MIGRATION OF THE COMMON YELLOWTHROAT WITH AN EMPHASIS ON FLORIDA

By Walter Kingsley Taylor

The Common Yellowthroat (*Geothlypis trichas*) has one of the largest, continuous breeding ranges of any North American wood warbler. The species is the sole North American member of the genus *Geothlypis* and is represented by more described subspecies than any other member of its family (Parulidae). Although these attributes distinguish the Common Yellowthroat as being unique among other wood warbler species, few accounts on its migrations (either spring or autumn) have been written. Phillips et al. (1964: 158) remarked that the Common Yellowthroat is one of the least understood of United States birds. This paper presents data on relative abundance of each sex and age group, timing of migration, weights, and the migration routes of the Common Yellowthroat. Particular interest is directed to the migration of this species in Florida.

MATERIALS AND METHODS

The data used in this study were obtained from analytical accounts of nocturnal migrants killed at tall, lighted structures, airport ceilometers, and from annual banding operations. These sources provide large samples that are useful in studying migration and other aspects of avian biology. To supplement these data I examined all Common Yellowthroat recoveries that have been processed through May 1974 by the Bird Banding Laboratory.

Most of the specimens from Florida were obtained at the WDBO-WFTV TV tower near Bithlo in central Florida. Details pertinent to the tower and to the surrounding area were given by Taylor and Anderson (1973). In addition, 221 Common Yellowthroats were collected at the recently-erected (1974) 1,500-foot WSWB TV tower which is located about one mile from the WDBO-WFTV facility. Also 347 individuals collected at the WCTV TV tower, Leon County, Florida, were aged. In conjunction with the TV tower samples, data obtained from 336 Common Yellowthroats killed during migration at the Vertical Assembly Building (VAB), Cape Kennedy, Brevard County, Florida, are included.

Nondesiccated individuals were weighed to the nearest 0.1 g on an Ohaus triple beam balance. Sex was determined by dissection and age by skull ossification.

To make comparisons between regions, the percentage of Common Yellowthroats among the total number of identified parulids killed or banded was used (Tables 1 and 2). The types of assumptions to which this index of relative abundance is subject have been discussed in detail by Nisbet (1970) in his study of migration of the Blackpoll Warbler (*Dendroica striata*).

RESULTS AND DISCUSSION

Autumn migration.—Few large autumn disasters at tall, lighted structures and airport ceilometers in the United States have lacked

Common Yellowthroats. Of 80,406 parulids reported killed during autumn migration at these man-made structures in Canada and in the United States, 9,190 (11.4%) were Common Yellowthroats (Table 1). Of 183,438 parulids banded during autumn migration

TABLE 1

Occurrences of Common Yellowthroats among warblers killed in nocturnal autumnal migration.[1]

State/Province	Total warblers	Common Yellowthroats	Percent
Plains			
Ontario	1,460	78	5.3
Saskatchewan	1,072	10	0.9
Manitoba	589	34	5.8
North Dakota	154	11	7.1
Kansas	586	176	30.0
Iowa	1,972	144	7.3
Missouri	874	422	48.3
Great Lakes			
Minnesota	2,600	220	8.5
Wisconsin	12,228	166	1.4
Illinois	878	45	5.1
Indiana	172	0	0.0
Michigan	647	5	0.8
New York (upstate)	427	38	8.9
Eastern Inland			
Kentucky	184	8	4.3
Tennessee	20,359	693	3.4
Atlantic Coast			
New Hampshire	74	24	32.4
New York	715	69	9.7
Maryland	1,311	130	9.9
Washington, D.C.	892	347	38.9
North Carolina	6,904	1,342	19.4
South Carolina	3,149	144	4.6
Georgia	3,098	335	10.8
Jacksonville, Fla.	58	8	13.8
Tallahassee, Fla.	10,618	985	9.3
Orlando, Fla.	8,839	3,420	38.7
Cape Kennedy, Fla.	546	336	61.5
Totals	80,406	9,190	11.4

[1]data compiled from published and unpublished studies that cover primarily the past 15 years (see Acknowledgments and Appendix).

