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Survey of Potential Predators of the Endangered Amargosa Vole (*Microtus californicus scirpensis*)

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***Abstract*.—As part of a comprehensive program assessing threats to the persistence of the endangered Amargosa Voles (*Microtus californicus scirpensis*) in the Mojave Desert of California, we used point counts, owl call surveys, camera-trapping, and scat transects to investigate diversity and activity of potential predators near Tecopa, California, USA. Of 31 predator species within the critical habitat of the vole, the most commonly detected were Coyotes (*Canis latrans*), Domestic Dogs (*C. lupus familiaris*), and Great Blue Herons (*Ardea herodias*). Predator species richness and detections were highest in the northern part of the study site where voles are more abundant. Predator detections were most common in the fall. We observed vole remains in 3.9 % of scat or pellet samples from Coyotes, Bobcats (*Lynx rufus*), and Great-horned Owls (*Bubo virginianus*). These data can support management activities and provide needed baseline information for assessment of the impact of predators on Amargosa Voles, including whether over-predation is limiting recovery and whether predators regulate this species.**

Key Words.—endangered species; Mojave Desert; population regulation; species richness.

Introduction

Predators can regulate prey populations (Korpimaki et al. 2002; Banks et al. 2004), limit prey dispersal and patch colonization (Nie and Liu 2005; Smith and Batzli 2006) and restrict prey species to sub-optimal patches (Fey et al. 2006; Eccard et al. 2008). Overharvest of endangered prey species by predators may reduce prey population viability (Hartt and Haefner 1995), particularly when predator numbers are maintained by common prey species that are sympatric with endangered prey. The Amargosa Vole (*Microtus californicus scirpensis*) is a Mojave Desert rodent that is federally listed as endangered and has one of the narrowest niche breadths of any North American mammal (U.S. Fish and Wildlife Service [USFWS] 1997). Limited, fragmented, and lost habitat, low genetic diversity, predation, and disease all impact Amargosa Vole persistence (USFWS 1997; Ott-Conn et al. 2014).

Fewer than 500 individuals exist, occupying approximately 36 marsh patches near Tecopa, Inyo County, California (Cudworth and Koprowski 2010; Janet Foley et al., unpubl. report). Survival rates as low as 0.35 individuals/month were inferred to be caused at least partly by predation (Klinger et al. 2015). With low survival rates and high variability in population growth rates, population viability analysis predicted unacceptably high risks of extinction within 20–24 y (Foley and Foley 2016). Importantly, impacts of predators on voles could be enhanced by abundance of sympatric prey species. The Recovery Plan for Amargosa Voles (USFWS 1997) lists the study of predation on Amargosa Voles as an important task. The primary objective of our research was to inventory potential predators of the Amargosa Vole by species and guild. We also explored data for temporal trends, geographical distributions, and habitat associations in predator detections.

Methods

***Study site*.**—We conducted this study near Tecopa in the Mojave Desert in southeastern Inyo County, California. The climate is characterized by wide daily and annual fluctuations in temperature, from a mean winter low of 3.2° C to a mean summer high of 41.0° C (www.ncdc.noaa.gov). The region experiences low and variable precipitation with mean annual rainfall of 12.3 cm. Amargosa Voles are almost completely dependent on Olney's Threesquare Bulrush (*Schoenoplectus americanus*) for food and cover (Klinger et al. 2015). Additional common plant species include rushes (*Juncus* spp.), Common Reed (*Phragmites australis*), cattail (*Typha* sp.), Salt Grass (*Distichlis spicata*), Yerba Mansa (*Anemopsis californica*), Boraxweed (*Nitrophila occidentalis*), Slender Arrowgrass (*Triglochin concinna*), Alkali Sacaton (*Sporobolus airodes*), mesquite (*Prosopis* spp.), and other wetland and desert plants (Rado and Rowlands 1984).

