NATIONAL FISH AND WILDLIFE FOUNDATION
Final Report

Project Name and Number:	Long-Term Amur Tiger Research and Conservation, Russia (grant #2006-0097-012)
Grant Amount:	$40,000
Reporting Period:	August 1, 2006 – July 31, 2007
Recipient Organization/Agency:	Wildlife Conservation Society (WCS)
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1. SUMMARY *In four to five sentences, provide a brief, cumulative summary of the project.*

This project is an ongoing long-term telemetry-based research program of the Wildlife Conservation Society (WCS) that began in 1992 on Sikhote-Alin Zapovednik, and focuses on cub survival, dispersal, and the effects of human-induced mortality on tiger population dynamics. The effort includes a graduate student training program that supports Russian students conducting field research on tigers for their dissertations, and attempts to pair Russian students with foreign students. In addition, because WCS has the necessary personnel and equipment to capture tigers, we assist the government's Inspection Tiger team in responding to tiger-human conflicts. During the reporting period, we monitored seven different tigers (three were cubs and the others dispersal-age subadults). Three graduate students conducted field research, and we handled six tiger-human conflict situations.

2. INTRODUCTION *Describe the original conservation need and objectives.*

Successful conservation must be based on good information. Our goal from the inception of the Siberian Tiger Project (STP) in 1991 has been to develop a detailed understanding of tiger ecology for use in credible conservation plans. Our credibility was established through our strong scientific fieldwork, which has allowed our team (of Russians and Americans) to maintain our strength and identity as an objective scientific entity in the region. This is very important in Russia, where knowledge is respected as a critical element of conservation. We made tremendous progress in both field investigations and conservation, and believe the scientific effort must continue for the following reasons:

- *Long-term research:* We are currently addressing several important research issues, including the effects of poaching on tiger population dynamics, cub mortality and dispersal patterns, impacts of tigers on prey populations, and a comparison of techniques (traditional snow-tracking, camera trapping, DNA from hair snags, and capture/telemetry) for estimating tiger densities – many of which require long-term research. For example, we recently learned that when tigers are well protected from

human-induced mortality for long periods, survivorship, reproduction, and density of adult females may increase dramatically.

- *Training the next generation of conservationists:* Training Russian and foreign students has become one of our primary objectives. The project has taken on eight Russian undergraduate students and seven graduate students for year-long, degree-related internships. However, there are too few young Russian biologists in the Russian Far East, and it is vital to future scientific and conservation efforts to provide better training and incentives to study conservation biology. We are increasing our capacity to house and train students, as well as the number of students, both Russian and foreign, in our program. Maintaining our research activities is fundamental to this expansion.

- *Addressing human-tiger conflicts:* Trained response teams are important for safe and effective management of human-animal conflicts. In 1999, a Tiger Response Team (TRT) was created as part of Inspection Tiger, a department of the Russian Ministry of Natural Resources. Its responsibility is to address and resolve problems between humans and tigers. We work closely with TRT to provide training onsite and overseas in handling tiger-human conflicts, and assist in obtaining financial support for TRT. Our training has provided alternatives to killing problem tigers, such as negative conditioning and translocation. The Team directly addresses conflicts in an expeditious and conservation-sensitive manner, thus promoting better attitudes toward tigers, and increasing conservation awareness in local people. This collaboration is only possible because the Siberian Tiger Project maintains equipment, supplies, and staff necessary for capturing and transporting problem tigers.

Based on the above arguments, and the continuing threats to wild Amur tigers, we feel that this research project should continue. Long-term research is critically important, as validated by our recent surprising findings on tiger density and reproduction – which resulted from 13 years of dedicated field research. These results have strong implications for our understanding of the threat from poaching, and the number of tigers that may be expected to fit into protected areas. In addition to providing valuable data on tiger ecology, our program provides a platform from which we can address tiger-human conflicts, and train the next generation of Russian conservation biologists.

Objectives

Research:

• Monitor cubs (two litters expected) to determine survival rates, and sub-adults (one currently collared) to determine dispersal movements.

• Monitor tigers in our core study area to determine if recent doubling of density and reproductive output is sustainable.

• Equip two tigers with GPS (Global Positioning System) collars to collect data on predation rates and pressure on ungulate populations.

• Conduct three camera-trapping/hair snagging sessions for capture-recapture density estimates.

Graduate-student training:

• Bring on four new students, two Russian and two foreign (one Russian and one non-Russian student have already been identified).

Tiger-human conflicts:

• Continue to assist Inspection Tiger with tiger-human conflicts as the need arises, conduct the necessary interventions, and monitor the outcomes.

• Continue field training for the Tiger Response Team.

3. METHODS

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

Drs. John Goodrich and Dale Miquelle direct the field research and tiger/conflict response work, while Dr. Goodrich actively supervises all research activities. Research is conducted on the Sikhote-Alin Biosphere Zapovednik (SABZ) under a joint written agreement between the Zapovednik and WCS. Field work is conducted by full-time field technicians and, currently, two Russian graduate students, and an American graduate student. Undergraduate students typically spend several months conducting field work and collecting data for their undergraduate theses. The Tiger Response Team consists of personnel from the Ministry of Natural Resources, with either Dr. Goodrich or a Siberian Tiger Project capture specialist accompanying them at their request. SABZ supplies permits for capture and for radio-frequencies, which must be renewed annually.

Research Program:

We monitor radio-collared tigers from the ground on foot, from vehicles, and by air, collecting data on most aspects of tiger ecology. However, we focus on cub survival and causes of mortality, dispersal, predation rates, and the question of whether current high densities and reproduction in our core study area are sustainable. We monitor dispersal movements primarily via weekly radio-telemetry flights in an Antonov-2 biplane. We recaptured (see Goodrich et al 2001 for capture and anesthesia techniques) three cubs of the tigress known as Pt35 to fit them with permanent radio-collars in autumn 2006, and subsequently monitored their dispersal. To study causes of cub mortality and survival rates, we attempt to capture cubs by hand at four to six weeks of age when the mother is absent, to fit them with expandable break-away collars. When a mortality signal is detected, a ground crew is dispatched immediately to find the cub and determine the cause of death. We will use Cox proportional hazards models applied to telemetry-based cub survival data to estimate cub survival rates and compare them to other age and sex classes.

Our density-estimation study is being coordinated by one Russian and one American graduate student. They use the non-invasive mark-recapture methodology (Karanth and Nichols 2002), including camera trapping, collection of hair and scat for DNA, “sniffer” dogs (Kerley and Solkina 2007), and tracks in snow. Results will be compared to traditional Russian snow-

tracking techniques and our density estimates based on capture and telemetry. Data collected will also be compared to density estimates from the annual Amur tiger monitoring program, and used to assess and calibrate the accuracy of expert assessments based on snow-tracking.

Tiger-Human Conflicts:

For each conflict, we dispatch one or two people equipped to capture and transport a tiger. When appropriate, we attempt to scare away tigers from areas where they are creating problems using flares and rockets. When this negative conditioning does not work, or if we believe the situation was too dangerous, we attempt to capture the animal to assess the animal's condition and the situation, to determine whether the animal should be released nearby, relocated, rehabilitated (for wounded and/or emaciated animals), sent to a zoo, or, as a last resort, euthanized. If the tiger is re-released or relocated, it will be radio-collared and subsequently monitored (Goodrich and Miquelle 2005). The STP, as well as other WCS scientists and veterinarians with extensive tiger experience, assist the Russian team in every conflict situation, in the field, via phone, or by
e-mail. We recently began working with local veterinarians, including Mr. Evgeny Slabi, the head veterinarian for Terney Raion, and veterinarians from the private Alex Clinic in Vladivostok.

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.*

In addition to the logic framework table (see Figure 1, pp 12-13), our results are presented below in relation to each objective stated in the proposal. We also provided results that were not directly related to our initial objectives.

