

PUBLIC PERCEPTIONS ABOUT THE FRUIT BATS IN TWO HORTICULTURALLY IMPORTANT DISTRICTS OF PAKISTAN

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ABSTRACT

This study reflects the awareness level and public attitude towards bats in two northern districts of Pakistan that are important for their horticulture-based economy. A total of 225 persons were interviewed in Peshawar (n = 103) and Charsadda (n = 122) districts of the Khyber Pakhtunkhwa (KP). 100% of the respondents were unaware of the ecological services rendered by bats and reflected a negative attitude towards them. They did neither like to eat them (99.6%) nor did they consider them to be hematophagous (blood sucking) (96.9%). Bats were of no use (98.7%) and were symbols of bad omen (78.2%). All of them (100%) refused to have bat roosts close to their house. There was a firm belief that bats feed solely on fruit, particularly persimmon *Diospyros kaki* (81.5%) and inflict heavy economic losses (43.8%). This aversive attitude is leading to unnecessary killing of the bats in the area and 16.4% of the respondents claim to have killed bats. Conservation education and non-consumptive wildlife-oriented tourism is needed to convince the people that superstitious beliefs and myths about the bats are baseless.

Key words: Awareness; Conservation; Food; Fruit bats; Hematophagy; Indian flying fox; Persimmon

INTRODUCTION

Bats are the least studied group of small mammals in Pakistan (Mahmood-ul-Hassan *et al.*, 2009) comprising more than one fourth of the known mammal species of the country (Roberts, 1997). Although eight bat families are reported to exist, the exact number of number of bat species present is uncertain. Information on many species is based only on museum or literature surveys, with no recent population or distributional information (Roberts, 1997; Mahmood-ul-Hassan and Nameer, 2007). The chiropteran biodiversity of the country is, however, comparable to other regions of the world with similar climate and topography. The diversity of Pakistan's bat fauna is comparable to the largest biogeographic region of the world – the Palaearctic; 25 genera and eight families of bats exist in the whole Palaearctic as compared to Pakistan, where more than 50 species of bats representing 26 genera and eight families are present within a small geographic area (Mahmood-ul-Hassan and Nameer, 2007). Bats, however, are disliked by the people and are often labeled as vermin for feeding on ripe orchard fruits. Bats are given no protection by law in Pakistan and are hunted by local “hakeems” (local health practitioners) for their body fat to be used as a potion and as a cure for rheumatic pains (Roberts, 1997). Fruit bats are included in fourth schedule of the Punjab Wildlife (protection, preservation, conservation and management Act) 1974 section 2 (v) among the animals that allowed to be hunted without any legal permission.

The Kyber Pakhtunkhwa (KP), formerly North Western Frontier Province (NWFP), covers an area of 562000 hectares of which 30.1% is cultivated. Fruit farming has been an important business of the province and the total fruit production during 2005-06 was 252900 tons (Anonymous, 2007). Peach (*Prunus persica*), guava (*Psidium guajava*), citrus (*Citrus* spp.), plum (*Prunus cerasifera*), pear (*Pyrus calleryana*), apricot (*Prunus Armeniaca*), banana (*Musa acuminata*), apple (*Malus domestica*), date (*Phoenix dactylifera*), mango (*Mangifera indica*), pomegranate (*Punica granatum*), and grapes (*Vitis vinifera*) are the commercially important fruits that contributed 20.4%, 17.1%, 14.9%, 13.1%, 10.9%, 7.2%, 5.4%, 5.0%, 3.5%, 1.3%, 0.7% and 0.5% to the total fruit production of the province during 2005-06, respectively. Both Peshawar (35°50' 36" north latitude and 71° 21' 45" east longitudes; area = 1270 km²) and Charsadda (34° 18' 13 north latitude and 71° 37' 51 east longitude; area = 990 km²) constitute the core of this horticultural economy with 62.2% and 73.7% of the cultivated area, respectively. The literacy rate in Peshawar (41.8%) is higher than in Charsadda (31.1%). The male literacy rate (56.0 %) in Peshawar is also higher than in Charsadda (46.9%) (Anonymous, 2009). A majority of the fruit farmers in these districts are unaware of ecological services rendered by the fruit bats and do not hesitate to kill them on account of their misbeliefs. They consider fruit bats as pests that poach ripe fruits from their farms at night. This lack of ecological awareness seems to be the major impediment in bat conservation and is resulting in mass persecution of fruit

bats in the area that may lead towards local extinction of these bats in future.

