Final Report - Mohamed bin Zayed Species project number 242535358

This is an ambitious conservation project that aims to integrate scientific knowledge derived from ecological and population genetic studies with the implementation of conservation measures targeting the coastal dune habitats where these species occur. By combining genetic tools, ecological niche modeling, and some spatial analysis, the project seeks to assess the conservation status of *Ctenomys australis* and *Ctenomys pulcer*, two subterranean rodents with highly restricted distributions. Also, our project aims to identify the main threats to the conservation of these endemic rodents and to foster strong engagement with local communities in the coastal towns located within the distribution ranges of both focal species, promoting awareness and collaborative stewardship of native biodiversity.

The support provided by the MBZSC Fund and the Fonseca Leadership Fund has been instrumental in the successful implementation of our project. It has facilitated the acquisition of essential equipment and the execution of field expeditions to collect critical data. These activities include recording burrow occurrences, documenting the focal species in their natural habitats, and obtaining tissue samples for genetic analysis. Additionally, we conducted spatial analyses and species distribution modeling that allowed us to obtain information about the habitat, which will be used for the management and conservation of the species.

Figure 1. A. *Ctenomys australis*, commonly known as the Southern tuco-tuco. B. *Ctenomys pulcer*, or the Beautiful tuco-tuco.

Fieldwork

The coastal sand-dune landscapes in the Buenos Aires Province, Argentina, are remarkably beautiful and attract a considerable number of tourists. However, conducting fieldwork in these areas presents significant challenges (Figure 2). Urban development is limited to resort areas and a few small towns, leaving long stretches of dunes in between largely uninhabited. Reaching these remote areas often requires extensive travel along the beach and across the dunes.

At the end of 2024 and during 2025, we carried out eight field trips. We visited areas near the towns of Monte Hermoso, Pehuen-Có, Necochea, and the small towns of Marisol and Reta. (Figure 3). During these field expeditions, we captured rodents, collected tissue samples from 132 individuals, and recorded the georeferencing of active burrows and the vegetation cover near each one.

