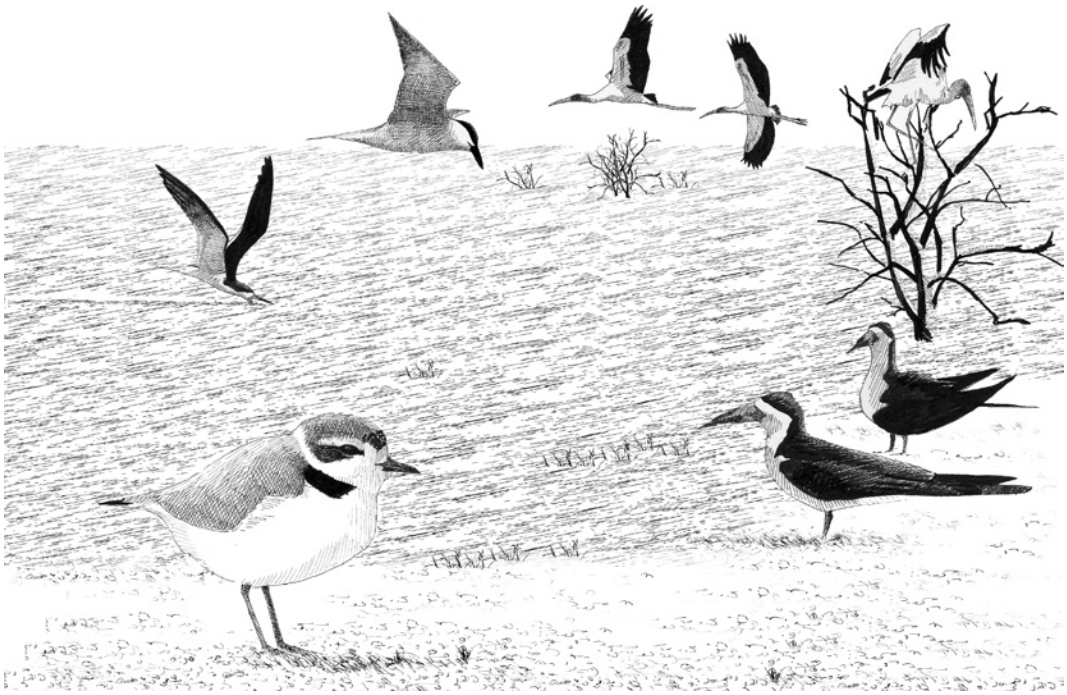
II

Species Accounts



Andy Birch

PDF of Sonora Yellow Warbler account from:

