

# Evidence of the Matthew effect in scientific research on mammals in the Chinese First-class National Protected Animals list

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## To the Editor,

China is one of the world's biodiversity hotspots for conservation priorities (Myers et al. 2000). The wide range of habitats has contributed to the richness of China's mammal fauna and diversity. It has the third highest number of mammal species amongst all countries (Mittermeier et al. 1997). Overall, more than 10 % (556/5416) of mammal species in the world live in China (Wilson and Reeder 2005). Forty-three entries in the State Key Protected Animal List, issued soon after the China's Wildlife Law was adopted in 1989 in Category I (First-class National Protected Animals, FNPA), five are for genera and 38 for species (*Moschus* spp. were subsequently added in 2003; see supplementary material, Appendix 1 for the list).

Because of the diverse distribution ranges, population densities, and economic values, mammals listed as FNPAs attract uneven academic and public attention. In order to obtain a comprehensive understanding of the status quo of research on FNPA mammals, we retrieved the research literature published from 1989 to 2013, included in the Chinese Science Citation Database (CSCD; <http://sciencechina.cn/>) and Institute for Scientific

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Information (ISI) Web of Science (<http://www.isiwebofknowledge.com/>) using simple bibliometric analyses.

A total of 2809 scientific outputs (1750 in Chinese; 1059 in English) related to FNPA mammals and maintained an approximately exponential growth over the 25 years (see supplementary material, Appendix 1 for details). Three items, Giant Panda (*Ailuropoda melanoleuca*), Sika Deer (*Cervus nippon*) and Snub-Nosed Monkeys (*Rhinopithecus* spp.) occupied about half of the publications; each of these three had a total exceeding that of the last 24 species together (Table 1). A hierarchical cluster analysis demonstrated that *A. melanoleuca* was the super-star with over a quarter of all 2809 publications.

The “Matthew effect” is a tool used by sociologists and economists to qualitatively describe the dynamics of individual progress and the interplay between status and reward

**Table 1** Number of total publications related to mammals in FNPA during 1989–2013

Common name	Scientific name	1989–1997	1998–2005	2006–2013	In total	Percentage total
Giant Panda	<i>Ailuropoda melanoleuca</i>	111	259	406	776	27.63
Snub-Nosed Monkey	<i>Rhinopithecus</i> spp.	51	95	208	354	12.60
Sika Deer	<i>Cervus nippon</i>	21	72	167	260	9.26
Musk Deer	<i>Moschus</i> spp.	10	40	112	162	5.77
Tiger	<i>Panthera tigris</i>	8	43	101	152	5.41
Langur	<i>Trachypithecus</i> spp.	27	55	65	147	5.23
Pere David’s Deer	<i>Elaphurus davidianus</i>	10	25	69	104	3.70
Indo-Pacific Humpbacked Dolphin	<i>Sousa chinensis</i>	3	21	66	90	3.20
Gibbon	<i>Nomascus</i> spp.	20	6	62	88	3.13
Takin	<i>Budorcas taxicolor</i>	5	33	31	69	2.46
Tibetan Antelope	<i>Pantholops hodgsonii</i>	2	7	47	56	1.99
Przewalski’s Gazelle	<i>Procapra przewalskii</i>	2	21	29	52	1.85
Przewalski’s Horse	<i>Equus caballus</i>	2	9	37	48	1.71
Asian Elephant	<i>Elephas maximus</i>	2	12	24	38	1.35
Black Muntjac	<i>Muntiacus crinifrons</i>	2	7	28	37	1.32
Eurasian Beaver	<i>Castor fiber</i>	7	6	23	36	1.28
Snow Leopard	<i>Uncia uncia</i>	2	3	25	30	1.07
Assam Macaque	<i>Macaca assamensis</i>	12	8	9	29	1.03
Sable	<i>Martes zibellina</i>	6	11	12	29	1.03
Other 24 species		44	59	149	252	8.97
	Sum	347	792	1670	2809	100.00

Species with related publications over 1 % of all were listed here

(Petersen et al. 2011). It takes the name from the adage in the Gospel of St. Matthew: “For to all those who have, more will be given.” Here we use the research literature as a proxy for scientific attention, so that the positive feedback captured by the Matthew effect is related to the number of articles. Our studies indicated that Chinese scientists were continuously paying attention to a few mammals, such as *A. melanoleuca*, *Rhinopithecus* spp. and *C. nippon*, and had published up to 1390 papers on them since 1989. In contrast, seven species, including *Macaca cyclopis*, *M. leonine*, *Naemorhedus baileyi*, *Tragulus javanicus*, *Hemitragus jemlahicus*, *Arctictis binturong*, and *Capricornis swinhoei*, had no more than three papers each since becoming listed as FNPAs. We conclude that the Matthew effect operates in the scientific research of FNPA mammals in China, and suggest that this kind of bias may be universal at the world-wide scale.

The evidence of the Matthew, the rich get richer, effect in the FNPA research literature could be interpreted in two ways. First, some species attract increasing attention due to their scientific or economic values. For example, the Sika Deer (*C. nippon*) is a traditionally used animal which has been comprehensively studied; sika antler velvet is a famous and precious tonic, for which there is a great demand in both domestic and international markets. Although well-studied, great concern has been continuously paid to it (Table 1). Secondly, the natural habitat and population density of the large mammals plays a crucial role in the selection of objects for study and that may also determine the scientific input. The Himalayan Thar (*Hemitragus jemlahicus*) inhabits steep rocky mountain sides, especially at 3000–4000 m a.s.l., and appears to be found only in a few spots along the southern Tibet border near Qubuo River (Smith and Xie 2008). Because of difficulties in data collection at high altitudes, there have been little researches published in the last 25 years.

Scientific research can provide critical knowledge on various aspects for the conservation of FNPA mammals. Although basic studies have been conducted on certain animals, much still remains unknown about the behaviour, ecology and reproductivity of the other protected species. We consider that the multidisciplinary collaborations are urgently required to start to redress the balance. Knowledge of most of the listed species remains at a primary stage and funding requests to redress the balance should therefore merit a generous response. We suggest that wildlife management departments establish more special programmes or foundations to encourage FNPA studies. Government agencies and research groups should also endeavour to balance the scientific attention accorded to each protected species, especially to those were poorly researched in the past. Endangered and Critically Endangered species in the IUCN Red List, such as *Equus kiang* and *Lipotes vexillifer*, should be a particular priority due to their conservation status.

For species that are not easy to find in situ, local people could be trained to assist in data collection. Infrared motion-triggered cameras are particularly useful for monitoring animals and have been widely used in mammal resource surveys, population estimates, and behavioral ecology (Carthew and Slater 1991; Karanth and Nichols 1998). Using this technology, information on animals and their condition can be easily obtained with minimal disturbance to them. Other technologies, such as remote sensing (RS) and geographic information systems (GIS), may also enhance the monitoring and management efficiency of protected species.

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