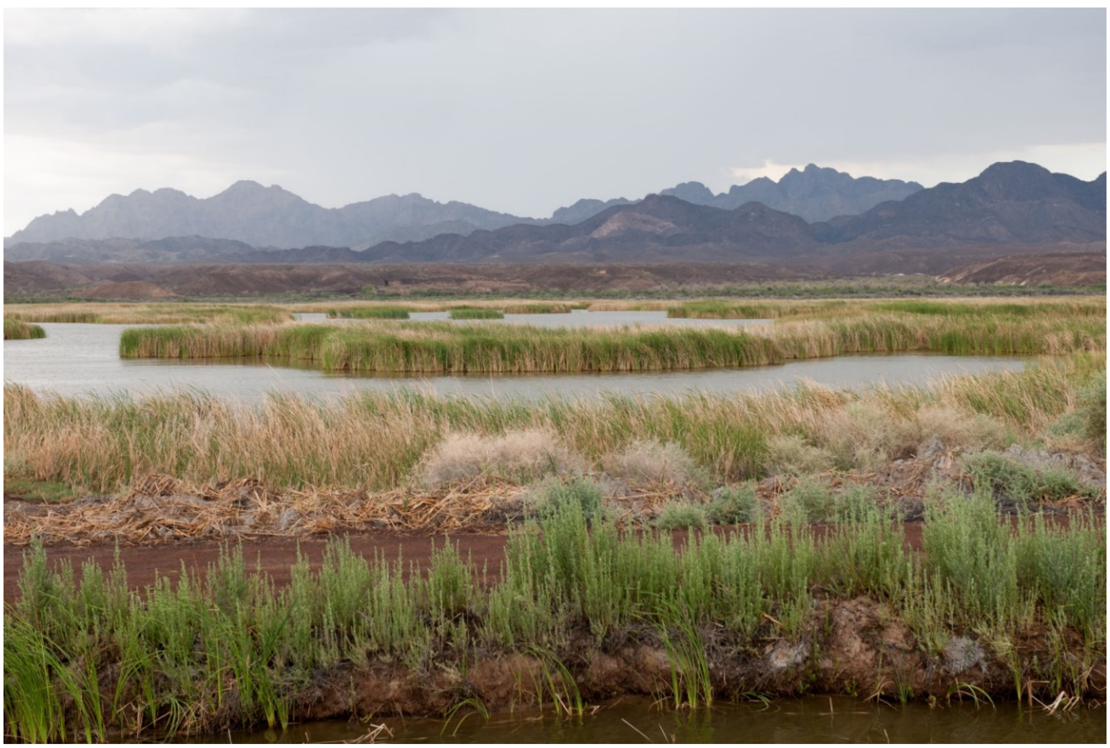
Lower Colorado River
Multi-Species Conservation Program

Balancing Resource Use and Conservation

California Black Rail Documented Use of Water Depths

2019



March 2019

Work conducted under LCR MSCP Work Task C66

Lower Colorado River Multi-Species Conservation Program
Steering Committee Members

Federal Participant Group

Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

Arizona Participant Group

Arizona Department of Water Resources
Arizona Electric Power Cooperative, Inc.
Arizona Game and Fish Department
Arizona Power Authority
Central Arizona Water Conservation District
Cibola Valley Irrigation and Drainage District
City of Bullhead City
City of Lake Havasu City
City of Mesa
City of Somerton
City of Yuma
Electrical District No. 3, Pinal County, Arizona
Golden Shores Water Conservation District
Mohave County Water Authority
Mohave Valley Irrigation and Drainage District
Mohave Water Conservation District
North Gila Valley Irrigation and Drainage District
Town of Fredonia
Town of Thatcher
Town of Wickenburg
Salt River Project Agricultural Improvement and Power District
Unit "B" Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma County Water Users' Association
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Other Interested Parties Participant Group

QuadState Local Governments Authority
Desert Wildlife Unlimited

California Participant Group

California Department of Fish and Wildlife
City of Needles
Coachella Valley Water District
Colorado River Board of California
Bard Water District
Imperial Irrigation District
Los Angeles Department of Water and Power
Palo Verde Irrigation District
San Diego County Water Authority
Southern California Edison Company
Southern California Public Power Authority
The Metropolitan Water District of Southern California

