Final report to WildCats Conservation Alliance from the Zoological Society of London

Carnivores Disease Circulation in Lazovsky Zapovednik and Adjacent Areas

May 2017-December 2018

Project contact and coordinator: Mikhail Goncharuk

Email: Mikhail.goncharuk84@gmail.com

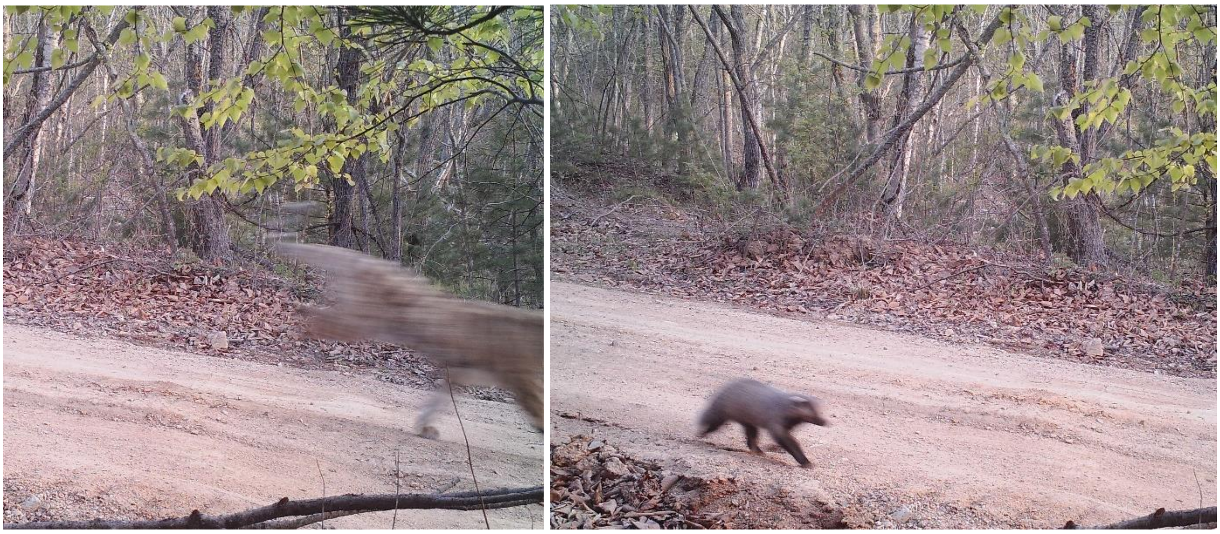

Image: Two consecutive camera trap phots showing a young Amur tiger chasing a badger in a hunting attempt. Badgers are often eaten by tigers; a behavior that may be important for spread of diseases.

Introduction

The project is in south-east of Primorsky Krai in the Lazo area which includes Lazovsky Zapovednik (LZ), and adjacent settlements. Lazovsky Zapovednik (LZ), also known as a Lazovsky State Nature Reserve, is located on the most south-eastern part of Russian Far East. LZ is a core habit for Endangered Amur tiger (*Panthera tigris altaica*) and has been proposed as the most suitable site for the Critically Endangered Amur leopard (*Panthera pardus orientalis*) reintroduction. The landscape is populated by a variety of different meso-carnivore species such as Asian badger (*Meles leucurus*), raccoon dog (*Nyctereutes procyonoides*), leopard cat (*Prionailurus bengalensis*), fox (*Vulpes vulpes*), Eurasian otter (*Lutra lutra*), several smaller mustelids, as well as domestic dog (*Canis lupus familiaris*) and domestic cat (*Felis catus*). These animals, because they typically occur at high densities, are thought to play a key role in the transmission of infectious diseases, common in carnivores, between Amur tigers that currently inhabit this area or Amur leopards following reintroduction in future. With this in mind, since the spring of 2008, we have been conducting serological surveys to identify the presence of a number of selected pathogens that could pose a threat to big cats, including canine distemper virus (CDV), rabies, parvovirus, coronavirus, toxoplasmosis, feline leukemia virus and feline immunodeficiency virus, in targeted areas of LZ and adjacent settlements. Results from our preceding long-term wildlife disease monitoring study show the occurrence of these selected diseases in different parts of the study area. However, to fully understand the effect these diseases could have on populations of meso-carnivores and thus to populations of big cats, we continued our disease monitoring work through our camera trap surveys to estimate meso-carnivores density in LZ.