Marshes inhabited by voles tend to be patchy, fed by springs and surface flow, and from 290–420 m in elevation (Janet Foley et al., unpubl. report). There are approximately 40 marsh patches in the Tecopa region and three in Shoshone. For this study, we surveyed in and near marshes with and without Amargosa Voles, in

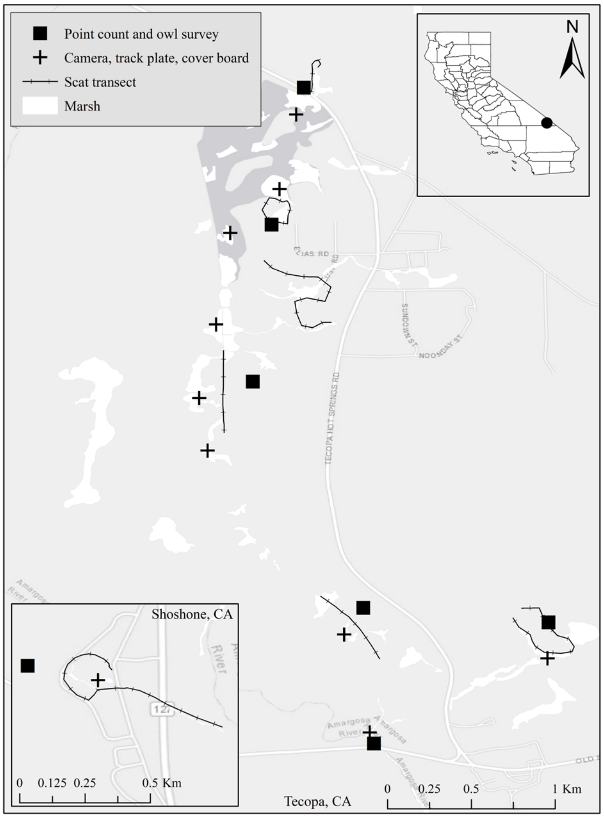

Figure 1. Locations near Tecopa and Shoshone, Inyo County, California, where surveys for predators of Amargosa Vole (*Microtus californicus scirpensis*) were conducted using point counts, owl call surveys, camera traps, and cover boards.

three different elevation zones (playa to the west, canyon south of the Old Spanish Trail, and in the Tecopa Hills on the east side of the site), and along an array from north to south (Shoshone, north Tecopa, south Tecopa separated at a natural break among marshes; Fig. 1). Each survey method (e.g., cameras, point counts, etc.) was conducted with a different spatial focus as described below. Sites with and without voles were included to evaluate whether voles might be an attractant for certain types of predators, or conversely, if certain predator assemblages affected vole presence. The elevation zones were chosen because of similarities within zone in vegetation community and hydrogeology. Playa areas tended to be very flat, and marshes in the playa were surrounded by alkaline playa dirt with very little vegetation cover. Hills housed the sources of most local warm springs and marshes in this zone were surrounded by moderately more diverse vegetation, while towards the canyon, the Amargosa River comes above ground, vegetation is progressively more diverse, and patches between marsh are characterized by saltbush scrub (Barbour et al. 2007).

Field methods.—We collected data on potential predators of voles between October 2013 and December 2014. We obtained data on vole presence from complementary live-trapping and sign survey studies (Deana Clifford et al., unpubl. report). Because our goal was to identify as many different predator species in the range of Amargosa Voles as possible, we implemented camera-trapping, cover boards, point counts, callback surveys, and scat surveys, and recorded incidental observations. Stations for each of these survey techniques differed: (1) we performed callbacks and point counts on hilltops to maximize hearing and viewing of predators at multiple nearby marshes, (2) camera-trapping within marsh patches, and (3) scat surveys along inter-marsh transects (Fig. 1).

