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From fear to admiration: traditional and local knowledge about rattlesnakes (genus *Crotalus*) in Zacatecas, Mexico

Jesús L. Lara-Galván[1,2,3], Juan F. Martínez-Montoya[1,*], José J. Sigala-Rodríguez[2], Ernesto Peredo-Rivera[1], Christine M. Kaiser[4], and A. Márcia Barbosa[5]

Abstract. Numerous misconceptions and myths about rattlesnakes persist in Mexico, and both the negative perceptions of these snakes as threats to human safety and their traditional uses have contributed to their persecution. We therefore investigated how local residents perceive and utilise rattlesnakes while also working to dispel widespread misinformation about rattlesnake biology, behaviour, and ecology. For this purpose, 240 semi-structured surveys were conducted in 48 localities in Zacatecas State. Most of the interviewees had experienced at least one encounter with a rattlesnake, mainly in summer afternoons, on highways, asphalt roads, and dirt roads. Medicinal use emerged as the main reason why rattlesnakes are hunted because respondents believe that they are useful in the treatment of various ailments, including cancer, allergies, heart disease, rheumatism, muscle fatigue, and joint pain. We present the most common myths related to rattlesnakes in Zacatecas and highlight people's interest to learn more about these organisms and their conservation.

Keywords. Conservation, ecology, ethnobiology, traditional uses, Viperidae.

Introduction

Knowledge of the herpetofauna in Zacatecas State, Mexico, is increasing, with 149 reported species (25 native amphibians, 119 native reptiles, five introduced species; Sigala-Rodríguez et al., 2026). Although gaps in the information about their basic biology remain, progress has also been made in ethnozoological knowledge about amphibians and reptiles (e.g., Ávila-Villegas, 2017; Gamboa-Arteaga and Sigala-Rodríguez, 2020). In this study, we focused on the ethnozoology of rattlesnakes, genus *Crotalus*, of which ten species have been recorded in the state (Fig. 1): *C. aquilus*, *C. atrox*, *C. basiliscus*, *C. lepidus*, *C. molossus*, *C. polystictus*, *C. pricei*, *C. scutulatus*, and *C. willardi* (Lara-Galván et al., 2020; Uetz et al., 2026). *Crotalus ornatus* also occurs in Zacatecas (Villalobos-Juárez et al., 2025; Sigala-Rodríguez et al., 2026) but it was omitted from our study because it was confirmed for Zacatecas only after our investigation was complete.

In Mesoamerica, wildlife has historically occupied a prominent place in both the practical and cultural lives of local communities, serving as a source of food, medicine, material resources, and spiritual significance. For example, Guerra-Roa et al. (2010) alluded to the fact that in Mesoamerica animals have been used as a source of food, for clothing and medicine, and even as part of rituals. Fuentes-Mascorro (2014) mentioned their use as pets, a situation that continues to this day (Moreno-Lara et al., 2022; Pineda-Vázquez et al., 2022).

Rattlesnakes are a unique group of snakes of great human interest for a variety of reasons, including their ecology and taxonomy, their human interactions, and their relevance to public health in the context of human–snake conflict (Lara-Galván et al., 2025). Their ethnobiology is an essential aspect of Mexican culture, where these reptiles have been considered mythical beings since pre-Hispanic times (Gatica-Colima and Jiménez-Castro, 2009) and are fundamental in the way nature is interpreted.

[1] Colegio de Postgraduados, Campus San Luis Potosí, Iturbide 73, Colonia Centro, 73620 Salinas de Hidalgo, San Luis Potosí, Mexico.
[2] Colección Zoológica, Departamento de Biología, Universidad Autónoma de Aguascalientes, 20131 Aguascalientes, Mexico.
[3] Dipartimento di Biologia, Università di Firenze, Via Madonna del Piano 6, 50019 Sesto Fiorentino, Italy.
[4] Graduate School of Global Environmental Studies, Kyoto University, Yoshida-Honmachi, 606-8501 Sakyo, Kyoto, Japan; and Sektion Herpetologie, Leibniz-Institut zur Analyse des Biodiversitätswandels, Museum Koenig, Adenauerallee 127, 53113 Bonn, Germany.
[5] Spatial Biology Lab (SBL), Universidade do Porto, 4430-146 Vila Nova de Gaia, Portugal.
[*] Corresponding author. E-mail: altiplanooeste@gmail.com

Figure 1. Rattlesnakes (genus *Crotalus*) native to the State of Zacatecas, Mexico. *Crotalus ornatus* was extralimital and not included in this study. (1a) *C. aquilus*, female. (1b) *C. aquilus*, male. (2) *C. atrox*. (3) *C. basiliscus*. (4a) *C. lepidus*, female. (4b) *C. lepidus*, male. (5) *C. molossus*. (6) *C. polystictus*. (7) *C. pricei*. (8) *C. ornatus*. (9) *C. scutulatus*. (10) *C. willardi*. Photos by Jesús Lenin Lara-Galván (1a, 1b, 2, 4b, 5, 9), Jacobo Reyes-Velasco (3), Eric Centenero-Alcalá (4a, 7, 10), Rubén A. Carbajal-Márquez (6), and Peter Schulze Niehoff (8).

