Volume 35 (October 2025), 308–311

Herpetological Journal SHORT NOTE

https://doi.org/10.33256/35.4.308311

Published by the British Herpetological Society

Radio telemetry of the Valcheta frog *Pleurodema somuncurense*: study of spatial ecology and home range in a Critically Endangered species

Calvo Rodrigo[1], Velasco Melina Alicia[1], Rolón Melisa Celia Jazmin[1], Martinez Aguirre Tomás[1], Igor Berkunsky[2] & Kacoliris Federico Pablo[1]

[1]Sección Herpetología, División Zoología Vertebrados, CONICET- Facultad de Ciencias Naturales y Museo, Universidad Nacional de La Plata. Av. 122 y 60 s/n, La Plata 1900 CP, Buenos Aires, Argentina

[2]Instituto Multidisciplinario sobre Ecosistemas y Desarrollo Sustentable, CONICET-Universidad Nacional del Centro de la Provincia de Buenos Aires, Arroyo Seco s/n, Tandil 7000 CP, Buenos Aires, Argentina

This study represents the first application of radio telemetry on the Critically Endangered Valcheta frog *Pleurodema somuncurense* from Argentina's Patagonia, aimed at understanding its spatial ecology, daily movements and home range. Six adult individuals were equipped with radio transmitters to assess their activity patterns and habitat use. Average travel distances from sunset to night detection and from sunset to sunrise were 6.47 m (± 4.2) and 6.32 m (± 4.87), respectively, with no significant difference (Student's t-test, $p = 0.42$, $\alpha = 0.05$). Over a complete activity cycle, individuals moved an average of 8.62 metres (SD = 2.2). The estimated home range was 39 m² including an individual with heightened movement, and 30 m² excluding it. Movements ≤ 5 m were categorised as local adjustments, while > 5 m were exploratory migrations, the latter comprising 25.54% of movements in most individuals, though one frog exhibited 56.25%. Despite successful data collection, high mortality and transmitter displacement highlight the technique's limitations in aquatic anurans. Findings from this study provide valuable data on *P. somuncurense*'s habitat connectivity needs, informing restoration and conservation efforts across its restricted range. Future studies should consider adjusting the telemetry approach to mitigate the impact on behaviour and survival.

Keywords: connectivity, Somuncura plateau, transmitter, amphibian conservation

Amphibians represent one of the most threatened groups of vertebrates worldwide, with 36% of species in some threat category (González del Pliego et al., 2019; IPBES, 2019; IUCN, 2016; Luedtke et al., 2023). In Argentina, the Valcheta frog *Pleurodema somuncurense* is a microendemic species confined to the headwaters of the Valcheta stream on the Somuncura plateau in northern Patagonia. Habitat threats and restricted distribution led to this species being categorised as Critically Endangered on the IUCN Red List (IUCN, 2016). The presence of invasive exotic fish species like rainbow trout *Onchorhynkus mikiss* impedes natural connectivity among populations, presenting significant conservation challenges and highlighting the necessity of restoring natural corridors (Velasco et al., 2018). In this context, a detailed knowledge of the spatial ecology and movement of this almost exclusively aquatic amphibian is essential.

Radio telemetry is a tool widely used in wildlife research (McGowan et al., 2017), as it provides accurate data on the location and movement of animals. Despite technological advances, its application in amphibians remains difficult due to its sensitive skin and soft body structures (Naef-Daenzer et al., 2005; Altobelli et al., 2022). This study aims to record information about the home range and activity of the Valcheta frog, through the study of its spatial ecology, daily movement, evaluation of the technique's applicability and discussion on how this information can be used for future conservation efforts.

In March 2022, six adults individuals of *P. somuncurense* were selected and manually captured at Estancia 'El Rincón' (40° 59'26.62" S, 66° 40'35.73" W), located on the Somuncura plateau in Río Negro Province, Argentina. Due to the critical conservation status of this species, the study was conducted with a limited sample size of six individuals. To ensure robust and meaningful results despite the small sample size, strict selection criteria were applied. Only adult frogs of both sexes with a snout-vent length greater than 34 mm and a weight exceeding 3 g were chosen. Additionally, individuals were required to be in good external condition, free from visible injuries and exhibit normal movement responses, including the ability to recover their posture instantly when turned upside down. Sex was determined by secondary sexual features, such as the presence of nuptial pads on fingers (Cei, 1980). Each individual was measured using a digital caliper (accuracy of 0.01 mm) and weighted on a digital scale (accuracy of 0.1 grams).

