Report to New Mexico Department of Game and Fish
Share with Wildlife Program

Investigation of the current distribution of the Northern Leopard Frog (*Rana pipiens*) in New Mexico, 2024

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OBJECTIVES

The objectives of this investigation are to understand the current distribution of the northern leopard frog (*Rana pipiens*) in New Mexico through surveys of recent and historic localities for this species and to collect tissue samples from captured northern leopard frogs and other amphibians to submit for *Batrachochytrium dendrobatidis* (*Bd*) infection analysis.

INTRODUCTION

During the varied history of leopard frog study (1782 to present), there has been considerable evolution in our understanding of the various species and their relationships to one another. At one time, all leopard frogs were considered *Rana pipiens*, which later gave rise to the "*R. pipiens* complex" designation (Hillis et al. 1983). As our understanding increased with new species descriptions based on morphology, call variables, genetics, and habitat uses, the variation in this group of frogs became evident. All "true frogs" are in the family Ranidae and until recently, those in North America were categorized in the genus *Rana*. Frost et al. (2006) proposed generic nomenclatural changes in North American anurans which are not universally accepted within the herpetological community (Pauly et al. 2009). There are currently approximately 27 leopard frog species known in the New World which range from Canada in the north to Panama in the south (Hillis and Wilcox 2005), three of which are believed to be extinct and eight of which have not been described. Five species of leopard frogs are known to be native to New Mexico. These five species represent three separate clades within the *R. pipiens* complex (Hillis and Wilcox 2005); three of the five species have experienced declines in the last 40 years (Christman and Painter 2000, USFWS 2002, USFWS 2011). The lowland leopard frog (*Rana yavapaiensis*) is state listed as endangered and is likely extirpated in New Mexico, as only one observation has been reported in the last 25 years (Christman and Painter 2000). The Chiricahua leopard frog (*R. chiricahuensis*) was listed as threatened under the Endangered Species Act (ESA) and has experienced a >70% decline in populations in Arizona and New Mexico (USFWS 2002). The northern leopard frog (*R. pipiens*) population that occurs west of the Mississippi River was proposed for federal listing; however, a 12-month status review did not recognize differences between the eastern and western populations (USFWS 2011).

Rana pipiens ranges from southern Quebec west to extreme southern Mackenzie District of Canada, south to Pennsylvania and Kentucky in the east, with isolated records in Maryland and West Virginia. It occurs west to the Pacific states; south to Nevada, Arizona, and New Mexico; and throughout the Rocky Mountain states (Degenhardt et al. 1996 and Stebbins 2003). It occurs in a broad array of elevations from near sea level to circa 3050 meters and its habitats include any slow-moving freshwater in grasslands, shrublands, woodlands, and forests (Stebbins 2003).

Rana pipiens is listed as a Species of Greatest Conservation Need (SGCN) in New Mexico (New Mexico Department of Game and Fish [NMDGF] 2016), but this species currently has no legal protection in New Mexico except from commercial collection. *Rana pipiens* is considered vulnerable (S3) in the state of New Mexico by NatureServe (https://www.natureserve.org/). Recently, the Center for Biological Diversity and other environmental groups petitioned the U.S. Fish and Wildlife Service (USFWS) to list the western populations of *R. pipiens* under the

Endangered Species Act, recognizing its vulnerable status in the Southwestern U.S. (Nichols 2006).

Declines have been reported throughout the range of *R. pipiens*, but mostly in the west. These areas include Alberta and British Columbia in Canada and the states of Montana, Idaho, Washington, Oregon, California, and Nevada (Stebbins 2003, Lannoo 2005). In addition, declines have been reported in parts of Utah (Lannoo 2005), Colorado (Corn and Fogelman 1984; Hammerson 1999), Arizona (Clarkson and Rorabaugh 1989), and New Mexico (NMDGF, C. W. Painter and R. D. Jennings *unpubl. data*).

In New Mexico, declines have been reported from the Lower Rio Grande (below Caballo Reservoir), in the Jemez Mountains (Christman *pers. obs.*; Cummer et al. 2002), and in the Chuska Mountains (Painter and Jennings *unpubl. data*). The suggested reasons for *R. pipiens* declines have varied as our understanding of the scope of worldwide declines has increased; amphibian pathogens such as the emerging chytridiomycetes pathogen *Batrachochytrium dendrobatidis* (*Bd*) are more widespread and problematic within amphibian populations than are other threats to these populations. *Bd* is considered an emerging pathogen on a global scale (Daszak et al. 2000) and has been implicated as the primary factor in the declines of amphibians in the Western U.S. (Corn 2003, Fellers et al. 2001), Central America and Australia (Berger et al. 1998), and others. *Bd* was documented in North America (Quebec) as early as 1961 (Ouellet et al. 2005) and in New Mexico as early as 1984 (Christman and Jennings 2018). This pathogen originated in Korea (O'Hanlon et al. 2018) and has been documented on every continent except the South Pole. *Bd* is known from every major river drainage in New Mexico (Christman and Jennings 2018), where there are 12 species of amphibians which have been documented to be infected with *Bd*: two salamanders (Jemez Mountains salamander, *Plethodon neomexicanus*, and barred tiger salamander, *Ambystoma mavortium*) and 10 anurans representing four families (cricket frog, *Acris crepitans*; boreal chorus frog, *Pseudacris maculata*; boreal toad, *Bufo boreas*; southwestern toad, *B. microscaphus*; Woodhouse's toad, *B. woodhousii*; plains leopard frog, *Rana blairi*; American bullfrog, *R. catesbeiana*; Chiricahua leopard frog, *R. chiricahuensis*; and northern leopard frog, *R. pipiens*). Ranid frog species have been the most affected by *Bd* with *R. chiricahuensis* being the most affected (70% or more decline in populations in NM and AZ; USFWS 2002). *Rana catesbeiana*, *R. pipiens,* and *Ambystoma tigrinum* have been implicated as potential carriers or reservoir species of *Bd* (Daszak et al. 2004, Woodhams et al. 2008, and Davidson et al. 2003), a designation which implies that these species are not adversely affected by *Bd.* In fact, there is evidence that suggests that *R. pipiens* is susceptible to *Bd* (Voordouw 2010). There are other amphibian species in New Mexico which test positive for *Bd* but appear to persist on a population level (*Acris crepitans* and *Pseudacris maculata*; Christman and Jennings 2018). However, we do not have sufficient data to suggest that those species are unaffected. *Rana catesbeiana* has not shown evidence of *Bd*-related declines despite evidence of infection across their native and introduced ranges. Declines in *R. pipiens* in western Canada and the United States were significant enough to warrant a full status review by the USFWS, but a 12-month finding found listing to not be warranted (USFWS 2011). Mock and O'Donnel (2016) suggest that genetic differences between western and eastern populations may affect the differences in *Bd* infection rates and susceptibility observed in these two populations.

Bullfrogs (*R. catesbeiana*) are a non-native invasive species in New Mexico and have been implicated in the decline of native ranid frogs and other riparian obligate herpetofauna in the west (Hammerson 1982, Hayes and Jennings 1986, Schwalbe and Rosen 1988). Bullfrogs may impact other frog species through intense predation, predatory or competitive larval interactions, and the transmission of parasites or pathogens (Hammerson 1999, Garner et al. 2006). However, native frogs have declined in the absence of bullfrogs (Corn and Fogleman 1984, Christman *pers. obs.*), and bullfrogs are just one factor associated with declines of native frog species. Bullfrogs in New Mexico nevertheless are an invasive species in the state and considered undesirable.

METHODS

Locality Data

Locality data used to determine historic sites (Appendix 1) were obtained from the Museum of Southwest Biology at the University of New Mexico and from earlier U.S. museum inquiries conducted by Dr. Randy Jennings during prior leopard frog investigations. Data collected during this investigation involved the use of 1:100,000 scale Bureau of Land Management (BLM) maps, 7.5 min United States Geological Service (USGS) quad maps, and a Garmin eTrex Global Position Satellite (GPS) unit set to North American Datum 1983 (NAD 83) and collected in Universal Transverse Mercator (UTM) coordinates in zone 12 or 13. Maps for the final report were created using the free and open source QGIS (https://qgis.org/).

