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AUTUMN MIGRATION OF GRAY-CHEEKED AND BICKNELL'S THRUSHES AT KIPTOPEKE, VIRGINIA

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Abstract.—We examined the magnitude and timing of autumn migration for the Gray-cheeked/Bicknell's Thrush complex using banding data collected during 27 autumn seasons at Kiptopeke, Virginia. The average autumnal capture rate for the Gray-cheeked/Bicknell's thrush complex was 7.7 ± 8.9 (SD) birds/1000 net-h (range 0.5 to 36.4 birds/1000 net-h). For the 27 years combined, 90% of the captures occurred between 20 September and 15 October with an overall median capture date of 5 October.

The timing of Gray-cheeked and Bicknell's thrush migration was compared for years where adequate morphological data were collected. All thrushes captured in these years were classified as Bicknell's, "overlap thrush," or Gray-cheeked Thrush based on wing chord. The proportion of birds within each thrush category was relatively even for the selected years with average capture rates of 3.2 ± 2.2 (SD), 4.3 ± 3.8, and 5.9 ± 6.5 birds/1000 net-h for Bicknell's, overlap, and Gray-cheeked Thrushes respectively. Median date of capture for the Bicknell's Thrush was statistically distinguishable from that of the Gray-cheeked Thrush in only one year (Mann-Whitney U-test, $P < 0.001$). Age ratios were highly skewed to hatching-year birds for all thrush groups. Data presented provide evidence of a relatively large movement of Bicknell's and Gray-cheeked thrushes through coastal Virginia. Historic banding information from other locations may help to clarify the migration ecology of this species complex.

MIGRACION OTONAL DE *CATHARUS MINIMUS* Y *C. BICKNELLI* EN KIPTOPEKE, VIRGINIA

Sinopsis—Examinamos ia magnitud y el tiempo de la migración otoñal del complejo de *Catharus minimus/ C bicknelli* utilizando datos de anillaje colectados durante 27 temporadas otoñales en Kiptopeke, Virginia. El promedio de captura otoñal del complejo *Catharus minimus/ C. bicknelli* fué de 7.7 ± 8.9 (S.D.) aves/1000 horas/red (alcance 0.5 a 36.4 aves/1000 horas red). Para los 27 años combinados, 90% de las capturas ocurrieron entre septiembre 20 y octubre 15, con una mediana generalizada para fecha de captura del 5 de octubre. El tiempo de la migración del complejo de *Catharus minimus/ C. bicknelli* se comparó en años para los cuales se colectaron datos morrológicos adecuados. Todas las aves capturadas en esos años se clasificaron como complejo de *Catharus bicknelli,* ave sobrelapante, o *Catharus minimus* de acuerdo con las medidas de largo de ala. La proporción de aves en cada categoria fué relativamente pareja para los años seleccionados con tasas de captura promedio de 3.2 ± 2.2 (S.D.), 4.3 ± 3.8 y 5.9 ± 6.5 aves/1000 horas/red para *Catharus bicknelli,* ave sobrelapante, y *C. minimus* respectivamente. La mediana para la fecha de captura de *Catharus bicknelli* fué estadisticamente diferenciable de la de *C. minimus* tan solo en un año (Mann-Whitney U test, $P < 0.001$). Las razones de edades estuvieron altamente viciadas hacia aves en su año de nacimiento para aves de todos los grupos. Los datos presentados proveen evidencia de un movimiento relativamente grande de *Catharus bicknelli* y de *C. minimus* a través de la costa de Virginia. Información histórica de anillaje de otras localidades pueden ayudar a clarificar la ecología migratoria de este complejo de especies.

A recent taxonomic revision elevates the Bicknell's Thrush (*Catharus bicknelli*) to a fully recognized species (American Ornithologists' Union 1995, Ouellet 1993) from its previous status as a subspecies of the Gray-cheeked Thrush (*C. minimus*). The two species are allopatric on the

breeding and winter grounds (Ouellet 1993). The Bicknell's Thrush breeds in northeastern North America, from New York state north to the Gulf of St. Lawrence and west to southeastern Quebec and winters in the Greater Antilles (Ouellet 1993). In North America, the Gray-cheeked Thrush breeds from Newfoundland, across northern Canada to Alaska and winters from Central to South America (Ouellet 1993). Information on differences between these two species during migration remains incomplete (Ouellet 1993). Our current understanding of Bicknell's Thrush migration is based on museum specimens collected among scattered geographic locations (Lee 1995, McNair and Post 1993, Ouellet 1993) and the recent use of spectrographic analysis of nocturnal flight calls (Evans 1994). These records indicate that Bicknell's Thrush migrate along the Atlantic slope (i.e., east of the Allegheny Mountains) during both spring and autumn. The Gray-cheeked Thrush has documented migratory records along the Atlantic slope as well as locations west of this landmark (Annan 1962, Bent 1949, Ouellet 1993).