External 0.27-gram HOLOHIL LB-2X transmitters were attached using harnesses, a commonly employed method in anuran studies (Altobelli et al., 2022). The

Correspondence: Calvo Rodrigo (rolo.clv@gmail.com)

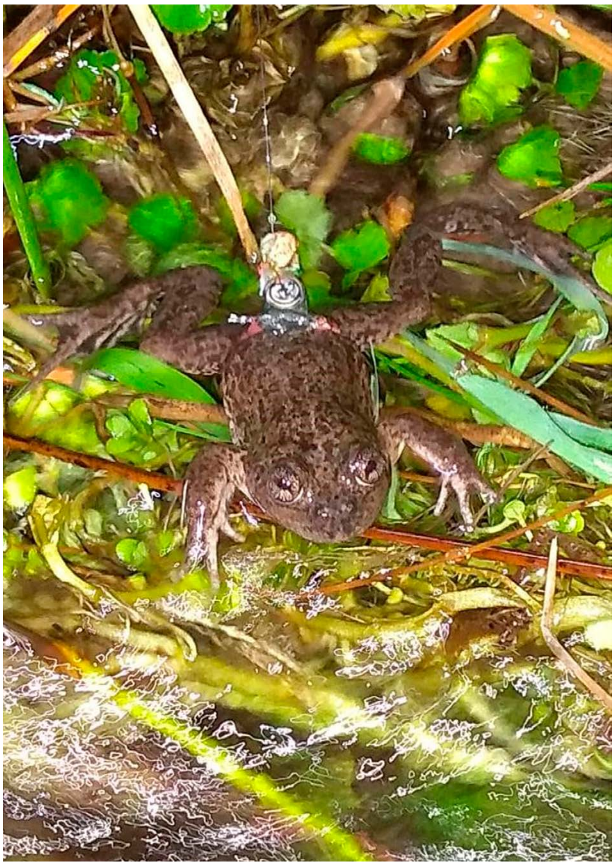

Figure 1. An adult Valcheta frog *Pleurodema somuncurense* with a telemetry harness attached.

harnesses were manually crafted from elastic thread covered with beads, following the design of Muths (2003). Each harness was placed on the thinnest part of the body, just anterior to the hind legs, to prevent sliding forward or backward (Fig. 1). To reduce the effects associated with this technique, we used transmitters weighing less than 10% of each frog's body mass (White & Garrott, 1990; Richards et al., 1994). In this study, the transmitters averaged 4.62% of the frog's body weight (+SE), ranging from 3.3% to 6.13% of the total weight of the individuals. After transmitter placement, the frogs were observed in a container with water, rocks and plants (emulating the stream microhabitats) for 24 hours to assess behavioural responses before release. A normal behavioural response was defined as the ability to move freely among plants and seek cover immediately when detecting an observer, which served as a proxy for typical activity patterns before reintroduction to their original capture locations. Once confirmed, the frogs were released at their original capture sites and tracked for ten days, the duration being limited by transmitter battery life. During this time, their precise locations were recorded twice daily, one detection point in the morning (between 08:00 h and 10:00 h) and another detection point at night (between 21:00 h and 22:00 h). Given that *P. somuncurense* exhibits nocturnal activity, primarily moving between 20:00 h and 06:00 h (Velasco & Calvo, pers. obs.), both detection points represent movements occurring at night. The morning location represents the frog's movement from the prior night detection until sunrise. The nighttime location represents the movement from sunset to night detection. Both detections (morning and night) represent frogs' full activity period from sunset to sunrise. This approach provided insights into nocturnal activity patterns and habitat use across 24 hours. To identify the peak activity period, we compared the distances between detections using a Monte Carlo t-test, hypothesising that longer distances would occur during peak activity.

