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CARNIVORES PUBLIC APPRECIATION IN RURAL AREAS OF THE COASTAL RANGE OF SOUTHERN CHILE

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ABSTRACT

Human-wildlife coexistence in rural coastal areas of southern Chile is analyzed, emphasizing the variable nature of interactions and the negative impacts of human-wildlife conflict on both human well-being and wildlife populations. The objectives of the study include exploring local perceptions of carnivores, investigating the social factors that influence these perceptions, and collecting data through structured surveys to obtain information for specific conservation interventions. To investigate the conflict between humans and carnivores in rural areas of southern Chile, structured surveys were carried out using questionnaires. The questionnaire addressed various topics, including demographic and socioeconomic information, management techniques used, predation history, and perceptions of carnivores in the area. A total of forty-three surveys were collected, revealing the deep vulnerability of rural dwellers to conflict and the high impact of livestock losses on their livelihoods. The most valued and commonly used handling techniques turned out to be confinement and the use of guard dogs. Respondents reported attacks by both native species (mainly pumas and foxes) and exotic species (dogs and introduced American minks) in roughly equal measures. The losses suffered by these ranchers were quantified as substantial, especially considering their reliance on subsistence economies.

KEYWORDS: carnivores, conflict, livestock, questionnaire, wildlife.

VALORACIÓN PÚBLICA DE LOS CARNÍVOROS EN ÁREAS RURALES COSTERAS DEL SUR DE CHILE

RESUMEN

Se analiza la coexistencia entre humanos y vida silvestre en áreas rurales costeras del sur de Chile, haciendo hincapié en la naturaleza variable de las interacciones y los impactos negativos del conflicto entre humanos y la

vida silvestre, tanto en el bienestar humano como en las poblaciones de vida silvestre. Los objetivos del estudio incluyen explorar las percepciones locales de los carnívoros, investigar los factores sociales que influyen en estas percepciones y recopilar datos a través de encuestas estructuradas para obtener información para intervenciones de conservación específicas. Para investigar el conflicto entre humanos y carnívoros en áreas rurales del sur de Chile, se llevaron a a cabo encuestas estructuradas mediante el uso de cuestionarios. El cuestionario abordó diversos temas, incluyendo información demográfica y socioeconómica, técnicas de manejo empleadas, historia de depredación y percepciones de los carnívoros en la zona. Se recopilaron un total de cuarenta y tres encuestas, revelando la profunda vulnerabilidad de los habitantes rurales al conflicto y el alto impacto de las pérdidas de ganado en sus medios de vida. Las técnicas de manejo más valoradas y comúnmente utilizadas resultaron ser la confinación y el uso de perros guardianes. Los encuestados informaron sobre ataques tanto de especies nativas (principalmente pumas y zorros) como de especies exóticas (perros y visones) en medidas aproximadamente iguales. Las pérdidas sufridas por estos ganaderos se cuantificaron como sustanciales, especialmente teniendo en cuenta su dependencia de economías de subsistencia.

PALABRAS CLAVE: carnívoros, conflicto, cuestionario, ganado, vida silvestre.

INTRODUCTION

In rural areas, the coexistence between humans and wildlife is inevitable due to the close proximity and population density of humans in these regions. These interactions can range from positive to negative, varying in intensity and frequency. Negative interactions, scientifically known as human-wildlife conflict, represent the conscious antagonism between wildlife and humans, leading to adverse impacts on human well-being, wildlife populations, and the environment (Soulsbury & White, 2015).

Human-Wildlife Conflict and Its Impacts. Human-wildlife conflict is defined as any interaction between humans and wildlife resulting in adverse effects on human socio-economic and cultural aspects, wildlife conservation, or the environment (WWF, 2005; Dickman *et al*., 2014). This conflict is one of the leading causes of carnivore population decline, affecting them through habitat fragmentation, gene flow limitations, road mortality, behavioral changes, disease transmission, and exposure to toxins (Tigas *et al*., 2002; George & Crooks, 2006; Ordeñana *et al*., 2010; González-Gallina & Hidalgo-Mihart, 2018). These conflicts are prevalent worldwide and are often driven by suspected predation on livestock and trophy hunting interests (Treves & Karanth, 2003; Silva-Rodríguez *et al*., 2009; Caniglia *et al*., 2013; García-Solís *et al*., 2022). Traditional responses involve retaliatory killings, leading to persecution and local extinctions (Treves & Naughton-Treves, 1999; Woodroffe *et al*., 2005; Silva-Rodríguez *et al*., 2009; Marchini & Macdonald, 2012; Ohrens *et al*., 2016). Rural areas, where human populations are more vulnerable, are hotspots for human-carnivore conflicts (Sacristán *et al*., 2018; Zorondo-Rodríguez *et al*., 2020).

These conflicts have far-reaching consequences. Livestock predation, one of the primary triggers of human-carnivore conflicts, causes significant economic losses for rural communities reliant on agriculture and animal husbandry (Treves & Karanth, 2003; Silva-Rodríguez *et al*., 2009; Caniglia *et al*., 2013; García-Solís *et al*., 2022). This economic burden can create negative attitudes towards carnivores, further escalating the conflict. Moreover, the depletion of carnivore populations disrupts the delicate balance within ecosystems, leading to cascading effects on prey populations, vegetation dynamics, and overall biodiversity (Prugh *et al*., 2009; Creel *et al*., 2011; Ripple & Beschta, 2012). The loss of carnivores can result in an overabundance of herbivores, leading to habitat degradation and altered ecosystem functioning (Beschta & Ripple, 2012; Ripple & Beschta, 2012). Therefore, addressing human-wildlife conflict and finding sustainable solutions is crucial for the conservation of both carnivores and the ecosystems they inhabit.