Human fascination with snakes has made them deities, mystical beings, demons, or guardians. Examples of this are Quetzacoátl, the 'Feathered Serpent' in Aztec culture (Lazcano-Villarreal et al., 2010), and Kukulkan, who commonly appears in the Mayan pantheon (Fuentes-Mascorro, 2014). In fact, rattlesnakes continue to have a notorious influence on the customs and identity of Mexicans, proof of which is the presence of a rattlesnake on the national coat of arms (Sigala-Rodríguez and Vázquez-Díaz, 1996).

It should be emphasised that it is the residents in each community who have first-hand contact and live with these organisms, and their perception towards rattlesnakes will be different from that of a specialist researcher. This is why the inclusion of traditional and local information is essential for a better understanding of rattlesnakes in Zacatecas and in general. Thus, in this study, we provide local biological information about these snakes, their main medicinal uses, their use as food and for commercial purposes, and we also consider human perception, behaviour, and the myths associated with rattlesnakes. Finally, we present a compilation of data on human–snake conflict and traditional treatments.

Materials and Methods

Workflow. To carry out this research, we followed a specific workflow (Fig. 2). We used maps from Lara-Galván et al. (2020) to define the municipalities and specific localities throughout Zacatecas to conduct 240 surveys and then analysed the collected survey data as described below.

Study area. Our study area comprised the entire state of Zacatecas in north-central Mexico (Fig. 3), with extreme coordinates of 25.1255°N in the north, 21.0300°N in the south, 100.7358°W in the east, and 100.4022°W in the west (INEGI, 2017). Zacatecas has a surface area of 74,669 km^2 and the elevation in the state ranges from 725–3197 m (INEGI, 2013). The main climate in Zacatecas is semi-dry, with an average annual temperature of 17°C and total annual precipitation of 510 mm (INEGI, 2008). Rainfall is mainly recorded during the summer, with July and August being the wettest months and November–April generally very dry (Climate Data, 2018). The human population consisted of 1.6 million inhabitants in a recent census (INEGI, 2020), of whom 41% live in rural areas. There are four indigenous groups (Wixárika, Náhuatl, Tlapaneco, Tepehuano; INEGI, 2017), of which only the first has a particular cultural relationship with rattlesnakes.