The survival of the non-game, non-charismatic wild creatures like bats depends not only on the environmental issues but also on social and cultural matters (Enriquez and Mikkola, 1997). The general public attitude towards bats has not been investigated extensively throughout the world except the studies conducted in the western countries (Toops, 1995; Davey *et al.*, 1998; Prokop *et al.*, 2009). Keeping in mind this paucity of knowledge regarding public attitude towards bat in Pakistan, the present study was designed to answer following questions:

1. What is the level of knowledge and attitude of the people towards bats in Peshawar and Charsadda districts?
2. Does the level of knowledge and attitude towards bats change with education and locality.

MATERIALS AND METHODS

A total of 225 persons, all inhabiting the villages of Peshawar and Charsadda districts, were interviewed from January 2009 to April 2009 by two (male) interviewers. Of these, 122 persons were interviewed in Charsadda district and the remaining 103 in Peshawar district. Three of the Peshawar respondents were visiting their families and actually belonged to Mardan (n = 2) and Parachinar (n = 1) districts. Response from these three individuals was included with those of Peshawar district. All the respondents were associated with fruit farming business either as farmers, tenants or contractors. The minimum age of the respondents was 15 year but there was no upper age limit. The respondents ranged from 15 to 63 years in Peshawar district and 15 to 80 years in Charsadda district. More than half of the respondents at both these districts aged between 21 to 40 years.

The education level of the respondents in both the districts was significantly different (n = 225; $\chi^2 = 31.3$; df = 3; p < 0.01). A majority of the respondents at Peshawar were undergraduate or graduate (40.8%) as compared to Charsadda where majority of respondents were illiterate (44.3%) (Table 1). A person who has successfully completed ten years of school education and obtained a secondary school certificate (SSC) is "matriculate" whereas; one who fails to obtain SSC is "undermatric". Similarly, one who successfully completes fourteen years of education is "graduate" while one who fails to attain this level is "undergraduate".

All the respondents were requested to complete a questionnaire and cross the appropriate box. The questionnaire was prepared in Urdu, the national language of the country, however it was also translated into Pashto (the provincial language) for illiterate

respondents and their answers were recorded by the interviewer. All the respondents were males and no female could be interviewed. Interviewing females (by male interviewers) is impossible in these districts as speaking to unknown men is considered to be a taboo in that male-dominated society. The data obtained from the questionnaires was encoded and analyzed using SPSS 17.0.

RESULTS AND DISCUSSION

Awareness Level of the Respondents

Bat sighting. Most of the respondents in Peshawar and Charsadda districts had seen fruit bats and there was no significant difference between the respondents in both districts in this regard (n = 211; $\chi^2 = 1.78$; df = 1; p < 0.05) (Table 1). The response was different in different age groups ($\chi^2 = 13.33$; df = 3; p < 0.05). The majority of the respondents (n = 11) who had not seen bats aged between 15 to 20 years (Table 1).

Maximum number of bats observed (roosting or flying). Almost 41% of the respondents (n = 92) claimed that they had seen one to 200 bats roosting together in a single instance, 9.3% claimed that they had seen 201 to 500 bats, 17.3% claimed that had seen between 501 to 1000 bats, while 26.2 % claimed that they had seen more than 1000 bats roosting together in single instance. The response was significantly different in both districts ($\chi^2 = 69.44$; df = 4; p < 0.01) (Table 1).

Misconception about Bats

Bat eating. All the respondents from Peshawar and 99.2% of the respondents from Charsadda district refused to eat bats ($\chi^2 = 0.85$; df = 1; p < 0.05).