The Ecological Importance of Carnivores. Carnivores play a vital role within ecosystems, regulating prey populations, influencing trophic cascades, and maintaining community dynamics (Brown *et al*., 1999; Crooks & Soulé, 1999; Terborgh *et al*., 1999; Creel & Winnie, 2005; Ray *et al*., 2005; Ripple & Beschta, 2005; Bump *et al*., 2009; Prugh *et al*., 2009; Genovart *et al*., 2010; Hawlena & Schmitz, 2010; Creel *et al*., 2011; Beschta & Ripple, 2012; Ripple & Beschta, 2012; Kuijper *et al*., 2013; Allen *et al*., 2014; Iriarte & Jaksic, 2017; Barry *et al*., 2019). They help regulate herbivore populations, preventing overgrazing and promoting healthy vegetation growth (Prugh *et al*., 2009; Ripple & Beschta, 2012). Through their predatory activities, carnivores exert top-down control on prey species, shaping their behavior, distribution, and abundance (Allen *et al*., 2014; Iriarte & Jaksic, 2017). Furthermore, carnivores have indirect effects on ecosystems by influencing the behavior of mesopredators, which can have cascading impacts on lower trophic levels (Ray *et al*., 2005; Beschta & Ripple, 2012).

Due to their large home ranges, low densities, and slow growth rates, carnivores are particularly vulnerable to extinction (Ordeñana *et al*., 2010; Crooks *et al*., 2011; Caruso *et al*., 2016). Unfortunately, most wild carnivore populations have experienced significant declines in abundance and diversity (Crooks *et al*., 2011; Ripple *et al*., 2014; Caruso *et al*., 2016; Iriarte & Jaksic, 2017; Ferreira *et al*., 2018; van Eeden *et al*., 2018; Lamichhane *et al*., 2019). The loss of carnivores can disrupt ecosystem functioning and biodiversity, leading to negative ecological consequences. Protecting carnivores is therefore crucial for maintaining ecological balance and biodiversity, necessitating a top-down conservation approach (Treves & Karanth, 2003).

Social Aspects of Conservation and the Role of Surveys. Conservation must encompass a wide array of aspects, including ecological, social, economical and political dimensions (Castillo *et al*., 2020; White *et al*., 2021). The objective is to develop socially equitable conservation approaches through plural and dynamic partnerships (Castillo *et al*., 2020; White *et al*., 2021), where in public opinion and support play vital roles in carnivore conservation (Kellert, 1985; Riley and Decker, 2000; Andersone and Ozoliņš, 2004; Zorondo-Rodríguez *et al*., 2020). Conservation effectiveness relies on management practices and the acceptability of stakeholders, which can vary depending on their attitudes toward the target species (Kellert *et al*., 1996; Andersone and Ozoliņš, 2004). Given that the current biodiversity crisis stems from human social pressures, addressing the social component becomes imperative (Andersone and Ozoliņš, 2004). Unfortunately, carnivores are often perceived as threats to human interests (Silva-Rodríguez *et al*., 2009). Vulnerability of stakeholders, influenced by factors such as low educational level, rural location, livestock ownership, and dependence on protein resources, can contribute to negative attitudes toward carnivores (Silva-Rodríguez *et al*., 2009).

To bridge the gap between ecological conservation and human perspectives, it is essential to understand stakeholder perceptions, beliefs, and attitudes towards carnivores. Surveys have emerged as a cost-effective methodology for ecological studies, particularly in understanding stakeholder perspectives, human impacts on wildlife, and interdisciplinary research (White *et al*., 2005; Castillo *et al*, 2015; Caruso *et al*., 2017). By employing well-designed surveys and questionnaires, researchers can gather valuable data on local knowledge, attitudes, and practices related to carnivores. Surveys provide insights into the drivers of conflict, the effectiveness of current conservation strategies, and the social dimensions that shape human-wildlife interactions (Larivière *et al*., 2000; Zeller *et al*., 2011; Castillo *et al*, 2015; Caruso *et al*., 2017). They offer an alternative to direct field observations or signs, especially for rare or difficult-to-detect species, and can guide the development of targeted conservation interventions.

Objectives of the Study. In light of the increasing human population and expansion of human-modified environments, carnivores are pushed closer to human settlements, intensifying conflicts (Sacristán *et al*., 2018). Understanding the ecological importance of carnivores, addressing human-wildlife conflict, and incorporating stakeholder perspectives through surveys are crucial for effective conservation strategies in rural areas.

The objective of this study was to gain a better understanding of local perceptions of carnivores and to investigate the potential social factors that may influence these perceptions, such as educational level, ethnicity, or age. By examining these factors, we aimed to uncover the underlying drivers of human attitudes towards carnivores and their conservation.

Through the implementation of structured surveys by the use of questionnaires, we sought to gather valuable insights into the beliefs, knowledge, and practices of local communities in relation to carnivores. By analyzing the data collected, we aimed to identify patterns and correlations between socio-demographic variables and attitudes towards carnivores.