Nevada Participant Group

Colorado River Commission of Nevada
Nevada Department of Wildlife
Southern Nevada Water Authority
Colorado River Commission Power Users
Basic Water Company

Native American Participant Group

Hualapai Tribe
Colorado River Indian Tribes
Chemehuevi Indian Tribe

Conservation Participant Group

Ducks Unlimited
Lower Colorado River RC&D Area, Inc.
The Nature Conservancy

Lower Colorado River
Multi-Species Conservation Program

California Black Rail Documented Use of Water Depths

2019

Prepared by:

Chris Dodge, Wildlife Group

Lower Colorado River
Multi-Species Conservation Program
Bureau of Reclamation
Lower Colorado Region
Boulder City, Nevada
http://www.lcrmscp.gov

March 2019

Dodge, C. 2019. California Black Rail Documented Use of Water Depths, 2019. Lower Colorado River Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada.

Acronyms and Abbreviations

cm	centimeter(s)
HCP	Habitat Conservation Plan
in	inch(es)
LCR	lower Colorado River
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
m	meter(s)
n	sample size
SE	standard error

Symbols

>	greater than
<	less than
≤	less than or equal to
%	percent
±	plus or minus
$\bar{x}$	probability

CONTENTS

ABSTRACT

This report summarizes information on water depths at sites supporting populations of the California black rail (*Laterallus jamaicensis coturniculus*). A review of the published scientific literature for the California black rail was conducted, and data were analyzed from the Ciénaga de Santa Clara on the Mexican portion of the lower Colorado River. The data from the Ciénaga de Santa Clara did not have an adequate sample size for a reliable statistical analysis, but the results from the published literature did provide strong evidence to characterize how California black rails occupy areas with varying water depths.

There is some data characterizing water depths in areas occupied by California black rails on the lower Colorado River, but the more relevant data come from the larger populations of the species in the San Francisco Bay and in the Sierra Nevada foothills in Yuba County, California. California black rails utilize areas of shallow water, but can also use areas with varying water depths, such as tidally influenced wetlands. Optimal habitats created for California black rails should have gentle sloping landscapes that allow them to move into shallower areas as water levels vary.

INTRODUCTION

The California black rail (*Laterallus jamaicensis coturniculus*) is a subspecies of the black rail (*Laterallus jamaicensis*), the smallest rail in North America. The California black rail is found in California in tidal and freshwater wetlands along the coast, the Sierra Nevada foothills, the Sacramento Valley, the lower Imperial Valley, northwestern Baja California, and along the lower Colorado River (LCR). The California black rail is highly secretive and difficult to survey and detect. The species is almost never detected visually, and almost all detections come from auditory detections of vocalizations.

On the LCR this species is mainly found on the southern portion of the river at Mittry Lake near Yuma, Arizona, and in Mexico in the Ciénega de Santa Clara. Surveys for California black rails are conducted using the Standardized North American Marshbird Protocol (Conway 2011), both in Mexico and the United States, where the species is known to occur.

The Lower Colorado River Multi-Species Conservation Program (LCR MSCP) is tasked to create 512 acres of marsh habitat of which 130 acres are to be created to provide habitat for the California black rail (Habitat Conservation Plan 5.7.13.2 BLRA 1). The LCR MSCP Habitat Conservation Plan (HCP) states “Design of created habitat will be directed towards establishing moist-soil marshes that support a predominance of three-square bulrush with suitable water depths to replicate conditions present at Mittry Lake and Bill Williams Delta that support the species. Habitat will be designed, and managed to provide an integrated mosaic of patches of cattail, bulrush, and mudflat, interspersed with small patches of open water with varying water depths.” Furthermore, in Table 3-9 of the HCP habitat model for the California black rail, the Summary Habitat Description states that this species is “In the LCR MSCP planning area, typically associated with marsh edges with water less than 1 inch (in) deep…”

Based on the direction given in the HCP, the LCR MSCP currently manages marsh water levels to be as stable as possible during the California black rail breeding season in order to maintain areas at 1 in depths. This level was based on published information that indicated that, due to its small size, the California black rail only utilizes areas with shallow water (Flores and Eddleman 1995; Repking and Ohmart 1977). However, more information may be available to inform marsh habitat management from areas where the birds are found in tidally affected areas of the California coast. It is possible that they can adapt to spatially fluctuating water levels during the breeding season.

