VORONEZHSKY BIOSPHERE RESERVE

RUSSIAN RESEARCH INSTITUTE OF GAME MANAGEMENT
AND FUR FARMING

7th International Beaver Symposium

BEAVERS –
FROM GENETIC VARIATION
TO LANDSCAPE-LEVEL EFFECTS
IN ECOSYSTEMS

BOOK OF
ABSTRACTS

Voronezh, Russia, 14-17 September 2015

Voronezh 2015

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I welcome all the participants of the 7th IBS.

Voronezhsky reserve was established specifically for the protection of the beaver; it made significant contribution to the study and restoration of the population of this species. Our reserve has traditionally been the venue for major beaver meetings since 1948.

Now beaver symposiums have the international status, they are held once in three years and are growing in strength. The most topical issues of the study and control of beaver populations are discussed at these meetings. The program of the symposium contains proceedings of about 100 experts from 21 countries. I hope that Symposium participants who came to "The Mecca of Castorologia" will not only share experience but also get a unique opportunity to get acquainted with the rich history and present-day achievements of Voronezhsky reserve.

Director
Roman Kholod

Organized by:

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT OF THE RUSSIAN FEDERATION

DEPARTMENT OF STATE POLICY ON ENVIRONMENTAL PROTECTION

VORONEZH REGION GOVERNMENT

VORONEZHSKY BIOSPHERE RESERVE

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PROGRAMME
7th International Beaver Symposium

Sunday, 13 September 2015

All day: Arrival, Registration in Voronezhsky Biosphere Reserve and Accommodation.

10:00 – 12:00: Short-time excursions about Voronezhsky Reserve:
- ✓ «Museum of Nature»,
- ✓ «Beaver town»

12:00 – 14:00: Lunch

14:00-17:00: Short-time excursions about Voronezhsky Reserve:
- ✓ «Museum of Nature»**,**
- ✓ «Beaver town»

Monday, 14 September 2014

9:00 – 10:00: Registration

10:00 – 12:00: Opening of the 7th International Beaver Symposium

Plenary: Achievements of Voronezhsky Reserve in beaver research and preservation **(*Natalya Romashova*)**

Plenary: The trapping of beaver in Russia and Belarus – history and current status **(*Vladimir Safonov*)**

12:00 – 14:00: Lunch

SESSION 1: Biocenotic Relation and Impact on Ecosystems

Chaired by Prof. Vladimir Safonov & Dr. Peter Busher

14:00 – 14:20: Beaver habitat characteristics and long-term occupation: a GIS based logistic regression analysis (**Peter Busher**)

14:20 – 14:40: Beavers in forest-steppe Russia – main features and impact on fish and amphibians (**Ivan Bashinskiy**)

14:40 – 15:00: The hydrogeomorphological impact of beaver (*Castor fiber*) activities on embanked water courses in Central Romania (**Georgeta Ionescu**)

15:00 – 15:20: Beavers as an ecological restoration tool: A cautionary tale (**Glynnis Hood**)

15:20 – 15:40: The effect of beaver, *Castor fiber*, activity on zooplankton community formation in beaver ponds: experimental studies (**Irina Chalova**)

15:40 – 16:00: Coffee break

16:00 – 16:20: Riparian habitat modeling in the context of beavers (*Castor fiber*) repopulation in Brașov – Romania (**Claudiu Pasca**)
16:20 – 16:40: Land cover characteristics of beaver sites in Lithuania (**Alius Ulevičius**)
16:40 – 17:00: Coinfluence beaver and wood area along Pechora – Volga meridian (**Vladimir Brozdnyakov**)
17:00 – 19:00: Short-time excursions about Voronezhsky Reserve:
- ✓ "Museum of Nature "
- ✓ "Beaver town"
- ✓ Excursion along the ecological path "Turtle trail"

19:00 Individual dinner

Tuesday, 15 September 2015

SESSION 2: Genetics & Morphology

Chaired by Dr. Pavel Munclinger & Dr. Alius Ulevičius

9:00 – 9:20: Molecular ecology of beavers: where are we and where do we need to go? (**Pavel Munclinger**)
9:20 – 9:40: Reasons of polymorphism of beaver's populations in space of Eurasia (**Nikolai Korablev**)
9:40 – 10:00: Genetic monitoring of Eurasian beaver (*Castor fiber*) reintroduction in Switzerland (**Silvan Minnig**)
10:00 – 10:20: Comparative craniometry of the young Eurasian beaver (*Castor fiber* L.) from the medieval Novgorod the Great - A case study (**Andrei Zinoviev**)

10:20: Photo session
10:40 – 11:00: Coffee break

SESSION 3: Behavior & Ecology

Chaired by Prof. Frank Rosell & Dr. Yuri Gorshkov

11:00 – 11:20: Short-term effects of trapping on activity and movement patterns of Eurasian beavers *Castor fiber* (**Patricia Maria Graf)**
11:20 – 11:40: Factors affecting the length of territory occupation in a long-lived monogamous mammal (**Martin Mayer**)
11:40 – 12:00: Radiotelemetry in investigation of beaver population spatial structure (**Yuri Gorshkov**)

12:00 – 14:00: Lunch

14:00 - 14:20: New data in sexual behavior and reproduction in beavers (**Victor Silchenko**)

14:20 - 14:40: Knowing me, knowing you; the potential for long-term individual recognition in the Eurasian beaver (**Helga Tinnesand**)

14:40 - 15:00: Recent helminth fauna of beavers (**Boris Romashov**)

15:00 - 15:20: Mammals in beaver burrows (camera traps *vs* snap traps) (**Arunas Samas**)

15:20-15:40: Self-eating in beavers – trophic opportunism or reaction on stress? The unique case from Mongolian extreme winter 2015 (**Alexander Saveljev**)

15:40 - 16:00: Coffee break

16:00 - 17:00: Poster presentation

17:00 - 19:00: Short-time excursions about Voronezhsky Reserve:

- ✓ "Museum of Nature "
- ✓ “Beaver town”
- ✓ Excursion along the ecological path "Turtle trail"

19:00: Individual dinner

Wednesday, 16 September 2015

SESSION 4: Status and Dynamics of Populations

Chaired by Prof. Pjotr Danilov & Dr. Glynnis Hood

9:00 – 9:20: The history and implications of beaver return to the European North of Russia (**Pjotr Danilov**)

9:20 – 9:40: Long-term population dynamics of reintroduced Eurasian beavers (*Castor fiber*) in the suboptimal and pessimal habitats of Russian nature reserves (**Varos Petrosyan**)

9:40 – 10:00: Beaver family size - are there any geographic variations? (**Aleš Vorel**)

10:00 – 10:20: Beavers in Scotland: experiences to date, and the next steps (**Martin Gaywood**)

10:20 – 10:40: Update on the beavers in the River Tay, Scotland (**Paul Ramsay**)

10:40 – 11:00: Coffee break

***SESSION 5*: Management & Cultural**

Chaired by Prof. Efraim Lev & MSc Gerhard Schwab

11:00 – 11:20: Medicinal uses of the Eurasian beaver in the medieval Levant (**Efraim Lev**)

11:20 – 11:40: The story of human imagery of beavers from cave paintings to cartoons (**Derek Gow**)

11:40 – 12:00: Beavers invasion of the European origin in Republic of Tyva - real threat to a gene pool of the autochthonous *Castor fiber tuvinicus* (**Nikolai Kartashov**)

12:00 – 14:00: Lunch

14:00 – 14:20: The beaver is back! Status, experiences and challenges with beaver management in the Austrian provinces Upper Austria and Salzburg (**Gundi Habenicht**)

14:20 – 14:40: An adaptive National Beaver Management Plan – 16 years after reintroduction (**Thomas Borup Svendsen**)

14:40 – 15:20: Presentation(s) and choice of a venue of a next IBS

15:20 – 16:30: poster presentation

16:30: Information for excursion

18:00: Farewell dinner. Closing ceremony of the 7IBS

Thursday, 17 September 2015

8:30 – 19:00: Excursion on natural and cultural sights of Voronezh region

19:00: Individual dinner

Departure of symposium participants

Poster session

Adiya, Yansanjav	First results of beaver captive breeding in Mongolia
Adiya, Yansanjav, Samiya, Ravchig, Shar, Setev	History of translocation and building of breeding unit for beavers in Mongolia
Albov, Sergei	Behaviour of beavers (*Castor fiber*) in the drought in the Prioksko-Terrasnyi Nature Biosphere Reserve (Central European Russia)
Belkin, Vladimir, Fyodorov, Fyodor	Forest main drain canals as potential beaver feeding grounds
Bobretsov, Anatoli, Simakin, Leonid	Beaver reintroduction in the Upper Pechora basin and current state of the population
Brozdnyakov, Vladimir	Influence of anthropogenic pollution on beavers in Middle Volga
Emelyanov, Alexey	Ecological characterization of stable beaver settlements
Fyodorov, Fyodor	Beaver *vs* man: conflict of interest, its causes and prevention
Gorbunova, Yelena	Beavers in the Altai Nature Reserve
Ivanova, Eugenia, Emelyanov, Alexey	The phenomenon of multiple dendroactivity in Eurasian beavers
Kanshiev, Vladimir	History and current status of beaver population in the National Park Vodlozersky
Kataev, Gennady	Long-term observations over re-introduced beavers *Castor fiber orientoeuropaeus* on Kola Penninsula, NW Russia
Marchenko, Natalia, Golovkov, Aleksandr, Karpov, Nikolai	History of settlement and current situation with beaver population in Khopersky Nature Zapovednik
Minnig, Silvan, Balet, Anthony, Jacob, Gwenaлl	Noninvasive genetic analyses from castoreum and anal gland secretions
Mishin, Alexander, Trenkov, Ivan	Dry beaver ponds – attractive habitats for large mammals
Nitsche, Karl-Andreas	A statistical survey on International Beaver Symposiums from 1997 to 2012
Nitsche, Karl-Andreas	The wolf (*Canis lupus)* as natural predator of the beavers (*Castor fiberetCastor canadensis*)
Oliger, Tatyana	Beaver activity as one of the main environment-forming factor in Nizhne-Svirsky Nature Reserve
Pankov, Alexey, Pankova, Nadezhda	Habitat selection by Eurasian beaver (*Castor fiber* L.) in inundated lands of Oksky Nature Reserve
Põdra, Madis Aguilar Gymez, Cesar	Status and management of illegally released Eurasian beaver (*Castor fiber*) in Spain
Podshivalina, Valentina	The zooplankton in small beaver inhabited rivers on the territory of nature reserves in Middle Volga region
Polaz, Sviatlana, Anisimava, Alena, Yurchanka, Darya	The control of epizootic situation and the preventive action against of helminthiasis beaver
Puzachenko, Andrey, Korablev, Nikolai	Allometry and morphological diversity in one autochthonous and two reintroduced populations of Eurasian beavers (*Castor fiber*)

Röber Günther, Baumann, Hans, Nitsche, Karl-Andreas	Elbe-Beavers (*Castor fiber albicus*) in opencast-mining landscapes near Bitterfeld, Saxony-Anhalt, Germany
Saveljev, Alexander, Lavrov, Vladimir	"*A spectre is haunting Europe – the spectre …*" from Siberia. Verification of ways of penetration of genes of West Siberian beavers *Castor fiber pohlei* into Austria
Sivkov, Andrey	Role of beavers in natural complex of Pinezhsky Nature Reserve
Trenkov, Ivan	Portable video-cameras in studying of beavers – first experience from Southern Siberia
Vasin, Alexander	Restoration of West Siberian beavers (*Castor fiber pohlei*Serebrennikov 1929)
Yanuta, Rygory, Anisimava, Alena, Velihurau, Pavel, Polaz, Sviatlana, Balcerak, Marek	Population dynamics of beaver in Belarus and its determining factors
Zarubin, Boris, Makarov, Valeri, Safonov, Vladimir	Current status of beaver fur market in Russia
Zavyalov, Nikolai	Beavers (*Castor fiber*) in the Rdeysky Nature Reserve (NW Russia): results of 10-year monitoring
Zavyalov, Nikolai, Artaev, Oleg, Potapov, Sergei, Petrosyan, Varos	Beavers (*Castor fiber*) of Mordovia Nature Reserve Central European Russia: population history, modern state, and their further prospects

ABSTRACTS

FIRST RESULTS OF BEAVER CAPTIVE BREEDING IN MONGOLIA

Adiya, Ya.

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Gatsuurt breeding unit was established in 2012 for the purpose of breeding beavers in captivity for future reintroduction, and to study their diet and rate of food consumption (for budgeting captive feeding expenses) and demography. The amount of barley, mixed fodder, sugar beet, carrot, vegetable mixture, pieces, branch, and bark of aspen tree and brewer's yeast required for adults was calculated. The amount of barley pellets, cow milk, black bread, salt and nutrient use vitamins added to the standard diet, given to the baby beavers in the postpartum period when separated from their parents at 5 to 6 monhts was also calculated.

From January to March of the first year following translocation to Mongolia, some families with mature individuals flourished, but not all reproduced. We concluded that this was due to multiple factors such as lack of adjustment to their new environment, a lack of permanent water and water supply shortages because of limited number of ponds, and poor nutrition because of significant loss of energy in the cold environment. The estrus cycle of beavers in the breeding unit increased from late November to the end of March. Six offsping were born from four females in 2014 and the kits weight at birth was 453-568 gr. With sufficient quantity and quality of food and a normal environment, two year old beavers can produce offsping, but this depends on body weight.

There is an inverse relationship between body weight and number of kits. The body weight of new born beavers in litters of two was less than single newborns by 80-105 g. My results show that young beaver body weight increased rapidly in the first 4 months by 4-6 kg. The body weight increased by 1590-2880 g in their fourth, fifth and sixth months.

The Beaver reintroduction and breeding unit translocated seven individuals from Kirov province of Russia and 13 individuals from Germany, selected for breeding and to study their body mass growth and behavior. The rapid increase of body weight occurred during the first and second years for individuals. The maximum weight was 5665 g and an average weight at 2 years was 3400 g. The increase in body weight slowed and stabilized between two and three years of age. No change in body weight occurred in four to five year old individuals. Adult beaver body weight ranged from 16.2 to 23.6 kg.

Three males and one female, died. One died from infection by hemotracis, toxicosis, tuberculosis and coprostasis between 2012 and 2014, after moving to at the breeding center.

Keywords: Eurasian beaver, Mongolia, captive breeding, postnatal developing

HISTORY OF TRANSLOCATION AND BUILDING OF BREEDING UNIT FOR BEAVERS IN MONGOLIA

Adiya, Ya.[1], Samiya, R.[2], Shar, S.[2]

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Between 1942 and 1962, Russian and Mongolian scientists studied the distribution and habitat of beavers and determined that beavers disperse through the external tributary of the Bulgan River, which resulted in a decrease in their number. Because of this, beaver reintroduction to the internal tributary rivers was initiated and the first study was begun.
Several reintroduction projects were organized, such as four individuals being released in the Khovd River in 1959, three pairs from Voronezh Nature Reserve to the Yeruu River of Selenge basin in 1962, 35 individuals from Bulgan River to Khovd River by scientists of National University of Mongolia and University of Halle (Germany) in 1974-1985, and 37 individuals to the Tes River in 1985-2002 (Stubbe & Davaa 1983; Stubbe et al 2005, Saveljev et al 2015).
Two groups of beavers belong to so-called *C. f. "europaeus"* from Bavaria, Germany (14 individuals) and from Kirov, Russia (27 individuals) in 2012 were bought to Ulan-Bator. From last group 16 beavers (9 males, 7 females) of seven families were reintroduced to the Zaan River (Tuul River left tributary, Selenga basin, N from Ulan Bator). The beavers overwintered at the Zuunmod of Zaan riverhead and near the Bayanzurkh of the Terelj riverhead (Samiya et al 2012).
In accordance with Resolution №53 of members of the presidium of Ulan Bator citizen's representative's khural of 2012 and the mayor's order A/354 the beaver breeding and reintroduction unit was approved and established. A dedicated facility has been built following the standards of the beaver farm in Voronezh and adjusted for the Mongolian climate. The capacity is 15 reproductive families, who are provided clean well water, heating equipment and pools for swimming. One family is kept in a 4x2.3m area. Twenty-four individuals from 10 families are kept and bred to increase the population in this facility.
Our goal is to further implement the mission in Mongolia and select the best available site for developing a beaver population in wild. We plan to carry out the required study and to facilitate the reintroduction of beavers because they act as ecosystem engineers and enhance environmental services.