Surveys

Amphibians were surveyed in aquatic habitats following USFWS survey protocols for Chiricahua leopard frogs (USFWS 2003). Surveys involved walking the perimeter of stock tank and stream habitats watching for jumping frogs (plop counts), listening for calls, and dip-netting under banks and in vegetation for adult and larval amphibians. Binoculars were used to observe frogs at a distance. Temperature data were collected at aquatic habitats surveyed. Temperature data were collected using a thermometer (appropriate for air or water).

Sites where tadpoles were observed are considered breeding localities. Distinct localities were generally defined as being more than a mile distant from one another or otherwise geographically separated.

Chytrid Fungus (*Bd*) Investigations

This portion of this investigation was focused on identifying the presence of *Bd* in *R. pipiens* or other amphibians at surveyed sites. All leopard frogs that could be captured were swabbed for *Bd* testing. Tissue samples were collected by swabbing the ventral skin surface of the body and thighs of frogs with sterile wooden cotton swabs. The end of the wooden swab was then cut off and placed into a vial with 70% ethanol and labeled with date, locality, and species for later reference. Samples were pooled at each locality where two or more amphibians of a species were captured. Tissue samples were then sent to Pisces Molecular in Boulder, Colorado for *Bd* testing using genetic PCR techniques developed for this purpose (Annis et al. 2004). Each frog for which a skin swab was collected was weighed, measured, and sexed. Each frog was handled

using new nitrile gloves (discarded after handling each frog) and clean bags to prevent contamination between samples.

Collections
Specimens were collected at sites with populations with 20 or more frogs and 100 tadpoles (not exceeding two adults or five tadpoles per site) to provide voucher specimens for future research, and genetic samples were collected at each site (not exceeding 20 samples per site). Adult amphibian and reptile specimens were preserved in 10% formalin and larval amphibian specimens were preserved in 5% formalin. A tissue sample was collected from each voucher specimen prior to being fixed in formalin. All amphibian and reptile specimens were deposited at the Museum of Southwestern Biology (MSB) at the University of New Mexico in Albuquerque, New Mexico.

Permits
Investigations and collections were conducted under the appropriate state permit (NMDGF Scientific Collecting Permit 2969). Permits were granted by the Gila, Cibola, Santa Fe, and Carson National Forests; Bureau of Land Management (Taos and Farmington Districts); New Mexico State Parks (Coyote Creek, Eagle Lake, Cimarron Canyon); the Navajo Nation; Sevilleta, Bosque del Apache, Rio Mora, and Maxwell National Wildlife Refuges; and the Middle Rio Grande Conservancy District (MRGCD). In addition, permissions were granted to survey private lands on three private ranches, and two private properties.

RESULTS

Historic vs. Current Distribution
There are approximately 382 museum records for *R. pipiens* from New Mexico housed at 25 museums. Of those 382 records, approximately 235 historic localities can be identified. A review of museum records (Appendix 1, Appendix 2), 2009–2010 data (Appendix 4), and unconfirmed reports indicated that there are several areas where *R. pipiens* likely remain extant. These areas include the San Juan River below Navajo Dam (San Juan Co.), in the Chama area (Rio Arriba Co.), the Mora area (Mora Co.), and north to a private ranch (Colfax Co.). Other areas include downstream of Cochiti Reservoir (Sandoval Co.) on the Rio Grande to at least Corrales and Sandia Pueblo. This last area is governed by a patchwork of tribal and private entities.

During 2023, we conducted 81 surveys in 10 counties (Bernalillo, Catron, Colfax, McKinley, Mora, Sandoval, San Juan, San Miguel, Santa Fe, and Socorro) representing ~62 localities. *Rana pipiens* were found at 15 of those sites (Appendix 3). Forty of the 81 sites surveyed were previously surveyed in 2009–2010. Eight of those 40 sites still had *R. pipiens* (Table 1). In 2023, five of those 40 sites surveyed in 2009-2010 (two stock tanks in Van Bremmer Canyon, two sites along Van Bremmer Creek and one on Cerrososos Creek on a private ranch in Colfax County) were dry and one site had been severely affected by the 2022 Calf Creek Fire on the east slopes of the Sangre de Cristo Mountains (specifically, Manuelitas Creek on private property in San Miguel County), which potentially accounts for the loss of those populations. Twenty-three of the 81 sites surveyed in 2023 were historic (pre-2009) sites; *R. pipiens* were present at three

historic sites: Sapello River (private property), Coyote Creek State Park, and Cimarroncito Reservoir (private ranch).

During the 2024 effort, we conducted 184 surveys in 11 counties (Bernalillo, Catron, Cibola, Colfax, Mora, Mc Kinley, Rio Arriba, Sandoval and San Juan), representing ~81 sites and found *R. pipiens* during 14 surveys at seven sites (Appendix 3). Twenty-two of the 184 surveys conducted were at sites previously surveyed in 2009–2010; five of those 22 sites still had *R. pipiens* present (Table 2). In 2009–2010, 21 of the same 22 sites had *R. pipiens.*

Table 1. Summary of *Rana pipiens* surveys conducted in 2023. # positive = *R. pipiens* present in 2023.

	# of Sites surveyed (# positive, %)	# of Localities (# pos., %)
Historic (pre-2009)	23 (3, 13%)	17 (3, 18%)
2009–2010	26 (8, 31%)	32 (8, 25%)
New	32 (4, 13%)	31 (4, 13%)
Totals	**81 (15, 19%)**	**70 (15, 21%)**

Table 2. Summary of *Rana pipiens* surveys conducted in 2024. # positive = *R. pipiens* present in 2024.

	# of Sites surveyed (# positive, %)	# of Localities (# pos., %)
Historic (pre-2009)	26 (8, 31%)	16 (3, 18%)
2009–2010	22 (11, 50%)	16 (5, 31%)
New	136 (4, 3%)	49 (3, 6%)
Totals	**184 (14, 8%)**	**81 (7, 9%)**

