Mammal Camera Trap Study in Riparian Habitat along the Las Vegas Wash, 2018-2019

Las Vegas Wash Coordination Committee

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ABSTRACT

Over the past 20 years restoration efforts along the Las Vegas Wash have resulted in significant habitat changes. The Las Vegas Wash Wildlife Management Plan was created in 2008, establishing management objectives and laying out additional baseline monitoring. From 2009 to 2011, the first iteration of a large and medium sized mammal study was conducted using motion-triggered camera traps. This study recorded eight target species and recommended that future work focus on riparian habitat. The second iteration of the study ran from April 2018 through June 2019. Over the course of 46 weeks, the cameras recorded eight target species, five species that were recorded in the previous study and three new species.

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1.0 INTRODUCTION

The Las Vegas Wash (Wash) is the final outflow of the Las Vegas Valley's watershed carrying highly treated wastewater, shallow groundwater, urban runoff, and stormwater to Lake Mead. Increased population size in the 1950's resulted in perennial flows that created wetland and riparian habitats along the Wash. Over the years, the Wash has experienced degradation and loss of these habitats by increasing daily flows and flood events. In 1998, the Las Vegas Wash Coordination Committee (LVWCC) was formed to help stabilize and enhance this valuable resource.

The LVWCC is a partnership between local, state and federal agencies, environmental groups, businesses, the university and private citizens. Over the past 20 years, the LVWCC has worked on improving the conditions of the Wash. To this end, they have constructed 21 erosion control structures (weirs), added riprap to over 13 miles of bank to help with stabilization, removed over 550 acres of non-native plants, and revegetated over 500 acres with native plants. Several biological resource surveys have been completed, and the data was used to produce the Las Vegas Wash Wildlife Management Plan (Shanahan et al. 2008). The plan established management objectives and called for additional baseline monitoring, including a mammal camera trap study.

A study conducted by Bradley and Niles (1973) provided historical data for large and medium sized mammals along the Wash. Using direct observations and observations of sign (i.e., scat, burrows, tracks, etc.), Bradley and Niles identified 12 large and medium mammals. Eckberg and Foster (2011) conducted the recommended baseline study from 2009 through 2011 to determine how degradation of habitat and subsequent restoration may have influenced the abundance and diversity of these species. Using motion-triggered game cameras, eight large and medium sized mammals were identified. The study recommended that a second iteration be completed a few years later focusing on riparian habitats along the Wash (Eckberg and Foster 2011), as all target species had at least one capture in riparian sites and riparian locations made up 63.5% of all captures (Eckberg and Foster 2011). Additionally, three species that had not been documented in the area since the 1970s were identified in riparian sites during the study: striped skunk (*Mephitis mephitis)*, Western spotted skunk *(Spilogale gracilis)*, and ring-tailed cat *(Bassariscus astutus)*.

2.0 MATERIALS AND METHODS

The study was conducted within the Clark County Wetlands Park (Wetlands Park) boundary (Figure 1). In order to survey during all seasons (winter, spring, summer, and fall), the survey began in April 2018 and concluded in June 2019. Following the recommendations from the 2009-2011 study, efforts focused on riparian habitats along the Wash. Four locations were chosen as primary sites because they appeared to have the best riparian habitat along the Wash, were easily accessible, and showed signs of wildlife activity (prints, scat, etc.). The primary sites were Cottonwood Cell_Site 111, Upstream Pabco North, Upstream Historic Lateral North, and Downstream Pabco South. (Note: The Cottonwood Cell_Site 111 location was comprised of two sampling sites that were typically treated as one.) Although the majority of camera sets were at the primary locations, cameras were also set at other locations that looked suitable for wildlife (Figure 2). The exact location cameras were set within each site varied over the course of the study.