For camera trapping, we chose nine marshes that were evenly spaced over the range of Amargosa Voles and accessible from a road in Tecopa (Fig. 1), and a tenth marsh that was in the type locality for the Amargosa Vole in Shoshone, California, and was undergoing restoration for future vole reintroduction. At each site, we deployed 2-3 RC Covert or PC900 HyperFire (Reconyx, Holmen, Wisconsin, USA) cameras if a marsh was < 0.5 ha or 4–5 cameras in marshes > 0.5 ha, for a total of 36 cameras. Where signs of Amargosa Voles were absent at a marsh, we baited cameras with predator lure (Carmin's Canine Call, New Milford, Pennsylvania, USA, and Caven's Terminator Bait, Pennock, Minnesota, USA) to increase sensitivity, but we did not bait cameras in vole-occupied marshes so as not to increase predation on voles. We mounted cameras to U-posts using bailing wire and placed them along the marsh periphery near game trails or predator scat. We trimmed vegetation as needed to minimize false triggers, and programmed cameras to take five photographs at a time, with no delay between the next set of images if the camera was triggered. Cameras were active for 13 mo starting November 2013. We downloaded camera data monthly, although occasionally memory cards filled in less than a month. Skilled personnel (ADR, ANR) recorded date, time, and species of predators from images. Each of the 10 trapped marshes also received two 1-m^2 cover boards under which snakes and lizards were expected to hide (Grant et al. 1992), which we checked once per month.

We performed predator point counts at seven high vantage points from which we could see and hear predators in the same marshes assessed by cameras, as well as 30 additional marshes and playa between marshes. We surveyed the marshes and playa for diurnal and crepuscular species with binoculars one day per month, three times each day (dawn, mid-day, and dusk) for 15 min. At these same point count locations, we also conducted monthly 15-min callback surveys beginning approximately one hour after dusk, using recorded calls of the three most common owl species (Leonard Warren, personal communication): Great-horned Owl (*Bubo virginianus*), Long-eared Owl (*Asio otus*), and Barn Owl (*Tyto alba*). Although calls could attract predators, the duration of the survey was very short and we thought it unlikely to represent a risk to voles.

Lastly, we conducted monthly scat surveys beneath roost sites in trees and power-lines and along seven

200–700 m long transects located proximally to camera-trapping sites (Fig. 1). We recorded numbers of scat, removing samples from transects to avoid duplicate observations in subsequent surveys. Owl pellets were tentatively attributed to species based on repeated observations of a single owl species at the roost site. We identified the species of scat using a field guide (Elbroch 2003). When rodent bones were present, we disinfected the material in mild bleach solution, and identified bones to the lowest taxonomic level possible (Lawlor 1979; Jones and Manning 1992).

***Analysis*.**—We maintained data in Excel and analyzed them with the statistical program R (http://www.r-project.org). We used Sanderson's AllPictures Method to differentiate repeated camera shots of the same predator individual from differing individuals (Sanderson and Harris 2013). We inferred statistical significance at $P \leq 0.05$. We compiled a comprehensive list of vole predators from all assays and reported numbers of observations by point counts, camera-trapping, and incidental observation grouped into the following guilds: aerial hunters, pursuit hunters, waders, and non-native (Table 1). Summary statistics of point counts and camera data included species richness (S) and number of records by guild for north vs. south marshes, and whether the marsh was in the Amargosa Canyon, hills, or desert playa. We examined differences in S by region (hills, playa, or canyon) using ANOVA and by district (north or south) with a Student's *t*-test.

Because of bias due to some marshes having baited cameras, we did not perform spatial statistical analyses for predators. We did compile data from marshes with and without bait to perform temporal statistical summaries. We used a Mann-Whitney U test to assess whether baited and unbaited marshes differed in median detections per marsh. We evaluated whether the number of what we considered independent camera detections (i.e., occurring at least 120 min apart) of all predator species combined and of the most common species differed seasonally (winter: December-February, spring: March-May, summer: June-August, fall: October-November), and between night (between sunset and sunrise) and day (between sunrise and sunset) using Poisson regression. We calculated prevalence of vole remains in predator scat and pellets (number of scats or pellets with vole remains/ number total number of scats or pellets examined) using the prop.test function in R, and inferred statistical differences in prevalence among the three predator species whose scat or pellets contained vole bones using a Chi-square test.

