National Fish and Wildlife Foundation
Final Programmatic Report

Project Name and Number:	Ecology of Amur Tigers in Primorye (2004-0103-017)
Recipient Organization/Agency:	Wildlife Conservation Society
Recipient Contact:	Colin Poole, Director WCS Asia Program ______
Recipient E-mail:	cpoole@wcs.org_____________________________
Recipient Phone:	718.220.5885_______________________________
Recipient Web Address:	www.wcs.org_______________________________

1) Summary

In four to five sentences, provide a brief, cumulative summary of the project.
We completed the first year of a new telemetry-based field research project designed to collect ecological data on Amur tigers and leopards in southwestern Primorski Krai, where tigers exist in an isolated sub-population of about ten animals together with the last remaining population of about 30 Amur leopards. The goal is to collect data on both species in this location to provide information crucial to conservation planning in an area that is subject to considerable ongoing and planned development. Field work began in mid-October 2006 with a very successful first capture season – we captured three adult tigers (two male, one female) and two adult male leopards. We identified two potential health problems – heart murmurs and abnormal sperm – in both species, the significance of which is unclear, but may be indicators of inbreeding depression.

2) Introduction

Describe the original conservation need and objectives.
The Amur or Siberian tiger is a classic landscape species, ranging across a variety of human-influenced landscapes, and competing with people for critical habitat and resources. International efforts have been underway for more than 15 years to save this population from extinction. After an apparent rapid decline in numbers in the early 1990s, in recent years, partly due to a fifteen-year-long effort of the Wildlife Conservation Society's (WCS) Siberian Tiger Project and associated conservation activities, the tiger has begun to show signs of stability. Poaching has declined, and improved scientific understanding of the species' ecological requirements has enabled planners to begin taking constructive long-term conservation actions, including: protected area planning and management; establishment of a legal basis for corridors between protected areas; road closures to reduce mortality of tigers and their prey; management of game populations outside protected areas to benefit both humans and tigers; education and outreach to ensure a local understanding of the role tigers play in the ecosystem; bi-lateral discussions to establish transboundary reserves that will connect tiger populations in the Russian Far East and northeast China, and reestablish viable tiger populations in China.

The effectiveness of nearly all these projects depends on a continued strong, scientific effort to understand the ecology of this northernmost population of tigers. Over the past twelve years, the Siberian Tiger Project has successfully developed a baseline database on Amur tigers through persistence and a commitment to incremental increases in our understanding of tiger ecology, including population dynamics, predator-prey relationships, social structure, dispersal, reproduction, and survivorship. This database is the backbone of our conservation efforts, and is what distinguishes our efforts from all other conservation organizations working in the region: we recommend conservation actions based on our understanding of tiger ecology, and the requirements for population persistence. Our research efforts provide a platform to conduct conservation in a responsible and effective manner, and provide us the credibility to address bureaucrats and politicians as scientists with a real understanding of tiger ecology and conservation needs.

The goal at the start of the Siberian Tiger Project was to collect baseline ecological data and, to this end, we chose a strictly protected area to conduct our research roughly in the center of the Amur tiger's geographic range: the Sikhote-Alin Zapovednik. However, now that we have developed a considerable database on baseline tiger ecology with which to make comparisons, it is time to begin research on tiger populations in other areas to determine the effects of various perturbations on tigers. It is clear that in many unprotected areas throughout the Amur tiger's range, prey populations have been severely depleted, yet monitoring has not detected declines in tiger populations. Learning how tigers survive in these areas, and their reproductive and mortality rates, may provide important keys to tiger conservation.

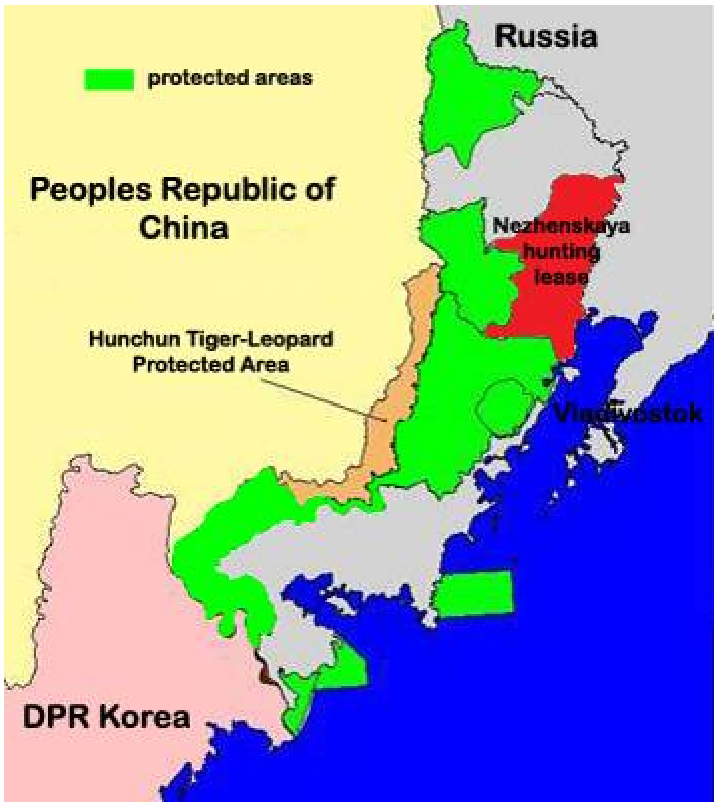

Figure 1. Southwestern Primorye, including the location of protected areas and a proposed study area, Nezhanskaya (Neshinskoe) Hunting Lease.