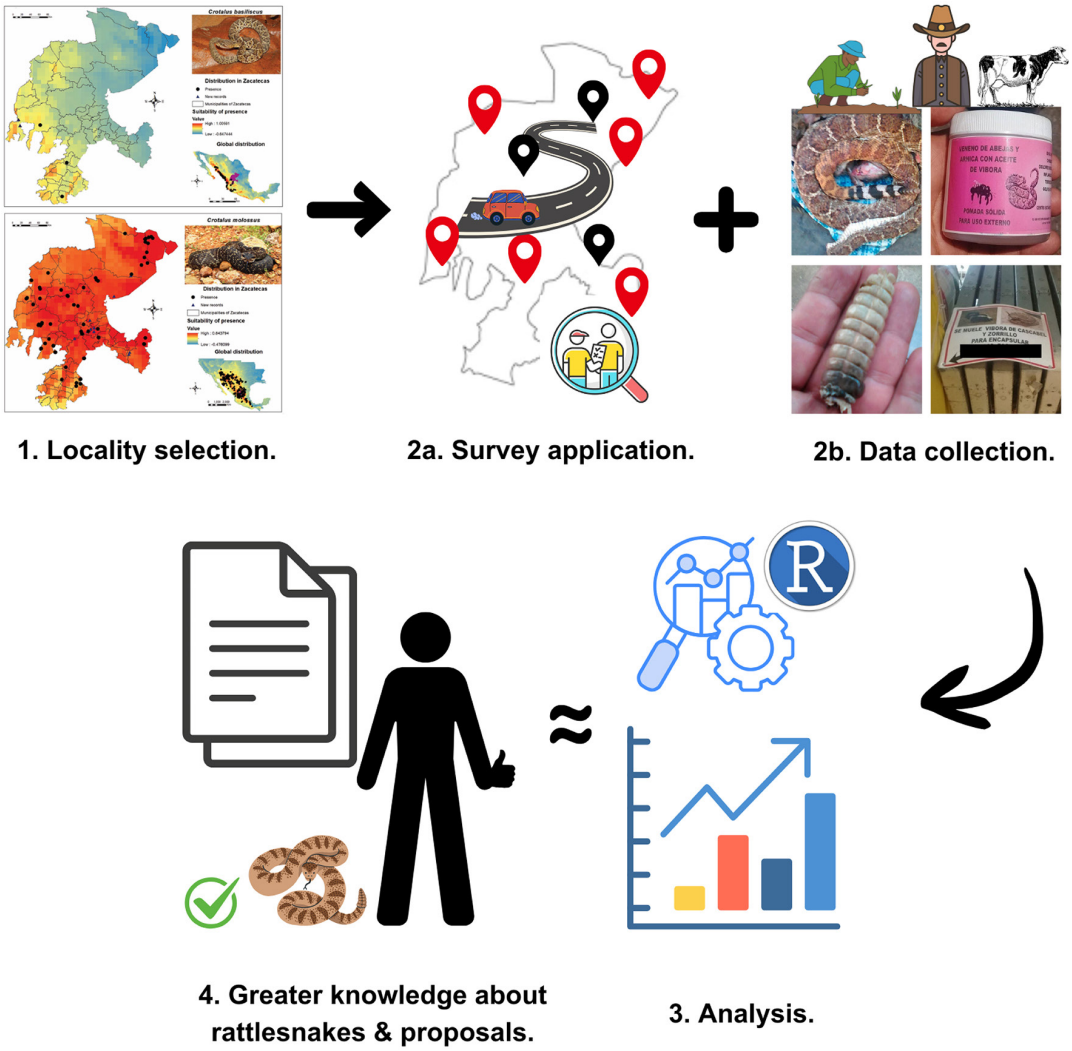

Figure 2. Workflow of the analysis and collection of traditional knowledge on rattlesnakes. This image was built from suitability maps by Lara-Galván et al. (2020), as well as from the research team's photographic material and freely available icons from Canva Pro.

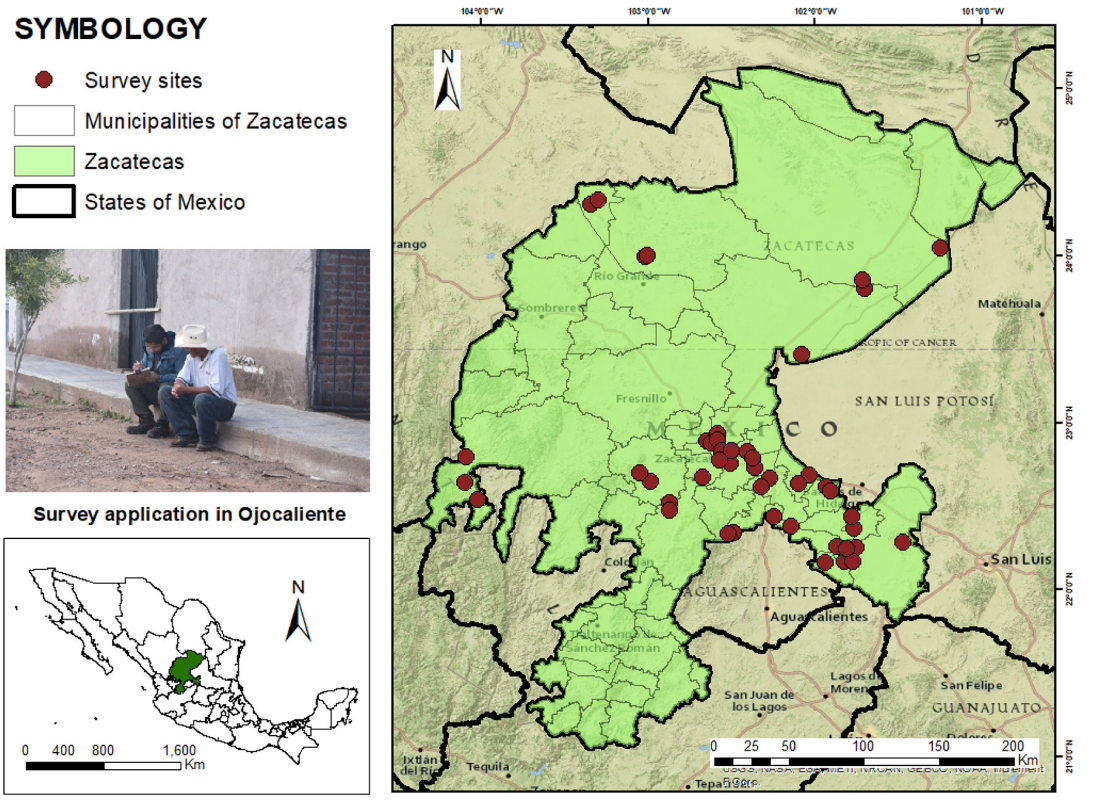

Figure 3. Local communities surveyed (red circles) in Zacatecas State (bright green shading), Mexico. Zacatecas is in north-central Mexico and is in the arid Mexican Plateau. Photo by Juan Felipe Martínez-Montoya.

Surveys. A total of 240 surveys with semi-structured and open-ended questions was conducted in 48 localities across 22 municipalities in Zacatecas (Fig. 3). These were selected based on the likely rattlesnake ranges in Zacatecas identified by Lara-Galván et al. (2020), taking into consideration additional information obtained during fieldwork and provided by local residents. We surveyed the municipalities of Genaro Codina, General Francisco R. Murguía, General Pánfilo Natera, Guadalupe, Jerez, Juan Aldama, Loreto, Luis Moya, Mazapil, Morelos, Ojocaliente, Pánuco, Pinos, Trancoso, Valparaíso, Vetagrande, Villa de Cos, Villa García, Villa González Ortega, Villa Hidalgo, Villanueva, and Zacatecas. In 19 of these, we surveyed at the two localities with the highest suitability for rattlesnakes, and in Loreto, Pinos, and Valparaíso, we selected three sites each using the same parameters. Five surveys were completed at each locality, in two different ways: (1) Two of the five surveys were completed by people with a greater likelihood of direct contact with rattlesnakes, such as shepherds, farmers, stockbreeders, and collectors of wildlife (snakes, rodents, rabbits, hares, skunks). (2) The remaining surveys were completed serendipitously by trying to cover both sexes and a broad distribution of age ranges (0–10, 11–20, 21–30, 31–40, 41–50, 51–60, 61–70, 71–80, 81–90 and > 90 years), as defined in this study. Age ranges were used to construct Cluster Groups (CG) as follows (Table 2, Fig. 4): 40–54 (CG1), 56–65 (CG2), 85–102 (CG3), 27–39 (CG4), 67–78 (CG5), 8–25 (CG6).