The findings of this study have the potential to contribute to the development of targeted conservation interventions that address specific social factors influencing human perceptions of carnivores. By considering the social dimensions of human-wildlife interactions, conservation efforts can be tailored to promote coexistence, enhance stakeholder engagement, and foster positive attitudes towards carnivores.

Ultimately, the integration of ecological research, social aspects, and stakeholder engagement can pave the way for sustainable coexistence between humans and carnivores, ensuring the persistence of both wildlife and human communities in these shared landscapes.

Carnivores' attacks on livestock have been reported in the study area over the last years (CONAF, 2012; el Llanquihue newspaper, 2022; Guerrero, 2016), but no action has been taken by the authorities to mitigate the loss or promote coexistence, only few examples from personal initiatives. For local farmers, carnivores' attacks have significant consequences on their subsistence economies, as livestock is one of their main source of income (Municipalidad de Purranque 2019). The carnivores presumably involved were puma (*Puma concolor*), South American grey fox (*Lycalopex griseus*), kodkod (*Leopardus guigna*), dog (*Canis familiaris*), and invasive American mink (*Neovison vison*). In most cases, puma and dog are related to livestock attacks, being with the bigger size, and the smaller carnivores, South American grey fox, kodkod, and American mink with poultry attacks.

We administered structured surveys using a questionnaire to gather data from local residents residing in these rural area, where most of the people's occupation is farming, small-scale crops, and some livestock (Municipalidad de Purranque 2019). Another aim of the study is to provide information about the conflict to the authorities and stakeholders to mitigate the consequences, as mitigation is one of the priorities for large carnivore conservation (IUCN, 2006; Dickman *et al*., 2014).

MATERIAL AND METHODS

Study area. The study area is located in the Valdivian Eco-region (40°- 42° S) in the humid temperate forest of the coastal range (Mittermeier *et al*., 2004; Smith-Ramírez, 2004). Specifically, in the Purranque Commune in Osorno Province of Los Lagos Region, Chile. It contains three types of landscapes: pre-mountain range, mountain range and coast (Figure 1). The latter belong to the Lafken Mapu Lahual Indigenous Protected Area (McAlpin, 2008). The Valdivian Rainforest is one of the top conservation priorities worldwide due to its high levels of endemism and biodiversity (Mittermeier *et al*., 2004).

The climate is rainy temperate, characterized by moderate temperatures (average of the coldest month is 7.5 °C, of the warmest month is 22 ºC, with a yearly average over 10 ºC (di Castri and Hajek, 1976; Köppen *et al*., 2011). Rains occur throughout the year, lacking a dry season (di Castri and Hajek, 1976; Köppen *et al*., 2011). During 2017, the rainiest month was August (289.4 mm) and the lowest precipitation was during November (22.8 mm), averaging 112 mm yearly (Agrometereología, 2021).

The pre-mountain range is a human-dominated landscape, with small-family livestock owners and large patches of exotic plantations of eucalyptus (mainly *Eucalyptus nitens* and *Eucalyptus globulus* (Rodas-Trejo *et al*., 2010) and pines (*Pinus* spp.). The main activities are small-scale

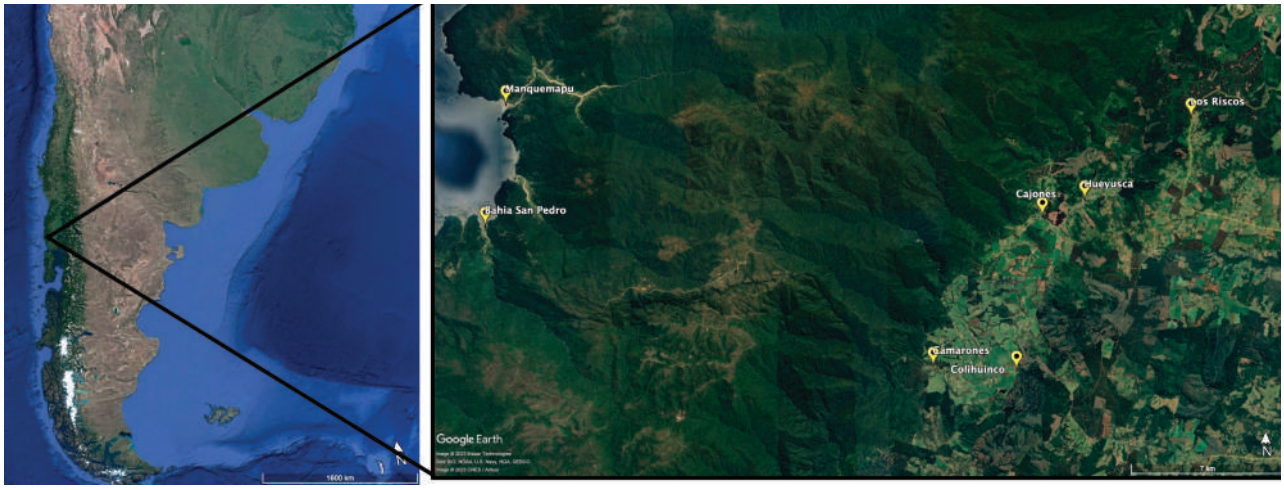

Figure 1. Study area (800 km² approximately). Coast locations: Manquemapu and Bahía San Pedro, and Pre-mountain range locations: Camarones, Collihuinco, Cajones, Hueyusca, Los Riscos, and Coligual.

livestock raising, agriculture, and eucalyptus forestry practices. There are still fragments of deciduous forest of Patagonian oak (*Nothofagus obliqua* now *Lophozonia heterocarpa* (Mosyakin *et al*., 2019), and Chilean laurel (*Laurelia sempervirens*), coigüe (*Nothofagus dombeyi*), and ulmo (*Eucryphia cordifolia*) mixed forest closer to the mountain range (Farías *et al*., 2008).

