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Short Communication

Translocation of problem Amur tigers *Panthera tigris altaica* to alleviate tiger-human conflicts

John M. Goodrich and Dale G. Miquelle

Abstract We translocated four Amur tigers *Panthera tigris altaica* captured after killing domestic animals or attacking people; two were released immediately and two following 162 and 388 days rehabilitation. All were radio-collared and released 150–350 km from their capture site. Two translocations were successful: the tigers caused no conflicts with people, killed wild prey, and survived their first winter, although one was poached after 1.1 year and one slipped its collar after surviving 10 months. In the two translocations that were unsuccessful, both tigers moved to areas of high human activity and were killed by people. At least in some cases, translocation appears to be a viable alternative to killing or removing problem tigers from the wild.

Keywords Amur tiger, carnivore-human conflicts, *Panthera tigris altaica*, Russian Far East, translocation.

As human populations encroach on wildlands, human-carnivore conflicts become more frequent, carnivore populations become more fragmented, and mortality from anthropogenic sources increases (Woodroffe & Ginsberg, 1998; Bekoff, 2001; Treves & Karanth, 2003). Reducing human-caused mortality of large carnivores that come into conflict with humans may be critical to retaining such populations (Tilson & Nyhus, 1998; Woodroffe & Ginsberg, 1998; Treves & Karanth, 2003; Miquelle *et al*., 2005). Translocation of large carnivores is one potential conservation tool to reduce mortality, alleviate conflicts, and supplement or re-establish wild populations (Griffith *et al*., 1989; Wolf *et al*., 1997). However, little is known about the effectiveness of translocation of many large carnivores, and although translocations have been conducted, few studies have documented their successes and failures (Nowell & Jackson, 1996; Breitenmoser *et al*., 2001; but see Belden & Hagedorn, 1993; Ruth *et al*., 1998). Consequently, those charged with resolving carnivore-human conflicts regularly take action and make conservation recommendations with little information.

In the Russian Far East depredations by Amur tigers are common, and occasional attacks on people elicit strong responses from local residents (Nikolaev & Yudin, 1993; Miquelle *et al*., 2005). Traditionally, such situations have been resolved by killing offending tigers (Nikolaev, 1985; Miquelle *et al*., 2005). Since 2000 we have been working with the Russian Ministry of Natural Resources' Inspection Tiger Department to resolve human-tiger conflicts in ways that protect citizens' welfare while retaining offending tigers in the wild. In four situations we translocated tigers that could not be otherwise discouraged from conflicts with people.

To our knowledge there have been four other recorded translocations of wild 'nuisance' tigers, but without monitoring results except for one that was killed by another tiger after release (Seidensticker *et al*., 1976; Nowell & Jackson, 1996). Attempts to relocate other large carnivores have met with mixed success (Griffith *et al*., 1989; Wolf *et al*., 1997). Many Amur tigers involved in conflicts with people have been starving or wounded and probably turn to domestic food sources as a last resort (Miquelle *et al*., 2005). We wanted to determine if these animals could be rehabilitated in captivity, if necessary, and released back into the wild without threat to human welfare.

We worked throughout the range of Amur tigers in Russia (Miquelle *et al*., 1999) and captured tigers upon request from Inspection Tiger. We radio-collared tigers (Telonics, Inc., Mesa, USA) and released them near the Sikhote-Alin Biosphere Zapovednik (SABZ; Fig. 1), where our telemetry research programme was based (Goodrich *et al*., 2001).

We translocated four tigers (Table 1) 150–350 km from their capture sites. Three (Pt43, Pt51, Pt52) were captured after killing dogs in villages, and one (Pt57) after it attacked and superficially scratched a person. It was unclear if the attack was defensive or a predation

John M. Goodrich (Corresponding author) and **Dale G. Miquelle** Hornocker Wildlife Institute, Wildlife Conservation Society, 2023 Stadium Drive, Suite 1a, Bozeman, Montana, USA. Email tiger372@yahoo.com

