be a regular phenomenon. It is certainly one that is poorly understood at the present time, and one on which Operation Recovery can throw a great deal of light in the future.

Weather and Migration

The opening of the period found extreme northern New England experiencing the coolest August since 1912. At the same time, Charles B. Fobes, writing in the *Maine Field Observer*, reported that the summer of 1957 was the driest at Portland, Me., since 1872. Boston's total rainfall for August and September was only 2.06 inches. Conditions varied within New England; Portland, Me., had only 0.80 inches of rain in August, but 4.34 inches were recorded at Moosehead Lake, Me. Although tropical air penetrated New England only twice in August (Aug. 10, 15), that month brought no less than seven cold fronts (Aug. 1, 4, 10, 12, 16, 21, 27). One coastal Low brushed the Northeast, on August 26-27.

The August 1 cold front brought polar air into southern New England. The only resulting migratory activity involved Yellow Warblers and Northern Waterthrushes at Middletown, R. I. The August 4 cold front was accompanied by rain and produced no noticeable flight that day or on succeeding days. The August 10 front reached the coast during daylight hours. The most notable new arrivals at Middletown were Catbird, Myrtle Warbler, Blackpoll Warbler, and Baltimore Oriole. The front reached Nantucket in mid-day on August 10, and on August 11 Cape May Warblers, Bay-breasted Warblers, and American Redstarts

were seen. During the night of August 11-12, cold air pushed southward over New England. Starting with the cold front passage of August 10, the most noticeable increase in numbers of any species at Middletown was in the Catbird. During the period August 10-13, 50 Catbirds were banded. There apparently was a trickling of small land birds through Nantucket, the most unusual being a male Hooded Warbler on the 12th.

Tropical air invaded New England on August 15 but was quickly displaced by polar air during August 15-16. However, polar air was not well established over New England until August 17, and on that day the first Swainson's Thrush was banded at Milbridge, Me. At Middletown, R. I., Whip-poor-will, Myrtle Warbler, Ovenbirds, and Baltimore Orioles were present, while on Nantucket the only new arrival noted was a Dickcissel. On August 18 a heavy flight of Catbirds was the most conspicuous element of the migration at Middletown, while the most unusual bird banded there was a Summer Tanager. Other migrants included Bobolinks, Hairy Woodpecker, Red-breasted Nuthatch, Blue-winged Warbler, Magnolia Warbler, Cape May Warbler, Bay-breasted Warbler, American Redstart, and Rose-breasted Grosbeak. On August 19, there was a heavy Bobolink migration at Middletown.

During August 20-21, polar air became established over New England. On the former date, at Grand Manan, conspicuous new arrivals included Black-billed Cuckoo, Traill's Flycatcher, Red-eyed Vireos, and a number of warbler species. By August 22, the polar High was centered over Quebec Province, with a resultant northeasterly air flow over coastal New England. On this date, no conspicuous increase in migrant numbers was noted at Grand Manan, N. B., Milbridge, Me., or Middletown, R. I. However, Nantucket experienced the first big flight of the season, with as many as 17 Cape May Warblers and 29 Bay-breasted Warblers banded. On August 23-24, a ridge of high pressure extended from Nova Scotia southwestward to Texas, with clear skies prevailing throughout that entire area. On these dates, apparently there was a small-scale movement which was detected at Grand Manan and Middletown, but was not evident at Nantucket. As mentioned previously, a coastal Low moved up the coast during August 25-27.

A polar cold front moved from the St. Lawrence Valley southeastward across New England and off the coast on August 27, producing a major temperature-drop from New Brunswick to New York and Pennsylvania during the night of August 27-28, with frost being reported in Maine on the 28th. That day produced a small increase in the number of migrants banded at Grand Manan, but no increase was noted at Milbridge, Me. Middletown, R. I., had a small influx, while Nantucket had the greatest number of birds banded during August; particularly spectacular were the 51 Bay-breasted Warblers banded at Nantucket. During August 29-30, the center of the polar High moved southeastward across New England. On the 29th, Grand Manan had an increase in migrants; but a notable drop in the number of new birds banded was experienced at Nantucket during the last three days of the month, and the situation was similar at Middletown.

During September four tropical warm sectors penetrated as far north as New England (September 3, 13, 16, 21-22), while polar cold fronts

traversed major portions of the area under discussion on September 4-5, 14, 17, 23, 26. Portland, Me., had a maximum temperature of 86° on September 3 and 13, according to Fobes, who also states that "the first snow of the season was reported from Jackman, Me., on September 26, when two inches fell."