in the United States, 26,213 (14.3%) were Common Yellowthroats (Table 2). Even though the Common Yellowthroat migrates in large numbers across a broad area of the United States, the majority of the eastern populations evidently pass through the Atlantic Coastal States during autumn migration. The percentages in Table 2 would be somewhat higher than they are at Kiptopeke Beach, Manomet, Brookhaven, Island Beach, Sandy Hook, Ship Bottom, and Bellevue if the October bandings were omitted from the calculations. This is primarily due to the large numbers of

Yellow-rumped Warblers (Myrtles), *Dendroica coronata*, that were banded at these stations in October. The percentages are about the same as they are at Ellenville, Farmersville, Allegheny Front Mountain, and Wadsworth if the October bandings were omitted from the calculations. These observations are consistent with the

TABLE 2

Occurrences of Common Yellowthroats among warblers banded while migrating in autumn.[1]

Banding location	Total warblers	Common Yellowthroats	Percent
Mount Desert, Me. (1970–1973, 1975)	2,089	44	2.1
Manomet, Mass. (1967, 1969)	2,521	228	9.0
Wadsworth Sanctuary, Conn. (1971–1975)	1,901	347	18.3
Brookhaven, N.Y. (1965–1974)	10,876	3,749	34.5
Vischer Ferry, N.Y. (1967–1973)	1,824	450	24.7
Farmersville, N.Y. (1966–1975)	2,451	139	5.7
Ellenville, N.Y. (1970–1975)	800	154	19.3
Binghamton, N.Y. (1970–1972)	580	89	15.3
Island Beach, N.J. (1956–1975)	77,850	11,836	15.2
Sandy Hook, N.J. (1971–1974)	2,237	270	12.1
Ship Bottom, N.J. (1969–1974)	1,221	83	6.8
Powdermill, Pa. (1959–1971; Leberman and Clench, 1972)	13,785	2,495	18.1
Bellevue, Md. (1969–1971)	888	149	16.8
Allegheny Front Mountain W. Va. (1970, 1972–1975)	16,247	517	3.2
Kiptopeke Beach, Va. (1969–1975)	47,631	5,512	11.6
Long Beach, Southport, N.C. (1973–1974)	312	51	16.3
Dauphin Island, Ala. (1970; Bagg, 1971)	225	100	44.4
Totals	183,438	26,213	14.3

[1]data compiled from published and unpublished studies. Individuals who sent results from their banding stations are mentioned in the Acknowledgments.

TABLE 3

Autumn recoveries of the Common Yellowthroat

Band number	Age	Sex	Banding locality	Date banded	Recovery locality	Date recovered
123035806	I	U	Sackville, N.B., Can.	7 Aug 73	Darien, Conn.	1 Oct 73
028027791	A	F	Chatham, Ontario, Can.	26 May 68	Bithlo, Fla.	8 Oct 71
011240480	I	F	Long Point, Ontario, Can.	23 Sept 68	Unionville, Pa.	1 Oct 68
011413307	I	U	Londonderry, Vt.	31 Aug 67	Tobay Sanctuary, N.Y.	4 Sept 67
011612229	I	M	Block Island, R.I.	3 Sept 67	Sewell, N.J.	5 Oct 67
011612467	I	F	Block Island, R.I.	14 Sept 67	Belleplain, N.J.	3 Oct 67
011679804	I	M	Block Island, R.I.	22 Aug 68	Rancocas Woods, N.J.	7 Sept 68
010784168	I	F	Brookhaven, N.Y.	21 Aug 64	Ponkapog, Mass.	19 Sept 64
072060200	A	M	Brookhaven, N.Y.	14 Oct 65	Guines, Havana, Cuba	29 Feb 68
011460017	I	F	Brookhaven, N.Y.	5 Sept 67	Tobay Sanctuary, N.Y.	9 Sept 67
012216318	I	F	Brookhaven, N.Y.	16 Aug 70	Palisades Park, N.J.	30 Aug 70
023025035	U	F	Atlantic Beach, N.Y.	6 Sept 64	Edgewater, Fla.	15 Oct 64
011480441	A	M	Atlantic Beach, N.Y.	28 May 67	Bradford, R.I.	11 July 69
011236677	I	U	Massapequa, N.Y.	20 Aug 66	E. Norwalk, Conn.	29 Aug 66
041064481	A	F	Drexel Hill, Pa.	14 Sept 41	Anchorage, Ky.	1 Jan 47