The mountain range is a more pristine landscape with a low human population and intervention. The vegetation is dominated by a mixed forest of coigüe with ulmo in the east slope, a narrow strip of Patagonian cypress (*Fitzroya cupressoides*) at the top, and tineo (*Weinmannia trichosperma*) with tepa (*Laureliopsis philippiana*) on the west slope (Farías *et al*., 2008).

The coast landscape has a few small indigenous settlements, whose main activity is fishing, complemented by the collection and handwork of local wood (Molina Otarola *et al*., 2006). The vegetation surrounding these settlements is dominated by tineo and tepa (Farías *et al*., 2008). No official population records are available for San Pedro Bay or Manquemapu, though the local government estimates they have about 40 and 100 inhabitants, respectively.

An essential feature of our study area is their inhabitants, as there are several native communities of Huilliche natives (people from the south); they are one of the several Mapuche ethnic groups, whose lives are linked to nature and its resources, especially the Patagonian cypress. Wood handicraft is one of their main activities, but they also work the land, raise livestock and crops, or do fishing if they live close to the coast, all in a traditional fashion (Alcamán, 1997; Molina Otarola *et al*., 2006).

Study design. The chosen methodology to evaluate the perception of people in the area of carnivores was to carry out a series of structured surveys, following a questionnaire of 30 questions, divided into sections according to the following topics addressed: General Information, Characteristics of the Rancher, Management Techniques, Predation History, and Other Relevant Information (Supplementary Material 1). Before conducting the survey, a consent document on the anonymous use (Andersone and Ozoliņš, 2004; Røskaft *et al*., 2007; Napolitano *et al*., 2016) of the data obtained was presented and explained to the respondents. also Suppl. Mat. 1. Consent document was approved by the Ethics Committee at University of Los Lagos. The surveys were carried out in association with the Municipality of Purranque, giving greater legitimacy and helping in the presentation with the respondents, creating a climate of trust, and giving rise to the conversation.

Data and statistical analyses. Data were sorted, classified, and analysed using the online statistical computational package VassarStats: Website for Statistical Computation

(Richard Lowry 1998-2017). With this package, the means, variances, standard deviations, and standard errors were calculated and made the different comparisons using Chi-square tests.

RESULTS

General information and characteristics of the ranchers. A total of 43 surveys were conducted across eight localities to gather information about the ranchers. The respondents had an average age of 58 ± 2.20 years, with the majority having a low level of education and completing only primary education (41.86%). Additionally, 27.91% of the respondents identified themselves as belonging to the Mapuche ethnicity (Figure 2). The participants had been residents of the area for an average of 39.26 ± 3.42 years. Among the interviewees, 62.79% either worked or resided on farming land ranging from 0 to 30 hectares, most of which were owned by the ranchers themselves (79.07%). On average, there were 2.62 ± 0.22 people per household. Various productive activities were carried out on the properties, with the most common being poultry farming (17.89%), followed by cattle (13.69%) and sheep farming (13.69%). Other activities included milking (1.79%), cultivation of cereal crops (13.69%), native forest logging (3.57%), potato cultivation (10.71%), vegetable crops (10.71%), tree fruit plantations (8.93%), cider production (2.98%), forestry (4.76%), and other miscellaneous activities.

The primary sources of income were recorded, with the sale of products being the most important, followed by pensions and subsidies. Approximately 36.36% of the respondents stated that selling their products was their main source of income, while 23.64% relied on pensions and subsidies. Another 16.36% mentioned temporary jobs as their primary income source, and only 10.91% received their main income from permanent jobs. A small percentage (1.82%) derived their primary income from renting their lands.

Management techniques. The number of animals owned by the ranchers was recorded, and average values per household were obtained (Table 1). The study evaluated