While there was no significant weather activity in the area during September 1-2, polar air persisted over the Northeast, and we find an interesting pattern of migratory activity, such as 66 Swainson's Thrushes banded at Milbridge, Me., and 43 Catbirds banded at Middletown, R. I., during the two-day period, but with little or no activity at Nantucket. The effect of the cold front of September 4-5 was not detected until the 6th, when Nantucket had a tremendous flight of Savannah Sparrows (123 banded), plus 5 Yellow-breasted Chats and 3 Dickcissels. At Middletown, Tree Swallows and Catbirds predominated, with a day's total of 94 birds banded. At Island Beach, N. J., Catbirds predominated (92 banded) and there were many warblers including 10 Yellow-breasted Chats.

During September 7-10, the center of a polar High moved from west of the Great Lakes to the Atlantic east of Cape Cod. During this period, there were some interesting daily migratory sequences. For example, although capturing no warblers on September 7 or on September 8 (when showers were prevalent over eastern Massachusetts during the early morning hours), Dennis, at Nantucket, had a sudden influx of warblers on the 9th. During this period, Tree Swallows were found in the Middletown area, but they had departed by the 11th. At Island Beach, from September 6 through 10, the daily numbers of Catbirds banded were 92, 83, 76, 15, and 6. On the other hand, the numbers of American Redstarts banded there were: 15, 40, 14, 100, 21. Two other contrasting species at Island Beach were Red-breasted Nuthatches (3, 14, 3, 6, 2), and Baltimore Orioles (2, 2, 4, 27, 0).

Following the tropical warm sector over New England on September 13 a weak cold front pushed southeastward and became stationary over Long Island and New Jersey on September 14, with the general situation remaining virtually the same on the 15th. September 16 brought a tropical warm sector northeastward to New Brunswick. The ensuing cold front, accompanied by rain, passed off the coast of the Northeast during the night of September 16-17. Rains were general along much of the Atlantic seaboard at this time. Perhaps because of this, banding results were insignificant on the 17th. By the 18th, however, a cell of high pressure was centered near Montreal, with polar air well established over New England. On this date, all stations had an increase in the number of birds banded. At Nantucket, 135 birds were banded, including 13 Cape May Warblers and 16 American Redstarts. At Middletown, Brown Creeper, Winter Wren, and Slate-colored Junco were among the new arrivals. Island Beach had a total of 112 birds banded, as compared with 19 on the preceding day. Cape May Warblers and American Redstarts were important elements in this flight. At Ocean City, Md., where precipitation continued until 0100 on the 18th, 72 birds were banded that day, representing only a 40% increase over the previous day's total. At Chincoteague National Wildlife Refuge, Va., 30 birds were captured. This was the peak

daily total during the seven days that this station was in operation.

On September 19 the High was centered over the Gulf of Maine, and a warming trend was beginning over the eastern United States. This trend continued on September 20, and by the 21st tropical air had advanced northeastward to central Maine, New Brunswick, and Nova Scotia. This tropical warm sector persisted over the Northeast during the night of September 21-22. It is interesting to note that on September 20, following a night of warm, light southerly winds, but clear skies, 116 Catbirds were banded at Island Beach, N. J. This was the only species which showed an increase. That this increase was real and was due to an influx of newly arrived birds can be seen from the daily totals for the period Sept. 16-21 (11, 3, 11, 14, 116, 10).

During the morning hours of September 23, a vigorous cold front crossed the Atlantic coast lying between the Bay of Fundy and the Virginia Capes. At Nantucket, where the front did not pass until early afternoon, no migration was detected during daylight hours; nor was any noted at Middletown. Ocean City, Md., had only 9 birds on September 23. At Monkton, Md., however, where the front had passed shortly after midnight, Simon had Swainson's Thrush, Gray-cheeked Thrush, and Bay-breasted Warbler, indicating that this more westerly locality was already benefiting from the cold frontal passage. On September 24, with the more easterly stations within the cold air, results improved, but in varying fashion. Whereas Nantucket and Middletown had 58 and 31 birds, respectively, Ocean City, Md., had 230. This discrepancy was based mainly on the fact that the volume of Swainson's and Gray-cheeked Thrush transients was not as great in the Northeast as in the Middle Atlantic States. The same is true for the following day, September 25, when Robbins banded 202 birds at Ocean City. The two best days during the September 21-25 netting period at Brier Island, N. S., were the 24th and 25th, when Dr. Lewis banded 18 and 29 birds, respectively. For further discussion of the effects of the September 23 cold front see Newman (1958) and Laskey (1957).

