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# Comment on “Ivory-billed Woodpecker (*Campephilus principalis*) Persists in Continental North America”

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We reanalyzed video presented as confirmation that an ivory-billed woodpecker (*Campephilus principalis*) persists in Arkansas (Fitzpatrick *et al.*, Reports, 3 June 2005, p. 1460). None of the features described as diagnostic of the ivory-billed woodpecker eliminate a normal pileated woodpecker (*Dryocopus pileatus*). Although we support efforts to find and protect ivory-billed woodpeckers, the video evidence does not demonstrate that the species persists in the United States.

The ivory-billed woodpecker has received considerable attention following the April 2005 announcement of its rediscovery in the “Big Woods” region of Arkansas (1–3). The conclusion by Fitzpatrick *et al.* (1) that the species persists is based on several observations, sound recordings that resemble ivory-billed woodpecker calls and double raps, and a short video recording. The recent sight records (1, 4) were all very brief and most involved a single observer, matching

the pattern of reported observations over the past few decades (5–8). Although such observations provide strong impetus for continued searching and habitat protection, they cannot be taken to confirm the species’ presence because they do not provide independently verifiable evidence. Nor is the audio evidence reported to date considered definitive (9). Thus, confirmation that ivory-billed woodpeckers remain in the United States rests on demonstrating that the “crucial video of a large woodpecker” (1) cannot possibly be a pileated woodpecker.

Fitzpatrick *et al.* list five features to support their conclusion that the bird in the video is an ivory-billed woodpecker: (i) size, (ii) wing pattern at rest, (iii) wing pattern in flight, (iv) white plumage on dorsum, and (v) black-white-black pattern presumed to be a perched bird (1). Our analysis of the digital video and deinterlaced video frames (10) demonstrates that

this conclusion rests on mistaken interpretations of the bird’s posture, that several features visible in the video contradict identification as a typical ivory-billed woodpecker, and that other features support identification as a pileated woodpecker. The assessment that follows is keyed to the labeled frames in Fitzpatrick *et al.*’s supporting materials [fig. S3 in (1)].

**Size and wing pattern at rest.** Fitzpatrick *et al.* assume that the bird was positioned vertically on the trunk with its wings more or less folded in frames 33.3 and 50 (Fig. 1A). Our examination of specimens and photographs indicates that a typical ivory-billed woodpecker in that position would exhibit considerably less white and more black than is shown in these frames (Fig. 1). In our analysis [supporting online material (SOM) text], these frames show a bird that has already opened its wings in flight, exposing the underside of a fully spread right wing that is extended vertically (Fig. 1C). The observed pattern is that expected of a pileated woodpecker in this posture, with extensive white on the underwing coverts and bases of the flight feathers. Our estimate of the length of the white patch in the video better matches the extent of white on the ventral spread wing of a pileated woodpecker than that on the dorsal folded wing of a typical ivory-billed woodpecker (but see cautions in SOM). Movement of the tail away from the tree in these frames is also consistent with the hypothesis that the wings are fully spread (see SOM). With this interpretation of the bird’s posture, it is impossible to determine the bird’s size or wing pattern at rest.

**Wing pattern in flight.** To support their conclusion that the bird in the video showed “entirely white secondary and innermost primary flight feathers” (1), Fitzpatrick *et al.* presented