Research:

• *Monitor cubs (two litters had been expected) to determine survival rates, and sub-adults (one currently collared) to determine dispersal movements.*

We successfully monitored one litter of three cubs (Pt79, Pt80, and Pt81) during the reporting period. All three cubs survived until one year of age. They were recaptured at 14 months of age (Photo 1) and fitted with permanent collars to monitor dispersal movements (see Table 1 below).

Two of the three cubs dispersed and disappeared, despite extensive aerial searching over an area of about 10,000 square kilometers. We received subsequent information (a number from a radio-collar) that one cub was poached, and we believe the second had the same fate. The remaining cub (Pt80) settled in its natal home range, and we continue to monitor her as part of our resident tiger population.

Table 1. Data on tigers monitored on Sikhote-Alin Zapovednik, August 1, 2006 – July 31, 2007.

Tiger no.	sex	age	Dates tracked from	Dates tracked to	days tracked	Number of locations total	Number of locations report period	notes
37	f	14	11/17/1999	2/13/2007	2,645	443	20	Missing, probably poached.
49	m	9	5/22/2001	11/27/2006	2,015	526	23	Missing, probably poached.
55	f	6	10/24/2002	1/29/2007	1,558	295	36	Collar batteries died, recaptured Oct. 2007.
56	f	6	10/24/2002	7/31/2007	1,741	563	99	Pt35's daughter.
79	f	2	10/11/2005	2/17/2007	494	63	51	Missing, probably poached.
80	f	2	10/11/2005	7/31/2007	658	188	145	Pt35's daughter.
81	f	2	10/11/2005	2/13/2007	490	75	40	Poached.

Photo 1. Two 13-month-old cubs captured on Sikhote-Alin Zapovednik in October 2006.

We monitored two fewer cubs than expected (row one of logic framework in Figure 1, pp 12-13) because we were unable to capture one litter of cubs. However, we monitored one more dispersing animal than expected (logic framework, row two) because survival of Pt35's litter was higher than expected (100 percent). These data support our previous findings, i.e., that nearly all dispersing tigers get poached. This raises concerns over the ability of tigers to disperse through existing habitat. That is, connecting protected areas with suitable dispersal habitat alone may not be enough to ensure adequate genetic exchange throughout the metapopulation of Amur tigers. Therefore, dispersal corridors must be protected to reduce poaching.

• *Monitor tigers in our core study area to determine if recent doubling of density and reproductive output is sustainable.*

Tiger density remained stable on our study area during the reporting period, despite considerable turnover in the population. Three resident adults (Pt35, Pt37, and Pt49) were lost during the study period. We believe all were poached, but have not been able to confirm any cases of poaching. That all three were lost from the population is demonstrated by lack of tracks and camera-trap photos – and that all three have been replaced by new resident tigers. Pt35 was replaced by her daughter, Pt80. Pt37 was replaced by an unmarked female photographed by camera traps several times over a period of more than a year, and Pt49 was replaced by a new male (Pt85) captured after the reporting period. It is possible, but unlikely, that one or more of these tigers were killed in fights with other tigers and their collars destroyed. In 15 years of research, only once have we detected evidence of fighting (tracks in snow) by two unmarked adult males; and of over 50 tigers captured, only one bore wounds and scars that may have been caused by fighting.

Reproduction data were confounded by the loss of residents. Both Pt35 and Pt37 were lost when their previous litters had only recently become independent, but before they had time to produce new litters. Of the remaining two resident adult females, Pt56 produced a litter of three cubs, but Pt55 was not with cubs during the reporting period. However, she could have birthed a litter that was killed by an immigrating male following the loss of Pt49. Infanticide by immigrating males was demonstrated in Nepal (Smith and McDougal 1991), and has been suspected in our population (Goodrich et al. 2005). The loss of three resident tigers marks the end of an era of almost seven years of low mortality, from mid-1999 to 2006. However, the period of low mortality was sufficiently long to document the process of population recovery.

• *Equip two tigers with GPS collars to collect data on predation rates and pressure on ungulate populations.*

Although we had been informed that permits for GPS collars would be granted in 2005, they were not; so we were unable to collect data toward this objective.

• *Conduct three camera-trapping/hair snagging sessions for capture-recapture density estimates.*

We successfully conducted three camera-trapping surveys during the report period (Photo 2), and began collecting data for other density estimation techniques as well, including non-invasive DNA sampling of scat and hair; collection of scats for identification by sniffer dogs (Kerley and Solkina 2007); and snow-tracking. Density estimates from camera-trapping compared well with density estimates from our capture and radio-tracking methods. The number of trap nights was slightly lower than expected (Figure 1) because some cameras were damaged by animals and water, two traps were stolen, and some malfunctioned. However, this did not influence the outcome of the project, i.e., three density estimates were generated as intended.

Photo 2. A tiger photographed by a camera trap in central Sikhote-Alin Zapovednik.

Graduate-Student Training:

• *Recruit two new Russian and two foreign students.*

During the report period, two Russian (Svetlana Sutyrina and Kate Blank) and one American graduate student (Meghan Riley) were supported by WCS in conducting tiger research (see Photo 3). Both Sutyrina and Riley are working on our density estimation project, while Blank collected data to examine stress-related hormones in tiger scat. Additionally, two graduate students, Ivan Seryodkin and Alexey Kostyria, finished their PhDs and now work for the Far Eastern Branch of the Russian Academy of Sciences. They also work for WCS: Ivan Seryodkin is the primary Russian biologist on the project supported by this grant, and Kostyria is the primary Russian biologist on our tiger and leopard research project in southwestern Primorye. We had hoped to bring on an additional graduate student during the reporting period, but were unable to identify a suitable candidate. Potential graduate students in biology are rare in the Russian Far East because salaries for professionals in the field are very low, making young people reluctant to enter the field (hence the need for our program to encourage and support graduate students). However, we have identified two potential graduate students whom we expect to begin research in 2008.

Photo 3. Graduate student Svetlana Sutyrina during a recent capture of the cub of one of our radio-collared tigresses in SABZ.

• *Additional training and capacity building activities.*

Other activities not included in our initial objectives, but that are related to training and capacity building, are briefly reported on here. Two undergraduate students spent the summer of 2006 with us to gain field experience in radio-tracking and camera-trapping. One of these students (Yelena Salmanovna) returned in late June 2007, and will collect data for her Masters thesis. We also hosted a group of eight Chinese biologists and field technicians for ten days in December 2006 for training in monitoring techniques for tigers, leopards, and their prey. We continued construction of the "Sikhote-Alin Research Center," an office and housing facility for visiting students and scientists (see Photo 4). While we are still putting finishing touches on the building, we began to occupy it in autumn 2006. This facility is essential to our training and capacity building activities because housing and office facilities are not otherwise available in Terney.

Photo 4. Under construction but in use - WCS's Sikhote-Alin Research Center in Terney.

In cooperation with the Zoological Society of London, Henry Doorly Zoo, and the Primorskaya State Academy of Agriculture Veterinary School, conducted a workshop in Russia entitled, "Veterinarian Training in Wildlife Health and Tiger-Human Conflict Resolution Training" in April 2007. Financial support was provided by the Trust for Mutual Understanding. The goal of the workshop was to train veterinary students and practicing veterinarians stationed throughout tiger territory on wildlife health issues, including animal/human conflict situations. The workshop consisted of two sections: (1) five days of lectures on wildlife health issues and animal-human conflict resolution conducted at Primorski State Academy of Agriculture in Ussurisk, Russia; and (2) five days of hands-on immobilization, health examinations, and pathology examinations at the Utyos Wildlife Rehabilitation Center, Khabarovski Krai, Russia. Utyos houses a variety of rescued wild animals in need of health evaluations, making it an ideal place for this training session.