On September 26, another cold front crossed the Atlantic coast, north of the Virginia Capes. This was the leading edge of cold air flowing down the east side of a High whose center lay over the Great Lakes on September 27 and 28, and over Pennsylvania on September 29. Thus, the cold frontal passage of September 26 marked the beginning of a widespread migration on the eastern seaboard, which continued unabated through the 29th. Species which were involved in this flight included Yellow-bellied Sapsucker, Hairy Woodpecker, Eastern Phoebe, Blackpoll Warbler, Palm Warbler, Scarlet Tanager, Rose-breasted Grosbeak, Indigo Bunting, Pine Siskin, Slate-colored Junco, and White-throated Sparrow.

Weather Summary.—While it was generally true that the eastward passage of a cold front across the Northeast marked the beginning of a potentially good migratory period, there was sometimes a delay of 24 hours or more after the frontal passage before the first migrants were detected; this was true especially when an area of general precipitation followed passage of the front. Even when a heavy migratory flight was noted the first night (or day) after a cold front had passed,

the greatest density of migrants was frequently not attained until the second day.

The cold frontal passage brings in a northerly flow of polar air. This air flow may be weakened or strengthened by the subsequent positioning of the center of the High. When a High which has been centered in the vicinity of the Great Lakes moves eastward toward the Maritime Provinces, the northerly air flow may be sustained and even strengthened over New England and the Middle Atlantic States. Under these conditions migration intensity may rise from a fair level the first day to a peak on the second day, followed by a tapering off on the two or three following days. If, however, the High drifts southeastward toward the Middle Atlantic States, the polar air is warmed, and the wind gradually shifts to the southwest. Under proper conditions, this may then lead to a northeastward flow of tropical air. A situation of this type usually results in a rapid diminution of migratory activity.

RARITIES

All of the coastal netting operators who handled more than 500 birds in the fall of 1957 remarked on the occurrence of rare or unexpected species. In some cases these were birds not normally known to occur within 100 miles of the netting station (Prothonotary Warbler, Worm-eating Warbler, and Seaside Sparrow). In other instances they were species that are found with some regularity at mainland locations a few miles away, but which because of habitat preferences or restricted migration routes are seldom found, except under unusual circumstances, in the vicinity of the trapping site (White-breasted Nuthatch on Nantucket, Hairy Woodpecker at Island Beach and Ocean City). In still other instances it was simply a matter of discovering that sight observations frequently give an erroneous impression of the relative abundance of certain species. Secretive species such as the Yellow-breasted Chat and the Connecticut Warbler are easily overlooked by field observers, but since they feed near the ground in the midst of heavy cover they are readily taken in mist nets. *Empidonax* flycatchers are not only relatively quiet in autumn but next to impossible to identify even when well seen. Active field men along the Atlantic coast will be surprised to learn that out of more than 80 genera of birds taken during Operation Recovery, the genus *Empidonax* was among the top 12 in number of individuals banded. The total, 238, included all four eastern species as well as many individuals not identified.

The occurrence of a rare bird at a coastal netting station may presage a particularly heavy flight of that species. In 1956 at Brier Island, N. S., Dr. Harrison Lewis netted a Black-backed Three-toed Woodpecker. This anticipated by nearly a month the heaviest flight of this species in the Northeast since 1923. Similarly, in late June of 1957, Red-breasted Nuthatches were reported from Nantucket more than a month prior to the exceptionally heavy August flight. The vanguard of the extensive October Hairy Woodpecker flight reached nearly all coastal netting stations in late August and September, 1957, as did the White-breasted Nuthatch. The appearance of Myrtle Warblers in early August, 1957, at several coastal stations marked the beginning of an unprecedented early general arrival.

All of the above examples illustrate how in many instances an irruption of certain species could have been forecasted by the detection of individuals at coastal stations where, under normal circumstances, they are relatively uncommon or even rare.

It is difficult if not impossible at the present time to hazard a guess as to the origin of the various flights, or of any individual bird captured at coastal banding stations. Our lack of knowledge concerning subspecific differences coupled with the lack of facilities and equipment makes the subspecific identification of living birds impractical. We in eastern North America lack both the "tidy" racial differences of European birds and the degree of sophistication possessed by European banding stations.

