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Distribution and Abundance of the California Black Rail in South-eastern California

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ABSTRACT

The California Black Rail (*Laterallus jamaicensis coturniculus*) is very rare and local in southeastern California. During this survey we found only 116 individuals, 63% along the Colorado River in the vicinity of Imperial and Laguna dams and the remainder at scattered locations along the All-American Canal and near the Salton Sea. Most Black Rail habitat located during this survey is dependent on seep water from irrigation and waste water canals. In many cases this habitat is in danger of being destroyed by water reclamation conservation and flood control measures such as lining canals with concrete. On the Colorado River only the marsh area immediately above the dams are suitable for Black Rails habitable since the daily and weekly water fluctuations elsewhere preclude occupation by the species. The Black Rail is critically endangered in this area and only immediate action will ensure that the species is not ~~stop the elimination of the~~ extirpated species from the region.

MANAGEMENT RECOMMENDATIONS

1) Change the status of Black Rail in southeastern California from threatened to endangered.

2) Encourage the USDI Fish and Wildlife Service to list this population of Black Rails as endangered.

3) Preserve seep habitat along irrigation canals by either not lining canals or by providing water for these seep marshes if the canals are lined.

4) Develop habitat restoration methods to create suitable perennial marsh habitat dominated by three-edged bulrush. (*Scirpus olneyi*)?

Revising the statement this way I feel, frames it in a more positive way and also more accurately includes the inadvertent events that threaten this population (example etc.)

INTRODUCTION

The California Black Rail (*Laterallus jamaicensis coturniculus*) is listed as a Threatened Species by the California Department of Fish and Game. Baseline population data in northern and southern California was gathered in the 1970's (Manolis 1978; Repking and Ohmart 1977; Jureck 1975). Surveys conducted in northern California in 1986 and 1988 in the San Francisco Bay Region showed that the rails were absent in central and southern bay marshes. The highest densities were found along the tributaries of San Pablo Bay especially in undiked marshes (Evens *et al.*, Evens *et al.* 1989).

Repking and Ohmart (1977) conducted surveys along the lower Colorado River and determined that Black Rails were found primarily in the vicinity of Imperial and Laguna dams. They located a total of 106 rails in 1973 and 100 rails in 1974 and concluded that three-edged bulrush (*Scirpus olneyii*), shallow water depth, gently sloping shorelines, and minimum water fluctuations were necessary habitat components.

Other studies in southern California showed that populations of Black Rails were found in scattered locations in seep marshes along the canals. Surveys along the All-American Canal in Imperial County yielded counts as high as 80 individuals (McCaskie pers. comm). Surveys of sites on the Coachella Canal on the east side of the Salton Sea in the Imperial Valley showed [substantial] populations of at least 21 individuals in those seep marshes (Jurek 1975).

Habitat changes have taken place in recent years at most sites where Black Rails have been found in southeastern California. On the lower Colorado River, sustained flood flows from 1983 to 1984 inundated and destroyed much of the rail habitat along the main channel of the river. Away from the river, along the major irrigation canals, patches of marshes vegetation were dissected and destroyed ~~or degraded~~ when the dirt canals were lined to prevent seepage in the 1970's and 1980's. These habitat changes and the possibility of corresponding decline of the species, led to this survey in the spring of 1989.

STUDY AREA

The area covered by this study was the wetlands of southeastern California. Most wetland sites around the Salton Sea, along the Coachella and All-American canals, and along both sides of the Colorado River from Needles to Yuma were surveyed. A wide variety of wetland types were encountered including reed islands, river banks, backwater lakes, ponds, sloughs and seeps.

METHODS

We conducted surveys from 0600-1000 hrs in the morning and from 1700-2100 hrs in the evening. We did not conduct surveys if winds exceeded 25 km/hr. Each survey point required 6 minutes to complete. The survey technique consisted of walking or canoeing to a location in, or at the edge of, the marsh, waiting and listening for 1 minute, then playing a tape recording of a Black

Rail to elicit a response. The tape consisted of a 1 minute series of "grr" calls followed by 0.5 minutes of the "Kic-kic-kerr" calls. We then waited 3.5 minutes for a response before moving to the next sample point. We located each survey point approximately 100 m from the neighboring survey point. We plotted the survey locations on 7 1/2 minute USGS maps. All calls from one compass direction were considered to represent one rail unless two or more rails were heard simultaneously. Calls from more than 30° different compass direction were considered to represent different rails.