The lack of information on the migration of Bicknell's Thrush is due in part to the difficulty of visually separating this species from the Gray-cheeked Thrush (MacLaren 1995, Ouellet 1993). Because of this difficulty, data from field observations of this species have been combined with the Gray-cheeked Thrush (Lee 1995). Certain identification of the species during migration requires that birds be captured or collected so morphological measurements may be taken (Ouellet 1993, Wallace 1939). Information obtained from banding stations may prove beneficial in comparing the migrations of these two closely related species. The purpose of this paper is to provide information about and compare aspects of autumn migration for the Gray-cheeked/Bicknell's Thrush complex at a coastal Virginia banding station.

METHODS

Data included in the analyses presented here were compiled from the records of the Kiptopeke Banding Station. The station was established in 1963 near the tip of the Delmarva Peninsula (37°07′N, 77°00′W) and has been operated nearly every year since at the same location (the station was moved 5 km to the south in 1991, but was re-established on the original site in 1992 where it has remained to the present). We examined data for years when daily banding operations were conducted comprehensively during September and October. Thus, our analyses were limited to autumn seasons from 1968–1982, and 1984–1995. Autumn banding operations were initiated no later than 1 September in 10 years, 5 September in 16 years, and in one year on 7 September. Banding operations were terminated by 18 October in two years, 20–25 October in six years, and on or later than 26 October during the remaining 19 years. Birds were captured using mist nets that were opened daily at dawn (weather permitting) and closed between 1400 and 1600 h EST. An average of 34.3 ± 9.5 (SD) nets were operated per year (range 21–50). All nets were arranged in an east to west direction (Scott 1963). When the station was

established, nets were placed within an upland shrub and dune scrub habitat dominated by wax myrtle (*Myrica cerifera*). Since that time, the upland area has proceeded through several successional stages. Presently, nets are placed within dune scrub habitat, a forested stand dominated loblolly Pine (*Pinus taeda*) and various oak species (*Quercus sp.*), and an early successional, oldfield habitat.

In order to examine the timing of autumn migration for the Gray-cheeked/Bicknell Thrush complex, the total birds captured was summed over all years for each date. Because the proportion of net hours (index of trapping effort) for the combined years was not significantly different between September and October ($\chi^2 = 3.4$, $P > 0.1$), we used the summed daily captures over all years to describe the temporal distribution of this species complex and calculated a standardized capture rate (birds/1000 net-h) to compare annual variation in capture rate.

Gray-cheeked and Bicknell's Thrushes were separated by wing chord (Ouellet 1993, Pyle et al. 1987, Wallace 1939). However, because of overlap, this single morphometric character is not adequate to identify all individuals. For example, a female Bicknell's Thrush has a wing chord of 85–93 mm, a male Bicknell's ranges from 88–98 mm, a female Gray-cheeked ranges from 97–106 mm, while all male Gray-cheeked Thrushes have a reported wing chord over 99 mm (Pyle et al. 1987, Wallace 1939). Because of the overlap in wing chord between male Bicknell's and female Gray-cheekeds, we established an "overlap thrush" category for comparison. The three thrush categories were thus separated as follows: (1) Bicknell's Thrush (wing chord $\leq$ 93 mm), (2) overlap thrush (wing chord 94–98 mm), and (3) Gray–cheeked Thrush (wing chord $\geq$ 99 mm). Therefore, thrushes included in the overlap thrush category could possibly contain both male Bicknell's and female Gray-cheeked Thrushes. The age of all individuals was determined by standard skulling techniques (Canadian Wildlife Service and the United States Fish and Wildlife Service 1977).