Work Task C66 was developed in order to look at existing information and to identify the range of acceptable water depths in California black rail and Yuma clapper rail (*Rallus longirostrus yumanensis*) breeding sites, which would inform future management and design of marsh habitat at LCR MSCP conservation areas. An initial analysis of the influence of water depth on Yuma clapper rail occupancy was completed (Dodge and Rudd 2017). This report summarizes information on water depths of California black rail habitat from the scientific literature and from other sources.

SUMMARY OF EXISTING RESEARCH

The California black rail was first documented at an inland location along the LCR and Salton Trough in 1969 (Snider 1969). One of the first studies to look at the California black rail on the LCR was conducted by Repking and Ohmart (1977). This was the first time a population of California black rails was systematically surveyed on the LCR. Surveys were conducted in 1973 and 1974 in both summer and winter. California black rails were surveyed using call-playback at several locations on the LCR, and the majority of the detections were at Mittry Lake. The researchers estimated the locations of the birds and placed those locations on maps of the areas surveyed. The researchers also estimated abundances based on the number of detections but did not take into account detection probability. The authors speculate that the necessary components for supporting black rail populations are stands of three-square bulrush (*Schoenoplectus americanus*), shallow water depths, gently sloping shorelines, and minimal water fluctuations. These components were described based on observations of the habitat conditions found at Mittry Lake, where birds were detected. The authors did not describe actual water depths nor did they determine the habitat components based on statistical analysis.

The second major research project to be conducted on the LCR for the California black rail was by Flores and Eddleman (1995) from March 1987 to December 1988 at Mittry Lake. The researchers captured 36 California black rails and attached radio transmitters to each bird. They tracked each bird's locations five times a week during the daylight hours and once a month during night hours. The researchers measured several habitat characteristics in areas of heavy use, including water depth, in four 0.25-square-meter plots at each location and compared areas of heavy use to areas of randomly selected available habitat. California black rails were detected in habitats that were drier, closer to upland vegetation, and those that had greater overhead coverage and stem density in greater proportion to randomly selected plots. Among the different vegetation types used by California black rails, 83.4% used plots in southern cattail (*Typha domingensis*), 63.3% used plots in giant bulrush (*Schoenoplectus californicus*), and 95.9% used plots in three-square bulrush that had water depths of < 3 centimeters (cm) (1.18 in). The birds preferentially used the three-square bulrush vegetation type, but they were also frequently located in giant bulrush and cattails. The authors report that juvenile birds select sites with deeper water (mean ± standard error [SE], 3.9 ± 1.5 cm, n = 16) (1.54 ± 0.59 in) than was selected by adult birds (1.9 ± 1.7 cm, n = 128) (0.75 ± 0.67 in). The researchers stated that in previous research efforts conducted from December 1985 to February 1987 they had measured the annual range in variation of water levels at Mittry Lake to be ≤ 7 cm (2.76 in) (Eddleman 1989).

Flores and Eddleman (1995) provide recommendations on how to design California black rail habitat: They recommend that the habitat contain gradual sloping shorelines, flat or gradual sloping bottoms, and shallow water < 2.5 cm (0.98 in) deep that covers more than 25% of the substrate. The rationale for recommending water depths be < 2.5 cm is based on unpublished data from the researchers showing that the mean tarsal length of black rails is 2.5 cm, and then assuming water depths should not be any higher than the tarsal length of the bird.

Evens et al. 1991 conducted surveys in 1989 along the Colorado River and in Imperial Valley in many of the same areas that surveys were originally conducted in 1973 and 1974 by Repking and Ohmart. The authors compared the results from 1989 to those from 1973–74, and the results showed that areas where birds were found both in 1989 and 1973–74 had stable water levels between the two survey periods and areas without birds in 1989 that previously had birds had experienced more variability in water levels due to years of flood and drought. It is worth noting that during the interim between these projects, the LCR experienced some of the highest flooding ever recorded.

Other researchers found five nests while radio tracking five California black rails at Mittry Lake in 1988–89. Water depths at the nests averaged 1.2 ± 1.2 cm (0.47 ± 0.47 in), and no depths > 2.5 cm (0.98 in) were recorded at any nest (Flores and Eddleman 1993).