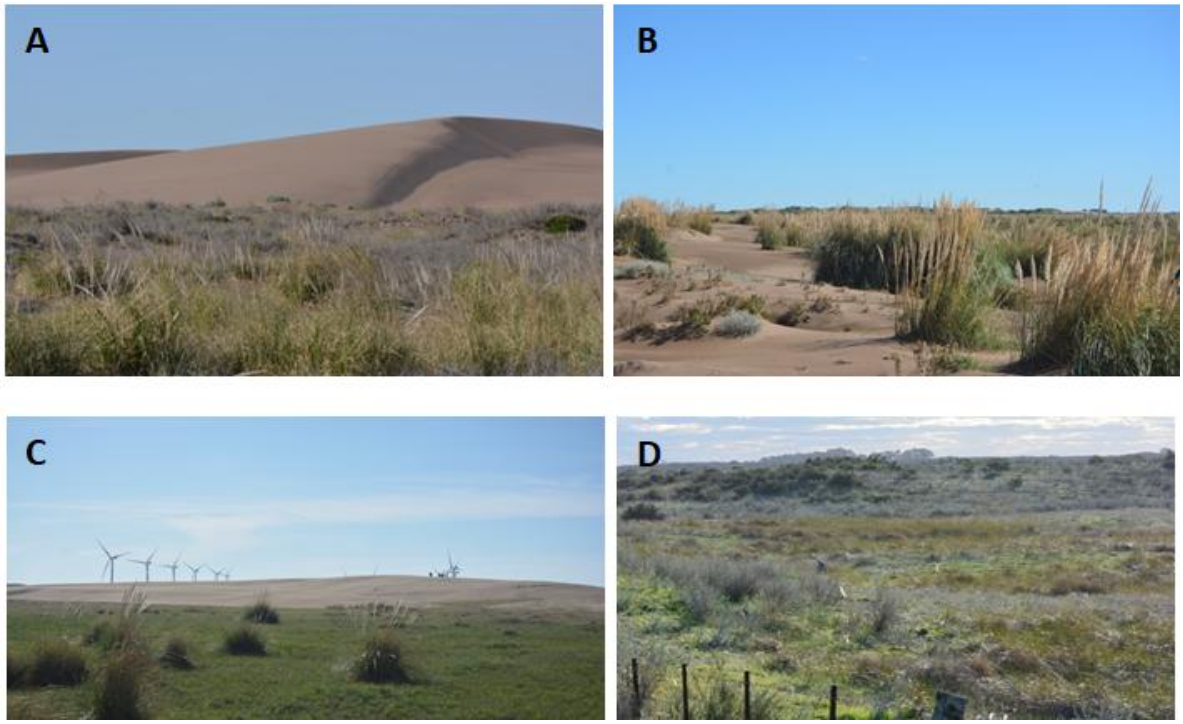

Figure 2. Pampas coastal ecosystem in Buenos Aires Province, Argentina, consisting mainly of grasslands, active dunes, fixed dunes, and semi-fixed dunes (A, B, C, and D). Among the most significant anthropogenic alterations affecting the habitats of subterranean rodent species is the installation of wind energy facilities (see picture C), which have markedly transformed both soil structure and native vegetation composition. This study, conducted within such modified landscapes, seeks to

generate robust, evidence-based data to support the conservation and management of native vertebrate species (e.g., *Ctenomys australis* and *Ctenomys pulcer*) inhabiting the coastal dune ecosystems of southeastern Buenos Aires Province.

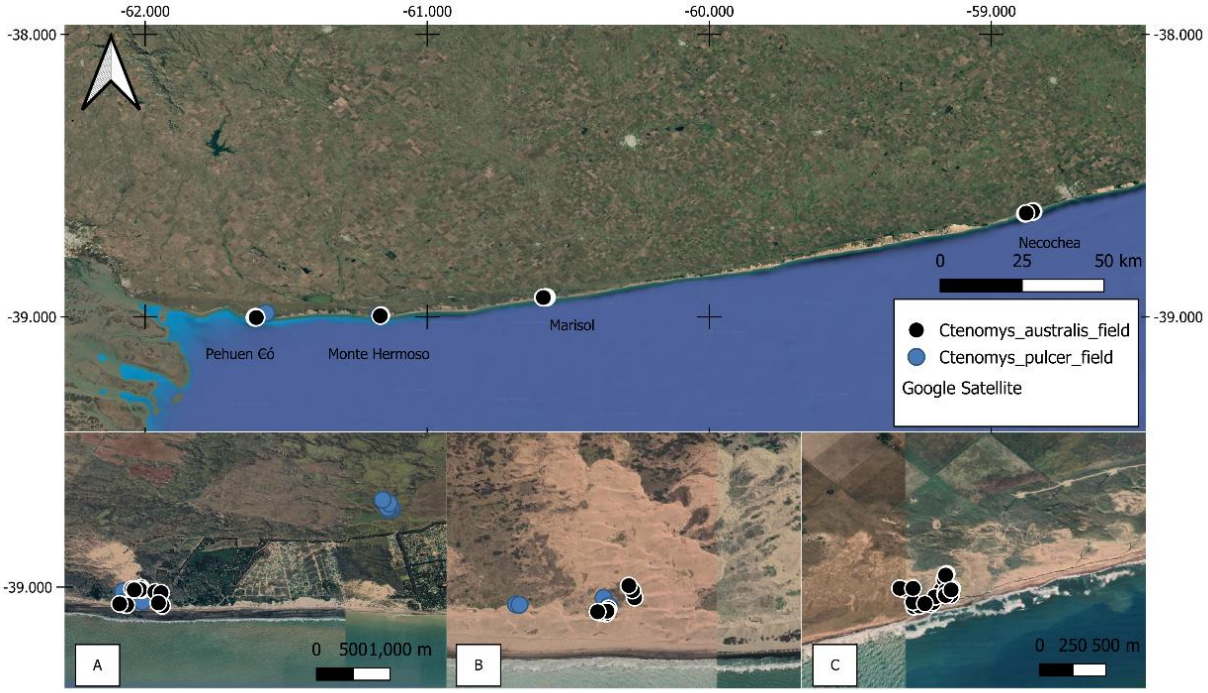

Figure 3. Localities visited in the fieldwork. A. Pehuen-Có, B. Monte Hermoso and C. Necochea. Records correspond only to captured individuals. Burrow records are not shown on the map.