Bats used as cure for diseases. Eight respondents in Peshawar (6.6%) district and 17.5 % respondents in Charsadda district (n = 18) were of the view that bats are used either as aphrodisiacs or for curing baldness. The opinion of the respondents about the bats with respect to this question was significantly different between districts ($\chi^2 = 6.51$; df = 1; p < 0.05) (Table 2).

Hematophagy by bats. Although an overwhelming majority of the respondents (96.9%) believed that bats do not suck human blood, a few respondents (n = 7) at Charsadda district believed them to be hematophagous. The response was significantly different between districts ($\chi^2 = 6.10$; df = 1; p < 0.05) (Table 2).

Usefulness of bats. The response to this question was similar in both the districts and 98.8% of respondents believed that bats were useless creatures ($\chi^2 = 2.57$; df = 1; p < 0.05) (Table 2).

Bat as symbol of bad omen. 96.1% of the respondents in Peshawar district and 63.1% of respondents in Charsadda

believed that bats were symbol of bad omen. The response was significantly different between districts ($\chi^2 = 35.71$; $df = 1$; $p < 0.01$) (Table 2).

Bat roost near the house. None of the respondents was willing to have a bat roost near his house.

Food Habits, Economic Losses and Bat Persecution

Bat food. It was found that 18.2% of the respondents had no idea about the food of bats. The remaining respondents were of the view that bats feed solely on persimmon (*Diospyros kaki*) (29.8%) or on a combination of persimmon with other fruits. The responses in both the districts were significantly different ($\chi^2 = 132.07$; $df = 16$; $p < 0.01$) (Table 3).

Estimated economic loss inflicted by bats. The majority of the respondents (66.2%) were unable to estimate the economic loss caused by bats in one night. The remaining believed that each night bats destroyed fruits worth Pakistan Rupees (Rs) 100 – 500 (9.3%), Rs 501 – 1000 (10.7%), Rs 1500 – 2000 (4.9%) and more than Rs 2000 (8.9%). The response was significantly different between districts ($\chi^2 = 63.46$; $df = 4$; $p < 0.01$) (Table 4).

Bat killing. More than 80% of the respondents in the both districts had never killed any bats. However, 14% respondents in Peshawar and 13% in Charsadda admitted that they had killed up to twenty bats in their life. One respondent in each of the districts claimed that he had killed more than 200 bats. People in both these districts were equally against bats ($\chi^2 = 1.90$; $df = 4$; $p < 0.01$) (Table 4); educated respondents were, however, less inclined to kill bats than illiterate ones ($\chi^2 = 26.5$; $df = 12$; $p < 0.01$) (Table 5).

Throughout the world, people like colourful birds, charismatic wild mega-fauna and pet animals like cats, and dogs and dislike invertebrates, bats, rats, reptiles and owls (Bjerke and Østdahl, 2004). Human attitudes toward most of the animals are influenced particularly by the species of animal. The education level and ecological literacy of an individual also plays a key role in shaping these biophilic or biophobic attitudes (Kellert and Westervelt, 1984). Such attitudes reflect cognitive behaviour of an individual as well as the whole society and can be assessed using questionnaires (Eagly and Chaiken, 1993). The present study was based on responses obtained from the rural segment of two districts of the KP on a questionnaire. The analysis of the responses reflected that people in both the districts had a strong sense of aversion and anxiety towards the bat as described by Kellert (1993) for invertebrates. This attitude may be attributed to the fact that bats are small and unfamiliar to humans both behaviorally and morphologically (Davey, 1994; Kellert, 1993; Wilson, 1987). Their physical appearance and aesthetic value does not evoke any biophilic response (Kellert, 1996;

Kellert and Berry, 1980) which normally is elicited for other animals having large size (Coursey, 1998; Kellert and Berry, 1980; Ward *et al.*, 1998) and neotenic (juvenile) features (Gould, 1980; Hirschman, 1994; Lawrence, 1989). The other factors that can appeal to humans such as similarity to humans, shape, type of locomotion, posture, surface texture, and color (Burghardt and Herzog, 1980; Kellert, 1996; Morris, 1967) are also absent in bats.