We analyzed years in which morphometric data were available for all individuals. This included the autumns of 1968, 1969, 1971, 1980. The total birds captured on each date was summed within the three thrush categories and used for statistical comparison. We also calculated standardized captures (birds/1000 net-h) to describe annual variation in capture rates. Because only four years were examined for this comparison, each year was analyzed independently to eliminate any bias due to yearly variation in timing of migration. We used a Mann-Whitney U-test to compare median dates of capture and a Kolmgorov-Smirnov two-sample test to compare shifts in the temporal distribution of capture between the thrush species and overlap category. There were no differences in the significance of results between the two statistical procedures so only Mann-Whitney U-statistics are presented.

RESULTS

A total of 3252 Gray-cheeked and Bicknell's Thrushes were captured over the 27 years examined. Average annual capture rate was 7.7 $\pm$ 8.92

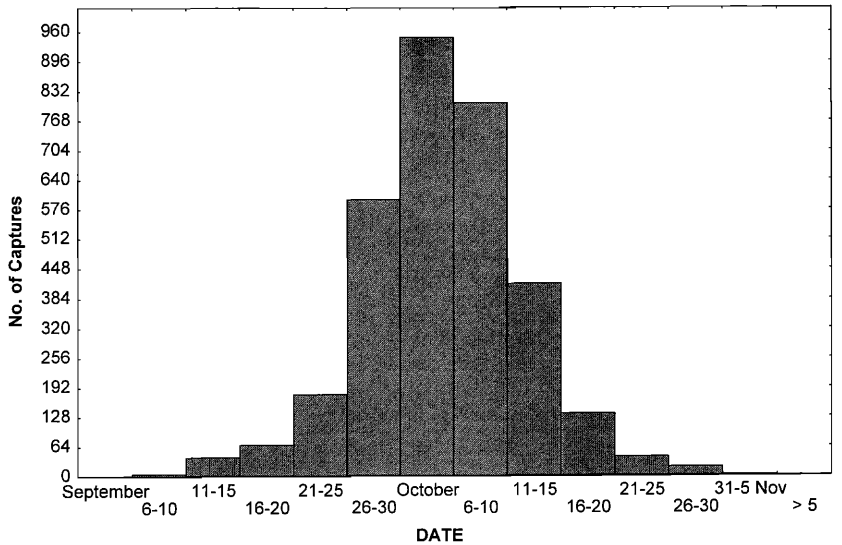

FIGURE 1. The combined number (n = 3252) of Gray-cheeked and Bicknell's Thrushes captured during September and October over 27 banding seasons at Kiptopeke, Virginia.

(SD) birds/1000 net-h. Capture rates varied among years ranging from a low of 0.5 birds/1000 net-h in 1994 to a high of 36.4 birds/1000 net-h in 1970. There was a significant decline in capture rate from 1968 to 1995 (Kendall tau = -0.71, $P < 0.001$). The median capture date for the Gray-cheeked/Bicknell's Thrush complex for all years combined was 5 October. Median capture dates for individual years (n = 27) ranged from 29 September to 9 October. The greatest volume of thrushes was captured between 20 September and 15 October (Fig. 1). This relatively short period accounted for 90 percent of all captures.

A total of 947 individuals within the three thrush categories were banded during the four years selected to compare Bicknell's and Gray-cheeked Thrush migration. Capture rates ranged from 1.3–6.3, 1.4–9.6, and 1.3–15.1 birds/1000 net-h for Bicknell's, overlap, and Gray-cheeked Thrushes respectively. The proportion of captures represented by the three thrush categories were significantly different between years (4×3 contingency table, $\chi^2 = 30.1$, $P < 0.001$). Over all four years, individuals captured were relatively evenly distributed among the three thrush groups (Kruskal-Wallis test, $\chi^2 = 3.2$, $P > 0.10$) with Bicknell's Thrush, overlap thrush, and Gray-cheeked Thrush accounting for an average of 30 ± 8.7, 32 ± 2.4, and 38 ± 8.0 percent of the total individuals, respectively.

