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Influence of ecological restoration initiatives on emotional bonds between indigenous peoples and the Chinese alligator

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As ecological restoration initiatives continue to revitalize degraded environments in the nature reserves, the dynamics of Indigenous people's emotional relationships with wildlife undergo significant shifts. Drawing upon the theoretical framework of emotion sociology, this research explored the intricate social mechanisms shaping Indigenous emotions toward wildlife. This research used a questionnaire survey. Based on a 10% sampling proportion, this research used the Kish selection method to draw a random sample of 361 households from the Chinese Alligator Reserve. It found that the main effect of the family population outflow (Coeff = -32.62), traditional cultural loss (Coeff = -2.51), pop culture familiarity (Coeff = 1.60) on Indigenous-wildlife emotion was significant. Meanwhile, the moderating effect of income is also clearly significant. This reveals the mechanisms by which ecological restoration initiatives create Indigenous and wildlife emotional ties are social support, cultural shaping, and income stratification. These findings underscore the importance of considering social effects in conservation efforts to foster sustainable relationships between Indigenous communities and wildlife in the nature reserves.

KEYWORDS

emotional sociology, wildlife reserves, indigenous communities, ecological restoration, indigenous-wildlife emotional bonds

1 Introduction

Since the Industrial Revolution, the rapid development of heavy industries has caused extensive damage to the ecological environment on which humans and animals depend. This damage threatens the survival of several wildlife species. To repair severely damaged ecosystems in nature conservation areas, some administrations have adopted ecological restoration methods. The comprehensive and long-term restoration of lost ecosystem services can be achieved through soil remediation, biodiversity restoration, resource management, and other methods (Aronson et al., 2016). Ecological restoration is a process involving human intervention in nature (Jackson and Hobbs, 2009). Managers and technical experts should restore the original natural environment according to scientific standards to provide more habitats for endangered wildlife.

Nature reserves in most countries have long since moved away from the traditional "fortress model", which excludes Indigenous people, to the "community co-management"

or “co-operative governance” model, which promotes the development of local communities (Murphree, 2000; Bennett et al., 2022). However, owing to a lack of funds, insufficient motivation, and conflicting policies, some of China’s nature reserves have not promoted community participation. This has led to the fact that ecological restoration initiatives in nature reserves may greatly impact Indigenous people’s culture, livelihoods, social relations, and daily lives. For example, Indigenous people may be deprived of their farmland and forced to change their production methods. Larsson et al. found that agricultural production as a moral economy encompasses their emotions, values, and a sense of management toward wildlife (Larsson et al., 2022). This means that the impact of ecological restoration on Indigenous peoples’ lives and production styles will further influence their emotions toward wildlife.

As an important indicator in research on the social relations between Indigenous people and wildlife (Beausoleil, 2020), emotion is considered a state of feeling with value (Hofbauer et al., 2001). The value of this emotion comes from three sources: the value of the encounter (Barua, 2016), the intrinsic value of both parties to the encounter (Seabrook-Davidson and Brunton, 2014), and the change in attitudes and behaviours that emotions can cause (Manfredo, 2008). Based on this idea, this study defines Indigenous emotions toward wildlife as a valued emotional relationship between Indigenous people and wildlife. This relationship includes emotional experiences and the concern, understanding, and empathy Indigenous people have for wildlife.

People’s emotions change immediately during wildlife encounters (Jürgens and Hackett, 2021). The positive emotions that people feel when confronted with non-threatening wildlife can help them understand the intrinsic value of wildlife, realise the importance of sharing the world with wildlife, and enhance their wellbeing and happiness. Indigenous people’s social changes may affect their emotions toward wildlife (Redpath et al., 2015). For example, Indigenous people attribute the disruption of community life as a result of ecological restoration to wildlife, thus creating disgust toward them (Slagle et al., 2013). This shows that ecological restoration will likely disrupt the emotions of Indigenous people toward wildlife if it interferes with their lives.

Researchers have focused on biophiles, attention recovery, and two-factor theories to explain human emotions toward animals while ignoring the importance of social mechanisms. The biophilic hypothesis comes from the evolutionary theory, which suggests that humans have the intrinsic property of responding positively to their natural environments (Joye and De Block, 2011). Humans are able to feel satisfied with their natural environment. Attentional recovery is a part of cognitive theory. Direct attention is believed to cause people to focus on uninteresting tasks and ignore exciting things (Eysenck et al., 2007). “Indirect attention enables people to pay attention to their natural surroundings and derive positive emotional responses from them (Wilterson et al., 2020). The two-factor theory of emotion integrates cognitive and social factors. It considers emotion to be the product of an unspecified state of arousal combined with rationalisation needs (Eitler, 2014). Although the two-factor theory focuses on social factors, it treats society as one of the roots of emotions (Rakover, 2021). It does not analyse the social factors that influence the emotions of Indigenous people toward wildlife. Indigenous emotions toward wildlife are

closely linked to the impact of ecological restoration on communities. However, it is unclear how ecological restoration in conservation areas affects Indigenous people’s emotions toward wildlife. Therefore, this study explored the social factors that influence Indigenous people’s emotions toward wildlife during ecological restoration through a questionnaire survey.

With the emotional turn in sociological research, researchers have begun to focus on the relationship between emotions, culture, family, and livelihood. In terms of culture, Gordon suggested that people do not simply feel and express emotions; instead, they also interpret, evaluate, and change emotions according to the culture [(Gordon and Kemperl, 1990): 157]. Based on this perspective, researchers have found that culture can affect people’s emotions toward wildlife (Thorn et al., 2012). For example, Jacobs noted that an appropriate culture can inspire positive emotions toward wildlife among Indigenous people (Jacobs et al., 2012). Therefore, it is essential to consider the impact of ecological restoration on Indigenous cultures in conservation areas.

On the one hand, managers may ignore the traditional culture of Indigenous people by using modern scientific knowledge as the only criterion (Runacres, 2023). The destruction of traditional culture may weaken the Indigenous people’s affection for wildlife. On the other hand, cultural markets may bring new popular culture to local communities. Cute images of wildlife formed through paintings, photographs, music, and movies evoke positive emotions toward them (Lawrence, 2008). This indicates that pop culture may enhance Indigenous peoples’ enjoyment of wildlife. Based on the above, the following hypothesis is proposed:

H1. The greater the loss of traditional culture, the weaker the positive emotions of Indigenous people toward wildlife.

H2. The more widespread popular culture is in the local community, the stronger the positive emotions toward wildlife are among Indigenous people.

Researchers consider emotion formation as a process of learning from social interactions. Simultaneously, emotions may underlie future changes in social relationships (Wang, 2013). Researchers have revealed the relationship between family member interactions and human-wildlife emotional connections based on this perception. They noted that Indigenous people’s close relationships with each other could motivate positive emotions toward wildlife (Thuy et al., 2011). Gogoi further noted that cooperation between Indigenous people can provide social support and mitigate negative emotions toward wildlife (Gogoi, 2018). Ecological restoration in conservation areas may require restoring some of the Indigenous people’s land as wildlife habitat. Consequently, some of these people will be forced to migrate out of their local communities. This will accelerate the outflow of the population and disrupt the family life of Indigenous people, which will lead to the shrinking of family size until the community dies (Vedeld et al., 2012). As the smallest social unit, the family plays an essential role in the stability of social life. The destruction of families may have a negative impact on Indigenous people. As Thondhlana found, administrators’ over-interference in the lives of Indigenous people resulted in them experiencing negative emotions and even psychiatric disorders (Thondhlana et al., 2020). Indigenous people may summarise the reason for the disruption of family life as wildlife

conservation, which weakens their positive emotions toward wildlife. Based on this, we propose the following hypothesis:

H3. The higher the rate of family member outflow, the weaker the positive emotions of Indigenous people toward wildlife.

