

Identifying *Empidonax* Flycatchers:

# The Ratio Approach

Many birders know that *Empidonax* flycatchers differ significantly with respect to wing and tail measurements ("morphometrics"). But how do these morphometric statistics translate into useful impressions in the field? The *Acadian Flycatcher* provides a good example of the approach implied by this question. Even if you do not consciously detect the long primary projection and long bill, note how these characters translate into sword-shaped wing tips and a long, sloping forehead with a hint of a crest.

Pickaway County, Ohio;  
September 2006.  
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**E***mpidonax* flycatchers are among the most intimidating of identification problems for birders in North America. Numerous attempts have been made to disentangle the intricacies and confusing variability of their plumage and structure. “The *Empidonax* Challenge” by Bret Whitney and Kenn Kaufman, consisting of close to 50 pages (in five separate installments), was published in *Birding* in the mid-1980s (Whitney and Kaufman 1985a, 1985b, 1986a, 1986b, 1987). No article of that magnitude or value has been published on the genus since. However, 17 years after its first installment was released, coauthor Kaufman commented that “It...was filled with warnings and cautionary notes, but some readers apparently missed those and focused on the pictures,” resulting in misidentification (Kaufman and Sibley 2002).

In fact, *Empidonax* flycatcher identification is so difficult that innovative researchers have come up with a formula to increase accurate processing of mist-netted individuals. Back in 1989, R. H. Benson and K. L. P. Benson described this formula in the journal *North American Bird Bander*. The formula was created to avoid mistakes made when “using a dichotomous key with any group where the ranges of measured characteristics exhibit large overlap.” In its essence, this formula involves comparisons of the ratios of and differences between measurements of a bird’s body parts (bill length and width, wing length, tail length, etc.). While a vast improvement over past methods, this mathematical equation could not provide 100% accuracy. And there was an obvious practical angle: How could a mere birder *in the field*, equipped with only binoculars and field guide, take on such a challenge?

Whitney and Kaufman taught readers how to look at *Empidonax* flycatchers, emphasizing light conditions, posture, and behavior. They prioritized what to look for, including structure, plumage, stage of molt, and wear as key factors. In part because of Whitney and Kaufman’s groundbreaking series, many birders are today familiar with terms like “primary projection” and “outer rectrix.” But what do such features ac-



The **Alder Flycatcher** combines relatively long wings with a relatively short tail, creating an overall long-winged impression. This long-winged impression is morphometrically expressed in terms of the *wg–tl* statistic (see text for details). Note the sword-shaped wing tips, typical of long-winged species. Alder Flycatcher's bill morphology is decidedly average, causing the species to appear neither large-headed nor small-headed.

Chippewa County, Michigan;  
May 2007. © Brian E. Small.



ually *look like* in the field? How do they contribute to our qualitative impression of a bird's appearance? For example, how does a long primary projection affect the overall shape of a bird? How can width of the bill be helpful when there is so much variability? This article presents a closer examination of some important structural features and how to interpret them for the purpose of field identification.

Wing morphology metrics are among the most important elements in *Empidonax* identification. But translating these numbers into an understanding of structure and overall appearance requires a bit of interpretive thinking. For example, a birder in the field might encounter a flycatcher and accurately perceive that it has a long tail. Conversely, the observer might see a short wing with little primary projection and interpret that as a long tail. In another example, an observer might determine that a bird appears short-tailed—a determination that could easily be an artifact of seeing a long primary projection and wing chord dwarfing the true tail length.

In recent years, birders have been paying increasing attention to the importance of body structure in bird identification. Several recent articles in *Birding*, for example, have emphasized the importance of body structure in shorebird identification (Crossley 2006, Lee and Birch 2006, Cox 2008). Of particular interest is a recent article in *Birding* that specifically addresses the use of morphometric ratios in the identification of North American woodpeckers (Lee et al. 2008)—exactly the same approach that I advocate for *Empidonax* flycatchers.

### Methods

I measured various wing, tail, and bill characters on specimens at the Delaware Museum of Natural History.

For each of the ten widespread North American *Empidonax* flycatchers, I made measurements on 24 specimens. (The Buff-breasted Flycatcher, quite restricted in range in North America, is excluded from my analysis.) The measurements were then used to calculate the most useful and readily observed body proportions (for example, difference





Above: Aitkin County,  
Minnesota; June 2002.  
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Below: Riverside County,  
California; April 2005.  
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between tail length and wing length, difference between bill length and bill width).