Keywords: Eurasian beaver, reintroduction, Mongolia, beaver nursery

BEHAVIOUR OF BEAVERS (*CASTOR FIBER*) IN THE DROUGHT IN THE PRIOKSKO-TERRASNYI NATURE BIOSPHERE RESERVE (CENTRAL EUROPEAN RUSSIA)

Albov, S.A.

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Monitoring of a beaver population in the Prioksko-Terrasnyi Nature Reserve (Moscow oblast, Russia) has been carried out continuously from beaver's reintroduction in 1948. The basic results of the long-term monitoring are stated in our publications (Zavyalov et al., 2010; European beaver …, 2012; Petrosyan et al., 2013). The analysis of a long-term number dynamics and the factors, which define it, has shown that summer droughts can be an important factor influencing the beaver population in the Reserve.

This report presents the results of a beaver behavior monitoring in the Prioksko-Terrasnyi Reserve during the droughts in 2010 and 2014. In 2010 the sum of summer precipitations constituted 79 % from average long-term value. July 2010 was the most droughty summer month: precipitations amounted to only 31% of norm. But July 2014 was even droughtier. The monthly sum of precipitations constituted only 19% from norm, and the temperature above ground reached 58°C. August 2014 was warmer than usually by 2.7°C, and precipitations amounted to 83 % of norm.

Reaction of beavers to water level decrease can be divided into several stages in the process of drought strengthening. 1) The drought beginning, a water level in beaver ponds decreases considerably – the beavers repair dams actively. 2) The water level is strongly lowered – the beavers deepen pools, clear away channels, and dig tunnels through dams. For a short time period the residual water bodies join into one unit that facilitates moving of beavers. 3) The water-level decrease proceeds, beaver channels dry – the beavers try to dig to water only at the burrow entrances for entrance is closed by water. 4) At the drought continuation two versions are possible: a) beavers begin their moving to water; b) beavers remain to winter in completely dried ponds, begin preparation of winter forages, but finally die in late autumn.

By the autumn 2010 the number of settlements in the Reserve has reduced from 16 to 13, and the total beaver number making up 44 individuals in 2009, has reduced to 34. On the contrary, in 2014 in comparison with 2013, the settlement number has increased by 1, and the beavers number has increased from 27 to 38 individuals.

Thus, in the Prioksko-Terrasnyi Reserve the beaver possibilities for adaptation allow to go through droughts without essential decrease in their number.

Keywords: beaver, behaviour, drought

BEAVERS IN FOREST-STEPPE RUSSIA – MAIN FEATURES AND IMPACT ON FISH AND AMPHIBIANS

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The study of beaver (*Castor fiber*) impact on steppe river ecosystems was conducted on the territory of the Nature Reserve Privolzhskaya Lesostep' (Penza region). Beavers settled the rivers from 2004 to 2012.
The lack of food resources and permanent watercourses limits beavers spreading in steppe. The formation of stable long-term ponds is possible in rivers with low discharge. The most favorable parts of rivers for beavers are remains of anthropogenic reservoirs, where swamps and high biomass of reeds are found. But the majority of beaver ponds are small and dams are easily destroyed by spring floods.
The rivers are inhabited by one lamprey and 6 fish species (*Eudontomyzon mariae, Esox lucius, Leucaspius delineatus, Sabanejewia baltica, Misgurnus fossilis, Barbatula barbatula, Carassius carassius*) and 5 amphibian species (*Lissotriton vulgaris, Pelobates fuscus, Bufo viridis, Rana arvalis, Pelophylax lessonae*). As a result of the damming the abundance and biomass of fish and species diversity and abundance of amphibians increased. During long-term existence of beaver ponds fish abundance was declining (the oxygen level was reduced), but the number of amphibians was still increasing (more shallow waters appears). Also beaver dams lead to isolation of fish in different parts of valleys and serve as barriers to spawning migrations (e.g. for pike and lamprey). When beavers leave ponds, amphibian abundance declines, and fish abundance increases – due to recovery of water flow.
Thus, despite some positive effects, beaver ponds are not the key habitats for fish and amphibians. The most stable settlements in steppe rivers are formed by former anthropogenic ponds, so we could assume that potentially beaver ponds may be an alternative to artificial reservoirs for conservation of pool ecosystems.

The authors are grateful to Dobrolyubov A.N. and Dgebuadze Yu.Yu. The work was supported by the RFBR (grants № 14-04-31458 mol_a and 15-29-02550 ofi_m).

Keywords: impact on ecosystems, steppe, small rivers, fish, amphibians

FOREST MAIN DRAIN CANALS AS POTENTIAL BEAVER FEEDING GROUNDS

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The viability of beaver colonies and their dispersal to new areas is largely dependent on the condition of the hydrographic network and food availability along the shore. Karelia is a region with a very ramified network of lake-river systems: the river network density is 5.3 km/1000 ha (Litvinenko and Lozovik, 2003).

At the same time, field and main drainage canals dug for large-scope drainage of wetlands and paludified forests have turned into new watercourses. Their network in Karelia is 68 km/1000 ha of drained land (Smirnov, 1977), including 18 km/1000 ha of main drainage canals. This value is three times that of the river network density in the republic.

Thirty-seven percent of all known beaver colonies in southern Karelia are associated with canals, and 77.4 % of colonies with main drainage canals (Kanshiev, 1986).

Deciduous undergrowth in middle taiga forest sites drained 30 years before was surveyed in the strip between canals and on earth banks along main drainage canals in a sedge-Sphagnum birch stand and a wild rosemary pine stand. Deciduous undergrowth in these habitats was found to account for 29.5 and 69.6 % of all trees up to 3 metres high. Aspen, alder and rowan undergrowth was scant (0.4 – 5.0 %), and the prevalent species were willow (22.8 and 11.7 % in the birch and the pine stand, respectively) and birch (68.5 and 83.1 %, respectively). Earth banks in the drained birch stand maintain up to 75.8 % of all deciduous coppice. This amounted to 1440 pcs./ha, whereas the density in the strip between canals (intensive drainage zone) was 400 pcs./ha. In the drained pine stand, earth banks maintained 65.0 % of all deciduous coppice. Its numbers were 1735 pcs./ha on earth banks, 681 pcs./ha in the intensive drainage zone, and 345 pcs./ha in the extensive drainage zone.

The same type of survey in a drained cowberry pine stand in the northern taiga subzone yielded similar results: predominance of birch in the undergrowth (71.4 %), and a three times more abundant deciduous coppice on earth banks compared to the strip between canals.

We conclude that forest drainage augments the food resources available to beavers, expands their suitable habitats, and helps them more successfully colonize new areas.

The study was funded by the federal budget under state-ordered project № 0221-2014-0006, Russian Foundation for Basic Research grant № 14-05-00439, and RAS Presidium grant “Living Nature”.

Keywords: forest drainage, beaver, browsable forage

BEAVER REINTRODUCTION IN THE UPPER PECHORA BASIN AND CURRENT STATE OF THE POPULATION

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By the end of 19th Century the last beavers were extirpated in the high Pechora river basin. The Pechora-Ilych Nature Reserve started the restoration of the beaver population in 1938 and 1940 when 8 and 11 animals respectively were brought from the Voronezh Nature Reserve and released on the Shezhim and Kedrovka rivers. By 1951 on the Shezhim River (60 km length) 8 colonies were established, with 35-40 animals. Beavers also arrived on Pechora River at this time 220 km from its source and on 19 its tributaries. The first beaver colonies in the Ilych River basin were observed in the end of 1950s. In 1965 animals inhabited all the large rivers of the nature reserve. Two main factors (river flow and food availability) influenced the beaver distribution in the nature reserve. More favorable habitat conditions for beavers existed in the high Pechora river basin, where 87% of colonies are located; the other 13% are in the Ilych river basin. More than a half (53.1 %) of all colonies are located in piedmont area, 30.2 % are in mountain area and 16.7 % are in lowland plains. The limiting factor in the plains area is food supply. The beaver numbers in the nature reservation continued to grow. In 1951 there were 150 animals, in 1956 the number was 200-220, and in 1958 there were 280-300 individuals. From 1963 to 1970 the beaver abundance stabilized at 300 animals. After this brief period of stability the population began to increase through the 1980s. There were 350 in 1976, 470 in 1985, and 700 in 2002. In last 10 years the beaver population has stabilized at 750-800 animals on 721,300 ha^2. Further population growth is limited by food supply. Pechora-Ilych Nature Reserve played a significant role in beaver restoration in the northern European part of Russia. From 1951 to 1966 126 animals were caught on its territory and then released in water reservoirs of the Komi Republic and in the Arkhangelsk region, where they became successfully established.

Keywords: *Castor fiber*, reintroduction, abundance, dynamics, Pechora-Ilych Reserve

COINFLUENCE BEAVER AND WOOD AREA ALONG PECHORA – VOLGA MERIDIAN

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From 1992 to 2014 beaver groups were examined from the dry steppe zone to the northern taiga along Pechora-Volga meridian. The only region where the beaver foraging activity limits the development of coastal trees and shrubs on the lower part of the settlement, is the area of the northern taiga, but here the effect of beaver on riparian plant communities is not critical in most settlements. In other regions such cases are rare and are associated with insufficient size of the reservoir, with initially a small amount of woody vegetation, or are the result of the impact of human activity on beavers.

Even in the zone of the northern taiga where tree distribution is limited, trees are not a factor limiting the development of the beaver population. The greatest impact the beaver has is on tree species diversity, rocks and tress of specific diameters. In 33.6% of settlements in the Pechora River and its tributaries in the upper reaches, and in 17% of settlements in the Volosnitse district we documented a shortage of preferred beavers food.

In the Samara lakes one beaver removes an average of two and half times the amount of woody vegetation that is found in the riverbed. The number of trees removed, by one beaver settlement in one year in the forest-steppe zone varied from 0.02% to 9.1% depending on the value of forage and quantitative composition of the beaver family. The number of settlements that remove up to 3% per year of trees is 91.2%. The trophic habitat base is not a factor limiting the development of the beaver population in all studied regions of the steppe zone in the northern boreal forest. Beaver foraging activity does not have a decisive impact on coastal plant communities.

The spatial structure of colonies and the number of beavers in the nature reserves is determined largely by intra-population mechanisms. In unprotected territories a factor of crucial importance on the population is the level of human impact. The number of beavers and the density of habitats are affected by human activities more than the depletion of the tree resource and included intra-population mechanisms of regulation of numbers.

In the zone of dry steppes the limiting factor is the water regime in reservoirs. On the Chagan River (Orenburg region) for 3 years we observed a few settlements in areas devoid of woody vegetation, which as a result of beaver foraging activity was gradually overgrown with willows. In the southern taiga (Kirov region) woody vegetation is recovering faster than in forest-steppe and steppe zone due to the pronounced effect of multiple resume from hemp. An interesting result obtained in north taiga was the preference by beaver for birch trees with diameters of 20 cm or 30 cm in the presence of large amounts of willow.

INFLUENCE OF ANTHROPOGENIC POLLUTION ON BEAVERS OF MIDDLE VOLGA

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Data was collected on the anthropogenic pollution of water 1992 to 2009 in the lower reaches of the Great Kinel River. The parameters evaluated were: maximum and average value of oil pollution, nitrite nitrogen, copper, phenols, the organoleptic characteristics of water. All abiotic and biotic factors, except an anthropogenic pressure, are optimal for the beavers: all colonies live in conditions of excess food, there are enough places for settling young adults, high banks are suitable for burrows and the reservoir has sufficient depth, and favorable fluctuations of water. Water pollution and poaching are decisive anthropogenic impacts.

The rapid growth of the beaver population downstream was connected with the reduction of anthropogenic pollution of water due to the new sewage treatment plants constructed in Otradny city. Growth was also influenced by the closing of the Timashevo Sugar Factory, reduction of fertilizer and herbicide use and decreasing livestock numbers in agriculture.

Phenols and oil products in water pollution is negatively correlated with the number of beavers and density. We have seen a sharp increase in the number of beavers when these pollutants are reduced.

Nitrite water pollution mean values are negatively correlated with the proportion of single individuals of the total number of beavers. One of the interesting results of this work is identifying a sustainable beaver population when faced with high levels of pollution from copper, at least in the time interval 1992-2009. A correlation for most indicators of the population with the amount of copper in the water were found. Copper water pollution negatively correlated only to the maximum values of single individuals with a share of the total number of settlements: more copper - less single beavers.

Keywords: beaver, anthropogenic pollution, correlation, deterrent factor, population, size, abundance

BEAVER HABITAT CHARACTERISTICS AND LONG-TERM OCCUPATION: A GIS BASED LOGISTIC REGRESSION ANALYSIS

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While it is documented how beaver activity influences habitat variables, fewer data are available on habitat changes after long periods of occupation. Using annual beaver census data collected from 1968 to 2011 on the Prescott Peninsula, Massachusetts, USA, and geospatial data we documented 54 potential beaver occupation sites. A multiple logistic regression model produced probability maps depicting the likelihood of beaver occurrence over a continuous landscape, successfully predicting 72.2% of the habitats colonized (actively used) by beavers in 2012. The model found that sustainable beaver colonization, over the course of several decades, most often occurs in areas with favorable geomorphic attributes (gradual stream slopes, large areas of upstream watershed, distance from reservoir shoreline), and that these "preferred" sites exhibit a distinct vegetative signature of disproportionately higher coniferous tree cover. The coniferous tree cover may represent the impact of beavers occupying a site for extended periods and illustrate the long-term impact on terrestrial vegetation community complexity.

Keywords: North American beaver, habitat preference, model

THE HISTORY AND IMPLICATIONS OF BEAVER RETURN TO THE EUROPEAN NORTH OF RUSSIA

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In the European North of Russia the beaver was extirpated over two hundred years ago. Due to active introductions and dispersals in the 1930s – 1950s, the beaver has re-colonized the natural ecosystems in the European North. Additionally, Finland and Russia (Karelia, Leningrad Region and Arkhangelsk Region) are now co-inhabited by two beaver species – the North American beaver (*Castor canadensis* Kuhl) and the Eurasian beaver (*C. fiber* L.).

The North American beavers, who have colonized a major part of Finland, Karelia and the Karelian Isthmus in the Leningrad Region, are descended from the 7 animals brought to Finland from the USA in the 1930s (Linnamies, 1956; Siivonen, 1956; Lahti, 1968; Ermala et al., 1989). Later, intraregional translocations of these animals took place in both Finland and Russia (n=270).

The Eurasian beavers introduced in the European North of Russia (n=1349) were from the Voronezh Region (26.5% of all releases in the study area), Byelorussia (20.8%), Mari Republic (12.5%), Smolensk Region (6.2%), Bryansk Region (5.3%), Ryazan Region (3.6%), Komi Republic (1.5%), and other regions (5.6%). Intraregional translocations of the European beaver have also been carried out (18%).

The present North American beaver population consists of 12,000 animals in Karelia and 1000 in the Karelian Isthmus, Leningrad Region (Danilov et al., 2007; Danilov, 2009). The Eurasian beaver populations are estimated at 4,000 animals in Karelia (own data), less than 50 in the Murmansk Region (Kataev, 2007), 23,000 in the Leningrad Region, 25,000 in the Novgorod Region, 17,600 in the Pskov Region, 21,000 in the Arkhangelsk Region, and 32,600 animals in the Vologda Region (Borisov, 2011).

At present, Eurasian beavers live in those areas in southern Karelia where North American beavers had been released, indicating that the introduced (invasive) species has been replaced by the endemic species (Danilov et al., 2007; Danilov, 2009; Danilov and Fyodorov, 2015; Danilov et al., 2011). In southern Karelia the closest distance between colonies of different beaver species is 10 km. A different pattern is observed in northeastern Karelia where North American beavers have spread into the Arkhangelsk Region and are colonizing areas inhabited by the Eurasian beaver. In the early 2000s is when North American beavers were observed in the Arkhangelsk Region, 30-40 km east of the administrative border with Karelia.

The study was funded by the federal budget under state-ordered project № 0221-2014-0006, Russian Foundation for Basic Research grant № 14-05-00439, and RAS Presidium grant “Living Nature”.