Researchers have pointed to livelihoods as a critical factor that can influence human-wildlife emotional relationships. Kaczensky argued that competition between humans and animals for survival resources encourages negative emotions toward wildlife (Kaczensky, 2007). Indigenous people depend on natural resources for survival. However, ecological restoration not only removes the land resources of Indigenous people but also prohibits them from entering the conservation area to obtain natural resources. When they lose their livelihoods due to ecological restoration, they are likely to develop negative emotions toward wildlife. When the Indigenous people had to hand over their land to conservation area management agencies, their hostile mindset toward wildlife became more intense (Shrestha and Alavalapati, 2006). This indicates that the more land Indigenous people lose, the less positive emotions they may have toward wildlife (Seabrook-Davidson and Brunton, 2014). Based on this, we propose the following hypothesis:

H4. The more land is lost, the weaker the positive emotions toward wildlife among Indigenous people.

2 Materials and methods

2.1 Research area

The Chinese alligator, also known as the Yangtze alligator, is a species of alligator endemic to China. It is one of the oldest surviving alligators on Earth. Despite their early appearance in Chinese literature, Chinese alligators have never been taken seriously by scientists. It was not until 1879 that French naturalists officially named this species as *Alligator sinensis* (Barbour, 1910).

In the past, Chinese alligators mainly lived in the Yellow River, Yangtze River, and other basins. However, with agricultural expansion, hunting, poaching, and climate change, their population has sharply declined, and its range has gradually contracted to a limited area in southern Anhui and the neighbouring Zhejiang Province (Thorbjarnarson and Xiaoming, 1999). In 1973, the United Nations listed this species as either endangered or prohibited. Biologists have warned in their articles that “if no conservation measures are taken, the Chinese alligator species will become extinct in the wild within 40–50 years” [(Watanabe, 1983): 176–181]. In 1982, China established the Chinese alligator Nature Conservation to save this endangered species.

Currently, the world’s largest population of wild Chinese alligators inhabits the CL Village. This village has an area of approximately 5 km² and a total population of 3,565. As of 2022, approximately 140 Chinese alligators inhabited the CL Village. In the long time of living together with the Chinese alligator, the Indigenous people created a rich culture and customs related to the Chinese alligator (You-Zhong and Xiao-Ming, 2004). For example, Indigenous people consider the Chinese alligator to be the embodiment of a dragon. Therefore, they regard

the alligator as sacred wildlife and often hold ceremonies and festivals to honour and protect them. At the same time, Chinese alligators have become an aid in Indigenous agricultural production (Maqsood and Rong, 2019). For example, the alligator’s call warns the Indigenous people about an approaching rainstorm. This prompts them to take timely measures to protect their farmlands from flooding.

However, with an increase in the number of Chinese alligators, the original habitat can no longer meet their survival needs. Therefore, the Chinese Alligator Nature Reserve Administration implemented ecological restoration in the village and reconstructed 800 ha of Indigenous land undergoing agricultural production into a habitat for the Chinese alligator (Pan et al., 2019). Before ecological restoration, the Chinese alligators lived only in a pond of approximately 50 ha (Figure 1A). After ecological restoration, the habitat of the Chinese alligator reached 850 ha (Figure 1B).

However, ecological restoration has had a negative impact on the agricultural production, family life, and cultural heritage of the Indigenous people. First, Indigenous people who have lost their land are forced to look for jobs in cities. According to the survey data, approximately 39% of displaced Indigenous people have migrated to urban areas in search of employment opportunities due to land loss in 2021–2022. Second, the outflow of young Indigenous people has led to a severe problem of population ageing in local communities. In 2022, the proportion of elderly people aged 60 and above accounted for 45%. And the average age of the village population was 58 years old. The average age of the Indigenous population has increased by 15% over the past decade. Owing to the disintegration of their families, it is difficult for these geriatrics to obtain sufficient family support. Finally, population ageing disrupts traditional cultural inheritance. According to the survey data, there has been a notable decline in the transmission of traditional cultural practices among younger generations, with only 40% actively participating in local traditional activities compared to 85% among the elderly population.

The ban on agricultural production, the disintegration of families, and the interruption of traditional culture have alienated Indigenous people from Chinese alligators. On the one hand, the ban on agricultural production means that the Indigenous people are no longer closely dependent on the Chinese alligators. This species is closely linked to local ecosystems. More seriously, they perceive the Chinese alligator as a threat to their livelihood and may feel hostile toward it. According to the survey data, over 55% of Indigenous respondents expressed concerns about potential conflicts with the Chinese alligators, citing incidents of livestock predation and damage to agricultural crops. On the other hand, the disintegration of families and the interruption of traditional culture have led to changes in the values of Indigenous people. It is unlikely that the new generation of Indigenous people will incorporate the traditional culture of protecting and respecting Chinese alligators into their daily lives. 60% of Indigenous youth reported feeling disconnected from their cultural heritage. This will weaken the Indigenous people’s positive emotions toward the Chinese alligator.

It can be seen that the CL Village not only reflects the conflict between Indigenous people and wildlife but also reflects the complex relationship between ecological restoration and Indigenous people.

