SURVIVAL OF DISPERSED ORPHANED CUBS OF TIGER *(PANTHERA TIGRIS TIGRIS)* IN FRAGMENTED HABITAT OF RANTHAMBHORE TIGER RESERVE IN INDIA

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Introduction

Increasing human population and developmental advancement resulting in rapid reduction and fragmentation of available habitats is posing a challenge for long term survival of large carnivores. The incidence of wild carnivores straying out of their habitat in search of space, food and cover into non protected area have considerably increased over the last two decades and have resulted even in mortalities among large carnivores either as a retaliatory action or as a preventive measure (Woodroffe and Ginsberg, 1998; Bekoff, 2001; Treves and Karanth, 2003). Reducing such human caused mortality of large carnivores is critical in retaining such populations (Tilson and Nyhus, 1998; Miquelle *et al*., 2005). Need for characterization and development of relevant measures have been suggested to reduce these conflicts (Nowell and Jackson, 1996; Woodroffe and Ginsberg, 1998; Linnell *et al*., 1999; Goodrich and Miquelle, 2005). Translocation or rehabilitation of animals in conflict to other suitable areas is one potential conservation tool to reduce mortality, alleviate conflict and supplement or re-establish wild populations (Griffith *et al*., 1989; Wolf *et al*., 1997; Goodrich and Miquelle, 2005). Although large number of translocations of wild animals has been conducted in past, the information on effectiveness of this tool is limited and only few studies have documented their successes and failures (Belden and Hagedorn, 1993; Nowell and Jackson, 1996; Ruth *et al*., 1998; Breitenmoser *et al*., 2001; Goodrich and Miquelle, 2005). The information on translocations of large carnivores is limited to their capture and release with little information on subsequent monitoring (Seidensticker *et al.,* 1976; Nowell and Jackson, 1996; Goodrich and Miquelle, 2005). In the present study we provide an insight into the survival of two orphaned tiger cubs at Ranthambhore Tiger Reserve between October 2008 to March 2010. During the study period male tiger cub came into conflict with human and was successfully rescued and rehabilitated in adjoining forest habitat while the female cub moved out into a fragmented landscape. The study also highlights the importance of subsidiary disturbed landscapes as habitats for large carnivores.

Material and Method

Ranthambhore Tiger Reserve (RTR) (1394 sq km) comprising of Sawai-Man Singh wildlife sanctuary (SMS WLS), Ranthambhore National Park (RNP) and Kela-devi Wildlife Sanctuary (KD WLS) forms a major landscape in the western India that holds potential tiger habitat with viable tiger population. The tigers primarily occupy the RNP, however, other areas have also been occasionally used by tigers. According to the biogeoraphic classification (Rodgers and Panwar,1988) the vegetation falls under 4 B (Semi-arid zone and Gujrat,-Rajwara biotic province). The area forms transition zone between the true desert and seasonally wet peninsular India.

A female tiger with two cubs was being monitored near Guda Forest Chowki (GFC), Sawai Madhopur range of RTR during March 2008 using pugmark (Choudhary, 1970; Sawarkar 1987; Singh *et al.,* 2007), camera trap (Karanth and Nichols, 1998) and direct sighting. The tigress however, succumbed to septicemia resulting from a wound on 1st September 2008, leaving ca $\leq$ 12 month old orphaned cubs (*Departmental records*). Both cubs were provided with buffalo meat initially as they were unable to hunt on their own and subsequently live baits were given for a period of two months till they were able to hunt on small preys. Smith (1993) reported that tiger cubs are not able to hunt themselves until they attain age up to 16-17 month and this formed the basis of such interventions. The presence of tiger cubs was established by four types of data: (1) opportunistic sighting (2) indices of presence pugmarks or tracks, kill of wild preys (*viz.* nilgai, wild boar); (3) attacks on domestic animals (*viz.* cattle, sheep and goat) and (4) photo-capture through camera trap. The data was recorded opportunistically in terms of space and time without any sampling plan or control of sampling effort. The data was plotted on a land use land cover map (1:50,000) based on satellite imagery and fieldwork. The locations were mapped using Arc View 3.1 GIS (ESRI, 1996). We estimated 100% minimum convex polygon (MCP) using

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Animal Movement extension (Hooge *et al.,* 1999) of Arc View 3.1 software for tigers and monitored habitat use. The locations of both the animals are shown in Figure 1. Two criteria were used to assess the success of translocation/dispersed orphaned cubs in fragmented habitat: (1) survival and settlement of animals through the first summer and winter, with evidence of predation on wild prey, and (2) absence of conflicts with people and domestic animals.

