Bill Color as an Age Character in Yellow Warblers

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ABSTRACT

A large sample of Yellow Warblers (N=960) was examined in the fall at Long Point, Ontario, to test whether lower mandible color was related to sex (based upon plumage characters) or age (based upon extent of skull ossification). No relationship was found between bill color and sex. However, there was a highly significant relationship between age and bill color. HY birds had lighter colored lower mandibles than AHY birds. "Pale" and "intermediate" bills correctly aged HY Yellow Warblers in 98.2% and 93% of the cases, respectively. "Dark" bills correctly aged 88.8% of the AHYs. In late summer and through September at least, the majority of Yellow Warblers can be aged reliably using bill color. However, this feature becomes progressively less useful in the winter and spring.

INTRODUCTION

Ageing and sexing Yellow Warblers (*Dendroica aestiva*) in fall is usually achieved by an examination of plumage features in combination with an assessment of the degree of skull pneumatization (Canadian Wildlife Service and U.S. Fish & Wildlife Service 1977; Pyle et al. 1987). During fall 1988, banders at Long Point Bird Observatory (LPBO) noticed variation in the lower mandible color of Yellow Warblers captured at Long Point, Ontario. In order to investigate whether this variation might be attributed to age or sex, mandible color was recorded subsequently for most Yellow Warblers banded.

METHODS

Yellow Warblers were captured in mist nets at Long Point, Ontario—a 32-km sandspit which extends out from the north shore of Lake Erie (centred on 42°35' latitude and 80°15' longitude). Southbound Yellow Warblers pass through Long Point from late July through mid September—earlier than any other warbler species.

LPBO personnel assessed the lower mandible color of 960 Yellow Warblers banded during fall 1989-92. This feature was also recorded in spring 1992, when an additional 160 birds were examined. Fall and spring data were analysed separately.

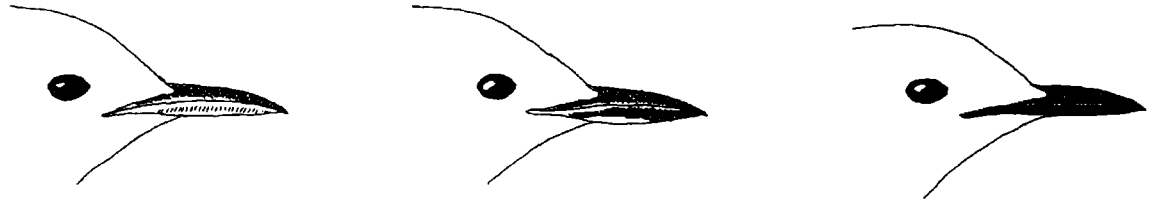
The bill area in question was the basal and central portion of the lateral faces of the lower mandible (Figure 1). The undersurface and cutting edge of the lower mandible tend to be light-colored on all birds, whereas the extreme tip tends to be dark. Therefore, these areas were not considered in the assessment. Bill color was assigned to one of the following three categories (see Figure 1):

1. Pale: Lower mandible markedly paler than, and strongly contrasting with, the upper mandible over all, or nearly all, of the area in question.

2. Intermediate: Part of the lower mandible pale (as above) and part dark (as below), or (more rarely) the whole lower mandible uniformly intermediate shade of gray (paler than the upper mandible but not sharply contrasting).

3. Dark: Lower mandible uniformly dark in color, with little or no contrast with the upper mandible.

Fall birds were aged according to degree of skull ossification and, when possible, sexed according to plumage criteria (Canadian Wildlife Service and U.S. Fish & Wildlife Service 1977; Pyle *et al.* 1987).



PALE INTERMEDIATE DARK

Figure 1. Color variations in the lower mandibles of Yellow Warblers.

RESULTS

Sex and Lower Mandible Color - Of 960 Yellow Warblers examined in the fall, 309 were sexed by plumage; 195 of these were males, and 114 were females (Table 1). There was no relationship between lower mandible color and sex (Chi-square value with 2 degrees of freedom = 1.95; $p > 0.10$).

Table 1. Lower mandible color of 309 male and female Yellow Warblers captured at Long Point, Ont., in fall 1989-92.