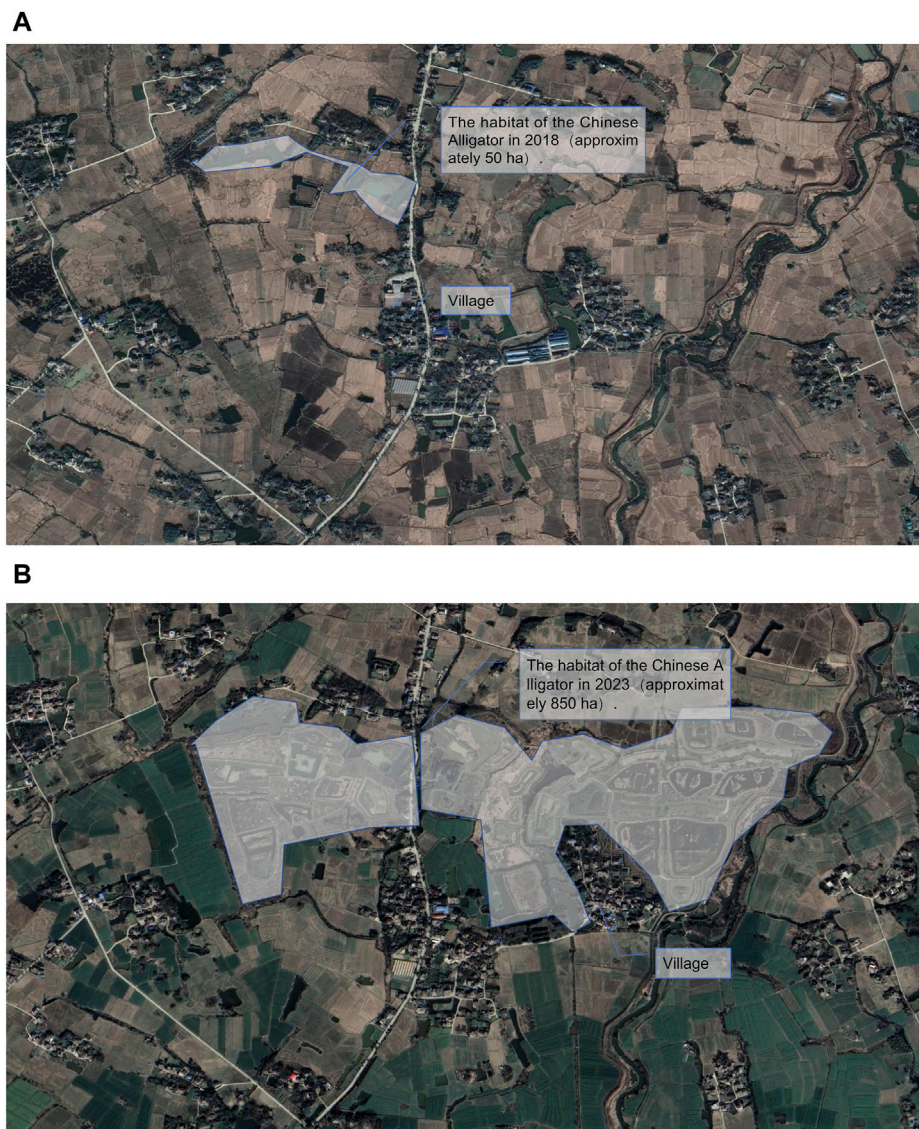


FIGURE 1
(A) Maps of villages and the Chinese Alligator habitat in 2018. **(B)** Maps of villages and the Chinese Alligator habitat in 2023.

Therefore, it was appropriate to choose CL Village as the research area. This is a unique and exemplary case that will help researchers understand how Indigenous people adapt their relationships with wildlife during ecological restoration.

2.2 Data collection

Mills and Gay recommended a sampling proportion of 10% of households in villages with more than 1,500 people (Mills and Gay, 2019). Based on a 10% sampling proportion, this study began with a random sample of 361 households. Subsequently, one member of each household was selected using the Kish selection method to complete the questionnaire. Respondents signed an informed consent form. A total of 366 respondents were sampled for this study, of which five respondents withdrew from the survey for personal reasons.

2.3 Variables

Based on a literature review and field description, the factors affecting Indigenous people's emotions toward Chinese alligators can be categorized into three aspects: family, livelihood, and culture. Combined with the questionnaire, the independent variables in this study were family population outflow rate, land loss rate, traditional culture loss, and pop culture familiarity.

The family population outflow rate is the ratio of the number of family members who have moved out of the local community to the total number of people in their original families. The land loss rate is the proportion of land lost by Indigenous people to the area owned by Indigenous people.

Traditional cultural loss refers to the degree of abandonment of traditional culture by Indigenous people. Popular cultural familiarity refers to the degree of acceptance and recognition of popular culture among Indigenous people. Choi developed a scale to assess cultural

TABLE 1 Categories of indigenous People's emotional responses to wildlife.

Species charisma	Emotion
Ecological Charisma	Ecological Emotion: the emotional experience of the ecological role of wildlife
aesthetic charisma	Aesthetic Emotion: the emotional experience of the external image of wildlife
corporeal charisma	Corporeal Emotion: the emotional experience arising from close and multi-sensory direct contact with wildlife

values based on the Dunlap New Ecological Paradigm (NEP) scale (Choi et al., 2007). Based on this scale, the degree of traditional cultural loss was measured using three questions: The questions were: “Do not know myths and stories about the Chinese alligator”, “Do not know folklore related to the Chinese alligator”, and “Do not know the symbolic meaning of the Chinese alligator’s call and image”. Three questions were used to measure familiarity with popular culture. The questions were: “Very familiar with movies and commercials about the Chinese alligator”, “Very familiar with animated images of the Chinese alligator”, and “Very familiar with jokes about the Chinese alligator”. Respondents were asked to give a score on a five-point Richter scale, ranging from “completely disagree” to “completely agree”. To facilitate empirical analysis, the scores of the questions were summed up to obtain scores for both traditional culture loss and pop culture familiarity. The higher the score, the greater the degree of traditional cultural loss or familiarity with popular culture.

Reliability and validity tests were necessary for the five-point Likert scale to measure traditional culture loss and pop culture familiarity. According to the reliability test results, Cronbach’s alpha coefficients were 0.841 and 0.754, respectively, indicating that the traditional culture loss scale and pop culture familiarity scale had good internal consistency. According to the results of the validity test, the KMO values were 0.728 and 0.623, respectively, and the chi-square statistics of Bartlett’s Test of Sphericity reached the 5% significance level; thus, the traditional culture loss scale and pop culture familiarity scale were considered to have good structural validity.

Previous studies have shown that the management of conservation areas affects Indigenous peoples differently across genders and age groups (Biru et al., 2017). There were also significant differences in the emotional responses to wildlife among groups of different genders and ages (Castillo-Huitrón et al., 2020). Thus, this study considered sex and age as control variables. In addition, this study uses income as a moderating variable. This is because income typically reflects an individual’s position within the socioeconomic system. Using income as a moderating variable can help researchers understand the differences in Indigenous people-wildlife emotional relationships between different income levels.

The dependent variable in this study was the positive emotions of Indigenous people toward wildlife. Indigenous people’s emotions toward wildlife include a mixture of different emotions. Some researchers have broken this down into discrete types of emotions (e.g., happy, sad, angry) (Izard, 1992). However, this approach ignores the fact that the same emotion has different intensities. To address this difficulty, researchers have begun to focus on core emotions and treat them as a continuum (e.g., different levels of fondness). To avoid oversimplifying Indigenous people’s emotions toward wildlife along a single continuum, this study

delineated three categories of emotions based on the types of wildlife charisma proposed by Lorimer: ecological, corporeal, and aesthetic emotion (Lorimer, 2015). Refer to Table 1 for definitions. These three types of emotions acknowledge the multiple values of animals and reflect a more prosperous Indigenous people-wildlife relationship. Notably, all three emotions are positive emotions that Indigenous people feel toward wildlife. Ecological emotions reveal Indigenous people’s recognition of and respect for wildlife as an essential species in the local ecosystem. Aesthetic emotions express Indigenous people’s aesthetic experiences with wildlife. Indigenous people view the colours, patterns, and forms of wildlife as sources of art and culture. Corporeal emotions reflect the intimate interactions between Indigenous people and wildlife. For example, when observing and touching wildlife, Indigenous people experience emotions such as joy, warmth, and affection.

Most researchers measured the subjective emotions in adults using respondents’ active verbal reports (Paul et al., 2020). Therefore, respondents were invited to rate each of the three dimensions of the positive emotions. The respondents were asked to select three numbers (which could be the same) from 0 to 10 to indicate the strengths of their ecological, physical, and aesthetic emotions. The higher the score, the stronger the respondent’s positive emotions toward the Chinese alligator. To specifically analyse the positive emotions of Indigenous people toward wildlife, this study did not add up the scores of the three dimensions. Instead, the corresponding data models were built separately as dependent variables.