People in both the districts were unaware the ecological role of bats. They were, however, more aware of the fruit bats, which are often active during the day, than to insect-eating bats, which are mostly nocturnal. Bats are disliked generally as they destroy fruits at night. Furthermore, bats are considered as a symbol of bad omen and in most respondent's view are useless creatures.

The attitude of the people, in almost all the cases, was different in both the districts. The respondents in Peshawar were comparatively more aware of the bats than that of the Charsadda district. Higher literacy rate in Peshawar may have positively influenced the attitude of people. Only a few respondents in Peshawar believed in most of the prevailing misconceptions about bats and only a fraction considered them as cure for various illnesses and blood sucking. Although there were certain myths about the bats in both districts, less people believed that drinking water in the bats' wing sharpened memory and cured rheumatic pains in Peshawar than in the Charsadda district. Some respondents also believed that baldness and rheumatic pains could be cured by massaging oil, obtained from the bats' fat, on head of bald persons and on the rheumatic joints but such misconceptions were more prevalent in the Charsadda than in the Peshawar district. Since a few respondents in the Peshawar believed these myths, a majority considered them useless where as respondents in the Charsadda district, who believed these myths, viewed them as useful creatures. None of the respondents in both the districts was willing to have bat roost close to his house as they could bring misfortune for their family. Bats are not used as food in the area mainly due to the religious constraints. People also avoid bats as in their opinion the bat's urine can cause eczema. A majority of the respondents also told that they always take bath after killing a bat that rarely ventures in their room at night. They were also of the view that bat can fly inside the ear and cannot be removed if it clings to their cloths. Fear from animals has traditionally been viewed as a biological predisposition that connects humans with potentially dangerous animals with fearful consequences (Seligman, 1971) or, more recently, by the "disease-avoidance" hypothesis (Davey, 1992, 1994; Davey *et al.*, 1998).

Prior to widespread bat conservation education and awareness programmes, a vast majority of people

also had similar beliefs about bats in the Americas, continental Europe and the United Kingdom. They also hated bats and considered them as loathsome and fearful creatures. They were believed to be blind rats with wings carrying rabies, causing blindness, sucking human blood and flying into people's hair (Toops, 1995). People in Latin America killed thousands of bats, believed to be vampires that fed on human blood (Morton and Murphy, 1995). In Australia flying foxes were named as black devils with wings. They were heavily persecuted through shooting, poisoning, electrocution, burning, and their roosts were disturbed by burning tyres and making noise (Grzelewski, 2000). Similarly, in a study of American's attitudes toward animals, bats were one of the most

disliked of all animals and were ranked with rats, roaches and rattlesnakes (Kellert, 1980). These attitudes and associated behaviours have no doubt contributed to a severe decline in bat biodiversity in different parts of the world (Toops, 1995), including the present study area.

In spite of all these misconceptions, people kill bats in both these districts on account of their destructive food habits. They think that bats heavily infest their fruit orchards and inflict heavy economic losses each night. This bat killing attitude was however, less prevalent in educated segment of the respondents indicating that conservation education can further campaigns can

Table 1. Education (a) and awareness (b, c, d) level of the respondents at Peshawar and Charsadda districts of Khyber Pakhtunkhwa (KP).

Response	% Respondents (n)			χ^2	Df
	Peshawar	Charsadda	Combined		
(a) Education level					
Illiterate	30.1 (31)	44.3 (54)	37.7 (85)	31.3**	3
Undermatric or matric	15.5 (16)	36.1 (44)	26.7 (60)		
Undergraduate or graduate	40.8 (42)	16.4 (20)	27.6 (62)		
Graduate	13.6 (14)	3.3 (4)	8.0 (18)		
(b) Have you ever seen bats?					
No	8.2 (10)	3.9 (4)	14	1.78NS	1
Yes	91.8 (112)	96.1 (99)	211		
(c) Maximum number of bats seen in that area (flying or roosting)					
No bat seen	3.9 (4)	8.2 (10)	6.2 (14)	69.44**	4
1-200	69.9 (72)	16.4 (20)	40.9 (92)		
201-500	4.9 (5)	13.1 (16)	9.3 (21)		
501-1000	12.6 (13)	21.3 (26)	17.3 (39)		
more than 1000	8.7 (9)	41.0 (50)	26.2 (59)		
(d) Have you ever seen bats? \times Age of respondent (Cross tabulation).					
	1	2	3	4	Combined
No	14.3(11)	2.6(3)	-	-	6.2(14)
Yes	85.7(66)	97.4(113)	100(27)	100(5)	93.7(211)
Total	77	116	27	5	225

