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Cat research in China

There are 55 species of terrestrial carnivores in China. Before the mainland was open to the outside world in 1978, most scientific research about wildlife emphasized morphological descriptions, geographic distributions, breeding traits, food habits, and economic values. This scholarship was consolidated into the Fauna Sinica Carnivora (Gao 1987).

Beginning in 1980 the government of China also expanded and emphasized the country's nature reserves. In 2007 the number of national and provincial reserves reached 1083 (China environment status bulletin of 2007, <http://www.mep.gov.cn/plan/zkgb/>). This large area of 136,256,849 ha (1.4 million km²) of protected land created habitat conditions suitable for the recovery of some wildlife populations. Since 1989 enforcement of China's Wildlife Conservation Law has curtailed illegal hunting and capturing of wild animals in many areas. Some carnivore populations are recovering, as evidenced by more traces, and are even causing problems in remote areas by preying on livestock (Johnson et al. 1996, Zhang 2004, Cai & Jiang 2006, Baatr et al. 2008).

Thirteen of the world's 37 wild cat species live in China. Wild cats were once hunted everywhere for their high quality fur and values in Chinese traditional medicine (Wang 1998, Sunquist & Sunquist 2002, IUCN 2010). Before the 1970's local residents were encouraged to hunt tigers and leopards as pests. But the government soon realized that unplanned harvesting would push some of these rare animals to the verge of extinction and conservation measures were put into action from the late 1970s to the present. However, due to their cryptic behavior and low population numbers, scientific research on carnivores is still rare in China. Details on population number, distribution, and status are needed for planning effective population management and habitat conservation.

In this paper we summarize ecological studies and conservation progress of wild cats in China by reviewing and summarizing research published since 1987. We hope this paper will serve as a reference for researchers and policy makers carrying out scientific studies and designing management plans.

Data collection procedure

Publications on Chinese wild cat ecology were found by browsing the websites of China National Knowledge Infrastructure (CNKI), Wangfang Data, and international journal database of ProQuest, IngentaConnect, Elsevier, ISI Web of knowledge, and Wiley-Blackwell. We also checked China National Library for books and research papers. Related ecological topics, habitat management, population conservation status and recovery trends were analyzed accordingly. Detailed population distribution data and status reports from some reserves were not used if we considered the data biased or not based on adequate field survey efforts.

Results and Analysis

Taxonomy and status

According to Fauna Sinica Carnivora there are 6 genera and 13 species of wild cats in China, while Smith & Xie (2008) recognized 8 genera and 12 species of felids. The authors of the latter book consider the distribution of the fishing cat *Prionailurus viverrinus* in Taiwan to be incorrect, but, even though this does not confirm its presence in China, Wang (2003a) claims he saw a fishing cat pelt in southern Yunnan Province. The Chinese mountain cat *Felis bieti*, North-China leopard *Panthera pardus japonensis* and South China tiger *Panthera tigris amoyensis* are endemic species or subspecies to China (Wang & Xie 2004; Table 1).

All the wild living cat species were assessed as Endangered or Critically Endangered except the leopard cat *Prionailurus bengalensis* by the China Species Red List (Wang & Xie 2004; Table 1).

Among the 13 cat species tiger, snow leopard *Panthera uncia* and fishing cat are listed as Endangered, and Amur tiger *P. tigris altaica* and Amur leopard *P. p. orientalis* as Critically Endangered in the IUCN Redlist (IUCN 2010). The South China tiger is suspected to be extinct in the wild is therefore listed as Critically Endangered (Possibly Extinct in the Wild; Tilson et al. 2004, Xu et al. 2007, IUCN 2010).

Ecological Studies

Research studies on the genus *Felis* sparsely address population distribution, food hab-

its, breeding periods, habitat selection, and genetic diversity (Liu et al. 1999, Ren 2002). Taxonomic analysis by traditional and genetic methods revealed the Chinese mountain cat, the only endemic cat in China, has a distribution reduced to Qinghai and Sichuan Provinces (Liao 1988, He et al. 2004). Distribution surveys and population assessment for the jungle cat *Felis chaus*, manul *Otocolobus manul* and wildcat *Felis silvestris* were reported by Yin & Liu (1993) and Jiang et al. (2005). For marbled cat *Prionailurus marmorata* and golden cat *Catopuma temminckii*, the only reports were for distribution by Sun & Gao (1976), and Ren (2002). Most of the research on small cats focused on the leopard cat (Han et al. 1995, Luo et al. 1995, Wang et al. 1997, Bai et al. 2004, Bao et al. 2005).

