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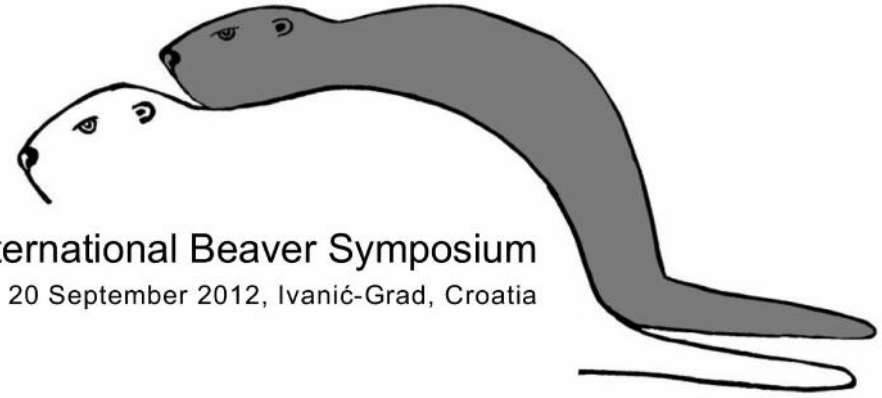

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6th International Beaver Symposium

Sunday, 16.sep.2012

14 ^{00} – 20 ^{00}	Registration, Accommodation, Information, Welcoming drink

Monday, 17.sep.2012

8 ^{00} – 10 ^{00}	Registration
10 ^{00} – 11 ^{30}	Opening of the 6th International Beaver Symposium
11 ^{30} – 12 ^{00}	**Plenary:** Grubešić, M., Margaletić, J., Bjedov, L., Tomljanović, K., Vucelja, M. "Beaver in Croatia" - 20 Years Later
12 ^{00} – 13 ^{30}	Lunch break
Biology	
13 ^{30} – 14 ^{00}	**Plenary:** Busher, P., E. What Goes in a Larder? Using Woody Species Selection and Food Caching to Better Understand Beaver Behavioral Ecology
14 ^{00} – 14 ^{20}	Patricia M. Graf, Wilson, R., P., Sanchez, L., G., C., Hackländer, K., Rosell, F. Diving Behaviour of the Eurasian Beaver (*Castor fiber*)
14 ^{20} – 14 ^{40}	Danilov, P., I., Fyodorov, F.,V. A Comparison of the Engineering Activities of the Canadian and the European Beaver
14 ^{40} – 15 ^{00}	Giżejewska, A., Spodniewska, A., Barski, D. Selected Toxic Metals in the European Beaver (*Castor fiber*) Tissues in North-eastern Poland
15 ^{00} – 15 ^{20}	Coffee break
15 ^{20} – 15 ^{40}	Bērziņa, Z., Gackis, M., Deksne G. Endoparasites Fauna of the Eurasian Beaver (*Castor fiber*) in Latvia
15 ^{40} – 16 ^{00}	Romashov, B.,V. Formation Laws of Helminth Fauna and Helminths Communities of Beavers (gen. *Castor*)
17 ^{00} – 17 ^{20}	Belova, O. Beaver (*Castor fiber* L.) Social Communities as Indicator of the Local Species State: Forest Natural Disturbance or Contributor
17 ^{20} – 17 ^{40}	Korablev, N.,P., Korablev, P.,N. General look on Translocations: Patterns of Morphological Variability in Reintroduced Populations of *Castor fiber*
17 ^{40} – 18 ^{00}	Petrosyan V.G., Golubkov, V.,V., Goryainova, Z., I., Zavyalov, N., A., Albov, S., A., Khlyap, L., A., Dgebudze, Y., Y. Modeling of Eurasian Beavers (*Castor fiber* L.) Population Dynamics in Tadenka River Basin (Prioksko-Terrasnyi Nature Biosphere Reserve)
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$9^{30} – 9^{50}$	Parker, H., Nummi, P., Hartman, G., Rosell, F. Should (and can!) the Invasive North American Beaver *Castor canadensis* be Eradicated from Eurasia?
$9^{50} – 10^{10}$	Schley, L., Dalbeck, L., Denné, R., Manet, B., Schwoerer, M.-L., Venske, S., Herr, J. Management and Eradication of the North American Beaver *Castor canadensis* in Western Europe
$10^{10} – 10^{30}$	Gizejewski, Z., Raczek-Zakrzewski, M. Farm Breeding of European Beaver (*Castor fiber* L.) in the Research Station of the Polish Academy of Sciences at Popielno
$10^{30} – 10^{50}$	Coffee break
$10^{50} – 11^{10}$	Angst, C. The new Water Protection Act in Switzerland: a Chance for the Beaver and a Model for Europe?
$11^{10} – 11^{30}$	Somođi, I. Monitoring and Maintaining Beaver Populations on Hydropower System of North Croatia
$11^{30} – 11^{50}$	Gackis, M., Bērziņa, Z. Beaver Hunting Success Using Whole Family Hunt-out Method
$11^{50} – 12^{10}$	Swinnen, K. The Pros and Cons in the Use of Camera Traps to Study a Spreading Beaver Population in Flanders (Belgium). A Practical Guide and Results
$12^{10} – 13^{30}$	Lunch break
Biodiversity	
$13^{30} – 14^{00}$	**Plenary:** Hood, G.A. Biodiversity and Ecosystem Restoration: Beavers Bring Back Balance to an Unsteady World
$14^{00} – 14^{20}$	Ulevičius, A., Samas, A., Skyrienė,G. Beaver and Alien Mammals: Could Invaders be Promoted by Impacts of Ecosystem Engineer?
$14^{20} – 14^{40}$	Bashinskiy, I., V. The Main Factors of Beaver's Impact on Amphibians in Small River Valleys
$14^{40} – 15^{00}$	Redin, A., Sjöberg, G. Effects of Beaver Dams on Invertebrate Drift in Forest Streams
$15^{00} – 15^{20}$	Coffee break
$15^{20} – 15^{40}$	Meßlinger, U. Beavers Boosting Biodiversity - Monitoring Some Animal World in North-Bavarian Beaver Sites
$15^{40} – 16^{00}$	Samas, A., Ulevičius, A. Significance of Beaver Built Structures for Small Mammals
$16^{00} – 16^{20}$	Hood, G., A., Larson, D., G. Beavers and Bugs, Channelling Biodiversity in Boreal Canada
$16^{20} – 16^{40}$	Law, A., Willby, N., J., Gilvear, D., J. Effects of Foraging by Beaver (*Castor fiber* L.) on Aquatic Vegetation in

