Meeting report

Giant panda conservation science: how far we have come

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The giant panda is a conservation icon, but science has been slow to take up its cause in earnest. In the past decade, researchers have been making up for lost time, as reflected in the flurry of activity reported at the symposium *Conservation Science for Giant Pandas and Their Habitat* at the 2009 International Congress for Conservation Biology (ICCB) in Beijing. In reports addressing topics ranging from spatial ecology to molecular censusing, from habitat recovery in newly established reserves to earthquake-induced habitat loss, from new insights into factors limiting carrying capacity to the uncertain effects of climate change, this symposium displayed the vibrant and blossoming application of science to giant panda conservation. Collectively, we find that we have come a long way, but we also reach an all-too-familiar conclusion: the more we know, the more challenges are revealed. While many earlier findings are supported, many of our assumptions are debatable. Here we discuss recent advancements in conservation science for giant pandas and suggest that the way forward is more direct application of emerging science to management and policy.

Keywords: giant panda; conservation science; habitat analysis; spatial ecology; molecular census; sustainable populations

1. INTRODUCTION

When we arrived on the giant panda scene about 15 years ago, we were surprised by how little was known about the world's favourite animal—and how this dearth of knowledge prevented meaningful conservation management in wild and captive settings. After a promising start (e.g. Schaller *et al.* 1985), it appeared that science had dropped the panda ball. Maybe the ball got rolling again in 2000, when the San Diego Zoo and WWF-US co-organized Panda 2000, a

major undertaking bringing 230 scientists and officials (50 from China) together in San Diego to share the latest findings. East met West, captive managers met field biologists, and many of us learned that panda conservation science had not been so stagnant as we thought, though much of it was Chinese research flying below our radar. Even George Schaller, founding father of Western panda conservation science, and noted pessimist concerning the panda's future, was impressed with the outcome of this conference, published in Lindburg & Baragona (2004). In the forward to this book, he remarked: 'In the 1980s, I was filled with creeping despair, as the panda seemed increasingly shadowed by fear of extinction. But now, in this new millennium (this book) rightly projects hope, optimism, and opportunity. As the volume editors note, the prospects for saving the giant pandas are today unequalled'.

The giant panda symposium at ICCB was a long overdue opportunity to review the activities of the last 10 years. The purpose of our brief report here is to highlight two major points from the symposium. First, panda conservation research is no longer impeded by lack of communication among international partners, and findings often grace the pages of *Science*, *Current Biology*, *Conservation Biology*, *Conservation Genetics*, *Biological Conservation* and *Biology Letters*, among others. Second, there has been an explosion of knowledge since Panda 2000, all of which will continue to improve opportunities to effectively conserve and manage this iconic species.

2. MAJOR THEMES

(a) *Identifying and measuring critical habitat variables*

Panda habitat has been the subject of more research than any other aspect of panda ecology. As is so often the case in science, just when we believe a conventional wisdom has been established, a new fact comes to light that forces the need to reassess the original premise. For example, Swaisgood and colleagues presented a new analysis from data collected across more than 70 per cent of the panda's range as part of the State Forestry Administration's Third National Survey (Yu & Liu 2004). It turns out—on a landscape scale—that topographic slope is not an important predictor of habitat use, as is commonly believed, but old-growth forests are. Old-growth forest also appears to be an important resource for panda mothers to rear their young. In the absence of warm, dry, panda-sized dens in large trees, panda mothers may be struggling to keep cubs alive in less desirable rock caves (see also Zhang *et al.* 2007). What should we do with all those recent habitat suitability models—and conservation planning and policy recommendations—based on a different understanding of habitat suitability (Liu *et al.* 2001; Shen *et al.* 2008)? More important, perhaps, is what these new results mean for the logging ban (Loucks *et al.* 2001; Morell 2008), soon to expire throughout the panda's range. As officials in the Chinese State Forestry Administration ponder this decision, it is important that they understand the importance of old growth for pandas.

Of course, attention remains focused on the most important question in panda conservation today—how

much habitat is out there and is it continuing to be lost? Ouyang (Chinese Academy of Sciences) reported that, based on satellite imagery, there has been an overall range-wide loss in habitat, but acknowledged encouraging localized gains from China's visionary 'Grain-to-Green' policy (Loucks *et al.* 2001). Also heartening is Liu's (Tsinghua University) GIS-based findings that at least in one new reserve (Guanyinshan) panda habitat is re-establishing itself. We can hope that a similar process is at play in the more than 50 new panda reserves established in the past two decades, despite evidence to the contrary in one key reserve (Liu *et al.* 2001).

No discussion of habitat availability would be complete without addressing the potential aftermath of the massive 2008 earthquake. Ouyang tackled this much-debated issue, concluding that range-wide loss has been about 5.5 per cent. As this species normally lives at low densities, it may well be that pandas have temporarily left the quake-damaged areas to forage elsewhere while the bamboo re-establishes itself. And, of course, all of this plays out against the backdrop of one great uncertainty—the effects of climate change. Although the data are still emerging and the best models still need to be identified, Delion (Smithsonian's National Zoological Park) demonstrated how theoretically climate alterations could cause the loss of 35–40% of panda habitat in the next 80 years.