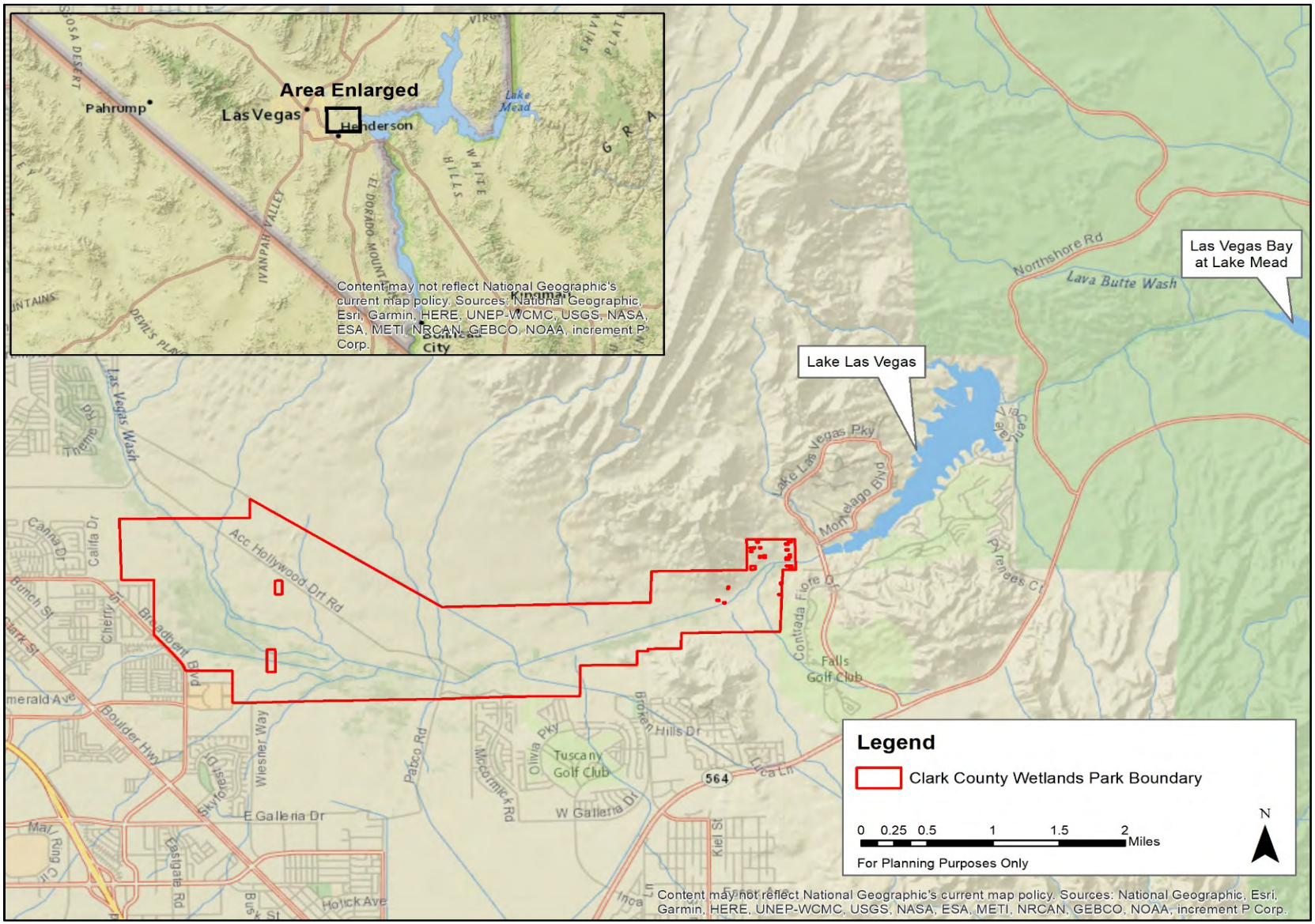

Figure 1. Las Vegas Wash location and general study area map.