	Scotland
$16^{40} – 17^{00}$	Coffee break
$17^{00} – 17^{20}$	Obidziński, A., Orczewska, A., Cieloszczyk, P. The Composition and Ecological Character of Flora on Beaver Lodges as a Manifestation of Beaver Habitat Engineering
$17^{20} – 17^{40}$	Chalova I., Krylov, A., Shevchenko, N., Lavrov, V. The Effect of Concentration of Beavers' Vital Activity Products on Cladocera Fertility in Laboratory Experiments.
$17^{40} – 18^{00}$	Westbrook, C., J., Whitfield, C., J., Baulch, H., M. Beaver Pond Contribution to Increased Global Atmospheric Methane
19^{00}	Dinner

Wednesday, 19.sep.2012

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$9^{00} – 9^{30}$	**Plenary:** Munclinger¸ P Microsatellites and Mitochondrial DNA Provide new Insight Into the Origin and Evolution of Eurasian Beaver Populations
$9^{30} – 9^{50}$	Jones, S.**,** Campbell-Palmer, R., Gow, D., Lloyd-Jones, A. The Battle for Britain: Beavers in the U.K.
$9^{50} – 10^{10}$	Campbell-Palmer, R., Jones, S., Needham, R. Scottish Beaver Trial...The Story so Far...
$10^{10} – 10^{30}$	Ramsay, P., Ramsay, L. The Curious Tale of the Beavers of the River Tay in Scotland
$10^{30} – 10^{50}$	Coffee break
$10^{50} – 11^{10}$	Halley, D., Teurlings, I. Distribution and Patterns of Spread of Recolonising Eurasian Beavers in Fragmented Habitat, Agdenes Peninsula, Norway
$11^{10} – 11^{30}$	Gozdziewski, J., Gizejewski, Z. Current Status of the European Beaver Population in Poland
$11^{30} – 11^{50}$	Saveljev A., P., Bochkov, A., V. Could Parasitic Mites Help to Clarify the Eurasian beaver Phylogeography?
$12^{50} – 13^{30}$	Lunch break
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$13^{30} – 13^{50}$	Kunovac, S., Trbojević, I. Beaver Distribution in Bosnia and Herzegovina Seven Years After Reintroduction
$13^{50} – 14^{10}$	Deberšek, B. Beaver (Castor fiber) Territories in Koroška region, Slovenia
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$14^{10} – 14^{30}$	Frosch, C., Kraus, R., Nowak, C. The Good, The Bad, and The Ragbag -Differential Genetic Consequences of Beaver Reintroduction Strategies in Germany
$14^{30} – 14^{50}$	Coles, B. Finding Beavers in the Past: an Archaeological View
$14^{50} – 15^{10}$	Coffee break
$15^{10} – 15^{30}$	Robstad, C., A., Graf, P., M., Rosell, F. Instrumentations of Wild Eurasian Beavers (*Castor fiber*)