Results

We recorded 31 predator species observed over the course of this study (Table 1). The most commonly detected were Common Ravens (*Corvus corax*), Northern Harriers (*Circus cyaneus*), Great Blue Herons (*Ardea herodias*), Great Egrets (*Ardea alba*), Coyotes (*Canis latrans*), Bobcats (*Lynx rufus*), and Dogs (*Canis lupus familiaris*). Incidental observations of Long-eared Owls, Greater Roadrunners (*Geococcyx californianus*), California Kingsnakes (*Lampropeltis californiae*), Gopher Snakes (*Pituophis catenifer*), a Coachwhip (*Masticophis flagellum*), a Spotted Skunk (*Spilogale gracilis*), and Domestic Cats (*Felis catus*; Table 1) were made. Anecdotally outside the temporal scope of this study, a Desert Kit Fox (*Vulpes macrotis arsipus*) was observed on camera in a marsh occupied by voles. We checked cover boards once per month, resulting in 240 trap nights, but did not detect any predators under cover boards.

Cameras recorded 13,614 camera-trap days across 10 sample marshes, resulting in the detection of 15 predator species (Table 1), including Bobcats, which were not detected through other methods and were only detected at baited camera sites. Of 8,520 images that clearly showed a predator, there were 831 independent events. Overall camera-trap success (number of independent events/number of camera-trap days) was 5.5%. The most frequently observed species on camera was Coyote, occurring in all 10 sampled marshes and at least once within each sample period. Baited cameras (two marshes) yielded 282 total detections and unbaited cameras (eight marshes) yielded 549; however, the average number of detections across periods was significantly higher (1.54) in unbaited compared with baited (1.29) marshes ($t = 2.99$, df = 574, $P = 0.003$).

Overall detections were more common during the day than night ($X^2 = 15.37$, df = 1, $P < 0.001$), with all common species being more active in day except Bobcats (Table 2). Coyotes were active during 24-h periods, with the fewest number of detections between 1400–1500 (n = 8) and the greatest number of detections between 1800–1900 (n = 55). While Bobcats were also active throughout the entire 24-h period, more events were observed during night (n = 77) than day (n = 52). Far more predators were detected on cameras in the playa than in the hills or canyon ($X^2 = 377.1$, df = 2, $P < 0.001$), comprising primarily Coyotes, although notable exceptions were Domestic Dogs and Bobcats found mostly in the hills and common wading birds (Great Blue Herons and Great Egrets) seen in both canyon and playa. Northern marshes also tended to have more predators on camera than southern or Shoshone ($X^2 = 240.9$, df = 2, $P = < 0.001$), with coyotes most commonly detected in northern marshes, but Domestic Dogs were more common in southern marshes and Shoshone, and Bobcats were far more common in southern marshes. Total predator detections varied significantly among seasons (Fig. 2) and was greatest in fall and lowest in winter and spring ($X^2 = 354.4$, df = 3, $P < 0.001$). Coyotes were the most abundant predators in all seasons except spring and were most abundant in fall. Domestic Dogs were absent during summer presumably due to changes

Table 1. Number of detections of predator species grouped by guild, as described in text, near Amargosa Vole (*Microtus californicus scirpensis*) habitat in Shoshone and Tecopa, Inyo County, California, between 2013 and 2014. Methods of observation include point count, camera-trap, and incidental observation.

			Number detected on:		
Guild	Common name	Scientific name	Point count	Camera trap	Incidental observation
Aerial					
	American Kestrel	*Falco sparverius*	9		
	Barn Owl	*Tyto alba*	1	4	
	Cooper's Hawk	*Accipiter cooperii*	1	7	
	Common Raven	*Corvus corax*	246	8	
	Great-horned Owl	*Bubo virginianus*	10	1	
	Long-eared Owl	*Asio otus*			3
	Loggerhead Shrike	*Lanius ludovicianus*	6	2	
	Merlin	*Falco columarius*	2		
	Northern Harrier	*Circus cyaneus*	57	4	
	Osprey	*Pandion haliaetus*	1		
	Prairie Falcon	*Falco mexicanus*	7		
	Red-shouldered Hawk	*Buteo lineatus*	3		
	Red-tailed Hawk	*Buteo jamaicensis*	17	3	
	Turkey Vulture	*Cathartes aura*	4		
Waders					
	American Bittern	*Botaurus lentiginosus*	17	5	
	Black-crowned Night-heron	*Nycticorax nycticorax*	1		
	Great Blue Heron	*Ardea herodias*	56	36	
	Great Egret	*Ardea alba*	49	3	
	Green Heron	*Butorides virescens*	1		
	Snowy Egret	*Egretta thula*	5		
Pursuit					
	Coyote	*Canis latrans*	114	593	
	Greater Roadrunner	*Geococcyx californianus*	2	7	3
	Bobcat	*Lynx rufus*		129	
	Kingsnake	*Lampropeltis getula*			4
	Gopher Snake	*Pituophis catenifer*	1		3
	Coachwhip	*Masticophis flagellum*			1
	Spotted Skunk	*Spilogale gracilis*			1
	Desert kit fox	*Vulpes macrotis*			At least 1 (scat)
Invasive					
	American Bullfrog	*Lithobates catesbeianus*	40	2	
	Domestic Dog	*Canis lupus familiaris*	63	27	
	Domestic Cat	*Felis catus*	4		6
Total			714	831	22