2.4 Statistical analysis

This study used ecological, corporeal, and aesthetic emotions separately as dependent variables. Studying different types of emotions as separate dependent variables provides a more complete picture of how emotions change and affect different things. Unifying these three dependent variables into a single variable may result in the loss of detailed information and make it difficult to explain the characteristics and effects of different types of emotions.

The family population outflow rate, land loss rate, traditional culture loss, and pop culture familiarity were used as dependent variables. Income was used as a moderator variable. Sex and age were used as the control variables. Because this data model involves moderating effects, this study used the PROCESS plugin based on SPSS 26.0. Hayes developed the PROCESS plug-in Model one for a moderating effect analysis based on SPSS (Hayes, 2012). The advantage of this plugin is that it can automate data centring, calculate multiplicative terms, and perform Bootstrap and Sobel tests to ensure accurate results.

TABLE 2 Demographic characteristics of the respondents.

Variable		Number
Gender	Female	172 (47.65%)
	Male	189 (52.35%)
Age	<26	76 (21.05%)
	26–40	79 (21.88%)
	41–55	68 (18.84%)
	56–70	73 (20.22%)
	>70	65 (18.01%)
Family size	<4	106 (29.36%)
	4–6	159 (44.04%)
	7–9	41 (11.36%)
	>9	55 (15.24%)
Family population outflow rate		0.46
Land loss rate		0.43
Traditional culture loss		11.86
Pop culture familiarity		10.72
Ecological emotion		5.99
Aesthetic emotion		5.48
Corporeal emotion		6.12

3 Results

3.1 Descriptive statistics

Researchers sent out 366 questionnaires and received 361 responses, resulting in a recovery rate of 98.63%. Table 2 demonstrates the basic information of the respondents.

Prior to the regression analyses, it was necessary to verify whether the respondents experienced different levels of emotions toward the Chinese alligator. This can help researchers determine appropriate regression models. Referring to the scheme proposed by Villar et al., this study categorised the respondents into low (0%–33.3%), medium (33.4%–66.6%), and high (66.7%–100%) groups (Villar et al., 2011). Comparative analyses were conducted to determine the level of the respondents' emotions toward the Chinese alligator in different subgroups. The results of this analysis are shown in Figure 2. It can be seen that there are some differences in the respondents' emotions toward the Chinese alligator in the different groups.

3.2 Regression analysis

Three data models were constructed using ecological, corporeal, and aesthetic emotions as the dependent variables. The results are summarised in Table 3. In order to present the results more easily, Figures 3A–C were generated by using the key data.

Model one used the respondents' corporeal emotions toward the Chinese alligator as the dependent variable. The results showed that the main effect of the family population outflow rate on corporeal emotions was significant (Coeff = -32.62 , $p < 0.001$). This implies that for every 1 unit increase in the family population outflow rate, the corporeal emotion of Indigenous people toward the Chinese alligator decreased by 32.62. Since the regression coefficient of the family population outflow rate \times income is positive (Coeff = 3.34 , $p < 0.001$), when income increases, the negative effect of the family population outflow rate on the dependent variable may weaken.

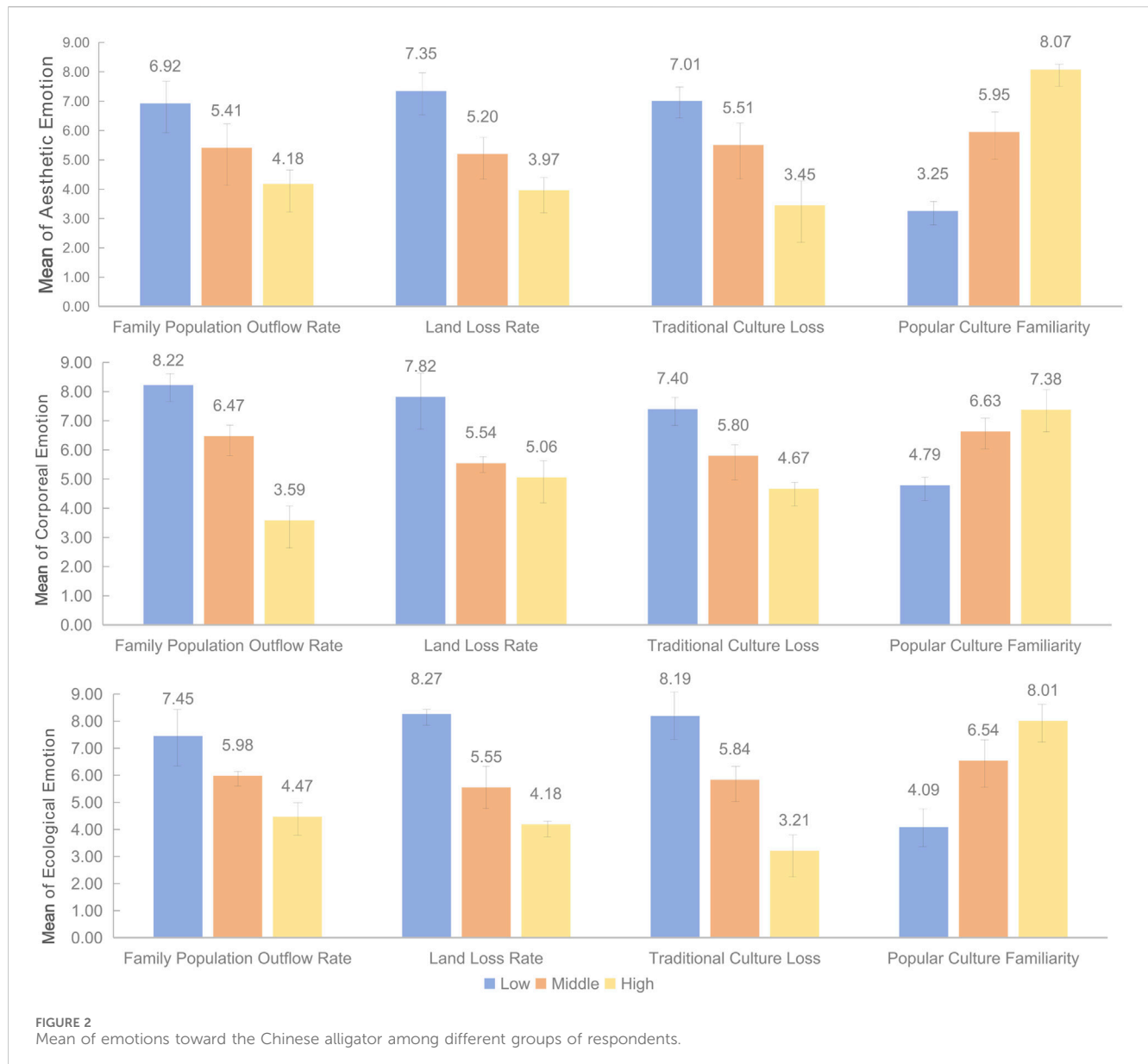
Model two used the respondents' ecological emotions toward the Chinese alligator as a dependent variable. The results showed that the main effect of traditional cultural loss on ecological emotion was significant (Coeff = -2.51 , $p < 0.001$). For every unit increase in traditional cultural loss, the ecological emotions of Indigenous people toward the Chinese alligator decreased by 2.51. This reflects the important role of traditional culture in increasing the ecological emotions of Indigenous people toward Chinese alligators. Similarly, this effect varied across income levels. Since the regression coefficient of traditional cultural loss \times income is positive (Coeff = 0.26 , $p < 0.001$), the negative effect of traditional cultural loss on the dependent variable may weaken as income increases. This finding suggests that income may mitigate the negative effects of traditional cultural losses on the dependent variable to some extent.

