CONTRIBUTED PAPER

Conservation Science and Practice
A journal of the Society for Conservation Biology

WILEY

Large carnivore encounters through the lens of mobile videos on social media

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Abstract

Understanding local encounters with large carnivores is important for promoting sustainable coexistence. The use of smartphones and social media in geographically remote areas offers a novel avenue to study human–wildlife encounters from a local perspective. We conducted a content analysis of mobile videos on social media ($n = 207$) to characterize human encounters with snow leopards, gray wolves, and brown bears on the Tibetan Plateau in China. We also used ethnographic interviews to understand the backgrounds and motivations of videographers. Results show large carnivore encounters are not necessarily conflictual. Over half of encounters are neutral without observable interference between people and predators. The likelihood of a "negative encounter" is significantly associated with the target species, the distance between the videographer and the animal, the level of human influence in the surroundings, and the presence of other animals (i.e., dogs and livestock). Local Tibetan herders document unusual encounters with carnivores using videos for various reasons, but what is deemed unusual is context-dependent and fluid. Our study demonstrates that social media videos can provide valuable insights into the diversity and complexity of human–wildlife interactions.

We encourage conservationists to develop visual participatory programs to better engage local people in conservation knowledge production.

KEYWORDS

brown bear, human–wildlife coexistence, human–wildlife conflict, smartphone, snow leopard, Tibetan Plateau, wolf

1 | INTRODUCTION

Human–wildlife coexistence in shared landscapes is a matter of urgent concern worldwide (König et al., 2020; Pooley et al., 2021). Living alongside wildlife, especially large carnivores, often involves a wide variety of encounters that affect people and wildlife in complex ways. For instance, in many villages on the high-altitude Tibetan Plateau, three large carnivore species—snow leopard (*Panthera uncia*), gray wolf (*Canis lupus*), and brown bear (*Ursus arctos*)—occasionally come into contact with Tibetan herders. Livestock depredation by snow leopards and gray wolves together with home break-ins by brown bears are serious concerns for both local communities and conservationists (Alexander et al., 2015; Dai et al., 2020; Li et al., 2013; Yan et al., 2019). Accordingly, conservation research often focuses on dramatic encounters featuring conflictual human–wildlife interactions (Frank et al., 2019), while documentation of nondestructive encounters remains scarce. This "negativity bias" (Buijs & Jacobs, 2021) masks the range of wildlife encounters as experienced by local people in their daily lives.

In the past decade or so, academic and public discourses about human–wildlife interactions have witnessed a shift from "conflict" to "coexistence" (Frank et al., 2019; Nyhus, 2016). A growing number of studies in the field of wildlife conservation underscore the positive aspects of coexisting with wildlife and the need for researching human–wildlife cooperation or mutualism (Cram et al., 2022; van der Wal et al., 2022). Similarly, scholars in the field of anthropology and other relevant social science disciplines have explored diverse human–animal interactions under various sociocultural contexts (Fuentes, 2012; Hardin & Remis, 2006; Parathian et al., 2018). The earlier emphasis on negative encounters is gradually giving way to a fuller and greater appreciation of complexities in human–wildlife interactions. Nevertheless, there is still a need to explore the discourses of conflict and coexistence and their underlying assumptions about human interactions with wildlife (Gao, 2019; Hill, 2021). To encourage a more accurate representation of human–wildlife interactions, we believe that it is equally important to consider ordinary encounters that bring about neither positive nor negative impacts on people and wildlife. This requires a more comprehensive and nuanced understanding of human–wildlife encounters from a local perspective.

Conventional data collection on human–wildlife encounters relies heavily on monitoring systems, household interviews, and questionnaire surveys (e.g., Alexander et al., 2015; Chen et al., 2016; Li et al., 2013; Songhurst, 2017). These methods are often time-consuming and resource-demanding. To address the limitations, many conservation researchers turn to social media data. A growing number of studies have demonstrated that visual materials, such as videos and photos shared by amateurs on social media, provide valuable insights into human–wildlife coexistence (Dylewski et al., 2017; Sbragaglia et al., 2020; Toivonen et al., 2019). Recent accessibility of smartphones in geographically remote areas, such as the Tibetan Plateau, enable conservationists to leverage the power of social media (Di Minin et al., 2015; Toivonen et al., 2019). Today many Tibetan herders use smartphones to videotape their encounters with wildlife and then post and share the videos on social media platforms such as WeChat, Kuaishou, and Douyin (see Figure 1 for examples of video screenshots). These videos offer a new data set for researching human–wildlife interactions.

In this study, we used mobile videos on social media to understand the everyday reality of living with large carnivores from a local perspective. We characterized and compared the common patterns of an encounter—the spatial, temporal, environmental, behavioral, and thematic elements—with snow leopards, gray wolves, and brown bears. We also used ethnographic interviews to reveal the backgrounds and motivations of the videographers. The combination of quantitative and qualitative data allows us to contextualize these mobile videos on social media and depict a richer picture of large carnivore encounters than otherwise might be available.

2 | METHODS

We adopted a mixed-method approach to collect and analyze data, focusing on large carnivore encounters that

FIGURE 1 Examples of video screenshots of encounters with snow leopard, gray wolf, and brown bear included in the analysis.

were recorded and circulated on social media from 2019 to 2021. We used "human–wildlife encounter" to refer to any event when a person or multiple people are aware of the presence of one or several free-ranging wild animals regardless of how far away they are (Jochum et al., 2014). We identified and analyzed encounter patterns including: spatiotemporal features of encounters as documented by the videos ("encounter conditions"); the observed dominant behavioral state of the target species ("encounter behaviors"); and the thematic focus of encounters ("encounter themes").

