

FIRST RECORD OF APPARENT HYBRIDIZATION BETWEEN THE YELLOW-BILLED AND BLACK-BILLED MAGPIES

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ABSTRACT: The Yellow-billed Magpie (*Pica nuttalli*) and Black-billed Magpie (*P. hudsonia*) are closely related, but their ranges are allopatric. Both species are nonmigratory and highly sedentary, with few extralimital records. In April 2023, a Black-billed Magpie was discovered in Redding, Shasta County, California, in an area occupied by Yellow-billed Magpies. The Black-billed Magpie occurred regularly with a Yellow-billed Magpie at a bird-feeder, and subsequently two juvenile magpies with light pink and gray bills were seen together there. Because of the rarity of this bill coloration and the coincidence with a mixed-species pair, we conclude that the juveniles were the pair's hybrid offspring. A literature review and records search indicate that each species occurs in the other's range exceedingly rarely, and this appears to be the first record of presumed hybridization between the species.

Hybrid birds are of interest because their frequency, survival, and reproductive success can indicate relatedness of parental types (Short 1971, McCarthy 2006). They also can indicate changes in habitat and geographic ranges that may increase encounter rates and result in increased competition or genetic introgression (Hanna et al. 2018).

The Yellow-billed Magpie (*Pica nuttalli*) and Black-billed Magpie (*P. hudsonia*) are closely related (Lee et al. 2003, Song et al. 2018, Kryukov et al. 2024), and both occur in California, albeit allopatrically. The Yellow-billed Magpie is endemic to the lowlands of the Central Valley, lower portions of the surrounding foothills, and the central Coast Ranges of California (Beedy and Pandolfino 2013, Koenig et al. 2022). The widespread Black-billed Magpie, on the other hand, occupies the colder basins and mountains of western North America from Alaska south to northeastern Arizona and northern New Mexico and occurs in eastern California at medium elevations at the western edge of the Great Basin (Beedy and Pandolfino 2013, Trost 2020).

The two magpies occur in different parts of Shasta County, California (Figure 1), an area of range separation between many related taxa in the Great Basin and Central Valley (Cicero 1996, 2004, Cicero and Johnson 1998, Delaney et al. 2008). The Yellow-billed Magpie is locally common within the Sacramento Valley portion of the county, generally up to 150 m elevation (Beedy and Pandolfino 2013, <https://eBird.org>; Figure 1). The Black-billed Magpie occurs in small numbers in the eastern portion of the county only in the Fall River Mills area (at about 1000 m elevation). The species' ranges in this region are about 75 km apart and are separated by mountains and coniferous forest. The range separation in Shasta County is narrower than the extensive separation created by coniferous forest to the north and forest and alpine habitat at higher elevations of the Sierra Nevada to the south (Figure 1).

Both species are nonmigratory and are seldom found outside of their breeding ranges. Yellow-billed Magpies generally remain year round within 3.5 km of breeding areas (Linsdale 1937, Verbeek 1973, Koenig et al. 2022), whereas Black-billed Magpies move somewhat more (Linsdale 1937, Trost 2020), with individuals found sparingly out of range in coastal northern California, the San Francisco Bay Area, Sacramento Valley, and Death Valley region (McCaskie et al. 1979, Small 1994, Heindel and Heindel 2023, eBird.org). Some extralimital records along the northern