Research was conducted in 2009 and 2010 at created marsh habitat on the Imperial National Wildlife Refuge to study California black rail and Yuma clapper rail use of habitat, including water depths (Nadeau et al. 2011). The researchers placed a series of piezometers in Field 16 and Field 18 at the Imperial Ponds Conservation Area. They then repeatedly surveyed for marsh birds and triangulated locations of the birds. The surveyors measured vegetation characteristics and water depths where they had located California black rails and Yuma clapper rails. Nadeau et al. 2011 determined that California black rail occupancy was positively correlated with chairmaker's bulrush (referred to by Repking and Ohmart as three-square bulrush; *Schoenoplectus americanus*) and southern cattail, and occupancy was highest if water depths ranged between -4.4 cm and 4.0 cm (-1.73 to 1.57 in). A negative depth indicates water levels below the surface, and the levels recorded correspond to saturated soils. The results of the research suggested that wetlands can be managed for both California black rails and Yuma clapper rails by maintaining water depths from saturated soil to 4.0 cm (1.57 in), maintaining stable water levels in shallow areas where California black rail habitat is found, and promoting chairmaker's bulrush in shallow areas under 3.0 cm (1.18 in) of depth and southern cattails in areas with > 3.0 cm (1.18 in) of depth where Yuma clapper rail are found.

In a recent study of dispersal of Yuma clapper rails at the Imperial Ponds Conservation Area, a California black rail nest was discovered in Field 14 (Harrity and Conway 2017). The nest was monitored from July 7 to August 4, when the eggs were determined to have hatched. The water depths at the base of the nest varied from 1 to 3 cm (0.39 to 1.18 in) during this period.

There have also been studies conducted in California outside the LCR where several larger populations of California black rail exist. There are three populations found in the San Francisco Bay area, the Sacramento-San Joaquin Delta, and in the Sierra Nevada foothills. Studies from these three populations provide stronger evidence for California black rail use of varying water depths and habitat.

California black rails were radio tracked in the San Francisco Bay to determine areas of use. From surveys conducted in 1996 (Evens and Nur 2002), one estimate of the California black rail population size is between 8,000 and 14,500 birds. Another survey effort conducted in 2001 estimated a population of 11,000 to 19,000 birds (Spautz et al. 2005). Either estimate would have the population of California black rails in the San Francisco area being a large majority of the total population of the subspecies. Most of this population is found in areas of varying water depths due to tidal fluctuations. Birds moved an average of 27.6 ± 1.8 meters (m) daily and 38.4 ± 5.5 m during extreme high tides. Water depths in areas with birds were between 0.36 and 1.6 cm (0.14 and 0.63 in) (Tsao et al. 2009). Birds may persist in areas that are inundated periodically for short time periods and where adjacent upland refugia is available (Tsao et al. 2009).

In the northern portion of San Francisco Bay, California black rail numbers were much higher in areas of tidal marsh compared to areas with restricted tidal flow (Evens et al. 1991). Further studies have also confirmed that California black rails preferentially use tidally influenced salt marsh areas in the San Francisco Bay area (Evens and Nur 2002; Manolis 1978; Spautz et al. 2005; Tsao et al. 2009).

More recent research into California black rail habitat use was conducted in the Sacramento-San Joaquin Delta inland from the San Francisco Bay (Tsao et al. 2015). California black rails were detected in the portions of the delta that are tidally influenced, including in-channel islands and areas of managed marsh. Researchers investigated the relationship between California black rail occurrences and remotely sensed landscape characteristics. The researchers modeled the data in Maxent software with two categorical predictor variables: vegetation type and tidal status. The model developed was highly predictive and was most informed by contributions from vegetation type (81.8%; SE = 0.34) and less informed by tidal status (18.2%; SE = 0.034). The response curve for tidal status produced a higher probability of presence at tidally influenced sites (70.1%; SE = 0.001) than at non-tidal wetland sites (10%; SE = 0.001).

Researchers conducted surveys for California black rails from 2002 to 2008 in Yuba County, California, in both the foothills of the Sierra Nevada and the Sacramento Valley (Richmond et al. 2010). In wetlands where California black rails were detected, the water depth averaged 2.12 ± 0.39 cm (0.83 ± 0.15 in). The largest source of water for these wetlands was from irrigation (68%), and, of the wetlands that were irrigated, 84% were intentionally irrigated and 16% were irrigated by leaks or seepage from canals. The authors of the study state that the abundance of water sources and gently sloped landscape in the area facilitated the formation of wetlands suitable for California black rails. They recommend a management strategy that maintains wetlands with variable water levels, which includes shallow water zones < 1.2 in deep.