(b) *Molecular ecology steps forward*

The notoriously intractable question—how many pandas are there?—was addressed at the conference both in a plenary address by Fuwen Wei and by several symposium speakers. With the application of modern molecular censusing techniques using faecal samples, we have a much better estimate of giant panda population size (Zhan *et al.* 2006)... or do we? Even these seemingly more rigorous estimates of population size are not immune to challenge (Guo 2007; Garshelis *et al.* 2008; Zhan *et al.* 2009). Regardless, wild panda numbers are extremely low, with the most optimistic estimate under 3000. Population census is not the only disparity highlighted by molecular censusing. Two genetic studies suggested female-biased dispersal (Hu, Chinese Academy of Sciences; Zhan *et al.* 2007), which is also supported by direct observations for one GPS-collared subadult female (Zhang). In contrast, one intriguing study reported by Zhu (Chinese Academy of Sciences) found genetic evidence for male-biased dispersal. In another report with immediate implications for policy makers, Zhu shared DNA evidence that rivers, and perhaps roads, are barriers to gene flow. Ouyang confirmed that these findings supported inferences gleaned from the Third National Survey that pandas avoid roads.

(c) *Other ecological and socioeconomic research*

Critical new ecological information is trickling in now that the Chinese government has lifted the decade-long moratorium on radiocollaring pandas (review in Durnin *et al.* 2004). Zhang reported new findings—based largely on data gathered from a few GPS satellite

collared pandas in the Foping Nature Reserve—that challenge some of our notions about panda mating ecology. Most striking was the documentation of an adult female that temporarily dispersed up to 50 km from her home range during the mating season—twice. What does this mean for our understanding of panda mating strategies and gene flow? Zhang also provided new evidence that greatly expands previous estimates of home range size estimated from VHF radiotelemetry.

Rounding out the symposium, two presentations from Michigan State University further increased our understanding of the all-important socioeconomic context surrounding panda conservation. Wei reported preliminary evidence that the increasing number of ecotourists to the Wolong Nature Reserve (a UNESCO World Heritage Site) affected habitat use patterns by pandas. However, the May 2007 earthquake halted tourism, allowing pandas to resume use of habitat in areas previously frequented by tourists. Thus, this catastrophe may be providing the chance for policy-makers to reconsider more appropriate strategies to manage tourism (and other human activities) in sensitive panda areas (see also Wang *et al.* 2008). In this context, Guangming He reported an interesting programme predicting such impacts: an open-access web-based programme to model the effects of various socioeconomic variables, a tool that may be especially useful for facilitating dialogue between scientists and policy-makers.

3. SYNTHESIS AND FUTURE DIRECTIONS

Although much progress has been made, there are still gaps in our scientific knowledge that need to be closed if we are to develop a more informed conservation strategy for pandas. One of the most difficult, but important, challenges will be identifying (and then enhancing) the ecological variables that limit population size. Only then can sustainable populations be realized. That knowledge will also guide the implementation of another high-priority—re-establishment or augmentation of populations through translocation of surplus or rescued wild pandas or release of captive-reared individuals. Development of such reintroduction programmes will meet considerable obstacles that can only be overcome if science is firmly wedded to management (Armstrong & Seddon 2008; Swaisgood in press). The ecology and behaviour of movement patterns will also be critical to designing a reserve and corridor system that will accommodate panda movements, such as long-distance dispersal, necessary to maintain genetic and demographic health. Too often policy makers espouse a 'build-it-and-they-will-come' approach to establishing linkages to unoccupied reserves. However, in reality, many animals will not disperse and settle in these areas unless appropriate behavioural and environmental considerations are met (Stamps & Swaisgood 2007; Swaisgood in press). To date, only four pandas have been tracked since the advent of GPS satellite telemetry, largely owing to the government moratorium on radiocollaring that has recently been lifted. Certainly, an expected increase in tracking giant

panda movements using the latest remote technologies (Rutz & Hays 2009) will help inform the processes important for conservation decision-making.

Finally, as can be ascertained from the affiliations listed in the symposium presentations (see electronic supplementary material), western zoos have played a significant role in conservation science for wild pandas, suggesting that zoos are beginning to fulfil their stated goals of becoming conservation organizations (Swaisgood 2009). Zoos also have contributed significantly to the dramatic increase in biomedical, reproductive and behavioural knowledge that has helped create a sustainable *ex situ* conservation breeding programme for this notoriously difficult-to-breed species (Wildt *et al.* 2006). This success has been largely based on scientists representing diverse disciplines (from both Chinese and western institutions) working hand-in-hand to develop basic knowledge and then transforming that intellectual capital into practical problem-solving. While this same strategy has been initiated for wild giant pandas, the challenges are far more complex. The recent giant panda symposium in Beijing demonstrated encouraging progress in the production of new biological information on the giant panda and its habitat.

The future of the panda should be bright, given the considerable public appeal, financial and institutional support from China and abroad and the apparent political will of China's State Forestry Administration to save the animal they refer to as their national treasure. Science is advancing, rapidly. Now it is time for science, management and policy-making to advance together.

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