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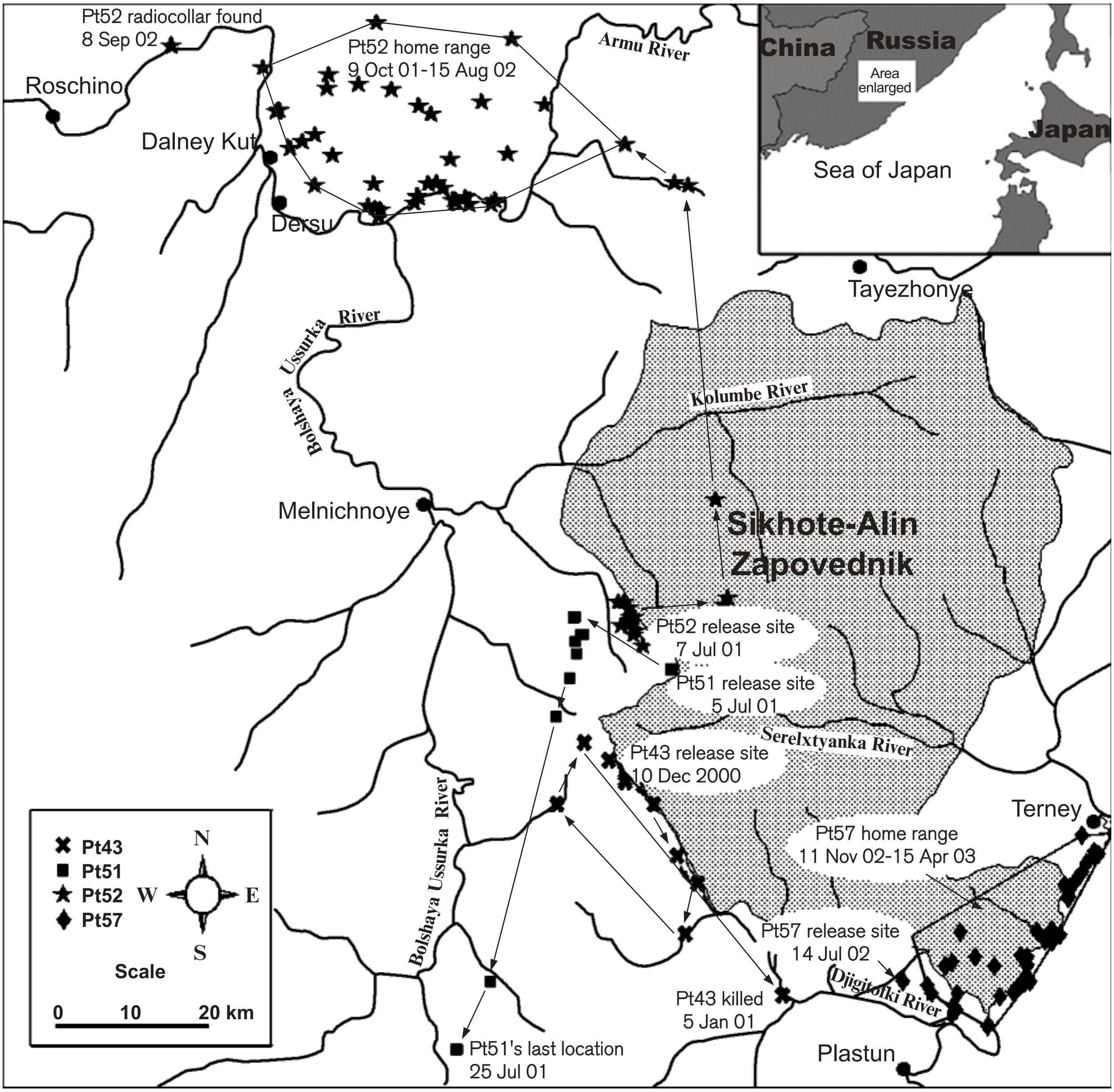

Fig. 1 Study area and movements of tigers (Pt43, Pt51, Pt52 and Pt57) translocated in the Russian Far East during 2000–2003.

Table 1 Characteristics of Amur tigers captured and translocated in the Russian Far East (see Fig. 1) during 2001–2003.

No.	Sex	Estimated age (years)[1]	Physical condition[2]	Problem caused	Days rehabilitated	Fate after translocation
Pt43	M	2	Very good	Killed dogs in village	0	Killed 2 dogs & shot by owner 27 days after release
Pt51	F	2	Poor	Killed dogs in village	388	Suspected poached 20 days after release
Pt52	F	3	Poor	Killed dogs in village	162	Survived 1.1 year & then poached
Pt57	M	0.6	Poor	Attacked person	0	Survived 10 months & then slipped collar

[1]At time of translocation
[2]Rated as poor, fair, good, very good, or excellent based on assessment of body fat, hair coat, and injuries at time of capture (Goodrich *et al.*, 2001)

attempt by the starving cub. Pt51 and Pt52 were rehabilitated in a 1 ha enclosure at Utes Wildlife Rehabilitation Center in Khabarovski Krai (Province) for 388 and 162 days, respectively, because they were both emaciated and Pt52 had recently lost two toes, probably in a trap. The enclosure contained natural forested habitat and was separated from other buildings and enclosures by *c*. 500 m of forest. To minimize conditioning to humans, tigers were fed daily by one person, who left food and vacated the area as quickly as possible. Tigers were fed mostly domestic pig meat because wild meat was rarely available.