However, we are able to detect within any given flight those species that are associated with a distinct faunal or regional group. For instance, from Massachusetts southward the Myrtle Warbler and the Red-breasted Nuthatch are certain to have originated in a region to the north; but there is no way of knowing whether the birds came from northern New England, Labrador, or the vast coniferous forests of Quebec or Ontario.

Similarly, the presence of southern and western birds along the northeastern coast in the fall leaves little doubt as to their general natal origin, but the specific area from which they departed and the route by which they traveled still remain undetermined.

In the past, attempts to determine the origins of such birds as the Prothonotary Warbler, Summer Tanager, Lark Sparrow, and Western Tanager were always directed toward a cause and effect relationship. Southern coastal storms were held responsible for the presence of southern stragglers, and intense, fast-moving polar Highs were thought responsible for western stragglers. In recent years there has been an increase in both the number and species of these straggler groups. This increase, together with the lack of direct correlation with these particular weather situations, indicates that these more obvious meteorological conditions may not be entirely or even largely responsible for the appearance of these birds in the Northeast. The mingling of birds of western and southern origin during the same period suggests the possibility that these birds travel similar routes, and are even a product of the same weather conditions.

Western Kingbird. One was seen at Brier Island, N. S., on September 24, 1957, and one at Middletown, R. I., on September 10, 1957. Several were seen at Nantucket, Mass., during September and October, 1957. There were many additional reports from the coastal regions south to Maryland. This bird has so increased in recent years that it can no longer be considered rare from Massachusetts southward.

Yellow-bellied Flycatcher. One banded at Kiptopeke, Va., on September 25, 1957, is considered a rarity in view of the fact that there is but one previous record for the eastern counties of Virginia (Murray, 1952). As many as 11 of this species were netted at Ocean City, Md., during the 1955 Operation Recovery period, so it is evident that the Yellow-bellied Flycatcher is considerably more common in fall in the Middle Atlantic Coastal Plain than had been realized.

Traill's Flycatcher. In 1955, the first year of Operation Recovery,

three Traill's Flycatchers were banded at Ocean City, Md., the first record of this species for the counties east of Chesapeake Bay. Two individuals banded in 1956 and three in 1957 indicate that this flycatcher occurs there regularly in small numbers.

Tufted Titmouse. It is interesting to note that, unlike other irruptive species of 1957, the Tufted Titmouse did not appear at any of the coastal netting stations prior to or during the large flight that invaded New England in 1957. This indicates that the movement of this species in the New England area did not take place in the same manner, or under the same conditions, as other southern stragglers.

Mockingbird. Three were banded in Middletown, R. I., during September 1957. Although an uncommon summer resident in Rhode Island, this species was reported in particularly large numbers during the early fall of 1957.

Wood Thrush. Single birds banded on September 1 and 11, 1957, constitute the second and third records for Plum Island, Mass. The Wood Thrush is not uncommon either as a transient or breeding bird on the mainland only a mile or two from the coast.

Yellow-throated Vireo. One was banded at Middletown, R. I., in late August, 1957. This is a rare, local nester within the State, and a particularly rare spring and fall transient along the coast.

Warbling Vireo. The first fall record for Nantucket was obtained when one was banded there on September 9, 1957.

Prothonotary Warbler. Singles were banded on September 2, 1956, and September 1, 1957, at Middletown, R. I. This bird has always been considered a spring straggler, but the past two years have provided four fall records in Rhode Island.

Worm-eating Warbler. This is a very rare fall transient northeast of New Jersey. One was banded at Rockport, Mass., in September, 1956, and one at Plum Island, Mass., September 9, 1957.

Kentucky Warbler. Accidental in Massachusetts. A bird banded on August 25, 1956, was the first ever recorded at Nantucket.

Mourning Warbler. Single birds banded at Ocean City in 1955, 1956, and 1957 are the only ones on record for the Eastern Shore (Del-Mar-Va Peninsula) of Maryland.

Yellow-breasted Chat. Regarded by most field observers as a rare bird in the New England States in fall, this species was taken at both Rhode Island stations, at the two most active Massachusetts stations, and at one locality in Maine. Two were banded at Kingston, R. I., *12* at Middletown, R. I., *20* (27 including the month of October) at Nantucket, Mass., 1 at Plum Island, Mass., and 1 at Medomak, Me. Griscom and Folger (1948) had only two Nantucket records. Still farther to the northeast, one was seen on August 26, 1957, at Grand Manan, N. B.; Squires (1952) lists six New Brunswick records, four of which are from the Grand Manan Archipelago. A separate paper on this species appears elsewhere in this issue, and still another, dealing more specifically with Operation Recovery, is under preparation.