The survey consisted of optional, open-ended questions linked to general information about the respondent, type of encounter, the biology of the species (including approximate time, place, and season of sighting), local common names, perception, behavioural characteristics, importance in ecosystems, main uses, epidemiological data, and conservation implications. Finally, anecdotes, myths, or beliefs about rattlesnakes were recorded as we learned about them, with testimony of a person

belonging to the Wixárika ethnic group of particular relevance. This series of questions was applied with the support of a physical photographic catalogue (O' Shea and Kaiser, 2013) of the species reported for Zacatecas (Lara-Galván et al., 2020, 2025; Sigala-Rodríguez et al., 2026). Each interviewee had to choose the photographs of the species with which they had come in contact, which we subsequently corroborated with their known geographic range.

Statistical analysis. Responses to our questionnaire were analysed using R statistics software v3.5.0 (R Core Team, 2016) using a multivariate approach. A cluster analysis was performed using the *factoextra* package of Kassambara and Mundt (2020) in order to group the respondents' answers. The optimal number of clusters was estimated using the elbow graph method through the *km_cluster* function. In addition, based on the *Ward.D2* method, a Gower distance was computed using the *fviz_nbclust* function. Finally, the *fviz_cluster* function was implemented to visualise the clusters.

Results and Discussion

Survey respondents. The 240 surveys were taken by 142 men (59%) and 98 women (41%) with an age range of 8–102 yrs (average age 42 ± 19 yrs). Among respondents, basic education (elementary and secondary school) was the predominant level of schooling, followed by those without any schooling, and a few with a bachelor's degree. As a consequence, the predominant occupation of respondents was in crop agriculture (n = 71, 30%), followed by those working around their homes (n = 63, 26%). The third-most abundant type of activity was related to the breeding, care, and sale of livestock (cattle, sheep, goats; n = 25, 10.42%), and all other professions (e.g., construction workers, salespersons, security guards, cooks, janitors, pollsters, nurses, environmental consultants, postal carriers, and hunter-gatherers) shared 24% (n = 58). The remaining respondents were engaged in education (as pupils or teachers in elementary schools n = 23, 9.58%). By our selection of localities, most of the interviewees were residents of a municipality on the Potosino-Zacatecano Plateau, particularly in the central and southeastern part of Zacatecas.

Rattlesnakes. The most frequently identified rattlesnake species were *C. atrox*, *C. lepidus*, *C. molossus*, and *C. scutulatus* (Fig. 1; Table 1). Another species mentioned several times was *C. basiliscus*, but we believe that this is a misidentification of *C. molossus* or *C. scutulatus* (Table 1). Given that *C. basiliscus* is a species rarely observed in the state, unlike the common *C. molossus* and *C. scututlatus* (Lara-Galván et al., 2020), this confusion is likely due to similarities in colouration, even though characteristics such as size and habitat preference would allow for a clear distinction of *C. basiliscus* (Campbell and Lamar, 2004). Furthermore, it is noteworthy that in some of the municipalities where respondents identified *C. basiliscus*, there are no confirmed records of the species and habitat suitability is low (Lara-Galván et al., 2020). A similar situation exists for *C. aquilus* and *C. pricei*, which were mistaken for *C. lepidus*, even though *C. pricei* is rare in the south of its range (Sigala-Rodríguez, 2008; Ayala-Rodríguez et al., 2022). These are species which, at first glance and to those without specialist knowledge, might appear similar. However, the morphological differences are marked, and *C. lepidus* is more commonly found in Zacatecas (Lara-Galván et al., 2020).

Interviewees stated that *C. lepidus* was a common species in localities with an elevation > 1500 m and with a rocky environment (including smooth rock walls), which provides many hiding, breeding, feeding, and resting places. They also alluded to the fact that *C. lepidus* was usually found in suburban areas (as frequently documented in newspapers and local social media) but was more frequently found in places with little disturbance by humans or livestock. This seems to confirm a point raised by French et al. (2008) that rattlesnakes generally prefer rural environments over urban areas.

Locals indicated that it was common to find rattlesnakes after the beginning of the rainy season, especially during the second half of summer and at the beginning of the autumn (August–October) coinciding with the snakes' *brama* (mating) period, when male rattlesnakes are believed to perform a courtship ritual towards the female (Senter et al., 2014). In addition, respondents agreed that there was a low probability of finding rattlesnakes during the cold season and during prolonged events of rain, but that they would re-emerge from their hiding places once the rain ended, even after long periods without food (Brock and Howard, 1962).