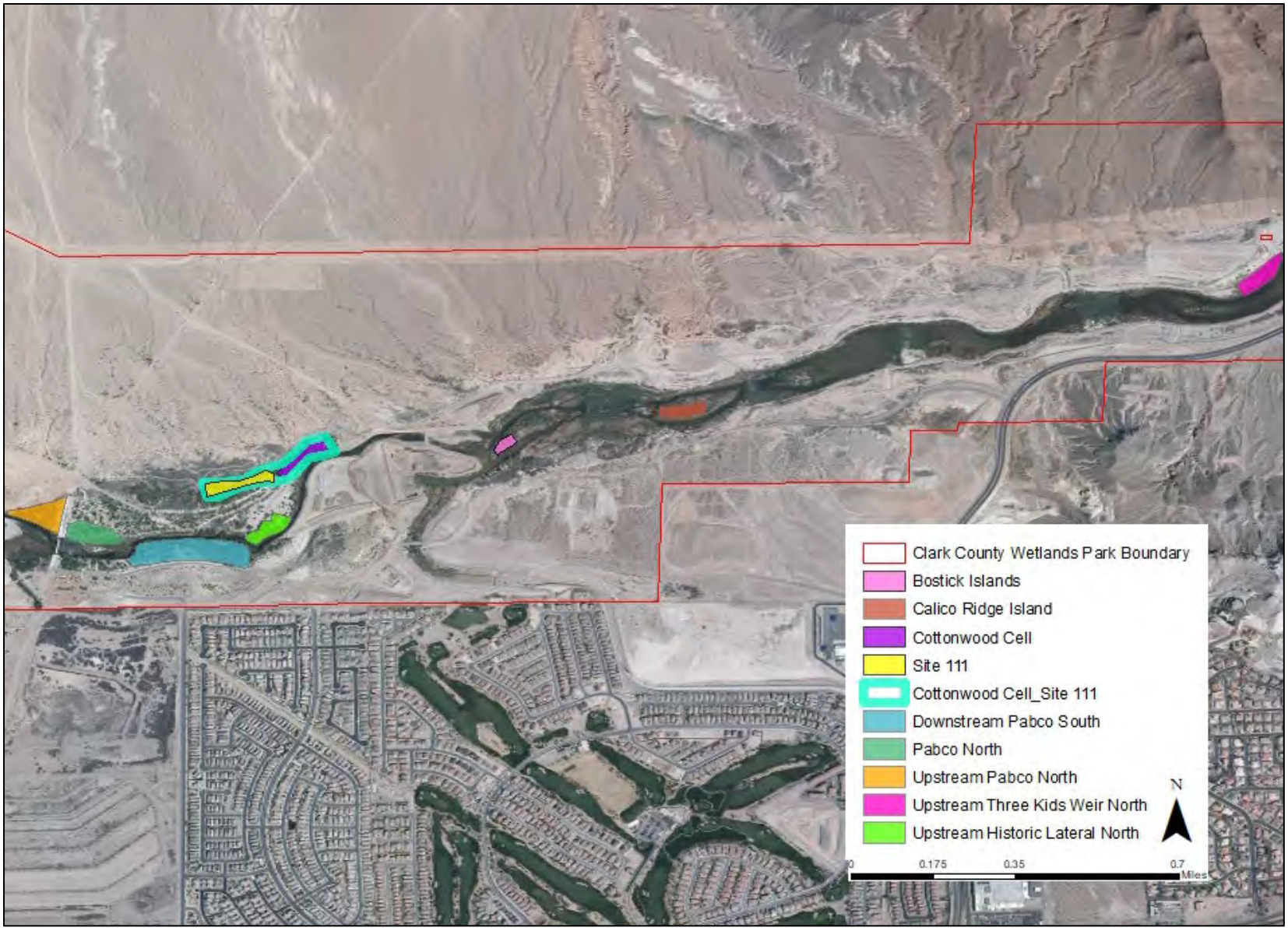

Figure 2. Mammal camera trap sites along the Las Vegas Wash.

All sampling locations were within close proximity of one another, with the furthest upstream and downstream sites less than three miles apart. All sites except Downstream Pabco South were located on the north side of the Wash or on islands. This was due in part to habitat availability but was also a result of trying to avoid areas with heavy foot traffic.

Sites were monitored using a maximum of four Browning Strike Force HD trail cameras. Cameras were typically deployed on Monday mornings and retrieved on Thursday afternoons. Prior to deployment, the date and time were set for each camera. To help prevent damage and theft, each camera was housed in a Browning security box with a Master Lock Python adjustable locking cable (Figure 3). Cameras were attached to tree trunks approximately three feet above the ground using adjustable straps. All cameras were equipped with a motion-triggered infrared sensor that allowed videos to be recorded day and night. Cameras were set to record two-minute videos during the day and 10-second videos at night. All videos were recorded onto a memory card and downloaded onto a computer at the end of each week. Unlike the previous study, coyote urine and cat food were not used as lures to attract animals into the sites.

All wildlife videos recorded were identified to species, where possible. Medium and large sized mammals were targeted, defined as mammals larger than one pound. Each species was counted based on the date and time on the images (Azlan and Lading 2006). If a species was identified on video within 30 minutes of another recording of that species, it was not counted as a new capture. Daily activity was divided into three categories: diurnal, nocturnal, and crepuscular. Diurnal activity was defined as occurring in the daylight period, beginning 60 minutes after civil twilight ended and 60 minutes before civil twilight began. Nocturnal activity was defined as occurring in the night time period 60 minutes after civil twilight began and 60 minutes before civil twilight ended. Crepuscular activity occurred during the remaining two-hour time blocks in the evening as daylight ended and night time began, and in the morning, as daylight began and night time ended.