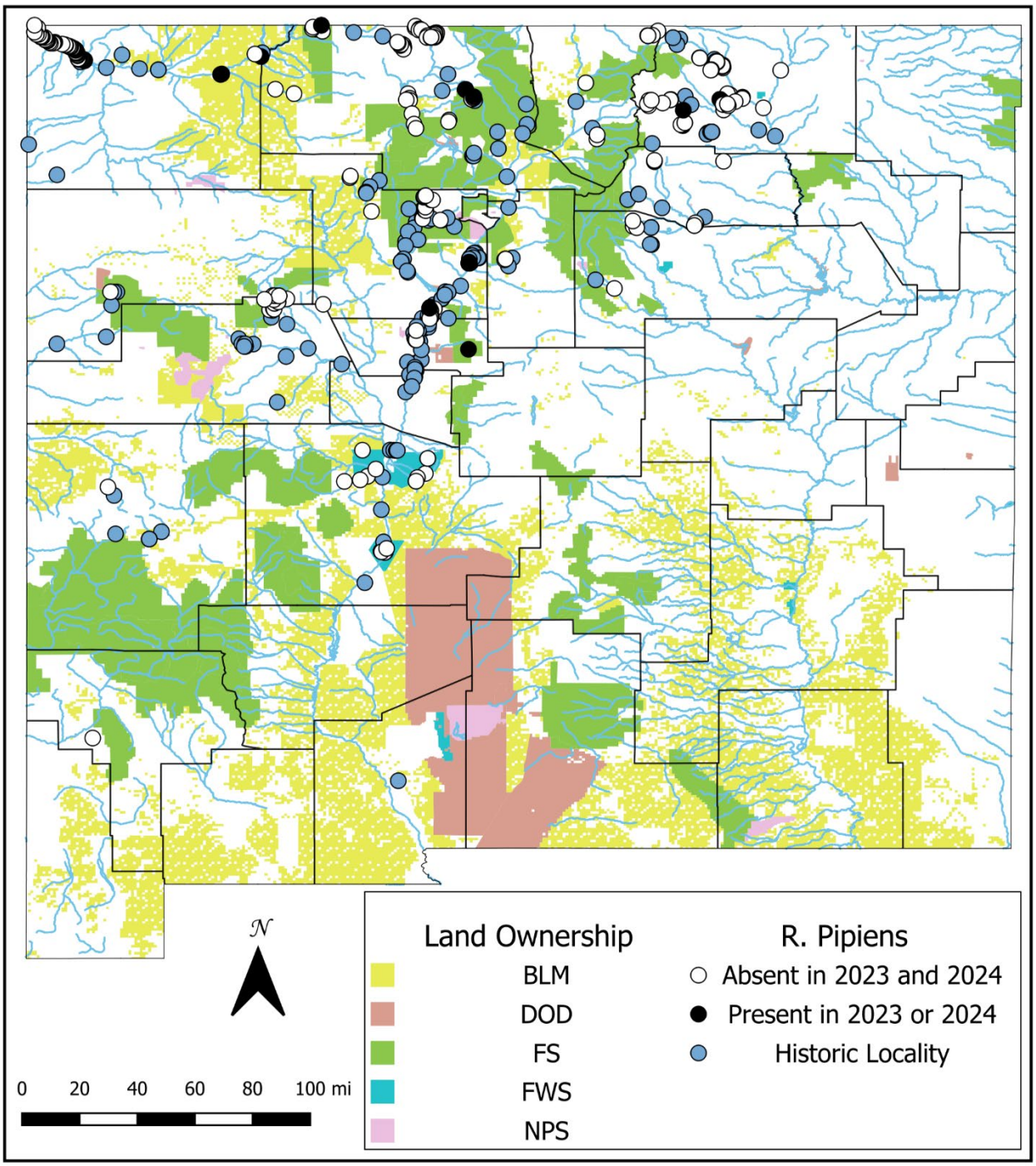

Figure 1. Map of *Rana pipiens* distribution. Open dot: Locality at which *R. pipiens* were absent in 2023 and in 2024. Black dot: Localities at which *R. pipiens* were present in 2023 and/or 2024. Blue dot: Locality surveyed prior to 2009 at which *R. pipiens* were not detected in either 2023 or 2024.

Tribal lands
We conducted surveys on the Navajo Nation along 37 river miles of the San Juan River from Shiprock Bridge to Four Corners Bridge and at sites on Sandia Pueblo adjacent to the Rio Grande (Figure 2). We found *R. pipiens* present on the San Juan River within 2 miles of Shiprock Bridge but not further downstream (n=3) and on Sandia Pueblo at two sites (n=2).

Figure 2. Side channel leopard frog habitat, San Juan River.

National Forest Lands
We conducted surveys on four U.S. Forest Service National Forests (NF) during this effort: Carson, Cibola, Gila, and Santa Fe. We found *R. pipiens* at two sites on the Jemez district of the Santa Fe NF at San Antonio Creek and Redondo Creek. These two observations on the Santa Fe NF are believed to represent dispersing juvenile frogs coming from populations on the Valles Caldera National Preserve. We also surveyed Rio Grande del Rancho on the Taos District of the Carson NF where *R. pipiens* were observed in 2010, but we did not detect them in 2023.

During surveys on the Carson NF, we detected *R. pipiens* at Trout Lakes (Figure 3) and Canjilon Lakes. Interestingly, Campbell and Degenhardt (1971) described *R. pipiens* as abundant in Lower Canjilon Lakes to the point of detriment to *Bufo boreas* meaning the numbers of leopard frogs were significant and possibly exerted a negative impact on the toads. The area surrounding Trout and Canjilon Lakes may represent the best metapopulation of *R. pipiens* currently in the state.

Surveys at Largo Creek above Quemado Lake in the Gila NF and in the Mount Taylor District of the Cibola NF did not detect *R. pipiens*. Largo Creek was dry, as were two tanks in the Mount Taylor District. One *R. pipiens* was observed at a tank in 2009 but none were observed in 2023 nor in 2024. There are several historic localities in this area, but we were not able to detect *R. pipiens* at any of those sites in 2023 or 2024.

Figure 3. *Rana pipiens* captured at Trout Lakes in 2024.

Bureau of Land Management

We surveyed sites on the Santa Fe and Chama Rivers located on lands managed by the Bureau of Land Management (BLM). We did not detect *R. pipiens* on either river, but we did detect

bullfrogs (n=7) on the Santa Fe River and Woodhouse's toad tadpoles at the confluence of the Cebolla and Chama Rivers. One of the two bullfrogs that we captured on the Santa Fe River was positive for *Bd*. In 2024, we surveyed sites on BLM along the San Juan River just west of Blanco and detected *R. pipiens* (n=3).

State Parks

Coyote Creek State Park was the only state park surveyed in 2023; *R. pipiens* and *P. maculata* were detected here (n=3). *Rana pipiens* was detected here in 2009 and tested positive for *Bd* at that time. Both northern leopard frogs and *Bd* appear to have persisted at this site since 2009. We also detected common snapping turtle (*Chelydra serpentina*; n=2) and wandering gartersnake (*Thamnophis elegans*) at Coyote Creek. We surveyed sites around Eagle Nest Lake and Cimmaron Canyon in 2024 but did not detect *R. pipiens* at those sites.

NMDGF State Wildlife Areas

Upper Charette Lake at Charette Lakes State Wildlife Area was surveyed in 2023. This was a positive site for *R. pipiens* in 2010, but Upper Charette Lake has dried up in recent years. We surveyed Sargent and Humphries State Wildlife Areas in 2024 but did not detect *R. pipiens*. Both areas had at least one pond with *R. pipiens* present in 2009-2010.

Middle Rio Grande

We conducted surveys in 2024 in the Peña Blanca and Albuquerque reaches of the Rio Grande. We found *R. pipiens* at Peña Blanca (n=7) and on the Rio Grande at Sandia Pueblo (n=2) (Figure 4). Reports of *R. pipiens* at a nursery in Corrales in 2022 and 2023 were verified by photos (A. Lamb, *pers. comm.*).

Figure 4. *Rana pipiens* in the Middle Rio Grande.

Chama Area West of Continental Divide

During boreal toad surveys in 2023 and 2024 at Trout Lakes, *R. pipiens* were observed (L. Pierce NMDGF *pers. comm*.) and follow-up surveys found them present in upper and lower lakes. We also detected *R. pipiens* at Canjilon Lakes (n=5), where they were not detected in 2006 (Christman 2006).

San Juan River Basin

We surveyed the wetland habitat below Navajo Dam adjacent to the San Juan River and found *R. pipiens* to be relatively common, much as they were in 2009. Frogs at this site tested positive for *Bd* as they did in 2009. This is another site where *R. pipiens* appears to continue to persist with *Bd.* Surveys in 2024 found *R. pipiens* present just west of Blanco and further downstream within two miles of the Shiprock Bridge (Figure 5). *Rana pipiens* may likely persist along the San Juan River from Navajo Dam to the vicinity of Shiprock; however, logistical challenges prevented the completion of surveys between Blanco and Shiprock.

Figure 5. *Rana pipiens*, San Juan River near Shiprock, 2024.

Upper Canadian River Basin

In 2023, we conducted 40 surveys in the Cimarron, Vermejo, Dry Cimarron, and Mora River drainages and 11 sites were positive for *R. pipiens* (28% detection rate). In 2009, where many of the same sites were surveyed, 47 surveys resulted in 15 sites where *R. pipiens* was detected (32% detection rate). Several sites were surveyed (Figure 6); *R. pipiens* were found to be widespread and locally common but appeared to be absent at higher elevations (Figure 6).

Figure 6. *Rana pipiens* habitat, Cimarroncito Reservoir, Philmont Scout Ranch, 2023.