(n = number of respondents; 1 = 20 years or below; 2 = 21 to 40 years; 3 = 41 to 60 years; 4 = above 60 years)

Table 2. A comparison of some misconceptions (a, b, c, d) about bats in the study area.

Response	% Respondents (n)			χ^2	df
	Peshawar	Charsadda	Combined		
(a) Bats as a cure for illness or disease					
No	93.4 (114)	82.5 (85)	88.4 (199)	6.51*	1
Yes	6.6 (8)	17.5 (18)	11.6 (26)		
(b) Hematophagy by bats					
No	100 (103)	94.3 (115)	96.9 (218)	6.10*	1
Yes	-	5.7 (7)	3.1 (7)		
(c) Usefulness of bats.					
No	100 (103)	97.5 (119)	98.7 (222)	2.57 ^{NS}	1
Yes	-	2.5 (3)	1.3 (3)		
(d) Bats as symbols of bad omen.					
No	3.9 (4)	36.9 (45)	21.8 (49)	35.71**	1
Yes	96.1 (99)	63.1 (77)	78.2 (176)		

n = Number of respondents; * = Significant; ** = highly significant; NS = Non-significant

Table 3. Food list of the Indian flying fox (*Pteropus giganteus*) in the opinion of people living in Peshawar and Charsadda districts of Khyber Pakhtunkhwa (KP).

Response	% Respondents (n)			χ^2	df
	Peshawar	Charsadda	Combined		
Don't Know	10.7 (11)	24.6 (30)	18.2 (41)	132.07**	16
Persimmon	57.3 (59)	6.6 (8)	29.8 (67)		
Persimmon and mango	1.0 (1)	9.0 (11)	5.3 (12)		
Persimmon and litchi	-	7.4 (9)	4.0 (9)		
Persimmon, litchi and mango	1.9 (1)	4.9 (6)	3.6 (8)		
Persimmon, litchi and guava	3.9 (4)	23.0 (28)	14.2 (32)		
Persimmon and guava	1.9 (2)	2.5 (3)	2.2 (5)		
Persimmon and loquat	-	2.5 (3)	1.3 (3)		
Persimmon, loquat and litchi	-	0.8 (1)	0.4 (1)		
Persimmon and figs	-	0.8 (1)	0.4 (1)		
Persimmon and pear	12.6 (13)	0.8 (1)	6.2 (14)		
Persimmon, orange and peach	2.9 (3)	-	1.3 (3)		
Persimmon and plum	1.9 (2)	-	0.9 (2)		
Persimmon and ber	2.9 (3)	-	1.3 (3)		
Persimmon and dates	2.9 (3)	-	1.3 (3)		
Persimmon, lichi, apple and ber	-	17.2 (21)	9.3 (21)		

(n = number of respondents; Apple *Malus domestica*, Ber *Ziziphus mauritiana*, Dates *Phoenix dactylifera*, Figs *Ficus palmate*, Guava *Psidium guajava*, Litchi *Litchi chinensis*, Loquat *Eriobotrya japonica*, Mango *Mangifera indica*, Orange *Citrus aurantium*, Peach *Prunus persica*, Pear *Pyrus calleryana*, Persimmon *Diospyros kaki*, Plum *Prunus cerasifera*; ** = Highly significant)

Table 4. Economic losses inflicted by bats (a) and the number of bats killed by the respondents (b) in the study area.