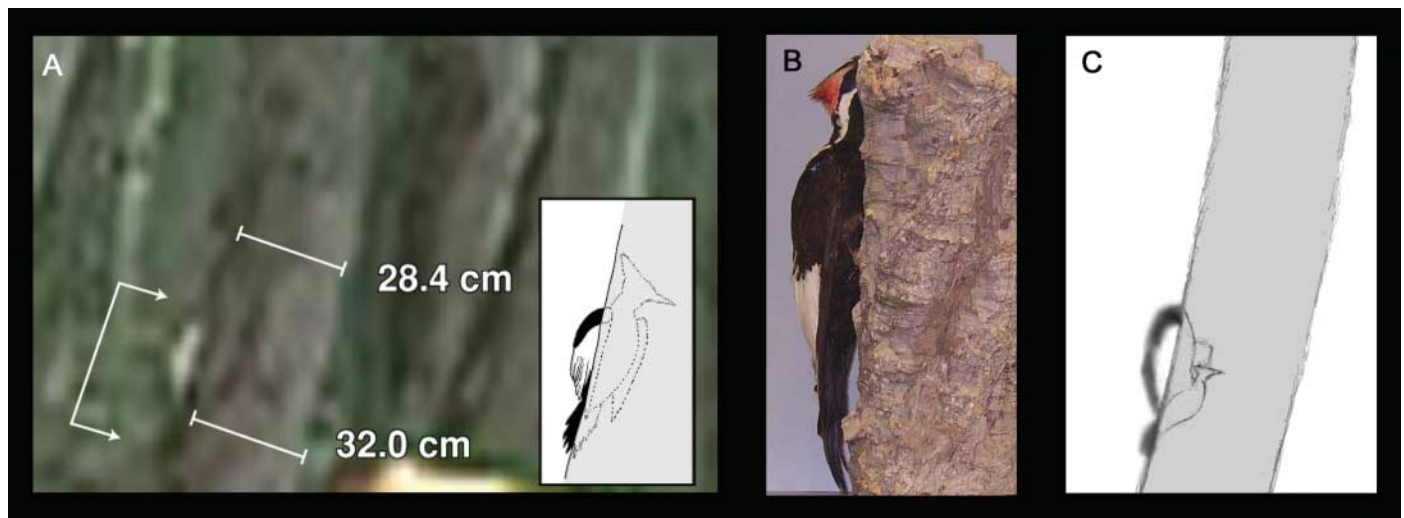
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**Fig. 1.** (A) Frame 33.3 from (1), in which it is proposed that the black and white object to the left of the tree trunk is an ivory-billed woodpecker positioned as illustrated in the inset sketch. (B) Photograph of a mounted ivory-billed woodpecker specimen, illustrating the limited extent of white

and the large amount of black on the folded wing typical of that species (Western Foundation of Vertebrate Zoology) (image flipped horizontally and cropped using Photoshop). (C) The posture we propose for the bird in the video.

**Fig. 2.** (A) and (C) show video frames (apparently frames 700 and 1000, although this is not stated) and interpretive sketches from Fig. 2 in (1). (B) and (D) show alternative explanations of the bird's positions in these frames that better match its appearance and behavior in adjacent frames, i.e., the bird is flying more directly away from the camera (sketches by D. Sibley). In each case, the new interpretation shows that the white in both wings is likely to be from their ventral surface. (E) and (F) illustrate the manner in which a bird's wings twist in flight, such that the leading edges are lower than the trailing edges, rendering the ventral surface of both wings visible during the downstroke when viewed from behind. (E) shows a female mallard *Anas platyrhynchos* [photograph, courtesy of Ducks Unlimited, scanned from (11); cropped slightly using Photoshop]. (F) shows a pileated woodpecker taking flight [video frame courtesy of M. M. Swan/ManyBirds]; cropped and adjusted slightly for contrast and brightness using Photoshop; note also the brighter translucent white at the base of the outer primary feathers, contrasting with the duller white underwing coverts and matching frame 300 shown in Fig. 3C.

