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Research Article

Natal dispersal of Ozark pocket gophers *Geomys bursarius ozarkensis*: who and when?

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Abstract

Natal dispersal is a fundamental phase of the life history of species despite associated risks with that dispersal. These risks are increased for subterranean mammals, which are uniquely adapted for movement in a subterranean environment and invest much energy into building burrows and creating food caches. The Ozark pocket gopher *Geomys bursarius ozarkensis* Elrod, Zimmerman, Sudman and Heidt, 2000, endemic to north central Arkansas, is an imperiled and geographically isolated subspecies of the plains pocket gopher *Geomys bursarius* Shaw, 1800. Understanding its natal dispersal patterns is necessary for long-term conservation plans. We conducted radio telemetry of 33 juvenile Ozark pocket gophers to characterize dispersal frequency, distance, seasonality, and sex bias. Natal dispersal was rare (9.1%) in Ozark pocket gophers and occurred over shorter distances (20–70 m) than documented in other gopher species. The low number of dispersers identified ($n = 3$) precluded us from determining seasonal or sex bias. We had limited evidence of above-ground dispersal despite the adaptations of pocket gophers to the subterranean environment.

Key words: juvenile, movement, pocket gopher, rodent, subterranean, telemetry

Introduction

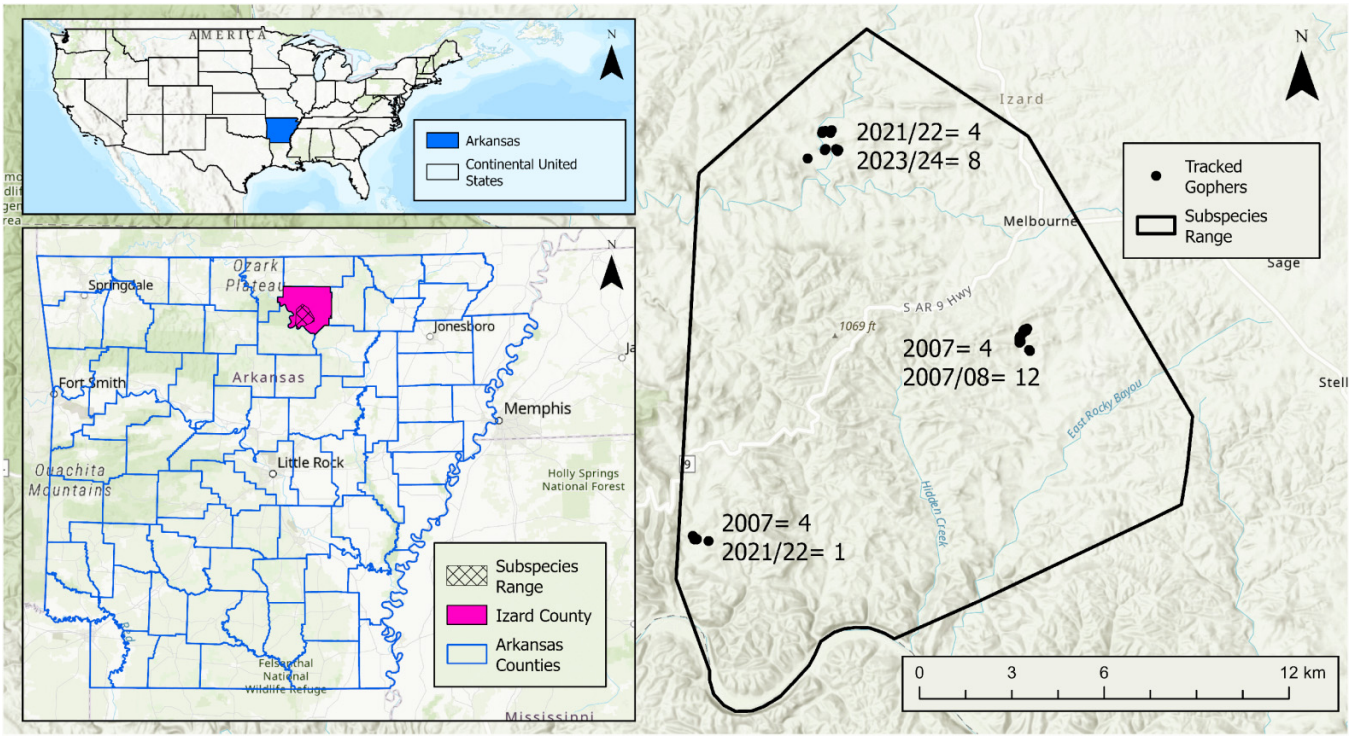
Dispersal of a species is necessary to reduce inbreeding or kin competition, expand the range of an existing population, and optimize the spatial distribution of resources and habitat (Harvey and Ralls 1986; Li and Kokko 2019). Typically, this dispersal function is more commonly performed by juveniles leaving the natal site (birth location) to establish a new territory (natal dispersal) than by breeding adults (breeding dispersal). Additionally, to further minimize inbreeding, one sex tends to disperse more than the other, with dispersal often female-biased in birds and male-biased in mammals (Greenwood 1980).