All detections were conducted under comparable habitat conditions, characterised by a vegetation cover percentage exceeding 60%, providing a homogenous environmental context for the observed movement behaviours. Following the analysis of Arreortúa-Martínez (2020), individual movements were categorised as local adjustments when they ranged from 0 m to 5 m and as exploratory movements when exceeding 5 m. This classification was carried out to define types of movements based on distance, where local adjustments reflected greater activity within a small area, while exploratory movements were identified as migrations in search of new resources (Marshall et al., 2006; Benhamou & Cornélis, 2010).

We employed the minimum convex polygon method to estimate the home range area, utilising the series of co-ordinates obtained in the field, following established methodologies (Mohr, 1947; Moorcroft et al., 1999; Powell, 2000). Given the aquatic habits of the species (Cei, 1969) and the absence of terrestrial observation records, each polygon was tailored to the stream section, extending up to one metre of shoreline. Furthermore, accumulation area curves were constructed for each individual based on all detections to determine the minimum number of detections required to delineate home ranges.

The sexes, sizes (mm) and weights (g) of the individuals were: 1) male, 35.55 mm, 5 g; 2) female, 40.01 mm, 6.5 g; 3) female, 36.90 mm, 5.7 g; 4) male, 38.22 mm, 5.3 g; 5) male, 34.70 mm, 4.4 g; 6) female, 44.18 mm, 8.18 g.

Some individuals exhibited stabilisation of the rarefaction curve between detections 5 and 14, showing consistency in their movement patterns over time. One individual displayed a rarefaction curve that was not stabilised, showing significant variability in movement activity (Fig. 2). The home range encompasses 39.08 m^2, including the individual with heightened movement activity, and 30.1 m^2 excluding this individual.

The average distance traveled was 6.47 metres (± 4.2) from sunset to night detection and 6.32 metres (± 4.87) from sunset to sunrise, with a full range of recorded distances ranging from 0.83 to 14.64 metres. Statistical analysis using a Monte Carlo t-test ($p > 0.05$) revealed no significant differences in movement patterns between these two observation periods, indicating consistency in activity levels throughout the night. Additionally, the analysis found no significant differences between male and female movement distances, indicating similar spatial behaviour across the sexes. Together, these two periods represent a complete movement cycle, with individuals averaging a total distance of 8.62 metres (SD = 2.2) per cycle. All six individuals exhibited both types

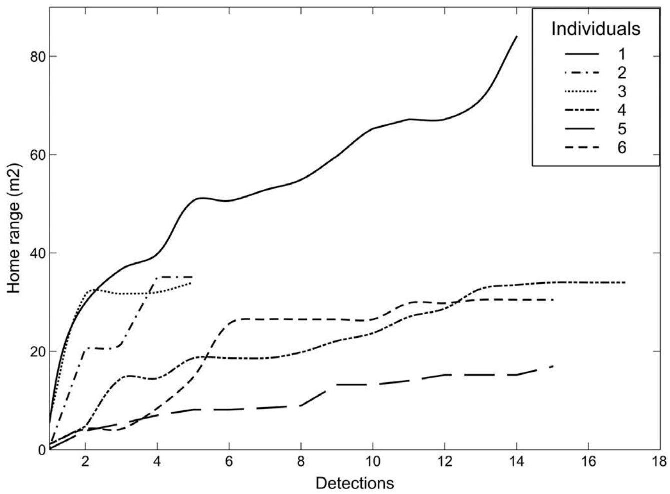

Figure 2. Rarefaction curve illustrating the increase in home range with successive detections.

of movements: local adjustments (0 to 5 metres) and exploratory movements (over 5 metres). On average, five of the six individuals exhibited 26% exploratory movements. However, one male demonstrated markedly greater exploratory activity, with 56% of their movements classified as exploratory. This individual traveled longer distances than the others, significantly expanding their area of activity. Of the six individuals tracked, two (33%) did not complete the 10 days observation period. One frog was found dead in the stream with its transmitter still attached during detection number 5, which corresponds to the third day of the study. Another transmitter was found atop vegetation (*Cortaderia* sp.), during detection number 6, also on the third day of the study, with no sign of the individual that had been carrying it.