122042217	I	F	Rector, Pa.	6 Sept 70	Markstay, Ontario, Can.	1 Aug 72
129003925	I	M	Rector, Pa.	1 Oct 72	Vereda Nueva, Havana, Cuba	6 Jan 73
031077593	U	F	Pleasantville, N.J.	21 May 61	Sanford, Me.	15 Sept 61
010411042	I	F	Island Beach, N.J.	13 Sept 62	Spanish Town, Jamaica	16 Oct 63
010185315	U	U	New Gretna, N.J.	8 Sept 63	Cape May, N.J.	21 Sept 63
011217275	A	M	Island Beach, N.J.	21 Oct 66	Altoona, Pa.	July 70
011573032	U	U	Island Beach, N.J.	2 Oct 67	Littleton, Mass.	17 Aug 68
011453510	I	F	Island Beach, N.J.	29 Aug 68	Wenonah, N.J.	9 Sept 68
128063808	A	F	Island Beach, N.J.	19 May 72	Kiptopeke, Va.	28 Sept 73
033077178	A	M	Brookeville, Md.	14 May 61	Denton, Md.	15 Sept 61
118092279	A	F	Williamsburg, Va.	15 May 69	Palm Beach, Fla.	Jan 74
010891502	A	F	Muskegon, Mich.	16 May 64	Avery, Tex.	1 Dec 65
012341523*	A	M	Pontiac, Mich.	2 May 70	Paincourt, Ontario, Can.	5 Sept 70
012341523*	A	M	Pontiac, Mich.	2 May 70	Paincourt, Ontario, Can.	12 Sept 71
010992078	A	M	Duluth, Minn.	21 Sept 64	Gary, Ind.	Oct 64
010236568	I	U	Aledo, Ill.	19 Sept 63	LaHuerta, Jalisco, Mexico	3 Dec 65

*same individual.

more important autumn recoveries of the Common Yellowthroat (Table 3) and with the data I have on racial determinations of autumn migrants. Of 24 Common Yellowthroats collected in 1969, 1970, and 1971 at the WDBO-WFTV facility during autumn migration, all belonged to the eastern, northeastern and southeastern races: four were *G. t. ignota* (29 September and 14 October); one was *G. t. typhicola* (11 September); five were *G. t. trichas* (11 September, 25 September, 7 October, and 9 November); one was *G. t. brachidactylus* (11 September); and 13 were *G. t. pelagitis* (11, 14, 29, 30 September and 5, 8, 11, 18 October). Of two banded autumn migrants recovered at WDBO-WFTV, one was an adult female Common Yellowthroat banded near Chatham, Ontario, on 26 May 1968. This individual was determined as *G. t. pelagitis*. Individuals that hit the Pensacola Bay bridge in northwest Florida during autumn migration belonged to *G. t. trichas, G. t. brachidactylus, G. t. typhicola, G. t. ignota, and G. t. ohionicola* (Weston, 1965). (The latter subspecies has not yet been accepted by the AOU Committee on Nomenclature.) Among Common Yellowthroats killed at Warner Robins, Georgia, during autumn migration, four specimens represented the race *brachidactylus* (Johnston and Haines, 1957).

In Florida, the Common Yellowthroat is more abundant in the peninsular than in the panhandle region during autumn migration at least insofar as these mortality records show. In an 18-year study at the WCTV tower near Tallahassee, Crawford's (1974) report, which included the comprehensive work of Stoddard and Norris (1967), listed 985 Common Yellowthroats killed in the autumn. This figure is substantially less than the 3,420 individuals collected at the central Florida facilities during six years for basically the same autumn months. A similar relative difference in numbers between WCTV and the central Florida TV towers is also exhibited by the Ovenbird (*Seiurus aurocapillus*) Cape May Warbler (*Dendroica tigrina*) and Black-throated Blue Warbler (*D. caerulescens*) (Taylor, 1972, 1973).