in the behavior of owners, and there was little seasonal change in detections of Bobcats.

Point counts yielded 717 predator observations, with predators documented in 40 marsh patches (Table 1). Coyotes and Common Ravens were present in the greatest number of marshes (n = 18) and were the most frequently detected species overall. Over the course of all sample periods, S per marsh ranged from zero to 29 (Table 3). Average S in northern marshes (8.83 ± 9.4 SD) was higher although not significantly so than in southern marshes (5.0 ± 5.0; t = 1.36, df = 35, P = 0.182, Fig. 3); similarly S across regions was not significantly different ($F_{2,36}$ = 1.006, P = 0.376), with mean S in playa of 7.9 ± 8.5, canyon of 14.5 ± 2.1, and hills of 5.0 ± 7.2 (Fig. 3).

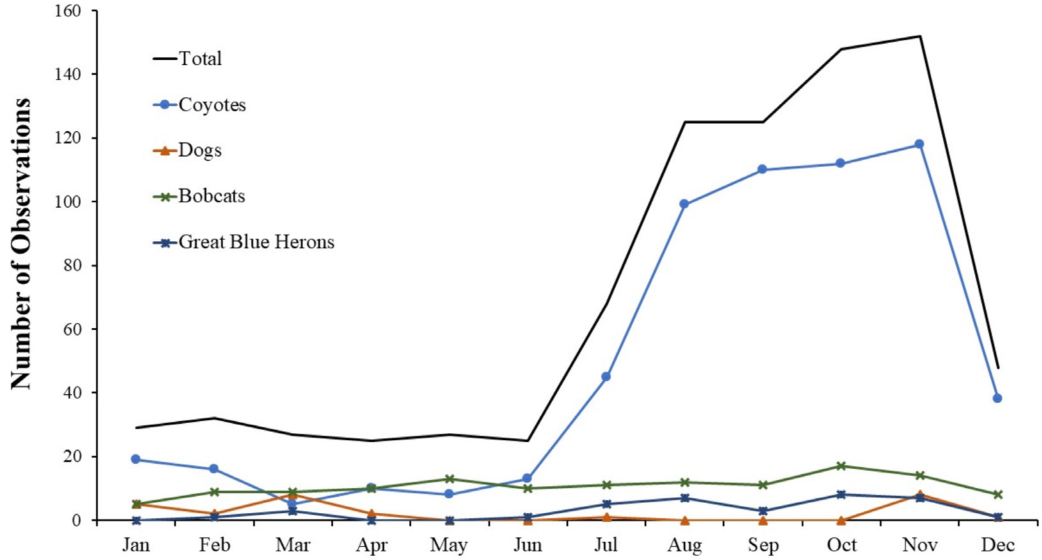

Figure 2. Seasonal patterns (number of independent events captured on camera) of predators of Amargosa Vole (*Microtus californicus scirpensis*) near Tecopa, Inyo County, California, between 2013 and 2014.