Southwestern Primorye represents the southern edge of the Amur tiger's current geographic range and of particular conservation importance in Russia because it represents a stronghold for many species at the northern edge of their geographic range, including tigers, leopards, Asiatic black bears, and yellow-throated marten. Although much of the area is protected (Figure 1), it is close to the primary human population centers of Primorski Krai, and subject to high levels of human disturbance and development and, consequently, the focus of considerable conservation attention. Conducting a research project in the area would be beneficial for several reasons:

1. This Amur tiger subpopulation is isolated from the main population to the north, but the degree of isolation is unclear. Snow-tracking surveys conducted in the winter of 2002-2003 suggest that the population has increased over the past several years more rapidly than would be expected from reproduction alone (Pikunov et al. 2003), suggesting that tigers are immigrating from the north. Telemetry studies of this population would allow us to determine the degree of isolation and identify movement/dispersal corridors (or lack thereof) between it and the northern population.

2. The area borders the most important habitat in China, including the recently created Hunchun Tiger-Leopard Protected Area in Jilin (Figure 1**)** and proposed protected area in Suiyang District in Heilongjiang. Telemetry studies would allow us to determine the degree of movement between Russia and China and the fate of tigers once they reach China, as well as to identify movement corridors in the transboundary area.

3. The area is the focus of several proposed or ongoing development programs, including an improved and expanding road network, railway development, expansion of the electricity grid, mineral/coal extraction, and potential development associated with the Tumen River Area Development Program. Data are badly needed on which to base recommendations to minimize the impact of these development projects. Additionally, our presence in the area gives us credibility with bureaucrats and politicians as scientists who understand tiger ecology and conservation needs.

4. Our focal study area, the Neshinskoe Hunting Lease, is unprotected and subject to high levels of human activity, especially over-harvest of prey, which is likely similar to other unprotected areas and vastly different from the Sikhote-Alin Zapovednik. Comparing data between these two sites will improve our understanding of the effects of human activities on tiger populations.

5. This area also contains the last existing population of Amur leopards, of which about 30 individuals remain in the wild. Current plans for leopard recovery include ecological research, construction of a captive breeding center, establishment of a second population, and possible supplementation of the existing population by releasing captive animals into the wild. A clear understanding of tiger ecology and the relationship between the two species is critical to the successful recovery of Amur leopards. Competition with tigers may be an important factor to conservation planning in the region. According to Valov (1989), historical evidence clearly suggests that leopards were common in Lazovskii Zapovednik at a time when the tiger was absent. As tiger numbers increased during the 1960s and early 1970s, leopard tracks were less often encountered, and then disappeared entirely. A documented kill of a leopard by a tiger was reported in March 2001 in the Borisovkoe Hunting Lease and Mr. V.N. Dyukov, an inspector with Inspection Tiger, has twice found leopards killed by tigers. Additionally, evidence indicates spatial separation between leopards and tigers, suggesting that leopards may avoid areas inhabited by tigers (Figure 2, Miquelle and Murzine 2001). Competition between leopards and tigers has been reported elsewhere (Seidensticker 1976, McDougal 1988) and, at the northern fringe of its range, leopards may be at a significant disadvantage in competing with tigers. A detailed understanding of the ecology of both species is essential to conserving them, and will help in the evaluation of conflicts between tiger and leopard conservation.