Interspecific associations

In 2023, *R. pipiens* were found sharing habitats with other amphibian species at 11 localities: *B. woodhousei* (6), *P. maculata* (2), and A. *mavortium* (3; Figure 7). At one of these 11 localities, *R. pipiens* were observed with two other species: *B. woodhousii* and *A. mavortium* (Appendix 3). In 2024, *R. pipiens* were found sharing habitats with other amphibian species at eight localities: *B. woodhousei* (2), *R. catesbeiana* (6), and A. *mavortium* (1). At one of these eight localities, *R. pipiens* were observed with two other species: *B. woodhousii* and *A. mavortium* (Appendix 3).

Figure 7. Tiger salamander (*Ambystoma mavortium*) at private ranch.

Chytrid Fungus (*Batrachochytrium dendrobatidis*) Investigations

We tested 30 individual amphibians (including 24 *R. pipiens*) for *Bd* infection during this investigation (Figure 8). In 2023, we tested 11 *R. pipiens,* two *R. catesbeiana,* and one *P. maculata* from eight sites. *Bd* was detected at three of those sites: Santa Fe River, Coyote Creek State Park, and San Juan River below Navajo Dam (Appendix 7). We detected *Bd* from two *R. pipiens* (one from Coyote Creek and one from San Juan River below Navajo Dam); there was a third detection from a *R. catesbeiana* from the Santa Fe River. In 2024, we tested 19 amphibians of four species: 13 *R. pipiens,* three *R. catesbeiana,* two *A. mavortium*, and one *B. woodhousii.* We detected *Bd* from four *R. pipiens* (one each from Trout Lakes, Peña Blanca, Sandia Pueblo, and the Jicarilla District of the Carson NF) and two *R. catesbeiana* from Peña Blanca.

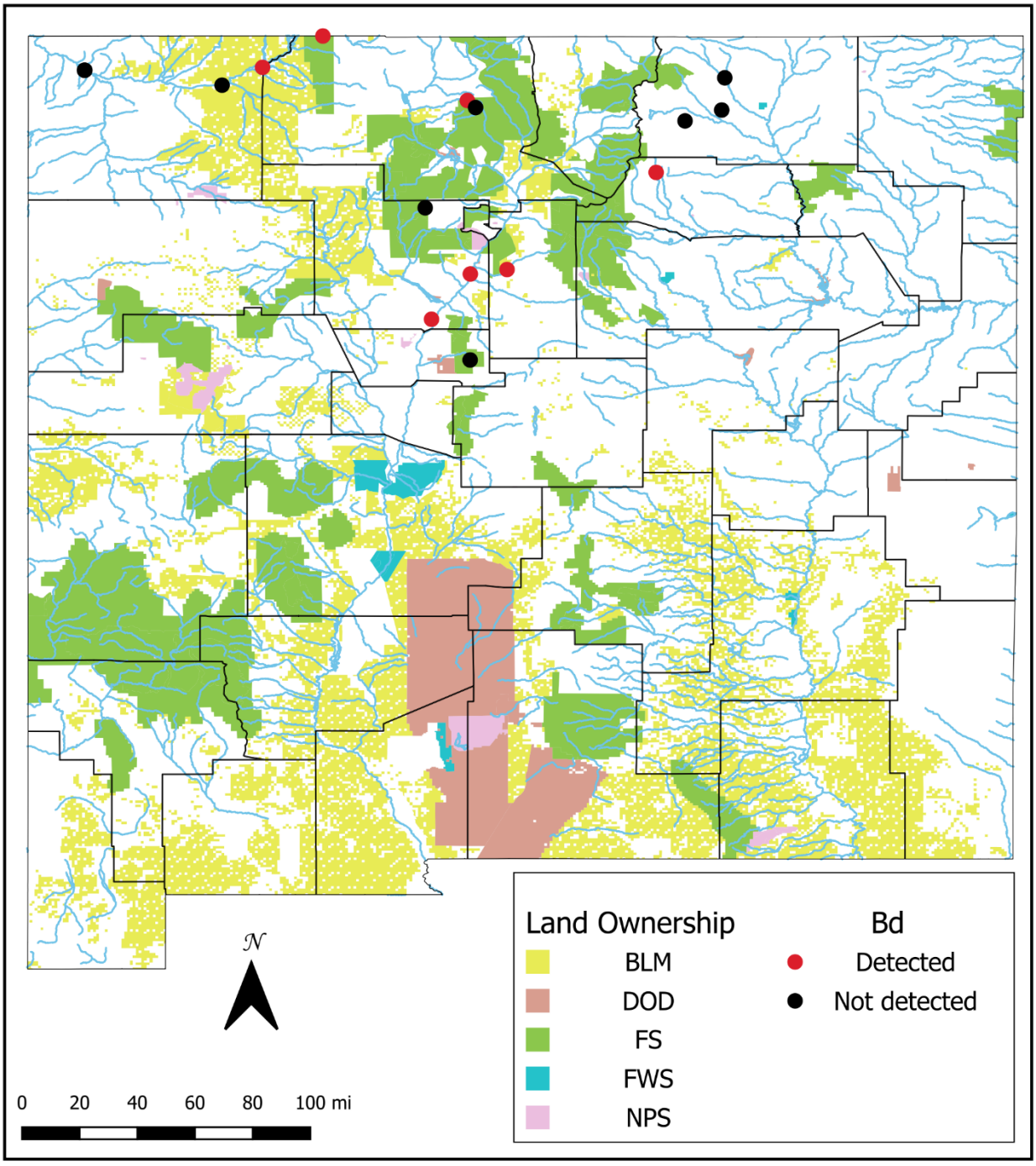

Figure 8. Map of 2023-2024 *Bd* results.

Invasive Predators

Invasive species that are thought to be detrimental to leopard frog species in the Southwestern United States include various crayfish species, bullfrogs, many of the centrarchid fish, salmonid fish, and ictalurid fish. During this investigation, *R. pipiens* were present at some localities that also had trout and/or bullfrogs and/or crayfish (Appendix 3). Trout were present with *R. pipiens* at eight survey sites; bullfrogs were present with *R. pipiens* at four sites; crayfish were found with *R. pipiens* at 11 sites. Two sites had both bullfrog and trout present and two other sites had bullfrog, catfish, and crayfish present.

Figure 9. Bullfrog (*Rana catesbeiana*) at the Santa Fe River in 2023.

DISCUSSION

Although *R. pipiens* populations still occur over much of their North American range, there is significant evidence that declines in both the numbers and size of populations have occurred and continue to occur. There is no single identifiable factor causing declines but likely the synergistic effects of pollution, disease (*Bd* and *Ranavirus*), habitat loss, and drought due to global climate change that are more likely the causes of amphibian declines (Corn 2003, Lannoo 2005). In New Mexico, *R. pipiens* populations persist in the northern portion of the state, but there are few localities where robust populations persist. Based on recovery criteria in the Chiricahua Leopard Frog Recovery Plan (USFWS 2007), a robust population is defined as 40 or more adult frogs for this closely related species. We did not observe any populations with this number of frogs. The timing of surveys may affect how many frogs are observed, such as during breeding events, post-breeding (e.g., time when frogs may be active away from water), or post-metamorphosis (e.g., when observed numbers may be skewed to juveniles).

During 2023–2024, we found *R. pipiens* to be extant in New Mexico in four geographic areas: 1) the San Juan River from Navajo Lake area downstream to the Shiprock area; 2) east slopes of the Sangre de Cristo Mountains from around Raton south to the Las Vegas area; 3) middle Rio Grande below Cochiti Reservoir downstream to about Rio Rancho/Sandia Pueblo; and 4) the upper Chama River watershed. There are also two introduced populations persisting in the Manzano Mountains near Tijeras and the Jemez Mountains on the Valles Caldera National Preserve. Both these repatriated populations have persisted for more than ten years.

