CHAPTER 8

Non-infectious diseases in Amur tigers

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Because rare and endangered wildlife species are often important yet vulnerable components of ecosystems, they play a valuable role as indicators of ecosystem function and in conservation of global biodiversity. The Amur tiger is a rare representative of the fauna of the southern Russian Far East. Protection of its range and ensuring the persistence of this tiger population in its natural environment also ensures the preservation of ecosystem services necessary for human survival.

Diseases are important factors which can impact wildlife populations. Across Primorskii Krai and the greater southern Russian Far East there are a range of diseases that are dangerous not only for wildlife but for humans as well. Some of these diseases exist only in this region and in adjacent countries, and are absent in other regions of Russia. Not all of the general recommendations for disease prevention within the Russian Federation are applicable to Primorye, and therefore wildlife disease research in this region is of great importance.

Little is known about the impact of diseases on Amur tigers due to a lack of research. Diseases in Amur tiger are studied as part of a general monitoring of infectious and non-infectious wildlife diseases in Primorskii and Khabarovskii Krais.

From 2007–2011, specialists from the Primorskaya State Academy of Agriculture conducted post-mortem examinations of 19 Amur tigers (11 males and 8 females) of different ages from both Primorskii and Khabarovskii Krais.

It was determined that during the period of study, tiger deaths were associated not only with anthropogenic factors (i.e. direct or indirect human impact) but with diseases as well (see figure in Korotkova et al., this volume). Deep snows in winter 2008 in Khabarovskii Krai and a die-off of ungulates in 2009–2010 in Primorskii Krai resulted in an increase of tiger-human conflicts and tiger mortality due to starvation. Most of the tigers we examined were less than one year old. In 2008 and 2009, all examined tigers were less than one year old, and in 2010 only one of five tigers examined was more than one year old.

Examination to determine cause of death was based primarily on necropsies. Necropsies also provided the opportunity to fully examine dead animals to determine patterns of pathological changes in body organs and systems and to detect other diseases (Zharov 2001).

During starvation, when an animal is dependent on body reserves, glycogen reserves stored in liver and muscles and fat are first used, followed by metabolism of protein from muscles and organs. The loss of 10–20% of body fluids is lethal for mammals (Zharov et al. 2000).

Tiger cubs aged 3–6 months died of starvation after their mother had been killed. All 8 tiger cubs had similar pathological changes: dehydration, absence of stable and consumable body fat, and atrophy of muscles and internal organs. Subcutaneous fat, leaf fat and fat reserves within the omentum, mesentery and epicardium took on the appearance of thin membranes with blood vessels inside, which with edematization became jelly-like and semitransparent. The color of atrophied internal organs varied from light red to brown (brown atrophy of liver, myocardium and muscles). Vishnevsky's spots were present in the stomach submucosal tissue. The liver had shrunk and its edges lacked parenchyma. Mucous and serous membranes were dry and anemic. Curvature of the lumbar spine was detected as well as breakage and damage of milk teeth.

All young tigers under nutritional stress had inflammation of the lungs, i.e. serous-catarrhal and purulent pneumonia, which was indicative of a general reduction in resistance of the body. In tiger cubs of this age we did not detect any nematodes in the gastrointestinal tract.

The results of blood tests of tigers with nutritional stress showed low hemoglobin levels typical for nutritional anemia due to the lack of iron, copper and vitamin B_{12} associated with chronic intoxication and gastrointestinal disorder (see Table 1).

Table 1. Results of blood tests of Amur tigers

Tiger sex and age	Erythrocytes, mln/mcL (10^{12}/l)	Leucocytes, thous/mcL (10^{9}/l)	Lymphocytes	Monocytes	Eosinophils	Hemoglobin, g/l
Male, 4 months	4.31	11.2	22	2	2	102
Female, 1.5 years	4.46	5.4	25	2	11	62
Female, 6 months	6.83	11.0	58	4	3	105

Note: lymphocytes, monocytes and eosinophils are recorded as % of total number of leucocytes in the blood

Low level of erythrocytes is consistent with a long starvation; low levels of leucocyte are associated with leucopoietic depression, emaciation, and low resistance of the organism. The low level of lymphocytes is the result of an inflammation process, and exudative pneumonia in particular (Vasiliev et al. 2003). The high level of eosinophils in the tiger cub 18 months old is the result of nematodosis.