We collected data on habitat variables in a 30 m radius at all survey points where we conducted rail surveys. This data consisted of percent cover by plant species, average height of each plant species, width of the marsh, and general hydrology type (ie. seep, pond, slough, lake, or river). We summarized the plant species percent cover data into three classes; dominant, subdominant #1 and subdominant #2. We compared habitat data by variable for sites at which we found Black Rails with sites where we did not find Black Rails using histograms and Chi-square analysis. Cramer's V is reported as a measure of the strength of the relationship. Posthoc, pairwise comparisons are made using Scheffe's method for multiple comparisons (Marascuilo and Serlin 1988). All hypothesis are tested at a=0.05. This analysis was only done on the Colorado River since we had insufficient sample from the All-American and Coachella canal and the Salton Sea locations.

RESULTS

We conducted our surveys from 23 March until 23 April 1989. Laymon surveyed the Colorado River 23 March to 23 April. Stallcup surveyed the Salton Sea 12-19 April and Evens surveyed the All-American and Coachella canals 10-14 April (Table 1).

Table 1. Location of surveys for Black Rails in southeastern California, March and April 1989.

Date	Time	Number of Points	Location	Observ.
			Salton Sea	
11 Apr	AM	10	Finney/Ramer lakes, SWMA	JE
12 Apr	AM	13	Finney Lake, SWMA	RS
13 Apr	AM	10+	Alamo River mouth	RS
14 Apr	AM	15+	New River mouth	RS
14 Apr	PM	15+	New River mouth	RS
14 Apr	PM	10	Finney Lake, SWMA	RS
15 Apr	AM	25	Wister Unit, SWMA	RS
15 Apr	PM	20	Hazard Tract, NWR	RS
16 Apr	AM	20	Wister Unit, SWMA	RS
16 Apr	AM	37	Wister Unit, SWMA	RS
18 Apr	AM	13	Wister Unit, SWMA	RS
19 Apr	AM	25	Whitewater River mouth	RS
			All-American and Coachella	
10 Apr	PM	10	Haley Rd., Coachella Canal	JE
11 Apr	PM	10	Haley Rd., Coachella Canal	JE
12 Apr	AM	18	Tilly Rd., Coachella Canal	JE
12 Apr	PM	10	Hot Springs Spa	JE
13 Apr	AM	20	All-American Canal, N side	JE
13 Apr	PM	10	All-American Canal, S side	JE
14 Apr	AM	7	All-American Canal, S side	JE
17 Apr	AM	10	Lower Salt Creek	RS
18 Apr	AM	11	All-American Canal	SL
19 Apr	PM	10	Salt Creek	RS

Table 1. (Cont.)

Date	Time	Number of Points	Location	Observ.
			Colorado River	
23 Mar	PM	16	Topock Marsh	SL
24 Mar	AM/PM	20	Topock Marsh	SL
25 Mar	AM	11	Topock Marsh	SL
26 Mar	AM	19	Topock Marsh	SL
27 Mar	AM	13	Bill Williams River	SL
27 Mar	PM	3	North of Earp	SL
28 Mar	AM	21	Bill Williams River	SL
29 Mar	AM	11	North of Earp	SL
31 Mar	AM	35	Mittry Lake	SL
31 Mar	PM	5	West Pond Area	SL
1 Apr	AM	9	Mittry Lake	SL
1 Apr	PM	27	West Pond Area	SL
2 Apr	AM	20	Mittry Lake	SL
2 Apr	PM	13	West Pond Area	SL
3 Apr	AM	21	West Pond Area	SL
4 Apr	AM	29	West Pond Area	SL
5 Apr	AM/PM	25	Mittry Lake	SL
6 Apr	AM/PM	31	Mittry Lake	SL
7 Apr	AM	9	Mittry Lake	SL
7 Apr	PM	12	Big Hole, Blythe	SL
8 Apr	AM/PM	20	Goose Flats	SL
9 Apr	AM/PM	24	Palo Verde Oxbow	SL
10 Apr	AM	15	Cibola Lake	SL
11 Apr	AM	17	Mittry Lake	SL
11 Apr	PM	8	West Pond Area	SL
12 Apr	AM/PM	22	Imperial Dam	SL
13 Apr	AM	32	Imperial Dam	SL
14 Apr	AM	20	Martinez Lake	SL
16 Apr	AM	7	Walter's Camp-Picachio SRA	SL
17 Apr	AM	18	Taylor Lake	SL
19 Apr	AM	19	Cibola Lake	SL
21 Apr	AM	11	Topock-Castle Rock	SL
22 Apr	AM	26	above Castle Rock	SL
23 Apr	AM	11	above Castle Rock	SL

RS = Rich Stallcup, JE = Jules Evens, SL = Stephen Laymon

We found a total of 116 Black Rails during the survey (Table 2), of which 61.2% The largest number of rails were found along the Colorado River. This included 44 on the Arizona side and 31 on the California side. The remaining rails were found in the vicinity of the Salton Sea (15) and along the All-American and Coachella canals (26). We did not find Black Rails along the Colorado River up stream from Senator Wash despite conducting seventeen days of surveys in that region (Table 1).