Callback surveys yielded 11 observations of Great-horned Owls including six in northern marshes, three in southern marshes, and two in Shoshone. We found 509 predator scat samples in the field, including 285 from Coyotes, 115 from Domestic Dogs, 67 from Bobcats, two from Spotted Skunks, and one from a Desert Kit Fox. We could not identify the rest. We found mammal bones in 219 samples. These scats originated from Coyotes, Domestic Dogs, Domestic Cats, and Bobcats. Thirty-nine owl pellets originated from Long-eared Owls (93.1% of pellets) and Great-horned Owls (6.9% of pellets). Pellets and feces were most abundant in southern marshes (n = 326, 59% of samples recovered), followed by northern marshes (n = 183, 33.4%), and Shoshone (n = 39, 7.1%). There were more scat samples recovered in January (n = 103) and February (n = 101) than all other months, during which we found no more than 53 samples. There were vole remains in one pellet sample, from a Great-horned Owl (3.6%; n = 29), and 18 scat samples from Coyotes (2.9%, n = 285) and Bobcats (17.5%, n = 67). The prevalence in Bobcats was significantly higher than for Coyotes and Great-horned Owls ($X^2 = 16.97$, df = 2, $P = 0.002$).

Discussion

Our survey of predators in the Amargosa River basin reveals a high diversity of 31 species of potential predators of Amargosa Voles, and vole bones in feces from Bobcats and Coyotes and pellets of Great-horned Owls confirm these species as predators. Extensive presence of some wading bird species in bulrush habitat occupied by voles strongly supports their potential as predators of the vole. We show increased predator pressure in autumn, and specific predators occupying differing spatial patches.

Among confirmed vole predators, Bobcats had high prevalence of vole bones within scat but were found only

Table 2. Differences in predator detections, inferred from independent observations on camera-traps near Amargosa Vole (*Microtus californicus scirpensis*) habitat in Shoshone and Tecopa, Inyo County, California, between 2013 and 2014. The most common wading bird species were Great Blue Herons (*Ardea herodias*) and Great Egrets (*Ardea alba*). Descriptions of how day and night, northern and southern, marsh region, and season are differentiated are provided in the text.

	All species combined	Common Raven	Coyotes	Domestic Dogs	Bobcats	Northern Harriers	Common wading birds
Day	472	8	320	27	52	4	39
Night	359	0	273	0	77	0	0
Canyon	46	0	14	0	1	0	22
Hills	282	2	125	22	128	0	0
Playa	503	6	454	5	0	4	17
North marshes	464	2	424	4	0	4	17
South marshes	268	6	118	9	95	0	22
Shoshone	99	0	51	14	34	0	0