### Wing and Tail Proportions

By analyzing the relationship of the length of the wing against the length of the tail (Table 1), we gain insight into whether a species appears chunky and long-tailed vs. sleek and short-tailed. One approach to this problem is to start with wing chord length (*wg*) and tail length (*tl*), and then look at the difference between the two (*wg-tl*). The resulting values provide a mental picture of each species' structure, using the concept of proportionality.

Consider the lateral view of an *Empidonax* flycatcher. Ignoring the head, the wing takes up a sizeable amount of what the observer sees of a perched bird. If the wings are short and the tail is long, then the bird appears relatively stout and long-tailed. Examples of this body structure include Dusky, Least, and Gray Flycatchers. In such cases, the wings barely reach the tail or do not reach it at all, resulting in a small *wg-tl* value. The *wg-tl* value represents an impression that is readily observed and generally consistent. It is probably the most important morphometric relationship to understand. If both the wings and tail are long, as with "Traill's"

Because of its relatively low ratio of bill length to bill width (*bl/bw* statistic), the **Yellow-bellied Flycatcher** (above) appears to be round-headed and to lack a crest. Such impressions are always subject to strong variation induced by a bird's behavior, and birders should never rely on a single feature for field identification of *Empidonax* flycatchers. For example, even though the **Pacific-slope Flycatcher** (below) also has a low *bl/bw* value, it can appear sleek and crested when alert. In this particular instance, other factors—plumage, location, date, and perhaps vocalization—would lead to the correct identification.





Flycatcher, then the bird appears well-proportioned. This translates to a mid-range  $wg-tl$  value. A short wing combined with a short tail is represented by a similar value. Birds having a short tail and long wings appear slender and of course short-tailed. This is represented by a high  $wg-tl$  value, as with Hammond's Flycatcher.

## Absolute Wing Length

Even though it is mathematically simpler than the difference between wing chord length and tail length ( $wg-tl$ ), the absolute length of the wing may be more difficult to ascertain in the field. In this regard, a commonly referenced and vital measurement is primary projection. Primary projection can be defined as the length of the 9th primary minus the length of the 5th primary. But rather than attempting to count the primaries and guess millimeters, I consider it easier to assess the

**Table 1. Wing and Tail Morphology.** Wing chord ( $wg$ ), tail length ( $tl$ ), wing-to-tail difference ( $wg-tl$ ), and primary extension ( $lp-ls$ ) for 10 ABA Area *Empidonax* flycatcher species. All statistics are averages in millimeters. Sample size for each species is  $n=24$ .

NOTE: The  $wg-tl$  statistic is averaged among individuals, not across the entire sample; hence, the  $wg-tl$  averages reported below are not necessarily exactly the same as the simple differences between the first ( $wg$ ) and second ( $tl$ ) columns.

Species	$wg$	$tl$	$wg-tl$	$lp-ls$
Yellow-bellied	66.4	52.8	13.6	13.7
Acadian	72.5	56.8	15.4	17.3
Alder	71.0	56.3	14.7	13.4
Willow	69.1	56.8	12.4	12.9
Least	62.7	53.6	9.2	10.7
Hammond's	68.3	54.6	13.7	16.0
Gray	70.1	59.8	10.3	11.1
Dusky	68.1	61.0	7.0	11.2
Pacific-slope	64.3	54.8	9.5	11.1
Cordilleran	67.9	58.4	9.5	12.2

### KEY POINTS:

1. The  $wg-tl$  statistic creates an impression of how long-winged an *Empidonax* flycatcher appears. For example, Dusky and Hammond's Flycatchers are quite different in this respect, even though the two species are often confused based on field examinations that focus too heavily on plumage. From lowest to highest  $wg-tl$  values, *Empidonax* flycatchers may be ranked as follows: **Dusky < Least < Pacific-slope = Cordilleran < Gray < Willow < Yellow-bellied < Hammond's < Alder < Acadian**

2. The  $lp-ls$  statistic is a measurement of primary projection, which creates another important impression of how long-winged an *Empidonax* flycatcher appears. This morphometric statistic translates into a particularly noticeable effect in the field for Hammond's and Acadian Flycatchers. The  $lp-ls$  gradient, from lowest to highest, is as follows: **Least < Gray = Pacific-slope < Dusky < Cordilleran < Willow < Alder < Yellow-bellied < Hammond's < Acadian**



Because its bill is both quite long and relatively narrow, the **Gray Flycatcher** appears notably long-billed in the field. It is long-tailed, too, but this character can be obscured somewhat by the fact that the species is also relatively long-winged. As always, behavior and ecology are crucial in the identification process. Note that the individual pictured here is on a sagebrush, a classic microhabitat for the species in early summer.