Bill Color	Male	Female
Pale %	50.3	43.9
(N)	(98)	(50)
Intermediate %	25.6	32.5
(N)	(50)	(37)
Dark %	24.1	23.7
(N)	(47)	(27)
TOTAL %	**100**	**100**
(N)	**(195)**	**(114)**

Age and Lower Mandible Color - 960 Yellow Warblers were aged by degree of skull ossification in the fall. Of these, 855 were HY and 105 were AHY (Table 2). There was a highly significant relationship between age and lower mandible color (Chi-square value with 2 degrees of freedom = 616.8; $p < 0.005$). About 77% of HY birds were categorized as having "pale" bills, and 75% of AHY birds were categorized as being "dark." Pale and intermediate bills correctly aged HY Yellow Warblers in 98.2% and 93.0% of the cases, respectively. Dark bills correctly aged AHY birds in 88.8% of the cases (Table 3).

Table 2. Lower mandible color of 960 HY and AHY Yellow Warblers captured at Long Point, Ont., in fall 1989-92.

Bill Color	HY	AHY
Pale %	77.1	11.4
(N)	(659)	(12)
Intermediate %	21.7	13.3
(N)	(186)	(14)
Dark %	1.2	75.2
(N)	(10)	(79)
TOTAL %	**100**	**100**
(N)	**(855)**	**(105)**

Table 3. Reliability of lower mandible color to separate HY and AHY Yellow Warblers captured in fall.

Bill Color	HY (% reliability)	AHY (% reliability)	N
Pale	98.2	1.8	671
Intermediate	93.0	7.0	200
Dark	11.2	88.8	89

Lower Mandible Color in Spring - During spring 1992, 160 adult Yellow Warblers were examined; 141 of these had dark lower mandibles, representing 88% of the total. Of the remainder, 9% were assessed as "intermediate" and 3% were recorded as "pale." Most of the spring birds were aged simply as AHY. Thus, there were insufficient data to test for statistical differences between ASY and SY bill colors. Still, we suspect that pale and intermediate bills in spring are probably more characteristic of SY birds than ASY birds.

DISCUSSION

We conclude that young Yellow Warblers have largely pale lower mandibles, which gradually darken to the color of the upper mandible. Thus, at least until mid-September, any Yellow Warbler with a pale zone on the basal and central portion of the lateral faces of the lower mandible can be aged as HY with 98% certainty. Similarly, any fall Yellow Warbler with a fairly uniform dark bill is probably (89% certainty) an adult, again at least until mid-September. Intermediates between the two extremes can be aged (93% certainty) as HY birds. A small proportion of the population (probably SY birds only) apparently retains some pale coloration into the following spring, but this requires verification.

As with any subjective assessment, the determination of lower mandible coloration is affected by observer experience and interpretation. Although some LPBO banders recorded pale and intermediate colored bills on some adult Yellow Warblers, we suspect that most of these determinations arose due to confusion surrounding the pale-colored cutting edge and undersurface that is characteristic of most Yellow Warblers' bills. In our personal experience, all adults that we checked had dark lower mandibles, both in spring and fall. Still, some "intermediate" birds could legitimately be assigned to either the "dark" or the "pale" category because there is a gradation between the two extremes of bill color.

For the most part, changes in bill color are believed to be controlled by the annual cycle of gonadal hormones (Mundinger 1972). Bill color is rarely mentioned as a character for ageing passerines, the most notable exception being Northern Cardinal (Yunick 1984; Pyle et al. 1987). Dwight (1900) noted that a marked deepening or change in bill color occurred in young birds of some species. In fact, he described the bill of juvenile Yellow Warblers as being "pinkish-buff becoming slaty." More importantly, Dwight also reported that Yellow Warbler bills were usually darker in adult winter plumage than in first-winter plumage. This is the only warbler species for which such a distinction was mentioned. Similar comments were noted by Curson et al. (1994).Can this technique be applied to other species of warblers? While Curson et al. (1994) note that bill color is lighter in juveniles of many species of warblers, only in the case of the Yellow Warbler do they mention that this lightness is retained beyond the post-juvenile moult. Likewise, at Long Point, we did not find any obvious signs that bill color was age related during casual examination of other species of warblers in the hand. This may be partly because other species pass through our region later in the fall when bill color distinction may not be quite so pronounced as it is in the earlier migrating Yellow Warblers.

On live birds, ageing Yellow Warblers by bill color is a reliable ageing technique in late summer, during fall migration, and perhaps also on the wintering grounds, depending on how rapidly the darkening process progresses. With practice, it should also be useful in field studies.

ACKNOWLEDGMENTS

Many thanks are extended to Dawn Brenner and Nadine Litwin for their help in assembling the data base and to Greg Poole, who helped develop the project. Richard Knapton, Jon Curson and an anonymous reviewer provided advice on the manuscript. We are indebted to the many volunteers who contributed to LPBO's banding program from 1989-92.

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