To compare results to those from the previous study, both absolute abundance and relative abundance index (RAI) were calculated. Absolute abundance was determined for each site, each species, and each season, and RAI was calculated for both the study area as a whole and for each sampled area for each species (Eckberg and Foster 2011).

$$RAI = \Sigma_j tn_j / \Sigma_j p_{ij}$$

Where p_{ij} is the number of independent detections for the *i*th species at the *j*th trap location, and tn_j is the total trap-nights at the *j*th trap location (O'Brien et al. 2003, Kawanishi and Sunquist 2004, Negrões et al. 2010, Eckberg and Foster 2011). Similar to the previous study, data was scaled to captures per 100 trap nights.

Figure 3. Placement of cameras.

3.0 RESULTS

Cameras recorded for 464 trap nights collecting 621 target species captures (Table 1). Although the study length was 56 weeks, there were 10 weeks that cameras were not set bringing our total to 46 weeks. Target species were identified as all mammals larger than one pound with the exception of the black rat (*Rattus rattus*). Black rat was included as a target species because they are known to occur in abundance along the Wash and can negatively impact native species, as well as carry diseases. All sites except Upstream Three Kids Weir North recorded at least two target species. Upstream Three Kids Weir North recorded only non-target species (i.e., greater roadrunner). The two most recorded species were desert cottontail and coyote with 296 and 202 captures, respectively. American beaver and black-tailed jackrabbit were the two species recorded the least, with just one and three captures, respectively.

Family	Scientific Name	Common Name	Captures	RAI
Canidae	*Canis latrans*	Coyote	202	43.53
	Urocyon cinereoargenteus	Gray fox	11	2.37
Castoridae	*Castor canadensis*	American beaver	1	0.22
Leporidae	*Lepus californicus*	Black-tailed jackrabbit	3	0.65
	Sylvilagus audubonii	Desert cottontail	296	63.79
Procyonidae	*Procyon lotor*	Northern raccoon	39	8.41
Felidae	*Lynx rufus*	Bobcat	13	2.80
Muridae	*Rattus rattus*	Black rat	56	12.07

Table 1. Target mammals recorded on trail cameras at riparian locations along the Las Vegas Wash from April 2018 to June 2019.

Although the same number of target species were identified in both Wash studies, some species varied (Eckberg and Foster 2011; Table 2). New species identified were gray fox, bobcat, and black rat (Figures 4-6) while striped skunk, spotted skunk, and ring-tailed cat were not captured during this iteration. This is the first time the gray fox has been documented since the first mammal study (Bradley and Niles 1973).

Figure 4. Photo taken of a gray fox at the Las Vegas Wash.

Figure 5. Photo taken of a bobcat at the Las Vegas Wash.

Figure 6. Photo taken of a black rat at the Las Vegas Wash.

A total of nine sites were sampled throughout the study, but not all sites were sampled evenly (Figure 7). The four primary sites (Cottonwood Cell_Site 111, Upstream Pabco North, Upstream Historic Lateral North, and Downstream Pabco South) were sampled at a higher rate. Also, although the Cottonwood Cell_Site 111 location was generally treated as a single site with cameras set among both locations most weeks, there were four weeks that cameras were set specifically in one or the other of the two sites (Figure 7).