The patterns of natal dispersal in subterranean mammals are of particular interest because common adaptations found in subterranean mammals (reduced vision or blindness, reduced external pinnae, rotated forelimbs, and elongated nails) may reduce their aboveground mobility and thus limit their dispersal capabilities (Nevo 1979). Further, subterranean mammals with limited above-ground mobility face increased risk of isolation as a result of land development and habitat degradation (Mammola et al. 2019). Natal dispersal of pocket gophers is vital for the long-term survival of the population, particularly because adult dispersal is rare after the burrow has been established (Daly and Patton 1990; Hafner 2016). However, the advantages associated with natal dispersal must be tempered with the ability to find mates in the subsequent breeding season.

Pocket gophers of the family Geomyidae are highly speciated and distributed across North and Central America in parapatric, isolated populations (Hafner 2016). Among species of pocket gophers, seasonal timing, strategy, and distance of dispersal, as well as the dispersing sex vary. Adult pocket gophers are solitary and territorial; however, the young of several species stay in their maternal burrow and begin to construct tunnels when their body mass reaches ~40 g (Vaughan 1962; Sudman et al. 1986). The construction of these tunnels by young pocket gophers can then lead to later dispersal events. For example, juveniles disperse around 7 weeks of age when they are 80–100 g, in the genera *Cratogeomys* (Smolen et al. 1980), *Thomomys* (Howard and Childs 1959), and *Geomys* (Connior 2011). The timing and mode of dispersal may be related to their breeding season. Pocket gopher populations in northern latitudes and high elevations reproduce only in the spring, whereas those at lower latitudes and elevations may breed and disperse year-round (Vaughan 1962; Adams 1966). The mode of dispersal (below vs. above ground) may be related to the availability of snow and plant cover, and the relaxed territoriality within shared tunnels which occurs during the breeding season (Howard and Childs 1959; Hafner 2016).

The timing, mode, and sex bias of dispersal in the highly isolated Ozark pocket gopher, *Geomys bursarius ozarkensis* Elrod, Zimmerman, Sudman and Heidt, 2000, remain largely unknown. First described in Elrod et al. (2000) as a subspecies

Fig. 1. Ozark pocket gophers *Geomys bursarius ozarkensis* ($n = 33$) were radio-tracked from three subpopulations in Izard County, Arkansas, USA. The years of sampling and sample size are indicated next to the site. The subspecies range was determined by Reusche et al. (2025). Base maps were sourced from Esri, TomTom, Garmin, Food and Agriculture Organization, National Oceanic and Atmospheric Administration, United States Geological Survey, OpenStreetMap contributors, and the Geographic Information System User Community. Maps are projected in NAD83 with the Universal Transverse Mercator 15N coordinate system.



of the plains pocket gopher *Geomys bursarius* (Shaw, 1800), the Ozark pocket gopher is classified as S1 (critically imperiled) and is considered a "species of greatest conservation need" in the Arkansas Wildlife Action Plan (Fowler and Anderson 2015). Because the Ozark pocket gopher is endemic to north central Arkansas, they are isolated from the nearest other population of the plains pocket gopher and their closest genetic relative, the eastern Missouri pocket gopher *Geomys bursarius missouriensis* McLaughlin, 1958, by 150 km (Heaney and Timm 1983; Elrod et al. 2000). Krakker and Krakker (2019) hypothesized that these subspecies were at one time connected; however, regional modifications due to intensive land use and suppression of natural fires have resulted in increased fragmentation of extant populations. Further, extirpation events have been documented in both sister taxa. Southern populations of the eastern Missouri pocket gopher have been extirpated due to the conversion of historic prairies to intensive row-farming agriculture (Krakker and Krakker 2019). Previously described populations of the Ozark pocket gopher were documented as extirpated in 2000 (Elrod et al. 2000) and later in 2025 (Reusche et al. 2025). These extirpation events were likely due to land development and flooding.

Our objective was to characterize the frequency (percentage of the juvenile population), timing (season), sex ratio, and mode (below or above ground) of natal dispersal for the Ozark pocket gopher. The Ozark pocket gopher occurs at a latitude consistent with potential year-round breeding (Connior 2011; Hafner 2016), which may result in year-round natal dispersal. Thus, we predicted that natal dispersal in Ozark pocket gopher would occur for 15% of juveniles as found in the southeastern pocket gopher (Warren et al. 2017) in all seasons—matching a likely year-round breeding strategy—most below ground, and be male-biased.

Materials and methods

Study site

The Ozark pocket gopher occurs in disjunct populations in the southeastern portion of Izard County, Arkansas (Fig. 1). Izard County is located within the Salem Plateau and is characterized by landscapes of dolomite and sandstone outcroppings historically interspersed with prairies. Ozark pocket gophers are found on private lands with primary successional stages such as grazing lands, hay fields, and frequently mowed areas (Connior et al. 2010; Reusche et al. 2025). Their occurrence is limited by the availability of loamy sand soils along the sandy deposits from creeks and springs feeding the White River (Reusche et al. 2025). Suitable prairies for pocket gophers are divided by rocky outcroppings, mountain terrain, springs, and creeks. Within portions of the streams there are sandy islands that have been inhabited by Ozark

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pocket gophers and may function as corridors for dispersal across waterways. The summers are hot and winters are mild with minimal snow cover (temperatures range from −5 to 32 °C annually; National Centers for Environmental Information 2024).