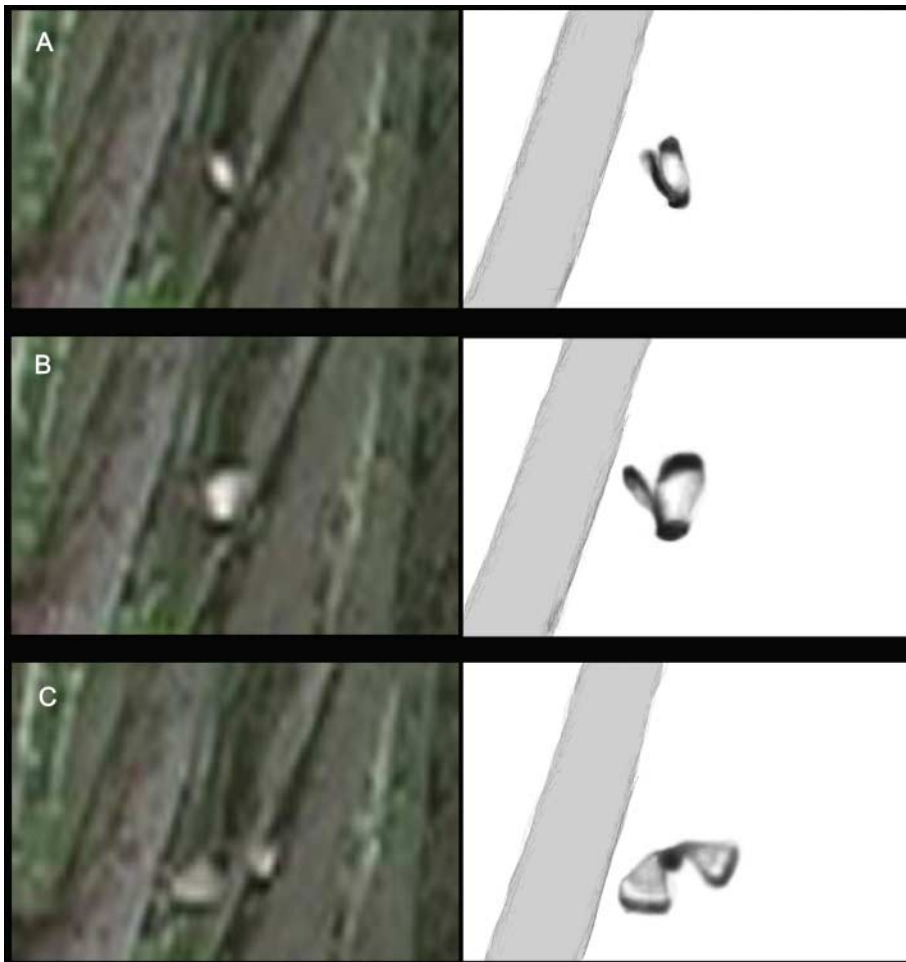


video frames (with interpretive sketches) in which white can be seen on both wings and two photographs of pileated woodpeckers for comparison (video frames and sketches reproduced in our Fig. 2). Those sketches and the comparison pictures of pileated woodpeckers, however, are incongruent with the bird's posture in the selected frames (SOM text), as shown by the entire sequence of frames (fig. S2). In our analysis of the bird's posture, the white on the wings can be accounted for by the ventral surface; in addition, due to blurring, the video frames probably show more white than was actually present on the bird (SOM text). Throughout the bird's flight, it is seen in a rear view. Extensive white is visible only on the downstroke, during which the leading edge of the wings angles down to propel the bird forward and the rear of the wings twist up. Consequently, during the downstroke the ventral surface of both wings should be visible (Fig. 2, E and F) and the dorsal surface largely hidden. Pileated and ivory-billed woodpeckers

both show extensive white on the ventral surface of the wings, and the presence of white is not diagnostic. In contrast, during the quick upstroke when the dorsal surface of the wings is most likely to be visible, the wings appear mostly dark (e.g., frames 216.7 and 333.3) (fig. S2); the entirely white secondary feathers of an ivory-billed woodpecker should be obvious throughout the wingbeat cycle. The observed pattern of little white on the upstroke followed by a large flash of white on the downstroke is expected for a pileated woodpecker.

Most important, three additional features of the wing pattern in flight match a typical pileated woodpecker but not a normal ivory-billed woodpecker: (i) Several frames of the bird apparently show a black trailing edge to the wings. In particular, frame 350 (Fig. 3A) shows a solid black patch on the left wing, and frame 383.3 (fig. S2) shows no white on the left wing. In both cases, one would expect the entirely white secondary feathers of an ivory-billed woodpecker to be obvious on both wings.

We maintain that the lack of an obvious black trailing edge in most video frames does not rule out an identification of pileated woodpecker (see SOM). (ii) Several frames (e.g., 266.7 and 366.7) (Fig. 3B) reveal a black band that curves around the wingtip and back along the wing's trailing edge. On an ivory-billed woodpecker, only the outer six primary feathers are black to their tips, creating a relatively small black patch on the wingtip that ends abruptly where it meets the outermost extent of the white trailing edge and does not curve back along the wing; in contrast, this curved appearance is typical of the black wingtip of a pileated woodpecker. (iii) Various frames (e.g., 300, 416.7, 533.3, and 650) (Fig. 3C) show a brighter white area on the outer wing that contrasts with the black wingtips and the duller, shaded, white closer to the body. This matches the translucent white patch at the base of the primary feathers of a pileated woodpecker. An ivory-billed woodpecker would be expected to show bright white along the entire length of the wing.