Age ratios among thrush categories were consistent among years ($\chi^2 = 3.2$, $P > 0.10$). The average percent of individuals that were hatching-year birds was 93.7 ± 6.1 (SD), 93.5 ± 8.9, 88.2 ± 7.1 for Bicknell's Thrush, overlap thrush, and Gray-cheeked Thrush respectively. However, the age ratio of all birds captured varied significantly between years (χ^2

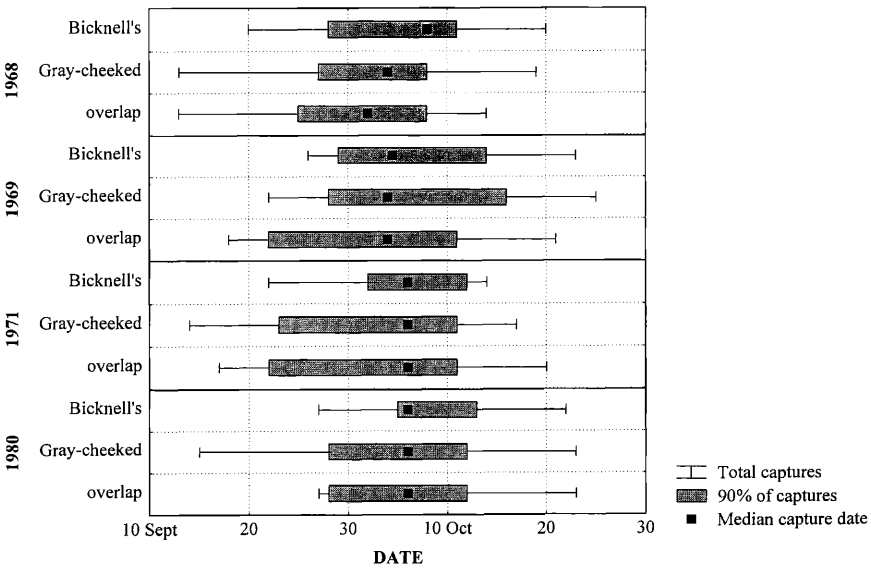

FIGURE 2. The temporal distribution of captures for Bicknell's, Gray-cheeked, and "overlap" thrushes for selected years at Kiptopeke, Virginia.

= 39.2, $P < 0.001$). The percentage of hatching-year birds of all thrush categories varied from a high of 98 in 1971 to a low of 83 in 1968.

Most of the Bicknell's and Gray-cheeked Thrush captures during autumn migration at Kiptopeke occurred over a 25–30-d period from mid-September to mid-October with peak dates falling during the first week of October (Fig. 2). Over the four years examined, no thrushes of this species complex were captured in the first week of September and only seven the last week of October. Comparisons of the median date of capture for Bicknell's and Gray-cheeked Thrushes, and for Bicknell's and overlap thrushes were significantly different in 1968 (Mann Whitney U-tests, U = 10,979, $P < 0.001$ and U = 6,657, $P < 0.001$, respectively) but did not differ between any other thrush category or in any other year (Mann Whitney U-tests, all P values > 0.10). Differences in the median date of capture between Bicknell's and Gray-cheeked Thrushes was 5 d in 1968 (7 October and 2 October, respectively), 1 d in 1969 (4 October and 3 October, respectively) and no difference in 1971 (5 October) and 1980 (7 October). In all four years, the range of dates encompassing 90 percent of captures for all three thrush categories overlapped. However, in 1971 and 1980 Bicknell's Thrushes were captured in a narrower time period compared to Gray-cheeked and overlap thrushes (ninety-percent ranges were 10 and 5 d shorter for the two years, respectively).

DISCUSSION

Capture rates of the Gray-cheeked/Bicknell's Thrush complex varied considerably among years and have declined in recent years. Both of these

trends are consistent with those of several other passerine species consistently captured at this location (Kiptopeke Banding Station, unpubl. data). Possible explanations for the decline in capture rate over the course of the study are many but most likely reflect a combination of local changes in the habitats being sampled (via succession) and broader population-level phenomenon (Robbins et al. 1989, Sauer and Droege 1992). Explanations for yearly variation in capture rates are equally numerous but most likely reflect a combination of variation in reproductive success (that influence the actual number of thrushes migrating) and climatological factors (that may influence the probability that thrushes stop in the vicinity of the banding station).

Aside from the annual variation in capture rate of thrushes, the seasonal timing of migration was consistent across years. The greatest volume of thrushes within the Gray-cheeked/Bicknell's Thrush complex move through the Kiptopeke area within the time period between 20 September and 15 October. As may be expected, this range of dates is slightly later than those reported from more northerly capture sites (Annan 1962, Thobaben et al. 1987) and slightly earlier than those reported from observations at more southerly sites (Lee 1995).