Tiger-Human Conflicts:

• *Continue assisting Inspection Tiger to address tiger-human conflicts as the need arises; conduct the necessary interventions; and monitor the outcomes.*

• *Continue field training of the Tiger Response Team.*

We assisted with six conflict situations during the report period:

Conflict One: On November 15, 2006, one of our marked tigers was shot and killed by hunters in Southeast Primorye, and one of the hunters was superficially scratched by the tiger. Inspection Tiger called upon WCS to assist with a necropsy and in assessing the situation. The hunters, a group of local policeman, had been conducting a game drive: several hunters stand in place, while others move through the woods driving game toward the standers. The tiger was feeding on a wild boar in the drive area. Tiger kills are often very conspicuous because crows, eagles, and griffons congregate at the kill site. Thus, it is possible that the hunters chose the area hoping to shoot a tiger, but they claimed that the meeting was purely by chance, the tiger charged them, and they shot in self defense. However, the necropsy (conducted by personnel from WCS, The U.S. National Institute of Health, the Institute of Biology and Soils, Far Eastern Branch of the Russian Academy of Sciences, and Inspection Tiger) clearly demonstrated that the first bullet entered the side of the tiger's rib cage from a 45 degree angle and from a great distance (about 90 yards). Had the animal been charging, the bullet would have entered from the front and from a close distance. The necropsy results also indicated that the tiger was alive and quite active for some time (perhaps several minutes) after being shot. Thus, the first shot was clearly not fired in self defense. A second shot to the head at very close range killed the tiger, but not before it managed to scratch the hunter. The incident is currently under police investigation, but it is unlikely that sufficient evidence exists to convict the hunters of poaching.

Conflict Two: On February 2, 2007, a private citizen found a four-month-old tiger cub on a road with a trap on its foot, and took it to Utyos Wildlife Rehabilitation Center in Khabarovsky Krai. John Goodrich and Nikolai Rybin drove to Utyos to meet a team from Inspection Tiger and a veterinarian from Alex Clinic in Vladivostok. The veterinarian treated the cub's broken toes and Inspection Tiger took the cub to a holding facility in Rozdolnaya (near Vladivostok) where it recovered and was later sent to a zoo.

Conflict Three: There were repeated reports of dogs killed in towns within the home range of Pt76, a tigress captured near the town of Chernigovka, Primorski Krai, in January 2006. Inspection Tiger held a meeting to discuss potential responses. It was decided that she would be captured and translocated. John Goodrich and Nikolai Rybin drove to the area in early February and spent several days searching, but could not locate her signal. The area was searched on several other occasions during February, but we were unable to locate the tigress. We concluded that she had been poached.

Conflict Four: On February 8, Inspection Tiger requested the assistance of John Goodrich and Nikolai Rybin to investigate a tiger attack in the village of Metioritney, Primorski Krai. A man was attacked apparently as a tiger was attacking and killing his dog a few meters from the man, who was about 50 meters from his house at the edge of the forest. When the tiger attacked the dog, the man attempted to climb a tree at which time the tiger noticed him, ran over and bit him on the leg, letting go only after the man screamed. The tiger then ran back to the dog and

dragged it about 100 meters into the forest, where it spent about two days eating the dog, despite such close proximity to people. Tracks in the snow confirmed his story, but neighbors suggested that he shot the tiger with rubber bullets from a pistol which can be purchased for self defense in sporting goods stores. After consuming the dog, the tiger approached another house at the edge of town, but was scared off by people. Inspection Tiger had arrived by that time (February 7) and attempted to further frighten the tiger with fireworks. On February 8, we tracked the tiger 3.5 kilometers from the town. The tiger left the area and no further problems were reported.

Conflict Five: On February 9, John Goodrich, Nikolai Rybin and an Inspection Tiger team drove to the towns of Malinovka and Lubitovka in Primorki Krai to investigate reports of a tiger killing dogs. A male tiger had killed three dogs (one in Lubitovka and two in Malinovka), displaying very bold behavior in the process. When he killed the first dog, he broke down a gate, and walked within a meter of the owner's house in the center of town to kill the dog. Hearing the commotion, the owner went outside and the tiger ran off. We tracked the tiger to the site where he had killed a dog the day before and dragged it into a dense thicket about a square kilometer in size. After circling the thicket and finding no tracks exiting, we drove into the thicket, following the tiger's track in the snow. We eventually found the remains of the dog, and shortly thereafter spooked the tiger from the thicket. A member of Inspection Tiger fired several shots into the air, and the tiger ran off into the forest.

Conflict Six: On February 15, Inspection Tiger requested we capture a tiger that had killed several dogs and threatened a person on a military base in the town of Rettikhovka, Primorski Krai. Nikolai Rybin and Vladimir Melnicov responded, set humane snares, and tracked the tiger for nine days, but were unable to capture it. The tiger eventually left the area, and there were no further reports of problems.

Photo 5. Hundreds of children, parents, teachers, and other citizens rallying outside of the Terney District administrative offices in celebration of Terney's first "Tiger Day," got the attention of local regional officials, causing an initially reluctant district mayor to appear and give a speech. Photo by J. Goodrich/WCS.

Education Activities:

Education and awareness-raising programs are an important part of building local support for tiger conservation and for teaching people how to live with tigers. John Goodrich gave four presentations on tiger conservation to local audiences in Terney in 2006. Additionally, "Tiger Day," a celebration devoted to Amur tigers and designed to raise conservation awareness, was celebrated for the first time in Terney, on September 15, 2006 (Photo 5). Hundreds of schoolchildren from nearby villages gathered in the district capital to take part in the celebration, which included games, quizzes, entertainment for children in the park, a parade along the town's main street, speeches by local authorities, a slide

presentation by John Goodrich, and performances prepared by children for the holiday. The festival was organized and supported by the Phoenix Fund, WCS, *Uragos* (an ecology club), and local authorities. It is significant to note that when the heads of the regional and local administrations (who are both based in Terney) were invited to speak at the festival, they declined. However, when hundreds of children, teachers, and parents gathered in the town square across the street from the regional administrative offices, both the town and district mayors appeared and gave speeches in support of the festival, which will now be held annually in Terney. We also worked with Russian and Welsh film crews, which produced documentaries that included the Siberian Tiger Project.

b. Post-Project Outcomes

i. *logic framework presented in the full proposal additionally included a The final column where predicted values of post-project outcomes were to be provided. If your application did not include a logic framework, please identify any medium- to long-term results that may occur after the project ends.*

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

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.*

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

This project is ongoing, so many post-project outcomes have not been achieved. Still, in as much as we made progress toward project outputs, we also made progress toward post-project outcomes. There will, of course, be continuing monitoring of post-project outcomes beyond this grant period. We anticipate having sufficient resources to continue evaluation and monitoring, and are aware of no particular revisions in the indicators, methods, or data that we will need to accomplish the post-project monitoring which is integral to the project's success.

Additionally, we list here a number of conservation-related outcomes not contained in Figure 1:

- Two scientists trained on WCS projects are now working for the Far Eastern Branch of the Russian Academy of Sciences, and are active in research and conservation of tigers and other large carnivores in the Russian Far East.
- Our research data have been used in a habitat management plan (Miquelle et al. 1999), parts of which were incorporated into the national conservation strategy for Amur tigers.
- Our research data on movements and home range have been used to improve monitoring protocols for Amur tigers.
- We have successfully tested tools for tiger capture, rehabilitation, and translocation to alleviate tiger-human conflict and reduce human-caused mortality of Amur tigers (Goodrich and Miquelle 2005).

5. DISCUSSION AND 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?*

This project is primarily a research effort. However, data collected will likely shed light on the impacts of current and future conservation activities.

Our efforts to alleviate tiger-human conflict in partnership with Inspection Tiger are evaluated in terms of tigers "saved," meaning the number of tigers not killed in conflicts where our teams responded. Of the six conflicts described above, the tiger was "saved" in only three instances (the cub with a trap on its foot survived, but was removed from the wild). However, this method of evaluation, while providing some important information, does not fully evaluate effectiveness for the following reasons:

- It is difficult to determine whether a tiger stops causing conflict as a result of our actions, or whether the tiger even survived (except for collared animals).
- In many conflicts, for instance Conflict One, the tiger has already been killed or badly wounded and is therefore not savable.
- This evaluation method does not account for changes in public attitudes resulting from our responses to the conflicts. Many locals seem to sincerely appreciate our efforts, perhaps making them more likely to respond to a conflict with a telephone call to Inspection Tiger, rather than with a bullet.