Since 11 September 1969, 3,420 Common Yellowthroats have been killed in autumn migration at the two central Florida TV towers: 1,122 in 1969; 857 in 1970; 731 in 1971; 489 in 1972; 150 in 1974; and 71 in 1975. The marked decrease in numbers in 1972, 1974, and 1975 is believed to be due to the fewer severe frontal conditions that reached the area. Also the 1974 and 1975 data came from the WSWB TV tower which has much less cleared area surrounding the structure than that of WDBO. Data are lacking from WDBO-WFTV during 1974 and 1975 since the tower collapsed on 8 June 1973.

Extreme dates for freshly-killed Common Yellowthroats were 2 August and 9 November. Of the 3,420 individuals killed in autumn migration, 5 were found in August; 1,647 in September; 1,761 in October; and 7 in November. No visits to the towers were made in December. The peak of the species' autumn migration in central Florida, therefore, lies between the last week of September and the second week in October. The disasters at the central Florida facilities are among the largest documented for this species.

The largest single kill took place on 28-29 September 1970 when 480 Common Yellowthroats were collected. At the WCTV TV tower in northwest Florida, over one half of the Common Yellowthroats were collected in October (Stoddard and Norris, 1967; Crawford, 1974). These workers found the species among casualties in all months except January.

Spring migration.—Available data to study the Common Yellowthroat's spring migration are not nearly as good as those obtained for the autumn (Tables 4 and 5). These data in addition to the

TABLE 4

Occurrences of the Common Yellowthroat among warblers killed in nocturnal spring migration.

State/Province	Total warblers	Common Yellowthroats	Percent
Ontario	684	49	7.2
North Dakota	29	16	55.2
Iowa	130	5	3.8
Illinois	16	0	0.0
Michigan	62	17	27.4
Kentucky	41	0	0.0
Tennessee	197	2	1.0
Texas	2,308	405	17.5
New Hampshire	15	6	40.0
Tallahassee, Fla.	4,214	48	1.1
Orlando, Fla.	148	14	9.5
Cape Kennedy, Fla.	3,155	308	9.8
Totals	10,999	870	7.9

TABLE 5

Occurrences of Common Yellowthroats among warblers banded while migrating in spring.

Banding location	Total warblers	Common Yellowthroats	Percent
Manomet, Mass. (1969)	93	33	35.5
Island Beach, N.J. (1971–1975)	4,684	1,756	37.5
Sandy Hook, N.J. (1971–1974)	1,313	401	30.5
Powdermill, Pa. (1959–1971)	4,557	551	12.1
Totals	10,647	2,741	30.5

TABLE 6

Spring recoveries of the Common Yellowthroat

Band number	Age	Sex	Banding locality	Date banded	Recovery locality	Date recovered
031037150	I	U	Roxbury, Me.	5 Sept 64	West Haven, Conn.	May 67
027057829	I	U	Castine, Me.	13 Sept 58	Storrs, Conn.	1 Apr 60
011938696	I	M	Plymouth, Mass.	14 Aug 69	Island Beach, N.J.	5 May 70
027051848	I	F	Middletown, R.I.	9 Sept 58	Hempstead, N.Y.	18 May 62
011680860	I	U	Block Island, R.I.	12 Sept 68	Great Gull Island, N.Y.	10 May 70
122070715	I	F	Kingston, R.I.	3 Sept 70	Central Village, Mass.	16 Apr 72
004008425	A	M	Huntington, N.Y.	23 May 30	Hoopersville, Md.	12 May 33
010671914	I	M	Quoque, N.Y.	2 Sept 63	Myrtle Beach, S.C.	8 May 64
011058572	I	U	Ellenville, N.Y.	19 Aug 65	Urbana, Va.	5 May 67
114030839	A	F	Bedford Hills, N.Y.	25 May 71	Bucks Harbor, Me.	25 May 73
121007765	I	U	Brookhaven, N.Y.	10 Aug 70	Barnegat, N.J.	11 May 73
011253916	I	M	Brookhaven, N.Y.	18 Sept 66	Vincentown, N.J.	10 May 67
012107787	I	M	Brookhaven, N.Y.	13 Aug 70	Fort Pierce, Fla.	28 Apr 71
011255662	A	M	Morrisville, Pa.	11 May 66	Martinsville, N.J.	17 May 66
021081558	A	M	Demarest, N.J.	12 May 56	Hanover, N.H.	14 May 56
033010569	A	M	Cape May, N.J.	9 Oct 62	Levittown, N.Y.	17 May 63
113018030	I	M	Seaside Park, N.J.	17 Sept 66	Nantucket Center, Mass.	9 June 73
121072133	A	F	Island Beach, N.J.	19 May 70	Stonington, Conn.	1 June 72