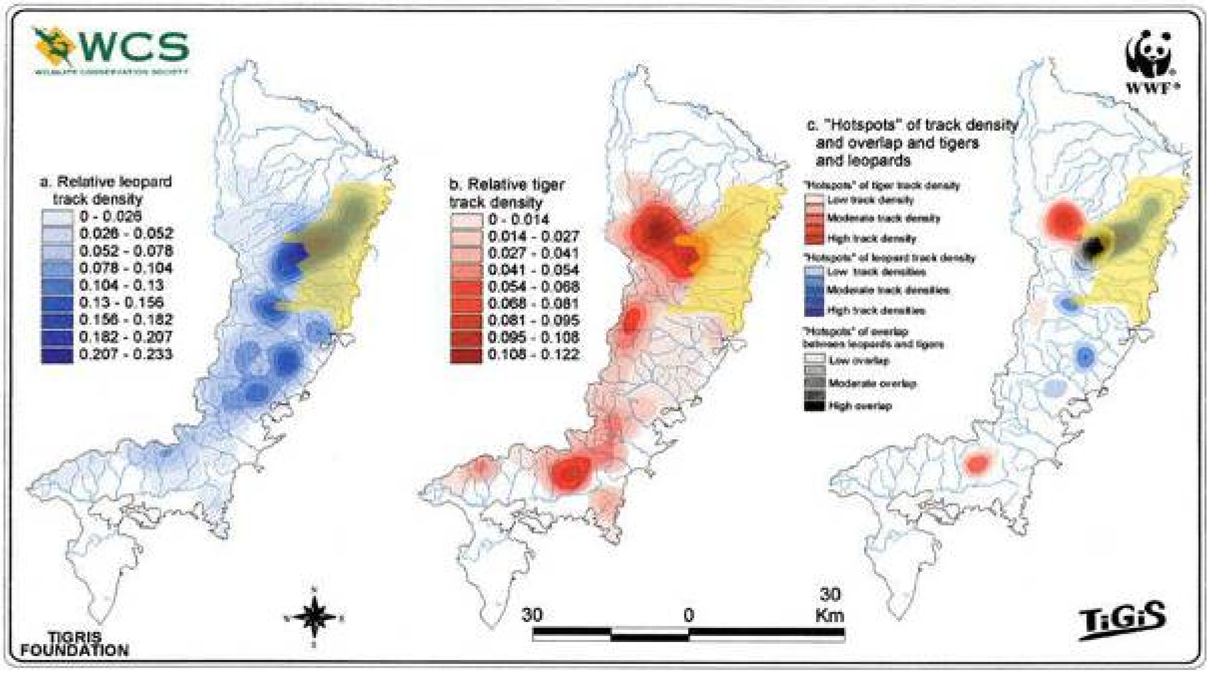

Figure 2. Track density for: (a) leopards; and, (b) tigers, based on a kernel estimator of track density; and, (c) areas of overlap in high density. Note that areas of high track density for both species rarely coincide. Neshinskoe Hunting Lease is shown in yellow.

6. Although historically Southwest Primorye was roughly at the center on the north-south gradient of the Amur tiger's geographic range, it now represents the southwestern edge of their range, and differs significantly from the Sikhote-Alin Zapovednik. The climate is warmer and snow-cover considerably lower than on the Sikhote-Alin Zapovednik. Red deer, which make up more than 50 percent of tiger prey in the north, are absent in Southwest Primorye, where sika deer and wild boar are the dominant ungulates.

After considerable delay, the Ministry of Natural Resources, Russian Federation, finally issued permits to capture four leopards and four tigers in Southwest Primorye in October 2006. The project started with a bang – we captured three adult tigers and two adult leopards in one month, marking our most successful capture season in 15 years of work in Russia.

Objectives: During our first year of work, we intended to:

1. Capture and collar five tigers and five leopards (three adult females and two adult males of each species).
2. Collect blood samples for disease and genetic analyses.
3. Monitor captured tigers to collect data on:
    a. annual and seasonal home range size, daily and seasonal movements, land tenure system, and social structure;
    b. reproduction (timing of breeding and birth, litter sizes, interval between litters);
    c. rates and sources of mortality;
    d. dispersal and long-range movements, particularly in the Russia/China border area;

e. food habits and prey biomass requirements to estimate tiger pressure on prey populations;
f. habitat use;
g. relationship between tigers and leopards, including interactions and avoidance, and overlap in space, habitat, and diet.

3) Methods

Describe all activities and methods. Give a yearly breakdown if this is a multi-year grant.

Personnel

Research is directed by Dr. John Goodrich, Dr. Alexey Kostirya, and Dr. Dale Miquelle, with Dr. Goodrich on site three months per year and Dr. Kostirya on site full time. Alexey Kostirya of the Institute of Biology and Soils (Far Eastern Branch of the Russian Academy of Sciences) worked for the Siberian Tiger Project (STP) from 1992 to 2001, and for WCS to date. He is the onsite Russian supervisor of a team of three field technicians. Kostirya has been conducting camera-trap surveys in Southwest Primorye since 2002, so he is familiar with the area. Two STP field technicians, Alexander Rybin and Vasily Shukin, work full time on this project. Other technicians are hired part time as needed. Rybin has been with the STP full time since 1998. He received formal training in capture and handling techniques in both Russia and the United States, and is an undergraduate student in ecology.

Study Area

We chose Neshinskoe Hunting Lease as the focal area for this study for several reasons. The area has good densities of both tigers and leopards, as determined from camera-trapping and snow-tracking surveys in the winters from 2002 to 2007 (i.e. Pikunov et al. 2003). We have already identified several areas where both species use well-defined travel routes, resulting in relatively high capture success rates. We are already familiar with the area because we have conducted leopard surveys. Also, we have a good working relationship with the Pacific Ocean Fleet Naval Hunting Society because the Neshinskoe lease is one of the primary hunting leases supported by the WCS project, "Managing hunting leases for effective wildlife/tiger conservation."