Hooded Warbler. In Rhode Island this bird is a rare summer resident at the northeastern limit of its range. It is unlikely that the small number of local breeding birds (mostly to the west) could account for the number banded at Middletown: two in 1956, and four in 1957.

Yellow-headed Blackbird. Three of this western species were seen and one banded at Nantucket during the fall of 1956.

Western Tanager. One was seen at Nantucket on September 27, 1957.

Summer Tanager. Single birds banded at Middletown on August 18, 1957, and at Island Beach on September 13, 1957, were north of their breeding range.

Dickcissel. In recent years, an uncommon vagrant along the Atlantic seaboard, increasing rapidly since about 1946 (Gross, 1956). During August and September, 1957, 12 were banded (and about twice that many observed) at Nantucket, 1 at Middletown, 2 at Island Beach, and 1 at Ocean City. Griscom and Folger (1948) had no Nantucket record for this species. As many as nine were seen on September 1 at Monhegan Island, ten miles off the coast of Lincoln County, Me. (where, incidentally, upwards of 500 Red-breasted Nuthatches were estimated the same day—Minot C. Morse Jr.). Palmer (1949) listed only seven Dickcissel records, all of single birds, for the entire State of Maine. A single bird was seen as far east as Brier Island, N. S.

Seaside Sparrow. One was banded on September 1, 1957, at Medomak, Me., more than 100 miles northeast of the northern limit of the breeding range.

Lark Sparrow. Formerly considered a rarity anywhere along the Atlantic coast, this species is now "a regular visitant in increasing numbers . . . chiefly on coastal points, islands and outer beaches" in fall in Massachusetts (Griscom and Snyder, 1955). It is also regular, though by no means common, southward along the coast. Although Nantucket banders banded only one this fall and did not capture any the two previous years of this study, several other individuals were seen there. Two were banded at Assateague Island, Md., in 1955, and one at Ocean City, Md., in 1956.

Clay-colored Sparrow. A well-marked individual of this western species was banded at Nantucket on September 30, 1957. Griscom and Snyder (1955) give only four specimen records for Massachusetts.

REPEAT RECORDS

Repeat records (recaptures at the same place within 90 days) can be used: (1) to show length of stay of individual migrants; (2) to measure daily turnover; (3) to determine the approximate percentage of banded birds in the local population; and (4) in the event of a recovery at another locality, to show more closely the length of time taken to make the trip. They can also be used to study changes in weight and progression of molt.

Some cooperators have neglected to record some of their repeats, especially on days when they were pressed for time. This has resulted in the loss of much valuable information. In at least one case known to the authors, a bird dismissed as having "just been banded" was in reality an unrecorded return from a prior year since the species in question had not been banded at that station in 1957.

Hundreds of repeats were obtained at Nantucket, Middletown, Island Beach, and Ocean City. At Nantucket the repeat records proved that the vast bulk of the transients stop for only minutes before moving

on. Only a small fraction (2 to 8%) of the transients repeated the day after banding. On the other hand, the passage of every sizable flight almost invariably produced a few lingerers — birds which remained from a few days to several weeks in the limited area of the Mothball Pines. The following are examples of birds that were present for a week or more: a Gray-cheeked Thrush (14 days), a Black-and-white Warbler (8 days), Yellow Warblers (13 and 15 days), Cape May Warblers (8, 9, and 9 days), a Myrtle Warbler (15 days), a Bay-breasted Warbler (20 days), Northern Waterthrushes (12, 13, 15 and 18 days), Yellowthroats (16 and 18 days), and an American Redstart (28 days). The Northern Waterthrush, it might be added, not only furnished the longest term repeats but provided the highest repeat ratio generally for transients. This rate, based upon number of individuals repeating sometime after the day they were banded, was 12 percent. This is a low figure compared to Ocean City where the over-all percentage of such repeats among all birds banded was 19 percent.

Ocean City transients that were present in the netting area for a week or more were a Least Flycatcher (7 days), a Black-and-white Warbler (8 days), an Ovenbird (9 days), and an American Redstart (9 days).