Other habitat characteristics were analyzed for the California black rail populations of the Sierra Nevada (Richmond 2010). The probability of detecting occupancy from a single playback survey was high ($\bar{x}$ = 0.84). It was determined that the probability of occupancy for California black rails was higher when Virginia Rails (*Rallus limicola*) were present than when absent. For both species, occupancy increased with marsh size, and marsh sized ranged from 0.013 to 13.99 hectares. California black rails were observed to colonize marsh habitat within a year after being created.

RESEARCH EFFORTS

The LCR MSCP worked with ProNatura Noroeste, a Mexican organization that collects marsh bird data on the Ciénega de Santa Clara near the southern end of the LCR. The LCR MSCP used occupancy modeling techniques to analyze the population of California black rails in the Mexican portion of the LCR. The analysis showed that the population is not large enough to allow for precise estimates of occupancy and detection probability therefore, no further analysis of the Mexican population will be conducted, and results from the published literature will be the only sources used to describe California black rail use of varying water depths.

DISCUSSION

The current LCR MSCP guidelines for managing the variability of water depths were developed when the program began, before much of the current information was available. Recent research has shown that California black rails inhabit tidally influenced areas with water depths that vary daily (Evens and Nur 2002;

Richmond 2010; Spautz et al. 2005; Tsao et al. 2009, 2015). The largest population, which represents a majority of all the known populations of this subspecies, use tidal areas in the San Francisco Bay (Evens and Nur 2002; Spautz et al. 2005; Tsao et al. 2009). The population of California black rails in the Sacramento-San Joaquin Delta preferentially use tidally influenced areas (Tsao et al. 2015). They also use created marshes in the Sierra Nevada Foothills, which are managed to have varying water depths.

Black rails are difficult to detect and survey, and caution has been advised when attempting to make abundance estimates from call-playback data (Conway et al. 2004; Legare et al. 1999, Spear et al. 1999). In more recent research conducted on California black rails, several authors suggest moving to an occupancy modeling approach to analyze call-playback data (e.g., Richmond et al. 2008). Other methods that estimate abundance based on distance sampling (e.g., Evens and Nur 2002; Spautz et al. 2005) or by using fixed-radius plots (e.g., Legare et al. 1999) have been questioned for several reasons. It has been demonstrated that black rails will move toward a surveyor using call-playback (Flores and Eddleman 1995), and this can affect the distance estimates used to calculate density and abundance both with distance sampling and using circular plots. It is also difficult to precisely estimate distances to birds using auditory cues (Richmond et al 2008).

Because California black rails are difficult to detect, it is also difficult to analyze their habitat requirements. Earlier studies on the LCR used naïve count data, without considering detection probability, and may provide biased estimates of abundance. This could then lead to inferences of habitat use that may be misleading (MacKenzie et al. 2017; Richmond et al. 2008). Most of the data came from one location, Mittry Lake, which is maintained at mostly stable water levels. While the continued presence of California black rails at Mittry Lake shows that stable water levels do not preclude use by the species, it does not indicate that it is a requirement. Later research in other parts of the range of the species, using methods that do not rely on naïve count data, indicate that the species does utilize habitats with varying water levels (Evens and Nur 2002; Manolis 1978; Richmond et al. 2010; Spautz et al. 2005; Tsao et al. 2009). The evidence showing that California black rails preferentially use areas that are tidally influenced may indicate that varying water levels in managed marshes is the best practice for providing high-quality California black rail habitat.

In summary, the published research shows that California black rails use shallow water of roughly an inch or less in depth. However, the birds utilize habitats where water depths vary on a daily basis by moving into shallower areas as water levels change. Optimal habitats created for California black rails should have gently sloping landscapes that allow them to move into areas of suitable depth as water levels vary.

LITERATURE CITED

Conway, C.J. 2011. Standardized North American marsh bird monitoring protocol. Waterbirds 34(3):319–346.

Conway, C.J., C. Sulzman, and B.E. Raulston. 2004. Factors affecting detection probability of California Black Rails. The Journal of Wildlife Management 68(2):360–370.