Radio-tracking provides a better evaluation tool, and we have also evaluated the effectiveness of our human- tiger conflict alleviation activities in this way. In the case of Pt76 above, we successfully kept her and her cub alive for more than a year (her cub survived to independence), but were not ultimately successful at stopping her from killing dogs and livestock. Since we began our partnership with Inspection Tiger, we have equipped six problem tigers with radio-collars, and three have survived as a direct result. We learned that translocation can be an effective means of alleviating conflicts, but it is by no means a cure-all. Hazing tigers with flares and fireworks was successful in one case several years ago, but not in the case of Pt76, likely because prey densities were so low within the home range of the latter that she had little choice but to eat domestic animals. Thus, evaluating the complete picture, including the tiger's age, physical condition, and residency status, as well as issues such as prey densities and husbandry practices, is important for making decisions tailored to each individual conflict.

These lessons can and have been shared with other organizations through scientific publications (Miquelle et al. 2005, Goodrich and Miquelle 2005), reports to funding and government organizations, scientific presentations, television documentaries, and popular publications (see attached publications list). We also presented results at a carnivore

conservation workshop in Seoul, Korea in 2006, and have been invited to present at a workshop in Bhutan in December 2007.

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.*

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

During the reporting period, results were disseminated via two documentary films (one aired in the U.K. and one on Russian national television (the size of viewing audiences is unknown); several local newspaper articles; talks to local people (four talks at 25-30 people each); reports to the Sikhote-Alin Zapovednik, WCS, and a variety of funding organizations. Our results are widely published in scientific and non-scientific formats and in television documentaries (see attached publications list).

c. NFWF Adaptive Management

Offer any suggestions for NFWF to help guide improvement of our project administration. None

6. REFERENCES

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

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.

Scientific Publications

Abramov, V. K. 1962. On the biology of the Amur tiger, *Panthera tigris longipilis,* Fitzinger, 1868. Vestn. Ceskoslov. Spolecnsti Zool. 26:189-202. In Russian.

Baogang, S., D. G. Miquelle, Y. Xiaochen, E. Zhang, S. Hiyai. G. Goshen, D. G. Pikunov, Y. M. Dunishenko, and I. G. Nikolaev, and L. Daming. 1999. 1999 Survey of Amur Tigers and Far Eastern Leopards in Eastern Heilongjiang Province, China, and Recommendations for their Conservation. A final report to The Wildlife Conservation Society. 67pp.

Bogatov, V. V., D. G. Miquelle, S. M. Krasnepeev, V. A. Rosenberg, and W. T. Merrill. 1997. Biodiversity Assessment and Planning Biodiversity Conservation in the Russian Far East. 1997.TaxoNewSia 1(1).

Bogatov, V. V., D. G. Miquelle, V. A. Rozenberg, B. A. Voronov, S. M. Krasnopeev, and T. Merrill. 2000. A Biodiversity conservation strategy for the Sikhote-Alin. Russian Academy of Sciences, Far Eastern Branch, USAID Environmental Policy and Technology Project. Vladivostok, Zov Taigi. 80pp

Carroll, C. and D.G. Miquelle. 2006. Spatial viability analysis of Amur tiger *Panthera tigris altaica* in the Russian Far East: the role of protected areas and landscape matrix in population persistence. J. Appl. Ecol. 43:1056-1068

Goodrich, J. M., L. L. Kerley, D. G. Miquelle, E. N. Smirnov, I. G. Nikolaev, H.Quigley, M. Hornocker, B. Schleyer, N. N. Reebin, and A. V. Kosteeria. 1999. Preliminary analysis of the system of home ranges of *Panthera tigris altaica* in Sikhote-Alin Biosphere Reserve. Pages 89-97 in A. A. Arictov, editor, International Conference on Rare Mammal Species in Russia and Adjacent Territories. Russian Academy of Sciences, Moscow. (In Russian with English summaries.)

Goodrich, J. M., L. L. Kerley, B. O. Schleyer, D. G. Miquelle, K. S. Quigley, E. N. Smirnov, I. G. Nikolaev, H. B. Quigley, and M. G. Hornocker. 2001. Capture and chemical anesthesia of Amur tigers. Wildlife Society Bulletin: 29:533-542.

Goodrich, J. M. and D. G. Miquelle. 2006. Amur tiger research: where have we been and where are we going? Pages XX-XX *in* Miquelle and Kulikov, eds, Proceedings of the international conference on conservation of the Amur tiger: Khabarovsk, September 25-27, 2003

Goodrich, J. M. and D. G. Miquelle. 2005. Translocation of problem Amur tigers to alleviate tiger-human conflicts. Oryx 39:1-4.

Goodrich, J. M. and D. G. Miquelle. 2005. Tiger Research on the Sikhote-AlinBiosphere Zapovednik: Importance and Application of Scientific Research to Tiger Conservation. Pages 153-161 *in* E. V. Potikha, editor, Results of Protection and Research of the Sikhote-Alin Natural Landscape. Primpoligraphkombinat, Vladivostok, Russia. 516 pp. (In Russian with English summaries.)

Goodrich, J. M. and D. G. Miquelle. 2005. Collection of field data on tigers. Pages 21-25 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, eds. 2005. Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Goodrich, J. M., K. S. Quigley, D. G. Miquelle, E. N. Smirnov, L. L. Kerley, H. B. Quigley, M. G. Hornocker, and D. Armstrong. 2005. Blood chemistry and infectious diseases of Amur tigers. Pages 43-49 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors. Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Goodrich, J. M., L. L. Kerley, E. N. Smirnov, D. G. Miquelle, B. O. Schleyer, L. McDonald, T. L. McDonald. 2005. Survival Rates and Causes of Mortality of Amur Tigers on and near the Sikhote-Alin Biosphere Zapovednik. Pages 69-75 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors, Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Goodrich, J. M., L. L. Kerley, D. G. Miquelle, E. N. Smirnov, H. B. Quigley, M. G. Hornocker. 2005. Social structure of Amur tigers on Sikhote-Alin Biosphere Zapovednik. Pages 50-60 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors, Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Goodrich, J. M., L. L. Kerley, D. G. Miquelle, E. N. Smirnov, H. B. Quigley, M. G. Hornocker. 2005. Effects of roads on survival of Amur tigers. Pages 172-176 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors, Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Goodrich, J. M., L. L. Kerley, D. G. Miquelle, E. N. Smirnov, H. B. Quigley, M. G. Hornocker. 2005. Effects of human disturbance of Amur tigers at kills. Pages 176-

178 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors, Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Hayward, G. D., D. G. Miquelle, E. N. Smirnov, and C. Nations. 2002. Monitoring Amur tiger populations: characteristics of track surveys in snow. Wildlife Society Bulletin 30(4):

Karanth K.U. and J. D. Nichols. 2002. Monitoring Tigers and Their Prey: A Manual for Researcher, Managers and Conservationists in Tropical Asia. Centre for Wildlife Studies, India. 193 pp.

Karanth K. U., J. D. Nichols, J. Seidensticker, E. Dinerstein, J. L. David Smith, C.McDougal, A. J. T. Johnsingh, R. S. Chundawat and V. Thapar. 2003. Science deficiency in conservation practice: the monitoring of tiger populations in India. Animal Conservation 6:1-10

Karanth, U. K. and Stith, B. M. 1999. Prey depletion as a critical determinant of tiger population viability. Pages 100-113 *in* J. Seidensticker, S. Christie, and P. Jackson, editors, Riding the Tiger: Meeting the Needs of People and Wildlife in Asia. Cambridge University Press, Cambridge, United Kingdom.

Kenney, J. S., J. L. D. Smith, A. M. Starfield, and C. W. McDougal. 1995. The long-term effects of tiger poaching on population viability. Conservation Biology 9:1127-1133.