Table 2. Location of Black Rails found during surveys in southeastern California, March and April 1989.

Site	Date	Time	Number of Rails	Location	Observ.
				Salton Sea Area	
A	11 Apr	PM	1	NW of Montgomery Rd. x Haley Rd. E. of Calipatria (T12S, R15E)	JE
B	12 Apr	PM	3	Below Siphon 19, Coachella Canal Rd. (T9S, R12E)	JE,RS
C	12 Apr	PM	3	Tilly Rd. east marsh, Hot Springs Spa. (T9S, R12E)	JE,RS
D	12 Apr	AM	1	Finney Lake, N edge of levie, S half of Lake (T13S, R14E)	RS
H	14 Apr	AM PM	13	Salton Sea shoreline just S of New River mouth (T12S, R12E)	RS
I	17 Apr	PM	1	Mouth of Salt Ck., S side (T8S, R11E)	RS
J	19 Apr	PM	1	Desert Aire Rd. x Coachella Canal Rd. (T8S, R11E)	RS
Total for Area			23		
				Colorado River Area, California	
K	31 Mar	PM	1	Pond along All-American Canal NW of Laguna Dam (T15S, R24E)	SL,TG
L	1 Apr	AM	5	N side of West Pond, along McKinney Rd. (T15S, R24E)	SL

Table 2 (cont.)

Site	Date	Time	Number	Location	Observ.
L	1 Apr	PM	3	N side of West Pond (T15S, R24E)	SL
L	2 Apr	PM	6	N side of West Pond (T15S, R24E)	SL
M	3 Apr	AM	1	Pond S of Senator Wash Rd., E of All-American Canal (T15S, R24E)	SL
M	3 Apr	AM	1	Pond N of Senator Wash Rd., E of All-American Canal (T15S, R24E)	SL
L	4 Apr	AM	5	N side of West Pond (T15S, R24E)	SL
N	11 Apr	AM	1	Pond 0.5 mi. S of Senator Wash Dam (T15S, R24E)	SL
P	12 Apr	AM	1	Squaw L., above Imperial Dam (T15S, R24E)	SL,JH
P	13 Apr	AM	7	Squaw L., slough to Senator Wash Dam (T15S, R24E)	SL,JH
Total for Area			31		
				Colorado River Area, Arizona	
Q	2 Apr	AM	7	Mittry L., upper boat ramp - S (T7S, R21W)	SL
Q	5 Apr	AM PM	16	Mittry L., N of upper boat ramp (T7S, R21W)	SL
Q	6 Apr	AM PM	15	Mittry L., S of upper boat ramp (T7S, R21W)	SL
Q	7 Apr	AM	6	Mittry L., S of overflow siphon (T7S, R21W)	SL
Total for Area			44		
				All-American Canal Area	
E	13 Apr	AM	2	2.4 mi. W of Drop 3, N side of levee rd. (T17S, R18E)	JE
E	13 Apr	AM	1	3.2 mi. W of Drop 3, N side of levee rd. (T17S, R17E)	JE
F	13 Apr	PM	13	1.9-2.4 mi. E of Drop 4, S side of levee rd. (T17S, R17E)	JE,RS
G	14 Apr	AM	1	0.1 mi. E of Drop 3, S side of levee rd. (T17S, R18E)	JE
O	18 Apr	AM	1	Mission Wash Siphon, S side of canal. (T15S, R23E)	SL,JH
Total for Area			18		
Total for Region			116		

Observer codes: Jules Evens (JE), Terri Gallion (TG), Joan Humphrey (JH), Stephen Laymon (SL),