Model three used the respondents' aesthetic emotions toward the Chinese alligator as a dependent variable. The results showed that the main effect of pop culture familiarity on aesthetic emotions was significant (Coeff = 1.60 , $p < 0.001$). For every unit increase in pop culture familiarity, the aesthetic emotions of Indigenous people toward the Chinese alligator increased by 1.60. This implies that as Indigenous people's familiarity with popular culture increases, their aesthetic emotions toward Chinese alligators significantly increase. However, the regression coefficient of pop culture familiarity \times income is negative (Coeff = -0.14 , $p < 0.05$). This implies that the positive effect of pop culture familiarity on the dependent variable weakens as income increases.

Notably, the main effect of the land outflow rate on Indigenous people-wildlife emotions and the moderating effect of income on land outflow rate and Indigenous people-wildlife emotions were insignificant. This may be because the CL Village is located in China's Yangtze River Delta region. The region has convenient transportation and a well-developed economy. Many Indigenous people can offset the adverse effects of land loss by working outside their homes. Thus, the reduction in available land has not disproportionately affected them.

4 Discussion

The different types of emotions of Indigenous people toward Chinese alligators are affected by different factors. This implies that the ecological restoration project in nature reserves has a multifaceted impact on Indigenous people's emotions toward Chinese alligators. Depending on their economic resources,



Indigenous people have to go out to work, resulting in a loss of family size. This results in a decline in Indigenous people's corporeal emotions toward Chinese alligators. When the traditional culture of the local community was destroyed, the Indigenous people's ecological emotions toward the Chinese alligator declined. With the spread of popular culture about Chinese alligators, Indigenous people's aesthetic emotions toward the Chinese alligators increased. Income had a moderating effect on all these effects. This implies that there is a complex relationship between income and family, cultural, and Indigenous peoples' emotions toward Chinese alligators. Therefore, there is a need to find a balance between social support, traditional cultural preservation, spreading popular culture, and the protection of Chinese alligators to enhance the positive feelings of Indigenous people toward the Chinese alligator. The following section discusses these three aspects: social support, cultural shaping, and income stratification.

4.1 Social support

Based on the results of model 1, the family population outflow rate was negatively correlated with corporeal emotion (Coeff = -32.62 , $p < 0.001$). This implies that the higher the rate of family outflow, the weaker the corporeal emotions of Indigenous people toward wildlife.

This finding is contrary to those of previous studies. Researchers have argued that the larger the family size, the more negative or angry Indigenous people feel toward wildlife (Obradović et al., 2022). The reason given by the researchers is that the larger the family size, the greater the demand for local natural resources by the Indigenous people. When conservation authorities restrict livelihoods, they treat wildlife more negatively (Shrestha and Alavalapati, 2006). However, the cases in the present study were different. Most of the Indigenous people living in the easily accessible CL village do not depend on natural resources within

TABLE 3 Results of regression analysis.

Variables	Model 1: (N = 361)	Model 2: (N = 361)	Model 3: (N = 361)
	Corporeal emotion	Ecological emotion	Aesthetic emotion
	Coeff [95%CI]	Coeff [95%CI]	Coeff [95%CI]
Family population outflow rate	-32.62*** [-46.46,-18.79]	-0.93 [-9.51,13.51]	-2.04 [-6.81,12.92]
Family population outflow rate × Income	3.34*** [1.49,5.18]	0.36 [-1.83,1.23]	0.42 [-1.74,0.88]
Traditional culture loss	-0.52 [-0.63,1.62]	-2.51*** [-3.47,-1.54]	-0.10 [-0.72,0.93]
Traditional culture loss × Income	-0.07 [-0.22,0.08]	0.26*** [0.13,0.39]	0.01 [-0.12,0.09]
Popular culture familiarity	0.26 [-0.69,1.21]	0.02 [-0.76,0.81]	1.60*** [0.93,2.28]
Popular culture familiarity × Income	-0.03 [-0.16,0.09]	-0.01 [-0.10,0.10]	-0.14*** [-0.23,-0.05]
Land loss rate	15.23 [-1.08,31.54]	16.37 [2.80,29.95]	11.08 [-0.54,22.72]
Land loss rate × Income	-2.01 [-4.19,0.16]	-2.18 [-3.99,-0.37]	-1.48 [-3.03,0.067]
Income	2.96** [0.30,5.63]	-1.27** [-3.49,0.94]	3.95** [2.05,5.85]
Age	-0.01* [-0.01,0.03]	-0.01** [0.01,0.02]	-0.02* [-0.01,0.03]
Gender	0.07* [-0.12,0.27]	0.01 [-0.14,0.1]	0.02* [-0.13,0.14]
Constant	-12.69*** [-32.93,7.54]	21.45*** [4.61,38.29]	-29.40*** [-43.83,-14.96]
R-sq	0.65	0.61	0.72

Coeff is standardized regression coefficient; CI, Confidence Interval. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

the village but choose to work outside the village. Therefore, when conservation authorities restrict livelihoods, the Indigenous people do not treat wildlife negatively because of an increase in household size and a shortage of natural resources.

In contrast, the Indigenous people showed negative emotions toward wildlife when family size was minimized. This may be because the outflow of family members makes the support networks between family members more fragile. This results in the Indigenous people losing the ability to protect and rescue wildlife. Indigenous people are no longer willing to take the initiative to protect and rescue wildlife, which weakens the corporeal emotions that arise from direct contact between the two. According to the sociology of relations, relational networks are essential for community governance, environmental protection, and resource use (Anderson et al., 2019). When relational networks are disrupted, people may lose the will and ability to collaborate, thus losing motivation to protect their wildlife.

4.2 Cultural shaping

Animals have always been essential cultural, mythological, and religious elements. Culture often includes people's imaginations, perceptions, attitudes, and emotions toward wildlife (Maddox, 2021). However, previous studies have neglected the fact that cultures are diverse. Different cultures describe human-wildlife relationships differently. This study defines culture as both traditional and popular.

Traditional culture is a summary of the experiences of Indigenous people over a long period, reflecting the role of

wildlife in daily life and agricultural production. For example, the call of a Chinese alligator can predict the arrival of a rainstorm. This could alert Indigenous people to prepare for floods. The myth that the Chinese alligator embodies the dragon enhances the Indigenous people's local identity. They consider themselves to be the descendants of the dragon. This means that traditional culture has integrated the role of wildlife in the ecosystem into the identity perception and daily life of Indigenous people, which is conducive to increasing the ecological emotions of Indigenous people toward wildlife. Thus, when traditional culture is destroyed, people tend to change their emotions toward wild animals. Based on the results of model 2, traditional cultural loss was negatively correlated with ecological emotions (Coeff = -2.51, $p < 0.001$). This finding is consistent with those of previous studies. López et al. found that local musical folklore is a powerful tool for raising awareness about animal conservation in The Colombian Caribbean. This can make people aware of the importance of animals in the local ecology (López-Angarita et al., 2022).