2.1 | Video collecting and filtering

From 2019 to 2021, the first author spent 30 months conducting ethnographic and ecological fieldwork in Sanjiangyuan, a vast area of over 360,000 km^2 on the eastern Tibetan Plateau in Qinghai Province, China. He asked local collaborators to forward large carnivore encounter videos to him whenever they came across relevant posts in WeChat groups. Local collaborators were aware that the first author was to use the videos for the purpose of this research. In September 2021, the first author also conducted a manual search for publicly available videos on two Chinese social media platforms—Kuaishou and Douyin (Note that Douyin is known as "TikTok" outside of China), using the Tibetan and Chinese names of the three large carnivores as keywords (Chinese pin yin: xue bao, lang, zong xiong; Tibetan Wylie: gsa', spyang ki, dred mong). Although the exact dates and places when and where these videos were recorded cannot be determined, it is likely that most of them were recorded by Tibetan

herders in Sanjiangyuan and shared on social media during the period when the first author was doing fieldwork in the region.

The research plan was reviewed and approved by the Institutional Review Board of the first author's affiliated university to ensure that ethical principles are followed to protect the rights of human subjects involved in the project (reference no. 2000025240). In this study, the personal data of social media users were not collected, nor was any information extracted that could reveal the identity of those who took or shared the videos. The mobile videos used in our analysis primarily focused on wildlife, with only a small percentage (12%) including people's voices or faces and none showing clear identifying features that would allow recognition or identification of any individual. With attention to data privacy and protection standards (Di Minin et al., 2021), strict data management procedures were implemented, including anonymizing the video sources and ensuring that the data was stored and processed on a secure digital system, available only upon request (see "Data Accessibility Statement").

The first and second authors screened through all the video-recordings to remove duplicates ($n = 68$), since videos from the two above-mentioned sources overlapped. We filtered out "unqualified" videos using the following criteria: (1) videos must feature encounters with free-ranging snow leopards, gray wolves, or brown bears, rather than those in captivity; (2) videos must be shot by amateurs rather than wildlife filmmaking professionals or from camera trapping; (3) videos must record encounters on the Tibetan Plateau in China rather than other places; and (4) each video must feature only a single,

TABLE 1 Video coding categories of encounter conditions and their descriptions.

Category	Description of observation
Time of day	
Daytime	Encounter in day light, including dawn and dusk
Night-time	Encounter at night after sunset
Uncertain	Unable to determine time of day, e.g., indoor encounters
Season	
Warm season	Presence of green vegetation
Cold season	Presence of yellow/dry vegetation or snow
Uncertain	Unable to determine season, e.g., indoor or night-time encounters
Status	
Individual	Presence of one individual animal in the encounter
Group	Presence of multiple animals in the encounter, including adult group, mother and cub, or litter
Topography	
Ridgeline	Encounter occurs on a ridgeline
Hillslope	Encounter occurs on a hillslope
Flat or valley floor	Encounter occurs on flat terrain or valley floor
Riverbank	Encounter occurs nearby a riverbank
Others	Encounter in other types of topography, e.g., indoor structure, town street, dumpsite
Vegetation	
Barren	Less than 10% of the ground has vegetation cover
Grassland	Dominant vegetation is grassland
Shrubland	Dominant vegetation consists of shrubs
Woodland	Vegetation dominated by open trees
Snow	Vegetation is covered by snow
Others	Encounter occurs indoor or around built structures, e.g., temple, corral, dumpsite
Presence of other species	
None	Only the target species is present, excluding the videographer
Human	Presence of other human individuals, in addition to the videographer
Dog	Presence of domestic or feral dog
Livestock	Presence of livestock animals, e.g., yak and sheep
Wild ungulate	Presence of wild ungulate, e.g., blue sheep and wild ass
Others	Presence of other species, e.g., birds
Distance from target species[a]	
Near	Distance between the videographer and the target species is approximately within 10 m
Medium	Distance between the videographer and the target species is approximately between 10 and 50 m
Far	Distance between the videographer and the target species is beyond 50 m
Level of human influence in the environment[b]	
Low	Absence of man-made construction in the encounter surroundings
Medium	Presence of man-made constructions less frequented by people, such as electric post, signal tower, bridge and livestock corral
High	Presence of man-made constructions much frequented by people, such as house, concrete wall and paved road

[a]In many footages where the encounter distance is not immediately apparent, we used visual cues in the footage—such as the field of view, landscape reference, changes in perspective when the camera moves or pans, the motion and "shakiness" of the footage, and any zooming in or out—to estimate the distance from the target species.

[b]We used the presence and type of man-made structures and the surrounding landscape in the footage as a proxy for the level of human influence on the landscape in the encounter environment.

continuous wildlife encounter (videos showing edited montages of multiple encounters were discarded). We evaluated every video by examining on-screen details, such as features of natural and cultural landscapes, the clothing of and languages spoken by videographers, and video qualities (e.g., focus, clarity). Videos for which we could not confirm the above criteria were removed ($n = 58$) from the analysis. Our final sample included 207 mobile videos for detailed analysis, which consisted of 93 videos of encounters with snow leopards, 49 with gray wolves, and 65 with brown bears.