During this investigation we sampled amphibians for *Bd* at 15 sites and found the pathogen present at seven sites, and on two species (*R. pipiens* and *R. catesbeiana*). We found *R. pipiens* that tested positive for *Bd* at five sites (Coyote Creek State Park, San Juan River below Navajo Dam, Trout Lakes, Sandia Pueblo, and the northern edge of the Jicarilla District of the Carson NF). Four of these sites had previously tested positive for *Bd*, with Sandia Pueblo being a new locality for this pathogen. The four sites from which *Bd* had previously been detected in 2009-2010 demonstrate that *R. pipiens* can apparently persist in the face of *Bd.* It is possible that *R. pipiens* at these sites had disappeared and then subsequently recolonized the sites after the 2009–2010 surveys, but it is impossible to know. Based on our experience with *Bd* infections in Chiricahua leopard frog (*Rana chiricahuensis*) populations in which some populations have persisted with *Bd* since 1987, it is our professional opinion that *R. pipiens* populations at these sites have also persisted with *Bd*. Rollins-Smith et al. (2002) discussed the potential buffering effect of skin peptides in *R. pipiens* against *Bd*. Woodhams et al. (2008) discussed the possibility of *R. pipiens* as a reservoir or carrier species for *Bd*. However, they were considering scientific supply shipments of frogs as potential means of transmission instead of transmission between multiple wild populations. However, there is insufficient data to suggest that wild populations of *R. pipiens* thrive in the presence of *Bd*.

As a wide-ranging species in North America, *R. pipiens* overlaps the ranges of many invasive aquatic species (e.g., bullfrogs, various crayfish, centrarchid fish, and ictalurid fish), which prey upon other southwestern amphibians. This range overlap may have exerted evolutionary pressures that resulted *R. pipiens* being able to co-exist with predatory invasive species in New Mexico. In arid regions such as the Southwestern U.S., *R. pipiens* is more likely to spend more

time near water post breeding than in more mesic parts of its range, thereby spending more time in proximity to bullfrogs where the two species co-occur and increasing the chances of predation or disease transmission. O'Donnell et al. (2016) suggest that genetic differences between eastern and western populations may be so significant that these populations actually represent two different species. Furthermore, these authors suggest that behavioral or other ecological differences in interactions with native predators and differing susceptibilities to *Bd* infection may affect *R. pipiens* populations differently.

The reasons behind why some *R. pipiens* populations appear to be robust in the face of *Bd* and/or predation pressure from invasive species while other populations appear to be smaller in size despite extensive potential habitat remain unclear. Within the scope of this investigation there are no data to support any definitive conclusions as to the reasons for declines in *R. pipiens* in New Mexico, but we suggest some of the factors which may contribute to observed declines.

RECOMMENDATIONS

Further surveys are needed to determine the complete current distribution of *R. pipiens*. Areas in need of survey include sites on tribal lands in the Chama River Basin, the Grants area, and the Middle Rio Grande from Española to Albuquerque.

Considering *Bd* is present in the environment, it should be standard procedure to clean any gear used in aquatic environments when moving between sites. A 10% bleach solution or a fungicide with Quat 128 should be used to clean waders, nets, and other gear to limit the spread of *Bd*.

Current knowledge of amphibian declines suggests that proactive conservation measures should be implemented to offset population losses prior to federal listing and/or during ongoing research that might be used in recovery actions. *Rana pipiens* is a species that could benefit from habitat improvements and enhancements on state and federal lands. Enhancements might include partial exclusion of livestock from sensitive habitats or limiting grazing time within riparian corridors, planting beneficial plants, and raising frogs for release into historically unoccupied habitats or habitats within their historic range. Frogs for repatriation efforts could come from the Trout Lakes area and could be released into various ponds on the Edward Sargent and Bill Humphries Wildlife Management Areas. These two Wildlife Management Areas would be closest geographically to the Trout Lakes, but other Wildlife Management Areas could certainly be considered.

In addition, monitoring programs could be established with the cooperation of land management agencies. These programs might provide information that would be useful in preventing the loss of populations, and thus foster the continued persistence of *R. pipiens* in New Mexico and the rest of the southwestern U.S.

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Appendix 3: 2023-2024 *Rana pipiens* survey results. Species abbreviations: Amma = *Ambystoma mavortium*; Bupu = *Bufo punctatus*; Buwo = *Bufo woodhousii*; Raca = *Rana catesbeiana*; Rapi = *Rana pipiens*; Psma = *Pseudacris maculata*.

Date	Locality	County	Species	Year last observed	Predators
30-Apr-23	La Jencia Creek	Socorro	Buwo		
30-Apr-23	Cedro Canyon, Cibola NF	Bernalillo	Rapi	2010	
1-May-23	Santa Fe River, BLM	Santa Fe	Raca	2010	
1-May-23	Rael Property pond, BLM	Santa Fe	Raca		
2-May-23	E. Fork Jemez River, above Battleship Rock, Santa Fe NF	Sandoval	none	1946	
2-May-23	Redondo Creek, Santa Fe NF	Sandoval	Rapi		
2-May-23	Sulphur Canyon, Santa Fe NF	Sandoval	none		
2-May-23	E Fork Jemez River, Los Conchas, Santa Fe NF	Sandoval	none	1967	
3-May-23	San Antonio Creek, Santa Fe NF	Sandoval	Rapi, Psma	1956	crayfish
4-May-23	Sapello River, Pritz W	San Miguel	none	1985	
4-May-23	Sapello River, Pritz E	San Miguel	Rapi, Buwo	1985	crayfish
5-May-23	Coyote Creek State Park	Mora	Rapi, Psma	2009	
6-May-23	Manuelitas Creek	San Miguel	none	2009	
6-May-23	Upper Charette Lake, NMDGF	Mora	none	2010	
23-Jun-23	Rio Grande del Rancho, Carson NF	Taos	none	2010	
23-Jun-23	Rio Chiquito, Carson NF	Taos	none		
24-Jun-23	Chama River - Boat launch	Rio Arriba	none		
24-Jun-23	Chama River - Above Nutria	Rio Arriba	none		crayfish
24-Jun-23	Chama River - Hotsprings	Rio Arriba	none		
25-Jun-23	Chama River - Above Archilleta	Rio Arriba	none		
26-Jun-23	Cebolla River	Rio Arriba	Buwo		carp
26-Jun-23	Chama River - Above Monastery	Rio Arriba	none		crayfish
26-Jun-23	Rio Gallenas	Rio Arriba	none		
30-Jun-23	Sepultura, stock tank	Socorro	none		
30-Jun-23	Cibola Springs	Socorro	Bupu		*Thamnophis cyrtopsis*
5-Jul-23	222, concrete drinker	Socorro	none		
7-Jul-23	Canyon Ojitos	Socorro	none		
7-Jul-23	Esquival, metal drinker	Socorro	none		
10-Jul-23	Upper Underwood Lake, private ranch	Taos	Amma		
10-Jul-23	unnamed stock tank, private ranch	Taos	none		
10-Jul-23	Beaver Lakes #1, private ranch	Taos	Psma, Amma	2004	Dytiscid larvae
10-Jul-23	Beaver Lakes #2, private ranch	Taos	Amma	2004	Dytiscids, leeches
10-Jul-23	Beaver Lakes #3, private ranch	Taos	Amma	2004	leeches
10-Jul-23	Beaver Lakes #4, private ranch	Taos	Amma	2004	leeches
10-Jul-23	Beaver Lakes #5, private ranch	Taos	Amma	2004	leeches