Objectives:

1. **Monitoring targeted infectious diseases in the study area**

In 2017-2018, we conducted four meso-carnivore live-trapping seasons across two trapping sites (Figure 1) over 3,470 trap-days. The first trapping site studied in spring of 2017 was located in the proposed Amur leopard reintroduction release site in the core of LZ. To maximize our efforts, we ensured that adequate representation of the landscape was sampled and considered tiger densities. The second trapping site studied in fall of 2017 and spring-fall 2018 focused on the eastern coastal part of LZ where camera trap monitoring has shown a higher tiger abundance. Veterinary and forestry students from Primorski State Agricultural Academy (PSAA) assisted in data collection during live-trappings, providing them with hands-on field experience which will be vital for their long-term development.

We set live cage traps along line transects parallel to streams and trails at 200m intervals. Traps were checked each day in late morning and captured animals were immobilized using combinations of tiletamine/zolazepam, tiletamine/zolazepam/meditomedine, and dexmedetomidin depending on the species. We monitored and recorded heart rate, breathing and body temperatures of each animal during anesthesia. We collected blood, ecto-parasites, nasal, oral and conjunctival samples, as well as biometric data from each individual captured. When we used meditomedin in combination with tiletamine/zolazepam or dexmedetomedin, atipamezole was also given to animals for faster recovery. Fluid therapy by intravenous infusion was also given to animals to prevent dehydration and to quicken thiletamin excretion. After recovery, the animals were released back to the wild.

Thirty-nine animals of eight species were trapped during the four seasons: leopard cat, hedgehog, squirrel, American mink, sable, raccoon dog, badger, otter (Table 1, Figures 2-9). Although hedgehog and squirrel are not carnivores we sampled them opportunistically when captured as by-catch. Samples are being stored in liquid nitrogen until laboratory tests can be conducted both in-country and exported for a collaboration with the University of Glasgow. Currently we are organizing our samples' analysis inside of Russia and there are two possible options: State Scientific Center of Virology and Biotechnology "Vector" (Novosibirsk) or Federal research center of Virology and Microbiology (Vladimir). Ideally, it is planned to test samples in cooperation with two organizations mentioned above and also in laboratories in the United Kingdom and USA for results' comparison. If results of testing will be equal to each other, later it will be worth testing all samples inside of Russia as it will save our funds for laboratory analysis (samples export costs much more than actual testing for its own). Accurate test results are critical to our work but few laboratories have the capacity to analyze samples from wild animals and careful evaluation of laboratory results is needed to determine current and future prospective collaborators. Test results will be done by summer. As we can't spend money until the moment of actual samples' testing – we will be grateful to keep this money available until the moment of testing.

Table 1. Species and number of animals trapped during 4 field seasons (2017-2018).

Species	**Total**	**Spring 2017**	**Fall 2017**	**Spring 2018**	**Fall 2018**
Leopard cat (*Prionailurus bengalensis*)	7	0	4	2	1
Asian badger (*Meles leucurus*)	14	2	2	6	4
Raccoon dog (*Nyctereutes procyonoides*)	5	0	3	1	1
American mink *(Mustela vision)*	1	1	0	0	0
Sable *(Martes zibellina)*	1	1	0	0	0
Red squirrel (*Sciurus vulgaris)*	1	1	0	0	0
Amur hedgehog *(Erinaceus amurensis)*	8	4	0	4	0
Otter (*Lutra lutra)*	2	0	0	1	1

Figure 1. Locations of live trapping surveys in spring 2017 (site 1) and fall / spring / fall of 2017-2018 (site 2)

Figure 2. Collecting biometric data from a live captured leopard cat

Figure 3. Collecting a blood sample from a live, captured raccoon dog

Figure 4. Physical examination of live, captured leopard cat by Mikhail Borisenko (left) and Mikhail Goncharuk (right)

Figure 5. Managing of fluid therapy for Asiatic badger

Figure 6. Students from Primorski State Agricultural Academy measuring the biometrics of a live captured sable.