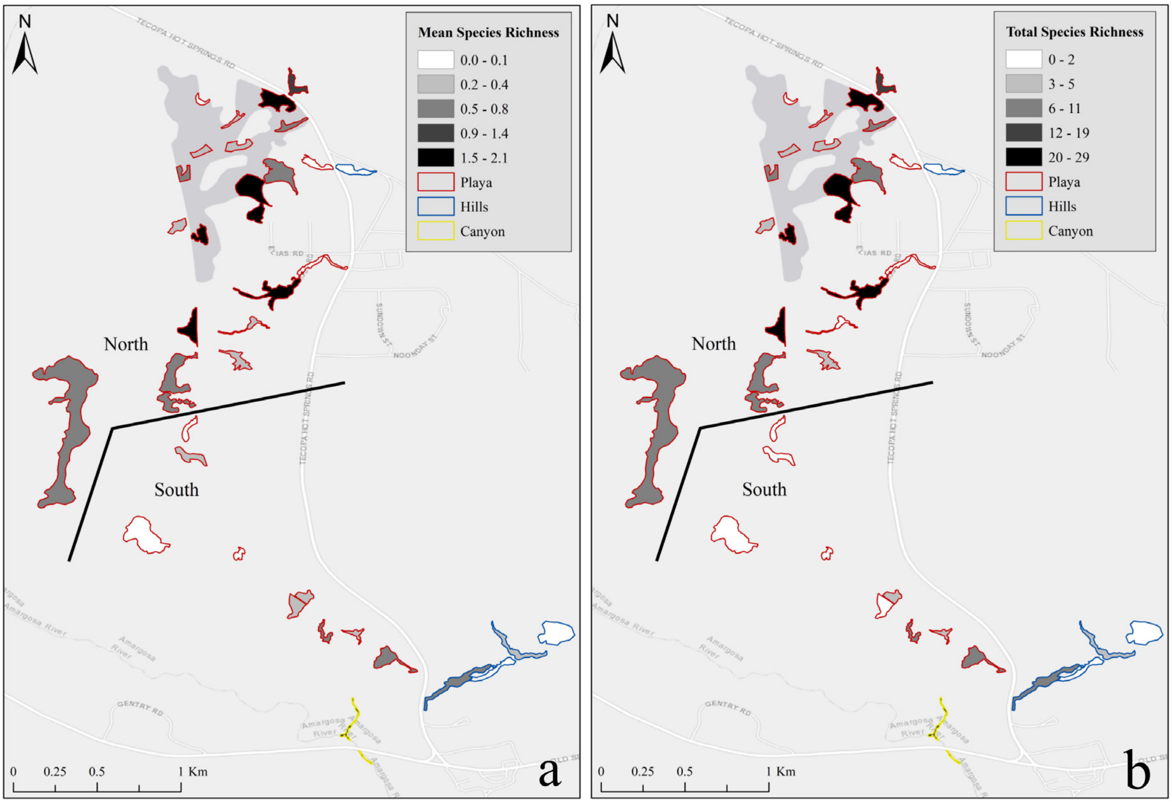

Figure 3. Yearly mean (left panel) and total (right panel) species richness of data collected monthly in marshes classified by region (North or South) and habitat type (Playa, Hills, Canyon) sampled through point count methods. Sampling occurred near Tecopa, Inyo County, California, between 2013 and 2014.

in a few marshes in the hill region. We only detected this reclusive species using baited cameras, and such cameras were only used in southern sites where habitat heterogeneity is greater than in the north. We cannot differentiate a detection bias because of baited cameras or whether Bobcats do not occur in northern marshes we did not bait. The most abundant non-native predator was Domestic Dogs with incidental Domestic Cats, highlighting potential anthropogenic threats to the Amargosa Vole.

Geographical patterns ranged from Shoshone, where habitat is being restored for future vole introduction, with 16 species of predators, including two snake species found only in Shoshone, to Tecopa where predator species richness tended to be higher to the north. Northern marshes tend to be more numerous, larger, and possibly more productive which could allow for coexistence of some species (Brown 1981). Total predator detections were also more numerous in the north. Voles are unlikely to move among northern and southern marshes based on genetic data (Krohn et al. 2017) although most predators we recorded would be able to readily move between northern and southern areas.

Habitat associations reflected different predator preferences as well as risk of predation for voles. Thick bulrush litter as well as tall, dense cover of live bulrush are very important cover for Voles (Klinger et al. 2015). Nevertheless, pursuit predators were abundant, and bulrush litter likely does not completely protect voles from being captured by Coyotes and Bobcats. Predator species richness was higher in the Amargosa River canyon than playa or hills, while total detections were higher in playa marshes than hills or canyon. Predator species richness was likely influenced by habitat heterogeneity, and in this

Table 3. Summary statistics associated with predator observations using point counts (direct observation) near Amargosa Vole (*Microtus californicus scirpensis*) habitat in Shoshone and Tecopa, Inyo County, California, between 2013 and 2014. Species richness is indicated by S: PSA = Predator S for all species, AS = Aerial S, WS = Wading bird S, PS = Pursuit S, IS = Invasive S, and PO = number of point count predator observations of predators. Predator guild, marsh grouping by north and south, region, and presence or absence or voles and bulrush are explained in text.

	Guild of Predator					
Sites	PSA	AS	WS	PS	IS	PO
Northern	19	10	6	1	3	413
Southern	16	9	2	2	3	236
Shoshone	9	5	0	2	2	66
Playa region	20	11	5	1	3	478
Hill region	8	5	0	1	2	174
Canyon region	8	3	1	2	2	63
All marshes	25	13	6	2	3	717

regard both southern sites and those in the canyon have the greatest diversity due to the close juxtaposition of wetland, upland, and edge plant communities. Domestic Dogs were uncommon on playa, which we expected as most homes in the area are in the hills, relatively distant from the playa. Possible spatial differences could also be influenced by intraguild interactions as described previously (Fedriana et al. 2000).