Kerley, L.L., G.P. Salkina. 2007. Using scent-matching dogs to identify individual Amur tigers from scats. Journal of Wildlife Management *in press.*

Kerley, L. L., J. M. Goodrich, D. G. Miquelle, E. N. Smirnov, I. G. Nikolaev, H. B. Quigley, and M. G. Hornocker. 2003. Reproductive parameters of wild female Amur (Siberian) tigers (*Panthera tigris altaica*). Journal of Mammalogy 84:288-298.

Kerley, L. L., J. M. Goodrich, D. G. Miquelle, E. N. Smirnov, I. G. Nikolaev, H. B. Quigley, and M. G. Hornocker. 2002. Effects of roads and human disturbance on Amur tigers. Conservation Biology 16:1-12.

Kerley, L. L., J. M. Goodrich, I. G. Nikolaev, D. G. Miquelle, E. N. Smirnov, H. B. Quigley, and M. G. Hornocker. 2005. Reproductive parameters of wild female Amur tigers. Pages 61-69 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors. Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Kostyria, A. V., and A. A. Belozor. 2002. Report on a camera trapping survey of tigers in Ussuriski Zapovednik and adjacent territory for winter and summer 2002. (in Russian).

Matyushkin, E. N. , D. G. Pikunov, Y. M. Dunishenko, D. G. Miquelle, I. G. Nikolaev, E. N. Smirnov, G. P. Salkina, V. K. Abramov, B. I. Bazilnikov, V. G. Yudin, and V. G. Korkiskho. 1999. Distribution and numbers of Amur tigers in the Russian Far East in the mid-1990s. Pages 242-271 in A. A. Aristova (ed.) Rare mammal species of Russia and neighboring territories. Russian Academy of Sciences Therological Society, Moscow (in Russian).

Matyushkin, E. N., Pikunov, D. G., Dunishenko, Y. M., Miquelle , D. G., Nikolaev, I. G., Smirnov, E. N., Salkina, G. P., Abramov, V. K., Bazylnikov, V. I., Yudin, V. G., & Korkishko, V. G. (1996). *Numbers, Distribution, and Habitat Status of the Amur Tiger in the Russian Far East: 'Express-report'*. Final report to the USAID Russian Far East Environmental Policy and Technology Project.

Matyushkin, E. N. and A. G. Yudakov. 1974. Tracks of the Amur tiger. Okhota i Okhotnichie Khozyaistvo. 5:12-17.

Matyushkin, E. N. 1978. Characteristic features of distribution and ecology of the Amur tiger as a geographical form of a species adapted to an extreme environment. International Tiger Symposium. Leipzig Zoological Garden. 1:23-32.

Matyushkin, E. N. , V. I. Zhivotchenko, and E. N. Smirnov. 1980. The Amur tiger in the USSR. IUCN, Gland, Switzerland.

Matyushkin, E. N. 1991. Preying patterns and behavior at the kill of Amur tiger. Bulletin Moscovsky Obschestva Ispytateley Prirody. 96:10-27.

Matyushkin, E. N. 1992. Tiger and elk on the coastal slopes of central Sikhote-Alin. Bulletin of the Moscow Oraganization for Investigation of Nature, Biology Branch. 97:3-19.

Matyushkin, E. N., D. G. Pikunov, Y. M. Dunishenko, D. G. Miquelle, I. G. Nikolaev, E. N. Smirnov, G. P. Salkina, V. K. Abramov, V. I. Bazylnikov, V. G. Yudin, and V. G. Korkishko. 1996. Numbers, distribution, and habitat status of the Amur tiger in the Russian Far East. Russian Far East Environmental Policy and Technology Project, A USAID Project, Washington, D.C., USA.

McDougal, C. 1977. The face of the tiger. Rivington Books, London, United Kingdom.

Miquelle, D. G. 1998. Tigers over-estimated, in News and Views section. Oryx 32 (1):15.

Miquelle, D. G., and E. N. Smirnov. 1999. People and tigers in the Russian Far East: searching for the "coexistence recipe". Pages 290-293 in 'Riding the tiger; meeting the needs of people and wildlife in Asia', eds. Seidensticker, J., S. Christie, and P. Jackson, Cambridge University Press, Cambridge.

Miquelle, D. G., E. N. Smirnov, H. G. Quigley, M. Hornocker E. G. Nikolaev, and E.N. Matyushkin. 1996. Food habits of Amur tigers in Sikhote-Alin Zapovednik and the Russian Far East, and implications for conservation. J. Wildl. Res. 1(2):138-147.

Miquelle, D. G., E. N. Smirnov, W. T. Merrill, A. E. Myslenkov, H. B. Quigley, M. G. Hornocker, and B. Schleyer. 1999. Hierarchical spatial analysis of Amur tiger relationships to habitat and prey. Pages 71-99 in 'Riding the tiger; meeting the needs of people and wildlife in Asia', eds. Seidensticker, J., S. Christie, and P. Jackson, Cambridge University Press, Cambridge.

Miquelle, D. G., H. G. Quigley, M. G. Hornocker, E. N. Smirnov, I. G. Nikolaev, and D. G. Pikunov. 1994. Conservation threats to the Siberian tiger. Pp. 274-278 in Thompson, I. D. (ed.) Proc. of the International Union of Game Biologists XXI Congress.

Miquelle, D. G., W. T. Merrill, Y. M. Dunishenko, E. N. Smirnov, H. B. Quigley, D. G. Pikunov, and M. G. Hornocker. 1999. A Habitat Protection Plan for the Amur tiger: Developing political and ecological criteria for a viable land-use plan. Pages 273-295 in 'Riding the tiger; meeting the needs of people and wildlife in Asia', eds. Seidensticker, J., S. Christie, and P. Jackson, Cambridge University Press, Cambridge.

Miquelle, D., H. Quigley, and M. Hornocker. 1993. Use of radiotelemetry in the study of the Amur tiger. Bulletin of the Moscow Society for the Study of Nature, Biology Branch. 98(3):63-72. (in Russian).

Miquelle, D. G., P. A. Stevens, E. N. Smirnov, J. M. Goodrich, O. J. Zaumyslava, and A. E. Myslenkov. 2005. Competitive exclusion, functional redundancy, and conservation implications: tigers and wolves in the Russian Far East. Pages 179-207 in Ray, J., J. Berger, K. Redford, & Steneck (eds.). Large Carnivores and the Conservation of Biodiversity. Island Press.

Miquelle, D. G., T. D. Arzhanova, and V. Solkin (eds.). 1996. A Recovery Plan for Conservation of the Far Eastern Leopard: results of an international conference held in Vladivostok, Russia. 81pp.

No author. 1998. A survey of tigers and prey resources in the Paektusan area, Lyangan Province, North Korea, in winter, 1998. Conducted by the Korean People's Democratic Republic Academy of Science Institute of Geography in association with:The Russian Academy of Science Far Eastern Branch Institute of Geography. Sponsored by The Wildlife Conservation Society

Miquelle, D.G., I. G. Nikolaev, J. Goodrich, B. Litvinov, E. N. Smirnov, and E. Suvorov. 2005. Searching for the Co-Existence Recipe: A Case Study Of Conflicts Between People And Tigers In The Russian Far East. Pages 305-322 in Woodruffe, R., and S. Thirgood (eds.). People and wildlife: conflict or co-existence? Cambridge University Press.

Miquelle, D. G. And A. Murzine. 2001. Spatial distribution of far eastern leopard in southwestern Primorski Krai, and recommendations for their conservation. Wildlife Conservation Society, Vladivostok, Russia.

Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors. 2005. Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Miquelle, D. G., L. L. Kerley, J. M. Goodrich, B. O. Schleyer, E. N. Smirnov, H. B. Quigley, M. G. Hornocker, I. G. Nikolaev, and E. N. Matyushkin. 2005. Food habits and conservation of Amur tigers on Sikhote-Alin Zapovednik and the Russian Far East. 2005. Pages 125-131 *in* Miquelle, D. G., E. N. Smirnov, and J. M. Goodrich, editors, Tigers of Sikhote-Alin Zapovednik: ecology and conservation. PSP, Vladivostok, Russia. 224 pp. (in Russian)

Myslenkov, A. I., and D. G. Miquelle. 2002. Use of radiotelemetry for the study of population dynamics of red deer. Pp. 189-192 in in The 7th Meeting of the UNESCO-MAB East Asian Biosphere Reserve Network: Capacity Building for Sustainable Management of East Asia Biosphere Reserves. Vladivostok, Dalnauka.