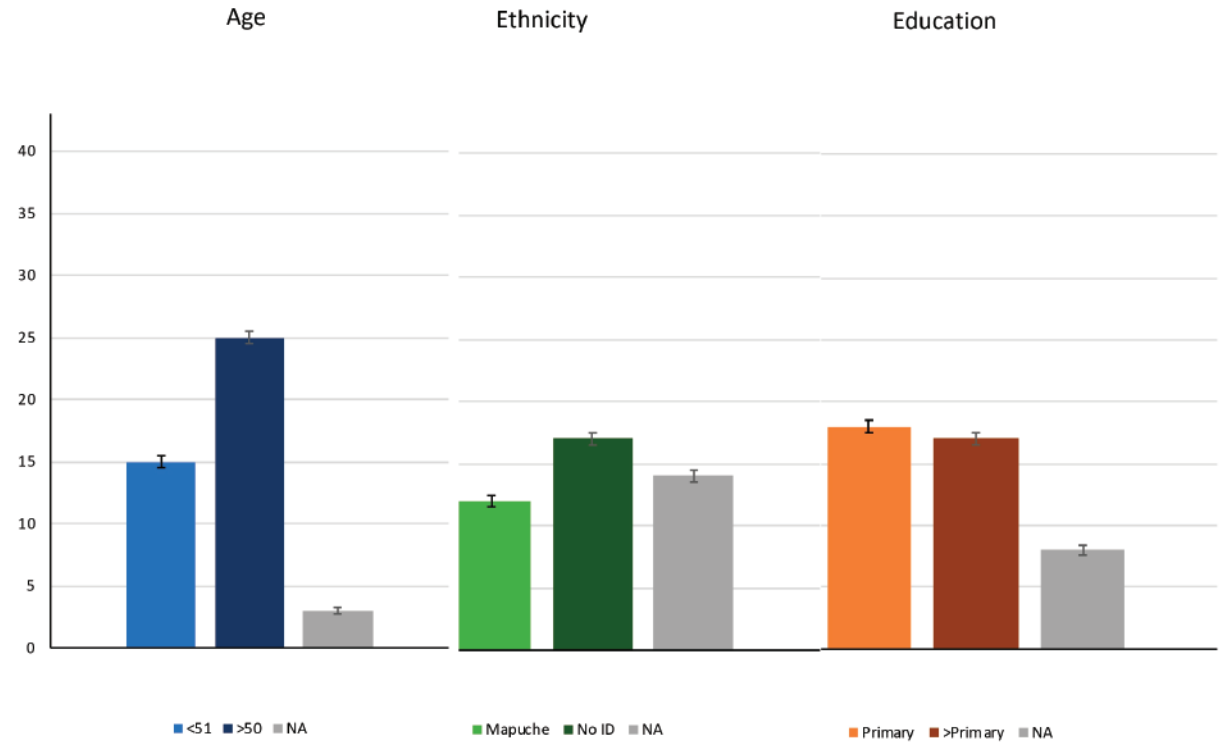

Fig 2: Ethnicity, age, and educational level of the local people interviewed. N/A (Not Applicable), the error bars are the standard deviation.

Table 1. Average quantity of animals per household.

SPECIES	AVERAGE OWNERSHIP	STANDARD ERROR
Sheep (*Ovis aries*)	16.95	4.46
Goat (*Capra hircus*)	1.65	0.79
Cattle (*Bos taurus*)	21.00	11.74
Horse (*Equus ferus caballus*)	0.37	0.14
Chickens (*Gallus domesticus*)	19.02	3.44
Goose (*Anser anser*)	1.51	0.45
Dog (*Canis familiaris*)	2.23	0.31
Cat (*Felis catus*)	1.35	0.29
Other	2.98	1.44
N/A	0.09	0.04

and compared different management methods used for livestock protection, focusing on which methods were considered better and which methods were actually employed. No significant differences were observed between the methods considered better and the ones used. Among the various techniques, the use of dogs and cattle confinement were the most prevalent, with 23.26% of the respondents utilizing dogs as a management tool, while 41.86% practiced cattle confinement (Figure 3 and Table 2). Since confinement was both highly valued and widely adopted, the study investigated whether its use could be influenced by social, cultural, generational, or educational factors. However, none of these factors significantly influenced the use of this management technique (Table 3).

Identification of species responsible for conflicts. Another important aspect was to determine the respondents' opinions regarding the species involved in the conflicts and responsible for attacking their animals. The data were grouped into two categories: native carnivores (including pumas and foxes) and exotic carnivores (including dogs and minks). This grouping was done to obtain larger sample sizes for statistical comparison and to study the potential influence of social aspects (Figure 4 and Table 4). According to the different social aspects considered, no significant differences were found regarding the attributions of responsibility in the carnivore conflict.