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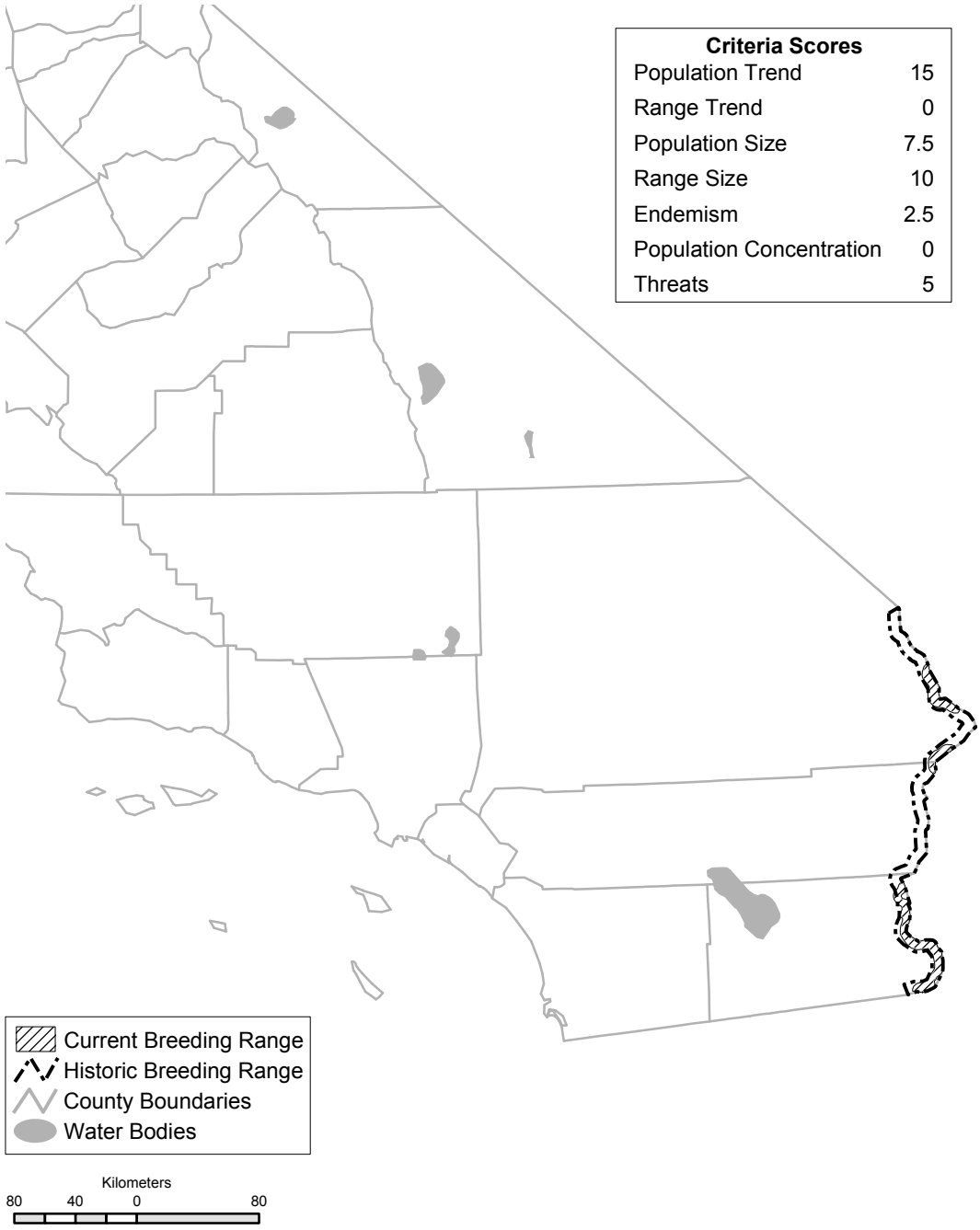
SONORA YELLOW WARBLER (*Dendroica petechia sonorana*)

Sacha K. Heath



Current and historic (ca. 1944) breeding range of the Sonora Yellow Warbler in California, where restricted to the lower Colorado River valley. Numbers declined greatly in the latter half of the 20th century. It is unclear, however, if this subspecies was extirpated by the 1960s or 1970s then recovered, or if substantial numbers remained locally and were simply detected by more thorough recent surveys.

Special Concern Priority

Currently considered a Bird Species of Special Concern (breeding), priority 2. Not included on prior special concern lists (Remsen 1978, CDFG 1992).

Breeding Bird Survey Statistics for California

Data inadequate for trend assessment (Sauer et al. 2005).

General Range and Abundance

As discussed more fully in the Yellow Warbler (*Dendroica petechia*) account (see above), this species breeds widely in the New World and comprises three subspecies groups, only one of which occurs in California. Of three breeding subspecies ascribed to California, *brewsteri* is best considered synonymous with *morcomi*; regardless, these occupy the bulk of the species' breeding range in the state. *D. p. sonorana*, the Sonora Yellow Warbler of this account, breeds only along the lower Colorado River in California, and from southern Arizona and southwest New Mexico to north-central Mexico and possibly the Colorado River Delta (Browning 1994, McKernan and Braden 2002, O. Hinojosa in litt.).

Seasonal Status in California

Arrives to breed on the lower Colorado River in early April and nests mainly from mid-May through July (Rosenberg et al. 1991) and rarely to late August (R. McKernan unpubl. data).