**Fig. 3.** Video frames on left, with interpretive sketches by D. Sibley on the right. **(A)** Frame 350 showing extensive black on the secondary feathers along the trailing edge of the elevated left wing. **(B)** Frame 366.7 showing the ventral surface of the wing and a broad black band curving across the wingtip and down toward the trailing edge of the wing. **(C)** Frame 300 showing both wings moving down rapidly, near the bottom of the downstroke, with the brightest white visible on the outer wing just inside the black wingtips (compare also Fig. 2F). All three features are typical of a pileated woodpecker, and all are inconsistent with the expected appearance of an ivory-billed woodpecker.

**White plumage on dorsum.** The video frame shown in Fig. 2C also shows a vague pale blur in the region of the bird's back that was used as evidence for the presence of dorsal longitudinal white stripes. Contrary to the sketch in Fig. 2C (*J*), however, the bird is flying almost directly away and little of its back is visible. This pale area occupies only a few pixels in the original video frames and is only apparent in a few frames. The image quality does not allow resolution of the striped pattern diagnostic of an ivory-billed woodpecker, and other possible sources of this pale blur include the pale head markings of a pileated woodpecker, light reflecting off the bird's back, or video processing artifacts.

**Black-white-black pattern.** In the video, a black-white-black pattern is present 26 to 21 s

before the flying bird appears. The source of this pattern was neither seen when the video was made nor found when the site was revisited but was interpreted as “a large, perched woodpecker” (*J*). It is not clear that the object is a bird or that it was actually on the tree trunk, rather than between the tree and the camera. Most disconcertingly, similar patterns are visible elsewhere in the video (see SOM). One appears to be a cluster of emerging leaves (frames 0455 to 0520), two are visible shortly after the bird has flown away (fig. S1), and none show diagnostic features of an ivory-billed woodpecker.

Two additional features—wingspan and flight pattern (fast wingbeats, direct flight)—were proposed as features suggesting that the bird is an ivory-billed woodpecker (*J*). We agree

that “we lack sufficiently comparable data for objective comparison” (*J*) of these features (see SOM text).

With our new understanding of the bird's movements, all observed features are consistent with a typical pileated woodpecker and some are inconsistent with a normal ivory-billed woodpecker. We conclude that one cannot reject the hypothesis that the bird is a normal pileated woodpecker (i.e., the null expectation); moreover, the evidence firmly supports this hypothesis. Ivory-billed woodpeckers may persist in the southern United States, and we believe that conservation efforts on their behalf should continue. Verifiable evidence for the ivory-billed woodpecker's persistence, however, is lacking.

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12. We are extremely grateful to J. Fitzpatrick, M. Dantzker, K. Bostwick, R. Charif, M. Lammertink, R. Rohrbaugh, and K. Rosenberg at Cornell University's Laboratory of Ornithology for providing access to video frames described in the original paper and discussions on this topic. We thank everyone who has discussed the topic with us; especially insightful comments came from B. Benz, S. Cardiff, D. Dittmann, R. Erickson, G. Graves, S. Howell, J. Jackson, K. Kaufmann, D. Lane, C. Marantz, R. Prum, P. Pyle, M. Robbins, J. Rowlett, M. Rubega, B. Whitney, C. Witt, and four anonymous peer reviewers. We gratefully acknowledge the use of the following collections: Academy of Natural Sciences of Philadelphia (N. Rice), American Museum of Natural History (P. Sweet), Louisiana State University Museum of Natural Science (J. V. Remsen Jr., S. W. Cardiff, D. L. Dittmann), Museum of Comparative Zoology at Harvard University (A. Pirie, J. Trimble), and Western Foundation of Vertebrate Zoology (WVZ) (R. Corrado). We thank L. Ballard and D. Compton for photographing the specimen at WVZ and M. M. Swan/ManyBirds for use of the pileated woodpecker video frame.

#### Supporting Online Material

[www.sciencemag.org/cgi/content/full/311/5767/1555a/DC1](http://www.sciencemag.org/cgi/content/full/311/5767/1555a/DC1)  
Materials and Methods  
SOM Text  
Figs. S1 and S2  
References

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