Local biological knowledge. In terms of habitat and feeding preferences, according to the interviewees, it is common to find rattlesnakes in a wide variety of ecosystems, from scrubland to pine-oak zones, and in temperatures ranging from 15–30°C. Specifically, respondents claimed to have found these snakes around certain plants, particularly near sotol (*Dasylirion*), barrel

Table 1. Compilation of local common names of rattlesnakes (genus *Crotalus*) in Zacatecas, Mexico (in Spanish), as well as the species with which they are often confused. The Snakes Seen column shows the percentages of survey participants who believe they have observed these species (with the aid of the photographic catalogue). *Crotalus ornatus* was not included in this study because the species confirmation came after our investigation.

Scientific Name	Common Name(s)	Snakes Seen	Mistaken For
C. aquilus	Víbora de cascabel Víbora flor de peña (in Villa García)	5%	*C. lepidus*
C. atrox	Víbora de cascabel Víbora de cascabel diamantada Víbora de cascabel cola de mapache	25%	none
C. basiliscus	Víbora de cascabel Víbora de cascabel tropical Víbora de cascabel de los ríos	13%	*C. molossus*, *C. scutulatus*
C. lepidus	Víbora de cascabel de montaña Víbora de cascabel de las rocas Víbora de las peñas Víbora gris Víbora verde	36%	*C. aquilus*
C. molossus	Víbora de cascabel de cola negra Víbora de cascabel serrana Víbora negra o prieta Víbora de cascabel amarilla	51%	*C. basiliscus*, *C. scutulatus*
C. polystictus	Víbora de cascabel Víbora de manchas redondas Víbora de cascabel ocelada	1%	none
C. pricei	Víbora negra Víbora ceniza Víbora de cascabel parda	5%	*C. lepidus*
C. scutulatus	Víbora de cascabel	17.5%	*C. basiliscus*, *C. molossus*
C. willardi	Víbora de cascabel café Víbora de cascabel de montaña	2.5%	none

cactus (*Echinocactus*), jatrofa (*Jatropha*), gobernadora (*Larrea*), nopal (*Opuntia*), pine (*Pinus*), oak (*Quercus*), and yucca/palm leaf (*Yucca*). For example, respondents indicated that *C. molossus* was commonly found during the preparation of crop fields (alfalfa, chili, beans, and maize) as already reported by Fernández-Badillo et al. (2021). Moreover, these rattlesnakes were often spotted inside the burrows of small and medium-sized mammals (such as rodents, rabbits, and hares), which are their prey. This shows that the snakes can act as regulators when it comes to the role of these mammals as potential agricultural pests. In addition, respondents also mentioned that rattlesnakes consumed small birds and lizards, which are natural insect controllers, and this highlights the important role of rattlesnakes in the food chain.

Finally, interviewees mentioned that the natural predators of rattlesnakes in Zacatecas were golden eagles (*Aquila chrysaetos*), red-tailed hawks (*Buteo jamaicensis*), and roadrunners (*Geococcyx californianus*), with claims to have observed confrontations between these animals. Respondents emphasised that domestic and feral cats represented a serious conservation problem, as they are one of the main non-natural hunters of rattlesnakes and other reptiles, as well as small birds and mammals.

Perception and relationship with humans. Our surveys showed that most respondents considered rattlesnakes to be dangerous because of their venom, which creates fear of these animals. However, their ecological importance in food chains was also mentioned in the survey responses, as noted previously by Gamboa-Arteaga and Sigala-Rodríguez (2020).

According to the data we obtained, rattlesnakes are persecuted in Zacatecas, with 138 (58%) of respondents reporting having killed at least one rattlesnake for the following reasons: (1) danger and fear of a bite to themselves, their livestock, and/or pets; (2) medicinal use; (3) to market the whole snake or some part of its body (skin, rattle, flesh, fangs, fat); (4) for no stated reason; (5) because rattlesnakes are visually unattractive; and (6) as a source of food for themselves.

Respondents clearly understood that rattlesnakes use their rattles as a warning method before attacking, as mentioned by Martínez Vaca-León and Manjarrez (2017). It is noteworthy that in most sightings reported, encountered rattlesnakes were calm and not aggressive at first contact. Respondents considered other snakes, such as the alicante (*Pituophis deppei*), more aggressive.

Local common names are another fundamental aspect of rattlesnake lore, as these can allow for identification and facilitate communication on biodiversity between human groups. It is therefore important to highlight the wide variety of common names in local languages (Table 1), as these create a link between people, their cultures, and the snakes (Aguilar-Sandí, 2018). It is well-known that people without specialised knowledge do not recognise organisms by their scientific names but refer to them using names passed down from generation to generation. However, it must be emphasised that both common and scientific names may refer to the same type of animal.

Medicinal uses. Almost half of our correspondents (48%) mentioned having eaten part of a rattlesnake at some point in their lives with the intent of treating a disease, including cancer (without specifying what type), or skin condition (acne, skin patches, skin blemishes). Other medical uses included the treatment of complications related to allergies, heart conditions, rheumatic conditions, muscle and joint pain, as well as leprosy, herpes, diabetes, and anaemia.