Pop culture can create attractive symbolic representations of wildlife through movies and animations, which can increase the appeal of wildlife to Indigenous people. This helps stimulate Indigenous people's interest in and concern for wildlife and improves their aesthetic emotions toward wildlife. Based on the results of Model 3, pop culture familiarity was positively correlated with aesthetic emotions (Coeff = 1.60, $p < 0.001$). This means that managers can mitigate conflicts between Indigenous people and wildlife by promoting popular culture. This is consistent with the results of previous studies (Baker and Winkler, 2020).

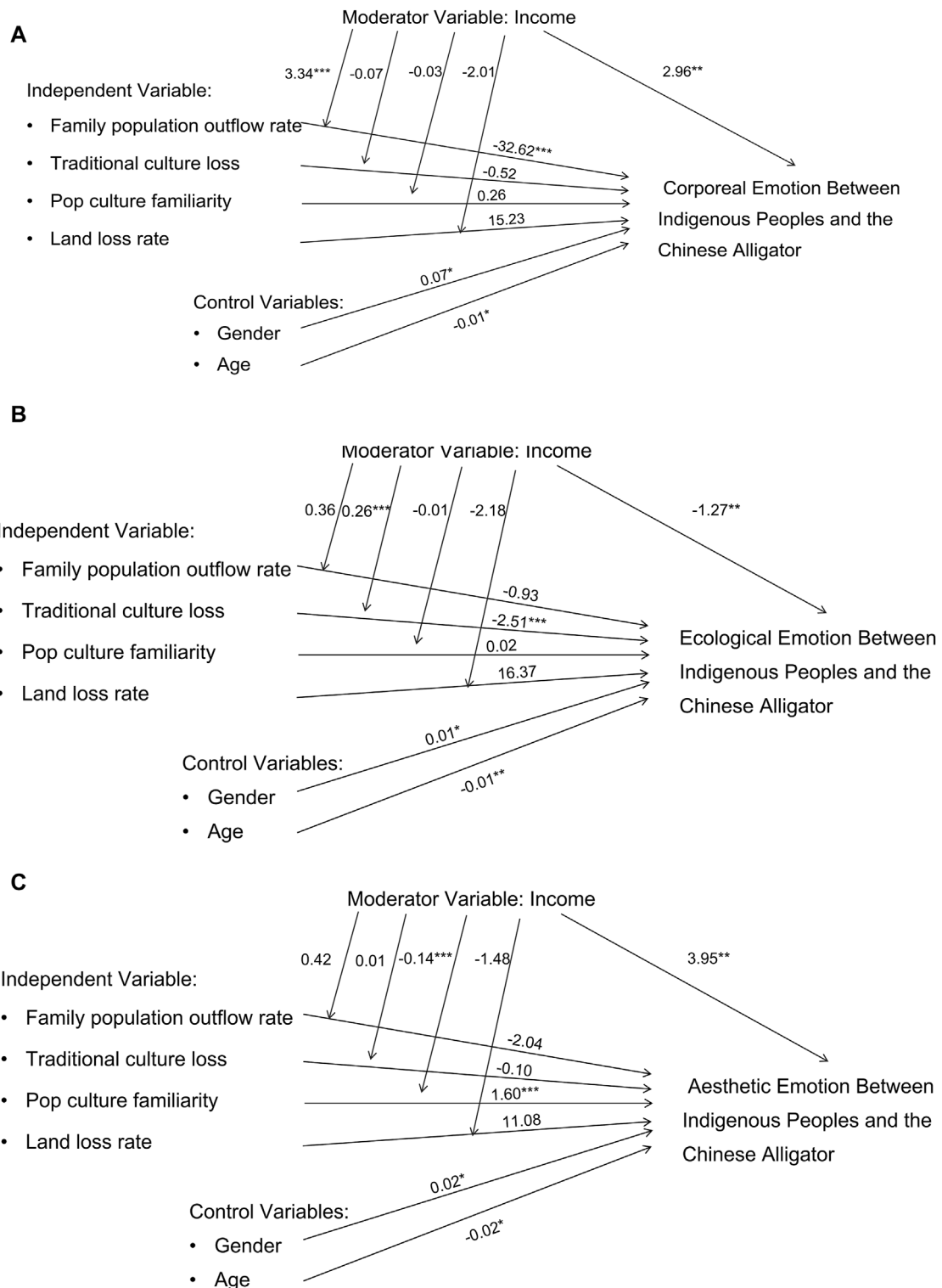


FIGURE 3 (A) Model 1: Regression Analysis Model for Corporeal Emotion. (B) Regression Analysis Model for Ecological Emotion. (C) Regression Analysis Model for Aesthetic Emotion. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4.3 Income stratification

The sociology of emotions argues that emotions, as resources, are not evenly distributed in society (Collins, 2019). As found in this

study, the interaction between the family population outflow rate and income on corporeal emotions was significant (Coeff = 3.34, $p < 0.001$), between traditional cultural loss and income on ecological emotions was significant (Coeff = 0.26, $p < 0.001$), and between pop

culture familiarity and income on aesthetic emotion was also significant (Coeff = -0.14 , $p < 0.001$). This indicates that income suppressed the adverse effects of the family population outflow rate and loss of traditional culture on human-wildlife emotions. This means that, compared to low-income Indigenous people, high-income Indigenous people can mitigate the negative impacts of the family population outflow rate and traditional culture loss on emotions. In other words, high-income Indigenous people can better maintain positive emotions toward wildlife.

This implies that wealth disparity affects Indigenous people's emotions toward wildlife. The Administration Bureaus for Nature Conservation have avoided excluding Indigenous people; however, the results have been limited (Bennett and Dearden, 2014). Some scholars have speculated that this is because project leaders ignore the complexity of local communities. The wealth gap in local communities has led to wildlife conservation not benefiting all Indigenous peoples, with the risk of this gap further increasing. The moderating effect of income confirms the existence of "local community complexity" and suggests that income groups have different adaptive capacities.

This study only focuses on nature reserves that neglect the rights and interests of Indigenous people. However, many nature reserves have begun to pay attention to their rights and interests. By working together with the Indigenous people, they can improve the effectiveness of the governance of nature reserves and simultaneously promote the economic development and cultural preservation of Indigenous communities. For example, Stoffle found that by respecting the sovereignty of the Skokomish Indian people and involving the tribes in watershed management, tribal cultures could be fully utilised in restoring channel-maintaining flows and salmon populations (Stoffle, 2022). Jinka et al. found that indigenous people, government representatives, and local non-governmental organisations had different perceptions of tiger conservation and economic development (Jinka and Hoffman, 2023). The key to achieving balanced development of nature reserves is promoting cooperation and communication between all parties. Similarly, Nyssönen points out that conservation organisations with expertise and skills need to understand cross-culture, respecting and taking into account the traditional knowledge, cultural values, and ways of life of Indigenous people, even if they have expertise and skills in the field of environmental conservation (Nyssönen, 2022). This means that while implementing ecological restoration and protecting wildlife, the Administration Bureau for Nature Conservation must 1) enhance cooperation among Indigenous people and build a social support network for local communities; 2) preserve and promote traditional local culture while utilising popular culture appropriately to promote a positive image of wildlife; 3) enhance equality in local communities and reduce the gap between the rich and poor.