Figure 4. Fieldwork activities. The images depict portions of the natural habitats where tuco-tuco burrows are surveyed within the coastal dune systems of Buenos Aires Province. These ecosystems are not only critical for the conservation of tuco-tucos but also play a key role in preserving numerous endemic species associated with coastal dune environments.

Figure 5. Search for active burrows in natural areas of dunes.

Figure 6. Fieldwork activities: Traps installed to capture Tuco-tucos.

Rodent capture was conducted using live traps (Oneida Victor No. 0) covered with foam to minimize potential harm to the animals (Figure 6). Each captured individual was weighed, its sex was identified, and a small fragment (2 mm) of the tail was collected as a tissue sample (these procedures were approved by our university's Animal Care Committee, along with the required permits for capturing animals in the field). Subsequently, the tissue extraction area was disinfected with iodine, and the

animals were returned to their burrows. Finally, we carried out laboratory work, performing DNA extractions on the tissues obtained in the field, which yielded high-quality quantifications and results (Figure 7).

Figure 7. Field work, sample tissues extraction, release of an individual of Southern tuco tuco at its burrow, and laboratory procedures to DNA extraction.

Please indicate whether this grant helped you leverage other financing, and if so, how much?

Yes, the experience of writing and winning this grant application (MBZSCF) enabled me to successfully apply for a student grant award as well. This grant will enable my research team and me to advance our analysis of landscape structure and fragmentation in coastal dunes—the habitat of tuco-tucos—by integrating the species distribution model I am developing with a comprehensive landscape fragmentation assessment. Together, these components form essential pillars of my doctoral research. The award, granted by the Neotropical Grassland Conservancy, was for $1,500 USD.

Please outline additional findings, results or thoughts relevant to the grant and funding

Species Distribution Models (SDM) were built using 463 records for *C. australis* and 141 records for *C. pulcer*. The records include those collected during the field expeditions of this project, as well as historical data from our research group and data from specimens housed in museums. We used Sentinel-2A satellite imagery to build the SDMs at a 60 m resolution, due to the small distribution range of our rodents and our aim to obtain high-resolution habitat information. We found that the SDM of the Southern Tuco-Tuco is mainly explained by the Digital Elevation Model (DEM), with the species being more associated with low elevations near the sea. The SDM of the Beautiful Tuco-Tuco (*C. pulcer*) is explained primarily by satellite band B11 (shortwave infrared), which is related to soil and vegetation moisture. The model of the Southern Tuco tuco showed us that it is near to 387.47 km^2 along the coastal Pampas Ecosystem. Then, we used the SDMs to analyze other topics related to the conservation of coastal Tuco-Tucos. We performed a supervised landscape classification using machine learning in Google Earth Engine to identify vegetation cover and land use within the coastal dunes. Other available land use and land cover (LULC) products only classify dunes as grasslands and therefore fail to capture the diversity of landforms and land-use types within the dune ecosystem. Finally, we found that the land cover with the highest suitability values for the Southern Tuco-Tuco model corresponds to Active Dunes, followed by urbanized areas and Semi-fixed Dunes (Figure 8). We are currently conducting connectivity analyses and identifying the largest, most connected, and best-conserved habitat patches for the Southern Tuco-Tuco. Additionally, we will soon complete the sequencing of genomic data and incorporate this information into our analyses.