Our study examined daily and seasonal trends in predator detections. Aerial and wader predators were more abundant during the day. Nocturnal pressure from raptors was likely underestimated because of our use of a limited number of calls of owl species, reluctance of some species to call back, and our inability to see most raptors at night. Coyotes were common day and night. The majority of the predators are resident, while migrants such as Long-eared Owls, Osprey (*Pandion haliaetus*), and Black-crowned Night-heron (*Nycticorax nycticorax*), and seasonally active predators such as Gopher Snakes and Coachwhips, were not observed during much of the year. Overall seasonality of predator detections favored the fall (comprising predominantly Coyotes and herons), during the period when vole populations are in the downward phase of their population cycle (Foley and Foley 2016, Janet Foley et al., unpubl. report). It is unlikely that this is a delayed numerical response (given the annual birth pulses and long generation times of most predators) but rather a behavioral response. Predators may be recruited to the area throughout the time of abundant prey due to high birth rates of small mammals in the summer but then remain and even increase into the fall even as prey resources diminish. In addition, predator activity may appear increased if they are more visible because they are spending more time hunting in the face of reduced food.

The question of whether these predators are regulating voles or possibly overharvest voles and diminish population viability is very important for vole conservation. All of the seven most ubiquitous species (Ravens, Coyotes, Domestic Dogs, Great Egrets, Great Blue Herons, Northern Harriers, and Bobcats) are generalists, and we did not detect specialist predators (e.g., weasels, *Mustela* sp.). Among studies examining how microtine populations are influenced by top-down regulatory factors (Korpimaki et al. 2002; Banks et al. 2004), many are done at high latitude and examine voles subject to specialist predators. Instead, the Amargosa Vole occurs at one of the lowest latitudes in which predation on microtines has been studied. Further work would be helpful to clarify specific vole-predator interactions, as incidence, abundance, and proportional frequency of a species are not necessarily indicators of potential impacts. For instance, there was an approximately 700% increase in Common Ravens in the western Mojave Desert from 1969 to 2004 (Boarman and Kristan 2006), with a shift toward individuals becoming permanent residents due to human-provided food, water, and nest sites (Knight et al. 1993; Boarman and Berry 1995). Despite this, and their relatively high frequency in our sampling, we have no evidence that they are a meaningful predator on Amargosa Voles. In contrast, American Bitterns (*Botaurus lentiginosus*) were of moderate frequency in our samples, but this is likely because they are cryptic and less likely to be detected by of our survey methods. Nevertheless, bitterns have disproportionally greater effects on voles than our data would indicate, as we have directly observed bitterns hunting and even capturing voles.

Our study is preliminary and narrow in temporal scope, and our assessment of predator activity is unfortunately not paired with detailed data from the same space and time on vole numbers. The fact that baited cameras were used in the only two marshes where we were confident there were no voles was a bias in that more predators were likely observed because of the bait, precluding us from comparing numbers between marshes with and without bait and (or voles). Some methods, such as scat surveys, which were conducted monthly, may have underestimated predators, although in this highly arid environment, we have observed scat persisting for multiple months. Nevertheless, there is a very large number of potential predators on the Amargosa Vole, some of which may have a strong influence on vole population dynamics and demography, particularly Coyote, Bobcat, American Bittern, Great-blue Heron, Great Egret, Northern Harrier, and owls. Our study provides valuable baseline data for assessing potential top-down influences on Amargosa Voles, in support of earlier writers emphasizing the need for such research to manage this species (USFWS 1997; Leroy McClenaghan and Stephen Montgomery, unpubl. report).

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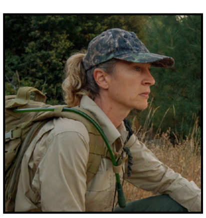

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