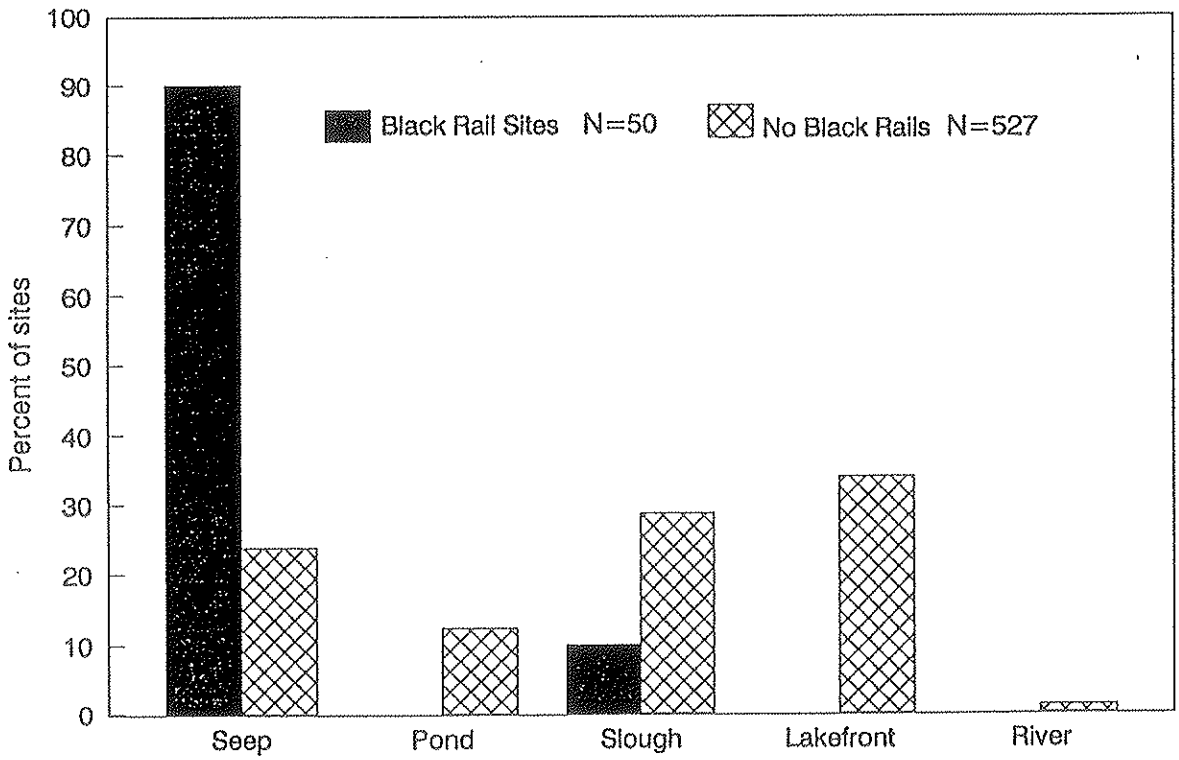
Colorado River

We surveyed a total of 577 points along the Colorado River and found Black Rails at 50 of those sites (8.7%). Habitat descriptions were made at all sites. All Black Rails were found at sites that were moist or wet, but without deep standing water. We classified the habitat into five hydrology types; seeps, ponds, sloughs, lake front, and river front. We found 90% of the Black Rails at seeps created by leakage of dams and canals, and found 10% at slough areas in the pool of Imperial Dam (Figure 1). Black Rails were present at 26.5% of the seep sites (n=170) and 3.2% of the slough sites (n=157). No Black Rails were detected at pond sites (n=48), lake front sites (n=179) or river front sites (n=23). The water levels at the sites where Black Rails were present were, without exception, free from the daily and weekly fluctuation experienced on the main river channel. A Chi-square test comparing the distributions of the used sites versus expected sites across the five hydrology categories showed a significant difference (X^2=94.51 > critical value X^2, 4d.f.=9.49, V=0.40). A posthoc analysis of all pairwise contrasts showed that seeps were used more frequently than expected by chance when compared to all other hydrology types (seep-pond Z=7.82; seep-slough Z=6.36; seep-lake Z=7.82, seep-river Z=7.82; critical value for Z 4d.f.(S^*)=3.08).

We found five general categories of dominant vegetation at our survey sites; Three-edged bulrush, cattail (*Typha angustifolia, T. domingensis*), tall bulrush (*Scirpus californicus.*), native bushes and