Dodge, C. and N. Rudd. 2017. Marsh Bird Water Depth Analysis, 2016 Progress Report. Annual report prepared by the Lower Colorado Multi-Species Conservation Program, Bureau of Reclamation, Boulder City, Nevada.

Eddleman, W.R. 1989. Biology of the Yuma Clapper Rail in the Southwestern U.S. and Northwestern Mexico, Final Report. U.S. Fish and Wildlife Service Contract 4-AA-30-02060. July 1989.

Evens, J.G. and N. Nur. 2002. California black rails in the San Francisco Bay region: spatial and temporal variation in distribution and abundance. Bird Populations (6):1–12.

Evens, J.G., G.W. Page, S.A. Laymon, and R.W. Stallcup. 1991. Distribution, relative abundance and status of the California black rail in western North America. The Condor 93(4):952–966.

Flores, R.E. and W.R. Eddleman. 1993. Nesting biology of the California black rail in southwestern Arizona. Western Birds 24(2):81–88.

_____. 1995. California black rail use of habitat in southwestern Arizona. The Journal of Wildlife Management 59(2):357–363.

Harrity, E. and C. J. Conway. 2017. Dispersal Behavior of Yuma Ridgway's Rails. 2017 Annual Report for Imperial National Wildlife Refuge. Wildlife Research Report #2017-01. Idaho Cooperative Fish and Wildlife Research Unit, Moscow, Idaho.

Legare, M.L., W.R. Eddleman, P.A. Buckley, and C. Kelly. 1999. The effectiveness of tape playback in estimating black rail density. The Journal of Wildlife Management 63(1):116–125.

MacKenzie, D.I., J.D. Nichols, J.A. Royle, K.H. Pollock, L. Bailey, and J.E. Hines. 2017. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Elsevier.

Manolis, T. 1978. Status of the Black Rail in central California. Western Birds 9:151–158.

Nadeau, C.P., C.J. Conway, M.A. Conway, and M. Ogonowski. 2011. Restoration of Managed Marsh Units to Benefit California Black Rails and Other Marsh Birds: An Adaptive Management Approach, Final Report. Wildlife Research Report #2011-01. U.S. Geological Survey Arizona Cooperative Fish and Wildlife Research Unit, Tucson, Arizona, USA.

Repking, C.F. and R.D. Ohmart. 1977. Distribution and density of black rail populations along the lower Colorado River. The Condor 79(4):486–489.

Richmond, O.M.W. 2010. Inferring Ecological Relationships from Occupancy Patterns for California Black Rails in the Sierra Nevada foothills. Doctoral dissertation. University of California, Berkeley.

Richmond, O.M., J. Tecklin, and S.R. Beissinger. 2008. Distribution of California black rails in the Sierra Nevada foothills. Journal of Field Ornithology 79(4):381–390.

Richmond, O., S. Chen, B. Risk, J. Tecklin, and S. Beissinger. 2010. California black rails depend on irrigation-fed wetlands in the Sierra Nevada foothills. California Agriculture 64(2):85–93.

Snider, P.R. 1969. Southwest region. Audubon Field Notes 23:681.

Spautz, H., N. Nur, and D. Stralberg. 2005. California Black Rail (*Laterallus jamaicensis coturniculus*) Distribution and Abundance in Relation to Habitat and Landscape Features in the San Francisco Bay Estuary. U.S. Department of Agriculture Forest Service General Technical Report PSW-GTR-191.

Spear, L.B., S.B. Terrill, C. Lenihan, and P. Delevoryas. 1999. Effects of temporal and environmental factors on the probability of detecting California Black Rails (Efectos de los factores temporales y ambientales en la probabilidad de detectar individuos de *Laterallus jamaicensis coturniculus*). Journal of Field Ornithology 70:465–480.

Tsao, D.C., J.Y. Takekawa, I. Woo, J.L. Yee, and J.G. Evens. 2009. Home range, habitat selection, and movements of California black rails at tidal marshes at San Francisco Bay, California. The Condor 111(4):599–610.

Tsao, D.C., R.E. Melcer, Jr., and M. Bradbury. 2015. Distribution and habitat associations of California black rail (*Laterallus jamaicensis cortuniculus*) in the Sacramento–San Joaquin Delta. San Francisco Estuary and Watershed Science 13(4).