Keywords: North American and Eurasian beavers, introduction

ECOLOGICAL CHARACTERIZATION OF STABLE BEAVER SETTLEMENTS

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The duration of settling of animals in certain territories naturally depends on the quality of protective properties of the habitat, its accessibility, the abundance and recovery rate of food resources (Shilov 1952, Zaripova et al 1976, Dvornikova 1986). In this case, the life of family groups occupying places with comfortable conditions, in theory, should be different from the others regarding a variety of environmental features associated with both well-being of the territory and the duration of its optimization by the residents.

The quantitative assessment of subpopulation formations with different proportion of continuously existing settlements, which was performed earlier, allowed establishing their role in the maintenance of the spatial structure and patterns of population dynamics (Nikolaev 1984, 1998; Emelyanov 2004, 2013). In this presentation an attempt to characterize stable populations, identify the intensity of construction activity, food storing, and reproductive activities is made. The data for the analysis were from beaver settlements in the Nature Reserve Voroninsky and its buffer zone between 1998 and 2014. We documented 190 beaver settlements, 184 places of food storage (food caches), 168 constructions and 240 cases of traces of animals living in first year settlements.

A preliminary analysis found that the settlements were divided into three classes according to an index (the ratio of the number of the cases registered to the number of the registration years). The first class comprises the settlements with the index value of 0.1 to 0.3, the second with values from 0.4-0.7, the third (the most stable one) with values from 0.8-1.

The settlements in the last class (n = 32) did not differ from others in the frequency of food stockpiling (stock index = 0.2 ± 0.03), but had more constructions, which was unreliable (constructing index = 0.23 ± 0.05). However, reproductive activity was much more common in these sites (reproductively index = 0.36 ± 0.04).

Keywords: the beaver, settlement, settlement stability

BEAVER *VS* MAN: CONFLICT OF INTEREST, ITS CAUSES AND PREVENTION

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As its range is expanding and abundance is growing the beaver more and more tends to settle on man-made watercourses (drainage ditches) and streams along utility lines, thus impacting human infrastructure and the economy.
In northern Karelia, 55 % (n=43) of beaver colonies occur near highways, railways, power lines, which are areas offering better food resources for beavers compared to natural habitats. Average beaver population density in human dominated environments is 3-5 colonies per 10 km of the linear infrastructure, whereas the density is 1-2 colonies per 10 km of natural shoreline.
Southern districts of Karelia offer better conditions for beavers, and their population density is higher, approximately 4 – 8 colonies per 10 km of shoreline. However, specific conditions and heavy nuisance results in a considerably lower beaver population density along roads than in the north (0.8 – 1 colonies per 10 km of roadside watercourses).
Up to 37 % of all beaver colonies in southern Karelia are concentrated around drainage ditches (Kanshiev, 1986). The density of beaver settlements in these habitats ranges from 2 to 4 colonies per 10 km (Fyodorov, 2013).
Known beaver damage to human facilities has amounted to 58 events over 2 years (2013-2014), including: 67.2 % flooding of roads, 22.4 flooding of border engineering infrastructure, 6.9 % impairing drainage system operation, 3.5 % flooding of farmland. To mitigate the damage, the Republic of Karelia Ministry of Agriculture issued 11 licenses and 74 beavers were removed.
In the period from 2008 to 2012, KarelEnergo company staff recorded 28 occasions of power line failures caused by the falling of beaver-browsed trees. Repairing them cost 936 man-hours. Measures have been worked out to mitigate the detrimental effects of beaver activities.
The results of the author's own studies and the materials provided by the Republic of Karelia Ministry of Agriculture, Fish and Game were used in the discussions.
The study was funded by the federal budget under state-ordered project № 0221-2014-0006, Russian Foundation for Basic Research grant № 14-05-00439, and RAS Presidium grant "Living Nature".

Keywords: beaver, forest drainage, engineering infrastructure, roads, damage

BEAVERS IN SCOTLAND: EXPERIENCES TO DATE, AND THE NEXT STEPS

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In June 2015, Scottish Natural Heritage (SNH) reported to the Scottish Government on the issues surrounding beavers in Scotland. This report ('Beavers in Scotland') will be used to inform a decision on the future of beavers in Scotland, including wild-living populations that currently occur in Argyll and Tayside.

The report included assessments of:

- Beaver interactions with the natural environment
- Beaver interactions with the human environment
- Legal and management issues
- A range of possible, future scenarios for beavers in Scotland

The work has been informed by a number of significant projects including a scientifically monitored trial reintroduction in Argyll, an examination of the implications of beaver presence on land use in the Tayside catchment, an examination of potential beaver interactions with salmonid fish, GIS-based studies of potential habitat availability and future population expansion, and an extensive review of beaver effects on biodiversity. If beaver populations expand and remain in Scotland, there will be a need to plan appropriate management at national and local levels in discussion with key stakeholders.

Keywords: Beaver, reintroduction, Scotland, impacts, interactions, management, environmental, biodiversity, socio-economic

BEAVERS IN THE ALTAI NATURE RESERVE

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In the 18th and 19th centuries beavers widely invaded the Altai territory. In the early 20th century, the number of beavers in Russia was severely disrupted, and in in Gorny Altai they were completely exterminated. The last beaver was caught on the river Lebed in the middle of the 19th century. Since the early 1950s of the 20th century in the Altai region there was an active reintroduction of the species.

In the 1980s "reacclimatizated" beavers from the upper tributaries of the Lebed River got into the basin of the Teletskoye Lake and into the valley of the Kamga River (Northern part of Teletskoye Lake basin).

The first signs of activity of Eurasian beavers (*Castor fiber* Linnaeus, 1758) were noticed in the reserve in October 1988 in the lower part of the Kamga River, about 100 metres from the mouth, there was marked a willow specifically nibbled by a beaver. The information obtained in 1993, 1994, 1999, 2002-2005, 2008-2014 revealed that in the valley of the Kamga River beavers moved up to 6-7 km above the mouth. In January 2009 traces of beaver activity were found on the left bank of the Kyga River, 6 km from the river mouth. The beavers had made a dam with the length of about 200 meters, the height of 0.5 meters, which swamped about 50 hectares of forest, piled about 50 aspen trees and willows 5 to 40 cm in diameter. The animals gnawed the bark of aspen trees and carried branches under the ice of the lake. Everywhere near the dam there were footprints of beavers in the snow. This was the first report of beavers at the beginning of the lake - in the valley of the Kyga River (the southern part of lake Teletskoye). In 2009 traces of beaver activity were noticed in the estuary of the Kyga - specific nibble of trees and footprints in the sand. In 2011 the research staff examined the habitat of beavers in the Kuga valley. On the 6th kilometer from the mouth on the left bank of the river, 150-200 m from the bank into the woods, were found some traces of beavers: a built dam, a beaver lodge, specific nibble of trees. In 2013 the traces of beavers were noticed in the lower part of the Chulcha River valley in about 50 kilometers from the mouth of the Chulyshman River.

Keywords: re-acclimatization, Altai Reserve, habitat, Teletskoye Lake, signs of vital activity

RADIOTELEMETRY IN INVESTIGATION OF BEAVER POPULATION SPATIAL STRUCTURE

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The external placing of radio transmitters on the body of aquatic mammals (beaver, muskrat, otter) leads to additional risks of equipment loss when the animals touch the reservoir bottom or fall trees. For this reason abdominal transmitters are more effective. To study the beaver population spatial structure we used IMP/400 transmitters. The detection radius of this device is averages 2 km and according to the manufacturer battery life is 665 days (we recorded more than 1000 days). These radios transmit signals 12 hours a day. For signal detection we used a TR-4 receiver, which was programmed for 100 channels in the range 142-220 MHz. The power source is two 9 volt batteries. The equipment included the RA-14K Rubber Ducky "H" antenna with elastic "whiskers".

Our radio telemetry protocol was to switch on the receiver in "wide search" in areas where beavers with implanted transmitters were suspected of being. When the signal was detected we determined by its intensity the direction to follow to search for the animal. When the "labeled" beaver was close to us we switched the receiver to "narrow search" and we determined the beaver location with an accuracy of 2-3 meters.

The radio transmitter implantation into the peritoneal space consists of four stages: 1) preparation of transmitters for implanting, 2) preparation of beaver for surgery, 3) transmitter implantation, and 4) rehabilitation of animals after surgery.

During the study in Volzhsko-Kamsky Nature Biosphere Reserve more than 300 locations were documented. With the help of radiotelemetry we determined the beavers' migration activity within the area of release. The distance that beavers moved from the point of release to the place where they settled varied from 2 to 16 km. At the same time we determined home ranges areas. In summer home ranges were approximately 7.0 ha, in winter they were 0.25 ha.

Keywords: beaver, spatial structure, radiotelemetry, abdominal transmitters

THE STORY OF HUMAN IMAGERY OF BEAVERS FROM CAVE PAINTINGS TO CARTOONS

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The engineering activities of beavers have fascinated humans from the earliest of times. Archaeological evidence from a number of European sites clearly indicates that Mesolithic humans preferentially selected living sites in beaver generated landscapes which provided then with a rich range of foraging opportunities while affording refuge from large predators such as big cats. Although it is quite possible that early images from cave art or carvings were principally driven by wonder the relationship between humans and beavers has changed radically over time. From a position of respect they became a commodity which was exploited to the point of virtual extinction. With more enlightened times as their worldwide recovery began opponents and supporters of their presence began to latch on to the potential of humorous imagery to push their particular agenda. This presentation will chart the use of beaver images as a mirror of human society's ability to reflect and project its own interests onto another species.

THE HYDROGEOMORPHOLOGICAL IMPACT OF BEAVER (*CASTOR FIBER*) ACTIVITIES ON EMBANKED WATER COURSES IN CENTRAL ROMANIA

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In the last 150 years, after beaver (*Castor fiber*) extinction, the natural landscape of the Brasov depression (Central Romania) suffered substantial changes, mainly due to human population growth and development.
After beavers were reintroduced on the Olt and Râul Negru Rivers, they migrated upstream to colonize different tributaries. Beavers began interacting with river engineering works and the landscape by building dams and dens.
To assess the hydrogeomorphological impact of beaver activities eight river sectors were analyzed with lengths between 272 and 671 meters, and a variable number of dams (0-4 dams). The analysed watercourses have a low gradient (generally less than 1%) and a double profile cross section (riverbed sized to discharge current flow and flood plain bounded by earth embankments, sized to discharge outstanding flows).
To estimate the effect of beaver dams on the spill channel regime, hydraulic simulations were performed using Mike 11 application taking into account the presence of beaver dams or removing them.
The measured dams' height is between 0.27 – 2.30 m, and their width between 4.49 -10.43 m straight related to the water course cross section. The dams were built if woody vegetation was present within the embankments only in the minor riverbed covering (in 17 from 20 situations) less than 20% of the active cross section area.
The presence of dams causes flow slowdowns due to reduced riverbed gradient and to the buffer effect of ponds created behind dams. As a result, the flow discharged by the sectors of riverbeds with beaver dams diminishes by an average of 28%, but the capacity to exhaust even large floods (generating discharges with long return period - 20-100 years) is not affected.

Keywords: beaver impact, hydrology, embanked water courses

THE PHENOMENON OF MULTIPLE DENDROACTIVITY IN EURASIAN BEAVERS

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The study was done on two parts of the Vorona River. The signs of activity we studied were represented by the damage caused by beavers to the bark of the trees which were not eaten. Among them there were the trees exposed to dendroactivity for several seasons and years. According to the results of examinations in permanent study areas in autumns of 2012-2015 there were 352 cases of bark damage to trees of nine species. The relevance of the research is determined by the need to test the hypothesis that there is a relationship between signs of dendroactivity and olfactory traces, and also the appropriateness of considering bark damage as one of visual reference points for beavers. The analysis of factors of repeatedly damaged tree distribution as the most pronounced elements of dendroactivity was performed with the help of the multiple regression method. The predictors: the species of the damaged tree; the location of the trace regarding the boundaries and the centre of the settlement; presence of cache food in the settlement; olfactory traces are less than one meter from each other, or there are some tracks of other animal species; the orientation of tracks in the direction of the river line; remoteness from the bank; belonging to shelters and pathways of different type. The determination ratio (R^2 = 0.10) indicates the presence of factors not taken into account and a satisfactory predictive value of the model (F = 2.89, P = 0). The analysis of the equation and unstandardized regression ratio as well as the frequency of binary signs showed that instances of multiply renewed bark damage are reasonably more frequent on *Quercus robur* trees (18.3% instances; χ^2=4.05; P = 0.04), on rarely visited reconnaissance paths by the borders of settlements (β= - 0.11), and the frequency of damages themselves increases the farther it is from the bank (β = 0.11). The signs studied are not found on the way to other water bodies (β = -0.11) and on *Acer negundo* (β = -0.15). The regression analysis disproved the hypothesis that the signs of dendroactivity tend to be found in places with olfactory marking and mammals of other species. Thus, the phenomenon studied is a manifestation of distress that occurs when an obligate amphibiont moves considerably far away from the bank along rarely visited paths in places of contact between beavers from adjoining settlements, and it is not connected with marking activity. This may explain the reasons why both repeated and single variations of dendroactivity occur. The question is how stress-dependent signs of life activity, distributed in space rather randomly, can be found on the same trees for several years. The apparent explanation to this is high frequency of beavers settling in the same places. Results of studying the schemes of long-term use of the paths in the settlements will help better understanding of the phenomenon under study.

Keywords: beaver, marking behaviour, territoriality, damage to trees

THE BEAVER IS BACK! STATUS, EXPERIENCES AND CHALLENGES WITH BEAVER MANAGEMENT IN THE AUSTRIAN PROVINCES UPPER AUSTRIA AND SALZBURG

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About 150 years ago the last beavers in the two Austrian provinces of Upper Austria and Salzburg were killed. In the 1970s beavers were reintroduced near Vienna as well as in the Inn River at the Bavarian/Upper Austrian border. The actual current population of beavers is estimated at about 800 individuals in Upper Austria and at about 150 individuals in Salzburg. For many years the expansion of the beaver population happened mostly unnoticed by most people. Now, with beaver activity in intensively used agricultural areas and in areas with high densities of human settlements and infrastructure there is a more attention given to beavers. Human-Beaver conflicts are dominating discussions between human oriented land use and nature conservationists. The call for regulating the beaver population densities as a conflict management tool is increasing. Clear thresholds concerning the favorable population status of beavers according to the habitats directive of the European Union are missing.

Austria is a small country, however nature conservation is not regulated by one federal law, but by nine different laws in the nine Austrian provinces, which deal with nature conservation issues only on a provincial level. Another important point concerning beaver management is that in some provinces hunting laws regulate management, while in others by nature conservation laws regulate management. Exchange of experiences between the provinces is not very common.

It is an extremely large challenge to integrate the ecosystem benefits created by beaver in an environment, which are used by people on a multifunctional level. When getting into detail, big differences in beaver management all over Austria show up, with different guidelines and different protection targets.

This presentation compares the different beaver management approaches of two neighboring provinces in Austria. The focus of the comparison is on the challenge of considering all issues influencing beaver management, which are often contradictory, including the interests of property owners, public institutions, nature conservation, public opinion and last but not least the recommendations of the beaver experts.