Figure 7. Mikhail Goncharuk is checking airways of otter

Figure 8. Mikhail Goncharuk is monitoring heart-rate of Asiatic badger

Figure 9. The author working on a very unusual white otter captured in Fall 2018. Anesthesia of otter with use of field isoflurane anesthetic kit

2. Estimation of wild meso-carnivores density

Despite knowing which infectious diseases are present in the landscape, it is difficult to understand and, moreover, anticipate what effect they could have on populations of meso-carnivores and to population of big cats. In collaboration with Wildlife Conservation Society's (WCS) epidemiologist Martin Gilbert, we studied CDV in domestic cat and dog populations in settlements around LZ in 2014. In order to fully understand the epidemiological effects of CDV we also need to estimate the densities of wild carnivores in our study area.

We proposed to use two concurrent approaches to estimate densities of targeted meso-carnivore species in 3 study areas (Figure 12): 1) to estimate badger density using den surveys in conjunction with camera trap surveys because badgers live in colonies and can be individually recognized from photographs; and 2) to estimate other solitary species densities using camera traps without the need for individual recognition (Rowcliffe et al. 2008). Due to labour and resource-intensive nature of both methodologies, we undertake each methodology separately, beginning with estimating badger density, to maximum efforts. Previously it was planned to survey densities of solitary species by using Rowcliffe's methodology in spring 2018, but because there is little information on targeted species' spatial ecology, we decided to put all our efforts on badgers' study. However, during 2017-2018 we made a try to estimate population of solitary mesocarnivores by setting up number of camera traps in three study areas (Site 1 – 1940 trap/days; Site 2 – 3036 trap/days; Site 3 – 1286 trap/days). Number of species per 100 trap/days during 2017 and 2018 years are shown in graphics (Figure 10,11).

Figure 10. Number of meso-carnivore species per 100 trap/days in studied areas in 2017