A comparison of

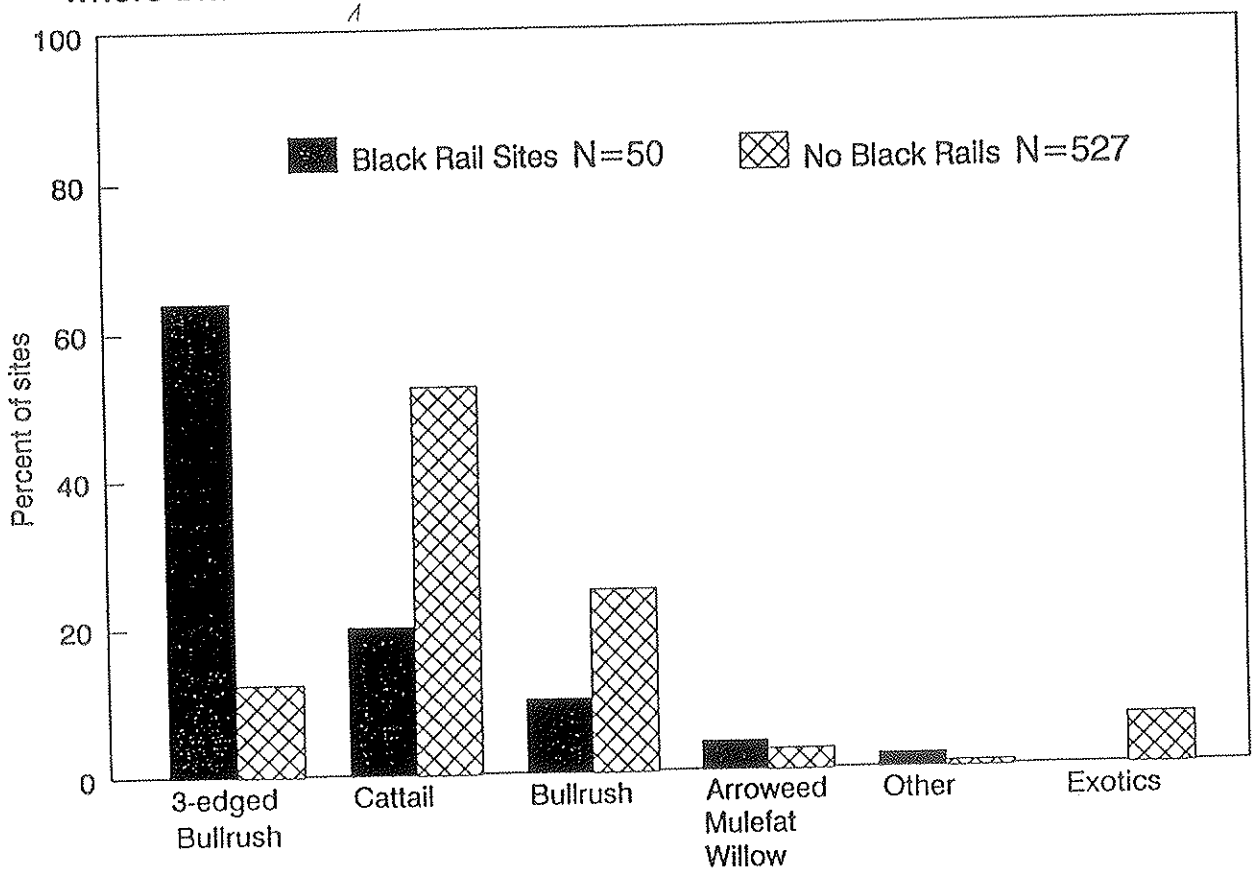
Figure 1. A Habitat type at sites along the Colorado River where Black Rails were ~~and were not found~~ present or absent.



trees ~~consisting~~ including of arrowweed (*Tessaria sericea*), mulefat (*Baccharis* sp.), willow (*Salix* sp.) and cottonwood (*Populus fremontii*), and exotics ~~consisting~~ including of tamarisk (*Tamarix chinensis*) and giant reed (*Arundo donax*). Among the 50 sites at which we found Black Rails, 64% were dominated by 3-edge bulrush, 20% were dominated by cattail, 10% were dominated by tall bulrush and 6% were dominated by bushes and trees (Figure 2). We detected Black Rails at 33% of the sites dominated by the 3-edged bulrush, 9.1% of the sites dominated by bushes and trees, 3.7% of the sites dominated by tall bulrush and 3.5% of the sites dominated by cattail. Black Rails were not found at sites dominated by exotic vegetation. A Chi-square analysis comparing the distribution of used versus expected, across the five vegetation categories showed a significant difference (X^2=88.14 > critical value X^2 4d.f.=9,49, V=0.39). A posthoc analysis of all pairwise contrasts showed that 3-edged bulrush was preferred over all other vegetation categories (3-edged bulrush-bulrush Z=5.81; 3-edged bulrush-cattail Z=6.03; 3-edged bulrush-exotics Z=5.01; 3-edged bulrush-brush and trees Z=3.08; critical value for Z 4d.f.(S^*)=3.08). Sites dominated by brush and trees were also preferred over tall bulrush (z=3.32).

