**PROJECT TITLE: Fall Dispersal and Genetic Diversity of Ozark Pocket Gopher**

**PROJECT SUMMARY:** The Ozark pocket gopher (*Geomys bursarius ozarkensis*) is listed as critically imperiled in Arkansas because this subspecies is geographically restricted and threatened by landowners who consider it a nuisance. Its restricted and isolated range may be associated with a low genetic diversity, furthering their vulnerability to extinction. We propose to assess gene flow through a study of fall dispersal and genetic diversity of this subspecies using radio-tracking and DNA samples from tail snips. This study, which will focus on juveniles and subadults (as individuals most likely to disperse), will help refine the conservation status of the Ozark pocket gopher.

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**PROJECT BUDGET**

| | |
|---|---|
| **SWG Amount Requested** | **$93,397** |
| **Match* Amount (35%)** | **$51,148** |
| **Total Amount** | **$144,545** |

*these are non-federal dollars supplied by Arkansas State University

The references used in this proposal are available upon request.

**Fall Dispersal and Genetic Diversity of Ozark Pocket Gopher**

**Need –** The Ozark pocket gopher (*Geomys bursarius ozarkensis*; hereafter OPG) is a subspecies of plains pocket gopher endemic to the Ozarks (Elrod et al. 2000), and occurs almost exclusively in the southern one-third of Izard County, Arkansas (Connior et al. 2010). The population of about 3,500 individuals (Kershen 2004) is limited to a 2,300-km$^2$ range bordered to the south by the White River**.** The OPG is threatened by nuisance control efforts and its restricted and isolated range may be associated with a low genetic diversity, furthering its vulnerability.

Identifying dispersal in subterranean fauna is problematic. Generally, little is known about this subspecies' patterns of dispersal. Dispersal by pocket gophers is considered to be dominated by juveniles and subadults (Busch et al. 2000; Williams & Cameron 1984), with burrow extension as the normal mechanism (Howard & Childs 1959), although Connior & Risch (2009) identified a male moving above ground. Genetic spatial autocorrelation can be used to identify a sex and age group bias in dispersal in small mammals (Banks and Peakall 2012) and in birds (Temple et al. 2006; Rolland and Johnson, in prep). However, genetic data alone cannot provide insight in the behavioral patterns of dispersal (Griesser *et al.* 2014). Tracking individuals can add valuable information such as movement patterns and their seasonality.

This proposal directly addresses the need to study fall dispersal and genetic diversity of this critically imperiled subspecies listed as an AR SWG Funding mammal priority since 2017. In addition to the OPG's patterns and rates of dispersal already highlighted as a research need 18 years ago (Busch et al. 2000), determining if their restricted range has led to a decline in their genetic diversity has been identified in the Arkansas Wildlife Action Plan (Fowler 2015, p. 904) as another critical data gap to fill.

**Purpose and Objectives –** The purpose of this project is to fill knowledge gaps in OPG's genetics and dispersal patterns. Our objectives are to (1) assess gene flow and the genetic structuring of the current OPG population; (2) determine temporal trends in genetic diversity through a comparison with museum specimens; and (3) characterize dispersal patterns (timing, distance, etc.).

**Location –** The study will be conducted in the Ozark Highlands Ecoregion, around Melbourne in Izard County, Arkansas (Fig.1A). We will focus our trapping efforts in pasture lands and hay fields within the OPG distribution (Fig. 1B).

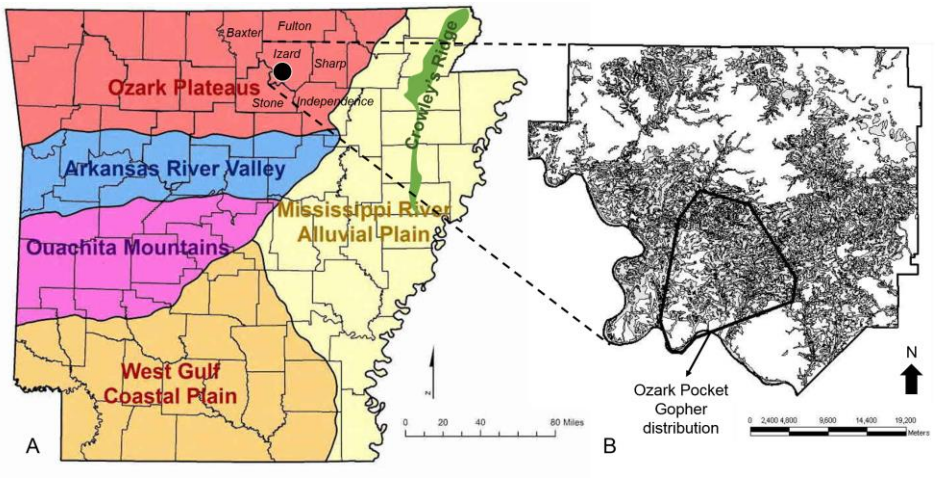



*Figure 1. Study site in Izard County, AR, in the Ozark Plateaus Ecoregion (A) with the OPG distribution (B; Connior et al. 2010).*