Results

Two cubs were sighted with a female tigress at GFC during March 2008 for the first time and were aged to be ≤ 3 month old. The cubs were seen unaccompanied following death of the female on 1st September 2008. Their age was assessed between (8-12 months) based on their photo-capture and body size during October 2008 and were identified to be of both sexes based on direct sighting. A total four photo-capture of both cubs were retrieved in camera trap during October 2008 to December 2008 (Fig. 1) in different location. Both the cubs dispersed out in different direction and were subsequently located in the fragmented habitat (Fig. 1).

Male cub monitoring and dispersal

The male cub was located on the outskirts of the national park near the Kutalpura village during February 2009 (Fig. 1) and remained in human dominated landscape for a period of more than a month. Though the animal was sighted on two occasions, the pug marks revealed animal to be continuously moving over an area of 25 km^2 in the human dominated landscape. The animal made frequent kills of domestic pigs and cow calves; however, it could consume the kill only partially due to high anthropogenic disturbances. The general body condition on direct sighting of the animal was poor. Later the animal was responsible for injuring four people and killing domestic livestock in the village, thus resulting in conflict. It was unclear whether the attacks were defensive or a predation attempt by the starving cub. Various attempts to localize the animal for capture were made employing live baits during this period. The animal could finally be located on a kill and was successfully immobilized employing a mixture of ketamine hydrochloride and xylazine hydrochloride at a dose rate of 2.2 mg/kg and 1.2 mg/ kg respectively on 21 March 2009. The animal was translocated to SMS WLS about 25 km from the site of capture (Fig. 1). Analyses of social structure or tiger densities present in this area were not carried out. Subsequent to release, the animal was able to make successful kills of both the wild prey as well as feral. The details are given in Table 1.

Female cub monitoring and dispersal

The female cub naturally dispersed outside the national park and the last photo-capture of the female was recorded on the periphery of RNP (Fig. 1) on 12 December 2008. Subsequently the animal dispersed outside the RNP into fragmented and degraded habitat adjoining SMS WLS which primarily includes ravines of Chambal river. The area holds a considerable population of nilgai, wild pigs and feral cattle besides domestic livestock that venture into the area for grazing. The pugmarks were reported near ravines of Chambal river by villagers and forest staff after one month of last photo-capture. Presence of the female tiger cub was confirmed by pug marks.

Area utilization

Based on the location recorded using pugmark, camera trap, direct sighting and attack on livestock's between 22 March 2009 to March 2010 spanning 365 days, it was inferred that both the sub-adult tigers used an area of 230 km^2 of SMS WLS. The male cub tiger settled in the southern part within SMS sanctuary and used an area of 18 km^2 (minimum convex polygon) (*n*=56 locations) (Fig. 1). Five direct sightings and five photo-captures were recorded in two different locations after release. The animal appeared to be in good physical condition.

The female tigress established itself in the northern part of the SMS sanctuary and used an area of 19 km^2 (minimum convex polygon) (*n*=34 locations). There was no direct sighting of the tigress; though the animal was photo-captured once after dispersal. Pugmarks were frequently recorded near villages and river bank indicating presence of animal and habitat use. (Survival of carnivores is one of the criteria to assess the success of the adaptation of animal in fragmented habitat). Both the tigers settled in SMS WLS and are thriving (≤ 24 month old) (Fig. 2).