2.2 | Video content analysis

First, we reviewed all the 207 videos and developed a coding system for the content analysis with respect to encounter conditions, encounter behaviors, and encounter themes (see Tables 1 and 2 for the coding categories and descriptions). For every video, we first documented its length and the conditions under which the encounter occurred: time of day, season (cold season, warm season, uncertain), topography, vegetation, status (individual, group), the presence of other species, the distance between the videographer and the target species (near, medium, far), and the level of human influence on the landscape in the encountering environment (low, medium, high). In the footages where the encounter distance is not immediately apparent, we used visual cues—such as the field of view, landscape reference, change in perspective when the camera moves or pans, the motion and "shakiness" of the footage, and any zooming in or out—to estimate the distance from the target species. We used the presence and type of man-made structures and the surrounding landscape in the footage as a proxy for the level of human influence on the landscape in the encounter environment.

Second, we categorized "behavioral state" by referring to available ethograms for the Felidae (Stanton et al., 2015), Canidae (MacNulty et al., 2007), and Ursidae (Jordan & Burghardt, 1986; see Table 2 for descriptions). Behavioral states are behaviors of relatively long duration, such as periods of feeding, attacking or social interaction, and they are different from behavioral events (e.g., yawning, rubbing, and clawing), which are of relatively short duration (Bateson & Martin, 2021).

And, third, we identified the repeatedly occurring themes and classified them according to the direct impacts of an encounter upon the expression and perceived gratification of needs of either wildlife or human. In this way, we developed a list of six encounter themes: (1) noninteracting encounter (e.g., passing-by), (2) wildlife interfering with human (e.g., snow leopard attacking livestock and brown bear damaging furniture), (3) human interfering with wildlife (e.g., people chasing brown bears), (4) wildlife-dog interaction (e.g., gray wolves fighting feral dogs), (5) human facilitating wildlife needs (e.g., people rescuing trapped brown bears), and (6) others (e.g., encounter with a dying animal).

We further grouped encounter themes into three encounter types: Neutral for theme 1, Negative for themes 2, 3, 4, and Positive for theme 5. We are aware that whether an encounter is considered facilitative (positive) or interfering (negative) largely depends on the specific contexts and subjective perspectives. For the content analysis, we focused on observable actions displayed at the moment of a video-recording instead of the motivations and perceptions of the videographer or other person(s) in the scene, while also trying to avoid overinterpretation. We classified wildlife-dog interaction as negative because dogs on the Tibetan Plateau, domestic or feral, are generally associated with disturbances to wildlife (Young et al., 2011). Theme 6 (others) was not included in any of the encounter type because of its small sample size.

We conducted a first round of preliminary coding to refine the coding system. After that, the first and second authors each analyzed all the videos using the predetermined categories. Acknowledging that multiple encounter behavioral states and themes may be present in a single video, we decided to include only the most salient behaviors and themes in our analysis. Intercoder agreement before reconciliation was 80.8% for encounter behavior (Cohen's kappa = 0.813) and 84.9% for encounter theme (Cohen's kappa = 0.813). The two coders discussed the differences to reach a final coding decision. Chi-square tests were used to compare the proportions of encounter behavior and encounter theme under different encounter conditions and across different species. In addition, we fitted a binary logistic regression model using a forward stepwise selection (Wald) process to assess the effect of various encounter conditions on the likelihood that an encounter is negative. The logistic regression assessed the effect of target species, time of day, season, status, distance, presence of other species, level of human influence, topography, and vegetation on the likelihood of a negative human–wildlife encounter in a video. Limitations of stepwise regression analysis are well recognized, especially with respect to data mining exercises (Whittingham et al., 2006). Instead of fitting models with many potential predictors, our variables were carefully selected based on existing knowledge about human–carnivore interactions on the Tibetan Plateau (Tables 1 and 3). Rather than attempting to estimate the significant effect of a large number of different variables, we aimed to

TABLE 2 Categories and descriptions of the behavioral states of target species and the main encounter types and themes observed in videos.

Category		Description
Behavioral state		
Inactivity		Behaviors in which the target species is at rest and stationary or performing minimal movements, e.g., lying down, sitting, sleeping, standing, and hiding.
Locomotion		Behaviors that enable the directional movement from one location to another, rapidly or relaxed, e.g., pacing, walking, running, and fleeing
Feeding		Behaviors associated with the ingestion of food, e.g., eating, chewing, and drinking
Attacking		Behaviors involving pursuing wild or domestic prey, or other species such as feral dogs, with the likelihood of causing injury, regardless of purpose, e.g., chasing, fighting, lunging, and biting
Socializing		Behaviors in which individuals of the same species engage in social interactions, e.g., playing and rubbing
Interacting		Behaviors involving interactions with physical environment or nonliving things, e.g., conspicuously searching, manipulating, and damaging objects
Others		Other behavior, e.g., urinating, marking and vocalizing
Encounter type and theme		
Neutral encounter	Noninteracting encounter	Encounters featuring stereotypical ordinary activities of target species in relatively natural environment. Such activities are those that one would expect to see in free-ranging wildlife, for example, walking, resting, and predation on wild prey. There are no obvious, direct interactions between people and target species
Negative encounter	Wildlife interfering with human[a]	Encounters featuring target species interfering with human needs and activities, for example, attacking livestock, damaging human property (e.g., house, window, furniture), foraging in or nearby human settlements (e.g., garbage site). These are the typical types of interactions that conservationists generally consider as human–wildlife conflicts
	Human interfering with wildlife	Encounters featuring human-instigated attempts to interfere with the needs and activities of target species, for example, chasing, yelling, or throwing objects at the animal
	Wildlife-dog interaction	Encounters featuring target species interacting with feral or domestic dog, for example, chasing and fighting
Positive encounter	Human facilitating wildlife needs	Encounters featuring human attempt to facilitate the needs and activities of target species, for example, humans rescuing trapped animal or feeding wildlife
Others	Others	Other conspicuous themes not included in the above mentioned, e.g., encounter with a dying animal

[a]In these encounters where wildlife directly poses threats to the safety of human or their properties, people may yell at, chase away, or throw objects at the target species to defend themselves. The main theme of these encounters is still considered "wildlife interfering with human." In comparison, when human instigates interference with wildlife without being in threat, for example, yelling at an animal resting from a distance, the encounter theme is considered "human interfering with wildlife."

test the relative effects of a given set of candidate predictors.