Keywords: beaver management, Austria, compensation, conflict management, communication strategies, management tools

SHORT-TERM EFFECTS OF TRAPPING ON ACTIVITY AND MOVEMENT PATTERNS OF EURASIAN BEAVERS *CASTOR FIBER*

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Bio-logging technology has experienced a significant upturn in the last decade, in particular within the field of behavioural ecology. Animal-borne data loggers have been used to study a broad range of animals in their natural habitats with potential implications on management and conservation actions. The increased focus on miniaturization may lower the impact on tagged animals in general, however, the capture and tagging procedure itself might be stressful and may alter an animals' behaviour. In this study, we aimed to investigate whether short-term effects of trapping are apparent in activity and movement patterns of Eurasian beavers *Castor fiber* during the first week after the capture event. We deployed GPS units (n = 23) and acceleration data loggers (n = 13) on free-ranging, dominant beavers (20 males, 16 females) in Telemark county, Norway. GPS data was used to determine movement patterns (distance moved, displacement rate from the lodge) and accelerometry data allowed for investigating activity levels (mean overall dynamic body acceleration over 15 min) of beavers, as well as the period of time the animals spent active. Both distance moved and displacement from the lodge did not change significantly after release. However, a separate analysis on the first night after capture showed that beavers tended to reside significantly closer to their lodge in the first hours after release. Moreover, we found a significant positive relationship between activity and time after release, which leveled out with time. The animals also showed a significantly reduced active period in the first two nights after capture, and went earlier back into their lodge during those two nights. These findings indicate that beavers did not alter their movement patterns after the capture event, which is likely related to their high territoriality and duties regarding territorial maintenance, such as patrolling and scent-marking. However, the animals reduced their activity significantly in the first nights after release, something that may allude to a more cautious behaviour. This is supported by the fact that the animals also stayed significantly longer inside their lodges in the first two days, thereby taking advantage of being in a safe refuge. Based on these findings, we recommend removing data for the first two nights after capture to prevent capture-effect biased results.

Keywords: accelerometry, activity, *Castor fiber*, capture effect, data logger, Eurasian beaver, GPS, movement, overall dynamic body acceleration, trapping

BEAVERS AS AN ECOLOGICAL RESTORATION TOOL: A CAUTIONARY TALE

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In many areas of Eurasia and North America, the reintroduction of beavers is often promoted as a means to achieve ecological restoration of aquatic habitats. The proven ability of beavers to impound water and enhance aquatic biodiversity is an important measure of success following these reintroduction programs. As ecosystem engineers, North American beavers (*Castor canadensis*) are well known for building dams and lodges. When combined with the excavation of complex networks of channels by beavers, the extent of landscape alteration can be significant. My research in boreal Canada determined that through channel excavations alone, beavers increased average wetland perimeters by over 575%, with some channels extending over 200 to 300 meters away from the wetland edge. Estimated soil displacement exceeded 1,700 m^3 per km^2. In novel (human-constructed) habitats, I was also able to quantify similar changes in riparian forest composition and physical modifications of the pond edge over a 14-month period. After three beavers were introduced to the 0.5 ha site, they cut more than 3,000 woody stems during the non-winter months and increased pond perimeters significantly. From an ecological perspective such changes increase habitat heterogeneity and create more resilient wetlands. From a human-wildlife conflict perspective, the beaver's ability to modify areas so dramatically presents a challenge for reintroduction programs, despite sound ecological goals. Our understanding of the true extent of ecological engineering by beavers and the potential positive and negative impacts on landscapes can help guide our decisions on potential release sites and appropriate mitigation measures, which then can help determine the long-term viability of reintroduction programs.

Keywords: beavers, channels, ecological engineering, isolated wetlands

HISTORY AND CURRENT STATUS OF THE BEAVER POPULATION IN THE NATIONAL PARK VODLOZERSKY

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The territory of the National Park Vodlozersky covers an area of 472436.0 ha and is administratively divided between the Republic of Karelia (southern part) and Archangelsk Oblast (northern part). Its almost 160km width defines the diverse conditions of the beaver habitat.

There were no special cases of beaver releases in the area. Beaver presence is mainly due to cases of Eurasian beaver release in the Archangelsk Oblast (Semenov, 1969) and North American beaver release in the Republic of Karelia (Kanshiev, 2003), which were performed with 30 years apart.

Eurasian beaver. Beaver releases took place in the late 1940s and at the beginning of the 1960s, 100 km and 70 km distant from the park border respectively. The fate of the released beavers long remained unknown. It was only in the middle of 1980s when the first cases of their appearance were observed.

North American beaver. Two beaver releases took place at the beginning of the 1980s in Belomorsky and Segezhsky districts with 50km and 70km distant from the park border respectively. At the end of the 1990s they had got across the water systems and appeared near park's border, which they crossed at the beginning of the 2000s (Danilov *et al*. 2007).

The beaver population was counted in 2014 with 48 settlements and 170 beavers identified. Considering the incompleteness of the investigation, the real beaver population should be calculated 30-40% higher than this number. Beavers have colonized almost all wetland areas, reaching the smallest streams such as swampy creeks and roadside ditches. The prospects for further resettlement are limited, since both species live in close proximity.

Thus, the NP Vodlozersky is one of the rare places which is inhabited by both beaver species, the Eurasian (*Castor fiber* L.*)* and the North American (*Castor canadensis* Kuhl) and can serve as the foundation and the starting point for their comparative study.

Keywords: beaver, distribution, population, ecology

BEAVERS INVASION OF THE EUROPEAN ORIGIN IN REPUBLIC OF TYVA – REAL THREAT TO A GENE POOL OF THE AUTOCHTHONOUS *CASTOR FIBER TUVINICUS*

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The native population of the Tuvinian beaver (*Castor fiber tuvinicus*) inhabits in eastern part of Republic of Tyva and is included in the Red Data Book of the Russian Federation (2001) with the status of an endangered subspecies. The main indigenous group is located in Todzha Hollow - in the Zapovednik Azas. According to census data collected in 2013 and 2014 on the Azas and Bash-Khem rivers the population of beavers in the zapovednik reached a historical maximum of 107 and 101 individuals in 34 settlements, respectively.

However, a real threat for the Tuvinian beaver gene pool is present. For many years the natural migration of beavers of European origin (*Castor fiber "europaeus"*) from the adjacent Republic of Khakasia and Krasnoyarsky krai to the Tuva area has been occuring. Animals of these hybrid (*C. f. orientoeuropaeus* × *C. f. belorussicus*) populations demonstrate high fertility, a darker color and larger size compared to smaller, light-brown endemic subspecies. Migrants actively colonize the basins of the Bolshoi Yenissei (Biy-Khem) and Khemchik rivers (Saveljev et al., 2012; our data).

An inspection of rivers in Todzha region from 2008-2014 revealed separate settlements of European beaver with robust populations. The largest group is located in the Systyg-Khem River basin. In 2013 along this river from the riverhead to the mouth we counted 23 settlements. We also observed 9 settlements on the Shet-Khem River. Their habitations also were observed on tributaries of the Kugar, Chapshi, Aina, and Bilyalig rivers. From 37 visually observed beavers 21 animals had a black color, 12 animals were dark brown and 4 were brown. The total number of the Systyg- Khem population was at least 180 animals, which is twice the size of the autochthonous Azas population.

Stable settlements of migrants have been recorded on the Biy-Khem, Khamsara, Kadyr-Os, Chavash, and Kazas rivers and also on other rivers of Todzha. The migrant beaver settlement nearest to the zapovednik is 45 kilometers.

Thus, a rapid beaver population growth and range extension is occuring in Todzha Hollow. However these beaver are not the Tuva subspecies. Their movement into and colonization of the Zapovednik Azas area is only the matter of time. Because of this it is necessary to take prompt measures for conservation of the gene pool of the autochthonous *C. f. tuvinicus.*

Keywords: autochthonous population, Tuvinian beaver, European beaver, zapovednik, gene pool, Tuva

LONG-TERM OBSERVATIONS OVER RE-INTRODUCED BEAVERS *CASTOR FIBER ORIENTOEUROPAEUS* ON KOLA PENINSULA, NW RUSSIA

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The beaver population on the Kola Peninsula demonstrates the unique issues that face a population living in the northern part of the range. In 1934 and 1937 fourteen beavers, *C. fiber orientoeuropaeus,* from Voronezh were reintroduced in the Lapland Nature Reserve (LNR). This was the first time a planned reintroduction of a species on northern limit of their rnge was attempted and regular observations were carried out by Semenov-Tjan-Shansky 1938, Poyarkov 1953, Nasimovich & Semenov-Tjan-Shansky 1959 and others to document the success of the reintroduction.

By the summer of 1947 the inspection of three rivers revealed 30 settlements with more than 100 individuals (Nasimovich 1948). The maximum the population density on the Chuna River was 2.1 settlements per 1 km documented between 1946-1948. Continuation of annual census counts has shown a gradual depression of the population level of beavers in LNR. The census in 1959 recorded the population of beavers in LNR as 18 family groups and 4 single animals for a total of 76 individuals (German 1960). The next two decades represented a period of population decline and stabilization to 45-50 beavers.

Release of beavers in other districts of the Murmansk Region also were made in 1935, 1936 and 1957 (total of 53 beavers) on the rivers Ponoi and Olenitsa. Inspection in 1959 found that the Murmansk Region was inhabited by 150 beavers, including the territory of LNR, which had approximately 100 individuals (Zharkov 1961). Poaching occurred in the unprotected territory of beavers (Kanshiev 1978). The Contemporary Kola beaver population is located within the territory of LNR, its nearest vicinities, and also isolated settlements on the western part of Murmansk Region. By the “most optimistic” estimates no more 30-40 beavers total are present, including in the LNR and its buffer zone with 14-21 animals (Kataev 2011).

Keywords: beavers, re-introduction, nature reserve, population dynamics

REASONS OF POLYMORPHISM OF BEAVER'S POPULATIONS IN SPACE OF EURASIA

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The metric traits of Eurasian beaver (*Castor fiber* L. 1758) skulls from eleven autochthonous and reintroduced populations (944 specimens) from Eastern Poland to the Russian Far East were investigated by using parametric and non-parametric multidimensional statistics. Different factors of polymorphism such as sexual size dimorphism, origin of animals, geographical variability and macroclimatic parameters were taken into account. We did not find any significant size sexual dimorphism in beaver skulls. However, significant influences of history of origin and geographical variability as well as macroclimatic gradient on morphological peculiarities of skull were confirmed. Among factors of population polymorphism in relation to its powerful influence on skull morphology, the belonging to autochthonous population connected with origination, the geographical and macroclimatic parameters were allocated. From 21 of macroclimatic factors significant influence on morphological variability were confirmed only for six: precipitations and temperature contrast through a year (the hottest and the coldest month/quarter; the wettest and the driest month/quarter). Absence of ordered geographical variability (*i.e.* Bergman's generalization) was detected. These Results allow us to deduce genetic factors, as well as, document a population's development, thermo-exchange reasons, adaptive biomechanics of jaw apparatus and the net primary production of ecosystems as important promoters of size-adjusted polymorphism. Our results point out an epigenetically adaptive as well as hereditary transmission of morphological features of skull size variability in autochthonous and reintroduced beaver populations. Among factors influencing polymorphism the main driver is the origin of the population, while the adaptation to local environmental conditions is secondary.

Key words: *Castor fiber*, geographical variability, hereditary transmission, abiotic environmental factors, adaptation

THE EFFECT OF BEAVER, *CASTOR FIBER*, ACTIVITY ON ZOOPLANKTON COMMUNITY FORMATION IN BEAVER PONDS: EXPERIMENTAL STUDIES

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Beaver activity influences many aspects of the wetland areas they occupy. Since beavers defecate in the water this influences the nitrogen and phosphorus content, affecting the water chemistry of the area. We conducted experiments that demonstrate the presence of beavers in an aquatic environment promotes an increase in nitrogen (N) and phosphorus (P) concentrations, decreases the N/P ratio, which stimulates an increase in the abundance and biomass of bacterial plankton. Under such conditions the abundance and biomass of *Daphnia (Ctenodaphnia) magna* increases. When large *D. magna* and smaller *Ceriodaphnia dubia* co-exist the abundance and biomass of *Daphnia magna* increases more due the effects beaver activity has on the water chemistry. In similar experiments under conditions without beaver excrement present we observed a predominance of *Ceriodaphnia dubia*. A seven-day test with *C. dubia* demonstrates that in water from aquariums where D. magna reaches mass development due to beaver excrement, the abundance of *Ceriodaphnia* decreases. Our data suggest that the nutrients present in beaver excrement that alter the water chemistry, stimulate the development of large-sized representatives of the genus *Daphnia*. However this also inhibits the reproductive functions of smaller Cladoceran species. This fact combined with greater competitiveness of large Cladoceran species under conditions of high level of nutrients, determines the formation of zooplankton communities in beaver ponds with high abundance, biomass, and low uniformity.

Keywords: bacterial plankton, zooplankton, *Daphnia (Ctenodaphnia) magna*, *Ceriodaphnia dubia*, abundance, biomass, bioassay

MEDICINAL USES OF THE EURASIAN BEAVER IN THE MEDIEVAL LEVANT

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Animals and products derived from different organs of their bodies have constituted part of the inventory of medicinal substances used in various cultures since ancient times. Intensive research into the phenomenon of zootherapy in the Levant from early medieval to present-day traditional medicine, yielded 99 substances of animal origin which were used medicinally during that long period. Fifty-two animal extracts and products were documented as being used from the early Muslim period (10th century) to the late Ottoman period (19th century). My presentation will deal with one of the unique medicinal substances – the beaver.

The dry secretion accumulated on the foreskin of the Eurasian beaver's penis or its testicles were used as a medicinal substance in the medieval Levant. The Arabic name of this substance was *jundibadastar,* and in Latin *castoreum*. The lumps of dried secretion were sold in pairs; therefore according to some scholars, it was assumed that these were beaver testicles.

Dioscorides mentions the '*kastoros orchis*' and its medicinal applications, mainly in treating the bites of snakes, scorpions and other poisonous creatures, as well as an emmenagogue and an abortive. Arabic medical authorities such as al-Kindi (9th century) reported that it was used as a component in an ointment for the nose and the head, in a clyster, and as a remedy to cure insanity. Benevenutus, the Jerusalem eye-doctor, mentions the use of *castoreum* as a component in the famous 'Jerusalemite Electuary' which was used to treat cataracts; and Maimonides (12th century) asserted that the '*qastorin*' was a component in a remedy for external use to treat the bites of snakes and other poisonous creatures, in a clyster to treat stomach pains and fever, and as a remedy to strengthen the body and the heart. *Jundibadastar* is mentioned as a simple in several Cairo Genizah fragments regarding the treatment of several eye conditions, headaches and diseases of the brain, jaundice, weakness of sexual organ, and as aphrodisiacs.

According to Maimonides' description given in the first person, it appears that he knew the animal, its behaviour and habits. Since he had spent most of his life in Spain, Morocco and Egypt where beavers cannot be found, I therefore argue that he probably saw an otter (*Lutra lutra*) that preys on other animals, that lives in Europe, North Africa and Asia (including the Middle East). We may therefore assume that in these regions physicians made use of otter testicles for medicinal purposes though the original use was of the beaver testicles.

HISTORY OF SETTLEMENT AND CURRENT SITUATION WITH BEAVER POPULATION IN KHOPERSKY NATURE ZAPOVEDNIK

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Khopersky Nature Zapovednik (KNZ) was founded in 1935 at the boarder of the steppe and forest-steppe geographical zones, in the Khoper River valley, N 50°42', E 42°00'. The conservation area covers 16.2 thousand hectares, 74 percent of which are floodplain landscapes with numerous lakes. Local flora and fauna are characteristic of broad-leaved forests spreading here into the steppe zone along the river valley. This supports a high level of biodiversity. Forests cover 85.7% of the territory of KNZ.

Beavers had been hunted out on this territory by the beginning of 20th century. Fifteen animals were re-introduced from the Voronezh Nature Zapovednik in 1937. The beavers from Khoper population belong to *Castor fiber orientoeuropaeus* (eastern European beaver). All animals have black fur. They settled on the territory of the KNZ randomly and evenly. At 40 kilometers from the Zapovednik's borders, the beavers were recorded living in two groups of lakes in 1948-49 (9-12 years after reintroduction) and in 1955-57 (17-20 years after reintroduction). This coincided with the peaks of migration from the KNZ territory, which was confirmed by a reduction in population growth in those years.

Each new beaver settlement began with a pair of animals forming a family. Eventually the size of the family reached the maximum that could be accommodated by the local supply of woody vegetation, which was sometimes followed by a wiping out of entire willow and aspen groves. The family then moved to another place or even another lake with sufficient food resources. The family would keep moving around and would come back to the initial site in about 10 years time. The length of such cycle depends on a speed of the willow re-growth.

In 1986 the size of the beaver population had reached its maximum size and then it was in decline. The decline wasn't caused by a limitation of the food resources, but reflected the internal density-related population processes. The minimum of the population size was recorded in 1998. Since 1999 the number of beavers grew steadily until 2008 when it stabilized at 550-600 animals.