Emaciated adult tigers did not have fat deposits in the hypoderm, around kidneys, in the groin, or in the pericardium. What fat tissue remained was dark yellow due to a concentration of lipochrome. Hypostatic pneumonia associated with long decumbency or paragonimiasis was detected. Nematodes and tape worms were

abundant in the gastrointestinal tract of all emaciated adult tigers and resulted in tract inflammation. Two tigers had trematodes in their lungs and their spleens.

A three-year-old male tiger, which died after an extended illness with signs of central nervous system damage, was nutritionally stressed, dehydrated, and had hypostatic pneumonia, catarrhal haemorrhagic gastroenteritis, haemorrhagic glomerulonephritis; and oral cavity papillomatosis. We also found 25 paragonimiasis nodules in his lungs and spleen and more than 300 adult nematodes in his stomach and intestinal tract.

No apparent pathological changes of large intestine mucosa were found. In emaciated tigers the intestines were empty and formed by longitudinal folds. Even when the large intestine contained coarse hair, sharp bone parts and claws of prey there were no evidence of inflammation or visible damages of the mucosa.

These analyses of pathological changes in adult tigers and tiger cubs demonstrated that lung inflammation is a secondary symptom based on low resistance of the body due to hypothermia and extended starvation. Inflammation of the stomach and intestine was apparently the result of helminth infestation.

We hope that the results of our research will help to increase understanding of the nature of Amur tiger diseases, and to assist in our joint responsibility to conserve natural ecosystems and the need to live in harmony with nature. Finally, we hope this work will contribute to the Amur tiger conservation and conservation of the integrity of the unique Sikhote-Alin ecosystem.

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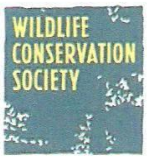

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Болезни и паразиты диких животных Сибири и Дальнего Востока России: монография / под ред. И.В. Серёдкина и Д.Г. Микелла. – Владивосток: Дальнаука, 2012. – 224 с.

Diseases and parasites of wildlife in Siberia and the Russian Far East: monograph / I.V. Seryodkin and D.G. Miquelle, editors. Vladivostok: Dalnauka, 2012. 224 p.

Монография посвящена результатам исследований болезней и паразитов диких животных в разных регионах Сибири и Дальнего Востока России: от Якутии до Камчатки. Большое внимание уделяется проблемам распространения инфекционных и паразитарных заболеваний у хищных млекопитающих. Показаны потенциальное влияние болезней на популяции диких животных и роль домашних животных и человека в распространении инфекций. Обсуждается значение данной темы в вопросах сохранения популяций редких и промысловых видов животных и управления ими. Книга предназначена для широкого круга читателей: ветеринаров, биологов, врачей, охотоведов, экологов, студентов и аспирантов этих специальностей, а также специалистов природоохранных организаций и административных учреждений.

Книга подготовлена и напечатана при финансовой поддержке Общества сохранения диких животных (WCS), являющегося негосударственной природоохранной организацией, деятельность которой базируется на научных исследованиях. Задача общества – сохранение диких животных и экосистем путем разработки и применения новейших научных подходов, основанных на полевых исследованиях, для решения критических экологических проблем.

Табл. 18, ил. 21, библ. 278.

This monograph is devoted to studies focusing on wildlife diseases and parasites in Siberia and Russian Far East, from Yakutia to Kamchatka. Much attention is paid to the spread of infectious and parasitic diseases in carnivores. The potential impact of diseases on wildlife populations and the role of domestic animals and humans in the spread of such infections are discussed, as is the significance of this topic for conservation and management of populations of rare and commercially-valuable animal species. This book is intended for a wide range of readers: veterinarians, biologists, doctors, game biologists, ecologists, students and graduate students of these professions, as well as for professional environmental organizations and government agencies.

This book was prepared and published with financial support from the Wildlife Conservation Society (WCS), a non-governmental science-based conservation organization. WCS's goal is the conservation of wild places and wildlife through the development and application of new scientific approaches based on field studies that address critical environmental problems.

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