For medium sized cats there was only one report on the distribution of the clouded leopard *Neofelis nebulosa* (Yang et al. 2009) and there were two on food habits, suitable habitats and population numbers of lynx *Lynx lynx* in northwest and northeast China (Abdukadir et al. 1998, Tian et al. 2002). Our research revealed that hares and birds were the main food for lynx at a nature reserve in Inner Mongolia (Yuan 2009).

Studies on big cats have been given much attention because it is easier to find the activity traces in the field. Reports from two nature reserves in Shanxi Province revealed the number of leopards was declining and they preyed on livestock in winter when wild prey was hard to catch (Wang et al. 1995a, Qiu et al. 1998). A field survey was conducted in Henan Province and the number of leopards was estimated at 40-68 individu-



Manul (Photo M. Foggin)

Table 1. Species distribution and threatened status of wild cats in China.

Genus	Species	Distribution provinces*	Conservation category**	Threatened status	
				CHINA	IUCN
<i>Felis</i>	<i>silvestris</i>	XJ, GS, NX, SC, YN	II	CR	LC
	<i>bieti</i>	QH, SC	II	CR	VU
	<i>chaus</i>	YN, XZ	II	EN	LC
<i>Otocolobus</i>	<i>manul</i>	XZ, XJ, QH, GS, NMG, HeB, SC	II	EN	NT
<i>Pardofelis</i>	<i>marmorata</i>	YN	PC	CR	VU
<i>Catopuma</i>	<i>temminckii</i>	JX, ZJ, FJ, GD, GX, GZ, HuN, HuB, SC, YN, XZ, AH, HeN, S'X	II	CR	NT
<i>Prionailurus</i>	<i>bengalensis</i>	All provinces except XJ	PC	VU	LC
	<i>viverrinus</i>	TW			EN
<i>Lynx</i>	<i>lynx</i>	XJ, XZ, QH, SC, YN, GS, NMG, SX, HeB, HLJ, JL	II	EN	LC
<i>Neofelis</i>	<i>nebulosa</i>	AH, JX, ZJ, FJ, GD, GX, GZ, HuN, HuB, S'X, SC, YN, XZ, GS, TW, HeN	I	EN	VU
<i>Panthera</i>	<i>pardus</i>	XZ, YN, GZ, SC, QH, HuN, HuB, JX, FJ, GD, GX, S'X, SX, HeB, BJ, HeN, AH, HLJ, JL	I	CR	NT
	<i>tigris</i>	XZ, YN, GD, FJ, HuN, JX, HLJ, JL	I	CR	EN
	<i>uncia</i>	QH, XZ, XJ, GS, SC	I	CR	EN

*Abbreviations stand for provinces and autonomous regions. AH for Anhui Province, BJ for Beijing, FJ for Fujian P, GD for Guangdong P, GS for Gansu P, GX for Guangxi AR, GZ for Guizhou P, HaiN for Hainan P, HeN for Henan P, HuB for Hubei P, HuN for Hunan P, JX for Jiangxi P, NMG for Inner Mongolia Autonomous Region, SC for Sichuan P, S'X for Shan'xi P, SX for Shanxi P, TW for Taiwan P, XJ for Xinjiang AR, XZ for Xizang AR, YN for Yunnan P, ZJ for Zhejiang P.