Methods

Capture activities began in October 2006, using techniques developed in the Siberian Tiger Project (Goodrich et al. 2001). In short, tigers and leopards were captured in foot snares and anesthetized with Zolatil. Adult tigers were fitted with GPS collars with a battery life of greater than two years and programmed to collect one to four locations per day; or VHF collars. Collars are programmed to download data on demand, allowing us to collect location data as necessary and when animals are in accessible areas, which should greatly reduce flight time and associated expenses. Leopards were fitted with conventional VHF transmitters.

Although animals with GPS collars must be found via VHF at some point in order to download the data saved in their collars, GPS collars provide a number of advantages over conventional VHF transmitters. Locations can be collected daily and automatically, regardless of our ability to regularly find an animal. More frequent and accurate locations improve our ability to locate prey items, especially small prey that tigers finish quickly, and will allow us to develop more accurate estimates of tiger pressure on ungulate populations. Perhaps most importantly, GPS collars allow us to monitor remote or otherwise inaccessible areas and animals – areas such as the border between Russia and China, and animals such as adult males and dispersing young that move over large areas and are difficult to monitor via conventional telemetry. With GPS collars, we can collect detailed information on travel routes of dispersing animals, allowing us to identify important travel and dispersal corridors.

Animals with either collar type are monitored from the ground on foot and in vehicles. Because data from GPS collars are downloadable on demand, we can retrieve data opportunistically from the ground when an animal is within signal range. Collecting locations will provide data on annual and seasonal home range size, daily and seasonal movements, land tenure system, social structure, dispersal, habitat use, and to some extent, the relationship between tigers and leopards.

4) Results

a) Outputs

i) *Using the logic framework model presented with your application (Fig. 1), enter in actual values of short-term outputs. Enter in any additional indicators not included in the full proposal used in the analysis. If your application did not include the logic framework, describe project outputs, any realized post-project outcomes and quantify the results using indicators and baselines.*

ii) *Attach any supplemental graphs, maps, photos and other types of analytical output for the project evaluation.*

iii) *Identify and briefly explain discrepancies between what actually happened compared to what was predicted to happen in the grant proposal using information presented above.*

Logic Framework

There was no logic framework in the original proposal. Project outputs relative to initial objectives are described below, quantified where possible, and discrepancies between intended and actual results are discussed.

Current Project Status

After considerable delay, the Ministry of Natural Resources, Russian Federation, issued permits to capture four leopards and four tigers in Southwest Primorye in October 2006. We captured Amur tigers and Amur leopards from October 18 through November 17, 2006 in the upper reaches of the Neshina River on the Neshinskoe Hunting Lease, where we established a tent-camp as a base of activities. The capture team consisted of Dr. Kostyria, Dr. Goodrich (WCS), Ivan Seryodkin (Institute of Geography, Far Eastern Branch of Russian Academy of Sciences), Mr. Rybin (WCS), Melody Roelke (National Institutes of Health), and a representative of Inspection Tiger. We set 15 Aldrich snares with transmitters that would emit a signal with a specific frequency for each snare when an animal was captured. We monitored snares 24 hours a day, and visually checked snares at least once every morning. When a signal was received, day or night, we immediately checked the snare and anesthetized the animal captured.

Table 1. Notes on animals captured in Southwest Primorski Krai, Russia, October 18, 2006 – November 17, 2006.

Date	ID No.	Sex	Estimated age (yrs)	Weight (kgs)	Notes
10/26/2006	Pt82	M	12-16	180	Tiger; fit with GPS collar; poached on November 16, 2006
10/29/2006	Pp01	M	12-14	45	Leopard
11/02/2006	Pp02	M	6-7	57	Leopard
11/08/2006	Pt83	F	8-10	127	Tiger; fit with GPS collar
11/10/2006	Pt84	M	5-6	179	Tiger

The season was one of our most successful in 15 years of work in Primorye - we captured three adult tigers (Photo 1) and two adult leopards in one month (Table 1), making excellent progress toward meeting our first project objective (capture and collar five tigers and five leopards). All animals were removed from snares within three hours of capture. All animals were in good to excellent physical condition. While we did not capture any female leopards, tracks of a female leopard with at least one cub were noted in the area. Unfortunately, one tiger (Pt82) was poached just a few weeks after capture (see appended necropsy report). We trapped again in spring 2007 and unintentionally recaptured Pp01. Capture efforts in the spring were hindered by unusually deep snow, which prevented access to the back country; hence, we did not meet our objective of capturing five tigers and five leopards.

We made excellent progress toward our second objective: Collect blood samples for disease and genetic analyses, and conduct full biomedical analyses. Veterinarians Melody Roelke (Laboratory of Genomic Diversity, National Institutes of Health, USA) and John Lewis (Wildlife Vets International, UK) collected biological materials including blood, tissue, sperm (from Pt84 and Pp01), and hair, and conducted medical evaluations of all animals captured, and two poached animals (Pt82 and an unmarked young female leopard found in spring 2007). Extensive analyses of the biological materials are necessary before any conclusive results can be determined, but preliminary analyses suggest the following:

1. The first leopard captured (Pp01) was dehydrated (8-10 percent) and was provided intravenous fluids (Photo 2). The reason for dehydration was unclear.