This study represents the first radiotelemetry experience conducted on this Critically Endangered species and the first national study on the use of this technique on small amphibians. While the method provided valuable information on the species' movement patterns, range and dispersal capabilities, it also presented significant challenges, particularly in the aquatic environment inhabited by the Valcheta frog. Despite its contributions, the results should be interpreted with caution, as the study also faced some limitations that could influence the robustness and applicability of the results, including the small sample size, high mortality rate and the potential impact of telemetry on frog behaviour.

Given the conservation status of *P. somuncurense*, the sample size was necessarily small, restricting the ability to generalise movement patterns to the entire population. Complementary methods, such as capture-mark-recapture, could serve as an alternative to obtain larger sample sizes with lower risks, but fewer detections per individual. Furthermore, the transmitters may have influenced the frogs' natural behaviour by inducing stress or altering their activity patterns. It was also hypothesised that the presence of the transmitter could have increased the frogs' visibility, reducing their ability to evade predators and making them more susceptible to predation. These potential adverse effects should be carefully considered in future studies, particularly when working with threatened species. To minimise these risks, it could be crucial to adapt the transmitter design. For example, shortening the antenna could reduce entanglement and visibility, although it may also complicate detection. Alternatively, painting the antenna with colours that reduce reflectivity may help make the frogs less visible to predators.

In this study, a dead frog was found in the stream with its transmitter still attached. Although the exact cause of death was not determined by necropsy, it is suspected that the antenna became entangled in dense aquatic vegetation, restricting movement and leading to fatal stress. Similar problems have been reported in other studies, where aquatic vegetation increases the risk of entanglement (Altobelli et al., 2022; Spießberger et al., 2023). A transmitter from another frog was found atop a bush (*Cortaderia* sp.), likely indicating predation by a bird. While predation is a natural process, the transmitter may have increased the frog's visibility or hindered its ability to escape predators (Kenward, 2001). These incidents highlight the importance of carefully evaluating transmitter design to reduce unintended impacts on behaviour and survival.

Despite these challenges, radiotelemetry offered significant advantages over traditional observational methods. By recording precise locations, this technique allowed for detailed analyses of movement patterns, home ranges and the connectivity between nearby populations. These findings have direct implications for habitat restoration and management strategies. For example, identifying the distances traveled by *P. somuncurense* provides critical information for designing restoration actions aimed at improving habitat connectivity. This can guide the rehabilitation of degraded areas to facilitate natural dispersal. Furthermore, understanding movement patterns within the stream allows conservationists to prioritise key microhabitats, such as deep pools and vegetation patches, for protection and management. Addressing habitat limitations and improving migratory corridors will be crucial to ensuring the long-term survival of this Critically Endangered species.

ACKNOWLEDGEMENTS

We gratefully acknowledge the partial financial support provided by the Conservation Leadership Programme, the Rufford Booster Grant, Amphibian Ark, the National Geographic Society, Re:wild, the Scientific and Fondo de Investigación Científica y Tecnológica (PICT 2018- 00891 and PICT-2019-03505), and PIP 803. Our heartfelt thanks also go to the Fundación Somuncurá for their logistical support and Pablo Rodriguez for the assistance in the fieldwork.

Author contributions

Rodrigo Calvo, Federico Pablo Kacoliris, Tomás Martínez Aguirre and Melina Alicia Velasco collected the data, analysed, and interpreted the results. Igor Berkunsky contributed to the design and implementation of necessary instruments for fieldwork and provided financial support. Rodrigo Calvo led the fieldwork and contributed to the statistical analysis. Rodrigo Calvo wrote the manuscript with the assistance of Federico Pablo Kacoliris and Melina Alicia Velasco. Melisa Celia Jazmin Rolón assisted with revisions based on reviewer feedback and contributed to language editing.

REFERENCES

Altobelli, J.T., Dickinson, K.J., Godfrey, S.S. & Bishop, P.J. (2022). Methods in amphibian biotelemetry: two decades in review. *Austral Ecology* 47(7), 1382–1395.