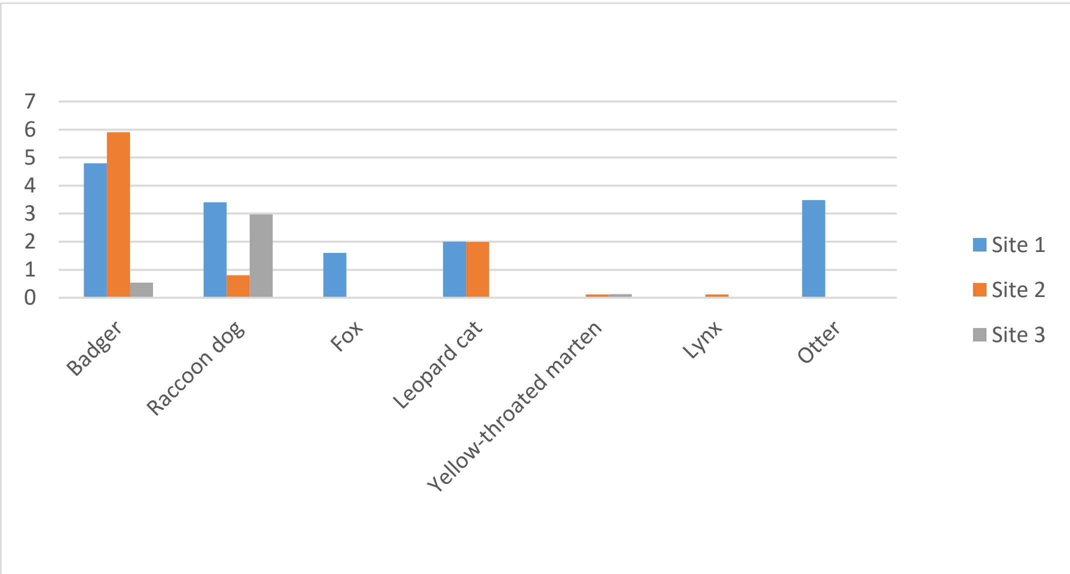

Fig. 11 Number of meso-carnivore species per 100 trap/days in studied areas in 2018

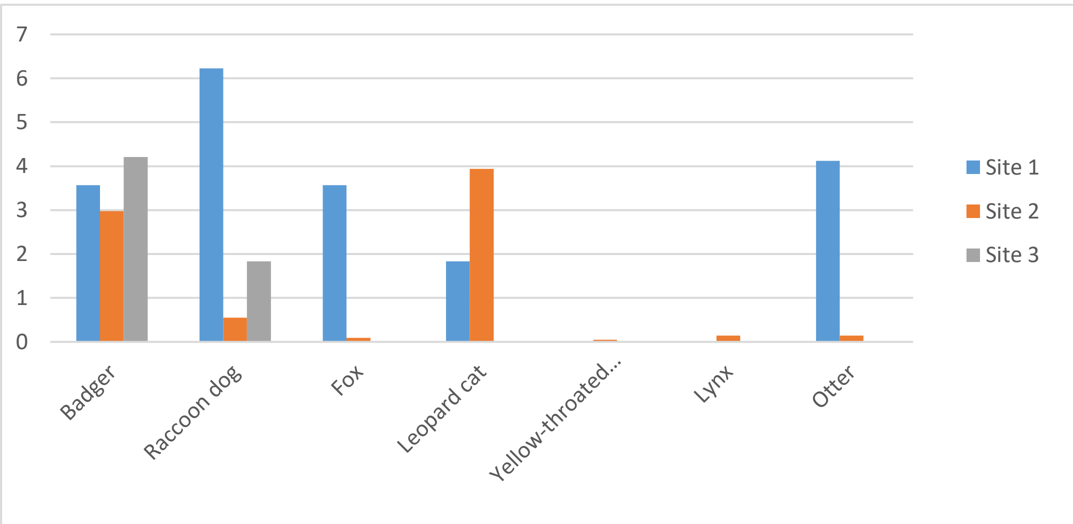

Figure 12. Sites for meso-carnivores density estimation with use of camera traps during spring/fall of 2017 and spring/fall of 2018.

Badger den (also known as setts) surveys were conducted on five 1 km^2 plots on 3 sites to estimate setts/1 km^2 (Figure 12), and badger abundance/sett was estimated using camera traps placed at selected den entrances from April-June 2017, from September--November 2017, and again from April-June 2018 and from September to November of 2018. Each badger was recognized by individual face marking recorded on camera trap photographs. We recorded 10 badger setts on five plots (2 setts/ 1-km^2) and through our camera trapping work, we identified one to seven badgers per sett (Table 2). Estimated number of badgers per sett (including litter) from spring of 2017 to fall of 2018 varied from 2,1 to 3,2 and thus estimated number of badgers per 1 km^2 varied from 4,2 to 6,4. In addition to badgers, camera trapping also provided valuable insight into the inter-species relationships important to effectively implement our Wildlife Health Programme. For example, our initial analysis of our camera trap images has provided evidence that badger setts and "toilets" are routinely visited by other carnivore species, including tigers (Figures 15 – 23) and these interactions may play a significant role in the transmission of diseases among carnivores.