Study area:		% Respondents (n)			χ^2	Df
Response	Peshawar	Charsadda	Combined			
(a) Economic loss (in Pakistan Rupees) caused by bats in one night						
Dont know	39.8 (41)	88.5 (108)	66.2 (149)	63.46**	4	
Rs 100 - 500	16.5 (17)	3.3 (4)	9.3 (21)			
Rs 501-1000	16.5 (17)	5.7 (7)	10.7 (24)			
Rs 1500-2000	7.8 (8)	2.5 (3)	4.9 (11)			
more than Rs. 2000	19.4 (20)	-	8.9 (20)			
(b) Number of bats killed.						
None	81.6 (84)	85.2 (104)	83.6 (188)	1.90 ^{NS}	4	
1-20	14.6 (15)	13.1 (16)	13.8 (31)			
20-100	1.9 (2)	0.8 (1)	1.3 (3)			
100 to 200	1.0 (1)	-	0.4(1)			
<200	1.0 (1)	0.8 (1)	0.9 (2)			

n = Number of respondents; ** = highly significant; NS = Non-significant

Table 5. Education level of Respondent × How many bats you have killed so far? Cross-tabulation.

Education level	% Respondents (n)					χ^2	df
	None	1-20	20-100	100 to 200	<200		
Illiterate	31.4(59)	74.2(23)	33.3(1)	100(1)	50(1)	26.5**	12
Matric or undermatric	30.9(58)	3.2(1)	33.3(1)	-	-		
Graduate or undergraduate	29.8(56)	12.9(4)	33.1(1)	-	50(1)		
Graduate	7.9(15)	9.7(3)	-	-	-		

n = Number of Respondents; ** = highly significant

minimize this biodiversity loss. Researchers propose that environmental knowledge is an essential precursor of attitude formation (Kellert and Westervelt, 1984; Kaiser, Wolfing and Fuhrer 1999) and increasing environmental

knowledge may result in more positive pro-environmental attitudes. Conservation education and awareness among the people and the promotion of non-consumptive wildlife-oriented tourism (Pennisi *et al.*,

2005) can serve as tool to halt mass persecution of bats in the present study area.

Implications for Further Research: Due to male-domination in both the districts, it was not possible (for males) to interview females of the area thus the response from the females could not be included in this study. Females form 51% population of the country and it would have been interesting to interview the females in both these districts. No such study has been conducted so far in any part of the country that has included women. Since women play a significant role transforming the thought of their descendants and since most of the attitudes in children, positive or negative, develop during childhood, it would be very interesting if attitude of the women of this area could be investigated. It would also be highly valuable to initiate an education programme about the value of bats in the study area (Kingston *et al.*, 2006) and then to reassess responses to the questionnaire after the programme to quantify the value of education in potentially altering peoples' perception of bats.