2.3 | Ethnographic interview

Analysis of the large carnivore encounter videos revealed little information about the videographers and their motivations. We therefore used the first author's ethnographic fieldwork in Sanjiangyuan to supplement our video content analysis. For the purpose of this paper the first author conducted semi-structured interviews, in May and June 2022, with 12 key informants who provided a majority of the videos we analyzed. Specifically, he asked interviewees to describe—to the best of their knowledge— sociodemographics of those who often videotaped their encounters with wildlife, tools they used, types of wildlife encounters frequently documented, motivations behind taking the videos and sharing them on social media, and influences of the videos on local attitudes toward large carnivores. Through long-term, on-site fieldwork, the first author developed considerable familiarity with

Tibetan language, society, and culture, which allowed him to build trust with his interviewees and ensure validity and reliability of the information collected from interviews. Notwithstanding, we agree that further analysis is necessary to make sense of the sociocultural complexities of the wildlife encounter videos and the videotaping practices among Tibetan herders, which is beyond the scope of this paper.

3 | RESULTS

3.1 | Encounter condition

The average length of the videos was 25 s ($SD = 22$, median = 16; Table 3). Of the 207 encounters, 89% ($n = 184$) occurred during the daytime and only 11% ($n = 23$) occurred at night; with no significant difference between species ($\chi^2 = 3.650$, $p > .05$). There were significantly more encounters recorded during the cold season (57%, $n = 117$) than the warm season (32%, $n = 66$) ($\chi^2 = 14.213$, $p < .001$); the proportions of cold-season encounters with both snow leopards and gray wolves were significantly higher than that with brown bears ($\chi^2 = 10.757$, $p < .005$). The seasonality of 24 encounters could not be determined because they were recorded indoors or at night in low light conditions. The majority of these were brown bear encounters.

In 72% of the encounters ($n = 150$), a single individual animal was recorded. In 28% of the encounters ($n = 57$), the animals appeared in groups of more than one individual, including adults, subadults and sometimes young. Encounters of both bear and snow leopard predominantly involved individual animals, whereas wolf encounters involved relatively more animals in packs.

Fifty-seven percent of the encounters ($n = 119$) occurred in an environment with low level of human influence, 24% in medium level ($n = 49$), and 19% in high level ($n = 39$; see Table 1). There were significantly more encounters in a low-human-influence environment ($\chi^2 = 55.072$, $p < .001$). We also found significant differences among the three target species ($\chi^2 = 50.880$, $p < .001$): there were more snow leopard encounters where the human influence level was low, and more bear encounters where this level was high. The level of human influence in these encounters also correlates significantly with seasonality ($\chi^2 = 8.900$, $p < .05$): during the cold season, there were more encounters in low-level human influence environments and fewer encounters in high-level human influence environments than during the warm season.

Thirty-five percent of the encounters were recorded at close range to the target species ($n = 72$), 37% at medium range ($n = 77$), and 28% at long range ($n = 58$). There is no significant difference in encounter distance ($\chi^2 = 1.455$, $p > .05$) and between species ($\chi^2 = 5.665$, $p > .05$). With respect to topography, the majority of the encounters occurred on hillslopes ($n = 83$, 40%) and flat terrains or valley floors ($n = 66$, 32%). Some of the encounters were indoor or in built environments (e.g., trash pit; $n = 37$, 18%). Chi-square test showed significant difference in topography of the encounter between the species ($\chi^2 = 34.812$, $p < .001$): the majority of snow leopard encounters occurred on a hillslope, while the majority of wolf encounters occurred on flat terrain or on the valley floor. In terms of vegetation, most encounters occurred either in grassland ($n = 80$, 39%) or in a barren landscape ($n = 58$, 21%). There was a significant difference between species ($\chi^2 = 18.711$, $p < .05$): there were more encounters with snow leopards and wolves in the snow than with brown bears. This is not surprising as brown bears hibernate during the winter.

3.2 | Encounter behavior

Locomotion was the dominant behavior of the target species in the majority of encounters ($n = 102$, 49%; Figure 2). The target species were attacking/hunting prey or dogs in 15% of the videos ($n = 32$), and were inactive or resting in 14% of the videos ($n = 29$). None of these attacks were directed toward humans. The target species were filmed feeding on prey or food items in 8% of the videos ($n = 16$). Eight percent of the videos ($n = 17$) depicted the target species performing "Other" behaviors, which include being trapped in pits or buckets. There were significantly more instances of locomotion than any other types of behavior recorded in these encounters ($\chi^2 = 44.351$, $p < .001$). Particularly, there were significantly more encounters of snow leopard in locomotion compared to the other two species ($\chi^2 = 59.760$, $p < .001$). Snow leopards were commonly observed moving away from the video frame. The majority of wolf encounters depicted the animal on the move (41%), hunting preys (20%), or fighting with dogs (19%). Some behavior states occurred at low frequency or were not performed by all animals. For example, only brown bears were observed to interact with the physical environment or objects, including attempting to open doors, cans, and tents. They were also the only target species recorded on video trapped in the plastic barrels that Tibetan herders use to store yak butter and other food. We observed only two instances of intraspecific socializing, with one involving snow leopards and the other wolves.