Field procedures

Fieldwork methods and procedures were approved by the Arkansas State University Institutional Animal Care and Use Committee (IACUC protocol #F20-21-204) and were conducted under Arkansas Game and Fish Commission Scientific Collection Permit #093020081 (2007–2008), #020520212 (2021), #122120211 (2022), and #112920221 (2023). All handling of mammals complied with the mammal use guidelines of the American Society of Mammologists (Sikes and the Animal Care and Use Committee of the American Society of Mammalogists 2016).

Juvenile Ozark pocket gophers were radio-tracked in April 2007 through July 2007, December 2007 through early-April 2008, mid-September 2021 and 2023 through mid-February 2022 and January 2024. Across the 4 years of study, we sampled in all months and seasons, except the month of August due to decreased gopher burrowing activity. Although Connior and Risch (2010) estimated home ranges of the Ozark pocket gopher from samples collected in 2007–2008, they did not evaluate natal dispersal. Therefore, we combined data from both studies.

We set box traps designed and used by Connior and Risch (2009*a*) into active burrows and blocked surface light with coverboards and dirt. Upon capture, individuals were marked with a passive integrated transponder (PIT) tag and we recorded the mass, reproductive status, and age class. We deployed a combination of SOPI-2070, SOPI-2090, SB-2, and PD-2HX subcutaneous transmitters supplied by Wildlife Materials Inc. (Murphysboro, Illinois, USA) and Holohil (Ontario, Canada), which did not exceed 5% of the body mass as established by the American Society of Mammologists (Sikes and The Animal Care and Use Committee of the American Society of Mammalogists 2016). Juveniles were distinguished from adults by having a weight of <115 g; juvenile body length was ≤215 mm for males and ≤200 mm for females (Pitts et al. 2005; Connior and Risch 2009*b*).

We intended to track an equal sex ratio but were limited by the 64% female bias in Ozark pocket gophers (Connior 2011). Further, the difficulty in capturing juveniles—68% of captured individuals were adults—exacerbated the problems associated with obtaining an equal sex ratio. Our sample size totaled 20 juveniles in 2007 and 2008 (7 males, 13 females) and 13 juveniles in 2021 and 2023 (5 males, 8 females).

To implant the transmitter, we sedated trapped individuals by first placing them in a clear container with an isoflurane-soaked cotton pad, allowing us to monitor their activity. We removed individuals once they had laid on their side and their breathing began to slow. Once sedated, the upper back was cleaned with isopropyl alcohol, and we implanted radio-transmitters subcutaneously between their scapulae via a small incision (Connior and Risch 2009*b*). To close the incision, we used surgical glue and monitored the gophers for recovery from anesthesia and for the glue to completely dry before we released them back into their burrows.

We tracked pocket gophers starting the day following capture 4–7 days a week. Radio-tracking was conducted using a homing technique with a TRX 1000S receiver and a 3-element Yagi antenna (Wildlife Materials, Inc., Murphysboro, Illinois). We recorded one GPS location per day sampled for each individual upon detection (Pynne et al. 2019, 2023), and the coordinates were projected in Universal Transverse Mercator Zone 15 using ArcGIS Pro 3.0.1 (Esri, Redlands, CA). Based on manufacturer specifications, we aimed to track for 4–8 months.

To collect additional data to determine the mode of dispersal, in 2007 and 2021, we set four drift fences 33 m long with 18.9 L pitfall traps spaced every 8 m on both sides of the fence (Connior and Risch 2009*c*) to observe aboveground dispersal (Howard and Childs 1959; Daly and Patton 1990). We placed the pitfall traps within a high-density field that included some of the tracked individuals. There were no pitfall captures in 2007 and a single capture in 2021, so the use of pitfall traps was discontinued in 2023. For gophers captured by the pitfall traps, we collected the same data as described above and marked them with PIT tags. Gophers were released on the surface and monitored until they had re-burrowed. Further, we deployed one game camera (Stealth Cam G45NGMAX, Irving, Texas) on each of the four drift fences in 2021, approximately 1 m off the ground that were set to capture three photos when motion was detected.

Data analyses

To characterize the dispersal timing of juvenile pocket gophers, we evaluated temporal changes in location via core home range and the distance moved using a minimum of 15 GPS points required by the analysis (Calenge 2006). We used kernel density with a bandwidth of hypertext reference to calculate core home ranges from 50% of the points and total home range from 95% of the points (Worton 1989). The average core home range length and the average core home range were compared for dispersing and nondispersing juveniles in addition to between males and females with a Kolmogorov–Smirnov test. For future comparisons to other pocket gopher home range studies, we also calculated the minimum convex polygon (MCP) from 50% of the points[1]. We obtained both the kernel density and MCP estimates using the Program R (R Core Team 2024) with the package adehabitatHR (Calenge 2006).

Smolen et al. (1980) defined dispersal in the yellow-faced pocket gophers *Cratogeomys castanops* (Baird, 1852) of Lubbock, Texas, as movement greater than the mean home range length. We considered changes in the core home range location to be dispersal if the individual established a new core home range, and did not return to their initial burrow. By contrast, we considered movements to be temporary long-distance movements if the gopher traveled a distance greater

[1] Tables S1 and S2.