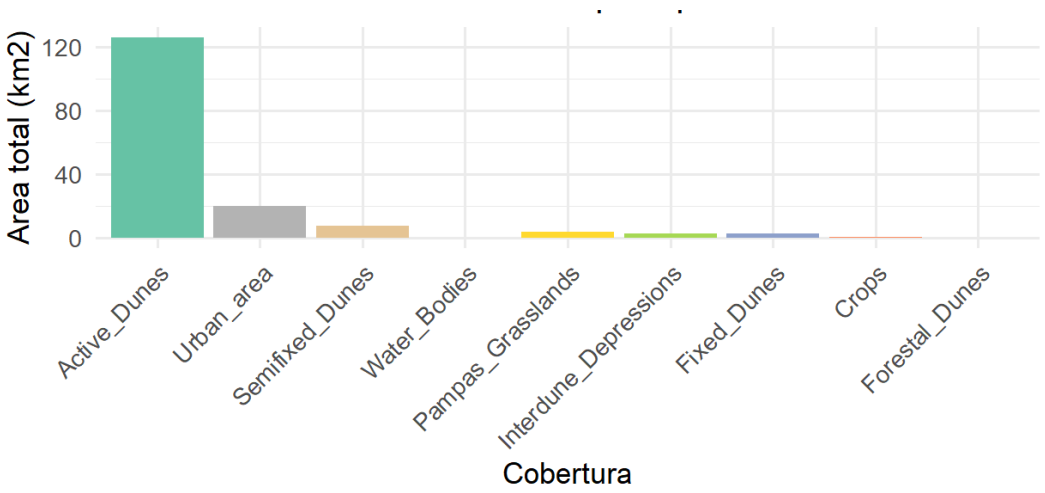

Figure 8. Total area for SDM of Southern Tuco tuco for each vegetation and use land cover.

Other relevant result is our participation as leader researchers in the evaluation of the conservation assessment of *Ctenomys pulcer* and *Ctenomys australis* with Sociedad Argentina para el Estudio de los Mamíferos (Argentine Society for the Study of Mammals: SAREM) (Figure 9). The Argentine Society for the Study of Mammals (SAREM; https://www.sarem.org.ar/) has initiated the 2024 Mammal Categorization of Argentina process ("CMA 2024") taking into account all mammal species in Argentina (more than 470 species). SAREM began the process in 2024 and completed it recently, in September 2025, when the progress was formally presented at the XXXVI Argentine Mammalogy Conference (https://jamsarem.com/) in El Calafate, Argentina. This initiative aims to update the findings of the 2019 Mammal Categorization of Argentina (https://cma.sarem.org.ar/). To achieve this, SAREM is compiling information on native mammal species gathered over the past five years. This information has been used to reassess the conservation status of these species following the IUCN methodology. The process has involved updating information on introduced species present in Argentina and assessing the severity of their environmental impacts based on the IUCN's Environmental Impact Classification for Alien Taxa (EICAT). Currently, this project focuses on categorizing the conservation status of two focal species: *Ctenomys australis* and *Ctenomys pulcer*. Based on the available information regarding the distribution, population sizes, life history traits, and current threats affecting these species, and all data that we able to collect in this project with the financial of MBZSC and GEF we propose that *Ctenomys australis* be maintained as an Endangered species (it had previously been classified as Endangered by our research group as well: https://cma.sarem.org.ar/es/especie-nativa/ctenomys-australis). Furthermore, we recommend that *Ctenomys pulcer*, a species described for the first time in 2023, be

included in the 2025 SAREM assessment as an Endangered species, in accordance with IUCN criteria.