010442976	I	M	Island Beach, N.J.	3 Oct 64	Tobay Beach, N.Y.	24 May 71
011122130	I	U	Island Beach, N.J.	2 Oct 66	Hillsborough, N.C.	16 May 67
011453447	U	F	Island Beach, N.J.	28 Aug 68	Point Pleasant, N.J.	9 May 69
012166648	A	M	Island Beach, N.J.	9 May 70	Falmouth, Me.	30 May 70
012524257	A	F	Island Beach, N.J.	19 May 71	Block Island, R.I.	28 May 71
028085677	A	M	Island Beach, N.J.	4 Sept 59	Stormville, N.Y.	12 June 72
011878352	I	M	Island Beach, N.J.	14 Sept 68	Keene Valley, N.Y.	14 June 71
126082001	I	F	Kiptopeke, Va.	20 Oct 71	Norristown, Pa.	14 May 73
011989640	I	F	Kiptopeke, Va.	29 Sept 69	Manomet, Mass.	20 May 70
010488062	I	M	Brunswick, Ga.	2 Oct 65	Loganton, Pa.	18 May 66
038043525	A	M	Orlando, Fla.	13 Dec 37	Batesburg, S.C.	11 May 39
010182050	A	M	Tawas Point, Mich.	16 Sept 61	Paincourt, Ontario, Can.	16 May 66
031000451	A	M	Muskegon, Mich.	18 May 63	Randolph, Wis.	May 65
010980400	I	M	Troy, Mich.	17 Sept 66	Hickory, N.C.	14 May 67
011339700	A	M	Cranbrook, Mich.	29 May 67	Paincourt, Ontario, Can.	25 May 68
011117475	I	M	Upham, N.D.	1 Sept 65	Bismark, N.D.	7 June 67
033026164	A	M	Cedar Falls, Iowa	12 May 62	Dundee, Mich.	13 May 66
028085486	A	F	Clackamas, Ore.	17 July 59	Parkfield, Cal.	26 Apr 60
011887046*	A	M	La Pine, Ore.	13 May 69	Tucson, Ariz.	18 Apr 70
011887046*	A	M	La Pine, Ore.	13 May 69	Deep Springs, Cal.	3 May70

*same individual.

spring recoveries (Table 6) indicate somewhat that the overall spring migration pattern resembles that of the autumn. Three specimens that hit the WDBO-WFTV TV tower during spring migration belonged to *G. t. pelagitis* (13 March and 1 May).

Recovery analysis.—In a letter to me (dated 7 March 1975), John Tautin of the Bird Banding Laboratory stated that approximately 1,620,443 wood warblers have been banded since 1955. Of this number, 93,517 (5.2%) were Common Yellowthroats. Tables 3 and 6 give the more significant recoveries for both autumn (31) and spring (38). In addition there were 280 instances where an individual Common Yellowthroat was recovered at or near the same area where it was banded the previous spring or autumn. Included in the 280 were 17 instances of an individual recovered twice or more. At the Powdermill Banding Station near Rector, Pennsylvania, 20 Common Yellowthroats banded as young birds were recovered the following year (Leberman and Clench, 1973). These data indicate that certain individuals perhaps travel over the same migratory route year after year.