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than the square root of the average core home range, i.e., 15 m (Connior and Risch 2010), and then returned to the core home range. Individuals that did not disperse are referred to as "non-dispersers".

Dispersal may occur in one movement or incrementally (i.e., over several days or through intermediate burrows), and for fossorial species, above or below ground. We used both dates from tracking to view movement chronologically and distance to determine whether a movement was temporary or dispersal. In the event of dispersal, we calculated separate core home range estimates before and after the dispersal event. The dispersal distance was measured as the distance between the center for each (pre- and post-dispersal) core home range.

For both dispersers and nondispersers, we also measured daily movement as the distance from the center(s) of the core home range(s). We calculated the core home range length as the maximum diameter of the 50% kernel. All distances were measured using the package geosphere (Hijmans 2023). We presented all gophers' mean daily movements and core home ranges with one standard error.

Due to the small number of dispersers ($n = 3$), we were unable to test for a sex bias in natal dispersal as a whole or by season. Finally, to determine the frequency of natal dispersal and assess its randomness, we performed a binomial test for proportion with an expected 50% chance of dispersal.

Results

We tracked 33 juvenile (64% female, 36% male) gophers (Table 1) for 25–148 days (mean 80 ± 7.5 days)[2]. The average core home range for all gophers was 129.1 ± 22.4 m^2 and did not differ among dispersers ($n = 3$; 92.6 ± 22.6 m^2) and nondispersers (136.4 ± 26.4 m^2; $D = 0.3$, $p = 0.7$) nor between males (138.9 ± 47.1 m^2) and females (122.8 ± 22.0 m^2; $D = 0.2$, $p = 0.7$). The average core home range length for all gophers was 13.4 ± 1.2 m and did not differ among dispersers (11.5 ± 1.5 m) and nondispersers (13.8 ± 1.4 m; $D = 0.4$, $p = 0.4$) nor between males (12.7 ± 2.1 m) and females (13.9 ± 1.5 m; $D = 0.2$, $p = 0.7$). Average daily movement from the center of the 50% kernel was 6.8 ± 1.0 m.

We observed temporary long-distance movement which did not result in dispersal in 6.4% of the movement data from 23 of the 33 juveniles studied (Fig. 2). In each case, temporary long-distance movements ranged from 15 to 295 m before the individuals returned to their original burrows and that return occurred before the next tracking session 24–72 h later (above ground or below). These temporary long-distance movements were observed in both males ($n = 8$) and females ($n = 15$) throughout the year, although they were more common in females (68% of the temporary long-distance movements) and during the winter (58% of the temporary long-distance movements). Further, we did not capture individuals in the pitfall traps in 2007, and we only captured one (untagged) female juvenile moving above ground (on 17 November 2021). Upon capture she was marked with a PIT tag and released above ground. Game cameras yielded no evidence of aboveground movement; however, we observed tracks of multiple gophers in the snow in January 2024. These tracks began with open burrows and there was evidence of attempted and successful arial predation of pocket gophers (Fig. 3).

There was a significantly less than 50% chance of dispersing (9.1%, $p < 0.001$), which occurred by two males and one female (Table 2). Natal dispersal occurred in the winter months of 2008 by the males and in the fall of 2021 by the female, with dispersing distances of 20, 30, and 70 m, respectively (Fig. 4). We were unable to determine the mode of dispersal for the dispersing gophers. All dispersing individuals had some temporary long-distance movements both before and after dispersing.

The first dispersing male was tracked starting on 18 December 2007, dispersed 20 m on 1 January 2008, and remained at the second burrow for the duration of the study until 6 April 2008 (Fig. 4B). Temporary long-distance movements for this male ranged from 15 to 20 m.

We began tracking the second dispersing male on 31 December 2007. This male dispersed 30 m on 27 January 2008 and remained at the dispersal burrow system until he was found crushed in his nest under a sunken backhoe 51 days after dispersing (Fig. 4C). In the days directly following dispersal, the gopher exhibited temporary long-distance movements of 20–30 m.

We began tracking the dispersing female on 3 October 2021. Prior to dispersing and among other temporary long-distance movements, she had traveled 295 m away from the initial burrow on 15 October 2021 but returned to her initial site the next day and was not recorded again at that distant point for the duration of the study (Fig. 4D). Her dispersal period occurred over a 29-day period (from 2 November to 1 December 2021) during which she was moving back and forth between the first burrow and the second ~70 m away. After 1 December, she remained at her second burrow for the duration of the study (12 February 2021).

Discussion

Although natal dispersal serves the functions of range expansion and reduced inbreeding, pocket gophers have a high energy investment when leaving a site to establish a new burrow (Bonte et al. 2012; Warren et al. 2017; Pynne et al. 2023), which may explain why natal dispersal was rare in Ozark pocket gophers. We expected seasonal timing and mode of dispersal to be of importance to balance cost-benefit. However, natal dispersal likely occurred year-round rather than during a specific season and long-distance movement likely required aboveground travel. Although these characteristics (timing, mode) and sex bias warrant more research, we have determined a distance of dispersal.