Russello, M. A., E. Gladyshev, D. Miquelle, and A. Caccone. 2005. Potential genetic consequences of a recent bottleneck in the Amur tiger of the Russian Far East. Conservation Genetics

Luo, Shu-Jin, Jae-Heup Kim, Warren E. Johnson, Joelle Wentzel, Janice Martenson, Marilyn Menotti-Raymond, Naoya Yuhki, Olga Uphyrkina, Howard B. Quigley, Dale G. Miquelle, Ronald Tilson, Gerald Brady, Paolo Martelli, Charles McDougal, Sun Hean, Shi-Qiang Huang, Wenshi Pan, Vellayan Subramaniam, James L. D. Smith, and Stephen J. O'Brien. 2004. Phylogeography and Genetic Ancestry of Tigers (*Panthera tigris*). PL^{O}S Biology 2 (12)e442: 1-19.

Pikunov, D. G., and D. G. Miquelle. 2002. Conservation of Amur tigers and Far Eastern leopards in the Tumen River area, Northeast Asia. Pp. 163-176 in The 7th Meeting of the UNESCO-MAB East Asian Biosphere Reserve Network: Capacity Building for Sustainable Management of East Asia Biosphere Reserves. Vladivostok, Dalnauka.

Pikunov, D. G., V. V. Aramilev, P. V. Fomenko, D. G. Miquelle, B. K. Abramov, and V. K. Korkisko. 1999. Numbers and distribution of leopards in the Russian Far East. Pages 277-297 in A. A. Aristova (ed.) Rare mammal species of Russia and neighboring territories. Russian Academy of Sciences Therological Society, Moscow (in Russian).

Pikunov, D. G., D. G. Miquelle, V. K. Abramov, I. G. Nikolaev, I. V. Seryodkin, A. I. Byelov, and V. G. Korkishko. 2003. A survey of leopards, *Panthera pardus orientalis*, in the Russian Far East. Wildlife Conservation Society, Russia, Vladivostok.

Pikunov, D. G.. D. G. Miquelle, M. G. Hornocker, H. B. Quigley, V. G. Korkishko, V. V. Aramilev, P. V. Fomenko, I. G. Nikolaev, V. K. Abramov. 1997. Number and distribution of the Far Eastern leopard in the Russian Far East in 1997. Report to the Hornocker Wildlife Institute and the Wildlife Conservation Society.

Schaller, G. B. 1967. The deer and the tiger. University of Chicago Press, Chicago, USA.

Seidensticker, J., and C. McDougal. 1993. Tiger predatory behavior, ecology, and conservation. Symposium of the Zoological Society of London 65:105-125.

Seidensticker, J. 1986. Large carnivores and the consequences of habitat insularization: ecology and

conservation of tigers in Indonesia ad Bangladesh. Pages 1-42 in Miller, S. D., and D. D. Everett editors, Cats of the World: biology, conservation, and management. National Wildlife Federation, Washington, D.C., USA.

Sharma, S., Y. Jhala, and V. B. Sawarkar. 2005. Identification of individual tigers (*Panthera tigris*) from their pugmarks. Journal of Zoology, London 267:9–18

Smirnov, E. N. 1993. The tiger population of the Sikhote-Alin Zapovednik and adjacent territory in the 1980s. Bulletin Moscovsky Obschestva Ispytateley Prirody. 98:37-44. (In Russian).

Smirnov, E. N. and D. G. Miquelle. 1999. Population dynamics of the Amur tiger in Sikhote-Alin State Biosphere Reserve. Pages 61-70 in 'Riding the tiger; meeting the needs of people and wildlife in Asia', eds. Seidensticker, J., S. Christie, and P. Jackson, Cambridge University Press, Cambridge.

Smirnov, E. N., I. G. Nikolaev, D. G. Miquelle, Goodrich, J. M., L. L. Kerley, H.Quigley, M. Hornocker, B. Schleyer, N. N. Reebin, and A. V. Kosteeria. 1999. New data on Amur tiger reproduction. Pages 414-426 in A. A. Arictov, editor, International Conference on Rare Mammal Species in Russia and Adjacent Territories. Russian Academy of Sciences, Moscow. (In Russian with English summaries.).

Smirnov, E.N., and D. G. Miquelle. 1996. Population dynamics of the Amur tiger (*Panthera tigris altaica*) in Sikhote-Alin State Biosphere Reserve. J. Wildl. Res.

Smith, J. D. 1984. Dispersal, communication, and conservation strategies for the tiger (*Panthera tigris*) in Royal Chitwan National Park, Nepal. Ph.D. dissertation, University of Minnesota, St. Paul, Minnesota, USA.

Smith, J. L. D., C. W. McDougal, and M. E. Sunquist. 1987. Female land tenure system in tigers. Pages 97-109 *in* R. L. Tilson and U. S. Seal, editors, Tigers of the World: the Biology, Biopolitics, Management, and Conservation of an Endangered Species. Noyes Publications, Park Ridge, New Jersey, USA.

Smith, J. L. D., C. McDougal, and D. Miquelle. 1989. Chemical communication in free-ranging tigers, (*Panthera tigris*). Animal Behaviour 37:1-10.

Smith, J. L. D., and C. McDougal. 1991. The contribution of variance in lifetime reproduction to effective population size in tigers. Conservation Biology 5:484-490.

Smith, J. L. D. 1993. The role of dispersal in structuring the Chitwan tiger population. Behaviour 124:165-195.

Stepenitski, V. B. (editor). 1996. Compilation of directives for nature reserves. World Wildlife Fund for Nature and Center for Nature Conservation, Moscow.

Sunquist, M. E. 1981. The social organization of tigers (*Panthera tigris*) in Royal Chitawan National Park, Nepal. Smithsonian Institution Press, Washington, D.C., USA.

Sunquist, M. E., K. U. Karanth, and F. Sunquist. 1999. Ecology, behavior, and resilience of the tiger and its conservation needs. Pages 5-18 *in* J. Seidensticker, S. Christie, and P. Jackson , editors. 'Riding the Tiger; Meeting the needs of people and wildlife in Asia. Cambridge University Press, Cambridge, United Kingdom.

Stephens P.A, Zaumyslova O.Yu, Miquelle D.G, Myslenkov A.I, Hayward G.D. 2006. Estimating population density from indirect sign: track counts and the Formozov-Malyshev- Pereleshin formula. Animal Conservation 9: 339-48

Uphyrkina, O., D. G. Miquelle, H. Quigley, and S. J. O'Brien 2002. Conservation Genetics of the Far Eastern Leopard *(Panthera pardus orientalis)* J. Heredity 93:303-311.

Uphyrkina, O., W. E. Johnson, H. Quigley, and D. Miquelle, L. Marker, M. Bush, and S. J. O'Brien 2001. Phylogenetics, Genome Diversity and origin of modern Leopard, *Panthera pardus.* Molecular Ecology 10:2617-2633.

Wentzel, J., J. C. Stephens, W. Johnson, M. Menotti-Raymond, J. P. Slattery, N. Yuhki, M. Carrington, H. Quigley, D. Miquelle, R. Tilson, J. Manansang, G. Brady, L. Zhi, P. Wenshi, H. Shi-Qiang, L. Johnston, M. Sunquist, U. Karanth, and S. J. O'Brien. 1999. Molecular genetic ascertainment of subspecies affiliation in tigers. In 'Riding the tiger; meeting the needs of people and wildlife in Asia', eds. Seidensticker, J., S. Christie, and P. Jackson, Cambridge University Press, Cambridge.