Date	Locality	County	Species	Year last observed	Predators
11-Jul-23	Vermejo River, private ranch	Colfax	Rapi, Buwo	2009	crayfish
11-Jul-23	Vermejo River, off channel pool, private ranch	Colfax	Rapi	2009	
11-Jul-23	Vermejo River, private ranch	Colfax	Rapi, Buwo	2009	crayfish
11-Jul-23	Vermejo River at Salyer's Canyon, private ranch	Colfax	Rapi, Buwo	2009	crayfish
11-Jul-23	Van Bremmer Canyon, private ranch	Colfax	Rapi, Buwo, Amma	2009	crayfish
11-Jul-23	unnamed tank, Van Bremmer Canyon	Colfax	none	2009	
11-Jul-23	unnamed tank, Van Bremmer Canyon	Colfax	none	2009	
11-Jul-23	Van Bremmer Canyon, private ranch	Colfax	Rapi, Amma	2009	crayfish, *T.elegans*
12-Jul-23	unnamed stock tank, private ranch	Colfax	Amma		
12-Jul-23	Van Bremmer Canyon, private ranch	Colfax	none	2009	
12-Jul-23	Van Bremmer Canyon	Colfax	none	2009	
12-Jul-23	Lower Vermejo River, upstream Van Bremmer	Colfax	Rapi , Buwo	2009	
12-Jul-23	Van Bremmer Canyon, upstream of Vermejo R.	Colfax	none	2009	
12-Jul-23	pond in the plains, private ranch	Colfax	Buwo, Psma		
12-Jul-23	Ponil Creek, E of Cimarron, private ranch	Colfax	Raca	2009	
13-Jul-23	pond, Fowler Pass, private ranch	Colfax	Psma, Amma		*T. elegans*
13-Jul-23	wetland, Fowler Pass, private ranch	Colfax	Psma, Amma		*T. elegans*
13-Jul-23	Bonita Creek, private ranch	Colfax	none	1961	*T. elegans*
13-Jul-23	Crater Lake, private ranch	Colfax	Psma, Amma	1985	*T. elegans*
13-Jul-23	Cimarroncito Reservoir, private ranch	Colfax	Rapi, Amma	2009	*T. elegans*
13-Jul-23	Cerrososos Cr, private ranch	Colfax	none	2009	
13-Jul-23	Cerrososos Cr,, private ranch	Colfax	none	2009	
13-Jul-23	windmill, Cerrososos Cr,, private ranch	Colfax	Rapi, Buwo	2009	Odonates
14-Jul-23	windmill, lower Cerrososos Cr,, private ranch	Colfax	Raca, Buwo, Amma	2009	*T. radix*
14-Jul-23	Cerrososos Cr,, private ranch	Colfax	none	2009	
14-Jul-23	No.2 Lake, private ranch	Colfax	Buwo, Raca		
14-Jul-23	unnamed stock tank, private ranch	Colfax	tadpole shrimp		
28-Jul-23	wetland, Valles Caldera NP	Sandoval	none		4 *T. elegans*
28-Jul-23	Pond, Valles Caldera NP	Sandoval	Amma	2023	4 *T. elegans*
28-Jul-23	San Antonio Creek, Santa Fe NF	Sandoval	none		3 *T. elegans*
16-Sep-23	Well, Sevilleta NWR	Socorro	none		
16-Sep-23	Well Seep, Sevilleta NWR	Socorro	none		
16-Sep-23	Well, Sevilleta NWR	Socorro	none		
16-Sep-23	Springs, Sevilleta NWR	Socorro	none		
20-Sep-23	Rio Grande del Rancho, Carson NF	Taos		2009	
21-Sep-23	Canal, southside, Bosque del Apache NWR	Socorro	Raca		

Date	Locality	County	Species	Year last observed	Predators
21-Sep-23	Largo Creek above Quemado Lake, dry	Catron	none		
2-Oct-23	San Juan River, below Navajo Dam	San Juan	Rapi	2009	
2-Oct-23	San Juan River at Simon Canyon	San Juan	none		
6-Oct-23	Interior Drain, Bosque del Apache NWR	Socorro	Raca		
6-Oct-23	Canal, northside, Bosque del Apache NWR	Socorro	Raca		
8-Oct-23	Tank, Cibola NF	McKinley	none		
8-Oct-23	Tank, Cibola NF	McKinley	none		
8-Oct-23	unnamed stock tank, Cibola NF	McKinley	none		
8-Oct-23	unnamed stock tank, Cibola NF	McKinley	none		
8-Oct-23	unnamed stock tank, Cibola NF	McKinley	none		
8-Oct-23	Tank, Cibola NF	McKinley	none		
16-Aug-24	Tank, Mt Taylor R.D., Cibola NF	McKinley	none		
17-Aug-24	Tank, Mt Taylor R.D., Cibola NF	McKinley	Amma larvae		
17-Aug-24	unnamed stock tank	Cibola	Amma larvae		
17-Aug-24	unnamed spring	Cibola	none		
17-Aug-24	unnamed spring	Cibola	none		
17-Aug-24	unnamed spring	Cibola	none		
17-Aug-24	Tank, Mt Taylor R.D. Cibola NF	McKinley	Amma larvae		
17-Aug-24	Tank, Mt Taylor R.D. Cibola NF	McKinley	none	2009	
17-Aug-24	Tank, Mt Taylor R.D. Cibola NF	McKinley	none		
17-Aug-24	unnamed stock tank	McKinley	none		
17-Aug-24	unnamed stock tank	McKinley	none		
17-Aug-24	unnamed stock tank	McKinley	none		
17-Aug-24	Tank, Mt Taylor R.D. Cibola NF	McKinley	none		
17-Aug-24	Tank	Mckinley	none		
19-Aug-24	unnamed stock tank, L Bar Ranch, NMDGF	Sandoval	none		
20-Aug-24	unnamed stock tank, Sargent WMA, NMDGF	Rio Arriba	none		
20-Aug-24	stock tank, NW corner Sargent WMA, NMDGF	Rio Arriba	Psma		
20-Aug-24	stock tank, NW corner Sargent WMA, NMDGF	Rio Arriba	none		
20-Aug-24	unmapped pond, Sargent WMA	Rio Arriba	none		
20-Aug-24	unnamed stock tank, Sargent WMA, NMDGF	Rio Arriba	Amma		
20-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		

Date	Locality	County	Species	Year last observed	Predators
21-Aug-24	unmapped pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	Psma		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	Amma		
21-Aug-24	unmapped pond, Sargent WMA	Rio Arriba	none	1997, 2009	
21-Aug-24	unnamed pond, Sargent WMA	Rio Arriba	none		
21-Aug-24	Rio Chamita, Sargent WMA	Rio Arriba	none		
21-Aug-24	Rio Chamita, Sargent WMA	Rio Arriba	none		
22-Aug-24	unmapped pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unmapped pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none		
22-Aug-24	unnamed pond, Humphries WMA	Rio Arriba	none	2009	
22-Aug-24	Upper Trout Lake, Carson NF	Rio Arriba	Rapi	1974, 2009, 2024	
22-Aug-24	Lower Trout Lakes , Carson NF	Rio Arriba	Rapi	1974, 2009, 2024	
22-Aug-24	Lower Trout Lakes , Carson NF	Rio Arriba	Rapi	1974, 2009, 2024	
23-Aug-24	ditch along US 84, at Navajo Canyon	Rio Arriba	none	2009	
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	Rapi	2010, 2024	
31-Aug-24	San Juan River	San Juan	anuran tracks	2009, 2024	
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	Rapi	2024	
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	Raca		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	Raca		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none	1987	
31-Aug-24	San Juan River	San Juan	none		

Date	Locality	County	Species	Year last observed	Predators
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none	1988, 2010	
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none		
31-Aug-24	San Juan River	San Juan	none	2008	
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none	2010	
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	anuran tracks		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		

Date	Locality	County	Species	Year last observed	Predators
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none	2010	
1-Sep-24	San Juan River	San Juan	toad tracks		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
1-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	anuran tracks	1961	
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none	1961	
2-Sep-24	San Juan River	San Juan	anuran tracks		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none	2010	
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	Buwo, Rana spp.		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	none		
2-Sep-24	San Juan River	San Juan	Buwo		
18-Sep-24	Tank, Zuni Mts, Cibola NF	Mc Kinley	none		
18-Sep-24	Tank, Zuni Mts, Cibola NF	Mc Kinley	Psma		
19-Sep-24	Tank, Jicarilla Dist, Carson NF	Rio Arriba	none		
19-Sep-24	unnamed tank, Jicarilla Dist, Carson NF	Rio Arriba	Amma	2010	
19-Sep-24	pond N. edge of Jicarilla Dist, Carson NF	Rio Arriba	Rapi, Amma	2010, 2024	