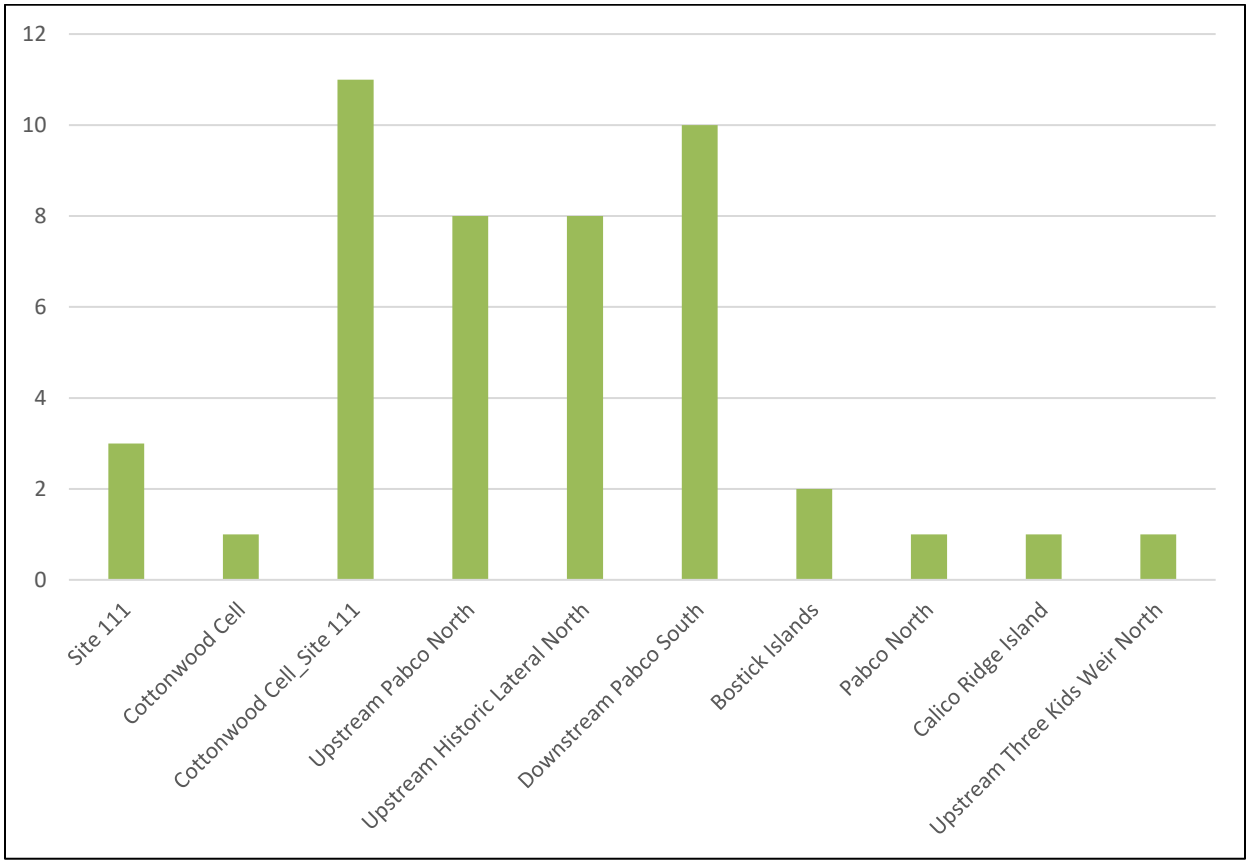

Figure 7. Total weeks cameras were set at each location.

Common Name	2009-2011	2018-2019
Coyote	X	X
Gray fox		X
Bobcat		X
Striped skunk	X	
Spotted skunk	X	
American beaver	X	X
Ring-tailed cat	X	
Northern raccoon	X	X
Black-tailed jackrabbit	X	X
Desert cottontail	X	X
Black rat		X

Table 2. Target mammals identified during the 2009-2011 and 2018-2019 Las Vegas Wash studies.

Sampling sites were all similar in vegetation composition and density except sites located on islands. These sites were more wetland than riparian, comprised mostly of cattails, and had denser vegetation than other sites. Although island sites were dense, they captured four of the eight target species, which was the average for diversity at each site. The most abundant species captured on island sites was black rat (Figure 5). Cottonwood Cell_Site 111 and Upstream Pabco North had the most captures of all locations (Table 3). Upstream Pabco North was also the most diverse, recording all target species except black-tailed jackrabbit. All sites were located adjacent to the Wash offering a water source for species. The Cottonwood Cell_Site 111 and Downstream Pabco South sites had the largest amount of mature riparian vegetation among all sites sampled.

Pabco North and Upstream Three Kids Weir North differed in habitat from other riparian sites. These sites had less canopy cover and were comprised of more desert scrub vegetation like mesquite and creosote bushes. These two sites recorded the lowest species abundance and diversity, but both were only sampled once (Table 3).

Seasonal abundance indicates that the highest mammal activity occurs during the spring (Table 4), although this is not consistent across all species. Three species, gray fox, black-tailed jackrabbit, and black rat were most abundant during the summer, and no species abundance was highest during winter sampling. The most abundant species, desert cottontail, was captured 130 times during the spring season, more than 40% of its total captures (Table 4). All species except for the American beaver and black-tailed jackrabbit were captured during all seasons. Although the American beaver is a relatively common species to see while visiting the Wash, it was only recorded once during the study.