Median date of capture for Bicknell's Thrush was significantly later compared to that of the Gray-cheeked Thrush in 1968 but similar for all other years examined. Thrushes that fell within the "overlap zone" had only a small influence on differences in passage times between the two species. This result is of importance because the overlap thrush category contains a skewed sex ratio for the two species. Intra- and interspecific differences in the passage of sexes would confound comparisons between the two thrush species.

The disproportionate number of hatching-year Bicknell's and Gray-cheeked Thrushes captured was consistent with age ratios of other passerines captured at this site (Stewart 1986) and at other coastal localities (Murray 1966, Ralph 1971). Comparison of age ratios between coastal and inland sites have documented relatively higher proportions of hatching-year birds at coastal locations. This may suggest an alternative route and/or strategy for older age classes (Murray 1966; Ralph 1971, 1981).

The data presented here provide evidence of the relatively large movement of Bicknell's Thrushes through Kiptopeke, Virginia. Based on the totals of the three thrush categories, a conservative average of 30% could be classified as Bicknell's. No other location has documented a comparable number of migratory Bicknell's Thrushes. Historic banding information from other locations may help to further clarify the seasonal and geographic occurrence of this species complex.

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LITERATURE CITED

ANNAN, O. 1962. Sequence of migration, by sex, age, and species, of thrushes of the Genus *Hylocichla,* through Chicago. Bird-Banding 33:130–137.

AMERICAN ORNITHOLOGISTS' UNION. 1995. Fortieth supplement to the American Ornithologists' Union Check-list of North American Birds. Auk 112:819–830.

BENT, A. C. 1949. Life Histories of North American thrushes, kinglets, and their allies. Dover, New York.

CANADIAN WILDLIFE SERVICE AND THE UNITED STATES FISH AND WILDLIFE SERVICE. 1977. North American bird banding manual.

EVANS, W. R. 1994. Nocturnal flight call of Bicknell's Thrush. Wilson Bull. 106:55–61.

LEE, D. S. 1995. Status and seasonal distribution of Bicknell's and Gray-cheeked Thrushes in North Carolina. Chat 59:1–8.

MACLAREN, I. 1995. Field identification and taxonomy of Bicknell's Thrush. Birding 27:358–366.

MCNAIR, D. B., AND W. POST. 1993. Supplement to status and distribution of South Carolina birds. Charleston Museum Ornithological Contribution No. 8. 44 pp.

MURRAY, B. G. 1966. Migration of age and sex classes of passerines on the Atlantic coast in autumn. Auk 83:352–360.

OUELLET, H. 1993. Bicknell's Thrush: taxonomic status and distribution. Wilson Bull. 105: 545–572.

PYLE, P. S., N. G. HOWELL, R. P. YUNICK, AND D. F. DESANTE 1987. Identification guide to North American passerines. Slate Creek Press, Bolinas, California.

RALPH, C. J. 1971. An age differential of migrants in coastal California. Condor 73:243–246.

———. 1981. Age ratios and their possible use in determining autumn routes of passerine migrants. Wilson Bull. 93:164–188.

ROBBINS, C. S., J. R. SAUER, R. S. GREENBERG, AND S. DROEGE, 1989. Population declines in North American birds that migrate to the neotropics. Proc. Natl. Acad. Sci. 86:7658–7662.

SAUER, J. R., AND S. DROEGE. 1992. Geographic patterns in population trends of Neotropical migrants in North America. Pp. 26–42, *in* J. H. Hagan and D. W. Johnston, eds. Ecology and conservation of Neotropical migrant landbirds. Smithsonian Institution Press, Washington, D.C.

SCOTT, F. R. 1963. Operation recovery at Kiptopeke Beach, Virginia. Raven 34:51–52.

STEWART, P. A. 1986. Fall migration of twelve species of wood warblers through coastal Virginia. North Am. Bird Bander 11:83–88.

THOBABEN, R. G., JR., T. A. THOBABEN, AND J. L. INGOLD. 1987. Fall migration of passerine birds in Ohio: a co-operative study by the Ohio Bird Banding Association. North Am. Bird Bander 12:47–53.

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