Historic Range and Abundance in California

Formerly an "abundant" breeder along the entire California side of the lower Colorado River valley below 600 ft (183 m; Grinnell and Miller 1944). In 1914, an estimated one to four males occurred in every 0.40 ha of willow and cottonwood habitat along the river (Grinnell 1914). Given the great expanse of willow-cottonwood habitats at the end of the 19th century, Rosenberg et al. (1991) speculated that the total size of the Yellow Warbler population in the lower Colorado River valley was "enormous" at that time.

Recent Range and Abundance in California

Despite population changes and local extirpations, the overall range of the Sonora Yellow Warbler today has changed little since 1944 (see map). By all known accounts, *sonorana* populations have fluctuated since their period of high abundance in the early 20th century. Reports of total extirpation along the lower Colorado (e.g., Small 1994) may have reflected localized extirpations rather than river-wide losses (R. McKernan in litt.). Comparing two extensive surveys of the lower Colorado River with Grinnell's (1914; see above) work provides evidence of a drastic population decrease beginning in the late 1950s (Rosenberg et al. 1991) followed by a recent potential increase (McKernan and Braden 2002). Regardless, the extent of riparian vegetation of suitable structure along the lower Colorado River is a small fraction of what it was prior to the 20th century (Rosenberg et al. 1991), and hence *sonorana* numbers likely remain far below historic levels.

By 1936, Hoover Dam had harnessed the Colorado's natural flood regime, completely altering the life-history cycle of cottonwoods and willows and inundating thousands of hectares of riparian habitat (Rosenberg et al. 1991). Rosenberg et al. (1991) reported that the Yellow Warbler bred "commonly" in 1952 but after 1955 had disappeared from historic nesting sites on the Arizona side of the river at the Bill Williams River delta and Topock. In the late 1970s and early 1980s, singing males were reported sporadically along the California side, and in 1986 one female was observed feeding a juvenile near Blythe (Garrett and Dunn 1981, Rosenberg et al. 1991). Rosenberg et al. (1991) suggested that the decline of these warblers along the lower Colorado likely reflected the massive loss of suitable willow-cottonwood habitat followed by breeding failures in replacement habitats and cowbird pressure in remaining suitable habitat (but see discussion below).

Between 1996 and 2002, the San Bernardino County Museum (SBCM) conducted focused surveys and a life history study for the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) in both native and non-native habitats of the lower Colorado River between Separation Canyon, Arizona, downstream to Gadsden Bend near Summerton, Arizona (McKernan and Braden 2002). Through this extensive effort, SBCM documented that breeding Yellow Warblers were broadly distributed and occurred in locally high relative abundance (McKernan and Braden 2002). SBCM determined the nesting subspecies as *sonorana* on the basis of phenotypical characters observed visually in the field and in the hand (R. McKernan in litt.). Yellow Warbler nests were in

both native and non-native habitats along the entire reach from Lake Mead to the Mexican border, and nesting was documented at more than 60 locations, more than half of these on the California side of the river (McKernan and Braden 2002, R. McKernan in litt.).

Given the extent that *sonorana* populations are currently using tamarisk (*Tamarix* spp.) as nesting substrate (see below), it is likely that current population numbers are supported by the warbler's ability to exploit this non-native tree. Introduction of tamarisk to the lower Colorado River in the 1920s further changed the native riparian plant community already devastated by extensive hydrological alteration (see above). As a result of these two factors, an estimated 160,000 to 180,000 ha of native riparian vegetation in 1894 (Mearns 1907) was reduced to roughly 25% (approx. 40,000 ha) of its former extent by 1986 (Anderson and Ohmart 1984, Younker and Anderson 1986). The remaining 1986 acreage was made up primarily of pure and native-mixed tamarisk stands (Ohmart et al. 1988). It is possible that the most marked decreases in *sonorana* occurred during and just after major riparian vegetation losses, but prior to the establishment of tamarisk and *sonorana*'s ability to exploit it.