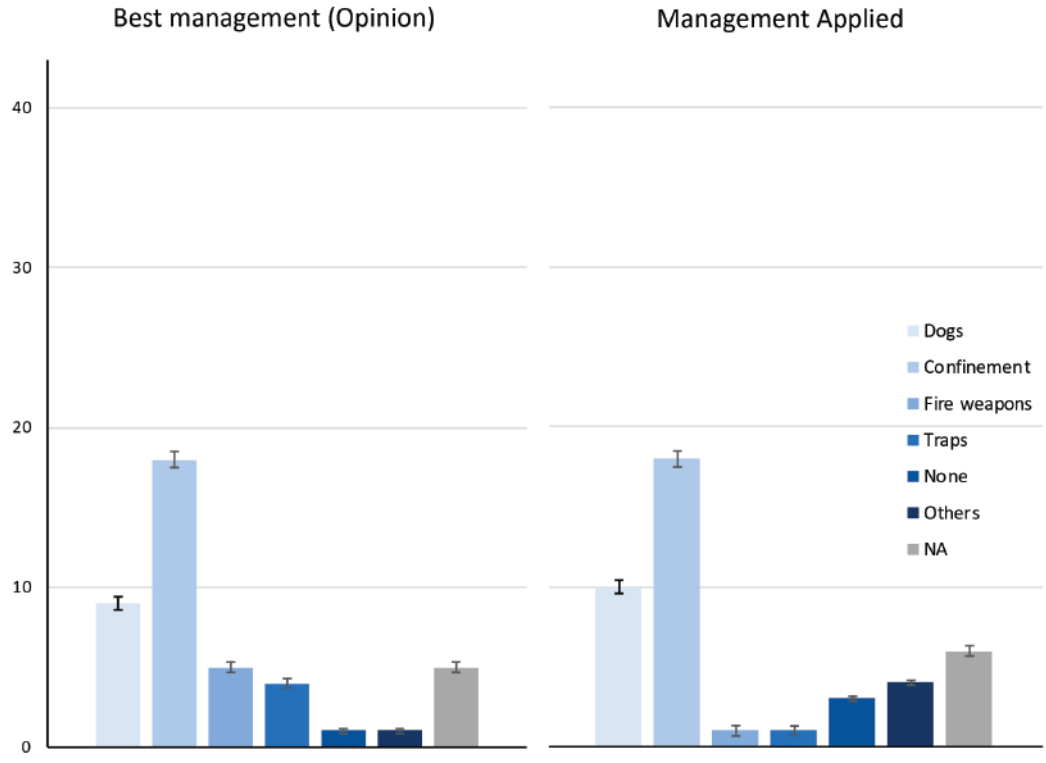

Fig 3: Opinion on the best management methods to protect livestock from carnivores and which methods are used. N/A (Not Applicable), the error bars are the standard deviation

Table 2. Comparison by X^2 of the methods on best management methods and the methods applied.

	Dogs (*Canis familiaris*)	Confinement
Best Management (Opinion)	13	22
Management Applied	15	24
x^2 test: P-value	0.84	0.89

Table 3. Comparison by X2 of the differences in the confinement method by three social aspects, ethnicity, age, and education.

ETHNICITY CONFINEMENT		AGE CONFINEMENT		EDUCATION CONFINEMENT	
Mapuche	11	<51	11	Primary	14
No Id	13	>50	19	>Primary	11
x^2 test: P-value	**0.79**	x^2 test: P-value	**1**	x^2 test: P-value	**0.76**

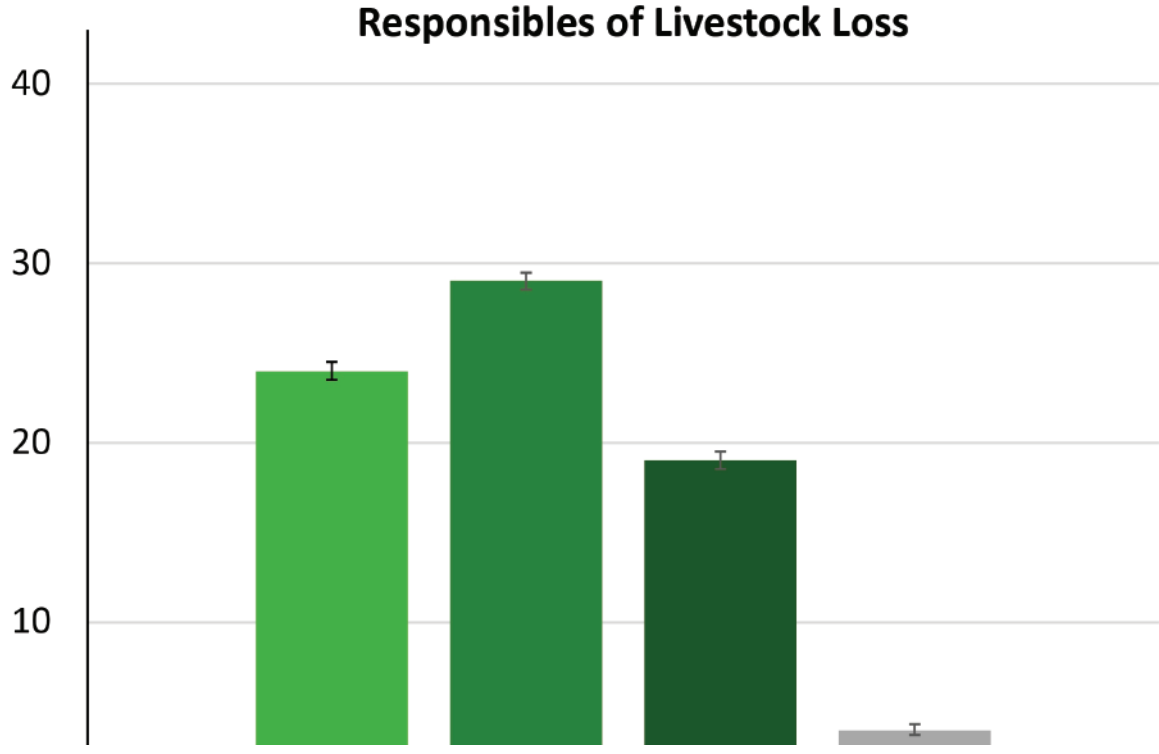

Fig 4: Opinion on the best management methods to protect livestock from carnivores and which methods are used. N/A (Not Applicable), the error bars are the standard deviation.

History of predation. A substantial majority of the respondents (86.72%) reported attacks on their domestic animals by carnivores. The study quantified the losses suffered in the last three years and attributed them to specific carnivores. The results are presented as relative average losses per household (Table 5).