Photo 1. John Goodrich (WCS) fits a radio-collar on a large (179 kg) adult male tiger while Melody Roelke (National Institutes of Health) collects sperm. All animals captured were in good physical condition, as this photo suggests.

2. Significant heart murmurs were noted for Pt83 and Pp01 (and two other leopards captured after the report period). These murmurs did not appear to be of immediate danger to the survival of these animals and both appeared healthy. However, the presence of heart murmurs in two otherwise healthy individuals raises concerns about the health of the overall populations of tigers and leopards in Southwest Primorye. Heart conditions can have a genetic basis, and may be an indication of inbreeding depression. However, to determine the significance of these findings, more animals will need to be assessed. Currently, we are using field ECG and ultrasound to collect further data on heart conditions (Photo 3).

3. Sperm was collected from one leopard and one tiger (Photo 2). Preliminary results indicate that both had greater than 40 percent abnormal sperm forms (i.e. deformed heads, coiled tails, severely distorted mid-sections). The quick recovery rate of the other two males prohibited semen collection and evaluation.

4. Clinical laboratory findings conducted in the field demonstrated that all cats had good red blood cell counts (none were anemic), all were negative for feline leukemia virus and feline immunodeficiency virus, and all were negative for heartworms. Serum will be tested to look at the overall health of each individual (serum chemistry panels) and will be screened for exposure to disease agents known to be pathogenic to non-domestic felids.

A team led by Dr. Kosterya monitored (and continues to monitor) the four remaining animals (Pt83, Pt84, Pp01, Pp02) to collect data toward our third objective, which is to monitor captured animals to collect data on:

Photo 2. Melody Roelke of the National Institutes of Health examines sperm of a wild Amur leopard while Ivan Seryodkin of the Russian Academy of Sciences administers intravenous fluids because the leopard was slightly dehydrated.

1. Annual and seasonal home range size (Figure 3), daily and seasonal movements, land tenure system, and social structure.

2. Reproduction (timing of breeding and birth, litter sizes, interval between litters).

3. Rates and sources of mortality.

4. Dispersal and long range movements, particularly in the Russia/China border area.

5. Food habits and prey biomass requirements to estimate tiger pressure on prey populations.

6. Habitat use.

7. Relationship between tigers and leopards, including interactions and avoidance, and overlap in space, habitat, and diet.

Home range sizes were estimated for one tiger and one leopard (Table 2; Figure 3) and some components of habitat use were also examined (Table 2). Very few locations were collected on Pp02 due to a collar problem (resolved when he was recaptured after the report period), and we have not received a signal from Pt83's collar since a week after her capture. We suspect the latter is due to collar failure (common with GPS collars), but it is possible that she was poached and her collar destroyed.

Table 2.

ID	**No. locations**	**Home range size (km^2)**	**Habitat features (means)** elevation (m)	slope (degrees)	aspect (degrees)	**Notes**
Tigers						
Pt82	3	na	na	na	na	Poached.
Pt83	3	na	na	na	na	Collar failure?
Pt84	9	697	171	9	113	
Leopards						
Pp01	29	75	186	13	142	
Pp02	7	na	313	18	300	Collar problem, but replaced in October 2007.

The critically low number of tigers (about ten individuals) and leopards (about 30 individuals) remaining in the extreme southwest portion of Russia makes them particularly vulnerable to the insidious effects of chronic inbreeding and to stochastic extinction events which can be precipitated by infectious disease. The only way to access the clinical, reproductive, and genetic health of the population, and to identify specific disease threats, is by hands-on evaluations. Our preliminary results suggest that there may be complications associated with small population size and inbreeding depression of both the leopard and tiger populations in Southwest Primorye. Both are probably isolated populations with little or no opportunity for exchange of genetic materials, and we would therefore expect that, sooner or later, burdens associated with inbreeding depression will arrive in these populations, if they are not already present. However, to understand the current situation, it is critical to continue to capture individuals to monitor population health and status. Without active monitoring and a commitment to assessing the health of a significant percentage of the population, it will be extremely difficult to make useful recommendations to conserve this population.

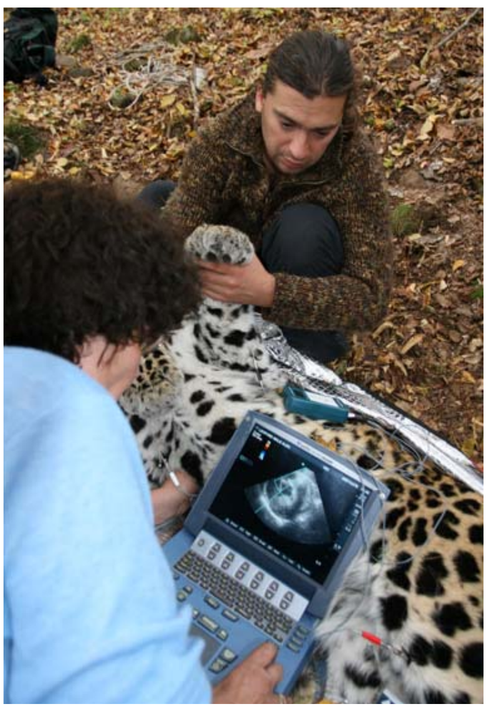

Photo 3. Veterinarian Melody Roelke uses ultrasound to examine a leopard's heart in the field.