Ecological Requirements

The Sonora Yellow Warbler formerly bred in the willow and cottonwood habitats that lined the Colorado River (Rosenberg et al. 1991). Yellow Warblers placed their nests in decadent willow stands and revegetated cottonwoods at Lake Havasu, Arizona (Lynn and Averill 1996). From 1996 to 2002, over 75% of 100+ sonorana nests found downstream of Davis Dam on the lower Colorado River were in tamarisk (R. McKernan in litt.). A preliminary analysis of nest microhabitat characteristics in relation to nesting success found no significant effects of tamarisk on the fate or productivity of *sonorana* nests (K. Ferree unpubl. data, summarized in McKernan and Braden 2002).

Brown (1903) reported that in the early 20th century *sonorana* countered Brown-headed Cowbird (*Molothrus ater*) parasitism by burying cowbird eggs. In California, Yellow Warblers will attempt several nests throughout the season but typically produce only one brood (very rarely two) per year (PRBO unpubl. data). However, basic life history traits of *sonorana*, such as number of nesting attempts and extent of double brooding, are unreported.

Likewise, there are no specific studies of the diet of *sonorana*. The Yellow Warbler is a generalist species that appears to adapt its foraging to variation in local vegetation structure (Petit et al. 1990). The overall Yellow Warbler diet in California contained over 97% animal matter, including ants, bees, wasps, caterpillars, beetles, true bugs, flies, and spiders (Beal 1907).

Although unknown for *sonorana*, Yellow Warblers have shown a high degree of site fidelity. Two studies found that 60%–64% of males and 32%–44% of females returned to their previous year's breeding grounds; 73% of males returned to the same territory (Studd and Robertson 1989, Knopf and Sedgwick 1992).

Adult or juvenile survivorship rates for California populations of *sonorana* have not been reported. The annual apparent adult survival probability for Yellow Warblers was estimated at 48% and 57% in the southwest and northwest regions of the United States, respectively (IBP 2005).

Threats

The halting of annual flooding, agricultural and urban development within historic floodplains, tamarisk invasions, and the death of much of the remaining riparian vegetation from excessive flood-control releases from dams have changed the structure, plant species composition, and function of the lower Colorado River's riparian system. As noted above, Rosenberg et al. (1991) suggested that the resulting major losses of willow-cottonwood riparian on the river were the initial and primary cause of Yellow Warbler declines.

Restoration efforts and management activities aimed at benefiting endangered species (e.g., Southwestern Willow Flycatcher) along the lower Colorado River (USDI 2004) will likely benefit *sonorana,* as Yellow Warblers are quick to respond to habitat recovery (e.g., Taylor and Littlefield 1986, Kreuper et al. 2003). Although beneficial, restoration efforts seek to replace only some of what has been lost, and floodplain developments and upstream dams will continue to alter the dynamic historic function of the river system. Additionally, human population growth coupled with the uncertainty of future demand for Colorado River water, which seems likely only to increase, pose a threat to future habitat recovery and, in turn, the bird populations that depend on it.

Rosenberg et al. (1991) speculated that Yellow Warblers nesting in replacement habitats of

Screwbean Mesquite (*Prosopis pubescens*) and tamarisk may have experienced higher rates of breeding failure than those nesting in native habitats, thereby causing further declines of the species. McKernan and Braden (2002), however, reported no significant effects of tamarisk on Yellow Warbler nest fates or productivity. They found that tamarisk habitats that appeared most suitable for *sonorana* were those patches that experience various amounts of seasonal flooding (McKernan and Braden 2002). Given that Yellow Warblers are currently nesting primarily in tamarisk, it is likely that this invasive plant provides the substrate characteristics and nest cover historically provided by shrub willow or other riparian shrubs. Even if further studies confirm tamarisk has no direct effect on these warblers, the effects of tamarisk on riparian ecological function (e.g., water table depth, native plant regeneration) may indirectly affect Yellow Warblers by limiting vegetative and structural diversity, riparian width, or foraging options, or by altering predator populations. Yet these indirect factors remain unexamined for *sonorana*.