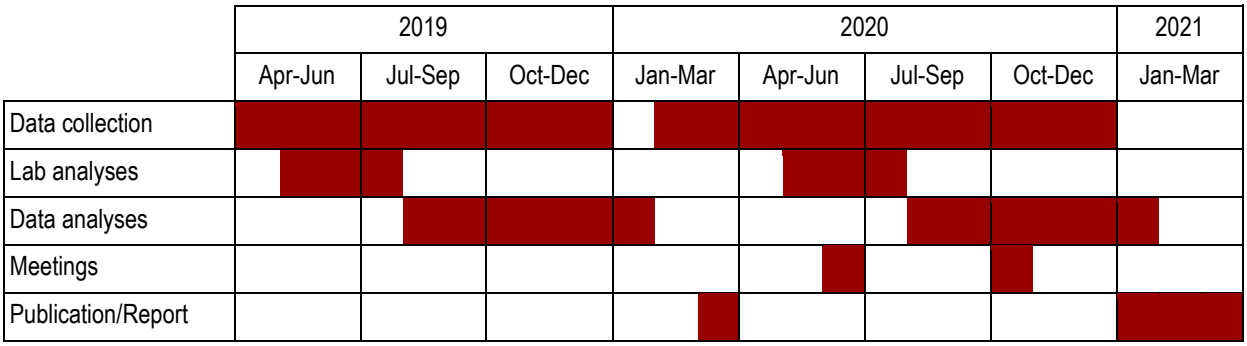
**Approach –** Juveniles are generally hard to trap; only 9% OPG (n = 179) caught by the Risch lab between December and June (Connior 2008) were juveniles, and Risch, who regularly brings his mammalogy class to the area in October, never captured juveniles. Therefore, we will conduct our field procedures from April to maximize captures until December to include times of dispersal events reported in previous *Geomys* studies (Adams 1966, Williams and Cameron 1984, Warren et al. 2017). We will use Connior and Risch's (2009) box trap. Upon capture, we will record weight, age, and sex following Connior and Risch (2009).

*For Objective 1*: We will use 10 microsatellite loci that were successfully amplified in Baird's pocket gophers (*G. breviceps*) and suitable for OPG (Welbourne et al. 2012) to determine the presence and degree of genetic structuring of this endemic subspecies. Five sites will be targeted throughout the OPG's range with 20 OPGs per site. We will isolate DNA from tail snips and amplify microsatellites of that DNA using PCR. Gene flow and population structure among 'subpopulations' will be determined and compared to telemetry data (see Objective 3). Following Temple *et al.* (2006), we will also conduct fine-scale spatial autocorrelation analyses to compare genetic structuring by sex and age. We anticipate that genetic structuring will be high even with a limited geographic distance due to their limited dispersal capability (Burt & Dowler 1999; Hafner et al. 1983).

*For Objective 2*: The Arkansas State University Museum of Zoology houses enough specimens to provide samples for genetic analysis. We will collect 50 specimens from the museum and perform genetic isolation and analysis as described in Objective 1. Heterozygosity and alleles per locus will be compared between museum specimens and individuals captured during the study.

*For Objective 3*: We will conduct a pilot study by radio-tagging 10 young individuals (~80–120 g), using 4-g radio-transmitters that we will implant subcutaneously between the scapulae to avoid transmitter losses. The implanted gophers will be radio-tracked daily until failure of the transmitter (about 6 months) or the individual's death. We will also implant a passive integrated transponder (PIT) tag in each individual captured to increase recapture data (Connior and Risch 2009). Finally, we will use drift fences and pitfall buckets at each of the 5 sites (see Objective 1) in case of above-ground dispersal (Adams 1966). After combining telemetry, PIT tag, and drift fence data, we will determine distances travelled, estimate individual home ranges (Calenge 2006), and assess factors of dispersal (weight, time, genetic isolation, etc.) with G-tests and logistic regressions. Genetic data will augment these distances to identify sex/age differences in dispersal using a spatial autocorrelation test (see Objective 1). Differing patterns of structuring among groups will reflect dispersal patterns (Temple et al. 2006).