Assessment of survival criteria of cubs

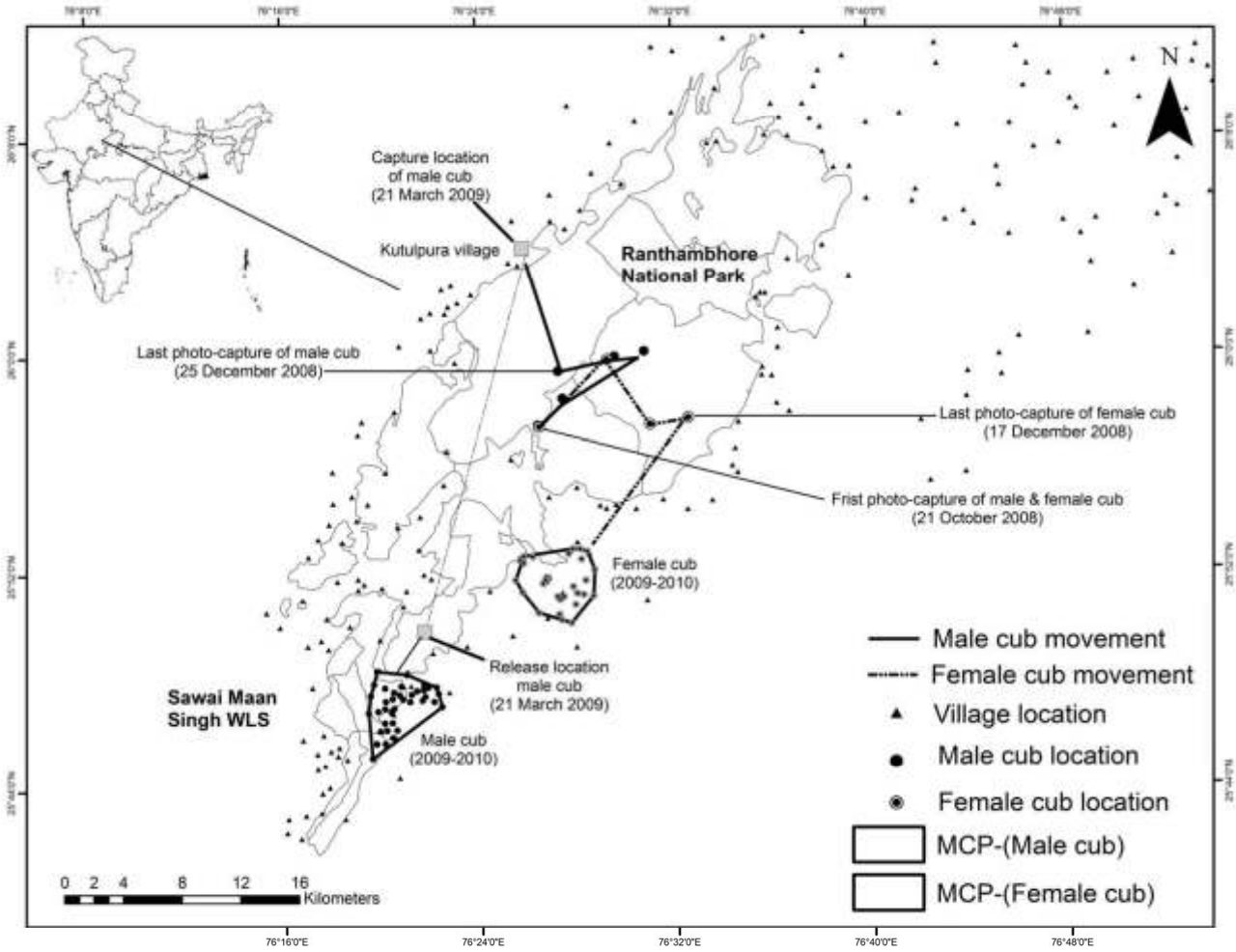
Both the animals met survival criteria to a considerable extent as they survived their first summer and winters, showed limited conflict with humans or domestic animals even though they used human dominated landscapes. Both animals avoided humans and examination of the kills revealed that both were natural prey (*n*=21) and domestic cattle (*n*=11) during summers, however, winter data was not available. The findings of this study suggest that the initial conflicts of these animals might have resulted from hunger as manifested by their poor condition rather than an affinity for people or domestic prey.

Table 1

Characteristics of tigers captured translocated in the RTR of India during 2008–2009.

Tiger ID.	Sex	Estimated Age (years)	Physical condition	Date of release	Cause	Fate
TM-34	Male	1.5	Poor	21-02-2009	Killed livestock and attacked people	Survived
TF-35	Female	1.5	Poor	11-12-2008	Killed livestock	Survived

Fig. 1



Detail of movement and distribution of orphan cubs in Ranthambhore Tiger Reserve, Rajasthan, India during October 2008 to March 2010.

Discussion

Non-protected and marginal protected areas (i.e. IUCN categories < IV) are important and vital for the existence of carnivores, both in terms of increasing the habitat availability, and also allows greater chances of genetic exchange between populations (Treves and Karanth, 2003). These areas contribute effectively in providing suitable habitats for carnivores in distress as they enhance the chances of their survival. SMS WLS, a good tiger habitat with adequate prey densities aided the animals to establish their own territories. Providing protection in these areas together with decrease in anthropogenic pressures would help in long term survival of the species. More than 70% of tiger habitats in the western Indian landscape are unprotected (Chundawat *et al.,* 1999); however, they provide large areas with a higher likelihood of vacant territories. While our sample size is small, this effort represents the documentation of survival of rehabilitated and naturally dispersed orphaned tiger cubs in the wild. Our observations suggest that such rehabilitation of orphaned animals in distress to other suitable habitats might be a feasible option for resolving tiger-human conflicts, and provides an alternative to the killing of