Age ratios.—Adults clearly predominate in the samples at the central Florida facilities in autumn. Of 3,082 aged, 2,031 were adults and 1,051 were immatures. There was no marked variation in age composition from one autumn season to the next. This same phenomenon was also observed at the Powdermill Banding Station where the Common Yellowthroat ranks as one of the most common wood warblers banded (Leberman and Clench, 1973:20).

In recent years, studies from banding operations and tower kills have shown that many migratory species in eastern North America show a higher percentage of adults migrating southward by an inland route than by a coastal one (Barry, 1971; Heintzelman, 1972). This situation clearly exists for the Common Yellowthroat at the inland central Florida facilities. However, discrepancies do exist at other stations (Table 7). At the Binghamton Station, New York, F. Marsi (pers. comm.) found that immatures of other species (both warbler and nonwarbler) also predominate at this inland station. Of 1,606 Common Yellowthroats studied at Powdermill over six consecutive years, Leberman and Clench (1973) found that immatures predominate at that inland station. The fact that immatures greatly outnumber adults at the inland WCTV TV tower in northwest Florida was unexpected (Table 7).

Timing of migration.—Although immature and adult Common Yellowthroats migrate together since individuals of both age groups hit the tower at the same time during a given kill, the majority of immatures probably precede the majority of adults (Table 8). This situation was also noted at the Powdermill Banding Station (Leberman and Clench, 1973). On the contrary, an early migration composed largely of adults giving way later on to a preponderance of immatures was recorded at a Kansas TV tower (Tordoff and Mengel, 1956).

TABLE 7

Age ratios of the Common Yellowthroat

Station	Total	Adults	Immatures	Percent of adults
Coastal				
Mount Desert, Me.	59	5	54	8.5
Block Island, R.I.	264	37	227	14.0
Ship Bottom, N.J.	70	10	60	14.3
Kiptopeke Beach, Va.	2,548	389	2,159	15.3
VAB, Fla.	258	17	241	6.6
Inland				
Marshfield, Vt.	772	92	680	11.9
Binghamton, N.Y.	79	16	63	20.3
New Land Research Reserve, N.J. (Heintzelman, 1972)	70	42	28	60.0
KOMU TV, Columbia, Mo. (Elder and Hansen, 1967)	97	31	66	32.0
Warner Robins, Ga. (Johnston and Haines, 1957)	27	16	11	59.2
WCTV, Fla.	346	97	249	28.0
WDBO-WFTV, WSWB, Fla.	3,082	2,031	1,051	65.9

Sex ratios.—Of 3,259 Common Yellowthroats collected in the autumn, 1,640 were males and 1,619 were females. Adult males clearly outnumbered individuals of the other age-sex classes (Table 8). Similar results were reported for the Black-throated Blue and Cape May warblers found at the central Florida facilities (Taylor, 1973).

TABLE 8

Seasonal casualty totals for 2,835 Common Yellowthroats collected at the WDBO-WFTV and WSWB TV Towers, autumns 1969–1972 and 1974–1975.

	Males		Females		
Dates	Adult	Immature	Adult	Immature	Totals
2 August	0	0	1	0	1
29 August	0	0	1	0	1
1-15 September	29	63	46	72	210
16-30 September	336	156	262	225	979
1-15 October	544	119	379	171	1,213
16-31 October	136	64	147	82	429
1-15 November	0	0	1	1	2
Totals	1,045	402	837	551	2,835

Weights.—The specimens were rated fat to very fat. Weights of 382 individuals are given in Tables 9 and 10. The weights for all age-sex classes are about the same whether the birds were killed in September or in October. Tordoff and Mengel (1956:34), studying Common Yellowthroats at a Kansas TV tower, found that males were heavier than females and that immatures were a little heavier on the average than adults.