TABLE 3 Frequency and percentage total (in parenthesis) of each encounter condition for snow leopard ($n = 93$), gray wolf ($n = 49$), and brown bear ($n = 65$).

Encounter condition		Snow leopard		Gray wolf		Brown bear		Total	
Mean video length (second)		21		30		21		25	
Time of day	Daytime	84	(90%)	46	(94%)	54	(83%)	184	(89%)
	Nighttime	9	(10%)	3	(6%)	11	(17%)	23	(11%)
Season	Warm	30	(32%)	11	(22%)	25	(38%)	66	(32%)
	Cold	58	(62%)	38	(78%)	21	(32%)	117	(57%)
	Uncertain	5	(5%)	0	(0%)	19	(29%)	24	(12%)
Status	Individual	81	(87%)	22	(45%)	47	(72%)	150	(72%)
	Group	12	(13%)	27	(55%)	18	(28%)	57	(28%)
Topography	Ridgeline	3	(3%)	4	(8%)	2	(3%)	9	(4%)
	Hillslope	47	(51%)	14	(29%)	22	(34%)	83	(40%)
	Flat or valley floor	14	(15%)	27	(55%)	25	(38%)	66	(32%)
	Riverbank	5	(5%)	4	(8%)	3	(5%)	12	(6%)
	Others	24	(26%)	0	(0%)	13	(20%)	37	(18%)
Vegetation	Barren	24	(26%)	15	(31%)	19	(29%)	58	(28%)
	Grassland	34	(37%)	20	(41%)	26	(40%)	80	(39%)
	Shrubland	10	(11%)	3	(6%)	6	(9%)	19	(9%)
	Woodland	0	(0%)	0	(0%)	4	(6%)	4	(2%)
	Snow	11	(12%)	11	(22%)	2	(3%)	24	(12%)
	Others	14	(15%)	0	(0%)	8	(12%)	22	(11%)
Level of human influence	Low	67	(72%)	30	(61%)	22	(34%)	119	(56%)
	Medium	19	(20%)	17	(35%)	13	(20%)	49	(25%)
	High	7	(8%)	2	(4%)	30	(46%)	39	(20%)
Distance from target species	Near	31	(33%)	13	(27%)	28	(43%)	72	(35%)
	Medium	33	(35%)	19	(39%)	25	(38%)	77	(37%)
	Far	29	(31%)	17	(35%)	12	(18%)	58	(28%)
Presence of other species	None	53	(55%)	20	(41%)	41	(63%)	114	(54%)
	Human	7	(7%)	4	(8%)	14	(22%)	25	(12%)
	Dog	7	(7%)	9	(18%)	6	(9%)	22	(10%)
	Livestock	21	(22%)	8	(16%)	2	(3%)	31	(15%)
	Wild ungulate	3	(3%)	4	(8%)	2	(3%)	9	(4%)
	Others	5	(5%)	4	(8%)	0	(0%)	9	(4%)

Note: The values in italics are frequencies of encounter conditions observed in the video samples. They are not results from statistical tests.
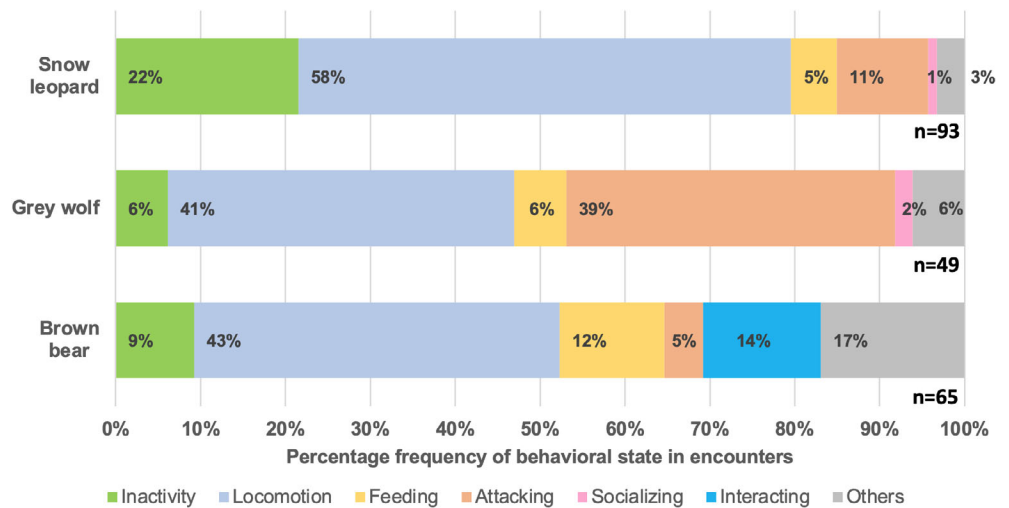
3.3 | Encounter theme and type

Most encounters showed natural, undisturbed behavior of the target species, with little to no interactions between the videographer and the target species ($n = 112$, 54%; Figure 3); over half of these ($n = 63$) were encounters with snow leopards. Fifty of the videos (24%) depicted the target species interfering human needs and activities with a negative outcome, such as attacking livestock and damaging human property. Eight percent of the videos ($n = 16$) depicted human-instigated interference with the target species, including chasing away or throwing objects at the animal

without being in obvious danger. Nine percent of the videos ($n = 19$) depicted the target species interacting with feral or domestic dogs. Only 3% of the videos ($n = 6$) depicted encounters where humans facilitated the actions of the target species (e.g., rescuing trapped animal, providing water). Six videos (3%) showed encounters that did not fall into any of the above categories and were categorized as "Others".