At Middletown the repeat records showed that migrants lingered for a period ranging from two days to two weeks or more. The following individuals remained within the netting area for a period of over five days: Wood Thrush (19 days), Swainson's Thrush (10 days), Black-and-white Warbler (6 days), Parula Warbler (8 days), Bay-breasted Warbler (10 days), Blackpoll Warbler (6 days, 8 days, 10 days), Palm Warbler (10 days, 12 days), Ovenbird (6 days, 7 days, 8 days, 12 days), Northern Waterthrush (6 days), Hooded Warbler (12 days), American Redstart (6 days, 7 days). For Catbirds there were 139 individuals that repeated at intervals between 2 and 48 days. For the first two-week interval there were 39 repeats; for the third and fourth weeks there were 56 repeats; during the fifth and sixth weeks there were 22 repeats; and during the seventh week there were only 2 repeats.

IMPORTANCE OF STATION RETURNS IN COASTAL BANDING

Basic to understanding coastal migration is the problem of how birds react to a boundary such as that between land and sea. Results so far obtained in Operation Recovery strongly suggest that such boundaries serve to funnel migration, temporarily at least, along thickets behind coastal beaches or along island chains. Such convergence of flight along "guiding lines" is a well-known phenomenon. Extensive banding at coastal points from year to year should not only serve to establish the existence of such flights locally, but should supply information as to why and under what conditions such flights occur and as to their direction, composition, and timing.

Answers to these questions are being obtained at many coastal banding stations, and, as might be expected, local differences, such as in topography, provide interesting variation to the over-all pattern. It appears from evidence so far available that coastal flights are not a fixed movement such as would occur if birds were following a route.

Weather factors, for example, seem to play too dominant a role to permit such a viewpoint.

Several species, *e.g.*, the Ipswich and Seaside Sparrows and some races of the Sharp-tailed Sparrow, are largely restricted to a narrow strip along the coast during the migration periods as well as in winter and on the breeding ground. There exists the possibility that many individuals of several other species adhere closely to a coastal route that is followed each fall and spring, year after year. This would be more likely in the case of species that travel regularly to the West Indies, than of those that fly across or to the west of the Gulf of Mexico.

Blake (1951) has shown that except under special conditions the chance of a transient songbird stopping at the same locality along its migration route in two different years is extremely remote. Hence, it is not at all surprising that no station return of a purely transient species has yet been reported as a result of Operation Recovery.

STATION RETURNS

In a situation (such as exists with an Operation Recovery netting station) where a banding station is operated for only a short period during the year, it is to be expected that a certain number of the permanent and summer residents will be recaptured in subsequent years. Returns of this sort, while of interest and value in adding to the life history data of the species involved, shed little light on the problems of migration and actually create a source of confusion and error. For example, the Catbird which is a common nesting bird of the coastal region is also an abundant migrant in this same region. Returns of Catbirds at coastal banding stations may be returns of permanent residents or of migrants.

From those stations which were not operated on a year-round basis, the following information concerning return records was received on birds which were thought to be permanent or summer residents.

The Catbird provided the most return records of any one species, with 5 from last year (2% of last year's bandings of this species) returning at Island Beach, and 2 (4% of the 1955 bandings) returning at Ocean City.

The two species with the highest return rates at Ocean City were both permanent residents. One (17%) Carolina Chickadee from 1955 and one (25%) from 1956 "returned" at Ocean City, as did one Cardinal (11%) from 1955 and 2 (14%) from 1956. Two (5%) Yellowthroats, a summer resident species, returned from 1956 at Ocean City, as did 1 Rufous-sided Towhee and 1 Carolina Wren (the latter a permanent resident).

Grand Manan had 2 (9%) returns on Red-eyed Vireos from 1956 and 1 each for Black-capped Chickadee, Magnolia Warbler, and American Redstart; Rockport had 1 each on Catbird and Rufous-sided Towhee; Cape May had 2 (40%) on Carolina Wrens from 1956, and Medomak had 1 American Goldfinch and 1 Song Sparrow.

Island Beach, in addition to the Catbirds mentioned above, had 2 (17%) White-eyed Vireos, 1 Carolina Chickadee, 1 Yellowthroat, and 1 Rufous-sided Towhee, all from 1956.

Percentages have been given above only for species with 2 or more return records.

A Myrtle Warbler that had been banded at Middletown, R. I., in October 1955 returned there on September 1, 1957. Unfortunately, there was no way of determining whether this was a wintering individual or a transient.

BIRD WEIGHTS

An analysis of the 1957 weight records will appear as a separate paper.