Yang, S., J. Jiang, Z. Wu, T. Li, X. Yang, X. Han, D. G. Miquelle, D. G. Pikunov, Y. M. Dunishenko, and I. G. Nikolaev. 1998. A survey of tigers and leopards in eastern Jilin Province, China, winter 1998. A final report to the UNDP and The Wildlife Conservation Society. 38pp.

Yudakov, A. G. and I. G. Nikolaev. 1987. Ecology of the Amur tiger. Winter long-term observations in the western part of the middle Sikhote-Alin, 1970-1973. Moscow, Nauka Press.

Reports/Statements

Baogang, S., D. G. Miquelle, Y. Xiaochen, E. Zhang, S. Hiyai. G. Goshen, D. G. Pikunov, Y. M. Dunishenko, and I. G. Nikolaev, and L. Daming. 1999. 1999 Survey of Amur Tigers and Far Eastern Leopards in Eastern Heilongjiang Province, China, and Recommendations for their Conservation. A final report to The Wildlife Conservation Society. 67pp.

Bogatov, V. V. D. G. Miquelle, S. M. Krasnepeev, V. A. Rosenberg, and W. T. Merrill. 1997. Biodiversity Assessment and Planning Biodiversity Conservation in the Russian Far East. 1997.TaxoNewSia 1(1).

Bogatov, V. V., D. G. Miquelle, V. A. Rozenberg, B. A. Voronov, S. M. Krasnopeev, and T. Merrill. 2000. A Biodiversity conservation strategy for the Sikhote-Alin. Russian Academy of Sciences, Far Eastern Branch, USAID Environmental Policy and Technology Project. Vladivostok, Zov Taigi. 80pp

Breitenmoser-Wursten, C., U. Breitenmoser, S. Christie, P Crawshaw, R Jackson, T. McCarthy, L. Marker, M. G. Mills, D. Miquelle, K. Nowell, and J. Sanderson. 2002. The status of the Iberian lynx: a statement by the USCN/SSC Cat Specialist Group. Cat News37(Autumn):2-4.

Kostyria, A. V., and A. A. Belozor. 2002. Report on a camera trapping survey of tigers in Ussuriski Zapovednik and adjacent territory for winter and summer 2002. (in Russian).

Matyushkin, E. N., Pikunov, D. G., Dunishenko, Y. M., Miquelle , D. G., Nikolaev, I. G., Smirnov, E. N., Salkina, G. P., Abramov, V. K., Bazylnikov, V. I., Yudin, V. G., & Korkishko, V. G. (1996). *Numbers, Distribution, and Habitat Status of the Amur Tiger in the Russian Far East: 'Express-report'*. Final report to the USAID Russian Far East Environmental Policy and Technology Project.

Miquelle, D. G., H. B. Quigley , M. Hornocker, E. N. Smirnov, I. G. Nickolaev. 1995. Past and present status, present threats, and conservation of the Siberian (Amur) tiger in the wild. Proc. Special Meeting of the Amur tiger EEP.

Miquelle, D. G., J. Goodrich, and S. Christie. July 26, 2001. Rehabilitation and Translocation of two adult female amur tigers.

Miquelle, D. G., T. D. Arzhanova, and V. Solkin (eds.). 1996. A Recovery Plan for Conservation of the Far Eastern Leopard: results of an international conference held in Vladivostok, Russia. 81pp.

No author. 1998. A survey of tigers and prey resources in the Paektusan area, Lyangan Province, North Korea, in winter, 1998. Conducted by the Korean People's Democratic Republic Academy of Science Institute of Geography in association with:The Russian

Academy of Science Far Eastern Branch Institute of Geography. Sponsored by The Wildlife Conservation Society
Paczkowski, J. "Kamchatka Brown Bear Conservation Program Interim Progress Report June 29 to November 8, 2002"
Pikunov, D. G.. D. G. Miquelle, M. G. Hornocker, H. B. Quigley, V. G. Korkishko, V. V. Aramilev, P. V. Fomenko, I. G. Nikolaev, V. K. Abramov. 1997. Number and distribution of the Far Eastern leopard in the Russian Far East in 1997. Report to the Hornocker Wildlife Institute and the Wildlife Conservation Society.
Smirnov, E. N., and D. G. Miquelle 1995 Amur tiger census in northeast Primorye Krai, Russia. Final Report to the Wildlife Conservation Society.
Yang, S., J. Jiang, Z. Wu, T. Li, X. Yang, X. Han, D. G. Miquelle, D. G. Pikunov, Y. M. Dunishenko, and I. G. Nikolaev. 1998. A survey of tigers and leopards in eastern Jilin Province, China, winter 1998. A final report to the UNDP and The Wildlife Conservation Society. 38pp.

Popular/Semi-Popular Articles

Aramilev, V. V., P. Fomenko, and D. G. Miquelle. 1999. A 1998 survey of leopards. Zov Taiga: 4:6-11 (in Russian).
Augustine, J.,D. G. Miquelle, and V. G. Korkishko, 1996. Preliminary Results of the Far Eastern Leopard Ecology Project: Implications for Conservation and Management. Zov Taigi.
Baogang, S. E. Zhang, and D. Miquelle. 1999. Siberian tigers on brink of extinction in China. Cat News 31:2.
Christie, S. 2002. Translocating tigers. Lifewatch. Autumn/winter20-21.
Goodrich, J. 2001. Letter from Russia. Notes From the Field. Wildlife Conservation Society. Winter 2001: 1.
Goodrich, J. 2002. Anesthetizing wild Siberian tigers. Wildlife Conservation Society Science and Exploration Website.
Goodrich, J. 2002. Cat capture: all in a day's work. Wildlife Conservation. 105 (3): 10.
Goodrich, J. 2002. Letter from Russia. Notes From the Field. Wildlife Conservation Society. Spring/Summer 2002: 2.
Goodrich, J. 2002. On a lynx. Wildlife Conservation. 105(4):22-23.
Goodrich, J. 2003. Chinese bile farms threaten Russian bears. Wildlife Conservation 106(1):6.
Goodrich, J. 2003. Tracking Olga. Wildlife Conservation: 106(3):4-6.
Goodrich, J. 2003. Letter from Russia. Notes from the field. Wildlife Conservation Society.
Goodrich, J. *In press.* Capture of Galia's cubs. National Geographic, Russia (in Russian).
Goodrich, J. 2004. Veterinarians report first case of canine distemper in wild tigers. Zov Taigi 6:26-27.
Goodrich, J. 2004. How young cubs received radio collars. Zov Taigi 6:22-27 (in Russian).
Goodrich, J. 2004. Helping cubs survive, part I. Vectnik Terney. 87:2. (in Russian).
Goodrich, J. 2004. Helping cubs survive, part II. Vectnik Terney. 88:2. (in Russian).
Goodrich, J. 2004. Tracking Olga. Vectnik Terney. 82: 2. (in Russian; translation of Goodrich 2003).
Goodrich, J. 2004. Against all odds. Vectnik Terney. 83:2.(in Russian; translation of Goodrich 2004).
Goodrich, J. 2004. The magic of the tiger. Pages 108-109 *in* V. Thapar, editor, Tiger: the ultimate guide. CDS Books, New York.
Goodrich, J. 2004. Team tiger. Wildlife Conservation 107 (3): 34-37.
Goodrich, J. 2004. Against all odds: a Siberian tiger is rescued from a poacher's snare. Wildlife Conservation 107 (3): 6-7.