Chi-square test showed that overall, there were significantly more neutral encounters ($n = 102$, $\chi^2 = 89.541$, $p < .001$) than negative and positive encounters. Among the three target species, there was also significant difference in encounter type ($\chi^2 = 15.869$, $p < .005$): the

FIGURE 2   Percentage frequency of behavioral state in encounters for snow leopard ($n = 93$), gray wolf ($n = 49$), and brown bear ($n = 65$).

majority of snow leopard encounters were neutral by nature ($n = 63$); bear encounters were negative ($n = 35$); while wolf encounters were neutral ($n = 26$) and negative ($n = 21$). We also found significant correlation between encounter theme and the distance between the video recorder and target species ($\chi^2 = 43.268$, $p < .001$), as well as the level of human influence in the surroundings of the encounter ($\chi^2 = 34.936$, $p < .001$).

The final model we developed using the forward selection (Wald) method consisted of the following predictor variables: target species, distance, level of human influence and presence of other species. This model was statistically significant when compared to the null model ($\chi^2 = 125.823$, $p < .001$; see Table S1), explaining 61% of the variation of encounter types (Nagelkerke R^2), and correctly predicting 84.5% of cases. All four predictor variables were significant ($p < .05$). Snow leopards were 76.8% less likely than bears to be in a negative human–wildlife encounter ($p < .05$). On the other hand, the presence of feral dogs and livestock increased the likelihood of a negative encounter by 220 times ($p < .001$) and 45 times ($p < .001$) respectively when compared with encounters with no other species present. When the distance between the videographer and the target species was close, an encounter was 73.4% less likely to be negative than when the distance was medium ($p < .005$), and 92.1% less likely when the distance was far ($p < .001$). An encounter was 72.0% less likely to be negative ($p < .05$) when the human influence level was medium than when this level was high, and 85.0% less likely than when this level was low ($p < .005$).

3.4 | Background and motivation of videographers

Smartphones preinstalled with a Tibetan language package began to appear in pastoral areas on the Tibetan

Plateau around 2011. Only iPhones were available at the beginning, and because of the hefty prices, most local herders could not afford it. As the Chinese government builds communication infrastructure to reach remote areas, affordable smartphones (RMB 1000–2000, roughly US\$150–300) produced by Chinese companies, such as Oppo and Vivo, have gradually become prevalent since 2015. In the meantime, sharing short mobile videos on Chinese social media platforms, for example, WeChat, Kuaishou, and Douyin, has gained popularity among Tibetan herders. Our observations and interviews with key informants suggested that the majority of the videos featuring large carnivore encounters were recorded by local Tibetan herders, both men and women, aging from 25 to 45 years old. Some videos were taken by drivers, and occasionally a few were recorded by tourists visiting the area in the summer.

Herders were motivated to record and post the videos on social media for various reasons. The primary purpose was to share unusual or dramatic wildlife behaviors with their families and friends. For instance, one informant stated:

> "If I recorded grey wolves, nobody would watch my video, since many have already seen them in the mountains. There is nothing rare to spot wolves afar and only people who do not see them often would want to record that. However, why do we record videos of wolves by the roadside? Wolves used to run away from humans, but now they would not—herders want to record this behavior. Snow leopards are more uncommon to come across; most people would record them if any were seen. They would then go home and tell their family, 'Hey, I have seen snow leopards today!' The same

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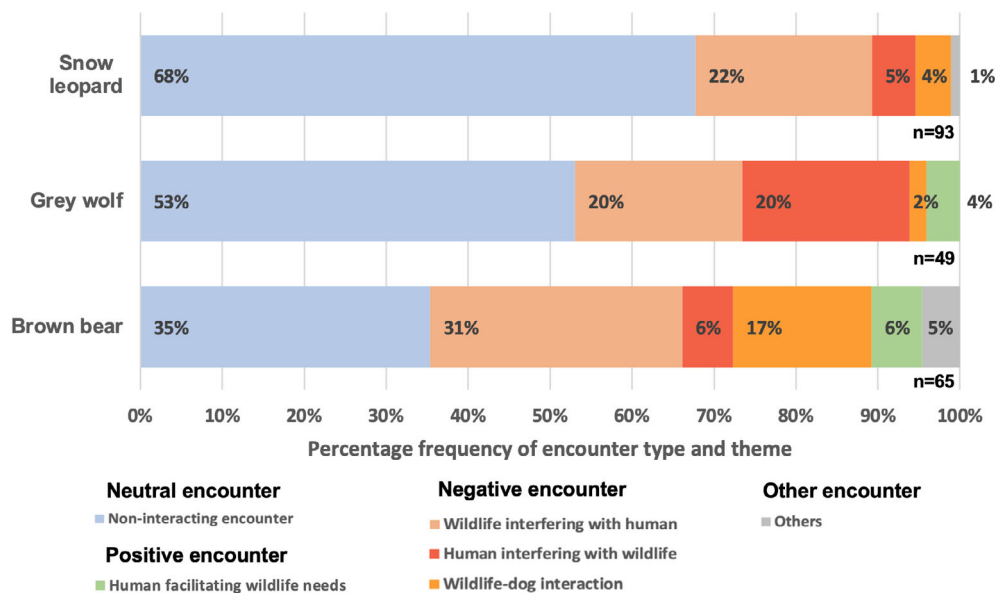Open Access

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FIGURE 3 Percentage frequency of encounter type and theme for snow leopard ($n = 93$), gray wolf ($n = 49$), and brown bear ($n = 65$).

applies to brown bears: initially, there were a great many videos posted online about bears entering someone's households; but as their presence becomes more common, the number of brown bear videos has decreased significantly in the past couple of years. There was only one video that was quite unique this year: a monk in a temple feeding five or six brown bears..." (November 14, 2021)