The daily movements of all tracked individuals were primarily within their core home ranges and were shorter than the average core home range length of nondispersing individuals, suggesting they remain largely within their burrow system. Temporary long-distance movements occurred most frequently in the winter and by females. These sex and tim-

[2] Table S1.

Table 1. Tracking periods and sex of juvenile Ozark pocket gophers (*Geomys bursarius ozarkensis*) tracked in Izard County, Arkansas, USA.

Year	Starting date	Ending date	Females	Males
2007	9 April 2007	24 July 2007	5	3
2008	27 December 2007	8 April 2008	8	4
2021	15 September 2021	12 February 2022	3	2
2023	8 September 2023	31 January 2024	5	3

Note: The month of August was excluded because of the difficulty trapping pocket gophers during the low mounding period.

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ing results might be an artifact of our sampling design—most gopher locations were obtained in the winter—or of the female-biased sex-ratio among the juveniles we tracked. Alternatively, we speculate that gophers—particularly females who need resources not only for survival, but also to build a nest, sustain pregnancy, and nurse the pups—might need to travel farther to find food and vegetation during the winter. Pocket gophers typically forage using an area-restricted search method (Romanach et al. 2007); however, to find new food patches individuals leave their foraging ground and explore along their extension tunnels. Despite strong territoriality for Botta's pocket gopher adults *Thomomys bottae* (Eydoux and Gervais, 1836), Howard and Childs (1959) determined that some tunnels served as common property and provided safe transportation through burrow systems without incurring a fight, which may allow juveniles to search for abandoned sites. Additionally, the tunnel length of plains pocket gophers may be as long as 155.5 m (Downhower and Hall 1966) and may allow pocket gophers to travel large distances underground within their burrow system.

Natal dispersal was less frequent for the Ozark pocket gopher in this study (9.1%, $n = 3$) than for the yellow-faced pocket gophers (28.6%, $n = 4$; Smolen et al. 1980) and the southeastern pocket gophers *Geomys pinetis* Rafinesque, 1817 (15.0%, $n = 3$; Warren et al. 2017). By contrast, natal dispersal was common for Botta's pocket gopher though the frequency was not reported (Daly and Patton 1990). With our limited sample size of three dispersers, we observed dispersal distances of 20–70 m. Despite some distance overlap, juveniles in other species dispersed longer distances between 40 and 600 m (Smolen et al. 1980; Daly and Patton 1990; Warren et al. 2017). Ozark pocket gophers also differed from other gopher species in that two of the three dispersal events occurred in a single day, whereas southeastern pocket gophers moved incrementally over 3–9 days (Warren et al. 2017; Pynne et al. 2023). Limited dispersal distances may be the result of disjunct available habitat within the Ozark pocket gopher's distribution. Rocky terrain may prevent gophers from traveling among sites and there may be a higher risk of predation while crossing these unsuitable areas without cover. Further, some of the gophers for which we lost a telemetry signal may have been attempting to disperse.

Dispersal can only occur within suitable habitats and is impeded by unsuitable areas (Vaughan 1963; Waser and Jones 1983; Parsons et al. 2022). Additionally, dispersal may be influenced by the density of the source population. The Ozark pocket gopher has a highly fragmented distribution because of rocky, mountainous terrain, creeks, and springs which cannot be burrowed through divide the suitable habitat, and some of the formerly suitable open prairies have transitioned into dense forest (Connior et al. 2010; Reusche et al. 2025). Our juveniles were tracked within hayfields that had adjacent grasslands, forested areas, and creeks.

Ozark pocket gophers have an average density of 20.4 gophers per hectare, and the density increases with the size of the suitable area (Connior et al. 2010). Occupancy patchiness due to suitable habitat isolation may be associated with a higher density of gophers than in other plains pocket gopher subspecies that occur at densities of 7.4–22.0 per hectare (Connior 2011). In turn, higher densities may be the result of the decreased dispersal frequency and distance. In some rodents, a high population density is associated with decreased dispersal and increased recruitment of kin of which adults are more tolerant (Lambin et al. 2001; Clutton-Brock and Lukas 2012; Mayer et al. 2017).

We could not determine a clear seasonal pattern of natal dispersal in the Ozark pocket gopher with one fall dispersal event and two winter dispersal events. These few observations are not enough to conclude whether Ozark pocket gophers have a year-round dispersal strategy. Furthermore, temporary large movements, which may have been exploratory relocation attempts, also occurred in all seasons but were most common in the winter when we collected the most data. Juvenile Ozark pocket gophers have been captured year-round, and pregnant females were captured in April, May, September, and October for this study. In other Geomyidae species and subspecies of plains pocket gophers, dispersal occurs mostly in spring (Miller 1946; Vaughan 1962; Hafner 2016) with documented exceptions. For example, plains pocket gophers in Colorado dispersed in the early spring (Vaughan 1962) and those in Minnesota dispersed in late summer (Adams 1966). Botta's pocket gophers in the southern part of their range (e.g., California), where breeding occurs year-round (Loeb 1990; Patton and Smith 1990), dispersed in summer to early autumn and also the following spring (Daly and Patton 1990).