The method of consumption was described to vary depending on the condition. Rattlesnake body parts, including the skin, head, rattle, or skeleton, can be eaten directly or in capsule form after natural drying and subsequent crushing. For example, respondents mentioned treating conditions such as diabetes and anaemia by consuming rattlesnake flesh (without bones) in 'stews' and sprinkling powdered rattlesnake parts on their food, similar to the use of table salt. On the other hand, purification of the bloodstream and reduction of obesity were treated by consumption of rattlesnake components in capsule form. Finally, rattlesnakes were said to help prevent bone fractures and dry lips when rattlesnake extracts were applied in the form of ointments. Using the species catalogue to identify rattlesnakes species, *C. atrox* and *C. molossus* were the species most frequently consumed. There was no reported preference for the age of the consumed snakes, but it was explained that adult rattlesnakes have more meat while the meat of juveniles was considered to be more tender.

Commercial implications. In addition to their medicinal value, rattlesnakes are hunted for economic interest. Indeed, they are used to make belt and chair coverings, ornaments, footwear, and handbags. It was also mentioned that their crotals (rattles) and fangs could be mixed with resin to make necklaces. Furthermore, rattlesnakes may be sold as pets to collectors. The price of dead rattlesnakes was reported to be USD 3–8 at the low end but as high as USD 27 or even higher when a snake is delivered to the consumer alive. The most sought-after rattlesnake species are *C. atrox* and *C. molossus*, due to their bigger size and the preferred size-price ratio: a longer length produces a higher sales value.

One of the respondents sells rattlesnakes, rodents, rabbits, hares, and skunks on the outskirts of a traditional market in the city of Zacatecas, the state capital, and said that he would catch approximately five snakes per week, all from Villa de Cos Municipality in the eastern central region of Zacatecas. This activity is a means of economic subsistence, and each snake was reported to carry a value of approximately USD 8. He further indicated that his hunting method was opportunistic and that he finds rattlesnakes when searching for rodents as he opens rodent burrows beneath prickly pear cactus (locally known as *nopales*, genus *Opuntia*) or agaves (locally *magueyes*, genus *Agave*). Finally, the interviewee assured us that it was increasingly difficult to find the same number of snakes, with the quantity having decreased throughout the season and annually, which is why he decided to expand to other species, such as rabbits, hares, and skunks. He perceived that all these species were more and more scarce.

Snakebite. The majority of the interviewees stated that they had been bitten by some species of rattlesnake as a result of inserting a hand or foot into a hole or burrow to extract rodents. In addition, they indicated that they did not wear protection, such as gloves and appropriate footwear, as also mentioned by Ochoa et al. (2021) and Lara-Galván et al. (2025). Most wore sandals at the time of the bite or even walked barefoot.

Myths and worldview. As part of the ethnozoological information gathered in this study, we identified several beliefs or myths about these organisms. For example, interviewees indicated that each segment of a rattlesnake's rattle represented one year of its life. This is an erroneous belief, since research has shown that rattlesnakes may lose parts or all of their rattle due to a variety of factors, with growth linked more to extrinsic factors, such as resource availability and predation pressure (Nava et al., 2024). Respondents indicated that leaving a rattlesnake alive when given the opportunity to kill it was considered a sin, since it could later attack another person and kill them. Even if a person survived a bite, beliefs indicated that the fang marks would 'sprout' (reappear) in following years. Rattlesnakes are believed to remove their fangs when drinking water in order to avoid poisoning themselves.

A group of people from the Wixárika ethnic group (on the border of Zacatecas and Jalisco) were the only ones who made reference to 'ku' (snakes) as distinct organisms in nature. They attributed supernatural powers to rattlesnakes, pointing out that they were the guardians of the forests and were sent to Earth by their God for the protection of the planet's resources. Furthermore, they mentioned that shamans (traditional healers in Mexican culture) had the ability to understand these organisms and were the mediators of these organisms with their God. They said that shamans had the ability to treat any illness or ailment naturally, even rattlesnake envenoming, by applying plants found in the region, accompanied by a series of prayers and chants. They also pointed out that if rattlesnakes were seen in dreams, this would indicate abundance in the rainy season and, therefore, the possibility of having a successful harvest. Finally, they referred to the fact that these organisms were an essential part of the food chain and should be respected as any other living being on Earth.

Statistical analysis. Of the total surveys, there was a greater tendency for men to complete them (n = 142, 59%) compared to women (n = 98, 41%). This is explained by the nature of the work done by men, which generally involves greater contact opportunities with rattlesnakes. Surprisingly, almost all respondents (n = 225, 94%) reported having had an encounter with a rattlesnake, and we were able to use 225 of the 240 surveys (in some cases we did not have the information required for the analysis). In this regard, Table 2 shows the general data concerning the members of each CG (Fig. 4), as well as some information linked to their relationship with rattlesnakes, with men predominating in all CGs. Other similarities between the different groups were that all respondents agreed that the way to detect the presence of a rattlesnake is through physical or visual contact, as opposed to hearing their rattles.

