Hermit Thrush (*Catharus guttatus*) Wing Formula in Eastern North America Differs from Pyle's Identification Guide

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ABSTRACT

We found that Hermit Thrush (Catharus guttatus) *wing formula data from central New Jersey and northwestern New York were not in agreement with the ranges reported in Pyle's (1997)* Identification Guide to North American Birds. *Our wing and tail data fit closely with the subspecies* C.g. faxoni. *We propose that the following additional ranges be presented in the* Guide *for differences between the primary (p) flight feathers of Hermit Thrushes in eastern North America.: p8 - p6, from - 2 to 2 mm; p8 -p5, from 3 to 9 mm; p8 -p1, from 18 to 25 mm. We alert banders that outlying measurements could represent a vagrant western subspecies. Our measurements for other* Cath-arus *thrush species and Wood Thrush* (Hylocichla mustelina) *were in agreement with Pyle.*

INTRODUCTION

Wing morphology, which includes relative lengths, emargination, and notching of primaries, is a useful tool for separating visually similar birds at species and subspecies levels in the hand, and defining their geographical and life style adaptations. Phillips et al. (1966) used wing morphology to separate difficult species of *Empidonax* flycatchers. Aldrich and James (1980) demonstrated that American Robin (*Turdus migratorius*) subpopulations differed geographically in wing morphology. Mulvihill and Chandler (1991) observed wing morphology differences between males of sedentary and migratory populations (subspecies) of Dark-eyed Juncos (*Junco hyemalis*).

Pyle (1997) used wing morphology, including wing formula which is the relative length and position of the tip of each primary, to separate similar species of *Catharus* thrushes in the hand. During routine bird banding at Featherbed Lane (FBL) we noted that the wing formula ranges for primaries p8 minus p6 and p8 minus p5 in migrating Hermit Thrush (*Catharus guttatus*) were not in agreement with the ranges reported in Pyle.

Pyle (1997), in the "Introduction" and in "A Note to Banders," encourages banders to field test and update information in the *Identification Guide to North American Birds*. In order to determine if the observed differences for p8 – p6 and p8 – p5 were truly representative of the Hermit Thrush we were encountering at FBL, Greg collected additional wing formula data on Hermit Thrush at Merrill Creek Reservoir (MCR), and Suthers collected additional data at Braddock Bay Bird Observatory (BBBO). We specifically set out to determine if the relative primary lengths reported in Pyle for Hermit Thrush were appropriate for use in the East.

METHODS

Data collection - Hermit Thrushes were captured in mist nets as part of standard monitoring projects at three banding locations in northeastern United States. Captures occurred during the months of October and November from 2004 – 2010 at BBBO (43°19'25" N, 077°43'03" W) at Lake Ontario near Rochester, NY, and MCR (40°45'01" N, 075°05'09" W) near Washington, western central New Jer-sey Highlands, and FBL (40°24'47" N, 074°46'19" W) near Hopewell, central New Jersey Piedmont.

Birds were identified as to species and banded with U.S. Geological Survey serially numbered bands. Wing formula measurements were taken of the primary distances in mm between p8 and p6, p8 and p5, p8 and p1, and longest p covert and p10, with a ruler without an end stop on the folded right wing, as described in Pyle's Figure 10. The technique was modified for live birds in the bander's hold by slightly opening the wing to allow for correct placement with the ruler zeroed for each measurement at the shorter feather tip and read at the longer feather tip. Wing length, tail length, fat score, and age by the criteria described in Pyle were recorded. Sex was not determined, due to lack of breeding evidence in the fall.

Table 1. Combined Overall Descriptive Statistics for Sites.

Variable	Sites	n	Mean	Median	Min	Max	IQR
Wing Chord	All	161	90.39	90.00	84.0	96.0	4.75
p8 - p6	All	161	0.22	0.00	-2.0	3.0	1.00
p8 - p5	All	161	4.80	5.00	2.0	12.0	1.50
p8 - p1	All	135	21.45	22.00	16.0	26.0	2.00
p covs - p10	All	104	0.92	1.00	-4.0	5.0	2.00
Tail	All	101	68.15	68.00	61.0	75.0	4.00

Table 2. Descriptive Statistics by Site for Wing Formula Measurements

Variable	Sites	n	Mean	Median	Min	Max	IQR
p8 - p6	BBBO	56	0.07	0.00	-2.0	3.0	0.00
	MCR	74	0.15	0.00	-2.0	2.0	1.00
	FBL	31	0.68	1.00	-1.0	3.0	1.00
p8 - p5	BBBO	56	4.93	5.00	2.0	11.0	2.00
	MCR	74	4.29	4.00	2.0	7.0	1.00
	FBL	31	5.81	5.00	3.0	12.0	3.00
p8 - p1	BBBO	55	21.02	21.00	18.0	24.0	2.00
	MCR	59	21.69	22.00	18.0	24.0	2.00
	FBL	21	21.90	22.00	16.0	26.0	3.00

Statistical analysis - Nonparametric statistical methods were used because some of the variables were asymmetrically distributed with data tails of extreme values (see Figs.).