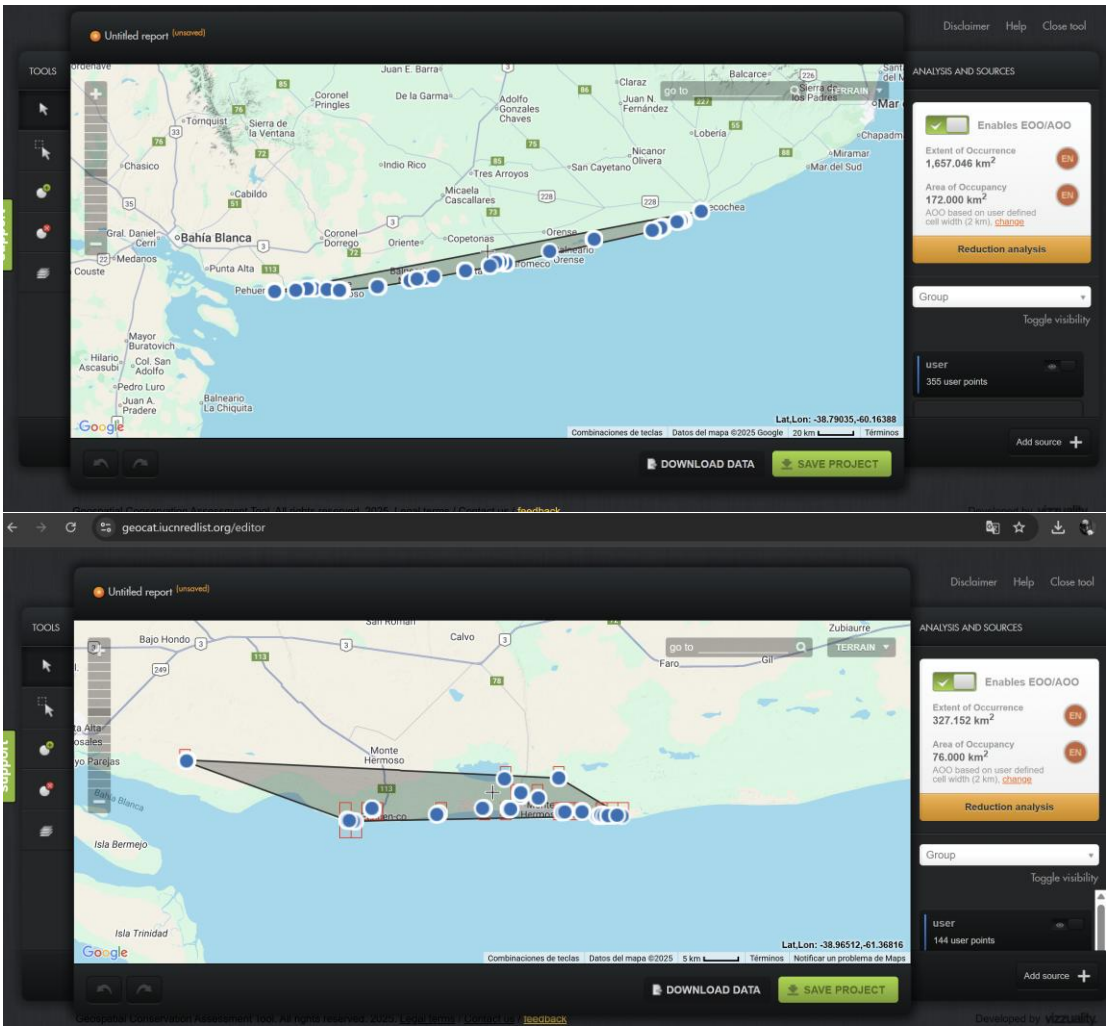

Figure 9. To estimate the Extent of Occurrence (EOO) and Area of Occupancy (AOO) of the focal species, one of the most widely used tools currently available is GEOCAT. The image shown illustrates how the GEOCAT platform calculates the EOO and AOO for one of the focal species of this project, *Ctenomys australis* (EOO=1657.04 Km2, AOO=172 Km2) *and Ctenomys pulcer* (EOO=327.1 Km2, AOO= 76 Km2).