We found six categories of the first sub-dominant vegetation, ie. the second most dominant species on the site; none, 3-edged bulrush, bulrush, cattail, exotic vegetation, and brush and trees. Among the 50 sites at which we found Black Rails, the first sub-dominant vegetation was bushes and trees at

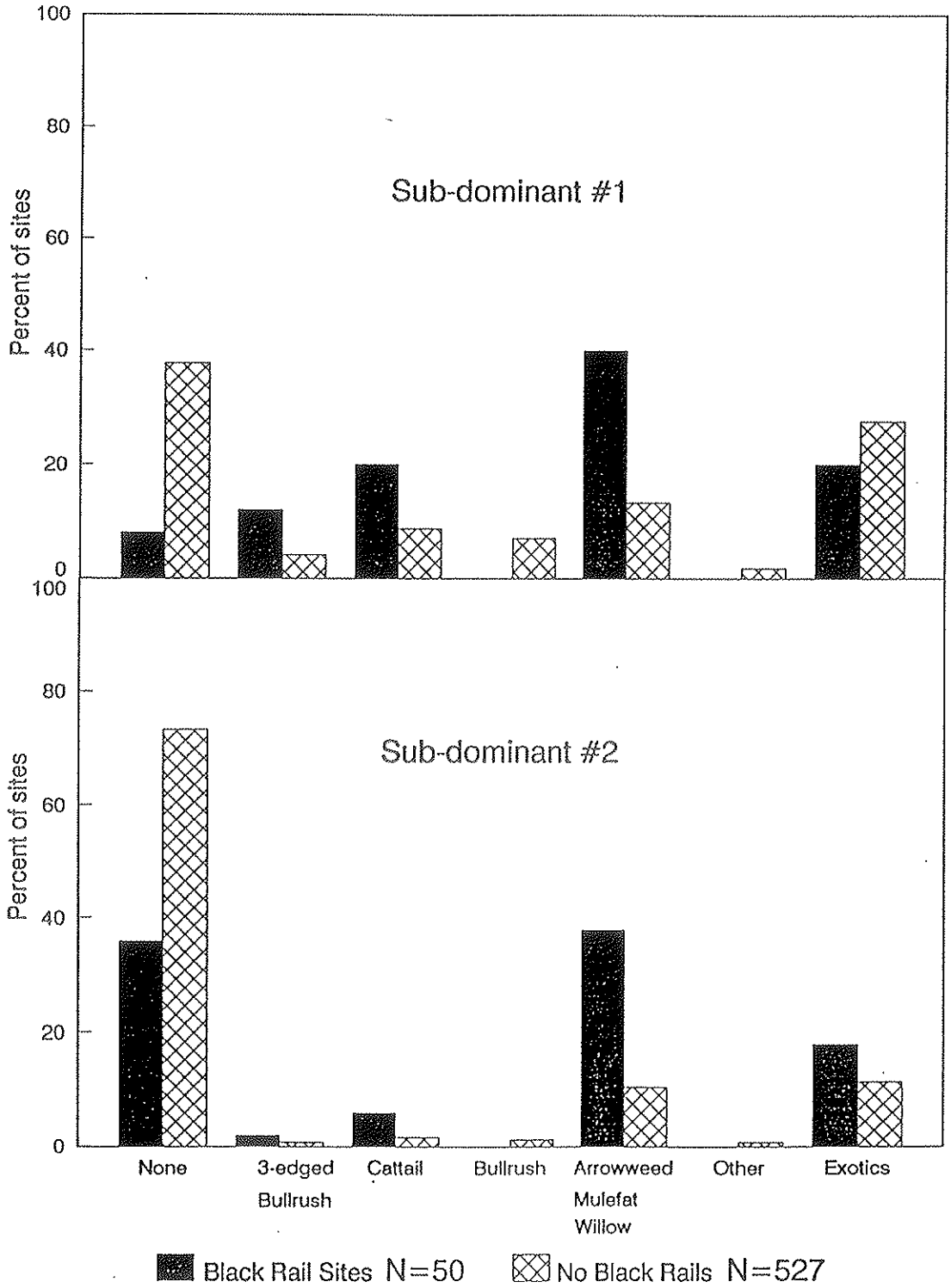
Figure 2. Dominant vegetation at sites along the Colorado River where Black Rails were and were not found



40%, cattails at 20%, exotic vegetation at 20%, 3-edged bulrush at 12%, and no sub-dominant at 8% of the sites (Figure 3). Black Rails were found at 22.2% of the sites with 3-edged bulrush as the first sub-dominant (n=27), 21.3% of the sites with cattail as the first sub-dominant (n=47), and 20.2% of the sites with brush and trees as the first sub-dominant (n=99). Black Rails were found at 6.5% of the sites with exotic vegetation as the first sub-dominant (n=155) and at 1.8% of the sites with no first sub-dominant (n=203). No Black Rails were found at sites where tall bulrush was the first sub-dominant (n=45). A Chi-square test comparing the distributions of the sites used versus expected, across the six first sub-dominant categories showed a significant difference (X^2=49.97 > critical value X^2 5d.f.=11.07, V=0.29). A posthoc analysis of all pairwise contrasts showed that Black Rails used sites with brush and trees as first sub-dominants significantly more than sites with no sub-dominant (Z=4.44, critical value for Z, 5d.f.(S^*)=3.33) or with tall bulrush as the sub-dominant (Z=5.01). Sites with cattails as the sub-dominant were also preferred over those with tall bulrush (Z=3.57).