Lake County, Oregon; June 2008. © Brian E. Small.

With its short bill, the **Hammond's Flycatcher** in a typical relaxed pose shows a fairly steep forehead, a rounded crown, and a head that appears a little too large. Relative to the tail, the wings are fairly long.

Riverside County, California; May 2007. © Brian E. Small.



longest primary minus the longest secondary. This can be determined by looking at the folded wing of a bird at rest. The values are generally consistent within a species. I refer to primary projection as *lp-ls* (see Table 1).

A long primary projection (>12.5 mm) is characteristic, not surprisingly, of birds that have long wing chords, for example, Acadian, Hammond's, and Yellow-bellied Flycatchers. A small primary projection value (<12.5 mm) normally translates to a short overall wing length, as with Least Flycatcher. Variation and overlap in primary projection length within a species are common. For any given *individual*, however, there is a general tendency for the following characters to be correlated: primary projection, absolute wing length, and the shape (rounded vs. pointed) of the folded primaries. If the tips of the primaries appear wide and rounded, they are likely short, as in Least and Dusky Flycatchers. If the primaries appear more tapered and pointed, that corresponds to medium or long primary projection, seen in Yellow-bellied and "Traill's" (Alder and Willow) Flycatchers. And if the primaries appear slightly bowed or sword-shaped, as in Acadian and Hammond's Flycatchers, that indicates especially long primary projection.

### **Absolute Tail Length**

Third, tail length (*tl*) within species of *Empidonax*

flycatchers is as variable as—or more variable than—any wing measurement. Thus, great care must be taken in applying *tl* in the identification process. That said, a few species have a noticeably short tail compared to other species, and a few have exceptionally long tails. Yellow-bellied and Hammond's Flycatchers are good examples of seemingly short-tailed species, although Least and Pacific-slope Flycatchers average shorter in hand. Dusky Flycatcher is the best example of an obviously long-tailed flycatcher. Its long tail is amplified by its short primary projection (see the section on "Wing and Tail Proportions," p. 33). The same applies to Gray Flycatcher to a lesser degree.

### **Bill Measurements**

Also of potential value in identifying *Empidonax* flycatchers by body structure is the bill. Although color is so often emphasized, bill *length* is an important trait, and two millimeters can translate into discernible differences in the field. Judgments regarding the shape and length of the bill (not to mention the shape of the head) are similar to those involved in assessing wing morphology. The observer must consider the components in relation to one another, and



then assess how they contribute to an overall impression.

Bill length (*bl*) is best used in conjunction with more easily noted features. Hammond's Flycatcher and Gray Flycatcher are examples of how valuable bill morphology can be in identification. Gray Flycatcher has both the longest bill and the greatest length (*bl*) to width (*bw*) ratio, *bl/bw* (see Table 2), making the bill appear both slim and long. Hammond's Flycatcher falls at the other end of the length spectrum. It has the shortest bill on average, causing many individuals to appear to have a head that seems abnormally large and notably rounded. Yellow-bellied and "Western" (Pacific-slope and Cordilleran) Flycatchers have bills that are notable for their low length-to-width (*bl/bw*) ratios. Their bills have more of a delta (or equilateral triangle) shape than other species in this genus, again, the result of a low *bl/bw* value (Table 2).



**Table 2. Bill Morphology.** Bill morphology, a function of bill length (*bl*), bill width (*bw*), and the ratio of the two (*bl/bw*), can create important impressions of structure that are discernible in the field. All statistics are averages in millimeters. Sample size for each species is *n*=24.

NOTE: The *bl/bw* statistic is averaged among individuals, not across the entire sample; hence, the *bl/bw* averages reported below are not necessarily exactly the same as the simple differences between the first (*bl*) and second (*bw*) columns.

