

# VOICE-PRINTING THE HERMIT THRUSH (*CATHARUS GUTTATUS*)

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## 1. INTRODUCTION

Each spring many migratory birds return to the woodlands of Nova Scotia. Among them is the secretive Hermit Thrush (*Catharus guttatus*), one of the most gifted songbirds in North America. Arriving in April, this bird sings well into the summer and migrates south as late as October. The Hermit Thrush is more often heard than seen, preferring to hide under the cover of leaves. The male shown in Fig. 1 was observed prior to foliation.

Sixty years ago, when spectrographic analysis of sound was in its infancy, Koenig et al. [1] published one of the first spectrograms of a Hermit Thrush song, along with several other bird vocalizations. In later years, Stein [2] noted that songs of individual Hermit Thrushes were quite different, Borror [3] found that each male had a repertoire of up to thirteen songs, and Rivers and Kroodsma [4] compared the songs of Arizona and New England birds.

Motivated by these earlier works, the author recorded and analyzed Hermit Thrush songs of birds living in and around the city of Halifax. The objective was to develop a database of voice-prints for individual birds and use it to acoustically identify them from one breeding season to the next.

## 2. RECORDING METHOD

From the outset, the modus operandi was to obtain audio recordings from birds in the most non-intrusive way possible. To this end, only birds located adjacent to roads or park trails were recorded. None of the birds were banded, marked, stalked or flushed out of hiding.

All of the audio recordings were made using Sony digital video camera recorders. A DCR-TRV525 was used in 2003 but in 2004 the author upgraded to a DCR-VX2100. The sampling rate was 48 kHz with 16 bit quantization. The more sophisticated DCR-VX2100 camera had a recording level meter for adjusting the input audio level. When the bird was not visible, the camera was simply pointed in the direction of the sound source.

Audio files in 'wav' format were extracted from Digital 8 and Mini DV video cassettes used by the DCR-TRV525 and DCR-VX2100 cameras, respectively. Spectral analysis was carried out using the Raven 1.2.1 interactive sound analysis software developed at the Cornell Lab of Ornithology.



Fig. 1. Video frame image of a Hermit Thrush recorded at Shubie Park in Dartmouth, Nova Scotia in April 2003.

## 3. STUDY SITES

Six woodland areas known to attract Hermit Thrushes were chosen based on easy access to birds from established roads or trails. These areas are listed below along with their locations relative to downtown Halifax. Within these areas, specific study sites were restricted to approximately 100 m of gravel road or trail. Currently eleven sites are monitored, four in A5, two in A1 and A4, and one in each of the others.

- A1. Lewis Lake Provincial Park (22 km WNW)
- A2. Hemlock Ravine Park (8 km NW)
- A3. Oakfield Provincial Park (30 km N)
- A4. Shubie Park (7 km NNE)
- A5. Lake Eagle (15 km NE)
- A6. Bissett Road Trail (10 km E)

## 4. RESULTS AND DISCUSSION

From April 2003 through July 2006, more than 4000 Hermit Thrush songs from 17 individual birds were recorded and analyzed at the 11 sites. Their repertoires ranged from 8 to 13 songs and a total of 165 unique songs were identified, with no two birds having a single song in common. Their song frequency band was 1.4 to 8.6 kHz.

A typical Hermit Thrush song recorded at Lake Eagle in May 2004 is shown in Fig. 2. The song begins with an introductory note ( $\alpha$ ) followed by a series of flute-like body notes, with the most significant ones labeled in temporal

order ( $\beta$  to  $\kappa$ ). Many songs also contain structures like the upsweeps to  $\epsilon$  and  $\iota$ . The bird that sang the song in Fig. 2 had an 11-song repertoire that contained about 350 notes and structures (i.e., upsweeps and downsweeps).

The study had a promising start in 2003 with five birds voice-printed, one in each of A1, A2, and A3, and two at the same site in A4. The bird in A1 was recorded in July and 12 days later in August. Its 9-song repertoire, including all notes and structures, remained unchanged. One of the birds in A4 was recorded in April and 91 days later in July with no significant change to its 11-song repertoire. It was now a matter of waiting until the spring of 2004 to acoustically re-identify one or more of these birds at the same sites.