Date	Locality	County	Species	Year last observed	Predators
19-Sep-24	Tank, Jicarilla Dist, Carson NF	Rio Arriba	none		
19-Sep-24	Tank, Jicarilla Dist, Carson NF	Rio Arriba	none		
20-Sep-24	pond N. edge of Jicarilla Dist, Carson NF	Rio Arriba	Rapi, Amma, Buwo	2010, 2024	
20-Sep-24	San Juan River, W of Blanco, BLM	San Juan	Rapi, Raca	2009, 2024	
20-Sep-24	San Juan River, W of Blanco, BLM	San Juan	Rapi	2009, 2024	
20-Sep-24	unnamed tank, BLM	Rio Arriba	none		
20-Sep-24	unnamed tank, BLM	Rio Arriba	none		
20-Sep-24	Eagle Nest SP	Colfax	none	1939	
20-Sep-24	Eagle Nest SP	Colfax	none	1939	
20-Sep-24	Eagle Nest SP - 6 Mile Creek	Colfax	none	1939	
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP - Campground	Colfax	none		
20-Sep-24	Cimarron SP	Colfax	none		
20-Sep-24	Eagle Nest SP	Colfax	none		
21-Sep-24	Unnamed stock tank	Taos	none		
21-Sep-24	Canjilon Creek	Rio Arriba	none		
21-Sep-24	Lower Canjilon Lake	Rio Arriba	none	1971	
21-Sep-24	Lower Canjilon Lake	Rio Arriba	none	1971	
21-Sep-24	Middle Canjilon Lake	Rio Arriba	Rapi	1971, 2024	
21-Sep-24	MIddle Canjilon Lake	Rio Arriba	none	1971	
21-Sep-24	Upper Canjilon Lake	Rio Arriba	Rapi	1971, 2024	
21-Sep-24	unnamed tank, W of Cuba, BLM	Sandoval	none		
21-Sep-24	unnamed tank, W of Cuba, BLM	Sandoval	none		
22-Sep-24	unnamed tank, S of Cuba, BLM	Sandoval	none		
22-Sep-24	Peña Blanca - lower end, Rio Grande	Sandoval	Raca, Rapi	1959 1993 2001 2010 2024	
22-Sep-24	Peña Blanca - lower end, clear ditch	Sandoval	Raca, Rapi	1959 1993 2001 2010 2024	
22-Sep-24	Peña Blanca - upper end, Rio Grande	Sandoval	Raca, Rapi	1959 1993 2001 2010 2024	
23-Sep-24	off channel pond, Sandia Pueblo	Bernalillo	Rapi, Raca	2024	
23-Sep-24	agricultural drain, Sandia Pueblo	Bernalillo	Rana sp?, Raca		
23-Sep-24	agricultural drain, Sandia Pueblo	Bernalillo	Rana sp?, Raca		
23-Sep-24	agricultural drain, Sandia Pueblo	Bernalillo	Rana sp?, Raca		

Date	Locality	County	Species	Year last observed	Predators
23-Sep-24	Sandia Lakes, Sandia Pueblo	Bernalillo	Raca		
23-Sep-24	Sandia Lakes, Sandia Pueblo	Bernalillo	Raca		
24-Sep-24	Rio Grande, Sandia Pueblo	Bernalillo	Rapi, Raca	2024	
13-Oct-24	Rio Grande, above Central Ave.	Bernalillo	none	1961	
13-Oct-24	Rio Grande, below Central Ave.	Bernalillo	none	1961	
13-Oct-24	Rio Grande, below Montano Ave.	Bernalillo	none	1971	
17-Oct-24	Canadian River	Colfax	none		
17-Oct-24	Vermejo River	Colfax	none		
17-Oct-24	Mora River	Mora	none	1986	
17-Oct-24	Sapello River	Mora	none		
17-Oct-24	Pecos River	San Miguel	none		

Appendix 4: 2009-2010 *Rana pipiens* survey results. Species abbreviations: Amma = *Ambystoma mavortium*; Buwo = *Bufo woodhousii*; Rabl = *Rana blairi*; Raca = *Rana catesbeiana*; Rapi = *Rana pipiens*; Psma = *Pseudacris maculata*.

Date	Locality	County	Species	# Obs.
Jun-24-09	Stone Lake, NE (Boulder Lake), Jicarilla	Rio Arriba	Rapi, Amma	5ad, 1000 tads
Jun-24-09	Hayden Lake, Jicarilla Apache Res.	Rio Arriba	Rapi, Buwo	1ad, Rapi
Jun-24-09	stock tank head of Amargo drainage, Humphries	Rio Arriba	Rapi, Psma	2 ad, 10tads
Jun-25-09	arroyo along US84/64	Rio Arriba	Rapi, Amma	1ad Rapi
Jun-30-09	Ponds, Chama	Rio Arriba	Rapi	12 ad, 200 tad
Jul-01-09	Tugboat Pond, Jicarilla Apache Res.	Rio Arriba	Rapi, Buwo, Amma	2 ad
Jul-01-09	Tio Lopez Pond, Jicarilla Apache Res.	Rio Arriba	Rapi, Buwo	79 ad, 100 tad
Jul-01-09	Elk Pond, Jicarilla Apache Res.	Rio Arriba	Rapi	1 ad
Jul-01-09	Sciliy's Pond, Jicarilla Apache Res.	Rio Arriba	Rapi	51 ad, 100 tad
Jul-15-09	stock pond, Sargent WMA	Rio Arriba	Rapi	1 ad, 10 tad
Aug-13-09	Ponil Creek, E. Cimarron	Colfax	Rapi	1ad, 7 juv
Aug-15-09	Spring, Mt. Taylor R.D., Cibola NF	Cibola	Rapi, Amma	1ad
Aug-16-09	Tank, Mt. Taylor R.D., Cibola NF	Mc Kinley	Rapi	1ad
Aug-18-09	Ponil Creek, E. Cimarron	Colfax	Rapi	6 juv
Aug-19-09	Vermejo River, at Salyer's Canyon confl.	Colfax	Rapi	2 ad, 1 juv
Aug-19-09	unnamed stock tank, Van Bremmer Canyon	Colfax	Rapi	4 ad, 4 juv
Aug-19-09	unnamed stock tank, Van Bremmer Canyon	Colfax	Rapi	15 juv
Aug-20-09	Van Bremmer Canyon, upstream of US 64	Colfax	Rapi	2 ad, 4 juv
Aug-20-09	Vermejo River, upstream of Van Bremmer Cr.	Colfax	Rapi, Rabl, R. spp.	4 ad, 2 juv
Aug-20-09	Van Bremmer Creek, upstream of Vermejo Riv.	Colfax	Rapi	15ad&juv, 10 tad
Aug-20-09	Cerrososos Creek, upstream of US 64	Colfax	Rapi	5 ad&juv
Aug-20-09	Cimarron River, Cimarron NM	Colfax	Rapi	2 juv
Aug-25-09	San Juan River, campground, BLM	San Juan	Rapi	2ad, 2 juv
Aug-26-09	San Juan River, Marsh below Navajo Dam, BLM	San Juan	Rapi, Raca	2 ad, 25 juv
Aug-26-09	Los Pinos River, trib. to Navajo Reservoir	San Juan	Rapi, Buwo	1 ad
Aug-26-09	spring below Ditch, E. Bloomfield, BLM	San Juan	Rapi, Psma	1 juv
Sep-01-09	Manuelitas Creek, private property	San Miguel	Rapi, Raca	3 ad, 20 juv
Sep-02-09	pond, Mora Nat'l Fish Hatchery	Mora	Rapi, Amma	2 ad, 4 juv
Sep-02-09	wellfield, Mora Nat'l Fish Hatchery	Mora	Rapi	3 juv
Sep-03-09	Coyote Creek, Coyote Creek State Park	Mora	Rapi	1ad, 1 juv
Sep-21-09	Cerro Canyon, Cibola NF, Sandia RD	Bernalillo	Rapi	11 juv
13-Apr-10	Cerro Canyon, Cibola NF, Sandia RD	Bernalillo	Rapi	2ad, 1 juv