Places with the greatest number of rattlesnake sightings were highways and minor asphalted or dirt roads, followed to a lesser degree by sightings of snakes resting on, among, or under rocks. This is explained by the accumulation of heat energy in such environments, which is attractive for the activities of ectotherms

Table 2. Data obtained during the multivariate analysis on the relationship of the population with rattlesnakes. Column headings use the following abbreviations: CG (cluster group), NPI (number of people interviewed, with the percentage of the total), AR/AA (age ranges/average age, in years), PS (predominant schooling), MA (main activity), PMS (places with most sightings), RECI (recognition of ecological and cultural importance), and CR (consumes rattlesnakes). Schooling includes elementary school (ES), secondary school (SS) and no formal schooling (NS). Areas of main activity include agriculture (A), work around the home (H), involvement in livestock and grazing (LG), trade (T), or formal studies (S). Sighting locations include roads, minor asphalt roads, and dirt roads (Roads) or resting on rocks (Rocks). Respondents could answer RECI and CR with yes (Y) and no (N). The percent yes and no responses are provided for CR.

CG	NPI	AR/AA	PS	MA	PMS	RECI	CR
1	59 (26%)	40–54/46	ES,SS	A, H	Roads	Y	Y 44 N 56
2	35 (16%)	56–65/60	ES	A, H	Roads, Rocks	Y	Y 51 N 49
3	5 (2%)	85–102/90	NS	LG	Rocks	N	Y 60 N 40
4	59 (26%)	27–39/33	SS, ES	A	Roads	Y	Y 53 N 47
5	27 (12%)	67–78/73	NS	A, H	Roads	Y	Y 56 N 44
6	40 (18%)	8–25/19	ES, SS	A, H, T, S	Roads	Y	Y 35 N 65

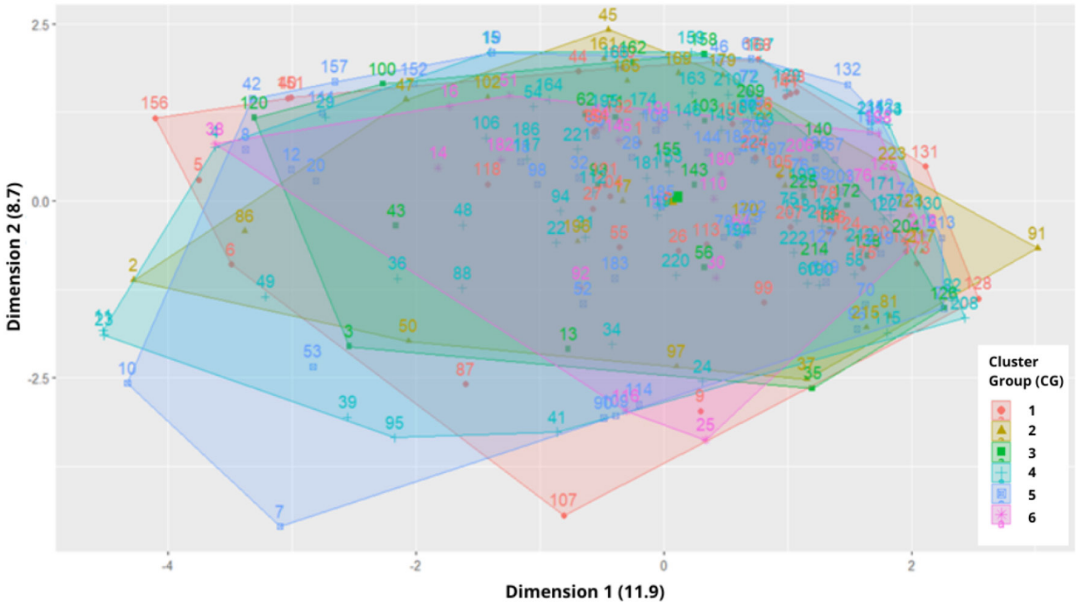

Figure 4. Hull plot of respondents' answers and Cluster Group (CG) formation. The coloured polygons represent the hulls of each CG, demonstrating substantial overlap among clusters as well as indicating limited spatial differentiation between groups. We assigned CG groups to the following age ranges (in years): 40–54 (CG1), 56–65 (CG2), 85–102 (CG3), 27–39 (CG4), 67–78 (CG5), 8–25 (CG6).

(Pough, 1966; Moniz et al., 2024). In this context, the results indicate that the largest number of sightings occurred in the afternoon, followed by the morning and evening, respectively. Moreover, late summer and early autumn were the seasons in which these species were more frequently seen. However, it is not uncommon to observe these snakes at the beginning of winter. For example, in December 2017 and 2023 a *C. molossus* was seen in Villa de Cos, Zacatecas and a *C. lepidus* was seen in Salinas, San Luis Potosí.

There is a generalised fear towards rattlesnakes in local communities in Zacatecas, since the vast majority of respondents indicated that they kill rattlesnakes when encountered in order to prevent bites, possible envenomation, and/or death. This human behaviour was especially noticeable in CG3 (the oldest age cohort), where the greatest aversion to rattlesnakes existed: 80% of CG3 members kill them and, unfortunately, they do not think these snakes are important to the ecosystems. This sense of fear is also very evident in the findings reported by Nagarkoti et al. (2026), who even mention that snakes could be killed in retaliation for attacks on livestock or pets. In contrast, the rest of the CGs considered them of biological, ecological, public health, and cultural importance. Members of the youngest cohorts (CG4, CG6) showed a desire to learn more about management measures, such as containment and safe translocation of rattlesnakes when encountered, as well as their conservation.