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REFERENCES

- Annonymous. (2007). *Pakistan Statistical Year Book*. Statistical Division, Federal Bureau of Statistics, Govt. of Pakistan. Islamabad.
- Annonymous. (2009). Bureau of Statistics, 1998 census report, districtwise literacy ratio of Population Northwestern Frontier Province. <<http://nwfp.gov.pk/nwfpgov/Departments/BOS/nwfp-ind-education-tab-23.php>>Accessed on 16 November.
- Bjerke, T. and T. Østdahl. (2004). Animal-related attitude and activities in an urban population. *Anthrozoös*, 17: 109-129.
- Burghardt, G. M. and H. A. Herzog, Jr. (1980). Beyond conspecifics: Is brother rabbit our brother? *Bioscience* 30: 763-768.
- Coursey, D. L. (1998). The revealed demand for a public good: evidence from endangered and threatened species. *New York University Environmental Law Journal*, 6: 411-449.
- Davey, G. C. L. (1992). Characteristics of individuals with fear of spiders. *Anxiety Research* 4: 299-314.
- Davey, G. C. L., A. S. McDonald, U. Hirisave, G. G. Prabhu, S. Iwawaki, C. I. Jim, H., De. Merckelbach, P. J. Jong, P. W. L. Lejny and L. Reimann, (1998). A cross national study of animal fears. *Behaviour Research and Therapy*, 36: 735-750.
- Davey, G. C. L. (1994). The "disgusting spider": the role of disease and illness in the perpetuation of fear of spiders. *Society and Animals*, 2: 17-24.
- Eagly A. H. and Chaiken, (1993). *The Psychology of Attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Enriques V. and H. Mikkola. (1997). Comparative study of the general public owl knowledge in Costa Rica, Central America and Malawi, Africa. Pp. 160-166. In *2nd International Symposium on Biology and Conservation of the owls of Northern Hemispheres*. February 5-9, 1997, Winnipeg, Manitoba, Canada.
- Gould, S. J. (1980). *The Panda's Thumb*, W. W. Norton and Co. New York.
- Grzelewski, D. (2000). Long considered black devils with wings, these bats today are stealing hearts – and mangoes – across Australia: Batty about flying foxes. *Smithsonian*, 31: 100-105.
- Hirschman, E. C. (1994). Consumers and Their Animal Companions. *Journal of Consumer Research*, 20: 616-632.
- Kaiser, F. G., S. Wolfing, and U. Fuhrer. (1999). Environmental attitude and ecological behaviour. *Journal of Environmental Psychology*, 19: 1-19.
- Kellert S. R. and J. K. Berry. (1980). Knowledge, affection, and basic attitudes toward animals in American society Phase III. U. S. Fish and Wildlife Service Report, U. S. Government Printing Office, Washington, DC.
- Kellert, S. R. (1980). American attitudes toward and knowledge of animals: an update. *International Journal for the Study of Animal Problems*, 1: 87-119.
- Kellert, S. R. (1996). The value of life: Biological diversity and human society, Island, Washington, DC.
- Kellert, S. R. (1993). Values and perceptions of invertebrates. *Conservation Biology*, 7: 845-855.
- Kellert, S. R. and M. O. Westervelt (1984). Children's attitudes, knowledge and behaviors towards animals. *Children's Environments Quarterly*, 1: 8-11.
- Kingston, T., A. Zubaid, G. Lim. and F. Hatta (2006). From research to outreach: environmental education materials for the bats of Malaysia. In *The Best of Both Worlds International Conference on Environmental Education for Sustainable development 2005*. FRIM, Kuala Lumpur, Malaysia

- Lawrence, E. A. (1989). Neoteny in American perceptions of animals. In *Perceptions of Animals in American Culture*, 57–76, ed. Hoage, R.J. Smithsonian Institution, Washington, DC. USA.
- Mahmood-ul-Hassan, M. and P. O. Nameer. (2006). Diversity, role and threats to the survival of bats in Pakistan. *J. Anim. and Plant Sci.* 16: 38-42.
- Mahmood-ul-Hassan, M., G. Jones, and C. Dietz. (2009). *The Bats of Pakistan: The least known creatures*. Verlag Dr. Muller. Germany.
- Morris, D. (1967). *The Naked Ape*. McGraw-Hill, New York.
- Morton P.A. and M.J. Murphy. (1995). Comprehensive approaches to saving bats. In: *Conserving Wildlife: International Education and Communication Approaches*. 103–118. ed. S.A. Jacobson New York: Columbia University Press. North American Wildlife and Natural Resource Conference. 45: 111–124.
- Pennisi, L. A., S. M. Holland, and T. V. Stein. (2005). Achieving bat conservation through tourism. *Journal of Ecotourism*. 3: 195 – 207.
- Prokop, P.J., Fančovičová and M. Kubiak. (2009). Vampires are still alive; Slovakian students attitude towards bat. *Anthrozoös*. 22: 19-30.
- Seligman, M. E. P. (1971). Phobias and preparedness. *Behavior Therapy*. 2: 307-320.
- T. J. Roberts. (1997). *The Mammals of Pakistan*. Oxford University Press. UK.
- Toops, C. (1995). Denizens of the dark. *National Parks*. March/April. 32–37.
- Ward, P. I., N. Mosberger, C. Kistler, and O. Fischer. (1998). The relationship between popularity and body size in zoo Animals. *Conservation Biology*. 12: 1408–1411.
- Wilson, E. O. (1987). The little things that run the world (the importance and conservation of invertebrates). *Conservation Biology*. 1: 344–346.