**Timeline**



**Expected Results and Benefits –** OPG, a species of greatest conservation concern (SGCN), will benefit from our project. Indeed, knowing OPG's genetic diversity will help determine its vulnerability and will help managers decide about possibly translocating individuals to establish secondary populations in suitable habitat. Other SGCNs that may benefit from this project are *Ambystoma tyrinum* and *Scaphiopus holbrookii* which share OPG habitat (Connior et al. 2008) and for which abundance data are lacking (Fowler 2015).

| Budget | Justification | SWG | Match (35%) | Total |
|---|---|---|---|---|
| Personnel | | | | |
| Project Leader (V. Rolland) | 1 mo of Academic Salary | | $7,000 | $7,000 |
| Project Partner (R. Johnson) | 0.75 mo of Academic Salary | | $7,889 | $7,889 |
| Graduate student | 14 mo @1400/mo | $19,600 | | $19,600 |
| Field Technician | 12 mo @1300/mo | $15,600 | | $15,600 |
| Fringes | | | | |
| Project Leader (V. Rolland) | 34.73% of salary base | | $2,431 | $2,431 |
| Project Partner (R. Johnson) | 29.66% of salary base | | $2,340 | $2,340 |
| Graduate student | 0.20% of salary base | $39 | | $39 |
| Field Technician | 7.75% of salary base | $1,209 | | $1,209 |
| Supplies & Services | | | | |
| Holohil LB-@X Transmitters | 10 @ 230 | $2,300 | | $2,300 |
| PIT Tags | 150 @ 187.50/box of 25 | $1,125 | | $1,125 |
| PIT Tag reader | 2 @ 100 | $200 | | $200 |
| Fence and trap supplies | | $500 | | $500 |
| DNA isolation | 150 @ $15/sample | $2,250 | | $2,250 |
| Microsatellite analysis | 9 loci @ $6/sample/locus | $8,100 | | $8,100 |
| Publication cost | | $1,500 | | $1,500 |
| Travel | | | | |
| Vehicle Mileage to study site | 24 180-mi round trips @ 0.42/mile | $1,814 | | $1,814 |
| Lodging (motel) | 12 mo @ $65/night | $23,400 | | $23,400 |
| Meetings | | $2,000 | | $2,000 |
| Tuition | | | | |
| Graduate student | 18 credit hr @ 322/credit hr | $5,796 | | $5,796 |
| Total Direct Cost | | $85,434 | $19,661 | $105,094 |
| Indirect Cost | 10 % of TDC | $7,964 | $ ------- | $7,964 |
| Match Indirect Cost* | 39.73% Match | $ ------ | $7,811 | $7,811 |
| Waived Indirect Cost | 39.73%-10% of SWG | $ ------ | $23,676 | $23,676 |
| Total Cost | | $93,397 | $51,148 | $144,545 |

**QUALIFICATIONS/EXPERIENCE OF PROJECT LEADER AND PROJECT PARTNERS INVOLVED**

**Arkansas State University** (A-State) is providing lab space, equipment (e.g., box traps, PCR), and assistance to this project within the College of Science and Mathematics.

***Dr. Virginie Rolland*** is a population ecologist with a Ph.D. from University Pierre et Marie Curie, Paris 6, France (2008). She is an Associate Professor of Quantitative Wildlife Ecology. Rolland's strength is in quantitative analyses of wildlife data, including telemetry and recapture data. She has recently studied geographic and genetic dispersal in birds, in collaboration with co-PI Johnson, and estimated small mammal population demographic parameters. Her recent work has led to three peer-reviewed papers currently in revision for international journals and two manuscripts in preparation adding to her 18 articles already published. Rolland is also the current secretary-treasurer of the Arkansas Chapter of the Wildlife Society and the Arkansas representative on the Southeast Conservation Affairs Committee.

***Dr. Ronald Johnson*** is a population geneticist with his doctorate from the University of Northern Colorado. He is a Professor of Genetics at A-State, with almost 40 peer-reviewed publications in the areas of ecology and population genetics. He will provide expertise in the area of gene flow and genetic structuring of Ozark pocket gophers.

***Dr. Thomas Risch*** is a mammalogist with a Ph.D. from Auburn University. He is a Professor of Animal Ecology, Curator of Mammals, and Chair of the Department of Biological Sciences at A-State. He is also currently serving as the President of the Arkansas Chapter of The Wildlife Society. Risch has 27 years of experience studying small mammals including the Ozark pocket gopher. He published 5 peer-reviewed papers on Ozark pocket gophers and their habitat in Izard County. He will provide knowledge in Ozark pocket gopher biology as well as training in field procedures.

All three research partners have experience mentoring graduate students.