Another informant suggested that the perceived potential to win awards and money also motivate many to take good-quality photos and videos:

"There is a wide range of information online these days... Herders all know that snow leopards are precious. They thought, 'So many outsiders would come here, hike up the mountains for hours, and wait for days. Still, they cannot capture any image of the snow leopard. If I manage to take great videos of the snow leopard, maybe I would have a chance to win some awards and earn some money out of it." (June 18, 2022)

Other explanations pointed to the use of video-recordings as evidence, as herders want to prove the existence of certain wildlife species or the impacts that wildlife species have on their lives. One herder, for instance, said,

"Before, some people claimed that there was no snow leopard here. I took videos of snow leopards so that we can prove their presence... Now, if they eat my livestock, I need

proof too when I want compensations from the government or make insurance claims." (June 23, 2022)

Another herder reported that he shared videos about livestock depredation by large carnivores in the hope that more people would help the dead livestock accumulate merits through reciting Buddhist prayers (mantra: Om Mani Padme Hum).

In addition, almost all of our interviewees mentioned that many people posted wildlife encounter videos on their social media platforms primarily to boost the number of their followers. Recently, young Tibetan people have begun livestreaming online, many hoping to become Internet celebrities or social media influencers with a large (i.e., more than 10,000) number of followers. Once they become influencers, they can in turn earn a living through promoting products for livestreaming shopping. According to an informant,

"It is so common these days among the younger generations to show off the number of viewers they gained after posting a video on Kuaishou. If you post unusual videos of wild animal encounters, everyone will think that you are so impressive and you can get more likes from followers." (June 20, 2022)

Although our interviewees generally felt that the social media videos had increased awareness and interest in wildlife, a few expressed concerns about the negative effects of the videos on people's attitudes toward wildlife. They were worried that greater fears toward large carnivores may be induced among viewers after watching

aggressive behaviors of bears and wolves. Further, some interviewees thought that the more people watch these videos, the more unsympathetic and impassive they might become toward the sufferings of both livestock and large carnivores.

4 | DISCUSSION

Achieving sustainable coexistence for the benefits of people and wildlife in shared landscapes requires a better understanding of the everyday reality of human–wildlife interactions from a local perspective. This study demonstrates that the analysis of large carnivore encounter videos on social media generates valuable knowledge on the patterns of human–wildlife encounters.

4.1 | Strengths and limitations of social media videos

Collecting data on human–wildlife encounters in remote areas such as the Tibetan Plateau is laborious and requires greater resources than is usually available to conservation researchers. Mobile videos on social media offer an alternative source of data useful for conservation studies. Yet, it should be noted that social media data are not without bias.

Videographers make decisions about when to turn on their smartphone cameras and what to record. For every video, some information of the encounter is excluded while other content is highlighted. As our interviewees observed, the sample videos we collected from social media tend to capture those encounters that people deem "unusual". It is likely that a considerable amount of large carnivore encounters goes unrecorded or unshared because local people think that the encounters are too mundane or ordinary. For example, encountering wolves is common for most herders and therefore does not trigger much interest unless wolves are seen engaging in dramatic behavior, such as fighting with dogs or attacking livestock. We also recognize that many large carnivores are vigilant and take cover before people can spot them. Large carnivore encounters may also happen by surprise, and in such cases, people may not have time to film the scene. Few footages capture panoramic views of the surrounding environment, thus in our analysis we had to rely on limited visual cues and proxies to infer encounter conditions, which may not always be accurate.

Similarly, videographers (or their relatives and friends) decide whether they are to share the videos on social media. Not every recorded encounter is uploaded to social media. Low-quality (e.g., blurry images) videos of mundane encounters, for instance, are probably not posted. In places where there is no reliable or affordable Internet access, the videos may not get shared even if large carnivore encounters are recorded. Despite our efforts to capture data as completely as possible, it is likely that our sample only represents videos that were widely circulated on social media at the time of data collection.

Due to these biases, our analysis of the mobile videos does not capture the totality of human encounters with large carnivores as experienced by people on the Tibetan Plateau. Rather, what is encompassed by the videos are "meaningful encounters" that people consider worth documenting and sharing for various reasons. Therefore, studying large carnivore encounter videos taken and shared by Tibetan herders not only reveals the patterns of meaningful human–wildlife encounters but also offers a glimpse into the "attention frame" (Lasswell & Kaplan, 1950) of local people as well as their "meaning-making" processes (Clark, 2021), which have significant implications for human–wildlife coexistence.

4.2 | Diverse human–wildlife encounters

Despite the tendency to gravitate toward unusual, dramatic encounters, our video data still shows a wide spectrum of human encounters with the three large carnivores. A large portion of the encounters are neutral, involving almost no observable direct interaction among humans and carnivores. More significantly, variations exist across the three large carnivores. Snow leopards, gray wolves, and brown bears each have their unique biological and ecological traits, and as our study reveals, human encounters with the three species display different spatiotemporal, behavioral, and thematic patterns. For example, many encounters with brown bears occur in environments with high levels of human influence, such as within or close to human settlements. This contrasts with most encounters with snow leopards that take place in less disturbed areas. There are more negative encounters with brown bears than for snow leopards or wolves. Conservation management policy and practice aiming for sustainable coexistence should therefore attend to the unique characteristics of different species (Clark & Rutherord, 2014).