In addition to dispersing during breeding seasons to facilitate gene flow, the mode and timing of natal dispersal may be related to reducing risk. As reviewed by Hafner (2016), the primary mode of dispersal among pocket gopher species is above ground, into an unoccupied or a newly constructed burrow. In the late spring and early summer, burrowing activity is at its peak and tall grasses may obscure predator vision and burrowing activity (Miller 1948; Cox and Hunt 1992). Later during the winter, snow may provide cover and is a less energetically costly substrate to tunnel through (Larrison

Fig. 2. (A) Thirty-three juvenile Ozark pocket gophers *Geomys bursarius ozarkensis* were radio-tracked from three subpopulations in Izard County, Arkansas, USA. (B) Nondispersing juveniles were tracked primarily around their burrow, but (C) a few underwent temporary long-distance movements. Points on maps (B and C) represent the radio-tracking locations of a juvenile, with one color per individual. The subspecies range was determined by Reusche et al. (2025). Base maps were sourced from Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community. Maps are projected in NAD83 with the Universal Transverse Mercator 15N coordinate system.

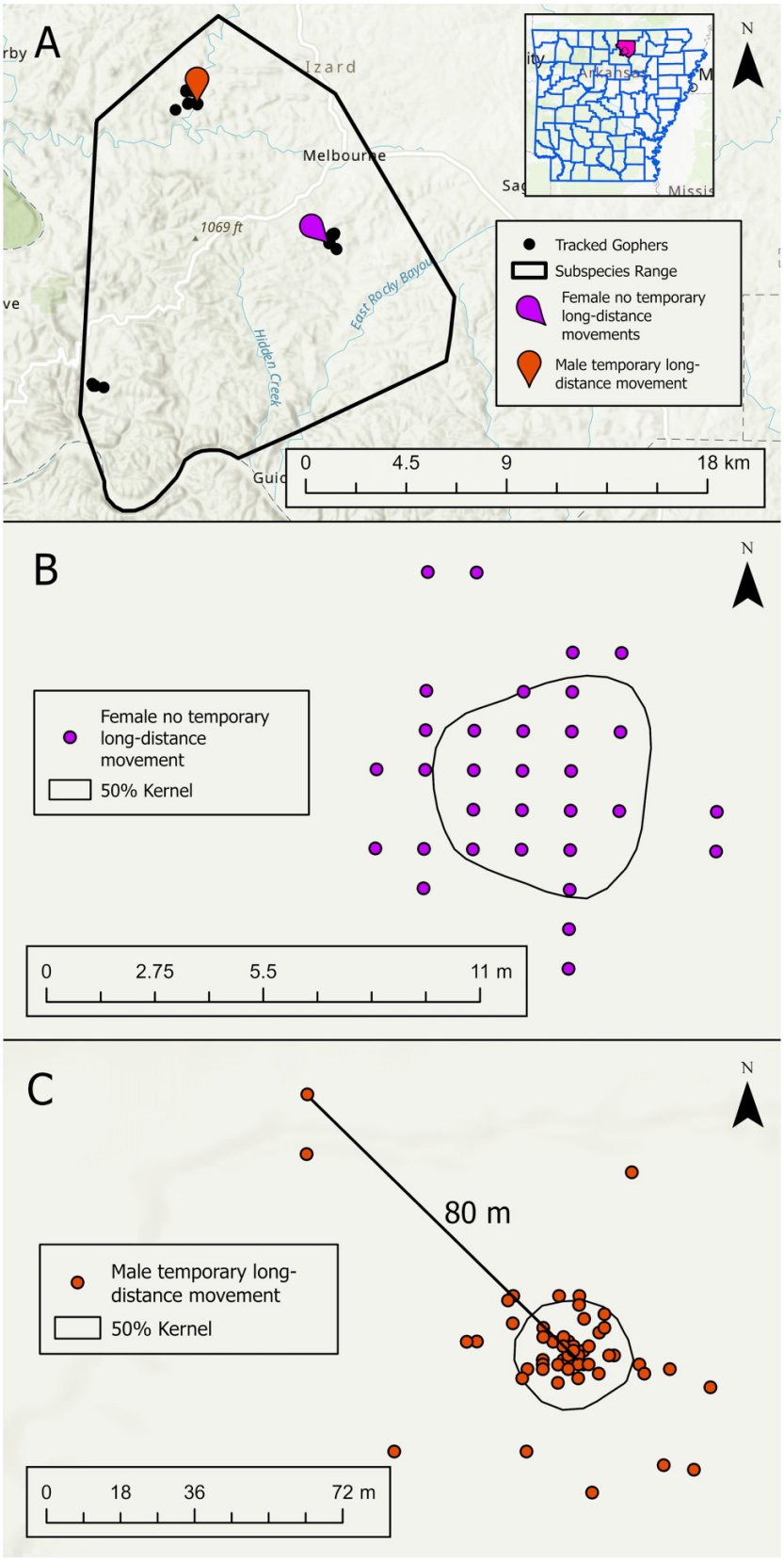

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Fig. 3. Tracks from an Ozark pocket gopher *Geomys bursarius ozarkensis* exiting a burrow hole were observed in the snow in January 2024 in Izard County, Arkansas, USA. Predation by an aerial predator was indicated by the predator's wings imprinted in the snow.