Carnivores appreciation. Lastly, the study recorded the interviewees' perceptions of several carnivore species involved in the conflicts, and the majority perceived them negatively. For instance, 64.29% considered the puma as a non-beneficial species, 67.44% held a negative perception of the fox, and the dog was perceived as

Table 4. Comparison by X^2 of the differences in the carnivores perception as esponsable of killing livestock by three social aspects, ethnicity, age, and education

ETHNICITY	NATIVE	EXOTIC	AGE	NATIVE	EXOTIC	EDUCATION	NATIVE	EXOTIC
Mapuche	8	8	<51	10	10	Primary	11	12
No Id	6	12	>50	14	19	>Primary	11	13
x^2 test: P-value	**0.34**	**1**	x^2 test: P-value	**0.82**	**0.88**	x^2 test: P-value	**1**	**0.92**

Table 5. Relative livestock losses by different carnivores species according to the respondents during the last three years.

	PREDATORS					
LOSS	*Puma concolor*	*Lycalopex griseus*	*Canis familiaris*	*Neovison vison*	Others	N/A
Ovis aries	4.77 ± 1.22	0.00	6.04 ± 2.30	0.00	0.04 ± 0.04	0.08 ± 0.05
Bos taurus	1.00 ± 0.68	0.00	1.33 ± 0.80	0.00	0.17 ± 0.17	0.00
Poultry	0.24 ± 0.24	9.16 ± 1.98	0.00	17.52 ± 7.85	0.60 ± 0.60	0.00
Other	0.00	0.00	1.00 ± 1.00	0.00	2.50 ± 2.50	0.00

both beneficial and non-beneficial in equal parts (41.86%). The mink received the most negative assessment, with 71.43% of respondents perceiving it as non-beneficial. Similarly, the skunk and the kodkod were perceived as non-beneficial by 66.67% of respondents (Figure 5). The perception data for carnivores were significant in all cases, except for the dog species (Table 6).

These data were further analyzed considering the social characteristics of ethnicity, age, and education (Table 7). However, as with previous comparisons, no significant differences were found in terms of carnivore perception based on ethnicity, age, or educational level.

DISCUSSION

The use of questionnaires in socio-ecological studies has witnessed a significant increase in the past decade. Questionnaires are particularly valuable tools for addressing various issues, including public perception studies, and their data are increasingly sought after and valued for decision-making processes (White *et al.*, 2005). They

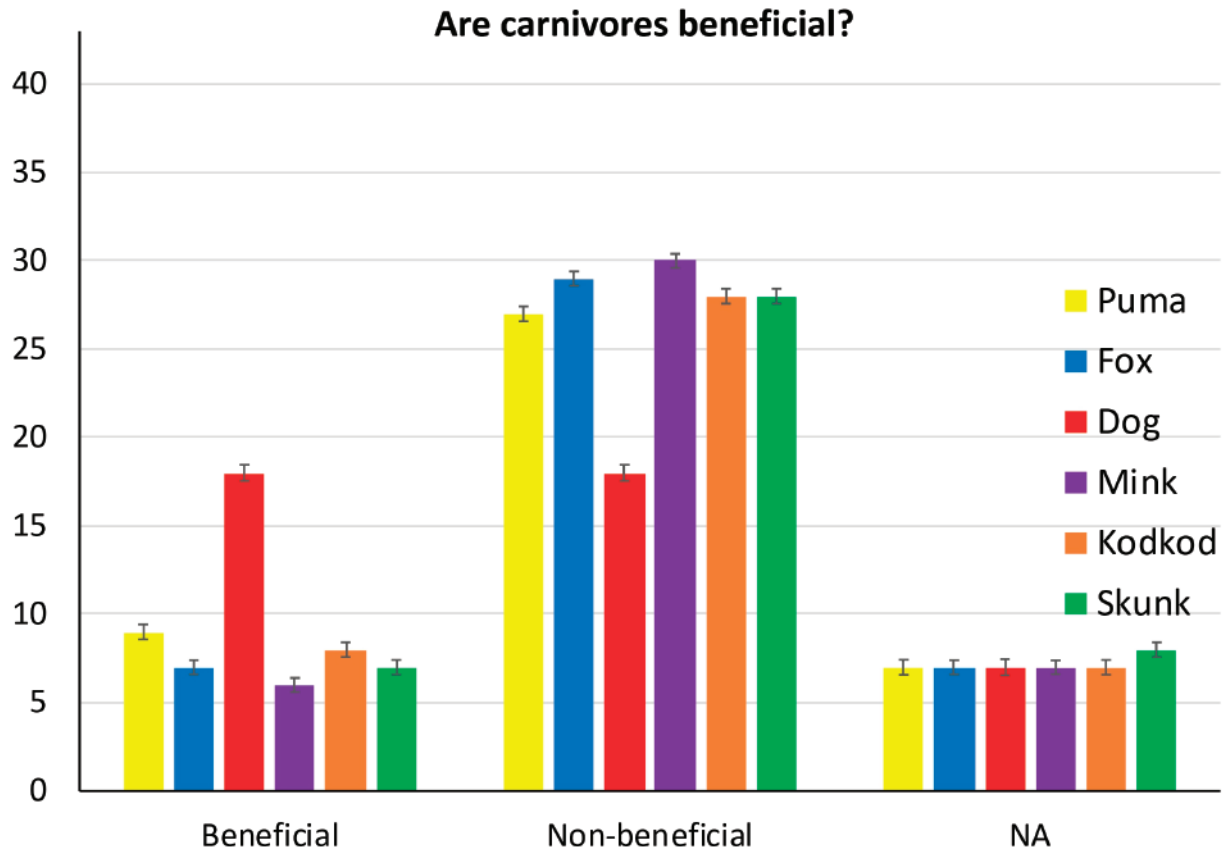

Fig 5: Carnivores perception by species. N/A (Not Applicable), the error bars are the standard deviation.