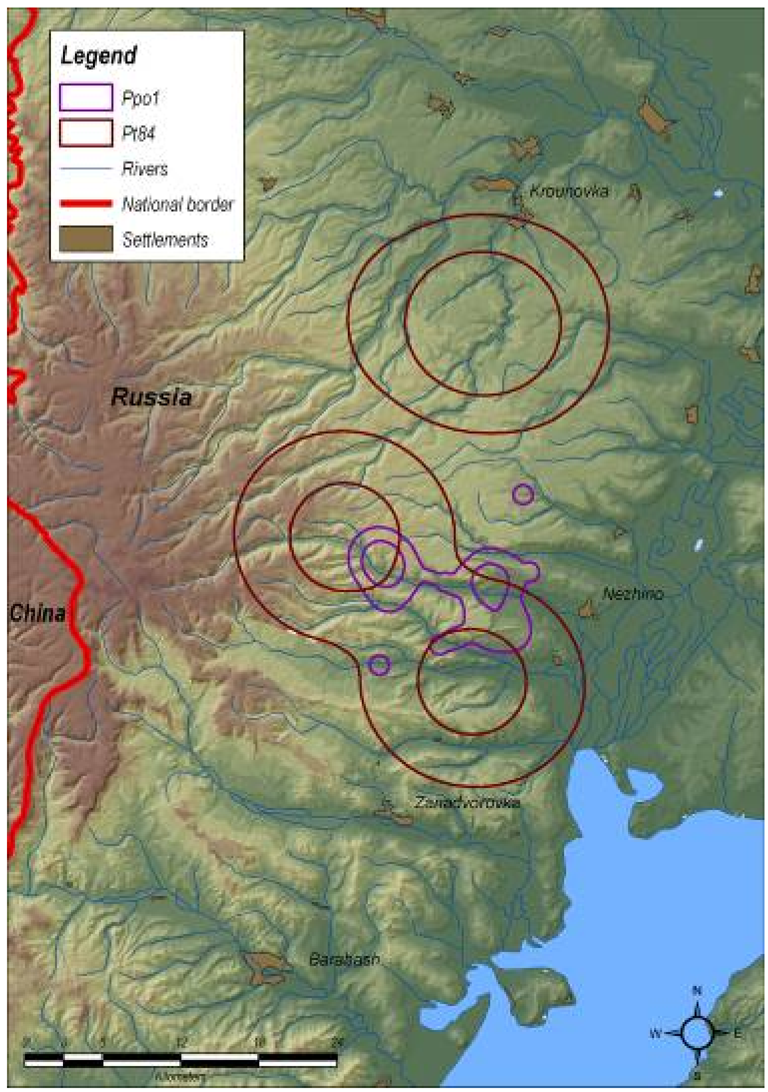

Figure 3. Map of home ranges of tiger Pt84 and leopard Pp01.

b) Post-Project Outcomes

i) *If your application did not include a logic framework, please identify any medium- to long-term results that may occur after the project ends.*

Expected medium- to long-term results include:

1. An understanding of tiger movements between Russia and China, which will help to protect movement corridors into China from Russia. This will ensure a mechanism for repopulation of Northeast China with Amur tigers should conditions improve there.

2. An understanding of movement patterns between the subpopulation of Amur tigers in Southwest Primorye and the main population to the north. This will provide information needed to create (if necessary) and protect habitat corridors between the two subpopulations, ensuring sufficient genetic exchange and, hence, the persistence of the southern subpopulation.

3. A comparison between the population in unprotected areas in Southwest Primorye and the protected population in Sikhote-Alin Zapovednik will shed light on the effects of human disturbances on tiger populations and, hence, help guide management actions to mitigate these effects.

4. A more detailed understanding of tiger prey needs will help to better manage ungulate populations as prey for both people and tigers, and provide fuel for education programs designed to improve hunter attitudes.

5. A better understanding of the ecology of both tigers and leopards in this area will help conservationists and managers to mitigate the impacts of various development projects on both carnivore populations.

ii) *Describe any progress towards achieving these post-project outcomes at this time.*

As described in section 4a above, we have captured animals and begun monitoring. The information gathered will form the database needed to meet post-project outcomes.

iii) *Will there be continued monitoring of post-project outcomes beyond the life of this grant? Are there adequate resources (staff and funding) for continued evaluation and monitoring? If not, briefly describe the additional resources needed.*

Tiger and leopard populations are monitored annually in the winter by snow-tracking and camera-trapping. A variety of organizations are involved in this monitoring, including the Institute of Biology and Soils, the Institute of Geography (both under the Far Eastern Branch of the Russian Academy of Sciences), World Wildlife Fund, and WCS. In all likelihood, this monitoring will continue indefinitely, so long as concern for these endangered populations continues. Such monitoring will provide a basis for assessing the impacts of conservation actions based on changes in animal numbers.

iv) *Describe any revisions in the indicators, methods and data that may be needed for post-project monitoring.*

While our research is based primarily on capture and telemetry, post-project monitoring will involve population estimation using camera-trapping and snow-tracking. These monitoring efforts began before our research project and continue to date.