We found four categories in our second sub-dominant grouping: 1) sites with reeds (3-edged bulrush, tall bulrush or cattail) (n=24); 2) sites with brush and trees (n=79), 3) sites with exotic vegetation (n=69) and 4) sites with no sub-dominants (n=404). Among the 50 sites at which we detected Black Rails, the second sub-dominant was bushes and trees at 38%, none at 36%,

Figure 3. Sub-dominant vegetation at sites along the Colorado River where Black Rails were and were not found.



exotic vegetation at 18% and reeds at 8% of the sites (Figure 3). Black Rails were present at 24.1% of the sites with brush and trees as the second sub-dominant, 16.7% of the sites with reeds as the second sub-dominant, 13% of the sites with exotic vegetation as the sub-dominant, and 4.5% of the sites with no second sub-dominant. A Chi-square test comparing the distribution of the used versus expected, across the four second sub-dominant categories showed a significant difference (X^2=36.25 > critical value X^2, 3d.f.=7.81, V=0.25). A posthoc analysis of all pairwise contrasts showed that Black Rails preferred sites with brush and trees as the second sub-dominant over no second sub-dominant (Z=3.43, critical value for Z, 3d.f.(S^*)=2.79).

All-American Canal and the Salton Sea

We surveyed the All-American Canal between Holtville and Yuma on 13, 14 and 18 April (Table 1). The only marsh habitat was found in seeps between drops 3 and 4 and at Mission Wash. We detected a total of 18 Black Rails in approximately 10 ha of habitat (Table 2). The habitat on the north side of the canal was a strip of marsh, dominated by cattail, approximately 30 m wide, 6.75 km in length, and 4.8 ha in extent. We surveyed 20 points and three Black Rails responded at two points. Both points where rails responded were cattail/*Phragmites* marsh with wet to damp conditions. On the south side we surveyed 17 points in 4.2 ha of habitat and 14 Black Rails responded at seven points. The habitat was a mosaic of cattail, willow, *Tamarix*, *Salicornia*, and *Phragmites* with no dominant species. The Mission

Wash site, where one Black Rail responded, was approximately 1 ha of marsh dominated by ~~cattail~~ Typha.

We surveyed the marshes at the Salton Sea and along the Coachella Canal 10-19 April (Table 1). We detected a total of 23 Black Rails in these areas, 13 at the mouth of the New River, 8 in seep marshes along the Coachella Canal, 1 at Finney Lake, and 1 at the mouth of Salt Creek (Table 2). The site near the mouth of the New River was on Salton Sea NWR, at the edge of the sea 0.3 km north of the intersection of Buchard and Foulds roads. This 7-ha site was predominately ~~three-edged bulrush~~ Scirpus sp., with a border of cattail and tall bulrush. The marsh was created by seepage from a drainage canal. The only other Black Rail detected on the Salton Sea was in a small marsh at the mouth of Salt Creek.

We found Black Rails at four sites along the Coachella Canal; 1 at Desert Aire Road, 3 at siphon 19, 3 nearby at Hot Springs Spa, and 1 near the junction of Montgomery and Halley roads. The site at Desert Aire Road was located 1 km east of the Coachella Canal. It is approximately 0.1 ha in extent and is dominated by three-edged bulrush with an overstory of cottonwoods and palms. The siphon 19 site located 2 km north of Spa Road is 2.5 ha in extent and is a mixture of cattail, Typha sedge (*Juncus sp.*) and pampas grass (*Cortadaria selloana*).

DISCUSSION

Population Comparison and Habitat Threats

Along the Colorado River Repking and Ohmart (1977) conducted an exhaustive survey in 1973 and 1974 from Needles to Yuma. In 1973 they found 106 Black Rails and in 1974 they found 100. In this same region we found 75 Black Rails during the 1989 survey, representing a 30% decline (Table 3). We found similar population levels at West Pond and Squaw Lake, higher levels at Mittry Lake and no rails at other sites. Arizona Game and Fish (1980) reported a total of 80 Black Rails at Mittry Lake where we found 44 and Repking and Ohmart found 18-22. Our survey numbers are a 100% increase over Repking and Ohmart, but represent a 45% decrease from the Arizona Game and Fish totals. (Table 3)

The sites where we found rails have stable water levels when compared to the remainder of the Colorado River system. The sites where we did not find rails but where they had been found in the previous study were all directly affected by fluctuating water levels. It is likely that the high water levels of 1983-1986 and the low water levels of the past few years have caused the extirpation of Black Rails on sites susceptible to fluctuation of the river.