PLANS FOR 1958

Most of the 1957 netting stations will be in operation again in 1958, and it is anticipated that there will also be stations on the coasts of Connecticut, New York (Long Island), and Florida. Banders with netting permits are encouraged to participate at some of the old stations or to set up new netting stations at other coastal locations. In order that the operation may be coordinated to best advantage, prospective participants are urged to make their plans known to the senior author as soon as possible. Sheets of instructions, suggestions, and material helpful in separating ages and sexes of certain key species will be supplied to all participants.

Instead of restricting the Operation Recovery dates to a two-week period as was done the first two years, coastal netting will be encouraged throughout the fall migration season. However, in order to gather the maximum comparative data between stations, the greatest effort will be concentrated around the period of peak movement of insectivorous species such as warblers, vireos, thrushes, and flycatchers.

Suggested dates for peak coverage are as follows:

Maritime Provinces and eastern Maine	August 16-September 7
Southern Maine through Long Island	August 30-September 14
New Jersey through Virginia	September 6-21
North Carolina	September 13-28
South Carolina	September 20-October 5
Georgia	September 27-October 12
Florida	October 4-19

This project is by no means limited to bird-banding permittees. On the contrary, there is an urgent need for full-time observers, moon watchers, record keepers, and general assistants. It will also be extremely helpful to have daily reports on casualties at radio and TV towers, ceilometers, and tall buildings. Banders who are unable to assist at coastal locations are urged to operate their home stations continuously during the Operation Recovery period for their state, and, if at all possible, to record weights and other information such as is requested of the coastal operators. The coastal banding records take on new significance when they can be correlated with direct observations of migration as well as with weather conditions, and when data from coastal localities can be compared with similar information from stations in the interior.

SUMMARY

In August and September, 1957, 22 netting stations were operated on and near the Atlantic coast from Nova Scotia to North Carolina. Two were manned for the entire two-month period, half of the others from 1 to 5 weeks, and the remainder for only a few days. Total bandings amounted to 11,613 individuals of 130 species, of which passerine birds made up 97 per cent of the total individuals. Nearly half the birds handled belonged to two families, Parulidae and Fringillidae. The 3 top species, Catbird, Song Sparrow, and Swainson's Thrush, comprised 30 percent of the total. A brief summary of location, habitat, and principal species banded is given for each station. At Middletown, R. I., 92 specimens of 3 species of Hippoboscidae were collected from netted birds.

Eleven direct recoveries were reported in 1957, as compared with one each in the 2 preceding years. Two of the 11 were subsequently taken at another coastal netting station, and a third was trapped at a feeding station. The shortest interval of recovery was 5 days for a Northern Waterthrush that was banded at Plum Island, Mass., on September 2 and recaptured at Island Beach, N. J., on September 7, 1957. Observed direction of migration and of local movement at netting stations is discussed, as is distribution of recovery records. Three of the first four recovery records came from north or east of the netting station, quite contrary to the expected direction of fall migration.

All cold-frontal passages during August and September are discussed, together with a brief review of their effects on migration at various coastal netting stations. The movement of a high pressure cell from the Great Lakes toward the Maritime Provinces results in a sustained northerly (southward) flow of polar air for two or more days after passage of a cold front; this produces several days of migratory activity, the second frequently being the best. If, however, the High drifts southeastward, stations to the north of its center soon experience a shift to warm, southwesterly winds and a rapid diminution of migration.

The status of 21 species of "rarities" is discussed. The importance of repeat records is reviewed, and examples are given of transients that remained at netting stations from one to four weeks. Station returns from prior years are summarized. Plans for the autumn of 1958 are announced.

APPENDIX I.

Scientific Names of Bird Species Mentioned in the Text

Red-tailed Hawk, *Buteo jamaicensis*
Red-shouldered Hawk, *B. lineatus*
Broad-winged Hawk, *B. platypterus*
Marsh Hawk, *Circus cyaneus*
Osprey, *Pandion haliaetus*
Peregrine Falcon, *Falco peregrinus*
Pigeon Hawk, *F. columbarius*
Sparrow Hawk, *F. sparverius*
Sora, *Porzana carolina*
Killdeer, *Charadrius vociferus*
Semipalmated Sandpiper, *Ereunetes pusillus*
Black-billed Cuckoo, *Coccyzus erythropthalmus*
Whip-poor-will, *Caprimulgus vociferus*
Chimney Swift, *Chaetura pelagica*