Table 2. Natal dispersal characteristics of Ozark pocket gophers (*Geomys bursarius ozarkensis*) in Izard County, Arkansas, USA in 2007–2008 and 2021–2022.

Sex	Dispersal date	Dispersal distance	First core home range (m^2)	Second core home range (m^2)	Days tracked	Fate
Male	1 January 2008	20 m	68	60	110	Tracking concluded
Male	27 January 2008	30 m	171	43	87	Killed by landowner
Female	2 November 2021	70 m	175	149	132	Tracking concluded

Note: Three juveniles were tracked for 87–132 days while dispersing 20–70 m from their core home ranges in January and November through December. If the radio-transmitters were still functioning at the end of the tracking period, we labeled the individual's fate as "tracking concluded".

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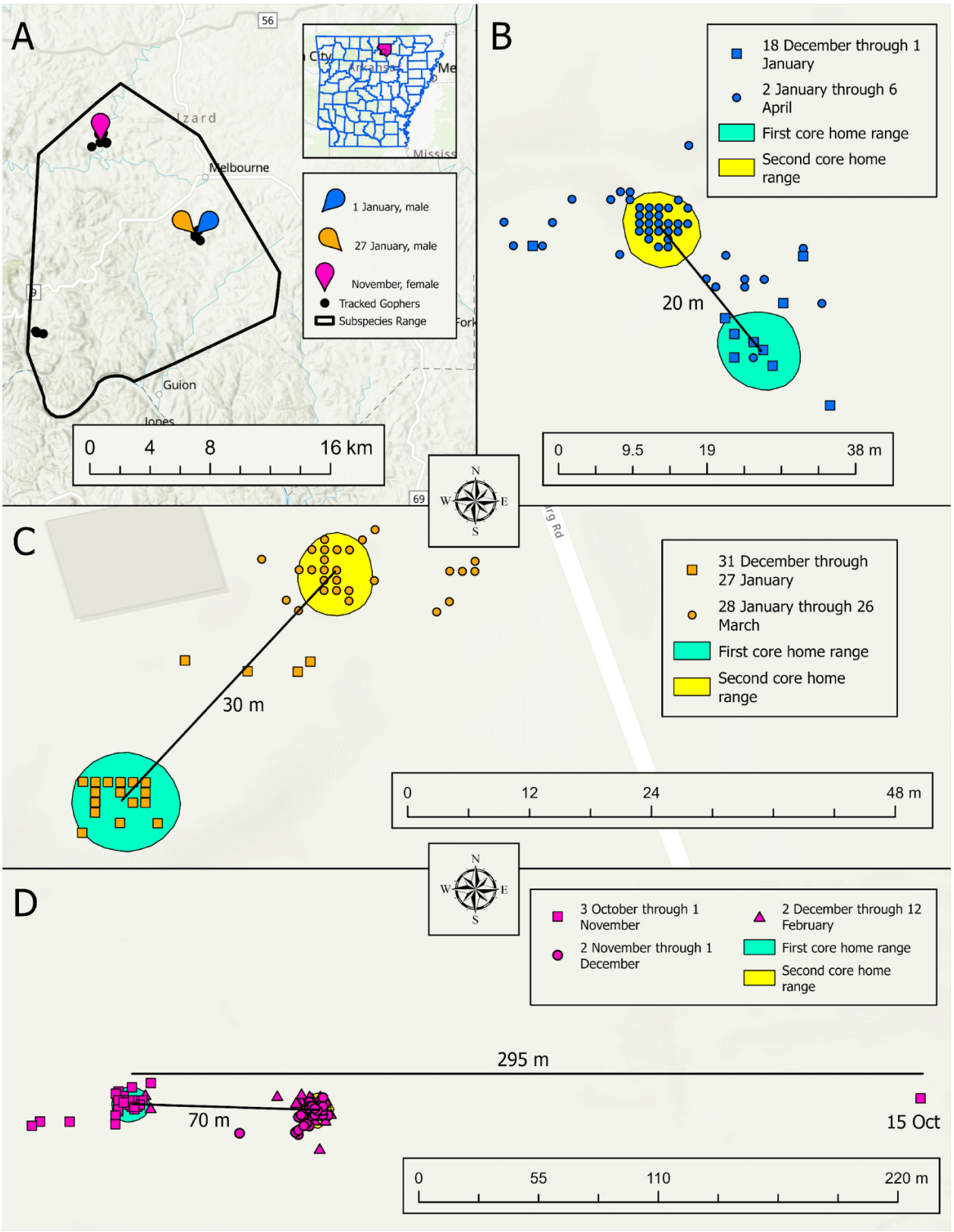
Fig. 4. (A) Natal dispersal of tracked Ozark pocket gophers (*Geomys bursarius ozarkensis*; $n = 33$) was observed by two males in 2008 (B and C) and one female in 2021 (D) in Izard County, Arkansas, USA. Core home ranges were determined with a 50% kernel for pre and post dispersal. The female traveled 295 m in mid-October before dispersing moving 70 m from the first core home range to the second core home range from 2 November 2021 to 1 December 2021. Shorter temporary long-distance movements were observed for the two males. The subspecies range was determined by Reusche et al. (2025). Base maps were sourced from Esri, TomTom, Garmin, FAO, NOAA, USGS, OpenStreetMap contributors, and the GIS User Community. Maps are projected in NAD83 with the Universal Transverse Mercator 15N coordinate system.