Keywords: beaver, population, historic data, population dynamics

FACTORS AFFECTING THE LENGTH OF TERRITORY OCCUPATION IN A LONG-LIVED MONOGAMOUS MAMMAL

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In territorial, monogamous species the establishment and defence of a territory is crucial to maximize individual fitness. This is especially true for long-lived species, which rely on a stable area for foraging and reproduction. A long-term individual-based monitoring program in southern Norway allowed us to follow the individual life histories of Eurasian beavers (*Castor fiber*) from adolescence in their natal colony, over dispersal and territory establishment till the end of territory occupation. We investigated the factors affecting the length of territory occupation, such as territory size, habitat quality, colony density, age at dispersal, and body weight. Preliminary results suggest that reproductive success was positively related to the length territory occupation, emphasizing the importance of holding a territory to increase fitness. Larger individuals were more successful in holding territories. As body weight was positively related to the age at dispersal, beavers that stayed in their natal colony longer were doing better when occupying a territory of their own. Our results support the maturation hypothesis, which states that an animal should wait until its physical and behavioural maturation before it secures a territory. We found that beavers living in smaller territories held them longer, suggesting that patrolling and defending large territories is costly. These patterns might be related to the high population density in our area. In conclusion, we found that body mass and territory size influence the length of territory occupation in a long-lived, monogamous species.

Key words: *Castor fiber*, dispersal, Eurasian beaver, fitness, life history, territoriality

GENETIC MONITORING OF EURASIAN BEAVER (CASTOR FIBER) REINTRODUCTION IN SWITZERLAND

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The Eurasian beaver (*Castor fiber*) has successfully been reintroduced in Switzerland between 1956–77. Tributaries of the Rhone river were repopulated with individuals from the refugium population in France (formerly recognized as *C. f. galliae*), whereas tributaries of the Rhine river were repopulated with individuals from the refugium populations in France, Norway (*C. f. fiber*) and Russia (*C. f.* ssp). Following the species geographical expansion, the released populations situated along the Rhine river and its tributaries came into contact. In the present study, we used a combination of mitochondrial and nuclear microsatellite markers from tissue and hair samples from 191 individuals found dead to ***i***) detect the potential presence of an invasive species, the North American beaver (*Castor canadensis*), ***ii***) to estimate the level of genetic diversity within populations, ***iii***) to infer the genetic structuring of beaver in Switzerland and identify zones of admixture between the released populations.
We did not find any evidence that American beaver is present in Switzerland. We observed a single mitochondrial haplotypes for each of the two refugium populations used to repopulate Swiss rivers and a third haplotype, from the refugium population in Germany (*C. f. albicus*; incidental release from a zoological garden in Bern in 2000). We could show that the beaver population along the Rhine river consists of two genetic clusters and we could identify admixed individuals with a *C. f. fiber* haplotype for which the nuclear genome assigned to *C. f. galliae*. These individuals descent from 1–2 females translocated from Eastern to Western Switzerland 30 years ago. We could also find a pattern of isolation by distance and a high level of inbreeding, as indicated by the fact that individual separated by distances of up to 50 km are related as half siblings. This study provides a first evaluation of the reintroduction program of beaver in Switzerland.

Keywords: Eurasian Beaver (*Castor fiber*), reintroduction, refugium population, mitochondrial control region, microsatellites, population structure, relatedness, Switzerland

NONINVASIVE GENETIC ANALYSES FROM CASTOREUM AND ANAL GLAND SECRETIONS

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Eurasian beaver (*Castor fiber*) was almost extinct in the last century and survived only as eight refuge populations (previously recognized as subspecies) along major rivers of Europe and Asia. The species is now protected across most of its range and has recolonized large parts of its former distribution range. Individuals from different refuge populations were used as sources during the restocking of rivers in European countries. Thus, identifying the origin of the released beavers became an important monitoring issue. In addition, the recent spread of North American beaver (*C. canadensis*) following incidental releases is calling for fast and reliable methods to identify individual species and refuge populations in order to manage the beaver populations in Eurasia. Sources of DNA for genetic analyses may be obtained from live-trapping individuals or setting non-invasive traps such as barbed wire to collect hair samples. In the present study, we used samples of soil where scent marks (castoreum and anal gland secretion) were deposited as a source of DNA, and amplified a fragment of the mitochondrial control region. This method allowed us to assign beavers from the study site to the refuge population of the river Rhone ("*C. f. galliae*"). Non-invasive genetic analyses could be used to identify American beaver, monitor the expansion of populations or the contact zones between populations from different mitochondrial lineages. This method provides an additional monitoring tool that can be used in post-release management programs.

Keywords: Eurasian beaver (*Castor fiber*), North American beaver (*C. canadensis*), reintroduction, refugium populations, management, mitochondrial DNA

DRY BEAVER PONDS – ATTRACTIVE HABITATS FOR LARGE MAMMALS

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It is a well-known fact that the beaver plays a role as an ecosystem engineer. Beavers create new habitats – ponds by stemming riverbeds and flooding the riparian ecosystem. When these ponds dry up, a new type of habitat is created being characterized by change of abiotic factors and species composition of the biota.

Our research was conducted from 10 June to 6 November 2014 in the basin of Ivnitsa River in the territory of the Voronezh SNBR (Voronezh and Lipetsk regions). We surveyed two inhabited beaver settlements using camera traps. For control, we surveyed dry marsh that was not inhabited by beavers but had similar conditions like a dry beaver pond. Camera traps (192 trap-nights) took pictures of 674 individuals of large mammals of eight species.

At the beaver settlements the frequency of visits (ind. per day) was for wild boar (*Sus scrofa*) – 0.76, moose (*Alces alces*) – 0.5, European roe deer (*Capreolus capreolus*) – 0.25, red fox (*Vulpes vulpes*) – 0.7, pine marten (*Martes martes*) – 0.07. Stray dogs visited the beaver settlement six times, European badger (*Meles meles*) and European polecat (*Mustela putorius*) were observed once. At the control marsh we registered 3.12 wild boar, 0.11 European roe deer and 0.02 red fox per day.

There is a noticeable predominance of visits to the dry beaver ponds by the predatory mammals. Apparently, predators are attracted by plentiful amphibians that are escaping from drought in the entrances of the beaver lodges and by micromammals. Presumably, predators are also attracted by the smell of castoreum. Ungulates, except wild boar, were visiting the beaver ponds more often, than the control marsh. Moose and European roe deer eat saplings and woody twigs, wild boars visit settlement for taking a mud bath and obtaining invertebrates and rhizomes in the soft ground.

Dry beaver ponds are attractive habitats for various mammals, who find favorable conditions here.

Keywords: beaver pond, habitat, large mammals

MOLECULAR ECOLOGY OF BEAVERS: WHERE ARE WE AND WHERE DO WE NEED TO GO?

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The advent of molecular tools has revolutionized our understanding of animal biology at the level of individuals and populations. Various aspects of beaver biology have been recently elucidated using mitochondrial and nuclear markers. Origin, admixture and establishment of the present-day populations have been studied in detail for the Eurasian Beaver. Genetic markers also provide new insights into the mating system and family structure in the two extant beaver species. The talk will review our current knowledge of the beaver molecular ecology and suggest new challenges in this field.

A STATISTICAL SURVEY ON THE EUROPEAN AND INTERNATIONAL BEAVER SYMPOSIUMS FROM 1997 TO 2012

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This poster presents the chronological sequence of the European and the International Beaver Symposiums. The Scandinavian beaver conferences are not include nor are the other national beaver conferences and meetings.

1st European Beaver Symposium, Bratislava, Slovakia, 15-19 September, 1997. Comenius University Bratislava, Institute of Ecology, Faculty of Natural Sciences & Slovak Zoological Society. Location: Comenius University Bratislava. Organizers: K.Pachinger, K.-A.Nitsche. Participants: 42. Countries: 17. Abstract papers: 34. Proceedings: 19 articles, 24 abstracts.

1st Euro-American Beaver Congress, Kazan, Russia, 24-28 August 1999. Ministry of Nature Conservation and Natural Resources of Tatarstan Republic, Location: Volga-Kama State Nature Zapovednik, Kazan. Organizers: Yu.Gorshkov, P.Busher. Countries: 7. Abstract papers: 17. Proceedings: *Transactions of Volga-Kama National Nature Zapovednik*. Volume 4 (2001), 17 articles.

2nd European Beaver Symposium, Bialowieza, Poland, 27-30 September 2000. Jagiellonian University Krakow, Carpathian Heritage Society. Location: Mammal Research Institute of PAS. Organizers: A.Czech, G.Schwab (pre-preparation: K.-A.Nitsche). Participants: 55. Countries: 18. Abstract papers: 54. Proceedings: *The European Beaver in a New Millenium*, 19 articles, 11 abstracts, 8 short notes.

3rd European Beaver Symposium & 2nd Euro-American Beaver Congress, Arnhem, The Netherlands, 13-15 October 2003. VZZ - Society for Study and Conservation of Mammals. Location: Hotel Haarhuis Arnhem. Organizers: Vilmar Dijkstra, Peter E. Busher, Ton Bosman. Participants: 105. Countries: 23. Abstract papers: 66. Proceedings: *Lutra* 2003 46 (No 2, *Beaver Special)*.

4th European Beaver Symposium & 3rd Euro-American Beaver Congress, Freising, Germany, 11-14 September 2006. Location: University of Applied Science, Weihenstephan. Organizers: V.Zahner, G.Schwab, M.Schmidbauer, K.-A. Nitsche, P.E.Busher. Participants: 86. Countries: 20. Abstracts: 61. Proceedings no published.

5th International Beaver Symposium, Dubingiai, Lithuania, 20-23 September 2009. Location: Seminar and Conference Centre Dubingiai. Organizers: A.Ulevičius, A.Paulauskas, P.E.Busher, K.-A. Nitsche. Scientific Committee: P.E.Busher, Glynnis Hood, A.Saveljev, V.Sidorovich, M.Stubbe. Participants: 105. Countries: 22. Abstract papers: 56. Proceedings: in *Baltic Forestry* select papers.

6th International Beaver Symposium, Ivanič Grad, Croatia, 17-20 September 2012, Location: City Hall Ivanič Grad. Organizers: M.Grubesic, M.Orsanic, B.Kovacic, J.Margaletic, K.Tomljanovic, L.Bjelov, M.Vucelja, G.Schwab, K.-A.Nitsche, V.B.Vlahek, D.Mucha, A.Bester. Scientific Committee: P.Busher, Glynnis Hood, A.Ulevicius, A.Saveljev, M.Grubesic, J.Margaletic. Participants: 103 Countries: 23. Abstract papers: 86. Proceedings: in *Sumarski List* – select papers.

THE WOLF (*CANIS LUPUS)* AS NATURAL PREDATOR OF THE BEAVERS (*CASTOR FIBER ET CASTOR CANADENSIS*)

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An overview of wolves as natural predator of the beaver in Eurasia and North America will be given. The influence by wolf on beaver populations is depending on local and seasonal conditions. Our knowledge about the relations between beaver and wolf is still incomplete and should be further examined. Wolves are not able to reduce beaver populations.

BEAVER ACTIVITY AS ONE OF THE MAIN ENVIRONMENT-FORMING FACTORS IN NIZHNE-SVIRSKY NATURE RESERVE

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The research on this topic was conducted over 30 years. By the time the reserve was opened (1980) only 6-8 settlements of the beaver *Castor fiber* L. were documented living in the territory. Over the years beavers moved further up along the springs and small rivers cutting at the nearby area aspen, birch, willow and alder trees. In 25 years they occupied all suitable habitat of the reserve and reached the maximum population size. At present there is some decline in the size of the population.

Clear ecotone habitats are formed along a series of dams along the streams where beavers cut trees. These habitats were later settled by animals that earlier had not found suitable conditions in the area. The development of the plant species community occurs after drying of the soil in the former ponds created by beaver dams, which then leads to the resumption of animal communities. Our research has documented the positive impact of beaver activity on species diversity and the changes in the riparian areas around ponds. We have also examined the initial stages of how animal communities develop at the sites of former beaver dams. Specifically we examined how beaver activity influences the populations of some mammal, bird and invertebrate species. We compared differences in water, wetland and forest bird species diversity and numbers at beaver influenced and beaver-free forest streams. Our research also looked at initial mesofauna species that occupy old beaver sites and the dependence of wild boar survival on the existence of the feeding areas at the shallow waters of beaver ponds in the Nizhne-Svirsky Reserve.

Keywords: beaver, influence, environment, animal communities

HABITAT SELECTION BY EURASIAN BEAVER (*CASTOR FIBER*) IN INUNDATED LANDS OF OKSKY NATURE RESERVE

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Beavers currently inhabit all types of waters in Oksky Nature Reserve (ONR), such as non-inundated lakes, inundated waters and beds of Pra and Oka rivers, ameliorative drains, and beds of Lamsha and Chernaya creeks. Most beaver settlements of the ONR are located in the flood land of the Pra river (72% of all settlements).

Beaver reacclimatization had been managed in the studied area from 1937 to 1940, after which these animals begun their self-reclamation in the reserve (Borodina, 1965). It was reported, that after their release beavers occupied optimal habitats at first, and then suboptimal places (Nolet, Rosell, 1994). At the first stage of the resettlement, before 1954, beavers occupied the flood land of the Pra, where they prefer loop lakes (more than 80%) to the river stream. However, only 35% of water reservoirs occupied in that period were constantly used by beavers resulting in a consistency index of 0.7 (the index is the number of years with beaver occupation divided by the total number of years). For inhabited water reservoirs, Spearman rank correlation was calculated between the index of occupation priority and several ecological factors, such as area, hydrological regime, a location in regard of river stream, forest cover and height of shores, inundation extent, grassy and wood forage abundance, and anthropogenic burden. Beavers preferred forested waters ($r = 0.59$, $p < 0.05$), located far from stream of the Oka big river ($r = 0.53$, $p < 0.05$) with low anthropogenic burden ($r = 0.31$, $p < 0.05$). Forested shores and farness from the Oka stream obviously facilitate a survival of animals during spring flood.

Analysis of correlation between the consistency index and above-mentioned factors has shown some relation of the index with forestation ($r = 0.45$, $p < 0.05$) and hydrological regime stability ($r = 0.42$, $p < 0.05$).

Keywords: Eurasian beaver, beaver settlement, nature reserve, habitat selection

RIPARIAN HABITAT MODELING IN THE CONTEXT OF BEAVER (*CASTOR FIBER*) REPOPULATION IN BRAȘOV – ROMANIA

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The reintroduction of Eurasian beaver (*Castor fiber*) in Romania started in 1998 and it was a complete success in terms of population growth and natural range enlargement.

The habitat modeling capacity of beaver was more and more obvious once with the increase of population densities, demonstrating the highly potential of this species to create new trophic niches for other species and implicitly biodiversity enrichment.

The study was conducted on a floodplain area near the Bârsa River, where the habitat became a fauna paradise, by the constant intervention of beavers that had colonized the area in 2009-2010. In the first stage of this study, the habitats were classified and existing forest stands, shrubs and herbaceous vegetation were demarcated according to their composition and age (for tree vegetation). Further, a habitat analysis has been performed grounded on the correlation of dendrochronological sampling and satellite images captured between 2005 and 2014. On the basis of the aforementioned method, the right moment for beaver installation within the studied area has been determined quite precisely. Finally, a GIS modeling has been conducted regarding the evolution of vegetation from 2005-2014, with the help of a 10x10m grid.

This study is a clear example in which beavers succeed to use, instinctively, in their best interest the opportunities offered by nature. Moreover, through the changes they produce in the environment, beavers have a strong impact on the natural succession processes.