Common Name	Bostick Islands	Calico Ridge Island	Cottonwood Cell_Site 111	Downstream Pabco South	Pabco North	Upstream Pabco North	Upstream Three Kids Weir North	Upstream Historic Lateral North
Coyote	2	-	86	15	2	69	-	28
Gray fox	-	-	1	8	-	2	-	-
American Beaver	-	-	-	-	-	1	-	-
Black-tailed jackrabbit	-	-	1	-	-	-	-	2
Desert cottontail	11	1	120	3	1	136	-	24
Northern raccoon	13	1	-	-	-	12	-	13
Bobcat	-	-	8	-	-	2	-	3
Black rat	27	2	9	6	-	2	-	10
Total	**53**	**4**	**225**	**32**	**3**	**224**	**-**	**80**

Table 3. Abundance of target mammals at sites along the Las Vegas Wash.

Common Name	Fall	Winter	Spring	Summer
Coyote	45	36	62	59
Gray fox	1	2	1	7
American beaver	0	0	1	0
Black-tailed jackrabbit	0	0	0	3
Desert cottontail	76	51	130	39
Northern raccoon	8	10	14	7
Bobcat	6	2	3	2
Black rat	2	15	19	20
Total	**138**	**116**	**230**	**137**

Table 4. Seasonal abundance of target mammals along the Las Vegas Wash.

Upstream Pabco North had the highest RAI both seasonally and overall (Table 5). Although spring had the highest number of captures overall, fall had the highest seasonal RAI. Summer had the lowest RAI of all seasons but also had the fewest sites without captures.

Common Name	Spring	Summer	Fall	Winter
Bostick Islands	-	5.33	-	12.33
Calico Ridge Island	-	-	2	-
Cottonwood Cell_Site 111	2.15	5.57	9.50	7.67
Downstream Pabco South	1.30	1.57	-	2
Pabco North	-	0.33	0.67	-
Upstream Pabco North	11.85	1	21.50	8.33
Upstream Three Kids Weir North	-	-	-	-
Upstream Historic Lateral North	4.33	3.11	2.33	-
Total	**19.63**	**16.92**	**36.00**	**30.33**

Table 5. Relative abundance index by site and season for all target species captured along the Las Vegas Wash.

Species captures were broken up into crepuscular, diurnal, and nocturnal activity (Figure 8). Due to small sample size, both the American beaver and black-tailed jackrabbit were removed from these results. The jackrabbit was captured three times all in the diurnal activity period and the beaver was captured just once during the nocturnal activity period.

Nocturnal activity was the most common for all species representing 67% of all captures. Crepuscular and diurnal activity were almost identical, accounting for 16% and 17% of captures, respectively. Gray fox and black rat were the only species that did not have any captures during the diurnal activity period.

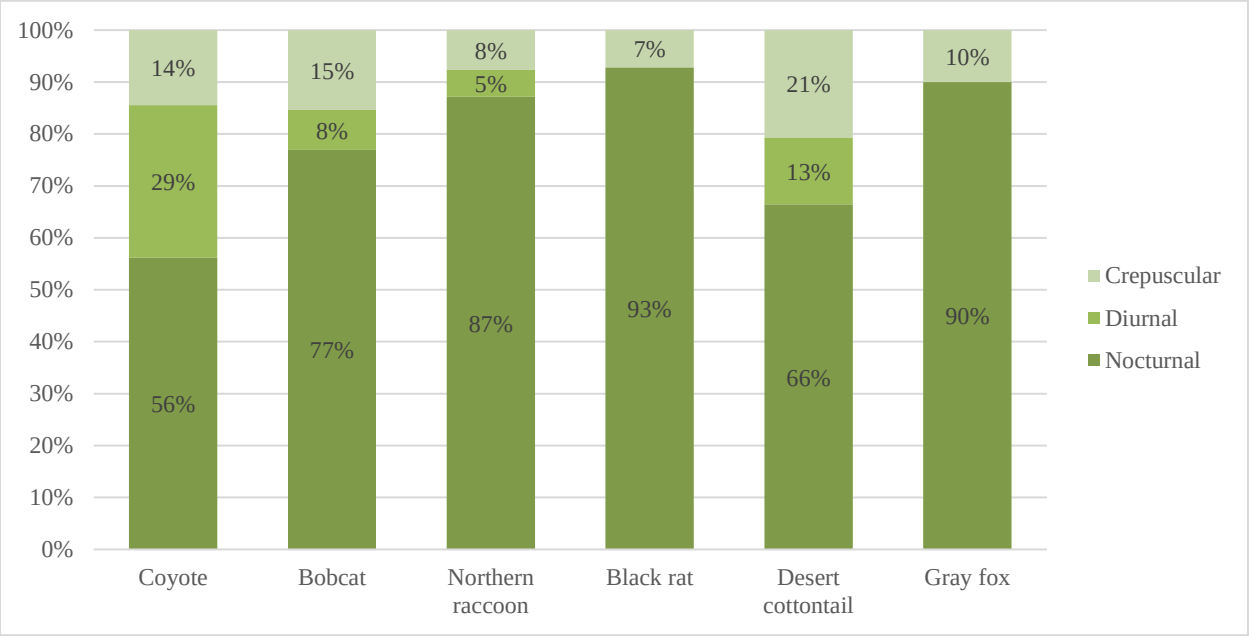

Figure 8. Percentage of crepuscular, diurnal, and nocturnal activity for target species recorded along the Las Vegas Wash.