5) Discussion & Adaptive Management

a) Lessons Learned and Transferability

i) *Describe the lessons learned about effective and ineffective conservation practices associated with this project. Which of these key lessons should be shared with other conservation organizations?*

ii) *To what extent did the evaluation and monitoring activities for this project inform your organization about effective conservation practices, and what lessons were learned from an evaluation perspective?*

iii) *Based on these lessons learned, what are your organization's next steps?*

As a research effort, this project does not involve direct conservation actions. However, data collected will shed light on the impacts of current and future conservation activities.

b) Dissemination

i) *Describe the extent of information communicated to the general public, key partners, other practitioners, scientific experts. Wherever possible estimate the extent of the outreach using appropriate quantifiable indicators such as meeting attendance, publication circulation figures etc.*

As this project is in its infancy, results have not yet been disseminated via scientific outlets. We have done two press releases in response to capture successes in 2006, which were picked up by local and national newspapers and local radio. A short film (about fifteen minutes) was produced about the project and the conservation issues it addresses, and was aired in its entirety on local Vladivostok television. Short versions were aired on Russian national news.

ii) *Attach any publications, brochures, videos, outreach tools, press releases and other appropriate "products" that resulted from this project.*

Press releases are appended.

c) NFWF Adaptive Management

i) *Offer any suggestions for NFWF to help guide improvement of our project administration.*

None.

6) References

i) Attach a list of secondary references used in conducting the project, including the evaluation.

The following is a condensed selection of references used in designing this project. An exhaustive list would include a wide variety of literature on felids, other carnivores, and data analysis and statistical techniques.

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Approved: ____________________________ Date: ________________
Signature

_Colin Poole, Director Asia Program___________________________
Print name and title

WCS
Wildlife Conservation Society
Russia Program

Dale Miquelle
Director Russia Program
Telephone / fax - Vladivostok:
7-4232-432-277 (433-436)
Email: dalemiq@vlad.ru
dmiquelle@wcs.org

PRESS RELEASE

FIRST FAR EASTERN LEOPARD CAPTURED IN SOUTHEAST RUSSIA STUDY OF FAR EASTERN LEOPARDS AND SIBERIAN TIGERS

Just three days after catching a tiger, an international team led by WCS biologists captured their first leopard in Southwest Primorski Krai in the southern Russian Far East. On October 29, 2006, an early morning check of a "trapline" revealed that a large leopard had just been caught. One of only 30 left in the wild, the animal was quickly attended to by an international team led by John Goodrich of The Wildlife Conservation Society and Alexei Kostyria of the Institute of Biology and Soils of the Russian Academy of Sciences, and Melody Roelke, a veterinarian from the Laboratory of Genomic Diversity, National Cancer Institute, USA. The 45-kg adult male was subjected to intensive biological and medical evaluations, including collection of sperm to assess its capacity to reproduce. The leopard was captured less than 20 miles from the Chinese border, and less than a mile from where a tiger had been captured just 3 days previous. On October 26, 2006, at approximately 3 a.m., a radio signal indicated that one of the snares set specifically to capture tigers had been triggered. The same team, working by flashlight, tranquilized the large adult male tiger and conducted the same suite of medical evaluations, which will provide the first pieces of evidence to assess the health status and risk of disease for both tigers and leopards in the southern Russian Far East. Genetic analyses, used in conjunction with these bio-medical evaluations, will be used to determine whether either tigers or leopards are suffering from the effects of inbreeding by closely related individuals, a common problem in small wildlife populations. Although there exist more than 400 Siberian tigers in the wild, less than 20 tigers in Southwest Primorye are isolated from the main population of Siberian tigers to the east and north, raising questions about their genetic composition and vigor of this subpopulation. With only 30 individuals remaining in the wild, all in Southwest Primorye, the Far Eastern leopard is even more endangered than the tiger, and hence concerns about the genetic status of this animal are even greater. Up to now, no information on these wild animals has been available to assess the risk of disease or inbreeding. Dale Miquelle, Director of the Wildlife Conservation Society's Russia Program, which has led coordination of this project, stated that, "This capture represents a milestone in our cooperative efforts to save the Far Eastern leopard and Siberian tiger from extinction. With the information gained from these animals, and others to come, we will be in a much better position to determine appropriate conservation actions." If inbreeding is considered a serious problem, new genetic material may be introduced into this population, as was done for the Florida panther. In that situation, when poor reproduction and physical abnormalities suggested that inbreeding was the culprit, pumas from Texas were introduced into Florida, resulting in increased reproductive rates and greater vitality of the Florida population. Such actions may be necessary for the Far Eastern leopard, but decisions will be made only after analyses of a representative sample of the remaining population.