Date	Locality	County	Species	# Obs.
10-May-10	Upper Charrette Lake, Charette Lakes State WMA	Mora	Rapi, Buwo, Psma	5ad Rapi, 20ad Buwo, 20ad Psma
11-May-10	Ocate Creek, Charette Lakes State WMA	Mora	Rabl	1 juv
17-May-10	Cerro Canyon, Cibola NF, Sandia RD	Bernalillo	Rapi	1 ad
25-May-10	Ocate Creek	Mora	Rabl	9ad and juv
26-May-10	Dry Cimarron, NE of Folsom, NMDGF access	Union	Rabl	3 ad, 9 juv
26-May-10	Dry Cimarron, 19 rd mi E Folsom	Union	Rabl, Raca	1 ad Rabl, 1ad Raca
26-May-10	Una de Gato Creek	Colfax	Rabl	2 juv
8-Jun-10	Cimarroncito Reservoir	Colfax	Rapi, Amma, Psma	8ad 50 tads Rapi, 50 tads Psma, 5 Amti
9-Jun-10	Cimarron River, NM Hwy 21 City Park	Colfax	Rabl, Raca	.
6-Jul-10	Cerro Canyon, Cibola NF, Sandia RD	Bernalillo	Rapi	3 ad, 2 juv
7-Jul-10	Pecos River, Santa Fe NF Anton Chico	San Miguel	Rana spp. (Likely Rabl), Buwo	.
21-Jul-10	Rio Grande, Peña Blanca, MRGCD	Sandoval	Rapi, Raca	.
22-Jul-10	clear ditch, Peña Blanca, MRGCD	Sandoval	Rapi, Raca	Rapi 13 juv, Raca 20+
23-Jul-10	Rio Grande, Peña Blanca, N. from Santo Domingo, MRGCD	Sandoval	Rapi, Raca	Rapi 26 juv, Raca 8
8-Sep-10	San Juan River, below Shiprock, Navajo Nation	San Juan	Rapi, Raca	2 juv, 5 juv (SUL=49,wt =13.5g, 48 12g)
8-Sep-10	San Juan River, below Shiprock, Navajo Nation	San Juan	Rapi, Raca	1 juv (SUL=42, 8g)
8-Sep-10	San Juan River, backwater, Navajo Nation	San Juan	Rapi, Raca	1 juv, 16 juv
8-Sep-10	San Juan River, backwater, Navajo Nation	San Juan	Rana spp., Buwo	4 Juv
9-Sep-10	San Juan River, side channel, Navajo Nation	San Juan	Rapi, Raca, Buwo	1 juv of each
16-Sep-10	San Juan River, side channel, Navajo Nation	San Juan	Rapi, Raca, Buwo	3 juv, 9 juv, 8 juv
16-Sep-10	San Juan River, return drain, river rt. Navajo Nation	San Juan	Rapi	1 ad, 2 juv
16-Sep-10	San Juan River, side channel, Navajo Nation	San Juan	Rapi, Raca, Buwo	6 juv, 1 juv, 1 juv
16-Sep-10	San Juan River, side channel, Navajo Nation	San Juan	Rapi, Raca	2 juv, 1 ad, 13 juv
16-Sep-10	San Juan River, backwater, Navajo Nation	San Juan	Rapi	1 juv
16-Sep-10	San Juan River, bank, Navajo Nation	San Juan	Rapi, Raca, Buwo	3 juv, 1 juv, 1 juv
17-Sep-10	pond above San Juan River, N. end Jicarilla Dist. Carson NF	Rio Arriba	Rapi	50 (10 ad, 40 juv)
17-Sep-10	unnamed gas well pond, Carracas Mesa, Carson NF	Rio Arriba	Rapi	1 ad, 1 juv
2-Oct-10	Rio Grande del Rancho, S. Talpa, Carson NF	Taos	Rapi	1 juv
3-Oct-10	Rio Grande del Rancho, S. Talpa, Carson NF	Taos	Rapi	1 ad, 5 juv
13-Oct-10	Cerro Canyon, Cibola NF, Sandia RD	Bernalillo	Rapi	2 ad

Appendix 5: *Bd* test results (2023-2024). Species abbreviations: Amma = *Ambystoma mavortium*; Buwo = *Bufo woodhousii*; Raca = *Rana catesbeiana*; Rapi = *Rana pipiens*; Psma = *Pseudacris maculata*. Results listed in bold font in the "Total *Bd*" column indicate a positive test result for *Bd*.

Date	Species	Sex	Locality	County	Field #	Total *Bd*
2-Oct-23	Rapi	Juv	San Juan River	San Juan	BLC-1191	0.00E+00
2-Oct-23	Rapi	M	San Juan River	San Juan	BLC-1192	0.00E+00
2-Oct-23	Rapi	M	San Juan River	San Juan	BLC-1193	0.00E+00
2-Oct-23	Rapi	M	San Juan River	San Juan	none	**1.62E+02**
13-Jul-23	Rapi	M	Cimarron-cito Res.	Colfax	none	0.00E+00
13-Jul-23	Rapi	F	Cerrososos Creek	Colfax	none	0.00E+00
5-May-23	Rapi	F	Coyote Creek State Park	Mora	none	**5.55E+04**
11-Jul-23	Rapi	F	Vermejo River	Colfax	none	0.00E+00
30-Apr-23	Rapi	F	Cedro Canyon	Bernalillo	none	0.00E+00
30-Apr-23	Rapi	M	Cedro Canyon	Bernalillo	none	0.00E+00
3-May-23	Rapi	Juv	San Antonio Cr	Sandoval	none	0.00E+00
1-May-23	Raca	F	Santa Fe River	Santa Fe	none	**3.18E+03**
1-May-23	Raca	M	Santa Fe River	Santa Fe	none	0.00E+00
5-May-23	Psma	M	Coyote Creek State Park	Mora	none	0.00E+00
22-Sep-24	Raca		Peña Blanca	Sandoval	GLH- 201	**2.23E+02**
22-Sep-24	Rapi		Peña Blanca	Sandoval	GLH- 202	0.00E+00
22-Sep-24	Rapi		Peña Blanca	Sandoval	GLH- 204	0.00E+00
22-Sep-24	Raca		Peña Blanca	Sandoval	GLH- 205	**9.77E+01**
22-Aug-24	Rapi		Trout Lakes	Rio Arriba	none	0.00E+00
22-Aug-24	Rapi	F	Trout Lakes	Rio Arriba	none	**3.19E+02**
22-Aug-24	Rapi	M	Trout Lakes	Rio Arriba	none	0.00E+00
22-Aug-24	Rapi	F	Trout Lakes	Rio Arriba	none	0.00E+00
20-Sep-24	Amma		Jicarilla Dist. Carson NF	Rio Arriba	none	0.00E+00
20-Sep-24	Amma		Jicarilla Dist. Carson NF	Rio Arriba	none	0.00E+00
20-Sep-24	Buwo		Jicarilla Dist. Carson NF	Rio Arriba	none	0.00E+00
20-Sep-24	Rapi		San Juan River	San Juan	none	0.00E+00
31-Aug-24	Raca		San Juan River	San Juan	none	0.00E+00
31-Aug-24	Rapi	F	San Juan River	San Juan	none	0.00E+00
23-Sep-24	Rapi	F	Sandia Pueblo	Bernalillo	none	**4.53E+02**
24-Sep-24	Rapi	M	Sandia Pueblo	Bernalillo	none	0.00E+00
20-Sep-24	Rapi	M	Jicarilla Dist. Carson NF	Rio Arriba	none	**9.59E+02**
19-Sep-24	Rapi	M	Jicarilla Dist. Carson NF	Rio Arriba	none	**2.69E+04**
21-Sep-24	Rapi		Upper Canjilon Lake	Rio Arriba	none	0.00E+00