Existing conservation efforts tend to focus on typical human–wildlife conflicts, such as livestock depredation, property damage, and human injuries incurred by large carnivores (Alexander et al., 2021). Yet, our study suggests that many other forms of human–wildlife encounters may also warrant attention from conservationists. These situations include but are not limited to: large

carnivores occurring in unexpected places and times (Johansson et al., 2020); interactions between feral dogs and large carnivores (Anil & Rahul, 2015); people getting too close to large carnivores to take photos; large carnivores not fleeing even in close proximity to people; people behaving inappropriately toward wildlife (e.g., chasing and yelling); people rescuing injured or trapped large carnivores; and, people approaching and handling the young of large carnivores. The diverse situations where humans are encountering carnivores, if not well managed, may develop into potential problems for long-term coexistence. Culturally sensitive awareness programs to guide and encourage proper human behaviors in these encounter situations are thus urgently needed.

Our regression results also show that negative interactions were associated with a set of variables, including the presence of feral dogs, the presence of livestock, the proximity of the human to the carnivore, and human impact on the surrounding environment. The results suggest that Tibetan herders and large carnivores coexist in shared landscapes, which are not characterized by separated habitats. They indicate however that human expansion and encroachment may risk exacerbating negative human–carnivore interactions. This finding underlines that conservation approaches need to address land-use regimes and incorporate wider development processes in order to promote sustainable coexistence (Frank & Schlenker, 2016).

4.3 | Beyond dichotomies

Recognizing the limitation of the discourse of "human–wildlife conflict," we, like others (e.g., Peterson et al., 2010; Redpath et al., 2015), recommend a shift away from a negative framing of encounters toward a more comprehensive, neutral term, such as "human–wildlife coexistence". In our usage, the term "coexistence" follows its basic dictionary definition: "the fact of living or existing together at the same time or in the same place" (Cambridge Dictionary, 2022). As such, human–wildlife coexistence involves a multitude of possible interactions between people and wildlife.

Our study shows that many everyday encounters between Tibetan herders and large carnivores may be neither positive nor negative. Furthermore, what is positive or negative are not objective facts but subjective evaluations made by different actors, whether they are observers (e.g., conservationists) or participants directly involved in human–wildlife interactions (e.g., herders). These actors are found in specific environmental and sociocultural circumstances, and have their own values

and interpretative perspectives. All evaluations are conditioned, often unconsciously, by each actor's unique complex of predispositions—resulting from their knowledge, past experiences, identities, demands, expectations, and other factors (Clark, 2021). These evaluations are also influenced by culture, as is illustrated by the case of providing food to wildlife. Our analysis categorizes feeding wildlife as a type of positive encounter because we consider the direct impact of the action upon the needs of the animal at the moment of encounter. More importantly, we take the local Tibetan perspective into account. To most Tibetans, feeding wildlife embodies an act of generosity and compassion, and humans have the obligations to help wildlife when they are capable of doing so. In contrast, many conservationists think of feeding wildlife as a disturbance to wildlife's natural behavior and, in turn, they categorize feeding wildlife as a negative encounter.

In addition to the positive-and-negative dualism, we draw attention to the dichotomy between unusual (or dramatic) and ordinary (or mundane) encounters. As our interviews suggest, what is unusual and what is ordinary are subjective and subject to change. Some types of human–wildlife encounters were rare in the past but have become more frequent in recent years. For example, snow leopards dispersing or moving across settings outside their typical habitat (such as in desert steppes, instead of mountains) are increasingly reported, possibly on account of increased human observation and social media use (Johansson et al., 2020). Our interviewees, as well as many herders the first author met during fieldwork, also complained that large carnivores were getting closer to human settlements because they had lost their fear of humans as a result of strict conservation policies. What was previously deemed abnormal is now becoming the new normal for local people.

The fluidity of positive/negative and ordinary/unusual encounters points to the importance of contextualization, problem orientation, and self-standpoint clarification in analyzing data on human–wildlife interactions (Clark, 2011). Ethnographic research, in this regard, can directly contribute to a more sophisticated and nuanced understanding of human relationships with wildlife beyond simple dichotomies.

4.4 | Conclusions and recommendations

This study demonstrates the potential of using mobile videos on social media to study human–wildlife interactions. As we have shown, mobile videos taken and shared by local people living with large carnivores are promising data for insights into human–wildlife coexistence.

Analyzing such videos not only helps conservationists understand human–wildlife encounters from local perspectives but also reveals emerging challenges and potential opportunities for coexistence efforts. The mobile videos also contain interesting data on the behaviors of different species that are hard to detect, even by researchers. Hence, they can contribute to the expansion of scientific knowledge on those poorly studied wildlife species. On the other hand, it should be noted that social media can influence attitudes, behaviors, emotions, and social norms (McLean et al., 2022). Therefore, education and participatory programs are needed to better engage local people to foster attitudes and behaviors conducive to long-term coexistence. Furthermore, it is important to consider legal and privacy concerns and take measures to minimize potential risks to social media users during data preprocessing, analysis, publication, and sharing (Di Minin et al., 2021).

Like many people in other parts of the world, Tibetan herders in remote areas are now increasingly connected with the outside world through their smartphone and internet access. They are not merely passive receivers of modern technology and outside information. They are taking advantage of the mobile technologies and social media to share their lives with, and get their voice heard by, people living far away in metropolitans, such as Beijing, Shanghai, and even New York. We believe this emerging community of local amateur wildlife videographers can play significant roles in the co-creation of knowledge that is crucial for understanding and promoting sustainable human–wildlife coexistence. We recommend, as do Swanson and Ardoin (2021), that conservation organizations use visual participatory methods to systematically collect wildlife encounter videos on social media and employ the data to its full potential to inform conservation policy and practice.

AUTHOR CONTRIBUTIONS

ACKNOWLEDGMENTS

CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

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