**I stands for national class one key protection species, II for national class two protection, PC for provincial class.

als in the remote mountainous areas for the years 1997-1999 by Wang et al. (2001). The authors indicated habitat fragmentation and poaching were the main causes of population decline. A study on food habits on the South-China leopard *Panthera p. amoyensis* indicated that food components varied with habitat and prey resources. The main prey changed from ungulates to bamboo rodents and further diversified with declining habitat quality (Kenneth et al. 1993, Hu 1994). Field surveys indicated a decline in Amur tiger numbers from 151 in the 1970's to 20-30 in the 1980's. There were 16-22 tigers in the early 1990's but the number decreased to 12-16 tigers during the later 1990's (Hao et al. 1997). A regional survey found 9-11 tigers in Heilongjiang Province in 2004 (Wu et al. 1994, Sun et al. 2005), whereas the number was around 7-9 in Jilin province (Li et al. 2001). Predation on livestock by tiger was severe at the Hunchun nature reserve (Liu et al. 2006) which may imply this area is the main distribution range of Amur tiger in China. The Bengal tiger is only known to live at Motou, Tibet with an estimated population of 11 in 1996, but this number decreased to 4-5 due to lack of prey (Qiu et al. 1997). The problem of livestock predation was locally

severe (Zhang et al. 2002). The distribution of the Indo-Chinese tiger showed a small number of 8-11 near the border of Yunnan province and Myanmar at the end of 1990 (Hu et al. 1999). Recently researchers got several photos of this tiger subspecies at Xishuangbanna nature reserve which proved the tiger is still alive there (Feng et al. 2008). No other ecological study was conducted for these tigers. Historically the South China tiger was distributed widely from the northwest to the southwest including southern China (Xiang et al. 1987). During the 1990's there were still tracks of tigers living in Guangdong and Jiangxi provinces (Koehler 1991, Yuan et al. 1994, Wang et al 1999), but currently there is no longer any evidence of resident tigers and they are only suspected to exist in the remote areas of Guangdong, Hunan, Jiangxi and Fujian provinces (Liu et al. 2002, Huang et al. 2003, Huang et al. 2004, Tilson et al. 2004, Liu & Peng 2005). As Tan Bangjie stated in 1982, passive protection measures to prohibit hunting are not enough to save the South China tiger, habitat rehabilitation and prey population recovery must be promoted in advance (Ma 1996). This goodwill was broken by the hunting activity to eliminate wild boars, the main prey of tiger, in Jiangxi province in

recent years (http://news.xinhuanet.com/school/2007-11/24/content_7136705.htm). Studies of snow leopards have recently surged with the support of World Wildlife Fund (WWF), Wildlife Conservation Society (WCS) and other international organizations. Population density, habitat, activity patterns and food habits of snow leopard were studied in Qinghai Province and Xinjiang Autonomous Region (Liu et al. 2003, Ma et al. 2005, Xu et al. 2005, Ma et al. 2006, Xu et al. 2006a, Xu et al. 2006b, Ma et al. 2007, Janecka et al. 2008, Xu et al. 2008).

Habitat Management

The established nature reserves supply suitable habitats for all of the wild cats. According to the China Red Data book of Endangered Animals (Wang 1998) improved management efficiency within nature reserves and better enforcement of anti-poaching laws is essential for recovery of cat populations. Since cat populations require large territories and abundant prey, their recovery cannot be expected to occur in a short time period. The problem of livestock predation by cats increases with lack of natural prey. Meta-populations require more habitat corridors linked to reserves



Fig. 1. Overview on the provinces of China.

and some nature reserves should be enlarged (Gao & Ma 1993).

Conclusion

Because the large cats of China are the most conspicuous species and attract more attention than smaller cats, ecological research has focused on them. A lack of research funds for studying the small cats has dampened the interest of scientists in investigating their ecology. This situation must be rectified by providing funds for the application of modern research techniques such as radio telemetry, molecular identification, and camera trapping studies. Only with detailed information on distribution, food resources, population genetics, and

habitat degradation can a practical conservation plan for population recovery be implemented. This is especially important in protected areas like nature reserves and for those species that are critically endangered. We are hopeful that with more effort placed in basic ecological studies and in curtailing illegal hunting and trading, wild cat populations will be maintained or allowed to increase. With improved management wild cat populations should be able to increase to levels experienced prior to the 1970s.

Acknowledgements

This paper was supported by the National Key Project of Scientific and Technical

Supporting Programs Funded by Ministry of Science & Technology of China (No.2008BADB0B01), and National Natural Science Foundation of China (No. 30570305). We are grateful to Urs Breitenmoser and two reviewers for comments on early drafts of this manuscript.

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