Identify threats to Tuco-tucos rodents

We have identified areas where coexistence with tuco-tucos is particularly challenging, largely because many new constructions have been built on dunes stabilized through afforestation. The information we have gathered will support the development of distribution models and help us examine the landscape features associated with tuco-tuco habitats. We hope to compare the information collected in the field with the results of the connectivity and genomic analyses. For example, in larger towns such as Pehuen-Có, Monte Hermoso, and Necochea, conflicts with tuco-tucos are less frequent and less noticeable, as most urbanized areas have paved roads and encounters with these rodents typically occur only in cabins located on the outskirts of the urban center. In small tourist villages like Marisol, where roads remain unpaved, the rodents have had no difficulty continuing to dig their burrows, both along the streets and in home gardens (Figure 10). This has led to ongoing conflict with the local community, making them increasingly unwelcome neighbors. Therefore, it is essential to engage with these communities and implement educational activities that promote coexistence between people and tuco-tucos, as the general perception of rodents tends to be highly negative. In other places, such as Necochea, few people are aware of the Tuco-Tucos, even though this is the area where most of the previous research on the Southern Tuco-Tuco was conducted. Miguel Lillo Park is also an important area with potential for restoration activities within the coastal dune ecosystem. A park with more than 600 ha in dune ecosystems. A civil association and park rangers are actively working on the conservation of the park. This area originally functioned as a plant nursery established to stabilize the dunes and expand the urban zone. They are now working to conserve the dune ecosystem and reduce forest plantations. For these reasons, we believe we can collaborate with this community to plan a future project focused on the restoration of Southern Tuco-Tuco's habitat.

Figure 10. Search for burrows in urban areas of dunes. Balneario Marisol: Tuco-tucos construct their burrows in the gardens of numerous beach houses, resulting in a negative perception within the community. This project aims to shift local community

perceptions regarding these subterranean rodents. Through soil displacement, tuco-tucos contribute substantial amounts of nutrients to the substrate, among other ecological benefits. In the communities where sampling is being conducted, our objective is to promote awareness and appreciation of native fauna conservation. We emphasize an ecosystem-based perspective of ecological balance, highlighting the role of tuco-tucos as a key component in food webs, serving as natural prey for various native predators (e.g., birds, reptiles, and other mammals).

Another threat we identified was the presence of dunes with exotic tree plantations (Figure 11). These plantations prevent the rodents from dispersing or establishing themselves and fragment their habitat. They are located very close to urbanized areas and continue to expand. In a previous study published by a member of our research group and related to this project, it was found that these forest plantations affect rodent migration on a local scale and contribute to population isolation. Once we obtain genetic data, we hope to analyze this pattern on a broader scale across the ranges of the Southern Tuco-Tuco and the Beautiful Tuco-Tuco.

Figure 11. Locations of fixed dunes with non-native forest plantations.

A core component of our conservation initiative involves the spatial mapping of exotic forest plantations—primarily *Pinus* spp., *Eucalyptus* spp., and *Acacia longifolia*—to assess the temporal loss and fragmentation of natural coastal dune ecosystems. This

analysis is conducted through supervised classification techniques and the integration of satellite imagery within Geographic Information Systems (GIS), allowing for the generation of spatially explicit data to inform habitat management and restoration strategies (Figure 12).