TABLE 9

Weights (in grams) of 153 Common Yellowthroats killed at WDBO-WFTV, September 1969–1972

Age and Sex	Number	Mean ± SD	Range
Adult males	35	11.70 ± 2.01	8.60 - 15.80
Immature males	34	10.32 ± 1.76	8.10 - 15.00
Adult females	38	10.48 ± 2.09	7.50 - 15.70
Immature females	46	9.80 ± 1.34	8.00 - 13.20

TABLE 10

Weights (in grams) of 229 Common Yellowthroats killed at WDBO-WFTV October 1969–1972

Age and Sex	Number	Mean ± SD	Range
Adult males	85	10.81 ± 1.34	8.70 - 14.70
Immature males	31	10.88 ± 1.60	8.80 - 14.00
Adult females	60	9.70 ± 1.09	7.40 - 12.00
Immature females	53	10.28 ± 1.31	8.10 - 13.90

SUMMARY

The Common Yellowthroat migrates in large numbers across a broad area of the United States. Most of the eastern populations evidently pass through the Atlantic Coastal States during autumn migration. These statements are based upon data obtained at tall, lighted structures, airport ceilometers, and banding operations. From these data in Florida, the species is more common in the peninsular area than in the panhandle region. Data obtained from 3,420 autumn migrating Common Yellowthroats collected from the WDBO-WFTV and WSWB TV towers in central Florida are presented and compared with data obtained at other facilities.

ACKNOWLEDGMENTS

Thanks are extended to the owners and operators of the WDBO-WFTV and WSWB facilities. Special appreciation is offered to Bruce Anderson, Bette Schardien, Boyd Thompson, Tanner Girard, and other students from F.T.U. who have helped collect and process the birds. Specimens from the VAB were donated to

F.T.U. by Lon Ellis, Dr. James Baker, and Robin Field. Those from the WCTV TV tower came by way of Robert Crawford and Dr. David Johnston. Unpublished data from tower kills were sent to me from H. W. Copland (Manitoba Museum of Man and Nature), Geoffrey Rytell (Omega Navigation Station), and J. H. Carter, III (Southern Pines, North Carolina). Subspecific identifications were made by Dr. John Aldrich of the U. S. National Museum; thanks are also extened to Drs. Richard Banks and John Weske of that institution. I thank the following individuals for supplying data from their banding stations: Robert Dewire (Wadsworth Sanctuary); F. R. Scott (Kiptopeke Beach); Dr. Robert P. Yunick (Vischer Ferry); Mrs. Kathleen S. Anderson (Manomet); Dennis Puleston (Brookhaven); Herman W. Cooper (Island Beach); Mrs. Roger Foy (Ship Bottom); Henry T. Armistead (Bellevue); Dr. Mary H. Clench (Powdermill); Dr. George A. Hall (Allegheny Front Mountain); Mrs. Frederick Marsi (Binghamton); Donald F. Clark (Farmersville); Mrs. Marian F. Metcalf (Marshfield); Mrs. Valerie M. Freer (Ellenville); Davis H. Corkran (Sandy Hook); Dr. Samuel R. Tipton (Long Beach); and Mrs. Robert Patterson (Mount Desert). Edward Reed kindly provided me with AMFO data. I thank all banders who responded to my questionnaire for verification of banding recoveries. Appreciation is extended to Jay Sheppard and John Tautin of the Bird Banding Laboratory.

LITERATURE CITED

Bagg, A. M. 1971. The changing seasons. *Amer. Birds*, **25:** 16-23.

Barry, J. J. 1971. Differential fall migration. *EBBA News*, **34:** 55-66.

Crawford, R. L. 1974. Bird casualties at a Leon County, Florida TV tower: October 1966–September 1973. *Bull. Tall Timbers Research Station*, No. 18: 1-27.

Elder, W. H., and J. Hansen, 1967. Bird mortality at KOMU-TV tower, Columbia, Missouri, Fall 1965 and 1966. *Bluebird*, **34:** 3-6.

Heintzelman, D. S. 1972. Age classes of birds migrating southward through central New Jersey—autumn 1970. *EBBA News*, **35:** 239-244.