The hydrology of the Senator Wash site where Repking and Ohmart found 10-21 Black Rails has been changed in recent years with the addition of a drain system at the base of the Senator Wash Dam making the site is no longer suitable for the species. The Mittry Lake site where the majority of the Black Rails on the

Colorado River were found, appears to be primarily dependent on seep water from the Gila Canal, not upon water from Mittry Lake. If this canal is lined to prevent seepage the habitat and the Black Rail population will likely decline.

Table 3. Comparison of the results by location for past and present surveys of Black Rails on the lower Colorado River.

Location	1973 1/	1974 1/	1980 3/	1989 2/
California				
West Pond	16	22		23
Imperial Reservoir	2	1		0
Squaw Lake	10	10		8
Senator Wash	21	10		0
Other river sites	11	15		0
Arizona				
Mittry Lake	18	22	80	44
Imperial Reservoir	14	9		0
Other river sites	14	3		0
Imperial NWR	0	8		0
Total	106	100		75

1/ = Repking and Ohmart 1977.
2/ = This Study.
3/ = Arizona Game and Fish 1980.

The site between drop 3 and 4 on the All-American Canal where we found 17 Black Rails has been surveyed in the past on several occasions. McCaskie (pers. comm.) stated that approximately 80 Black Rails had been found at this site and Jackson (1988) cited a recent estimate of 30-50 Black Rails for the site. Pumps have been installed at this site to return seep water to the canal. As a result the marsh has shrunk in size and quality and the Black Rail population has declined by 79%.

We were able to locate only one Black Rail along the portion of the Coachella Canal that Jurek (1975) surveyed in 1975. Jurek found a total of 21 Black Rails at 12 sites between Titsworth and Flowing Wells roads. Most of the marsh that existed in this area in 1975 has dried since the canal was rebuilt as a concrete lined rather than an earthen lined canal.

In 1988 Jackson (1988) surveyed the seeps and marshes along the unlined portion of the Coachella Canal from Niland to North Shore. She located a total of 11 Black Rails. We were able to find only 8 Black Rails in this region, but we were unable to gain access to Dos Palmos Marsh where Jackson found 6 rails. We have been assured that the Dos Palmos is still intact and hence our population estimate for this region should be increased to 14. The Bureau of Reclamation is currently preparing an EIR for a project to line this remaining unlined portion of the Coachella. It is very likely that if this project is undertaken without replacement water being provided, that Black Rails along the Coachella Canal will also decline further.

The largest population of Black Rails (13) away from the Colorado River was found along a drainage canal near the mouth of the New River. This site appeared to be watered by seepage from this drainage canal. Since the survey we have been informed that the seepage was stopped when work was done on the canal by The Army Corp of Engineers. It is likely that this site will no longer be suitable habitat for Black Rails.

Conservation Biology Considerations

Black Rails in southeastern California and southwestern Arizona have a small overall population size, very small average subpopulation size, and a patchy distribution. On the Colorado River there are 4 populations with an average population of 18.75 and a range from 1 to 44 Black Rails. Away from the river there are 9 populations with an average population size of 5.2 and a range from 1 to 17 Black Rails. Simulation modeling has demonstrated that populations with less than 10 pairs are very unstable and always become extinct in a short period of time (Richter-Dyn and Goel 1972; Roth 1974). Shaffer (1981) theorized that with a more realistic model this minimum number would increase. He felt that 25 pairs was a minimum for a subpopulation that should be free from extinction through stocastic events. If we assume that an average of 1.5 individuals from each pair responded during the survey, only 3 of the 13 subpopulations reach the 10 pair limit and only the Mittry Lake subpopulation reaches the 25 pair limit.

However, in addition to these threats of stocastic extinction we have demonstrated real threats to the habitat of the Black Rail in this region. When both the facts of diminishing habitat and the theories of population biology are brought together the outlook for the species in this region appears bleak. Today there is insufficient habitat to maintain the species in the long term and any further habitat loss, especially in core population areas, could lead to rapid

extinction in the entire region. Preservation of existing habitat coupled with creation of additional habitat through restoration efforts must be embarked upon immediately.

ACKNOWLEDGEMENTS

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