Figure 2

Photo-capture of orphaned tiger cubs reported in Ranthambhore Tiger Reserve during October 2008 to March 2010.
1& 2: Female cub aged 6 to 8 months and subsequently at ≤ 24 month)
3 & 4: Male cub aged 6 to 8 month and subsequently ≤ 24 month

problem causing animals. Since cubs were not radio tagged, the data on their nocturnal activity, predation pattern, behavior in response to human activity could not be obtained. Scrutiny of available literature did not provide information on the survival of orphaned tiger cubs in the wild though survival of orphaned cubs of black bear and grizzly bear has been reported in wild by several workers (Erickson, 1959; Johnson and Leroux, 1973; Payne, 1975; Jonkel, *et al.,* 1980; Alt and Eecham, 1984, Carney and Vaughan, 1987 and Clark, *et al.,* 2000). Our study suggests such orphaned tiger cubs may be appropriate candidates for translocation (those that lack the wariness of people or have made livestock killings), others may discontinue behaviours that initially brought them into conflict and have better chance of survival in the wild. With most tiger populations critically low, reducing mortality and retaining breeding individuals, especially females, is vital. The Indian landscape holds large areas of tiger habitat with relatively low tiger densities. Nonetheless, we believe these techniques may be useful for resolving human-tiger conflicts across their range, and possibly for reintroduction into vacant areas as and/or supplementation of small populations.

Conclusions

Rehabilitation and release of orphaned animal into the wild may offer a viable management alternative rather than sending the animals into captivity or killing them. Based on our study, tiger cubs ≥ 12 months have the ability to survive on their own and if in good condition, can survive and adapt into fragmented landscapes. Younger orphans < 6 months may be reared in captivity with minimal intervention until they are self-sufficient, although they should be prevented from regarding people as provider of food. Thus, rehabilitation and release of orphaned tiger can be successful and may be a viable alternative for managers.

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SUMMARY

Two orphaned tigers cubs aged 8-10 months of either sex were monitored over a period of one and half years between October 2008–March 2010 in the fragmented landscape of Ranthambhore Tiger Reserve (RTR), India. Both animals dispersed out into fragmented landscapes, however the male cub accidently ventured into human habitation and resulted in conflict. The cub was rescued and rehabilitated in an adjoining forest. The female cub dispersed naturally outside the national park area into Chambal ravines. Both the animals were monitored using camera trap and pugmark based tracking method during the study period. Both tiger cubs adapted well in the human dominated (fragmented) landscape, caused minimal conflict, and survived their first winter and summer till they attained the age of $\geq$ 24 months. This paper presents the survival of orphaned cubs in fragmented landscape and highlights the importance of translocation as a tool for alleviating conflict.

Keywords: Royal Bengal tiger, camera trap, human-wildlife conflict, dispersal, translocation.

रणथम्बौर बाघ रिजर्व, भारत के खण्ड प्राकृतावास में दो अनाथ व बिछड़े बाघ (*पैंथेरा टिगरिस टिगरिस*) शावकों का अतिजीवन

रणदीप सिंह, पराग निगम, सुरेन्द्र प्रकाश गोयल, बिशम्भर दत्त जोशी, सुदर्शन शर्मा व रघुबीर सिंह शेखावत

सारांश

दो अनाथ बाघ शावक (आयु 12 माह) को लगभग डेढ़ वर्ष तक (अक्टूबर 2008 से मार्च 2010) रणथम्बौर बाघ रिजर्व के खण्ड भूदृश्य में अनुवीक्षण किया गया। दोनों बाघ उस खण्ड भूदृश्य में बिछुड़ गये, हालांकि नर शावक अकस्मात् ही मानव क्षेत्र में प्रवेश कर गया जो कि मानव–वन्यजीव संघर्ष का कारण बन गया। बाघ शावक को पकड़कर निकटवर्ती जंगल में छोड़ दिया गया। मादा शावक प्राकृतिक रूप से ही जंगल के बाहर बीहड़ में विच्छेदित हो गयी। दोनों जानवरों का अध्ययन के दौरान कैमरा ट्रैप एवं पगमार्क विधि से अनुवीक्षण किया गया। दोनों बाघ शावको ने मानव बहुल क्षेत्र में अपने आपको अच्छे से ढाल लिया जिसके कारण बहुत कम संघर्ष हुआ एवं वह अपनी पहली ग्रीष्म व शरद ऋतु अपने जीवन के 24वें महीने तक देख सके। यह लेख खण्ड भूदृश्य में अनाथ बाघ शिशुओं के जीवन को दर्शाता है एवं पुर्नवासन को संघर्ष रोकने के एक तकनीक के रूप में प्रयोग की महत्ता पर रोशनी डालता है।

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