5 Conclusion

To save the Chinese alligator, the Administration Bureau for Nature Conservation implemented ecological restoration in the CL

Village, transforming the land used by Indigenous people for production and residence into a habitat for the Chinese alligator. While this has contributed to an increase in the number of Chinese alligators, it has also had a non-negligible impact on the emotional connections between Indigenous peoples and Chinese alligators. This study analysed Indigenous people's emotional experiences of wildlife based on the sociology of emotions and identified three important mechanisms: social support, cultural shaping, and income stratification. First, cooperation among family members is conducive to protecting and rescuing wildlife and increasing people's corporeal emotions toward it. Second, traditional culture increases the ecological emotions of Indigenous people toward wildlife by summarising the role of wildlife in their daily lives and agricultural production. Third, popular culture enhances Indigenous people's aesthetic emotions toward wildlife by constructing attractive wildlife representations. Finally, different income groups have different adaptive capacities in the face of the impact of ecological restoration on Indigenous people's emotions toward wildlife. Higher-income Indigenous people are better able to maintain positive emotions toward wildlife.

These findings reveal that the key to wildlife conservation lies in species management and addressing social issues. This is because wildlife is not living beings outside of human society but actors and participants in it. Their emotional relationships with people are embedded in social life. Phenomena such as migration, cultural diffusion, and income changes can affect the emotional experiences of Indigenous people toward wildlife.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/Supplementary material.

Ethics statement

The studies involving humans were approved by the Ethics Committee of the school of Public Administration. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

DW: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing—original draft, Writing—review and editing. JG: Conceptualization, Formal Analysis, Project administration, Resources, Supervision, Writing—review and editing. JY: Software, Writing—review and editing.

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References

- Anderson, E. P., Jackson, S., Tharme, R. E., Douglas, M., Flotemersch, J. E., Zwarteveen, M., et al. (2019). Understanding rivers and their social relations: a critical step to advance environmental water management. *Wiley Interdiscip. Rev. Water* 6 (6), e1381. doi:10.1002/wat2.1381
- Aronson, J., Clewell, A., and Moreno-Mateos, D. (2016). Ecological restoration and ecological engineering: complementary or indivisible? *Ecol. Eng.* 91, 392–395. doi:10.1016/j.ecoleng.2016.02.043
- Baker, L., and Winkler, R. (2020). Asian elephant rescue, rehabilitation and rewilding. *Anim. Sentience* 5 (28), 1. doi:10.51291/2377-7478.1506
- Barbour, T. (1910). A note regarding the Chinese Alligator. *Proc. Acad. Nat. Sci. Phila.* 62 (2), 464–467.
- Barua, M. (2016). Encounter. *Environ. Humanit.* 7 (1), 265–270. doi:10.1215/22011919-3616479
- Beausoleil, N. J. (2020). I am a compassionate conservation welfare scientist: considering the theoretical and practical differences between compassionate conservation and conservation welfare. *Animals* 10, 257. doi:10.3390/ani10020257
- Bennett, J., Sjölander-Lindqvist, A., Sandström, C., and Larsson, S. (2022). Addressing the Swedish large carnivore controversy: identifying roadblocks in collaborative governance to reduce conflict. *Front. Conservation Sci.* 3, 952242. doi:10.3389/fcsc.2022.952242
- Bennett, N. J., and Dearden, P. (2014). Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. *Mar. Policy* 44, 107–116. doi:10.1016/j.marpol.2013.08.017
- Biru, Y., Tessema, Z. K., and Urge, M. (2017). Perception and attitude of pastoralists on livestock-wildlife interactions around Awash National Park, Ethiopia: implication for biodiversity conservation. *Ecol. Process.* 6, 13. doi:10.1186/s13717-017-0081-9
- Castillo-Huitrón, N. M., Naranjo, E. J., Santos-Fita, D., and Estrada-Lugo, E. (2020). The importance of human emotions for wildlife conservation. *Front. Psychol.* 11, 1277. doi:10.3389/fpsyg.2020.01277
- Choi, A. S., Papandrea, F., and Bennett, J. (2007). Assessing cultural values: developing an attitudinal scale. *J. Cult. Econ.* 31, 311–335. doi:10.1007/s10824-007-9045-8
- Collins, R. (2019). Emotional micro bases of social inequality: emotional energy, emotional domination and charismatic solidarity. *Emot. Soc.* 1 (1), 45–50. doi:10.1332/263168919x15580836411823
- Eitler, P. (2014). “The ‘Origin’ of emotions: sensitive humans, sensitive animals,” in *Emotional lexicons: continuity and change in the vocabulary of feeling 1700–2000*, 91–117. doi:10.1093/acprof:oso/9780199655731.003.0004
- Eysenck, M. W., Derakshan, N., Santos, R., and Calvo, M. G. (2007). Anxiety and cognitive performance: attentional control theory. *Emotion* 7 (2), 336–353. doi:10.1037/1528-3542.7.2.336
- Gogoi, M. (2018). Emotional coping among communities affected by wildlife-caused damage in north-east India: opportunities for building tolerance and improving conservation outcomes. *Oryx* 52 (2), 214–219. doi:10.1017/s0030605317001193
- Gordon, S. L. (1990). “Social structure effects on emotions,” in *Research agendas in the sociology of emotions*. Editor T. D. Kemper (Albany: State University of New York Press), 157.
- Hayes, A. F. (2012). Process: a versatile computational tool for observed variable mediation, moderation, and conditional process modeling. Available at: <http://www.afhayes.com/public/process2012.pdf>.