Keywords: beaver repopulation, habitat modeling, dendrochronology, beaver impact

LONG-TERM POPULATION DYNAMICS OF REINTRODUCED EURASIAN BEAVERS (*CASTOR FIBER*) IN SUBOPTIMAL HABITATS OF RUSSIAN NATURE RESERVES

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Mathematical models of the Eurasian beaver population dynamics and beaver food resources availability have been developed for selected Russian reserves (Laplandskiy, Darvinskiy, Central-Forest, Prioksko-Terrasnyi, Okskiy and Khoperskiy) located in different forest zones: from forest-tundra to forest-steppe. It is shown that for these six study reserves 5 stages of beaver population development can be set: 1 - slow population growth, 2 - rapid population growth, 3 - fluctuation at the high or medium population levels, 4 - population decline, 5 - fluctuations at the low population level. With different rates of beaver food resources recovery this conceptual model of long-term beaver population dynamics has a clear interpretation. For example, at a high rate of the food resources recovery, long fluctuations at the high population size level are possible. The ***first type*** of beaver population dynamics has been observed on the Darvinskiy, Central-Forest and Khoperskiy reserves. Although, of these three reserves, only the Khoperskiy Reserve originally contained optimal beaver habitat. The Darvinskiy and Central-Forest Reserves were originally suboptimal habitats, but long-term beaver engineering activity has significantly improved beaver habitats there. Only for the Okskiy Reserve, the logistic growth (the ***second type***) of beaver population was observed. With slow or average rates of food resources recovery in the suboptimal habitats, a beaver population declines after reaching the first population peak. After that decline, fluctuations at low or middle population size levels were observed. The ***third type*** of population dynamics was observed for beavers in the Prioksko-Terrasny Reserve. The ***fourth type*** of population dynamics was observed for beavers of the Laplandskiy Reserve and is characterized by fluctuations of population size at a low level. We hypothesize that these four types of beaver population dynamics can be observed for most suboptimal habitats in Russia.
This work was supported by the Russian Foundation for Basic Research (grants № 15-04-06423 and № 15-29-02550).

Keywords: Eurasian beaver, mathematical model, suboptimal and pessimal habitats, logistic growth, population dynamics

STATUS AND MANAGEMENT OF ILLEGALLY RELEASED EURASIAN BEAVER (*CASTOR FIBER*) IN SPAIN

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The Eurasian beaver (*Castor fiber*) historically inhabited Ebro and Duero river basins in the north of the Iberian Peninsula. There are data of it´s presence from the late Roman period between IV and VI century and some doubtful data from later.
Unauthorised release of beaver was carried out in Spain in 2003. 18 individuals were liberated on Ebro River in the border area between Autonomous Communities of La Rioja, Aragon and Navarra. As a result of the release, the population was established and expanded fast during the next years. Here we provide an overview of the status and management of the beaver in La Rioja and Aragon as a two case studies, based on the official data of the two administration.
First study about the status of beaver was carried out by Goverment of La Rioja in 2007/2008 with the aim to clarify the status of the established population. The survey showed that near 90 km of Ebro River was occupied and the number of beavers was estimated to be between 28 and 41 individuals. Removal effort was made during next years, with the consent of the EU, and 123 beavers were captured on the main course of Ebro (on both riverbanks, in La Rioja and Navarra) and only five beavers in tributaries in 2008-2014. Despite of high number of captures,the species continued expansion along the Ebro river within the territory of La Rioja and Navarra, reaching to Basque Country (province of Alava) in 2015.
The Goverment of Aragon initiated the study about the situation of beaver in 2009. The species was found on 110 km long stretch of Ebro River in 2009/2010 and the number of individuals was estimated between 21 and 26. As a result of trapping carried out in 2010-2012, 26 beavers were captured and differently from La Rioja, decline in beaver number was seen. Still, dispersion to Castilla y León (province of Soria) was detected via tributaries in 2015.
Analyses of DNA samples, collected from three first beavers caught in La Rioja, were done in the University of Basque Country with the aim to identify the origin of beavers that have been used in the release operation in the Ebro River. Results of the study indicate that there is a hybrid population - one specimen was identified as *Castor fiber fiber*, and other two specimens represented characteristics of two subspecies, *Castor fiber galliae* and *Castor fiber albicus*.
As a conclusion, the beaver occupies today more than 300 km of Ebro River and a few hundred kilometres of it's tributaries in the territories of five Autonomus Communities (La Rioja, Aragon, Navarra, Basque Country and Castilla y León). It is very likely that removal of the illegally released beaver on such a large territory will not be viable and authorities responsible for biodiversity conservation face complicated choices on how to manage the illegally established population.

Keywords: Eurasian Beaver, *Castor fiber*, illegal release, Ebro River, Spain

THE ZOOPLANKTON IN SMALL BEAVER INHABITED RIVERS ON THE TERRITORY OF NATURE RESERVES IN MIDDLE VOLGA REGION

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The zooplankton composition, structure and abundance in beaver inhabited steppe and forest-steppe small rivers on the "Volga Forest-steppe" and “Prisursky” (Middle Volga region, Russia) Reserves were analyzed. In 2014 the zooplankton community was observed in six rivers during the main hydrological phases. In Summer Rotifers (45-65 % of species) were more diverse in steppe rivers, while Crustaceans (80% of species) were most abundant in forest river of Nature Reserve Prisursky. In Spring and Autumn each water type had its own dominant group. The zooplankton in steppe rivers consisted of Rotifers (p. *Lecane, Notholca acuminata* (Ehrenberg)), primary filtrators of Daphniidae (*Ceriodaphnia quadrangula* (O.F. Muller), *C. rotunda* Sars, *Daphnia longispina* O.F. Muller, *Simocephalus vetulus* (O.F. Muller)), secondary filtrators of Chydoridae *Alona costata* Sars, *A. rectangula* Sars, *Chydorus sphaericus* (O.F. Muller), *Disparalona rostrata* (Koch), *Picripleuroxus laevis* (Sars), Cyclopoida (*Eucyclops serrulatus* (Fischer), *Macrocyclops albidus* (Jurine), *M. fuscus* (Jurine), *Paracyclops fimbriatus* (Fischer), *Thermocyclops crassus* (Fischer)). Beaver ponds on these rivers were inhabited by *Brachionus quadridentatus* Hermann, *Platyias quadricornis* (Ehrenberg), *Pompholyx sulcata* Hudson and mentioned large Cladocera. The zooplankton fauna in forest-steppe small rivers was less diverse and had some unique features. There are Crustacea (*D. pulex* (De Geer), *Diaphanosoma brachyurum* (Lievin), *Mesocyclops leuckarti* (Claus), *Diaptomus castor* (Jurine)) and Rotifera (*Keratella testudo* (Ehrenberg), *Epiphanes brachionus* (Ehrenberg), *Brachionus quadridentatus* Hermann, *Euchlanis dilatata* Ehrenberg) in the beaver pond. Seasonal changes differed from small rivers in the south taiga region. In the beaver ponds during the main hydrological phases the Cladocera primary filtrators are dominant. Copepods are not abundant during spring and autumn floods, while substrate surface organisms are not numerous during the autumn flood.

Keywords: small rivers, zooplankton, nature reserves, Middle Volga, steppe, forest-steppe, *Castor fiber*

THE CONTROL OF EPIZOOTIC SITUATION AND THE PREVENTIVE ACTIONS AGAINST OF HELMINTHIASES BEAVER

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Protection and rational use of natural resources is not possible without a detailed study of biocenosis of these territories. In the natural biocenosis one of the components is parasitic species, which on one hand helps regulation of the host population, while on the other hand they prevent the introduction and intensive development of new species, which are related to the owner.

For the implementation of epizootic control it is necessary to carry out an annual examination of the internal organs and eliminate infected beavers. Monitoring of the helminthofauna and malacofauna freshwater and terrestrial biocenosis can serve as an indicator of ecological and parasitic assessment of territories. At the bonitation land in the hunting leases must take into account the sanitary-epizootic situation by the presence of potentially dangerous areas in helminthological relation, as well as according to the abundance of species of mollusks intermediate hosts of helminthes beaver. Therefore, the task of parasitological evaluation is to identify the main objects of monitoring, including the main types of helminthes beaver, (*Stichorchis subtriquetrus*, *Trichostrongylus axei* (Cobbold, 1879), *Travassosius rufus* (Khalil, 1922), as well as the intermediate hosts of helminthes.

Prior to transport to new places of settlement, the beavers, which are infected with worms, must be treated with special drugs by "stop - one". The dose depends on the age and body weight of the animal. The medicament "Bars stop - one " as active substance contains ivermectin, praziquantelum and applied to animals weighing 2-5 kg in dose - 1 ml of 5-10 kg - 2 ml, 10 - 20 kg - 3 ml, 20-30 kg - 4 ml, more than 30 kg - 5 ml. You can also use a complex drug anthelmintic "profender." As an active ingredient contains emodepsid and praziquantelum. Topically applied to the skin. Used in the following doses: animals weighing up to 2.5 kg - 0.35 ml of 2.5-5 kg - 0.7 ml, 5-8 kg - 1.12 ml, 8 kg - 0.14 ml per kg of body weight. The drug is completely eliminated from the body through 28-30 days.

Under natural conditions, in order to reduce the parasitic load is necessary to take measures to reduce the number of clams and carry out the removal of a beavers not less than once every 10-13 years (2-3 settlements of withdraw, 1-2 are left in reserve).

Keywords: beaver, helminthes infections, control of epizootic situation, prevention measures

ALLOMETRY AND MORPHOLOGICAL DIVERSITY IN ONE AUTOCHTHONOUS AND TWO REINTRODUCED POPULATIONS OF EURASIAN BEAVERS (*CASTOR FIBER*, CASTORIDAE, RODENTIA)

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Allometry is extremely common phenomenon, which is found in animals at different levels: from the sexes to species and higher taxonomic levels. Developmental stability is manifested in restricting the influence of variations in the internal environment on the phenotype. From another point of view, 'allometric mechanism' of regulation shows variation, and, therefore, it is the source of morphological diversity on the species level, and allometry may be an object of natural selection. To understand the constraints on morphological diversity connected with ontogenic and static allometry patterns better, we investigated 15 measures of skulls from three geographically isolated populations of Eurasian beaver belonging to the Eastern European subspecies *C. f. orientoeuropaeus*: populations from Voronezh Reserve, Oka Reserve, and Central-Forest Reserve. Ontogenic allometric growth in general length of a beaver's skull is dependent on specific growth of its rostral part. The result of PCA shows clear differences between ontogenic allometric patterns from all populations. The pattern of the autochthonic population is closer to the pattern of Oka Reserve population, and Central-Forest Reserve population is approximately equally spaced from the others. Allometry pattern affects the dimensionality of the models of morphospace and, therefore, affects general entropy (generalized measure of morphological diversity). Therefore, allometry is not only the force that constrained of phenotypic variations but also it is a force originating the specific modularity and morphospace' dimension of the skull among genetically connected populations of beavers. All these results confirm our preliminary hypothesis (Puzachenko & Korablev, 2014) about the influence of ontogenetic allometry on the skull parameters in different beaver's populations.

Keywords: skull, allometry pattern, morphological diversity

UPDATE ON THE BEAVERS IN THE RIVER TAY, SCOTLAND

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The initiative to return the Eurasian beaver to Scotland has now continued for twenty-one years if we start from the moment in 1994 when Duncan Halley wrote to the chairman of Scottish Natural Heritage, suggesting that the species be proposed for restoration to Scotland. Since then populations have been established in Argyll and Tayside, but at the time of writing the Scottish Government minister still has to decide whether to allow the return of the beaver and, if so, whether to protect the species or not. Why has this process taken so long in our country?

Three years ago in Croatia I spoke of the 'Strange Tale of the Beavers of the Tay'. This time, at Voronezh, I hope to speak about the story of the last three years.

2012 saw the declaration of a moratorium by the Scottish Government on efforts to remove the free living population of beavers in the Tay and its tributaries. The establishment of the Tay Beaver Study Group by Scottish Natural Heritage in 2011 initiated some monitoring of the beavers in 2013, which included trapping beavers to check on their health and genetic status as these animals were of unknown origin. One major concern was the risk that animals directly imported from Central Europe might carry the parasitic worm *Echinococcus multilocularis*. This risk was considered to be low but significant to Britain, which currently maintains an Em free status. We were glad that the beavers of the Tay turned out to be in excellent health after screening for *E.multilocularis* and several other diseases.

SNH commissioned Southampton University in England to carry out a survey of the scientific literature on the interaction between salmonids and beavers (Kemp et al. 2010). A majority of the papers cited showed that the presence of beavers was favourable to salmon. This seems to have quietened the anxieties of salmon fishery organisations to some extent. The hostility of low ground arable farmers to the return of the beaver has continued right up to the present, although by 2014 it seemed that the National Union of Farmers of Scotland and Scottish Land and Estates had reconciled themselves to their presence, if only in the uplands, and then only if a strict management regime could be enforced. In the meantime some farmers in Strathmore are shooting beavers in their drainage ditches.

It has become a cliché to say that the beaver is a keystone species that can bring with it many benefits to the management of the landscape, but it has become clear that the species may also be seen as an indicator of human mismanagement and at the same time a vehicle for repair and restoration of degraded habitats. This applies especially to the agricultural landscape and the management of rivers for salmon fishing. The publication of the brilliant Swiss document "Revitalisation de cours d'eaux: Le castor est notre allié" struck a welcome note in this respect.

Keywords: Eurasian beaver, Scotland, restoration

ELBE-BEAVERS (*CASTOR FIBER ALBICUS*) IN OPENCAST-MINING LANDSCAPES NEAR BITTERFELD, SAXONY-ANHALT, GERMANY

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Any tapping of an opencast-lignite mining constitutes a profound intervention into an overall ecological structures of landscape units. The course of the Mulde river had to be rerouted for the further development of lignite seams in the mining region of Bitterfeld (Saxony-Anhalt). Those opening-up measures destroyed eight beaver sites in the original flood plains. The beavers (n=24) had been captured from this area and released successfully within a reintroduction project at Peene river in northern Germany (Mecklenburg Western Pomerania) in 1975-78. Later, the Mulde river was diverted over a lenght of some 8 km to empty into the exhausted open cut Muldenstein, and lake Muldestausee with a surface of about 6,3 km² was created through which Mulde river flows. Large-scale renaturation measures were conducted, incl. re-afforestation of different softwood species, in order to re-integrate the mining-conditioned streams, mining lakes and (drainage) ditch systems into the landscape.
The activities of Elbe beavers, which immigrated to the region around lake Muldestausee from 1980, contributed to the development of ecologically very valuable habitats for a large number of plant and animal species. Dams built by those beavers resulted in the formation of large wetlands where, inter alia, cranes (*Grus grus*), marsh harriers (*Circus aeruginosus*), and great reed warbler (*Acrocephalus arundinaceus*) found nesting places. Presently there are five stable beaver sites with reproduction and some single settlements in this area (estimated: 30 - 50 beavers). Following extensive mining field protection and renaturation schemes the abandoned open-cut area Goitzsche is currently being flooded. Large-scale areas for the protection of nature and endangered species have been integrated into the future utilization concept. In view of permanently changed infrastructures and the partial destruction of habitats (amongst other things, missing food reserves) in the original settlement area of the beavers at rivers Elbe and Mulde we deem the future redevelopment of the post-mining landscape Goitzsche and futher southern areas of Leipzig (after the closure of coal mining operations) a great opportunity for an undisturbed and low-conflict as well as sustained development of the Elbe beaver population in this Central German region which used to be characterised formerly by chemical and mining industries. Future planning should include the beaver as a “landscape-changing” animal species.

HELMINTH FAUNA OF BEAVERS

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Beaver (*Castor* sp.) helminth fauna is connected with a number of ecological and geographical conditions and factors. First, the helminth fauna is "static" and it is made primarily of monohostal (highly specific) species. Second, the helminth fauna changes due to ecological conditions and can be considerably supplemented by helminths parasitizing other species of host animals. They can live in beaver ecotopes and, as a rule, have broad specificity (polihostal species). These helminths are considered as not being specific parasites to beavers, with infection occurring when a high number beavers exist in their habitats. This process is defined as “hostal radiation”. The analysis of beaver helminth fauna has been carried out using data from a wide range of publications. The two species of beavers have 33 types of helminths: 13 trematodes, 6 cestodes, 1 acanthocephala, and 13 nematodes. There are a great variety of trematodes and nematodes in beavers. Beaver helminths are divided into three groups by specificity and occurrence: 1) Obligate parasites (21.2 %), these are highly specific, or monohostal (stenoecic) helminths parasitizing only beavers; 2) Facultative parasites (18.2 %), these are broadly specific, or poligostal helminths (habitat versatility) steadily parasitizing many species or systematic groups of hosts including beavers under certain favorable ecological conditions; 3) Casual parasites, which are helminth species that meet rarely, can show narrow or broad specificity, infection occurs under condition of a large number of infection elements in the environment owing to a high number of obligate hosts, for example, wild hoofed animals and predators. Significant domination of biohelminths (trematodes), first, indicates a close relationship of beavers with water ecosystems and second, emphasizes a high variety of trophic-chorological communications of beavers. Comparison of the two species of beavers shows that they have a different number of helminth species. The Eurasian beaver has 25 helminth species while the Canadian beaver has 14 helminth species. They have eight common helminth species.

