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Pragmatic management increases a flagship species, the Himalayan brown bears, in Pakistan's Deosai National Park

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ABSTRACT

Deosai Plateau in Northern Pakistan was designated a national park to protect the largest remnant population of brown bears in Pakistan. The natural resources of this high elevation (3500–5000 m) park make a significant contribution to the livelihood of local and nomad communities. The present legislation excludes people from a park, which increases conflicts between management and local people. However, a pragmatic approach was adopted to involve people in conservation in Deosai. Community participation, achieved by recognizing rights and introducing incentives, reduced resistance against the conservation efforts, reduced grazing pressure in bear habitat and helped reduce poaching. The size of the brown bear population was set as an indicator of park success, and was monitored annually from 1993 through 2006. We observed a 5% annual growth of the brown bear population, suggesting that the conservation program has been successful due to a successful cooperation between an NGO, people, and the park management.

The increase of the bear population is significant, because we observed an extremely low reproductive rate, due to late age of first reproduction (8.25 years), a long reproductive interval (5.7 years), and a small litter size (1.33). The reproductive rate of the Deosai population is the lowest yet documented for brown bear populations. Poor habitat quality, low quality food, high seasonality, and extreme weather conditions in the Himalaya probably explain the poor reproductive performance. Considering such low reproduction and known exchange of individuals with neighboring populations, we believe that the observed growth was a sum of reproduction and immigration. Brown bears are declining throughout South Asia and often have low-productive rates. Therefore, conservation efforts for brown bears in this region must target reducing human-caused mortalities, particularly of adult females. Involvement of people can increase efficiency in conservation, in addition to reducing cost and conflicts.

1. Introduction

Protected areas (PA) are considered to be vital for both biodiversity conservation and sustainable development, and more than 100,000 PAs have been created worldwide (2003 United Nations List of Protected Areas). The number of PAs has grown impressively in South Asia during the last five decades; with about 1500 sites on the UN List, covering 6.87% of the

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total land (Chape et al., 2003). However, rapidly increasing human populations and demands for natural resources have arrested the creation of PAs in a struggle between conservation and development. Ecologically sustainable development that accommodates the economic and social needs of the society is the emerging perspective for PA management (Phillips, 1994). Resident communities are viewed increasingly as important stakeholders and their participation often is deemed crucial for the success of the PAs (Mishra et al., 1989; Dearden et al. 2005; Hiwasaki, 2005), although their participation in itself does not ensure success (Oates, 1995, 1999). This approach is very relevant in south Asian countries, where the livelihood of rural communities and PAs are essentially linked (Ghazali and Khairi, 1994).

In contrast, Pakistan's conservation policies and management strategies have changed little. Management of the >200 PAs in Pakistan occurs without public participation and current legislation neither recognizes public rights nor allows resource utilization within protected areas. Confrontations with local communities, financial constrains, and poor management infrastructure contribute to the fact that most PAs are not functional. IUCN (2000) developed a comprehensive action plan framework for strengthening the country's PAs and emphasizing community participation, but it largely remains to be incorporated into national policy.

Deosai National Park (DNP), in the Northern Areas of Pakistan, was created in 1993 (GoP Notification 1993). Alpine pastures are a rare and usually degraded resource in Northern Pakistan (Ehlers and Kreutzmann, 2000), where much of the landscape is just rock and ice. The vast grazing grounds of Deosai make a significant contribution to the livelihood of local and nomad communities. Fishing, falconry, and poaching of brown bears (*Ursus arctos*) for fat are other means of income. Because the wildlife legislation (Northern Area Wildlife Preservation Act 1975) does not allow any kind of resource extraction from a park, the new legal status of the area was not acceptable for the concerned communities. The Himalayan Wildlife Foundation (HWF), a nongovernmental organization that was instrumental in the creation of the DNP, took the case of Deosai as an opportunity to test emerging approaches towards PAs, where ecological sustainable rural development is linked with biodiversity conservation (Mishra et al., 1989). In 1993, HWF collaborated with the Northern Areas Forest and Wildlife Department and local communities on a conservation program based on three main principles: (1) recognition of community rights through a zoning plan of the park; (2) protection of biodiversity through a system of enforcement and monitoring; and (3) community involvement and assistance through (a) employing staff from neighboring villages, (b) developing ecotourism and training locals for various tourism-related services, (c) assisting communities and mobilizing resources for development projects, and (d) generating revenue and sharing it with the communities (see HWF, 1999a for details). The zoning plan allowed communities to continue utilizing pastures within specified areas of the park, but not in a core area for bears. This provision reduced the conflict with communities over park resources, and at the same time reduced human presence and grazing pressure in core bear areas. Principal (3) further catered cooperation and participation of the communities in park management. Monitoring and park management were completely integrated, as staff employed for law enforcement maintained permanent presence in the park, monitored individual bears, and contributed most of the data. Their continuous patrolling in the study area was probably the major factor deterring poaching.

The primary objective of DNP was to protect a small population of highly threatened Himalayan brown bear (*U. a. isabellinus*); therefore its population size was set as an indicator of the park's success from the beginning (HWF, 1999a). Achieving such an objective was complicated, because the population was very small, facing multiple threats, and living at the elevational extreme of the brown bears' range. Brown bears are found throughout most of the northern hemisphere and occupy a variety of habitats from tundra to temperate forests (Servheen et al., 1999). Variation in energy and environmental conditions over a geographical range induces variation in life history (Rosenzweig and Abramsky, 1993), consequently life-history traits in brown bear are diverse (Dahle and Swenson, 2003a; Stringham, 1990; Zedrosser, 2006). Habitat stability (i.e., the degree of its seasonality and predictability) and temporal stochasticity are the two environmental factors that have major impacts on life history (Clark and Yoshimura, 1993; Southwood et al., 1974). In environmental extremes (high seasonality, low productivity and temporal stochasticity), a conservative life-history strategy is expected (Boyce et al., 2002; den Boer, 1968). Deosai represents a highlands ecosystem (>3000 m, Mani and Giddings, 1980), characterized by unpredictable, unstable, highly seasonal, and extreme environmental conditions.

The life history of high-altitude brown bears has never been documented. However, brown bears living at higher latitudes in North America and Europe are known to be less productive (Ferguson and McLoughlin, 2000; Boyce et al., 2002; Swenson et al., 2007). High latitudes and altitudes are similar in environmental factors (e.g. thermic-seasonal events), though the latter have more severe conditions (Mani, 1990). The Deosai population might therefore be less productive than populations at lower altitudes. The reproductive performance and survival of individuals determine population growth (Schwartz et al., 2006). Because the Deosai population is small and facing threats like poaching and habitat loss, we considered it essential to document the population's rates of reproduction and mortality in order to formulate an appropriate management strategy for its long-term survival.

Our objectives were to (1) evaluate the effectiveness of park management in terms of the trend of the brown bear population and (2) estimate demographic parameters and factors affecting viability of high-elevation brown bears. Findings of this study can provide directions for the conservation of brown bears living elsewhere in high Asia.

2. Materials and methods

2.1. Study area

The DNP (75°27′E, 35°00′N) is a 1800 km^2 alpine plateau east of Nanga Parbat Peak, Northern Areas, Pakistan. Elevations range from 3500 to 5200 m, with about 60% of the area