Tigers were released into known tiger habitat but without any analyses of social structure or tiger densities in those specific areas. Following release we monitored radio-collared tigers on foot, from vehicles, and from an Antonov-2 biplane (Kerley *et al*., 2002). We attempted to locate animals at least once per week, but this was not always possible because of poor weather and distances dispersed. We located kills by searching areas where tigers remained for > 24 h, by tracking in snow, and by observations from the air. We estimated 100% convex polygon home ranges for tigers monitored for > 6 months.

We used two criteria for assessing translocation success: (1) survival through the first winter, with evidence of predation on wild prey, and (2) lack of conflicts with people and domestic animals. Although reproduction would be the ultimate criteria for success, our studies of radio-collared tigers (both translocated and not translocated) indicate that mortality prior to reproduction is high and apparently independent of translocation (Kerley *et al*., 2002, Miquelle *et al*., 2005). In addition, successful reproduction of male tigers is difficult to demonstrate, requiring genetic analysis of samples collected from offspring.

Both Pt52 and Pt57 met our criteria for success, i.e. they survived their first winter without conflicts with humans or domestic animals. Both avoided people and fed on natural prey ($n = 11$ kills and $n = 1$ kill and one scat for Pt57 and Pt52, respectively) suggesting that initial conflicts resulted from their emaciated condition rather than an affinity to people or domestic prey. Pt57 settled within SABZ, using an area of 299 km^2 ($n = 61$ locations) (Fig. 1). We saw him five times during radio-tracking flights 9–10 months after release and he appeared in good physical condition. Pt52 established a home range (614 km^2; $n = 43$ locations), but was poached 13.5 months after release. We believe this poaching event was unrelated to translocation. Rather, she met the same fate as most Amur tigers: 83% ($n = 23$) of deaths of radio-collared tigers were caused by humans, and 73% were poached (Miquelle *et al*., 2005). Reliance on survival as criterion for success would make most Amur tigers, translocated or not, unsuccessful.

Neither Pt43 nor Pt51 met our criteria for successful translocation. Both moved to areas with high human activity. Pt43 preyed on domestic dogs after translocation, despite good body condition, and was shot as it ran from a barn where it had consumed two dogs. We lost contact with Pt51's signal, despite extensive aerial searching, 20 days after release after her movements became localized near a logging camp. We believe she was poached and her collar destroyed, a pattern we have observed in other poaching incidents (Kerley *et al*., 2002). Pt51's extended captivity (>1 yr) may have conditioned her to humans. Despite her young age (<1 year) at capture, releasing Pt51 as soon as she was fit may have improved her chances of survival. Pt57 survived despite his young age (7 months) and poor condition when orphaned.

Although all tigers were released near SABZ, only one (Pt57) settled there for >1 month. SABZ contained higher prey densities, stricter protection against poaching, and consequently, higher tiger densities than surrounding areas (Miquelle *et al*., 1999; Smirnov & Miquelle, 1999), probably making it difficult for tigers to establish a territory. This characteristic makes similarly protected areas poor places to release translocated animals. However, $>70\%$ of tiger habitat in the Russian Far East is unprotected (Miquelle *et al*., 1999), providing large tracts of land with a higher likelihood of vacant territories.

While our sample size is small, this effort represents the only documentation of tiger translocation with subsequent monitoring. The data suggest that in some cases translocation is a feasible mechanism for resolving Amur tiger-human conflicts, and provides an alternative to killing problem animals. While some tigers appear inappropriate candidates for translocation (e.g. man-killers or Pt43, which lacked the wariness of people that most tigers display), others (i.e. Pt52 and Pt57) may discontinue behaviours that initially brought them into conflict and can survive in the wild. With most tiger populations critically low, reducing mortality and retaining breeding individuals, especially females, is vital. Our success was low, but improvements in techniques (e.g. minimum rehabilitation periods, better discrimination of potential candidates) may increase success. The Russian Far East holds large tracts of tiger habitat with relatively low tiger densities and low probability of encounters with people. Whether the same patterns would be noted with tigers in more densely populated areas of Asia is unclear. Nonetheless, we believe these techniques may be useful for resolving human-tiger conflicts across their range, and possibly for reintroduction or supplementation of small populations.

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Biographical sketches

John Goodrich is Field Coordinator of Sikhote-Alin carnivore research projects for the Wildlife Conservation Society. He has lived and worked in Russia for 10 years, where he conducts research on tigers, Asiatic black bears, brown bears and Asiatic lynx.

Dale Miquelle is Director of the Wildlife Conservation Society's Russia Program. He has lived and worked in the Russian Far East for 13 years, where he oversees conservation and research programs with a focus on large carnivores.