Cowbird parasitism poses a limited to moderate threat to Yellow Warblers (see species account above). However, as the current impact of cowbird parasitism remains unreported for *sonorana*, it is difficult to assess the relative intensity of this threat for this subspecies. Rosenberg et al. (1991) reported that *sonorana* remained "abundant" during the early 20th century, despite a high frequency of cowbird parasitism, and that warbler declines thereafter were from the combined effects of habitat loss, riparian replacement by invasive or typically xeric plants, and parasitism. East of the Sierra Nevada crest, 49% of 836 *D. p. morcomi* nests were parasitized. Yellow Warbler young fledged from 36% of 412 parasitized nests, and predation accounted for 38% of nest loss in 412 parasitized nests. Demonstrating a somewhat different response, Yellow Warblers nesting in tamarisk at Amargosa Canyon, Inyo County, fledged from only 2 of 16 parasitized nests (of 23 nests total), and 8 of the parasitized nests were predated (PRBO unpubl. data). These data suggest that Yellow Warblers do fledge young from parasitized nests (though to varying degrees and fewer than in unparasitized nests) and predation limits productivity to a large degree. The preliminary data from Amargosa Canyon might suggest that parasitism poses a larger threat to less abundant Yellow Warbler populations occupying small and isolated habitat patches. It is unknown whether *sonorana* responds comparably, though antiparasite strategies reported in the early 20th century (Brown 1903) indicate that this subspecies may behave similarly to others.

Predation accounted for a majority of nest losses of Yellow Warblers in northern California (Cain et al. 2003, PRBO unpubl. data). McKernan and Braden (2002) listed 5 snake, 6 mammal, and 15 avian species as suspected or confirmed nest predators of Southwestern Willow Flycatchers on the lower Colorado River, where sympatric Yellow Warblers would be similarly vulnerable. The effects of predation on *sonorana* productivity and population viability are unreported.

Management and Research Recommendations

- Protect, manage, and restore dynamic riparian systems that provide the mechanisms (e.g., seasonal flooding) to create early successional as well as more structurally complex vegetative components (e.g., herbaceous cover, shrub cover, and riparian tree canopy).
- Focus management and restoration efforts primarily on identifying and maintaining source populations capable of producing young in excess of adult mortality.
- Any tamarisk removal efforts should be implemented over a temporal and spatial spectrum that will allow for continual availability of *sonorana* nest substrate over the transition from dominance of riparian by non-native to dominance by native plants.
- Determine Brown-headed Cowbird parasitism rates and impacts of parasitism on nest survivorship and fecundity.
- Initiate landscape-level studies on the ecology of nest predators and parasitism within various habitat types (e.g., riparian vs. tamarisk) to make clear the most effective management options for increasing reproductive output at a regional level.
- Investigate potential indirect impacts of tamarisk on Yellow Warbler population viability.

Monitoring Needs

Current monitoring programs (e.g., Breeding Bird Survey) are inadequate for monitoring Sonora Yellow Warblers. It would be valuable to build on the foundation established by McKernan and Braden (2002) by continuing to monitor Yellow Warbler abundance and occurrence in all occupied (and newly restored) habitats on the lower

Colorado River. In doing so, it would be prudent to coordinate California monitoring efforts with those in Arizona, Nevada, and the Colorado River Delta of Mexico, and to use protocols that allow concurrent data collection for multiple species (ideally, off-road point counts based on variable circular plots). Monitoring currently unoccupied sites would be valuable for tracking population expansion. Nest-monitoring programs (e.g., Martin et al. 1997) should be established at reference sites of high Yellow Warbler abundance to further address regional threats such as predation and parasitism. Nest monitoring should be accompanied by nest-site habitat assessments, allowing for the identification of habitat features that may ease predation or parasitism pressures. Brown-headed Cowbird control measures should always be preceded by baseline studies and accompanied by concurrent nest monitoring to determine the success of control efforts (see Smith 1999). Monitoring results should be provided to existing coordinated restoration efforts (e.g., USDI 2004) so restoration practices can be modified as new information becomes available (Elliott et al. 2003).

Acknowledgments

The current status of the Sonora Yellow Warbler in California is entirely drawn from the work of R. McKernan of the San Bernardino County Museum, whose contributions to this account were invaluable. The reviews of J. Sterling, T. Beedy, and J. Evens, and the editing prowess of W. D. Shuford, also greatly enhanced this account.

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