

Common Ravens Prey on Cliff Swallow Nestlings in the Central Valley, California

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The Common Raven (*Corvus corax*) is a wide-ranging species that forages on a large variety of food items (Harlow et al. 1975, Ryser 1985, Marquiss and Booth 1986, Stiehl and Trautwein 1991, Avery et al. 1995). Its foraging behaviors include predation, scavenging, kleptoparasitism, simple search and collection, and other methods (Olson 1989, Nogales et al. 1999, Marzluff and Heinrich 1991, Simes et al. 2017). Predatory behavior in ravens has been well documented, and feeding on nestlings has been studied by many authors (e.g., Klicka and Winker 1991, Brambilla et al. 2004, Kelly et al. 2005, Coates and Delehanty 2010, Schauer and Murphy 1996). Ravens are also known to use cooperative behavior to facilitate predation on colonial nesting birds (Parmelee and Parmelee 1988). Plasticity in raven behavior has been documented (Neatherlin and Marzluff 2004, Marzluff and Neatherlin 2006) as has the positive impact it has had on the species success and distribution (Marzluff et al. 1994). This observed behavioral plasticity related to feeding is believed to have benefited Common Raven abundance and distribution (Luginbuhl et al. 2001).

Although the Common Raven has occupied the interior Coast Range in California for a long period, it has recently increased its breeding range to include many previously unoccupied areas in the foothills and on the floor of the Central Valley (Pandolfino et al. 2021). It also is associated with highways, due to its frequent use of road-killed carrion (Harju et al. 2018).

I observed Common Ravens exploiting a seasonal abundant resource associated with highway bridges. This previously unreported raven foraging behavior including presumed problem solving and possible cooperative behavior of two adult ravens preying upon Cliff Swallow (*Petrochelidon pyrrhonota*) nestlings.

I conducted wildlife surveys and nesting bird monitoring along 260 km of levee roads on the Delta-Mendota Canal, along the west side of the Central Valley of central California during summer of 2021. These surveys involved determining if proposed construction activities might impact sensitive species or nesting birds protected by the Migratory Bird Treaty Act. Approximately 100 bridges cross the canal through the section of the Delta Mendota Canal, between the towns of Tracy and Mendota, with nearly every bridge

supporting nesting birds (pers. obs.). Near Vernalis, San Joaquin County, the canal is crossed by the intersection of State Highway 132 and Interstate 5. Four adjacent bridges span the canal with steel girders supporting the concrete highway decking. The lower portions of these bridges span the waterway approximately 10 m above the water and support several hundred Cliff Swallow nests annually.

On 20 May 2021, at approximately 0945 hrs., upon my approach to the four adjacent bridges, I noted a pair of ravens grasping two separate, adjacent Cliff Swallow nests and flapping their wings as they hung from their feet with their backs parallel to the water on the northbound Interstate 5 bridge. One of the two ravens reached with its bill into the opening of the nest and appeared to probe unsuccessfully, while the second raven, about one meter away and also hanging from nests by its feet, watched closely. The first raven, after unsuccessfully probing, immediately made 2–3 bill thrusts at the outside of the mud nest approximately at the point where the smaller entrance-tube expanded to the larger nesting chamber. The entrance-tube portion of the nest cracked and crumbled away, landing in the water. A single Cliff Swallow chick simultaneously fell or leapt from the nest, falling toward the water below. At the same time the second raven, which was watching the first, released itself from the nest it was grasping and flew down toward the falling chick, grabbing the chick with its bill just above the water surface and then flew to a nearby telephone pole. The first raven flew to the same pole, retrieved the chick and made 3–4 bill thrusts at the chick, presumably killing it, and consumed the entire chick.

Both ravens then flew back to the Cliff Swallow colony, flying back and forth, paralleling the bridge, several times. One raven rolled abruptly and grasped a Cliff Swallow nest and repeated the probing and subsequent bill thrusting until the second nest entrance-tube collapsed. The raven then reached into the open nest and pulled a chick from the nest and flew to the same telephone pole where it again made several bill thrusts, and then fed on the chick. The second raven, while making low croaking calls, flew in small circles over the feeding raven, while both were mobbed by hundreds of Cliff Swallows.

After completing the second feeding, both ravens flew through the nest colony and were pursued and harassed by Cliff Swallows. The ravens then left the area and flew to an adjacent orchard where they perched at the top of a single tree and preened.

I scanned the Cliff Swallow nest colony and noted that many other broken nests at this site similar to the recently broken nests. I estimated that a total of 300 nests were present, and 30-40% of them looked similar, in that the entrance-tube was broken and missing and no sign of Cliff Swallow nest repair was evident (presumably indicating nest abandonment).

Predators that have been reported feeding on Cliff Swallows in California include American Kestrels (*Falco sparverius*), Acorn Woodpeckers (*Melanerpes formicivorus*), Loggerhead Shrikes (*Lanius ludovicianus*), and ants (Bent 1942, Wilkinson and English-Loeb 1982, Fajer et al. 1987). Gopher snakes (*Pituophis catenifer*) have also been frequently observed raiding nests of Cliff Swallows (pers obs.). Red-headed woodpeckers (*Melanerpes erythrocephalus*) have been reported to drill holes in the side of Cliff Swallow nests to remove eggs (Jones 1883); however, no other species has been reported to use this technique. Common Ravens were reported hanging from Cliff Swallow nests in San Luis Obispo County, California, but were not observed breaking nests or feeding on eggs or young (N.J. Schmitt, pers. comm; <https://www.allaboutbirds.org/news/naturalists-notebook-common-raven-raids-cliff-nests/>).

Based on the observations I report here, it appears that these Common Ravens have learned how to retrieve Cliff Swallow nestlings by breaking off the portion of the mud nest that deters predation by most other species. This incident included observations of the same behavior that clearly appeared purposeful and repeated. It also appeared that the second raven, during the first effort, anticipated the result, and thereby was able to successfully retrieve a falling chick before it hit the water below.

Common Ravens have been widely reported to exhibit multi-step problem-solving abilities (Heinrich 1995, Hanks et al. 2009, Heinrich 2011, Miller et al. 2016). Heinrich (1995) suggested that (inferred) insight by ravens had to include a string of otherwise unrelated behaviors, that were repeated in the same order and produced the desired result, which he showed they exhibited in his study. The ability of a species to behave flexibly, in conjunction with explorative behaviors, has been reported as likely to result in innovative behaviors that may be highly adaptive (Benson-Amran and Holekamp (2012). This innovative behavior was clearly shown by a Common Raven that learned to operate a water faucet in Death Valley, California, in order to acquire water (Miller et al. 2016). Cooperative multi-step problem solving appears to be demonstrated in the behaviors I observed.

The Cliff Swallow is a widespread and abundant species associated with highway bridges (Sejkora et al. 2011). My observations, in conjunction with the high number of nests that appeared to be broken in a similar fashion, suggests that these ravens learned a novel behavior that allows them to access a valuable and seasonally abundant resource. Given the proportion of nests apparently destroyed at this site, it is possible that a widespread adoption of this behavior could affect the abundance of Cliff Swallow populations in this area.

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