In the meantime, Hurricane Juan made landfall about 25 km southwest of downtown Halifax on 29 September 2003 [5]. This Category 2 storm caused extensive tree damage to sites A2, A3, and A4, all in the path of the high-wind eastern eyewall. The damage was less extensive at A1 just west of the track. Further damage occurred on 19 February 2004 during a record-setting blizzard that paralyzed the province of Nova Scotia with heavy snowfall and high winds.

If the five Hermit Thrushes recorded in 2003 survived the hurricane, they didn't return to the study sites in 2004. Furthermore, no Hermit Thrushes have maintained territories at these sites in 2005 or 2006. Consequently, seven additional sites were included in the study.

The breakthrough came at Lake Eagle (A5) in 2006, when the voice-prints of two Hermit Thrushes at different A5 sites matched those of two birds in 2005 at the same A5 sites. Both birds had 12-song repertoires which had not changed. An example of one of these songs is shown in Fig. 3 for May 2005 and Fig. 4 for May 2006. With its distinctive trio of downsweeps, this song was first recognized by ear.

It is important to note that these birds were never visually observed in 2005 or 2006. Since there was no definitive non-acoustic verification that they were the same birds,

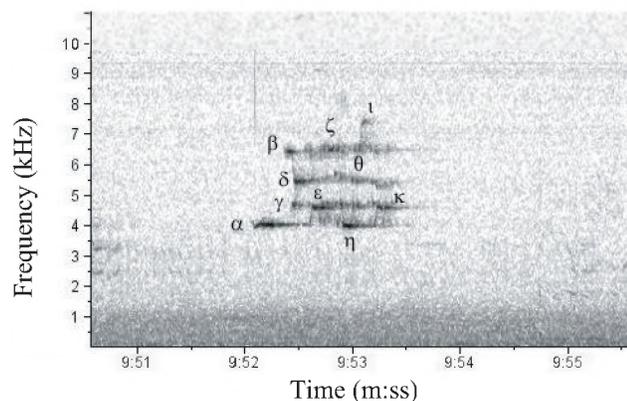


Fig. 2. Hermit Thrush song recorded at Lake Eagle in May 2004. (512-point FFT, 62 Hz filter bandwidth, Hanning window).

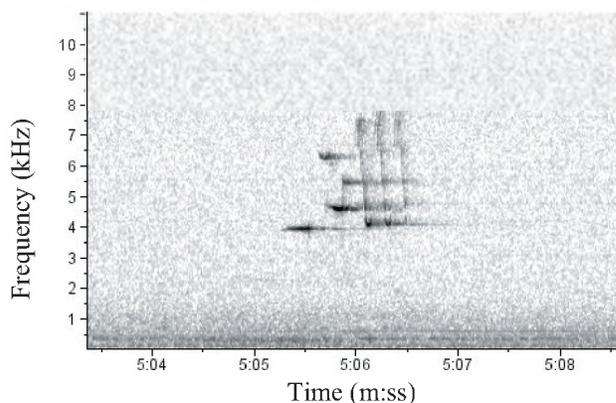


Fig. 3. Hermit Thrush song recorded at Lake Eagle in May 2005. (512-point FFT, 62 Hz filter bandwidth, Hanning window).

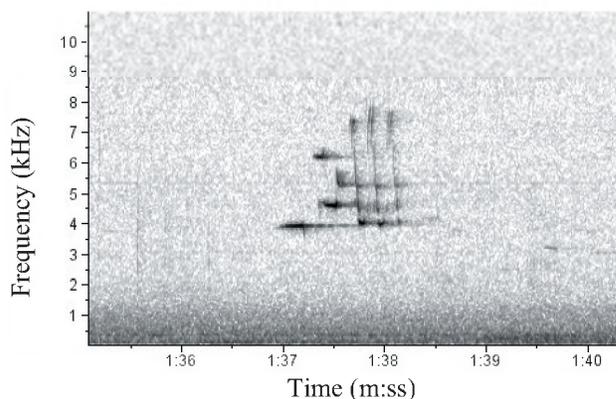


Fig. 4. Hermit Thrush song recorded at Lake Eagle in May 2006. (512-point FFT, 62 Hz filter bandwidth, Hanning window).

the conclusion that they were likely the same birds is based on voice-print matches and the fact that both birds were recorded at the same 100 m sites, in the same month, in two consecutive breeding seasons. It will be interesting to see if these birds return in the spring of 2007.

## REFERENCES

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