Species	<i>bl</i>	<i>bw</i>	<i>bl/bw</i>
Yellow-bellied	8.3	5.3	1.56
Acadian	9.8	5.8	1.68
Alder	8.6	5.4	1.59
Willow	9.5	5.6	1.69
Least	7.7	4.9	1.59
Hammond's	7.4	4.4	1.70
Gray	10.1	4.8	2.10
Dusky	8.2	4.7	1.76
Pacific-slope	8.4	5.5	1.54
Cordilleran	8.4	5.5	1.52

## KEY POINTS:

1. Bill length (*bl*) differences among species, although small, tend to be fairly consistent. Short-billed species, such as Hammond's, tend to appear relatively large-headed. The *bl* gradient, from shortest to longest, is as follows: **Hammond's < Least < Dusky < Yellow-bellied < Cordilleran < Pacific-slope < Alder < Willow < Acadian < Gray**

2. The ratio of bill length to bill width (*bl/bw*), although not something that we consciously compute in the field, nonetheless makes an impression. Note the extreme value for Gray Flycatcher. The *bl/bw* gradient, from lowest to highest, is as follows: **Cordilleran < Pacific-slope < Yellow-bellied < Least = Alder < Acadian < Willow < Hammond's < Dusky < Gray**

A classically short-winged *Empidonax* flycatcher, the **Dusky Flycatcher** at rest presents rounded primaries that show relatively little projection. The relatively long tail amplifies the short-winged look.

Inyo County, California; May 2005. © Bob Steele.

A good exercise is to try to observe *both* the length and the width of the bill of an *Empidonax* flycatcher. Although the **Least Flycatcher** is short-billed, its bill is not especially wide at the base; thus, the overall impression is of a bird with an average bill. The ratio of bill length to bill width (*bl/bw*) in Least Flycatcher averages the same as for Alder Flycatcher.

Roscommon County, Michigan;  
May 2004. © Robert Royse.



*Empidonax* flycatchers with long bills have a tendency to appear slope-headed and crested. Acadian and “Traill’s” (Willow and Alder) Flycatchers are good examples of species that appear crested and sleek, rather than chunky and round-headed; this effect is contributed to by their long bills. A good exercise with *all* wing, tail, and bill measurements is to think about how they contribute to overall impressions of appearance.

Given that many encounters with *Empidonax* involve side views (rather than views from below), bill width *per se* is seldom seen well. The ratio of length to width (*bl/bw*) can be assessed, however, with patient study. In particular, bear in mind that width often varies with length for any given individual within a species; in other words, *bl* and *bw* are directly correlated. For example, if an individual Least Flycatcher is relatively long-billed, then it will tend to be relatively wide-billed, too, maintaining the proportionality. Thus, within a species,

the impression of whether the bird’s bill is more-or-less delta-shaped remains unaltered. As with any other field mark, bill structure should always be treated as a supporting character, not as the single criterion for identification.

### Summary

The measurements and information in this article are to be taken in a certain context. The information in the tables is drawn from a sample of 240 museum specimens (*n*=24 per species, 10 species total), a number that is not all that large when one considers the variation in the statistics reported. I hope that the reader uses my data, analyses, and impressions to supplement other complete works on the genus *Empidonax*. An observer who chooses to apply the information in this article should be willing to look at large numbers of “real” flycatchers *in the field* to learn the proportionalities I have discussed. As always, birders must admit that vir-



tually no visual identification is irrefutable. Remember, too, that, in many instances, nothing is as reliable as hearing a singing or calling *Empidonax* flycatcher. And as always: A birder does not have to identify every bird encountered in the field, and should always keep an open mind for the oddball.

No question about it, *Empidonax* flycatchers remain one of the great puzzles for the North American birder. These little birds can be simultaneously frustrating and gratifying. Over the years many experts have contributed their data and knowledge to *Birding* and other popular press resources. They have provided a foundation for field identification. Seek them out! There is always more to learn.

## Acknowledgments

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**If there is one overarching truth about identifying *Empidonax* flycatchers, it is that no one field mark—nor any one approach—is the absolute best. The Willow Flycatcher is, on the whole, intermediate with regard to bill, wing, and tail measurements, and these characters probably provide only minor support in the identification process. As always, listen for songs and call notes, pay attention to microhabitat and geographic distribution, notice behavior, and, finally, don't ignore plumage.**

*Etobicoke, Ontario; July 2007. © Glenn Bartley.*