Arreortúa-Martínez, M. (2020). Patrones de movimiento de *Incilius spiculatus* (Anura: Bufonidae) en bosque mesófilo de montaña con distinto grado de perturbación. Dissertation, Instituto Politécnico Nacional, México.

Benhamou, S. & Cornélis, D. (2010). Incorporating movement behavior and barriers to improve kernel home range space use estimates. *The Journal of Wildlife Management* 74(6), 1353–1360.

Cei, J.M. (1969). The patagonian Telmatobiid fauna of the volcanic Somuncura Plateau of Argentina. *Journal of Herpetology* 3, 257–271

Cei, J.M. (1980). Amphibians of Argentina. Monitore zoologico italiano, N.S. *Monografía* 2, 1–609.

González del Pliego, P., Freckleton, R.P., Edwards, D.P., Koo, M.S., Scheffers, B.R., Pyron, R.A. & Jetz, W. (2019). Phylogenetic and trait-based prediction of extinction risk for data-deficient amphibians. *Current Biology* 29(9), 1557–1563.

IPBES (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. IPBES Secretariat, Bonn, Germany.

IUCN SSC Amphibian Specialist Group (2016). *Pleurodema somuncurense*. The IUCN Red List of Threatened Species 2016: e.T20372A85948443. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T20372A85948443.en. Accessed on 31 October 2024.

Kenward, R. (2001). *A Manual for Wildlife Radio Tagging*. Academic Press, London.

Luedtke, J.A., Chanson, J., Neam, K., Hobin, L., Maciel, A.O., Catenazzi, A., ... & Stuart, S.N. (2023). Ongoing declines for the world's amphibians in the face of emerging threats. *Nature* 622(7982), 308–314.

Marshall, J.C., Manning, J.V. & Kingsbury, B.A. (2006). Movement and macrohabitat selection of the eastern massasauga in a fen habitat. *Herpetologica* 62(2), 141–150.

McGowan, J., Beger, M., Lewison, R.L., Harcourt, R., Campbell, H., Priest, M., Dwyer, R.G., Lin, H., Lentini, P., ... & Possingham, H.P. (2017). Integrating research using animal-borne telemetry with the needs of conservation management. *Journal of Applied Ecology* 54(2), 423–429.

Mohr, C.O. (1947). Table of equivalent populations of North American small mammals. *The American Midland Naturalist* 37(1), 223–249.

Moorcroft, P.R., Lewis, M.A. & Crabtree, R.L. (1999). Home range analysis using a mechanistic home range model. *Ecology* 80, 1656–1665.

Muths, E. (2003). A radio transmitter belt for small ranid frogs. *Herpetological Review* 34(4), 345–347.

Naef-Daenzer, B., Fruh, D., Stalder, M., Wetli, P. & Weise, E. (2005). Miniaturization (0.2 g) and evaluation of attachment techniques of telemetry transmitters. *Journal of Experimental Biology* 208(21), 4063–4068.

Powell, R.A. (2000). Animal home ranges and territories and home range estimators. *Research Techniques in Animal Ecology: Controversies and Consequences* 442, 65–110.

Richards, S.J., Sinsch, U. & Alford, R.A. (1994). Supplemental approaches to studying amphibian biodiversity: radio tracking. In: *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians.* Heyer, W.R., Donnelly, M.A., McDiarmid, R.W., Hayek, L.C. & Foster, M.S. (Eds.). Smithsonian Institution Press, Washington, DC. 155–158 pp.

Spießberger, M., Burgstaller, S., Mesnil, M., Painter, M.S. & Landler, L. (2023). Telemetry and accelerometer tracking of green toads in an urban habitat: methodological notes and preliminary findings. *Diversity* 15(3), 328.

Velasco, M.A., Berkunsky, I., Simoy, M.V., Quiroga, S., Bucciarelli, G., Kats, L. & Kacoliris, F.P. (2018). The rainbow trout is affecting the occupancy of native amphibians in Patagonia. *Hydrobiologia* 817, 447–455.

White, G.C. & Garrot, R.A. (1990). *Analysis of Wildlife Radio-Tracking Data*. Academic Press, London.

Accepted: 26 March 2025