This study, initiated as a collaborative international project, which includes not only the Russian Academy of Sciences Institute of Biology and Soils and WCS, but the Zoological Society of London and the Laboratory of Genomic Diversity in Maryland, USA, is the first of its kind to provide vital indicators of the health status of leopards and tigers in this region. The project is part of a larger program to conserve both Siberian tigers and Far Eastern leopards which is overseen by the Russian Ministry of Natural Resources. Funding for this program has been provided by the National Fish and Wildlife Foundation's Save-the-Tiger Fund and a Darwin Initiative Grant to the Zoological Society of London.

For more information, contact:

Dale Miquelle
Russia Program
Wildlife Conservation Society
Email: dalemiq@vlad.ru

Necropsy report on Pt82

Tiger shot by hunter in Khasanski Raion, November 15, 2006.

Necropsy Report by Dr. Melody E. Roelke-Parker
Laboratory of Genomic Diversity
National Cancer Institute
Maryland, USA.

On November 16th I performed an autopsy of an old, adult male tiger that had been shot by hunters in the forests of Khasanski Raion, Primorski Raion, Russia on November 15, 2006.

NECROPSY FINDINGS

The overall condition of the animal was good. This was an old animal, perhaps 10 years old. Despite the fact that its incisors were extremely worn down, and all four canines were broken, the animal was clearly healthy and in good condition. The fact that its stomach was full with wild boar meat and hair demonstrated that it has just recently fed on wild boar (and people who collected this animal from the field reported that a wild boar had been killed and partially consumed by this tiger) also indicated that this animal was clearly a healthy animal in good condition.

Four bullet holes were found on the left side of the body:

Wound #1 was below the left eye, 10 cm from the nose. The bullet traveled downward and shattered the left mandible, resulting in hemorrhage within the jaw muscles of left masseter and ventral throat muscles. Pieces of a gold-colored bullet fragment were found near the bone fractures (retained as evidence)

Wound #2 was located 14 cm below ear (under the jaw), and 32 cm from nose on the left side. This is the probable exit wound from the bullet that entered wound #1.

Wound #3 was located in front of the left humerus at the shoulder joint, 48 cm from the nose. This may have been a re-entry point from the bullet emerging from wound #2. Lots of hemorrhage of subcutaneous tissue and muscle in shoulder. This bullet did not appear to pass into the interior cavities or have an impact on vital organs (this area was not dissected completely by MER).

Wound #4 was located mid-way along the body on the left side of rib cage 97 cm from nose. The bullet penetrated the left side of the chest, fracturing several ribs, passing through the left part of the diaphragm, severing the upper folds of the stomach, and creating two additional holes in the omentum. There was blood throughout the abdominal cavity. A crumpled silver fragment of a bullet was located 12-14 cm behind the diaphragm, amongst the stomach and intestines (retained as evidence). The stomach was filled with skin, hair, and meat of a wild boar. Large pieces of hide and much boar hair was found high in the thoracic cavity. Blood had flowed through the inguinal canal and surrounded the testes. Necropsy evidence suggests that the animal survived and was quite active for some time after the bullet entered the chest (damage from wound#4), allowing stomach contents to work their way throughout the chest cavity and for blood to enter the tissue space around the testicles.

All viscera were very autolyzed and covered with blood. Feces were spread around the anus and scrotum in an area of about 20 cm (occurred while running prior to death). The trachea had blood inside it which came from the jaw fracture, indicating that the animal had inhaled blood.

COMMENT

The single shot to the chest (wound#4) entered from the left side at approximately a 45^o angle, as evidenced by the bullet's trajectory path going through the chest wall, diaphragm, anterior stomach, and stopping in the mid-abdomen. This animal had to have lived for some minutes, and probably ran some distance before death in order for food from the stomach to have moved throughout the chest cavity and for blood to have coated all the intestines and worked its way down around the testes. The shot to the head/jaw/shoulder would not have killed the cat, but it would have stopped him. Blood from this bullet went into the trachea.

CONCLUSION

I believe that the first shot was delivered to the chest from off of the left side of the tiger (~45 degrees from the front) and it must have been shot from quite a distance as the relatively soft tissues of the intestine were able to stop the bullet from exiting the body. This was not a shot delivered in self defense. The injuries from this shot would have caused considerable pain, blood loss, and shock, but probably did not kill him immediately. The second shot (wounds #1, #2, and probably #3) was delivered at close range from straight ahead of the tiger, just off the left side. The jaw & shoulder shot(s) alone would not have killed the animal but would have stopped an injured, dieing tiger. The tiger's weakened state probably contributed to why the hunter sustained only minor injuries from his physical contact with the tiger.

Melody E. Roelke-Parker, DVM
Scientist & Wildlife Veterinarian
Laboratory of Genomic Diversity,
National Cancer Institute, Box B (Buid. 560 11-10)
Frederick, MD 21702 USA

TEL: 301-846-7479
FAX: 301-846-6327
e-mail: roelke@ncifcrf.gov