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1942; Ellison 1946; Vaughan 1963). However, the range of the Ozark pocket gopher does not experience either a high volume or frequency of snow, so local snowfalls typically do not fully obscure the animal to facilitate dispersal. Although the three dispersal events did not occur when snow was covering the ground we do have evidence of gophers of unknown maturity moving above ground via snow tracks in January 2024. Among these tracks, we documented predation of at least one pocket gopher by an aerial predator. Further, Connior and Risch (2010) observed one adult male Ozark pocket gopher moving through the snow a distance of approximately 165 m. We collected additional confirmation for above-ground movement by the capturing of a previously untagged juvenile female in mid-November via pitfall traps. Evidence of pocket gophers having the potential to swim was demonstrated by the presence of Ozark pocket gophers burrowing in the sandy islands within some of the larger creek systems (Reusche et al. 2025) and this swimming behavior is consistent with other pocket gopher studies (Kennerly 1963; Hickman 1977). In this study, the dispersing males may have moved above or below ground, but the female that made frequent, longer trips between burrows over an extended period, likely moved through an established tunnel system.

To ascertain the sex bias of natal dispersal in the Ozark pocket gopher, this study aimed to track an equal sex ratio of juveniles, but our sample set for juveniles was 64% female, consistent with the population sex ratio of 64% (Connior and Risch 2010). Pocket gopher populations are female-biased (Hafner 2016). This bias ranges from 60% to 66% among plains pocket gopher subspecies (Connior 2011), up to 80% in Botta's pocket gophers (Jones and Baxter 2004), 82% in yellow-faced pocket gophers (Davidow-Henry et al. 1989), and 95.5% in the Baird's pocket gopher (Medine et al. 2022). Our low sample size of dispersing individuals precludes us from estimating the sex bias of natal dispersal in Ozark pocket gophers, but this question remains important for future conservation actions. For example, managers might need to determine the sex ratio needed for a translocation effort to be successful. Other studies on pocket gophers have obtained mixed results as to which sex is more likely to disperse. Male-biased dispersal was identified in the plains pocket gopher (Zinnel and Tester 1994) and Attwater's pocket gopher *Geomys attwateri* Merriam, 1895 (Williams and Cameron 1984) and in Botta's pocket gopher natal dispersal was female-biased (Daly and Patton 1990).

Natal dispersal—and thus gene flow among populations—may be facilitated by habitat restoration and protection of the sandy islands within the creeks that act as dispersal corridors; however, there are no current protections by government agencies for these unique ecosystems. Increased fire regimens and the mechanical clearing of unmanaged forests may increase the connectivity of disjunct gopher habitat (Connior et al. 2010; Wagner et al. 2017; Duncan et al. 2020; Parsons et al. 2022; Reusche et al. 2025). For example, experimental mound building to enhance the habitat of the California tiger salamander *Ambystomata californiense* Gray, 1853 in California attracted the Botta's pocket gopher to the area (Cook et al. 2006), and may be a viable strategy to encourage colonization. Dispersal corridors, such as the sandy islands that may be used by the Ozark pocket gopher to cross the many local streams of the region, are vital for the movement of pocket gophers and therefore gene flow among subpopulations (Welborn and Light 2014; Painter et al. 2022). Relocating pocket gophers has been demonstrated to both remove nuisance gophers and establish new populations in previously vacant sites (Hansler et al. 2017; Pynne et al. 2019, 2023).

To better answer the question as to the natal dispersal of Ozark pocket gopher seasonally and by sex, more juveniles would need to be tracked; however, studies are limited by small sample sizes due to the difficulty in capturing juveniles, the size of the juveniles likely to disperse, and the size and cost of available transmitters weighing $\leq$5% of the animal's body weight (Sikes and the Animal Care and Use Committee of the American Society of Mammalogists 2016). A second limitation was that we were unable to determine at the time of capture whether the individual was still living within its mother's burrow system or had already made its first relocation. Future studies could evaluate breeding timing and target the burrows of pregnant females to transmitter juveniles while still in the maternal burrow. Further, genetic studies can determine maternity and offspring relationships and therefore provide insight into the movement patterns from the maternal burrow.

This study evaluated the natal dispersal of a rare endemic pocket gopher subspecies endemic to north central Arkansas. We identified limited dispersal activity and distances from two males and one female Ozark pocket gopher. While we could not determine the mode of dispersal undergone by these juveniles, we did find evidence of aboveground movement by Ozark pocket gophers. This suggests that like other gopher species, above ground movement is occurring despite the unique adaptations of pocket gophers to the subterranean environment and risks of predation. Further, dispersal may be occurring throughout the year as evident by the presence of juveniles and lactating females trapped throughout the seasons.

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Data availability

Data available upon request.

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The authors declare there are no competing interests.

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Supplementary material

Supplementary data are available with the article at https://doi.org/10.1139/cjz-2025-0116.

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