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- Hofbauer, R. K., Rainville, P., Duncan, G. H., and Bushnell, M. C. (2001). Cortical representation of the sensory dimension of pain. *J. Neurophysiology* 86 (1), 402–411. doi:10.1152/jn.2001.86.1.402
- Izard, C. E. (1992). Basic emotions, relations among emotions, and emotion-cognition relations. *Psychol. Rev.* 99 (3), 561–565. doi:10.1037/0033-295x.99.3.561
- Jackson, S. T., and Hobbs, R. J. (2009). Ecological restoration in the light of ecological history. *Science* 325 (5940), 567–569. doi:10.1126/science.1172977
- Jacobs, M. H., Vaske, J. J., and Roemer, J. M. (2012). Toward a mental systems approach to human relationships with wildlife: the role of emotional dispositions. *Hum. Dimensions Wildl.* 17 (1), 4–15. doi:10.1080/10871209.2012.645123
- Jinka, R. y. M., and Hoffman, D. M. (2023). “Development” definitions of internally displaced people and the government: a study of the Chenchu tribe in the Nallamala forest of southern India. *Front. Conservation Sci.* 4, 1126168. doi:10.3389/fcsc.2023.1126168
- Joye, Y., and De Block, A. (2011). Nature and i are two’: a critical examination of the biophilia hypothesis. *Environ. Values* 20 (2), 189–215. doi:10.3197/096327111x12997574391724
- Jürgens, U. M., and Hackett, P. M. (2021). Wolves, crows, and spiders: an eclectic literature review inspires a model explaining humans’ similar reactions to ecologically different wildlife. *Front. Environ. Sci.* 9, 593501. doi:10.3389/fenvs.2021.593501
- Kaczensky, P. (2007). Wildlife value orientations of rural Mongolians. *Hum. Dimensions Wildl.* 12, 317–329. doi:10.1080/10871200701555303
- Larsson, S., Larsson, S. O., Bennett, J., and Sjölander-Lindqvist, A. (2022). Contextualizing negative attitudes to wildlife and wildlife governance in the moral economy of Swedish farmers. *Front. Conservation Sci.* 3, 1014769. doi:10.3389/fcsc.2022.1014769
- Lawrence, R. L. (2008). Powerful feelings: exploring the affective domain of informal and arts-based learning. *New Dir. For Adult Continuing Educ. Special Issue Adult Learn. Emot. self* 120, 65–77. doi:10.1002/ace.317
- López-Angarita, J., Restrepo, M. P., Guzmán, K., and Escobar, D. (2022). Musical folklore as a tool for social-ecological change in the Colombian Caribbean. *Front. Conservation Sci.* 3, 1039430. doi:10.3389/fcsc.2022.1039430
- Lorimer, J. (2015). *Wildlife in the Anthropocene: conservation after nature*. Minneapolis: University of Minnesota Press, pp67–73.
- Maddox, J. (2021). The secret life of pet Instagram accounts: joy, resistance, and commodification in the Internet’s cute economy. *New Media and Soc.* 23 (11), 3332–3348. doi:10.1177/1461444820956345
- Manfredo, M. J. (2008). Understanding the feeling component of human–Wildlife interactions. Who Cares about Wildlife? *Soc. Sci. Concepts For Explor. Human-wildlife Relat. Conservation Issues*, 49–73. doi:10.1007/978-0-387-77040-6_3
- Maqsood, I., and Rong, K. (2019). Existing status and resurgence strategies for Chinese alligator (*Alligator sinensis*). *Pak. J. Zoology* 51 (3). doi:10.17582/journal.pjz/2019.51.3.rev2
- Mills, G. E., and Gay, L. R. (2019). *Educational research: competencies for analysis and applications*. New Jersey: Pearson, 45–49.
- Murphree, M. W. (2000). Community-based conservation: old ways, new myths and enduring challenges[C]//Conference on African wildlife Management in the new Millennium. *Coll. Afr. Wildl. Manag. Mwaka* 1, 3–1.
- Nyyssönen, J. (2022). Frame alignment between environmentalists and the Sami in the forest dispute in inari, Finland until the 2000s—competing conservation needs and

- obstacles for Co-living with the non-human. *Front. Conservation Sci.* 3, 925713. doi:10.3389/fcosc.2022.925713
- Obradović, S., Stojanović, V., and Milić, D. (2022). The importance of understanding the local community's attitude toward nature conservation. Available at: <https://assets.researchsquare.com/files/rs-1759803/v1/74006cd9-0936-43f2-a18b-63487333ec2c.pdf?c=1656695575> (Accessed on July 1, 2022).
- Pan, T., Wang, H., Duan, S., Ali, I., Yan, P., Cai, R., et al. (2019). Historical population decline and habitat loss in a critically endangered species, the Chinese alligator (*Alligator sinensis*). *Glob. Ecol. Conservation* 20, e00692. doi:10.1016/j.gecco.2019.e00692
- Paul, E. S., Sher, S., Tamietto, M., Winkielman, P., and Mendl, M. T. (2020). Towards a comparative science of emotion: affect and consciousness in humans and animals. *Neurosci. Biobehav. Rev.* 108, 749–770. doi:10.1016/j.neubiorev.2019.11.014
- Rakover, S. S. (2021). The two factor theory of understanding: consciousness and procedures. *J. Mind Behav.* 42.
- Redpath, S. M., Gutierrez, R. J., and Wood, K. A. (2015). *Conflicts in conservation: navigating toward solutions*. Cambridge, UK: Cambridge Univ. Press, 34–39.
- Runacres, A. (2023). Relocated tigers and relocated villagers: ferality and human–animal entanglement in Indian conservation. *Mod. Asian Stud.* 57 (1), 222–251. doi:10.1017/s0026749x21000688
- Seabrook-Davidson, M. N., and Brunton, D. H. (2014). Public attitude towards conservation in New Zealand and awareness of threatened species. *Pac. Conserv. Biol.* 20 (3), 286–295. doi:10.1071/pc140286
- Shrestha, R. K., and Alavalapati, J. R. (2006). Linking conservation and development: an analysis of local people's attitude towards Koshi Tappu Wildlife Reserve, Nepal. *Environ. Dev. Sustain.* 8, 69–84. doi:10.1007/s10668-005-0188-5
- Slagle, K., Zajac, R., Bruskotter, J., Wilson, R., and Prange, S. (2013). Building tolerance for bears: a communications experiment. *J. Wildl. Manag.* 77, 863–869. doi:10.1002/jwmg.515
- Stoffle, R. (2022). Release our river, let the salmon swim: skokomish efforts to restore their river. *Front. Conservation Sci.* 3, 898000. doi:10.3389/fcosc.2022.898000
- Thondhlana, G., Redpath, S. M., Vedeld, P. O., van Eeden, L., Pascual, U., Sherren, K., et al. (2020). Non-material costs of wildlife conservation to local people and their implications for conservation interventions. *Biol. Conserv.* 246, 108578. doi:10.1016/j.biocon.2020.108578
- Thorbjarnarson, J., and Xiaoming, W. (1999). The conservation status of the Chinese alligator. *Oryx* 33 (2), 152–159. doi:10.1017/s0030605300030416
- Thorn, M., Green, M., Dalerum, F., Bateman, P. W., and Scott, D. M. (2012). What drives human–carnivore conflict in the West-Province of South America? *Biol. Conserv.* 150, 23–32. doi:10.1016/j.biocon.2012.02.017
- Thuy, N. N., Dwivedi, P., Rossi, F., Alavalapati, J. R., and Thapa, B. (2011). Role of social capital in determining conservation attitude: a case study from Cat Tien National Park, Vietnam. *Int. J. Sustain. Dev. World Ecol.* 18 (2), 143–153. doi:10.1080/13504509.2011.560455
- Vedeld, P., Jumane, A., Wapalila, G., and Songorwa, A. (2012). Protected areas, poverty and conflicts: a livelihood case study of Mikumi National Park, Tanzania. *For. Policy Econ.* 21, 20–31. doi:10.1016/j.forpol.2012.01.008
- Villar, J., Pérez-Méndez, L., Basaldúa, S., Blanco, J., Aguilar, G., Toral, D., et al. (2011). A risk tertiles model for predicting mortality in patients with acute respiratory distress syndrome: age, plateau pressure, and P_{aO_2}/F_{iO_2} at ARDS onset can predict mortality. *Respir. Care* 56 (4), 420–428. doi:10.4187/respcare.00811
- Wang, P. (2013). A social stratification model for the sociology of emotions. *Shandong Soc. Sci.* 3, 55–59. doi:10.3969/j.issn.1003-4145.2013.03.009
- Watanabe, M. E. (1983). The Chinese alligator: is farming the last hope? *Oryx* 17 (4), 176–181. doi:10.1017/s0030605300025102
- Wilterson, A. I., Kemper, C. M., Kim, N., Webb, T. W., Reblando, A. M., and Graziano, M. S. (2020). Attention control and the attention schema theory of consciousness. *Prog. Neurobiol.* 195, 101844. doi:10.1016/j.pneurobio.2020.101844
- You-Zhong, D., and Xiao-Ming, W. (2004). Factors influencing the population status of wild Chinese alligators (*Alligator sinensis*). *Biodivers. Sci.* 12 (3), 324–332. doi:10.17520/biods.2004039