Table 6: Comparison by X^2 of the differences in the carnivores perception as if are they beneficial or not.

	YES	NO	X^2 TEST: P-VALUE
Puma *(Puma concolor)*	9	27	0.0046
Fox *(Lycalopex griseus)*	7	29	0.0005
Dog *(Canis familiaris)*	18	18	1
Mink *(Neovison vison)*	6	30	0.0001
Kodkod *(Leopardus guigna)*	8	28	0.0015
Skunk *(Conepatus chinga)*	7	28	0.007

are cost-effective and provide a substantial amount of data, making them a practical tool for considering the socioeconomic aspects of ecological studies (White *et al*., 2005; Castillo *et al*., 2015).

In this study, general information and characteristics of the ranchers were gathered through surveys conducted in eight localities. The majority of the respondents had a lower level of education, with most completing only primary education. They represented two cultural profiles: Mapuches, the largest native group in Chile, and those who did not identify with any ethnic group. The primary source of income for these ranchers came from what they produced on their land, particularly livestock and poultry farming. This highlights the vulnerability of these communities to conflicts with carnivores, as attacks on their livestock significantly impact their family economy, without any government compensation (Silva-Rodríguez *et al*., 2009).

Management techniques used by the ranchers to protect their livestock were evaluated and compared. Livestock fencing and livestock-guarding dogs emerged as the most popular and commonly employed methods, consistent with previous research (Moreira-Arce *et al*., 2018). Firearms also stood out, although their actual use was considerably lower, likely due to the illegality of killing protected species like pumas and the high cost associated with firearms.

The study aimed to investigate the influence of social characteristics on the choice of management methods but found no significant impact of factors such as ethnicity, age, or education. Additionally, the perception of which species were responsible for the attacks was examined, but again, no significant influence of social aspects was observed. Notably, the presence of free-roaming dogs, often owned by neighbors, posed a significant threat to livestock, native fauna, and even human safety.

To provide a better understanding of the conflict between carnivores and local livestock, the study recorded the number of domestic animal losses over three years. On average, a person in these locations would lose approximately ten sheep, two cows, and 26 poultry in a year, resulting in significant economic losses.

Table 7: Comparison by X^2 of the differences in the carnivores perception as if are they beneficial or not by ethnicity, age and education. *, the values were not enough high to run the x^2 test.

	Puma concolor		*Lycalopex griseus*		*Canis familiaris*		*Neovison vison*		*Leopardus guigna*		*Conepatus chinga*	
	YES	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**	**YES**	**NO**
Mapuche	5	6	4	7	6	5	3	8	5	6	4	6
No Id	3	12	3	12	8	7	3	12	3	12	3	12
x^2 test: P-value	*	0.68	*	0.89	1	1	*	1	*	0.68	*	0.68
<51	4	10	3	11	6	8	3	11	4	10	4	10
>50	5	17	4	18	12	10	3	19	4	18	3	18
x^2 test: P-value	*	1	*	1	0.89	0.72	*	1	*	1	*	1
Primary	3	13	2	14	6	10	2	14	3	13	3	13
>Primary	4	12	3	13	8	8	3	13	3	13	3	13
x^2 test: P-value	*	1	*	1	0.73	0.89	*	1	*	1	*	1

The perception of carnivores among these communities was predominantly negative, driven by the tremendous costs associated with living alongside them. Dogs, despite their conflicting role as both a tool in the field and a source of attacks, received mixed evaluations. Similarly, the kodkod and skunk, species with minimal involvement in the conflict, were negatively perceived, likely influenced by cultural traditions. Native carnivores such as pumas and foxes, responsible for the majority of livestock losses, were expectedly viewed negatively.

Social components were not found to influence these perceptions, although it was hypothesized that Mapuche ranchers, younger individuals, or those with higher education might have more positive views towards carnivores. However, due to the average age of the respondents being 58 ± 2.20 years, these factors could not be considered influential in this study.

While questionnaires are widely used in ecological and conservation studies, concerns about the reliability of the information obtained have been raised. Respondents may consciously or unconsciously provide biased responses, emphasizing the need for clear and concise questions in the questionnaire. The study benefited from the trust established with the help of the Environment Office of the Municipality of Purranque, although informal conversations occasionally led to unanswered or ambiguous questions, resulting in some missing data.

The study calls on authorities and governmental organizations with financial and organizational capabilities, such as the Municipality, PRODESAL, and INDAP, to support these communities without harming the natural environment or the species involved. Measures such as training workshops on effective prevention methods, nighttime enclosure of animals, use of protective dogs (large breeds raised alongside livestock), and secure pens and chicken coops can be implemented. Additionally, environmental education with a multidisciplinary approach can promote the benefits and importance of carnivores in the ecosystem, contributing to their conservation in human-modified environments (Silva-Rodríguez *et al*., 2007).

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