Keywords: Eurasian beaver, North American beaver, helminth fauna, trematodes, cestodes, nematodes

ACHIEVEMENTS OF THE VORONEZH RESERVE IN BEAVER RESEARCH AND PRESERVATION

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Comprehensive studies on the beaver and activities for its protection were begun in our country in 1920s. By then only small autochthonous scattered enclaves remained in Eurasia. Countrywide prohibition of hunting for beavers was one of the first effective measures at the state level. It led the rapid growth of the number of beaver populations. State “beaver” reserves (Voronezhsky, Berezinsky and Kondo-Sosvinsky) were created in three largest population sites. Since 1923 the Voronezhsky reserve has became the breeding base and the center of dispersal of Eurasian beavers. In 1932 an experimental beaver farm was founded for creation of breeding groups, breeding, studying and dispersal of the beaver. Since 1934 active capture and dispersal of Voronezh beavers has been occuring. The Voronezhsky reserve headed these works and became the coordinator on translocation of beavers in the country.

These works were based on scientific studies and were of research character. In the Voronezhsky reserve the following methods have been developed: 1) census and marking of beavers; 2) capture, keeping and transportation of these animals; 3) inventory of beaver settlements with the use of aircraft; 4) evaluation and estimation of capacity of beaver habitats; 5) conduction of biotechnical activities (managing) in beaver settlements. Results of this work were analyzed on seven All-Russia meetings on problems of dispersal and rational use of beavers. In the Voronezhsky reserve more than 2500 beavers were caught and settled in natural habitats of the former USSR and other countries in 1932-1976.

Since early 1960s the beaver again became a hunting species in Russia, and by the early 1980s the beaver population had been restored in the historic habitat.

Since its foundation the experimental beaver nursery of the Voronezhsky Reserve has become the first and only center in the country for the studying of biology and ecology of the beaver. Researchers have thoroughly studied the anatomy, morphology and physiology of beavers, developed taxonomy of Eurasian beavers and genetics of inheritance for fur color. Reserve staff developed methods of cage keeping and breeding of beavers, described rules of keeping and breeding of young animals. Over 50 infectious and helminth diseases of beavers have been described and offered methods of their diagnostics, treatment and prevention. More than 20 dissertations on "beaver" subjects were prepared in the Voronezh reserve.

The main achievement of the Voronezh reserve is restoration of the former area and population of the beaver in Eurasia.

Keywords: Eurasian beaver, Voronezh reserve, dispersal, reacclimatization, capture, evaluation, cage breeding

THE TRAPPING OF BEAVER IN RUSSIA AND BELARUS – HISTORY AND CURRENT STATUS

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Less significant rates of area and quantity restoration of Eurasian beaver *(Castor fiber* L.) compared to North American beaver (*Castor canadensis* Kuhl*)* is explained by low initial quantity of the first species (less than a thousand individuals in the beginning of the XXth century in USSR), peripheral location and long population isolation which probably caused gene pool depletion and inbreeding depression. The main task of the trade resumption period was to develop biological grounding and acceptable norms for practical use of European beaver resources matching the country's conditions. Because beavers are monogamous the possibility of family breakup after removal of at least one breeder was a cause of serious concern. Beaver trapping within constant areas from 1960-1966 in the Kirov region and their before-trade tagging in Belarus allowed us to determine that taking of dominant individuals makes it possible for younger individuals lower in hierarchy to actualize their breeding potential. Self-regulatory mechanisms activate as the population density increases and favourable habitats for migrating young become less available. Defined peculiarities of population growth dynamics form the basis of the recommendation to restrict taking of one grown beaver per colony and resume trapping in this colony only the next hunting season. Regular trade allowed acquiring mass biological material that significantly increased our knowledge about species population ecology and behaviour in the "under-the-ice" period, which is the most difficult to study. Actual drop in the commercial demand for furs obligates us to execute necessary measures of development and implementation of a population management system based on ecological priorities, and not based on the extreme position of comparing beaver to "alien species, most dangerous for natural ecosystems" (Khlyap et al., 2011).

Keywords: Eurasian beaver, population, ecosystem, population dynamics, trade

MAMMALS IN BEAVER BURROWS (CAMERA TRAPS *VS* SNAP TRAPS)

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The goal of this work was to assess the importance of beaver burrows to the abundance, diversity and structure of the small mammal community. Our study was carried in Širvintos, Vilnius and Molėtai districts in 2011-2015 where the mean density of beaver sites is 20 per 1000 ha. Two methods were used to document small mammal use of beaver burrows: snap traps and camera traps. Snap traps were used in the spring and autumn seasons, while camera traps were used in the summer and winter seasons. A total of 147 beaver burrows were studied. Snap traps captured six species of small mammals in beaver burrows. The Bank vole (*Clethrionomys glareolus*) was the most common species in both seasons. Other species like *Sorex araneus, S. minutus, Neomys fodiens, A. flavicollis,* and *Microtus arvalis* were rare. Bank voles occurred in 32% of beaver burrows in spring and in 56% of beaver burrows in autumn while the frequency of occurrence of other species ranged between 2-5% in all seasons.
*Reconyx PC800 HyperFireProfessional Semi-Covert IR*camera traps were used to monitor beaver burrows. Activated cameras were left in beaver burrows from 30 to 117 days. A standardized indicator of number of triggers per 30 days was used for later studies. A total of 20 mammal species were identified. For further analyzes mammals were divided into the two ecological groups of small mammals and carnivores. The most common small mammals caught with the camera traps were the bank vole, yellow-necked mouse, common and water shrews, while the most common carnivore was the American mink. We found that 100% of beaver burrows was visited by bank voles and 73% were visited by American mink.
The effects of habitats and season for mammals in beaver burrows were also examined. There was no statistically significant differences in species diversity and in trigger rate between rivers, drainage ditches and beaver wetlands. Meanwhile the effect of season was significant. The rate of triggers with small mammals was significantly greater in winter season than in summer ($p<0.05$). Also here was a tendency of greater rate of triggers in winter for carnivores.

Keywords. *Castor fiber*, *Clethrionomys glareolus*, *Apodemus flavicollis*, Soricidae, camera traps, beaver burrow, biodiversity

SELF-EATING IN BEAVERS – TROPHIC OPPORTUNISM OR REACTION ON STRESS? CASE FROM EXTREME WINTER 2015 IN NW MONGOLIA

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We describe a unique case of exemption from ice captivity of beaver *Castor fiber birulai* in the last days of winter 2015 on the Tes River (NW Mongolia).
Autumn 2014 was characterized by extremely low precipitation. The river appeared frozen at an unusually low water level. For the three months (December 1st - February 28nd) the temperature dropped below -30°C to 14+22+15 days. The registered minimum temperature was 38.5°C below zero. The thickness of the snow cover did not exceed 8 cm (these data were taken from the nearest weather monitoring station in Erzin, Tuva).
By the end of the winter frost (frazil) covered everything throughout the riverbed, especially – over beaver dams. Using chainsaws and other tools people released a family of beavers. When the five animals went out, it was found that they all had tail that had been eaten. No terrestrial predators were present in the area. The beavers were very thin, and immediately began to actively feed on willow branches. There is no doubt that being in such a desperate situation the animals caused such injury to themselves.
Beavers cannot be considered as an obligate phytophag. Direct observations of Alaskan beavers (*Castor canadensis*) foraging and feeding on discarded Chinook Salmon (*Oncorhynchus tshawytscha*) carcasses were reported (Gleason et al. 2005. Canadian Field-Naturalist 119: 591-593). High rate of opisthorchosis in beavers in the Voronezh region (Romashov 1958) is also indirect proof of "piscivory" of beavers.
We can assume that beavers in the conditions of extreme scarcity of food while being locked in their lodges had no choice but to chew (eat) their tails. Other – more probable – assumption: beavers were engaged in self-gnawing due to extreme stress. This phenomenon is known in animals kept in fur farms and zoos.
Some of the animals rescued from the ice captivity died due to hypothermia, while others – managed to survive.

Keywords: *Castor fiber birulai*, Mongolia, extreme winter, frazil, ecological trap, autophagy, self-gnawing

"*A SPECTRE IS HAUNTING EUROPE – THE SPECTRE …*" FROM SIBERIA: A VERIFICATION OF WAYS OF DETERMINING THE PENETRATION OF GENES FROM WEST SIBERIAN BEAVERS *CASTOR FIBER POHLEI* INTO AUSTRIA

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It has been 165 years since the publication of the *Manifesto of the Communist Party* by Karl Marx and Frederick Engels. Our use of part of the epigraph from this work is appropriate since recent genetic analysis from Vienna has documented a genetic "spectre" within the current Lower Austrian beaver population. This "spectre" is a haplotype typical in the West Siberian intraspecific lineage of *Castor fiber pohlei* (see article by Kropf, Holzler, & Parz-Gollner. 2013. in: Šumarski List, Zagreb, 11–12: 591–596). The question of how this haplotype of *C.f.pohlei* exists in the Austrian population more than 3,300 km to the west from the native home range remains unanswered. We are attempting to clarify this situation by examining the mtDNA, which is inherited from the maternal line. The beavers from Konda River who were members of the subspecies *Castor fiber pohlei* Serebrennikov 1929, were brought west from the Ural Mountains twice. The first in 1958 (one female kit) and the second in 1980 (six animals). Both times the animals were brought to the Voronezh Nature Reserve (nursery). Voronezh did not relocate the "Pure" aboriginal West Siberian beavers. Animals from the second (1980) group and their offspring all were lost in 1990-1991. One female kit (No 790), which Dr. Leonid Lavrov brought to Voronezh on September, 4nd, 1958 lived on the farm nine years. The first two years she lived in one enclosure with a North American male and no reproduction occurred. After that she was kept with a black male, *C. f. osteuropaeus* No 9/60, and they had seven kits between 1963 and 1967. She died in December 1969. The prepared specimen of female No 790 is now presented in the Voronezh Reserve museum. The "Siberian genetic trace" in Austrian beavers could come only from descendants of female 790. The best candidate is her daughter born in 1964 (No 11/64). This animal in a group of four pairs was sent on October, 13th, 1965 to Moscow for "opposite" export. At the end of the summer of 1965 the Voronezh nursery received three *C . canadensis* from Denmark and it is possible the eight beavers from Voronezh (including No 11/64) were sent there. Also, it is not known where two groups of wild East European beavers that were sent to Moscow in September 1967 and 1972 ended up since the archives of Enterprise "ZooOb'edinenie" were lost during the time of Perestroyka.

Keywords: *Castor fiber pohlei*, West Siberia, Austria, translocations

NEW DATA IN SEXUAL BEHAVIOR AND REPRODUCTION IN BEAVERS

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Observations were conducted from 2009 to 2015 with circus beavers. All previous observations were carried out on beaver farms in the USA, SU (Voronezh), Poland (Popielno), research institutions (e.g. Marin 1954; Krueger 1964), and zoos. The circus animals have been raised and trained from one month of age up to puberty in close contact with people. The animals were kept in cages in pairs (male and female), but had daily and repeated contact with all other members of the troupe while swimming in the pool and walking or training in the arena.

The first attempts of coitus were registered at an age of approximately 30 months and occurred from December, 25th until April. According to the circadian cycle of the animals readiness for pairing occurred in the evening. However, males (and some females) sometimes showed interest in individuals of the opposite sex and showed signs of a readiness for coitus during morning walks to the arena. It is interesting that males in a group showed interest in females living with another male, and this occurred often. Some days before readiness for pairing the females became more aggressive towards males. Females generally have a good appetite and they did not allow the males access to food and did not gorge on food themselves. On the day of mating a female is especially active and some of them make a full program in their cage. In a stage of full readiness for mating the female would enter the basin and begin to make a deep sound similar to a whistle, but much more rasping and long. Beavers would copulate 2-5 times, each copulation lasting 30 to 40 seconds.

Some anatomical features:

Males. While floating the raised erect penis is at an angle 45° to the tail. The erect penis of the two-year old beaver is 12 cm in length and 1.5 cm in diameter. The distal part (half) of the penis is covered by a rough epithelium. It possible this has a functional value during copulation.

Females. During estrus, which repeats every 12 days if no fertilization occurs, the vaginal epithelium forms a mucous lining called a "vaginal slick". Its shape exactly models the "architecture" of the vagina and the distal part of both horns of a uterus. The size of the vaginal slick is 10.5 cm. After coitus the vaginal slick is filled with ejaculate and the so-called "vaginal stopper" is formed. The vaginal slick and stopper are disappear within 1 to 2 days. The morphology of this formation allows to us to suggest that after a successful copulation it serves to block fertilization by other males. In our opinion, it does not serve as a reserve of semen as suggested by Ottow (1955), but protects against multiple paternity.

Keywords: Eurasian beaver, behavior in oestrus, vaginal slick, vaginal stopper, penis

ROLE OF BEAVERS IN THE NATURAL COMPLEX OF PINEZHSKY RESERVE

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Population of beavers (*Castor fiber)* existing on the territory of the Pinezhsky Reserve have developed from migrants coming from neighboring regions. In this study data collected by the reserve team for last 37 years was used. The first beavers appeared in the reserve in 1977. Possibly they came here from the west on inflows and have lodged on the Sotka River. The young animals left for reserve borders. Appreciable influence on the reserve complex was not marked at this time, and there were no marked attacks by predators on beavers.

During the second period (1997-2004) lakes and streams were occupied that were connected with the river Pinega. Dams were built for the first time. Activity of beavers is brightly expressed - on a place of the left colony there is a replacement spruce station on meadow and shrubby station.

The beaver's temporary holes, which were dug up by a bear, repeatedly meet. Beavers may also be pursued by lynx and wolverine. Sign of these predators have been found in colony territory, where the remains of a young beaver have also been found.

During the third period (2005-2014) begins settling of streams and lakes not connected with the Sotka and Pinega rivers. A colony of beavers existed for a short time, in comparison with the second period. Beavers were pursued by a bear and a camera trap repeatedly documented a wolverine and a lynx visiting the beaver settlement during winter time. The population dynamics of beavers in reserve in various stages of development are represented in the table.

Place/period	I period	II period	III period
Sotka River	2 settlements	2 settlements	4 settlements
Inflows of a Pinega River	no	2 settlements	2 settlements
Inland waterways	no	no	2 settlements
Total, ind.	8-10	16-20	24-32

Building of dams and flooding of coastal sites of lakes and bottomland of streams leads to desiccation birches and spruces, and after some time to loss of all dried up trees. It, in turn, entails change of the former floodplain complexes basically consisting from a fir-tree and only partially from a birch, on new complexes from a birch and a willow that does by their more suitable for dwelling of following generations of beavers. It is possible to assume that having mastered all a little suitable places, beavers will be compelled to leave to search for new sites of dwelling or to continue to live on old places small families that will lead to inevitable falling of number. After some time, forage conditions on the abandoned settlements will improve and there will be repeated colonization of these sites and the beaver population in the reserve will grow.

Keywords: beaver, moving, predators, population dynamics

AN ADAPTIVE NATIONAL BEAVER MANAGEMENT PLAN – 16 YEARS AFTER REINTRODUCTION

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Beavers were reintroduced in Denmark in 1999 after an intense debate. Eighteen beavers from the upper Elbe population were released in Flynder Å – in the western part of Jutland. The aims of the programme were to increase biodiversity and community dynamics by reintroducing an ecological keystone species, create a viable beaver population in Denmark and to fulfill the Bern Convention of 1986. The beaver reintroduction was carried out by The Danish Nature Agency (DNA), and the beavers were released on state owned land. The monitoring was supervised by the National Environmental Research Institute (NERI). No compensations for beaver damages were given, but DNA was obliged to solve problems for private land owners. For example by fencing trees to prevent beaver damage and regulate beaver dams to prevent flooding.