Ruby-throated Hummingbird, *Archilochus colubris*
Yellow-shafted Flicker, *Colaptes auratus*
Yellow-bellied Sapsucker, *Sphyrapicus varius*
Hairy Woodpecker, *Dendrocopos villosus*
Black-backed Three-toed Woodpecker, *Picoïdes arcticus*
Eastern Kingbird, *Tyrannus tyrannus*
Western Kingbird, *T. verticalis*
Eastern Phoebe, *Sayornis phoebe*
Yellow-bellied Flycatcher, *Empidonax flaviventris*
Traill's Flycatcher, *E. traillii*
Least Flycatcher, *E. minimus*
Tree Swallow, *Iridoprocne bicolor*
Bank Swallow, *Riparia riparia*
Barn Swallow, *Hirundo rustica*
Cliff Swallow, *Petrochelidon pyrrhonota*
Blue Jay, *Cyanocitta cristata*
Black-capped Chickadee, *Parus atricapillus*
Carolina Chickadee, *P. carolinensis*
Tufted Titmouse, *P. bicolor*
White-breasted Nuthatch, *Sitta carolinensis*
Red-breasted Nuthatch, *S. canadensis*
Carolina Wren, *Thryothorus ludovicianus*
Mockingbird, *Mimus polyglottos*
Catbird, *Dumetella carolinensis*
Brown Thrasher, *Toxostoma rufum*
Robin, *Turdus migratorius*
Wood Thrush, *Hylocichla mustelina*
Swainson's Thrush, *H. ustulata*
Gray-cheeked Thrush, *H. minima*
Veery, *H. fuscescens*
Cedar Waxwing, *Bombycilla cedrorum*
Starling, *Sturnus vulgaris*
White-eyed Vireo, *Vireo griseus*
Yellow-throated Vireo, *V. flavifrons*
Red-eyed Vireo, *V. olivaceus*
Warbling Vireo, *V. gilvus*
Black-and-white Warbler, *Mniotilta varia*
Prothonotary Warbler, *Protonotaria citrea*
Worm-eating Warbler, *Helmitheros vermivorus*
Blue-winged Warbler, *Vermivora pinus*
Parula Warbler, *Parula americana*
Yellow Warbler, *Dendroica petechia*
Magnolia Warbler, *D. magnolia*
Cape May Warbler, *D. tigrina*
Myrtle Warbler, *D. coronata*
Bay-breasted Warbler, *D. castanea*
Blackpoll Warbler, *D. striata*
Pine Warbler, *D. pinus*
Palm Warbler, *D. palmarum*
Ovenbird, *Seiurus aurocapillus*
Northern Waterthrush, *S. noveboracensis*
Kentucky Warbler, *Oporornis formosus*
Connecticut Warbler, *O. agilis*
Mourning Warbler, *O. philadelphia*
Yellowthroat, *Geothlypis trichas*
Yellow-breasted Chat, *Icteria virens*
Hooded Warbler, *Wilsonia citrina*
American Redstart, *Setophaga ruticilla*
House Sparrow, *Passer domesticus*
Bobolink, *Dolichonyx oryzivorus*
Yellow-headed Blackbird, *Xanthocephalus xanthocephalus*
Redwinged Blackbird, *Agelaius phoeniceus*
Baltimore Oriole, *Icterus galbula*

Common Grackle, *Quiscalus quiscula*
Brown-headed Cowbird, *Molothrus ater*
Western Tanager, *Piranga ludoviciana*
Scarlet Tanager, *P. olivacea*
Summer Tanager, *P. rubra*
Cardinal, *Richmondena cardinalis*
Rose-breasted Grosbeak, *Pheucticus ludovicianus*
Indigo Bunting, *Passerina cyanea*
Dickcissel, *Spiza americana*
Purple Finch, *Carpodacus purpureus*
Pine Siskin, *Spinus pinus*
American Goldfinch, *S. tristis*
Rufous-sided Towhee, *Pipilo erythrophthalmus*
Ipswich Sparrow, *Passerculus princeps*
Savannah Sparrow, *P. sandwichensis*
Sharp-tailed Sparrow, *Ammospiza caudacuta*
Seaside Sparrow, *A. maritima*
Lark Sparrow, *Chondestes grammacus*
Slate-colored Junco, *Junco hyemalis*
Clay-colored Sparrow, *Spizella pallida*
White-throated Sparrow, *Zonotrichia albicollis*
Song Sparrow, *Melospiza melodia*

APPENDIX II.

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