Data that will be obtained from such combined approach in study of sero-positivity of animals to targeted diseases and study of meso-carnivores densities will throw the light on influence of those diseases in population changes thus on threats and probability of transmission to highly endangered Amur tigers and potentially highly endangered Amur leopards that are planned to be reintroduced to the area in future. To the moment through cooperation with Wildlife Vets International (WVI) we have opportunity to perform combined analysis of sero-survey and demographic data by experienced wildlife epidemiologist Alexandra Thomlinson. Nevertheless, to understand in full degree the situation around meso-carnivores in Lazovsky reserve we will continue this work in frame of long-term monitoring.

Meso-carnivores wildlife health monitoring is respectively new branch of wildlife health study in our area. Thank you for this grant and for opportunity to deepen our study which will definitely serve (and actually serves to the moment) as a good model to other meso-carnivores wildlife health monitoring projects in Russian Far East.

Table 2. Badger camera trapping data collected April-June 2017, September-December 2017, April – Jun 2018 and September-November 2018 in LZ

Site from Figure 1	1 km² Plot	Sett	Trap/ days	Number of picture sets	Number of individual badgers identified (spring 2017)	Number of individual badgers identified (fall 2017)	Number of individual badgers identified (spring 2018)	Number of individual badgers identified (fall 2018)	Litters
Site 1 (Petrov)	1	A	724	177	4-5	4-5	1-2	4-5	Not seen
		B	362	189	1-3	4-5	2-3	2-3	Not seen
		C	362	356	2-3	2-3	2-3	2-3	Not seen
	2	A	362	317	1	3-4	2-3 (including 1 cub)	1-2	yes
		B	724	264	4-5 (including 3 cubs)	2-3	1-2	1-2	yes
Site 2 (Tochingos)	1	A	287	177	2-3	1	1-2	1-2	Not seen
		B	664	189	2-3	2-3	1-2	1-2	Not seen
Site 4 (Zvezdochk a)	1	A	211	23	1-2	No data	1-2	1-2	Not seen
	2	A	211	335	2-3	No data	3-4	3-7	Not seen
		B	211	427	1-3	No data	3-4	4-7	Not seen

Figure 13. ZSL's field crew conducting badger den, or sett, surveys on 1 km^2 plots and recording all badger dens

Figure 14. A family of badgers at a “sett”, photographed during a badgers’ density survey. Note Amur badgers have characteristically dark muzzles.

Figure 15. A badger photographed at a “toilet”

Figure 16. A lynx photographed at the same badger “toilet” as Figure 15

Figure 17. A raccoon dog at the same badger “toilet” as Figure 15

Figure 18. An Amur tiger at the same badger “toilet” as Figure 15

Figure 19. A badger on a settlement “entrance” on Tachingos

Figure 20. A tiger on a same badgers settlement “entrance” on Tachingos as on Figure 19

Figure 21. A badger on settlement on Petrov

Figure 22. A yellow-throated marten on same settlement as on Figure 21

Figure 23. A sable on same settlement as on Figure 21

Revised Budget after consulting with and gaining permission from ALTA to change the line items, but keeping the total amounts the same as the original grant.

	Unit cost	Number of units	Total cost£	Spent £
Salary (contribution to M. Goncharuk's salary	406.7£	12	4880	6,117.65
Per diem (90 days)	7.50£	2 students	1350£	2,131.09
Patrol and repair of car per month	225£	12 months	2700£	4,096.05
Equipment				
Veterinary pulse oximeter	640£	1	640£	93.68
GPS device	750£	1	750£	331.38
Backup hardware (stationary)	100£	1	100£	143.94
Backup hardware (portable)	75£	2	150£	123.07
Dewar flask	750£	1	750£	528.97
Camera traps	150£	15	2250£	2,044.50
Supplies				
Drugs (anaesthetics, emergency drugs, supplementary)			675£	378.77
Disposables			375£	180.35
Liquid nitrogen	25£	12 months	300£	159.45
Flash cards	7.50£	20	150£	226.43
Batteries	1£	480	480£	142.00
Export and laboratory testing				
Export to the UK			2225£	19.57
Analyses			2225£	
Total:			**20000£**	**16,716.90**