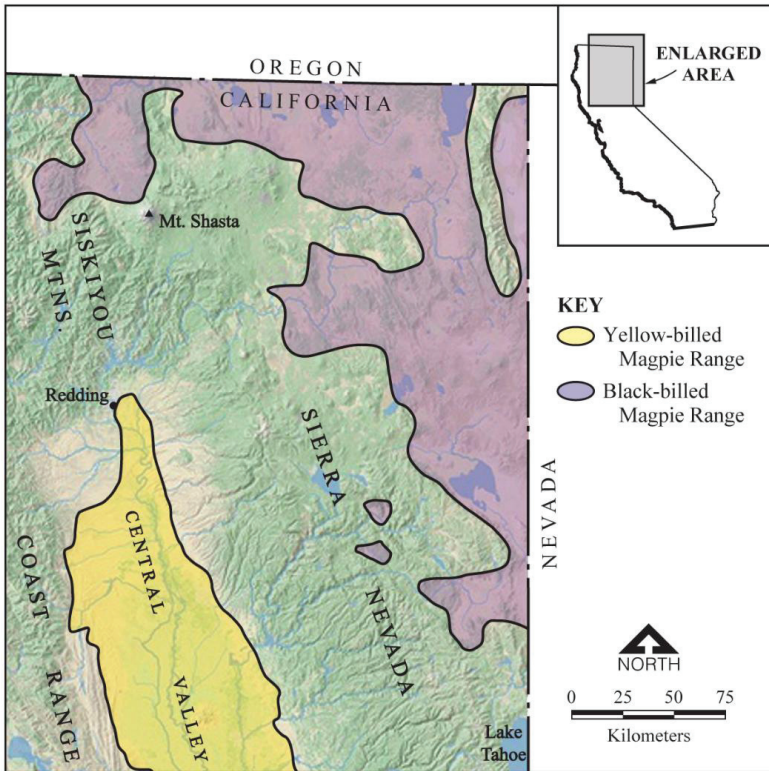


FIGURE 1. Geographic ranges of the Yellow-billed Magpie (yellow) and Black-billed Magpie (purple), in northern California near the location of the putative hybrid in Redding, California. Source: reports to eBird.org and vegetation interpretation from Google Earth.

California coast and in southern coastal California are believed to represent escaped captives (eBird.org).

The species' narrow range separation makes it surprising that hybridization has never been reported before, philopatry notwithstanding. No records of hybrids were reported in Linsdale's (1937) extensive treatment of both species, in either species' account in *Birds of the World* (Trost 2020, Koenig et al. 2022), a review of records of avian hybrids in eBird (Justyn et al. 2020), and in the compendiums of avian hybrids worldwide by McCarthy (2006) or Ottenburghs et al. (2015). Here we report apparent successful hybridization between the Yellow-billed and Black-billed magpies.

In April 2023, Yutzy was informed of a Black-billed Magpie accompanying Yellow-billed Magpies at a residential bird feeder in Redding, California, where Yellow-billed Magpies occur regularly. The Black-billed Magpie remained in the area for several months and was observed paired with a Yellow-billed Magpie. Later in the season, two fledglings there showed characteristics different from typical fledglings of each species, implying hybridization.

Observations were made at John Muegge's home in an older mixed residential

NOTES

and industrial neighborhood and the adjacent Nur Pon Open Space Park along the east bank of the Sacramento River at 170 m elevation (Figure 1). Woody vegetation consisted of tall gray pines (*Pinus sabiniana*), valley oaks (*Quercus lobata*), western sycamores (*Plantanus racemosa*), Fremont cottonwoods (*Populus fremontii*), and willows (*Salix* sp.) Suitable nearby herbaceous foraging habitat (Airola et al. 2021) consisted of annual grassland on vacant fields and lots, a school turf field, and a golf course.

On 9 April 2023, Muegge (pers. comm.) noticed that a magpie regularly accompanying one to five Yellow-billed Magpies at his feeders had an all-dark bill (Figure 2) and appeared larger than the Yellow-billed Magpies, matching the characteristics of an adult Black-billed Magpie. The group made near-daily visits for a few weeks, after which the Black-billed Magpie appeared only with a single adult Yellow-billed Magpie. The two birds then came together to Muegge's feeders until mid-May. The Black-billed Magpie was photographed at the feeders and at the Nur Pon Open Space during this period by Yutzy, Muegge, and several others (Figure 2).

On 7 June, Yutzy saw the adult Black-billed Magpie within a few feet of a Yellow-billed Magpie at the top of a large western sycamore at the Nur Pon Open Space. The Yellow-billed Magpie fed another magpie, presumably a fledgling. Although its age was not identified with certainty the date is within the Yellow-billed Magpie's typical fledgling period (Koenig et al. 2022). The Black-billed Magpie was not seen feeding the other bird, but its proximity suggested that it could be the mate of the Yellow-billed Magpie and thus the fledgling's other parent.