Descriptive statistics were calculated across all locations and for each location (Tables 1 and 2). Measurements by location were evaluated using a Kruskal-Wallis test. If an overall significant difference was detected at the $p \leq 0.05$ level, the Wilcoxon two-sample test was used to compare differences by location. Ninety-five percent reference ranges were calculated by the percentile method. SAS version 9.1 was used for all statistical evaluations.

RESULTS

Birds (n=161) with data on at least the wing chord, p8 - p6 and p8 - p5 were included. The descriptive statistics for data combined for all three study sites are presented in Table 1.

Comparisons within our own sites showed no differences for wing chord or tail measurements. Although we found small but statistically significant differences between our sites for p8 – p6, p8 – p5 and p8 – p1 measurements, the medians and means varied by 1.5 mm or less (Table 2). The p8 – p6 measurement at FBL was longer than at the other two sites (FBL vs MCR, $p = 0.013$, FBL vs BBBO, $p = 0.004$). The p8 – p5 measurement at MCR was shorter than at the other two sites (MCR vs BBBO, $p = 0.001$, MCR vs FBL, $p = < 0.001$). The p8 – p1 measurement was longer at MCR than at BBBO ($p = 0.015$).

Due to the small number of AHY birds, 17 of 161, we did not test for age-related differences. However, the longest p covert – p10 measurement did show an age-related difference, as expected (HY median 0.63, mean 1.00; AHY median 2.00, mean 2.08), and the other wing formula measurements were equal in median and differed by less than 0.5 mm in mean between the two age classes.

Comparison of our results with Pyle's Identification Guide - Hermit Thrush wing (n=161), tail

(n=101), longest p covert – p10 (n=104), and p6 - p9 (n=67) measurements were all in agreement for the species as described in Pyle. However, we observed inconsistencies between our data and Pyle's ranges for p8 - p6 (5-6 mm), p8 - p5 (11-13 mm), and p8 - p1 (20-22 mm) measurements.

The p8 - p6 measurement (n=161) in this study had a smaller difference between feathers, ranging from minus two to 3 mm with no overlap of the range reported in Pyle (Fig.1). The p8 – p5 measurement (n=161) also had a smaller difference between feathers than indicated by Pyle, ranging from 2 to 12 mm (Fig. 2). The p8 – p1 measurement (n=135) had a median of 22 mm, which was within Pyle's range but our data had a considerably wider overall range of 16 to 26 mm (Fig.3). Our 95% reference ranges (p8 – p6, -2 to 2 mm; p8 – p5, 3 to 9 mm; p8 – p1, 18 to 25 mm) are still considerably wider and different from the ranges reported by Pyle.

Evaluation of other thrush species—Swainson's Thrush (*Catharus ustulatus*) (n=26), Veery (*Catharus fuscescens*) (n=9), Gray-cheeked Thrush (*Catharus minimus*) (n=5), Wood Thrush (*Hylocichla mustelina*) (n=9), and Bicknell's Thrush (*Catharus bicknelli*) (n=5)—captured at MCR and FBL during fall migration showed no apparent inconsistencies in wing formula from the reported ranges in Pyle.

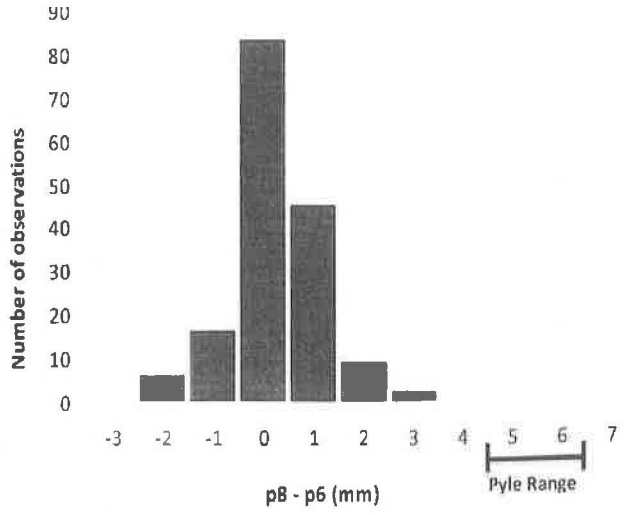

Fig. 1. Hermit Thrush primary difference measurement (p8 -p6) with comparison to range reported in Pyle (1997).