An additional 131 videos recorded of non-target species were analyzed during the study (Table 6). These species ranged from small rodents to bats to birds. Non-target species with the highest number of captures were Gambel's quail (n=52) and greater roadrunner (n=55). Of all non-target species videos, only 18 captures were unidentifiable. These species were unidentifiable because they were not fully in the frame, were hidden by objects, or moved too quickly out of the frame.

Non-target Species	Spring	Summer	Fall	Winter	Total
Desert pocket mouse	1	-	-	-	**1**
Desert woodrat	1	-	1	-	**2**
Long-tailed pocket mouse	1	-	-	-	**1**
Merriam's kangaroo rat	1	-	-	-	**1**
White-tailed antelope squirrel	-	1	-	-	**1**
Gambel's quail	15	11	6	20	**52**
Greater roadrunner	10	8	33	4	**55**
Other	4	12	2	-	**18**
Total	**33**	**32**	**42**	**24**	**131**

Table 6. Total number of non-target species captured by season at the Las Vegas Wash.

4.0 DISCUSSION

The first detailed account of large and medium sized mammals occurring along the Wash since the 1970s was completed in 2011 and throughout the past eight years the Wash has undergone significant changes. The construction of nine erosion control structures was completed during this time. Completing these weirs required heavy machinery, increased foot traffic by construction crews, destruction and subsequent restoration of habitats, and changes in flows of the Wash. Completing a second iteration of this study was critical to determine if these changes have had any impacts on species.

Results from the 2009-2011 study suggested focusing on riparian habitats for future work because all target species were captured at least once in these locations. Four primary sites were selected for the 2018-2019 study based on the results from the previous study. All target species were captured at these primary sites, therefore, focusing efforts on the recommendations helped achieve project goals.

Although Downstream Pabco South was one of the four main sites sampled and one of the largest sections of mature habitat, it captured only 5% of our total captures. This site is located on the south side of the Wash, next to a trailhead, and adjacent to a walking trail. Therefore, increased foot traffic in the area may help explain these results. The site with the highest species diversity was upstream Pabco North. Pabco North and Upstream Three Kids Weir North were the sites with the least amount of captures at 3 and 0, respectively. These results were not unexpected because these locations resembled more desert scrub habitats than riparian habitats. These sites were comprised mostly of quailbush, mesquite trees, and creosote bushes. Although mesquite trees can produce some shade, neither of these sites had any large mature trees.

Figure 9. Photo taken of a pack of coyotes at the Las Vegas Wash.

Three species documented in the previous study at the Wash were not captured during this iteration: striped skunk, western spotted skunk, and ring-tailed cat. All three of these species were documented at the Cottonwood Cell and only represented 10 of the total 210 unique captures (Eckberg and Foster 2011). The Cottonwood Cell has seen significant changes over the past few years, which may help explain these results. The expansion of the weir adjacent to this site may have impacted these species and potentially forced them elsewhere. Additionally, during the 2018-2019 study, this location yielded several videos of coyote packs (3-4 individuals) in the area that were not identified in the previous study (Figure 9). Coyotes are known to prey on these species, and their increasing presence may be another factor in why the species were not documented along the Wash. Bait was not used during the 2018-2019 study, which may also help explain results. In addition, these species were documented so scarcely in the prior study that there is the possibility they are still in the area and were simply not captured on

video. Cameras may have been placed in different locations within sites from the previous study and this may also have impacted results.

Figure 10. Photo taken of a kit fox.