NERI carried out surveys in 1999 just before the release. These surveys were repeated over varying intervals. Focus was on the development of the beaver population, done by annual "beaver counts", with 80 volunteers monitoring the beaver sites over 2 days. Observations were supplemented by NERI and DNA staff observations and mapping of territories, dams and lodges. The total number of beavers was 213 according to the beaver count in spring 2015. Furthermore surveys of vegetation (both aquatic and terrestrial), breeding birds, hydrology, dead wood (in dams, submerged and on the ground), insects (terrestrial and aquatic), amphibians, bats, fish, otters and "passability" of beaver dams (for salmonids) were carried out at least twice since the release. According to these measures, biodiversity increased for almost all groups – especially for dead wood, insects, amphibians and bats. The public interest in the project has been huge. From 1999 to 2014 DNA staff have arranged 930 guided tours with approximately 30,000 participants. Beaver damages have increased concurrently with the beaver population. In 2014, DNA staff spent approximately 1600 hours working with local landowners having problems with beavers, primarily issues associated with flooding.

In 2015/2016 the existing beaver management plan is going to be revised. The new plan is going to address a number of issues including target population level, geographic dispersal, compensation/subsidies, culling/removal of animals, water regulation of streams, public information, level of monitoring and when the beaver population can be considered viable. The intention is to make an adaptive management plan, involving all the main shareholders including government agencies, municipalities, landowners, environmentalists, anglers, hunters and ornithologists. The reason to make the plan adaptive is that goals, instruments and effects are uncertain – and furthermore likely to change over time.

Keywords: Adaptive management planning, beaver monitoring, ecological effects

KNOWING ME, KNOWING YOU; THE POTENTIAL FOR LONG-TERM INDIVIDUAL RECOGNITION IN THE EURASIAN BEAVER

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The social life of mammals depends strongly on chemical signals because they reveal detailed information about the sender including sex, age, social status, physical and reproductive condition, and individuality. Although an individual's scent will be subject to changes throughout life, allowing individual recognition over time is beneficial, especially when individuals have complex social interactions or are likely to meet on several occasions. The existence of individual-specific odours has been established in a wide variety of mammals. However, long-term studies of mammals are rare, and few studies have investigated how individuals' chemical profiles remain recognizable over a period of many years. In this study we used gas chromatography – mass spectrometry to investigate the chemical profile of anal gland secretion (AGS) samples from Eurasian beavers (*Castor fiber*) collected between 1997 and 2009. We hypothesised that the AGS profiles would provide multiple messages without losing the individual-specific profile. The AGS profile of each individual did change over time, but scent profiles from same individuals were still significantly more similar to each other than to scent profiles from different individuals. Thus, our results indicate that the AGS of the Eurasian beaver carries the potential for long-term individual recognition.

Keywords: Eurasian beaver, individuality, olfaction, recognition

PORTABLE VIDEOCAMERAS USED TO STUDY BEAVERS – FIRST EXPERIENCES FROM SOUTHERN SIBERIA

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Photo and video devices have significantly expanded the possibilities for investigating the behavior of beavers. I used the portable camera AquaSpy 15 Plus DVR to study life in the beaver lodges during June-September 2014.
A technical characteristic of apparatus allows to use it in a humid environment and in low light conditions. In the reserve "Kuznetsky Alatau" (southern Siberia) we examined 19 beaver settlements. The cameras were placed in the lodge through a hole made in the dome. Eighty-two trap-hours of data were collected. In all cases the beaver lodges are empty. We conclude from this that the beaver lodges are only temporary dwellings and beavers use them in this region of Siberia only during spring floods. Burrows were unavailable for the survey in this way because of difficulty in camera placement. Despite the these first negative results we believe that this apparatus can be used in studying the reproduction of beavers, as well as to assess the frequency of use of beaver lodges and burrows by other mammals.

Keywords: beaver lodges, video control, Siberia

LAND COVER CHARACTERISTICS OF BEAVER SITES IN LITHUANIA

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We have analyzed structure and diversity of land cover types in beaver sites located in a hilly landscape of eastern Lithuania. Majority of beaver sites are established in wetlands of various sizes. Many of these wetlands were created and maintained by beavers. Initially, beavers usually dammed various small streams and later transformations have led to the formation of wetlands. Maximum longevity of the beaver shaped wetlands is more than 40 years and the majority of them are still actively used by beavers. Occupancy of these wetlands by beavers is not permanent, with active use interchanging with short periods (3-5yrs.) of abandonment. Size of beaver wetlands varied from 0.4 to 9 ha with mean value of 2.2 ha. Seven types of land cover were distinguished in beaver wetlands: 1) sedge cover, 2) shrub cover, 3) reed and bulrush beds, 4) swampy forest, 5) snag stands, 6) horsetail beds, 7) *Sphagnum* spp. carpets. Sedge cover was found to prevail over the rest of coverage types. Size of beaver wetlands, their longevity and position in landscape ecosystem are analyzed among the factors influencing the land cover structure and its dynamics.

Keywords: *Castor fiber*, beaver wetlands, land cover types, structure, dynamics

RESTORATION WEST SIBERIAN BEAVERS (*CASTOR FIBER POHLEI* SEREBRENNIKOV, 1929)

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The conservation activities employed by the Verkhne-Kondinsky Reserve in the basin of the upper reaches of the Konda River between 1979 and 2013 allowed the number of West Siberian beavers to increase from 171 to 510 individuals (Table 1). In the basin of the Malaya Sosva River a marked increase in the number of beavers started in 2006, after the release of 24 individuals caught in the reserve on the tributaries of the river and the expansion of the reserve. As a result, the total population of West Siberian beavers on the Malaya Sosva River was gradually restored to the 1970 level and in 2013 was 99 individuals. The total number of beavers in 2013 in the basins of the upper reaches of the Konda River, the upper and middle reaches of the Malaya Sosva and Tapsui rivers was approximately 624 beavers.

Table: Dynamics of the number of beavers in the reserve «Verkhne-Kondinsky», reserve "Malaya Sosva" and surrounding areas

Locality	Year, the number of beavers						
	1979	1989	1999	2005	2009	2011	2013
Konda River basin: reserve "Verkhne-Kondinsky" and adjacent territory	171	261	300	327	348	384	510
Malaya Sosva River basin: reserve "Malaya Sosva" with the surrounding area	3	10	12	27	28	39	99
Tapsui River basin				9	15	15	15
Total	174	271	312	363	391	438	624

Further development of the autochthonous West Siberian beaver population is possible only in the north of the Konda-Sosva area because to the south, in Kondinsky area on the right tributary of the middle reaches of the Konda river, a large population of beavers, immigrants of European origin (Vasin & Saveljev, 2013) was established. These immigrant beavers pose a real threat to indigenous genetic population of beavers. The most rational way to encourage the development of the West Siberian population is the creation of subsidiary populations in the north of Western Siberia in the specially protected areas, primarily in the Verkhne-Tazovskiy reserve. Reacclimatization of the West Siberian beaver is one of the main tasks of the reserve.

Keywords: West Siberian beaver, population, Konda River, Malaya Sosva River

BEAVER FAMILY SIZE – ARE THERE ANY GEOGRAPHIC VARIATIONS?

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Latitudinal effects on biodiversity and biomass are well documented. However, little is known about the possible role of latitudinal effects on the social organization of group of living animals. The goal of our paper is to review beaver family sizes for both beaver species (Eurasian beaver *Castor fiber*, and for North American beaver *C. canadensis*). First, using published papers and graduate theses we extracted the mean family sizes of world populations. Second, we examined environmental factors of each analysed population (geographic position, habitat description, level of population development, climate characteristics, and others). Our aim was to identify whether the beaver family size varied geographically, and if so which factors influenced the variation. Three established GLM models (Climate, Habitat and Exploitation) revealed that the latitudinal effect was the most important cause of varying beaver family size, with the family size declining from in populations from south to north. We found a significant effect for the North American beaver, but only a raw trend for the Eurasian beaver. Thus, our results indicate that beaver families in temperate regions are larger and decrease in populations living at higher latitudes. Second, we focused on identifying the of causes of variability and analysed only the North American populations. When we reduced family size numbers to three basic age classes (juveniles, subadults and adults), we did not find any geographical variations. However, we could not find a sufficient number of studies from the Canadian and Alaska territories. We conclude that the beaver family size increases towards the more southerly latitudes (of the NS beaver range) and on a broad scale that the effect might be explained by the well-known latitudinal increase of ecosystem productivity.

Keywords: beaver, latitudinal effect, abundance, geographical variations

POPULATION DYNAMICS OF BEAVER IN BELARUS AND ITS DETERMINING FACTORS

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The current population (as of 2013) of beaver in Belarus, is estimated at 62,043 individuals. This does not include the number of species in reserves. This is down from a maximum estimate in 2009 of 65,044 individuals. A decrease in beaver nuymber has been documented since 2010 and the average bagging for the last five years is 10.5% of the population.

Estrous begins in December – early January, and the birth of young in March-April. Settling dispersing juveniles begins in mid-April. The average weight of adult beaver is 31.2 kg, with a maximum of 35.7 kg. Fertility, calculated by the number of spots on the placenta of 1 calving female, is 2.7.

As a result of the usage of trapping (averaged data from two study areas) in exploited populations the age structure in 2014 was: yearlings, 16.7%, 2 year-olds, 12.4%, 3 year-olds, 18.6%; 4 years and older, 52.3%. Results of trapping from unexploited populations were: yearlings, 8.5%, 2 year-olds, 8.5%, 3 year-old, 37%, 4 years and older, 42%.

In 2014, a number of factors adversely affected the size of beaver populations. In some regions of Belarus the year was quite dry, with low precipitation. This led to a decrease of the water level in small streams. In some areas the water level decrease was 40-60 cm. The most affected villages are located on the land reclamation systems. Some streams have dried up completely. Drought led to the migration of young individuals from settlements formed on the streams in 2014. In some regions, the loss of such settlements was as high as 57%.

A significant decrease in the quantity of wild boar in the last two years has led to a shift by wolf and lynxfrom boar to beaver. In spring, more than 87% of all analyzed scats contained the remains of beaver.

Keywords: beaver, population structure, population dynamics, Belarus

CURRENT STATUS OF THE BEAVER FUR MARKET IN RUSSIA

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Estimating the amount of beaver trapping using official statistics that are based on license records leads to false conclusions. The information received directly from companies purchasing and processing fur in the Kirov region produces different results. From 2000 – 2013, official statistics show an average of 1337 beavers trapped during a hunting season, while companies in Kirov purchased 4320 pelts. Experts state that up to 7000 beavers were trapped on the average during each season. In certain seasons the maximum beaver game bag in the Kirov region exceeded the officially declared statistical level for the whole country. Over this 13-year period the beaver population increased from 28,000 to 40,000 despite of average annual take of up to 20% of population. Maximum price of a beaver pelt increased to 1500 rubles (USD 30.0) during this period. In the last decade the motivation for beaver trapping changed. In the past the animals were taken first for the pelt, but today meat and castoreum have become important, and the cost of the these can exceed the pelt price. Additionally, the beaver safari has become popular in some federal districts of Russia. Given this, the total beaver take in Russia, according to the best estimation, exceeds 100,000 individuals. Take monitoring for beaver as well as for some other valuable wild animal species, should be conducted with use of the methods different from what are used currently, and this concerns both the Kirov region and all of Russia.

Keywords: beaver trapping, methods of monitoring, statistics

BEAVERS (*CASTOR FIBER*) IN THE RDEYSKY RESERVE (NW RUSSIA): RESULTS OF 10-YEAR MONITORING

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The Polisto-Lovat' bog system (PLBS) is a complex bog system, the largest and most ancient in northwest Russia. The Rdeysky Reserve (36 900 ha) was established in 1994 for the preservation of the natural complexes of the PLBS. Since 2003 the monitoring of beaver population in the reserve has been conducted. The study area of 1200км^2 includes the reserve territory, its buffer zone and the adjacent territories. The monitoring was carried out annually in the reserve, while in other territories with a smaller regularity. From 2003 to 2014 a total of 148 settlements were documented. Distribution of beaver settlements on different types of water bodies was : lakes 11, small rivers 70, drainage canals 46, bog water-currents 21. The majority of settlements are located in a strip 1-3 km wide on the bog edges. Nineteen inhabited colonies were in the reserve in 2004, 29 in 2005 and 2006, 30 in 2007, 28 in 2008, 36 in 2009, 34 in 2010, 33 in 2011, 37 in 2012, 43 in 2013, and 37 in 2014. The average duration of habitation was 5.44 ± 0.42 years (n=95). In 21 settlements the beavers lived continuously for 10 or more years. The average duration of a site was vacant was 3.70 ± 0.46 year (n=46).

The beaver population density is rather stable. The intercolonial distance was 1483 ± 762 m (± SD, n=55) in 2007 and in 2011 it was 1511 ± 938 (± SD, n=62). About 30% of the settlements were large, consisting of 6-8 beavers. In 89% of settlements beavers lived in lodges while 11% lived in burrows. Dams are observed in 85% of settlements. The average length of a dam is 23.4 ± 6.4 m (n=257). The longest dams and largest ponds were found on the borders between bogs and mineral soils. The length of beaver channels in one settlement was 1400 m, and the volume of excavated ground was 243 m^3.

Thus, 10-year monitoring showed that the beaver population in the study area was stable with a relatively high population density.

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Keywords: Eurasian beaver, beaver number, monitoring, protected natural territories

BEAVERS (*CASTOR FIBER*) OF MORDOVSKIY RESERVE (MORDOVIA REPUBLIC, THE CENTRAL EUROPEAN RUSSIA): POPULATION HISTORY, MODERN STATE AND THEIR FURTHER PROSPECTS

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The analysis of long-term population and colony dynamics of Eurasian beaver (*Castor fiber*) in the Pushta River basin and flood-plain lakes of the Moksha River in the Mordovskiy Nature Reserve from 1940–2013 are presented. In the Mordovskiy Reserve, the beaver population was established from 1936–1940 after reintroduction of 34 beavers from the Voronezh Nature Reserve. Seventy-three years after reintroduction, the total number and the number of the colonies have stabilized at 65-96 individuals and 20-29 colonies. We carried out complex analysis of the reserve nature conditions, climate, hydrologic network, beaver predator and disease influences, spatial distribution of colonies, beaver building and foraging activity and food resources. These data along with modelling by classical models of population dynamics (Malthus, Biverton-Hault and Ricker) and of time-series analysis allows us to suggest that the population is at a climax stage with minor fluctuations. Long-term fluctuations of the beaver number at a low level are caused by intensive removal of the aspen and birch from riparian forests as a result of beaver foraging, and by the development of black alder (*Alnus glutinosa*) stands in the beaver habitats. The future beaver population dynamics in the Mordovskiy Reserve will depend on both functional (rates of food resources restoration in abandoned ecotopes, scales and rates of black alder forest development in abandoned beaver settlements) and occasional (especially cold winters, winter floods and summer droughts) factors.
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Keywords: Eurasian beaver, reintroduction, beaver number, settlement number, mathematical and hypothetical model, forecast.

COMPARATIVE CRANIOMETRY OF THE YOUNG EURASIAN BEAVER (*CASTOR FIBER*) FROM THE MEDIEVAL NOVGOROD THE GREAT – A CASE STUDY

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The aim of this study was to investigate the unique find from the medieval Novgorod the Great – an almost complete skull of the young Eurasian beaver (*Castor fiber* L.). The Novgorod beaver has a large skull, which was equal to the skulls of the largest representatives of the modern autochthonous and reintroduced Eurasian populations of beaver of the same age. It even exceeded them in some measurements. Although it is difficult on the basis of the scarce sample to draw far-reaching conclusion, it is nevertheless interesting to suggest, that the basin of the River Volkhov had once been populated by the race of the large beavers, larger than many beavers, recently reintroduced in this region. Some beavers from the upper reaches of Don, Volga and Middle Oka, descending from animals from the autochthonous Voronezh population, approach to the Novgorod beaver. These animals belong to the subspecies *Castor fiber orientoeuropaeus* (Lavrov, 1981). Some measurements of the Novgorod beaver skull match the largest examples of the autochthonous or reintroduced representatives of *C. f. belorussicus* (Lavrov, 1981). Further studies are necessary to accept or discharge of the proposed hypothesis.

Keywords: beaver, skull, craniometry, race, subspecies, medieval Novgorod

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