The majority of respondents in CG2–5 stated that they had eaten rattlesnakes for different purposes at some point in their lives, with the youngest people (CG6) having reportedly consumed them the least. In addition, older people (CG3) provided the most information about rattlesnakes, even recognising sexual dimorphism in *C. lepidus*, with body colour grey in females and green in males.

Regarding medicinal uses, rattlesnakes are frequently utilised for the treatment of cancer and dermatological ailments as documented in two studies done in Chiapas State (Enríquez-Vázquez et al., 2006; Gómez-Álvarez et al., 2007). Likewise, in Guerrero State, locals also attributed healing effects to rattlesnakes (Zavala-Sánchez et al., 2018). However, there is no scientific confirmation that rattlesnake consumption helps cure any ailment. There is a great need to study consumption practices and processing snakes because, *Salmonella* bacteria have been detected in fresh meet of *Crotalus* in Chihuahua State (Gatica-Colima and López, 2008). Due to this health risk, more education of local populations on consuming rattlesnake meat are needed along with determining infection rates.

In respondents' reports of envenomings, the symptoms mentioned were swelling and redness of the affected area (mainly hands and feet), nausea, dizziness, vomiting, loss of consciousness, delirium, anxiety attacks, twitching, and temporary loss of vision. Most cases were treated with traditional remedies, such as drinking cow's milk, infusions, suction, cold compresses, splints, restricting circulation to the affected area, and resting. However, some of these practices have been shown to be not effective and even harmful (Franco-Vásquez et al., 2024). The main reasons for these treatments were the long distances people needed to travel to reach a hospital or even their inability to travel. Some people claimed, especially in rural areas, that hospitals did not have the necessary information on antivenom type or quantity, because they did not consider envenoming of great importance. Additionally, cattle are the domestic animal at the greatest risk because rattlesnakes are found resting or moving in pastures. An affected animal's symptoms are swelling of the head or limbs, which is reduced by puncturing the wound with the tip of a yucca/palm leaf (genus *Yucca*).

Related to the epidemiological implications, a higher incidence of snakebite was reported among men than women, probably due to the type of work done by men (e.g., agricultural activities, livestock breeding, wildlife sales). The results showed that men had a higher frequency of envenomings and this trend has been reported by Neri-Castro et al. (2020), Lara-Galván et al. (2025), and Gómez-Benitez et al. (2026). Respondents mentioned using plants as a treatment for rattlesnake bites, as also reported by Tuz-Canche et al. (2022).

Moreover, snake collectors are another major threat, exerting a huge pressure on rattlesnake populations. Indeed, collectors among the respondents also perceived that there had been an annual decline in encounter frequency. Other significant threats are mining companies (SGM, 2014), the drastic modification of their habitat, and domestic cats as predators (Arnaud, 2015; Mella-Méndez, 2021). According to SEMARNAT (2019), all these species are in the special protection category, which confirms that their populations are subject to alteration in their stability.

Finally, it is noteworthy that the use of photographic material (PM) in this type of study is essential (O'Shea and Kaiser, 2013), as many people in local communities lack the technical or taxonomic knowledge to scientifically identify species, but instead possess practical experience and the ability to recognise them through direct observation. PM facilitates the visual recognition of species, reduces identification errors, and helps obtain more accurate ethnozoological information. Furthermore, making this material accessible and available in the local language is a key strategy for promoting understanding, ownership and community participation. After all, it is local populations who have the most frequent and close contact with these species in their daily lives. This way, PM serves not only as a research tool, but also as a means of education, raising awareness and valuing traditional knowledge associated with herpetofauna.

Conclusions

With this broad approach to local knowledge about rattlesnakes in Zacatecas, we comprehensively present the relationship between local residents and these animals. Middle-aged and older people (> 40 years) living in rural localities have more traditional knowledge about rattlesnakes, compared to young citizens of urban populations. This is a key point, since it proves that older people in rural communities really do have great knowledge about these reptiles. Nevertheless, due to certain beliefs, often mistaken ones, fear prevails and concepts involving rattlesnake conservation are scarce in local traditions. Conversely, younger urban people with less or no direct knowledge about these reptiles seek to preserve them.

In addition, indigenous people emphasised the ecological potential of these reptiles and their importance in their customs, being the only interviewees that considered them deities. Moreover, people dedicated to agriculture, livestock raising and subsistence hunting were the ones who provided most information about these organisms, and they are also the most affected group in accidents involving these vipers.

Medicinal use was the main reason for hunting rattlesnakes, in order to treat diseases such as cancer or skin ailments, even though there is insufficient evidence to prove successful healing of these conditions. In some regions of the state, particularly in Villa de Cos Municipality, subsistence hunting exerts strong pressure on rattlesnake populations; residents and people dedicated to the trade of these organisms indicated a decrease in their presence over the years. In addition, land use change and the growth of the mining industry in Zacatecas were also mentioned as causes of this problem. Additionally, there are still areas in need of work, and future studies should try to fill data voids in many municipalities. Finally, the information in this study is expected to lay the foundations for future

programs that can guarantee the conservation of these stigmatised and persecuted organisms.

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