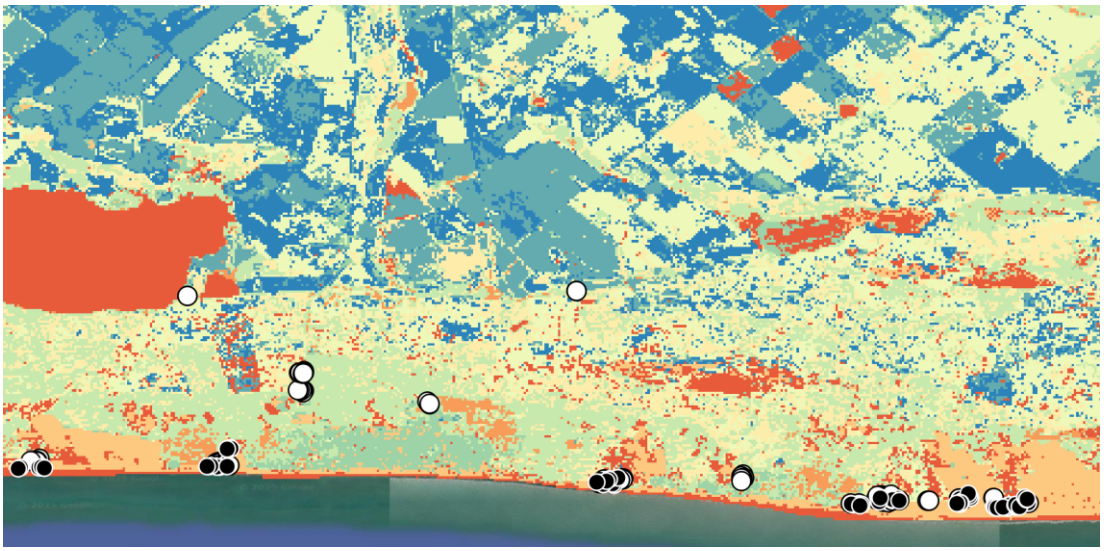

Figure 12. Supervised classification of coastal dune ecosystems in the Monte Hermoso area, showing land-cover and land-use categories, along with records of the Southern tuco-tuco (black points) and the Beautiful tuco-tuco (white).

Outreach activities

We developed social media engagement materials, including short videos and Instagram posts, which we published in our research group's official account: @ecogenpopmdq and a photo album in other resources: https://www.flickr.com/photos/202542006@N05/ and https://sites.google.com/view/ecolgenpopmamiferos?usp=sharing

Figure 13. Instagram posts about the project.

Additionally, we gave a talk on Tuco-Tuco conservation and the opportunities for habitat conservation in the Miguel Lillo Park in Necochea (Figure 14). The event was organized by the civil organization Asociación Amigos del Parque Lillo, where we presented relevant results from our project and information about the rodents. We also participated in a local meeting the following day with members of this civil organization and park rangers regarding reforestation activities in the park. In addition, we were interviewed by the local newspaper Ecodiario (https://elecos.com.ar/con-gran-interes-se-realizo-charla-sobre-el-parque-miguel-lillo). Additionally, I presented a poster about tuco tucos.

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Ecos Diarios

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Figura 14. Outreach activities included giving a talk on Tuco-Tuco conservation and Miguel Lillo Park, participating in an interview for the local newspaper Ecodiario, and taking part in a local meeting with civil organizations and park rangers. We also visited a reforestation area within the Miguel Lillo Park, and a street named “Los Tuco-Tucos.” Finally, I presented a poster at the II Latin American Workshop of Evolution, showcasing the species distribution models (SDMs) developed for the rodents.

Unforeseen difficulties

Working in the coastal dune ecosystem is challenging. The weather ranges from low temperatures in winter to high temperatures in summer, and it is windy almost all the time. Additionally, during one of our field trips, our truck got stuck in the dunes, and we had to hire a tractor to tow it out. Access to the dunes and some beaches in the area is restricted to four-wheel-drive vehicles, and the IIMyC truck’s four-wheel-drive system was malfunctioning. It was undergoing maintenance for a time, and due to high demand—since it is the only four-wheel-drive vehicle available at the institute—the timing of our field activities was delayed. Fortunately, we managed to complete all the project’s field activities. However, this delay affected our schedule in other aspects, such as obtaining provincial research permits and the authorization to export DNA samples for sequencing. These permits are issued annually, and ours expired while we were conducting laboratory activities. In addition, the institutional response

time has been longer than expected. We have requested an extension of our permits and are currently waiting to send the samples to MACROGEN in Korea for sequencing because we pay a pre-payment service for sequencing.

Acknowledgements

We thank the Mohamed bin Zayed Species Conservation Fund, the Fonseca Leadership Program, and the GEF for their financial support in developing our project. We also thank the Instituto de Investigaciones Marinas y Costeras (IIMyC, CONICET, UNMdP) for their support and for providing access to a 4×4 vehicle and laboratory facilities. To Nerio Bognanni, a local leader from Necochea, for his collaboration and for inviting us to participate in a local forum with the civil organization Amigos del Parque Lillo and park rangers.