Johnston, D. W., and T. P. Haines. 1957. Analysis of mass bird mortality in October, 1954. *Auk*, **74:** 447-458.

Leberman, R. C., and M. H. Clench. 1972. Bird-banding at Powdermill, 1971 and ten years reviewed. *Powdermill Nature Reserve, Research Report* No. 30.

———. 1973. Bird-banding at Powdermill, 1972. *Powdermill Nature Reserve, Research Report* No. 31.

Nisbet, I. C. T. 1970. Autumn migration of the Blackpoll Warbler: evidence for long flight provided by regional survey. *Bird-Banding*, **41:** 207-240.

Phillips, A. J., Marshall, and G. Monson. 1964. The Birds of Arizona. Tucson, Univ. of Arizona Press.

Stoddard, H. L., Sr., and R. A. Norris. 1967. Bird casualties at a Leon County, Florida TV tower: an eleven-year study. *Bull. Tall Timbers Research Station*, No. **8:** 1-104.

Taylor, W. K. 1972. Analysis of Ovenbirds killed in central Florida. *Bird-Banding*, **43:** 15-19.

———. 1973. Black-throated Blue and Cape May Warblers killed in central Florida. *Bird-Banding*, **44:** 258-266.

TAYLOR, W. K., AND B. H. ANDERSON. 1973. Nocturnal migrants killed at a central Florida TV tower; autumns 1969–1971. *Wilson Bull.*, **85**: 42-51.

TORDOFF, H. B., AND R. M. MENGEL. 1956. Studies of birds killed in nocturnal migration. *Univ. Kan. Publ. Mus. Nat. Hist.*, **10**: 1-44.

WESTON, F. M. 1965. A survey of the birdlife of northwestern Florida. *Bull. Tall Timbers Research Station*, No. **5**: 1-147.

APPENDIX

Many references were used in this paper but not mentioned in the Literature Cited. Most of the references have already been published in a previous paper (Taylor 1973, *Bird-Banding*, **44**: 258-266). I list in this appendix new references that were used but not previously listed in the above citation.

CARTER, J. H. III, AND J. F. PARNELL. 1976. TV tower kills in eastern North Carolina. *Chat*, **40**: 1-9.

FEEHAN, J. 1963. Destruction of birdlife in Minnesota—Sept. 1963 II. Birds killed at the Ostrander television tower. *Flicker*, **35**: 111-112.

GOODPASTURE, K. A. 1974. Fall 1972 television tower casualties in Nashville. *Migrant*, **45**: 29-31.

———. 1974. Fall 1973 television tower casualties in Nashville. *Migrant*, **45**: 57-59.

———. 1975. Nashville television tower casualties, 1974. *Migrant*, **46**: 49-51.

GREEN, J. C. 1963. Destruction of birdlife in Minnesota—Sept. 1963 III. Notes on kills at Duluth on September 18/19. *Flicker*, **35**: 112-113.

JANSSEN, R. B. 1963. Destruction of birdlife in Minnesota—Sept. 1963 I. Birds killed at the Lewisville television tower. *Flicker*, **35**: 110-111.

MOSMAN, D. 1975. Bird casualties at Alleman, Ia. TV tower. *Iowa Bird Life*, **45**: 88-90.

STRNAD, F. V. 1975. More bird kills at KROC-TV tower, Ostrander, Minnesota. *Loon*, **47**: 16-21.

WEIR, R. D. 1973. Bird kills at the Lennox plant of the Ontario hydro-electric system, spring 1973. *Blue Bill*, **20**: 23-24.

———. 1973. Bird kilis at the Lennox generating plant autumn 1973. *Blue Bill*, **20**: 55-57.

———. 1974. Bird kills at the Lennox generating plant spring and autumn 1974. *Blue Bill*, **21**: 61-62.

———. 1975. Bird kills at the Lennox generating plant spring and autumn 1975. *Blue Bill*, **22**: 37-38.

Department of Biological Sciences, Florida Technological University, Orlando, Florida 32816. Received 19 June 1976, accepted 29 July 1976.