Subsequently, through the end of June, the Black-billed Magpie came alone to the feeders, although Yellow-billed Magpies continued coming there at other times. The Black-billed Magpie was observed many times during this period. From the end of June until 16 July, the bird visited sporadically and was not seen thereafter in 2023 or 2024 when Muegge observed the feeders nearly daily and Yutzy searched for the birds regularly. Subsequently throughout the summer of 2023 about 18 juvenile Yellow-billed Magpies, identified by their shorter tails and bolder yellow facial markings, frequented the feeders.

On 23 July 2023, Muegge observed one juvenile magpie with a light pink bill with light- to dark-gray blotching near the tip (Figure 3). A few days later he saw two



FIGURE 2. Adult Black-billed Magpie, the presumed parent of the hybrid young, at backyard feeder in Redding, California, 10 June 2023.

Photo by Bob Yutzy



FIGURE 3. Presumed juvenile hybrid Yellow-billed Magpie \times Black-billed Magpie in Redding, California, 16 August 2023.

Photo by Bob Yutzzy

magpies with bills patterned similarly in pink and gray. The bill coloration of these young differed from the pure yellow of the other juvenile Yellow-billed Magpies that accompanied them. The two pink-and-gray-billed birds were frequently seen and photographed together through the last week in August (Figure 3). The bills of both birds were identical and remained the same over this period. The mostly light pink color of the bill and exposed facial skin of the hybrid young (Figure 3) differed from that of either parental species and from pigment-related abnormalities reported for these species by Linsdale (1937) and van Grouw (2021). Although hybrids usually exhibit either the traits of one parent or intermediate traits (McCarthy 2006), novel coloration in hybrids is reported regularly (e.g., Gholamhosseini et al. 2023).

Yellow-billed Magpie pairs typically fledge two young (Airola et al. 2021, Koenig et al. 2022). Although the bills of both magpie species are pink at hatching, by fledging they turn completely yellow in the Yellow-billed Magpie and mostly black in the Black-billed Magpie (Trost 2020, Koenig et al. 2022). Although Koenig et al. (2022) noted that some Yellow-billed Magpies have slight black at the very tip of the bill, this condition is apparently rare, as Airola has not observed it among hundreds of birds examined in the field, and it appears in only a few photos in Koenig et al. (2022).

We infer the two pink-and-gray-billed juveniles to be hybrid offspring for several reasons. First, the Black-billed Magpie regularly associated with a Yellow-billed Magpie during the breeding season. Also, the two juveniles with the uncharacteristic pink and gray bill color were in the same area where the adult Black-billed Magpie spent the breeding season. Finally, no such bill coloration has been previously reported within populations of either the Yellow-billed or Black-billed Magpie. For example, Airola observed at least several hundred juveniles and over 500 adults during studies of the Yellow-billed Magpie in the Sacramento region 2020–2024 (Airola et al. 2021, Airola 2023, unpubl. data) and never encountered a white- or pink-and-gray-billed bird among them.

The adult Black-billed Magpie's disappearance from Redding after 16 July 2023

NOTES

coincided with daily maximum temperatures over three days exceeding 43 °C, consistent with lab studies in which Black-billed Magpies died when ambient temperatures reached 40 °C (Hayworth and Weathers 1984). The daily high temperature in July averages 37 °C in Redding but only 32 °C at Fall River Mills, within the Black-billed Magpie’s typical range (<https://www.weatherworld.com/climate-averages/ca>). Thus the apparent fate of the Black-billed Magpie in Redding is consistent with high temperature functioning as a barrier to the species’ occurrence or persistence in the warmer Central Valley (Hayworth and Weathers 1984, Kryukov et al. 2024).