Goodrich, J. 2004. A two-year-old in trouble. Wildlife Conservation 107 (1): 8.
Goodrich, J. 2005. On the Sea of Japan. Priroda 1076: 52-54. (in Russian).
Goodrich, J. 2005. Capture of Galia's cubs. National Geographic, Russia 10:16-17 (in Russian).
Goodrich, J. 2006. Against all odds. Land Rover Lifestyles Magazine.
Goodrich, J. 2007. Russia's coolest cat. BBC Wildlife magazine. *In press*.
Goodrich, Kerley, Miquelle, Quigley, et al. 1995-2003. Tiger tracks: newsletter of the Siberian Tiger Project. Hornocker Wildlife Institute and Friends of the Earth. Published Quarterly.
Goodrich, J. L. Kerley, D. Miquelle, and E. Smirnov. 2002. Amur tiger conservation, roads, and human disturbance in the Russian Far East. CatNews No.36:2-3.
Goodrich, J., D. Miquelle, L. Kerely, and E. Smirnov. 2002. Roads and Amur tigers. Zov Taigi 59 (1): 26-31 (in Russian).
Goodrich, J., D. Miquelle, L. Kerley, and E. Smirnov. 2002. Time for tigers. Wildlife Conservation. 105 (1): 22-29.
Kerley, L., J. Goodrich, and D. G. Miquelle. 1996. Bears and tigers in the Russian Far East. International Bear News 5(2): 4-5.
Miquelle, D. G. 1998. Sharing the Spotlight. Zoogoer Magazine.
Miquelle, D. G. 1999. New wildlife reserve in Russian Far East. Cat News 31:2.
Miquelle, D. G. 2001. Tiger. Pp. 18-21 in D. MacDonald (ed.) The New Encyclopedia of Mammals. Oxford University Press.
Miquelle, D. G. 2000. Counting tigers in the Russian Far East: "How many are there?" versus "Is there a change?" Russian Conservation News.
Miquelle, D. G., 2001. Vladimir. Wildlife Conservation.
Miquelle, D. G., 2002. Happy Birthday, Olga. Zov Taiga 6.
Miquelle, D. G., E. Zhang, and M. Jones (eds.). 2001.Proceedings of the Workshop to Develop a Recovery Plan for the Wild North China Tiger Population, October 20-23, 2000, Harbin. Final report to U.S. Fish and Wildlife Service's Rhinoceros and Tiger Conservation Fund from the Wildlife Conservation Society.
Miquelle, D. G., J. Goodrich, and S. Christie. 2001. A tiger Odyssey. Zov Taiga 5(58): 56-68 (in Russian).
Miquelle, D. G., Quigley, H. G., and M. G. Hornocker. 1995. A habitat protection plan for the Amur tiger. 44pp.
Miquelle, D. G., V. V. Aramilev, and P. Fomenko. 1999. Far Eastern leopard census in Russia and the status of the subspecies across the Far East. Cat News 31:11-12.
Miquelle, D. G., Yu. Darman, P. Fomenko, D. Pikunov, V. Aramilev. 2001. The quiet spotted brother and the loud striped monster. Zov Taigi 3(56): 16-19 (in Russian).
Miquelle, D. G.. 1998. Tigers and leopards in Jilin Province, China. Cat News 28(spring):5-6.
Miquelle. D. G. 2001. Counting tigers in the Russian Far East: "How many are there?" versus "Is there a change?" CatNews 34:9-11.
Miquelle. D. G. 2001. Workshop on Recovery of the Far Eastern (Amur) Leopard, Vladivostok, Russia. CatNews 34:2-4.
Pikunov, D. G., and D. G. Miquelle. 1998. Tigers in North Korea. Cat News 28(spring):6.
Pikunov, D. G., V. V. Aramilev, I. G. Nikolaev, V. G. Korkishko, V. K. Abramov, P. V. Fomenko, and D. G. Miquelle. 2000. The decline of the Amur leopard in the Russian Far East. Russian Conservation News 24 (Fall/Winter): 19-21.
Pikunov, D., D. Miquelle, and P. Fomenko. 2002. Deep snows threaten last Far Eastern leopards . Cat News 36:6-7.
Quigley, H. 2002. Tiger by the tail. Wildlife Conservation. 105 (1):6-7.

Raygorodetsky, G. 2003. Not just any bears. Wildlife Conservation. 106(2):4.
Schoene, C.U.R., Jewgenow, K., Göritz, F., Arzhanova, T., Miquelle, D., Goodrich, J, Kostyria, A., Ziliakova, L.V., Christie, S. & Lewis, J. 2007. Beitrag der Tiermedizin zur Erhaltung gefährdeter Arten. Eine Möglichkeit: Das Amur Leopard & Wildlife Health Project. Deutsches Tierärzteblatt, 10:1258-61.
Seryodkin, I. and J. Goodrich. 2001. Radiocollared bears. Terney Herald. 21:1.
Seryodkin, I. 2002. Spring bear tracking. Conservation of Wild Nature. 24:18-23.
Seryodkin, I. 2003. With bears – good dreams! Terney Herald. 41:8.
Smirnov, E. N. 1999. Olga, Lena, Natasha and other … tigers. Priroda 1006 (6):40-50.
Smirnov, E. 2000. Meetings with tigers. Dalnauka, Vladivostok, Russia. 143 pp. (in Russian)
Smirnov, E. N. 2001. The Amur tiger must be saved by all means. Priroda 1026 (2):47-56.
Smirnov, Goodrich, et al. 2002. Two-page spread in the Terney newspaper about tigers and related issues. Monthly.
Smirnov, E. G. and J. Goodrich. 2005. "Radio-log" of an Ussuri cat: race with an antenna. Priroda 4:48-51.

Films/Television

Bears of the Russian Front. Survival Anglia. 2001.
Tigers in the Snow. National Geographic Society.
In the Shadow of the Tiger. Discovery (Joe Pontecorvo).
CBS Morning Show 1993.
CNN Newspiece 1994.
Champions of the Wild 2001.
Tiger Odyssey, Zov Taigi (3 part series on Vladivostok television)
Tiger Burning Bright, Natural History New Zealand and National Geographic Society (2003).

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Attachment: Logic Model

Logic Framework:

Activities	Project Outputs	Post-Project Outcomes	Indicator	Baseline Value	Predicted Value Project Output	Actual Value of Project Value	Predicted Post-Project Outcome
Radio-collar and monitor five-week-old cubs.	Estimates of cub survival and causes of mortality and potential ways to reduce mortality.	Potential to increase or at least avoid inhibiting tiger reproduction.	Number of cubs radio-collared.	6	10	9	20
Monitor dispersing tigers.	Description of dispersal routes, barriers to dispersal and of potential ways to enhance dispersal.	Improved habitat protection plans.	Number of dispersing tigers tracked from the onset of dispersal until they settle or die.	11	13	14	20
Monitor collared tigers on Sikhote-Alin Zapovednik, with focus on determining if population can withstand current high densities.	Data available on a variety of aspects of tiger ecology, we will determine if tiger populations can exist at densities twice as high as previously believed possible.	Potential to manage tiger populations at higher densities.	number of tigers monitored	50	55	53	75
Collection of data on predation sequences.	Improved estimates of tiger pressure on prey populations.	Recommenda-tions for improved prey management and improved hunter attitudes towards tiger conservation.	Number of predation sequences observed.	29	35	35	53

Continue capture-recapture density estimation studies.	Estimates of tiger densities on SABZ, a comparison of density estimates, and recommendations for improving current monitoring techniques.	Improved ability to monitor and study tiger populations.	Number of camera trap-nights.	200	3600	3134	12000
Train, assist, advise, and otherwise encourage and support graduate students currently conducting research, and search for new students	Improved capacity to collect, analyze, and publish data sets because there will be several graduate students involved with these activities.	Well trained conservation biologists equipped to deal with modern conservation issues at an international level.	Number of students enrolled in research.	1	3	3	15
Assist Inspection Tiger with conflict situations, relocating tigers when necessary, and train Inspection Tiger personnel.	Increased tiger survival and reduced risk to people and livestock.	Improved public attitudes towards tiger conservation, an Inspection Tiger team capable of working independently of WCS, and improved techniques for alleviating conflicts.	Number of conflict cases assisted.	29	32	35	60

Train, assist, advise, and otherwise encourage and support graduate students currently conducting research, and search for new students	Improved capacity to collect, analyze, and publish data sets because there will be several graduate students involved with these activities.	Well trained conservation biologists equipped to deal with modern conservation issues at an international level.	Number of well trained conservation biologists with graduate degrees	0	2	2	7