In addition to those species previously identified by Eckberg and Foster (2011), Bradley and Niles (1973) identified four other species that were not captured during this iteration: bighorn sheep, kit fox, muskrat, and badger. However, during the study period but during other work, photos were taken of a kit fox in a restoration area located just south of the Upstream Historic Lateral North site (Figure 10). Therefore, although no videos of this species were captured during the study, the images confirm that this species still utilizes the Wash. Similarly, there has been at least one visual encounter of muskrat at the Wash (Huening pers. comm.) despite there being no captures during this study. Also, more than a decade ago, two bighorn sheep were observed in a riparian site at the Rainbow Gardens Weir (Perkins pers. comm.). The site was adjacent to rocky cliffs, the preferred habitat of the species, but was removed in 2015 to improve stabilization and hydrology in the area. Prior to that, the only documentation of bighorn sheep along the Wash was in desert scrub habitat (Bradley and Niles 1973). Wash riparian areas currently have little to no suitable habitat for bighorn sheep. For stabilization, most steep banks and rocky slopes have been laid back to create a more gentle gradient. Badgers were also previously reported just in desert scrub habitat (Bradley and Niles 1973). There have been more recent reports of badger activity near the Nature Center at the Wetlands Park, but this area has heavy foot-traffic, so cameras were not set here to avoid potential vandalism.

In recent years, black rats have been documented in increasing numbers along the Wash. Urban expansion in the Las Vegas Valley has resulted in neighborhoods being built adjacent to the Wash, driving this species to expand its range into the area. This species was not documented during the 2009-2011 study. Although black rat droppings are only found in large amounts at the Wash during the summer months, the results show this species utilizes the Wash during winter and spring as well (captures declined substantially in the fall). Black rats are known to carry disease pathogens that can be transferred and harmful to humans (Banks and Hughes 2012). This species has been documented stealing bird eggs from nests and eating lizards, and it has been responsible for the decline of a number of native and endemic species (Banks and Hughes 2012, Banks and Smith 2015, Shiels et al. 2014). As the species is known to have negative impacts on both humans and the environment, it is crucial to understand where and when this species uses the Wash. Future efforts may want to determine population size of this species especially as urban growth continues adjacent to the Wetlands Park. Such information could be useful in developing a plan to control or eradicate the species from the study area.

For the first time during the mammal camera trap studies, bobcat and gray fox were recorded at the Wash. Both species had been previously documented during the Bradley and Niles (1973) study and bobcat was observed during other work in 2007 (Shanahan et al. 2008), but this

represents the first quantitative data. Gray foxes were documented at three of the primary sites but were most prevalent at the Downstream Pabco South site. There was documentation of two gray foxes recorded in one video during the study. Although the population size is unknown, there are clearly multiple individuals. Bobcat activity was documented at three of the four primary sites at the Wash, as well. Cottonwood Cell_Site 111 recorded 8 of the 11 captures. Although there are multiple videos of this species, it cannot be said with certainty that there is more than one individual utilizing the Wash. Bobcats are territorial and largely solitary, which may be why there are no videos of more than one individual (Sanders 1988). Bobcat territories can vary in size depending on habitat quality and food availability. Bobcats mostly prey on rabbits, and two of the three sites where this species was documented were the same sites at which desert cottontails were most abundant. Nocturnal activity accounted for 77% of video captures for this species.

Completing a second iteration of this study at the Wash has been valuable in understanding if the changes the Wash has experienced over the years have had any impacts on mammals. Although there were some species that were not documented during this study that had been previously known to utilize the Wash, there were also new species recorded. The species that were not recorded during this iteration may indicate changes in habitat, changes in predator abundance, changes in food availability, and/or impacts caused by construction of weirs. The Wash has also seen increased foot and bike traffic that may have contributed to driving these species elsewhere.

5.0 RECOMMENDATIONS

It is recommended that a third iteration of this study be completed in the next 5-10 years. The final weir was completed in the fall of 2018 eliminating major construction. Allowing the habitats to mature may encourage these species to reinhabit the Wash. Future work should continue to focus on riparian habitats, but a small amount of effort should be placed on desert scrub habitats in hopes of capturing videos of kit foxes. Understanding more about the population size of black rats will be crucial as we continue to see urban expansion in the Valley, and therefore, efforts should continue to be put into island sites because Bostick Island recorded the largest number of black rats during the study. Information on this species has been provided to landowners so that they can make management decisions. Upstream Pabco North was the most diverse site capturing all species except black-tailed jackrabbit. This location is adjacent to the Wash and adjacent to a recently cleared site that is scheduled to be replanted in 2020. These restoration efforts will expand this site and hopefully encouraged continued use by all species. It is recommended that at a minimum future work should include the four main sites used during this iteration but encouraged to add additional island and desert scrub sites. Restoring previously cleared areas should continue to provide additional habitat and connected habitat for these species. It is recommended that when possible riparian trees, like cottonwood trees and willow trees should be planted providing more ideal habitat for species at the Wash.

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