We searched for extralimital records of each species within the other’s range and reports of hybridization in historical bird observations from the Central Valley (Engilis 2013), museum specimens (<http://portal.vertnet.org/>), eBird.org and a compilation of eBird reports (Justyn et al. 2020), birders’ listservs, literature on the two species (Linsdale 1937, Trost 2020, and Koenig et al. 2022), and compendiums of avian hybrids worldwide (McCarthy 2006, Ottenburghs et al. 2015). We found only a few reports of each species occurring in each other’s range (Table 1). Four Yellow-billed Magpie reports, all since 1989, were within two areas in the westernmost portion of the Black-billed’s range in Shasta and Plumas counties (Table 1). We found only five Black-billed Magpie records, other than ours in Redding, within the range of the Yellow-billed Magpie; all were since 1957 within the Central Valley, scattered from Madera to Yuba County. We found no record or report of a Yellow-billed × Black-billed Magpie hybrid. The rarity of occurrence of each species within

TABLE 1 Extralimital Records of the Black-billed and Yellow-billed Magpies within the Other Species’ Range

Species and dates	Location, county, elevation	Notes	Observer
Yellow-billed Magpie			
16 Dec 1989	Fall River Valley, Shasta Co., 1015 m	One with no other magpies	B. and C. Yutzzy
12 Jun–10 Nov 2007	Indian Valley, Plumas Co., 450 m	1 with 10 Black-billed Magpies	C. Dillingham
27 Oct 2018	Fall River Mills, Shasta Co., 1014 m	No Black-billed Magpies in area	L. Jordan
20 Sep 2021	Fall River Mills	No Black-billed Magpies in area	L. Leslie
Black-billed Magpie			
22 Mar 1957	Elkhorn, Yolo Co., 25 m	2 birds	Kimball records ^a
6 Dec 1959	Thorton, Sacramento Co., 21 m.	2 birds	Kimball records ^a
14 Aug and 19 Sep 1971	Courtland, Sacramento Co., 20 m	2 birds	Kimball records ^a
17 Apr 1979	Raymond, Madera Co., 300 m	1 with Yellow-billed Magpies	fide A. Engilis
30 Dec 2015	Earl Rd., Olivehurst, Yuba Co., 20 m	1 with Yellow-billed Magpie	I. Gledhill
9 Apr–29 Aug 2023	Redding, Shasta Co., 170 m	Paired with Yellow-billed Magpie; 2 hybrid young seen subsequently	This study

^aSacramento Audubon Society records for 1950–1983 compiled by Betty Kimball (Engilis 2013), in the Museum of Wildlife and Fish Biology, University of California, Davis.

NOTES

the other's range and lack of previous records of hybridization, despite the apparent ability to do so successfully, appears to result from the separation of the species' geographic ranges (Figure 1), their high degree of philopatry, and low survival rates outside their ranges.

We found no recent changes in the breeding ranges or abundance of either the Yellow-billed or Black-billed magpie that would foster increased contact, and thus this case of hybridization. Contrarily, the arrival of West Nile virus to California in the early to mid-2000s has reduced populations of both species (Airola et al. 2007, Pandolfino 2017, 2020, Taylor and Trost 2021), which presumably reduces the potential for extralimital movements into one another's ranges.

Mitochondrial DNA studies imply that the Yellow-billed Magpie split from the more widespread, ancestral Black-billed Magpie (Lee et al. 2003, Song et al. 2018, Kryukov et al. 2024). The Yellow-billed Magpie has diverged in morphology (yellow bill and skin around eyes, smaller size), vocalizations, behavior (greater coloniality during nesting), and greater tolerance of heat (Hayworth and Weathers 1984, Kryukov et al. 2024). The apparent hybridization in Redding supports the inference of a close phylogenetic relationship between the species (Lee et al. 2003, Song et al. 2018, Kryukov et al. 2024).

Our results showing strong range separation and only a single reported hybridization do not support the suggestion by Lee et al. (2003) that the two taxa, as well as Eurasian forms of *Pica*, be treated as subspecies of *Pica pica*, rather than full species. Nor do they support McCarthy's (2006) inference that the two species interbreed extensively, on the basis of similarities in size and physical characteristics where their ranges are closest together. Rather, it appears more likely that the similarities indicate adaptations to a more similar warmer climate in areas of the species' ranges where they are in closer proximity. Although our observations show that the Yellow-billed and Black-billed Magpies can hybridize and that their offspring are viable, at least through fledging, review of species' distributions, extralimital movements, and lack of any known previous hybrids indicate that the two species are almost entirely reproductively isolated by the gap in their geographic ranges and their sedentary behavior.

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