DISCUSSION

Discrepancies between our data and Pyle's ranges could be explained by the following: Discrepancies of 1 – 3 mm could be measurement variations between individual banders (Nisbet et al. 1970). The larger ranges in our study could be a function of a larger sample size. Pyle used 95% confidence intervals that may have excluded outliers, including those resulting from skin preparation (P. Pyle pers. comm.). Lastly, the discrepancies could be valid and perhaps biologically relevant.

The smaller differences we observed between primaries near the wing tip (p7 being equal to or longer than p8 by 1 mm) leads us to consider that our data describe a more distally rounded wing, which is perhaps related to migratory strategy and other life-history strategies such as predator avoidance (see reviews by Lockwood et al. 1998, Swaddle and Lockwood 1998). The lack of an observable consistent pattern in the small differences we observed between our sites for the p8 – p6, p8 – p5 and p8 – p1 measurements, simply could reflect measurement differences between banders (Nisbet et al. 1970).

An explanation for the differences in wing formula that we observed may be associated with Hermit Thrush subspecies. We consider that Hermit Thrush subspecies differ not only in overall size and coloration (Aldrich 1968, Phillips 1991, Pyle 1997) but also may differ in wing shape. Our wing measurement ranges agreed with those from Powdermill Nature Reserve in western Pennsylvania (Mulvihill et al. 2004), suggesting they are representative of Hermit Thrush typically encountered in the East. Based on our capture locations in New Jersey and New York and the agreement of our data with the measurements given for wing chord and tail (Pyle 1997) for subspecies, we believe that our data are representative of the subspecies *C.g. faxoni*. Although Pyle attempted to include all subspecies evenly, the specimens he was working with were heavily biased toward western subspecies (P. Pyle pers. comm.). Even so, it seemed unlikely to Pyle to have this large a

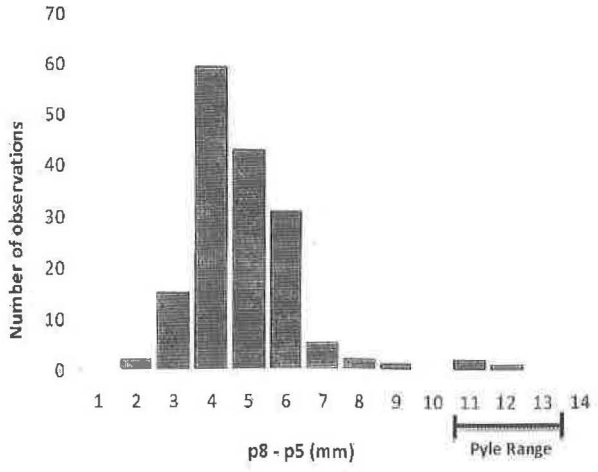

Fig. 2. Hermit Thrush primary difference measurement (p8 - p5) with comparison to range reported in Pyle (1997).

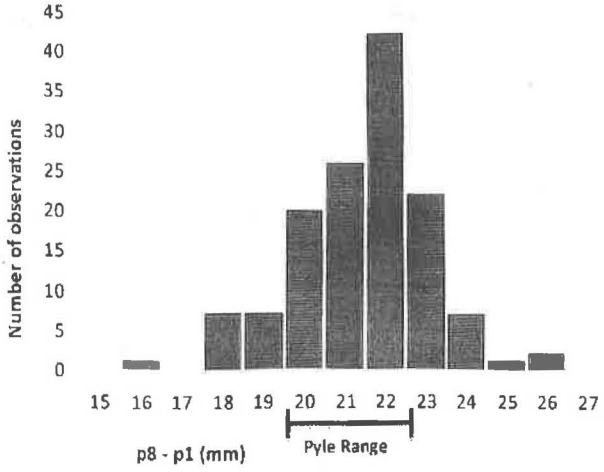

Fig. 3. Hermit Thrush primary difference measurement (p8 - p1) with comparison to range reported in Pyle (1997).

difference between subspecies, and the measurement ranges reported in the *Identification Guide* could be based on typographical errors of some sort (P. Pyle pers. comm.).

In conclusion, we propose that Pyle includes additional ranges for Hermit Thrush wing formula for use in the East. We suggest considering the following 95% reference ranges: p8 – p6, -2 to 2 mm; p8 – p5, 3 to 9 mm; p8 – p1, 18 to 25 mm. We alert eastern banders that measurements outside these ranges could represent a vagrant western subspecies.

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