$15^{30} – 15^{50}$	Goryainova, Z., I., Petrosyan, V., G., Zavyalov, N., A. GIS and Remote Sensing Data for Evaluation of the Eurasian Beaver (*Castor fiber*) Activity in Russian Natural Protected Areas
$15^{50} – 17^{30}$	Poster session
20^{00}	Congress Dinner at **Hotel SPORT**

Thursday, 20.sep.2012

8^{00}	Excursion to NP „Plitvička jezera” (Plitvice Lakes)
11^{00}	Arrival at NP “Plitvička jezera” (Plitvice Lakes)
$11^{00} – 15^{00}$	Tour with Guide
15^{30}	Departure
$16^{00} – 18^{00}$	Lunch in Authentic Restaurant
20^{30}	Arrival to Ivanić-Grad

"Beaver in Croatia" - 20 Years later

Grubešić, M.[1], Margaletić, J.[1], Bjedov, L.[1], Tomljanović, K.[1], Vucelja, M.[1]

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The "Beaver in Croatia" conceptual and descriptive started at 1992. The basis for the idea and following project was the experience gained in 1990/91 in beaver research as part of project "Beaver in Bavaria". The beginnings of the idea about beaver reintroduction in Croatia were the master thesis from Grubešić (1992) and presentation at the symposium on the Brijuni (Grubešić, 1992).
Description of the "Beaver in Croatia" project which officially began its realization was formed in late 1993 in collaboration with WGM's Munich and Faculty of Forestry, Zagreb.
What happened after?
After extensive preparation, the beaver reintroduction in Croatia was performed from 20.04. 1996. – 11.03.1998. and within this period 85 beavers were brought and reintroduced in Croatia. Rapid dispersion and successful reproduction soon made the beaver a resident of most aquatic ecosystem of central Croatia. Beavers also spread to neighbouring countries: Hungary, Slovenia, Austria and Bosnia and Herzegovina. However, a beaver population in Croatia originated from 1-2 family which probably came from Baja area in southern Hungary, where beavers were also reintroduced in 1996.

Beaver population status in Croatia is satisfactory; most suitable habitats are inhabited by beavers with available space for expansion in eastern Croatian. According to the results of continuous monitoring there are circa 400 families inhabiting Croatia (in late 2011.).
Beavers are well accepted by society and have significant media attention, but in some areas where they caused habitat destruction (mainly streams) and already filled their habitat capacity. In such areas they started to inhabit unsuitable and undesirable locations which of certainly leads to problems caused by beavers. So far up the arising problems were: damage to agricultural crops, damage to orchards, damage due to undermining the agricultural areas and problems that arise due to flooding or water-logging of the ground due to dam constructions.
Currently the unresolved question of beaver management in Croatia makes it difficult to address issues of beaver protection as well as managing damage caused by beavers. It is necessary as soon as possible to create a management plan and define ways to resolve further protection measures for beavers and measures to prevent or repair damage they cause. Croatia now has a stable beaver population and they are again a constitutive part of the Croatian fauna.

Keywords: beaver reintroduction, Croatia, monitoring, damage, population

NOTES

What Goes in a Larder? Using Woody Species Selection and Food Caching to Better Understand Beaver Behavioral Ecology

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A wealth of literature exists on beaver (*Castor fiber* and *C. canadensis*) ecology and behavior. Hundreds of journal articles have been and continue to be published on all aspects of beaver behavioral ecology ranging from foraging and construction activities to scent communication and parental investment. Yet, what do we really know about the behavior of these two species and what do we need to know to better understand and live with them? This presentation will discuss beaver foraging as it relates to the selection of woody species and their inclusion in the winter food cache. Specifically, data from a long-term investigation of food caching behavior from a population of the North American beaver in west-central Massachusetts, USA will be used to highlight our current understanding of this evolutionarily critical activity. Food selection and storage are critical in the life history of any species, and this is especially true of beavers. Beavers are choosy, generalist herbivores and energy maximizing central place foragers. There is an inverse correlation between increasing latitude and woody species use, yet across their range they "prefer" a relatively small number of woody species in a specific locality. Across the ranges of both species they cut and store branches of woody species for use during the winter when plant productivity is low and the ponds may freeze limiting movement. Both species are considered larder-hoarders since usually they store branches in one location at the entrance to or near the over-winter lodge or burrow. However, the North American species has been reported to be more active and consistent in this activity than the Eurasian species. The North American beaver has been documented to change forage preferences as the autumn progresses and to increase caching activity in response to decreasing temperatures. This paper reviews our understanding of food caching behavior in light of ecological considerations and evolutionary constraints. Patterns in woody species selection, including less preferred species, the growth and development of food caches and the relation between potential ecological factors are examined. A general pattern of food caching behavior is suggested that enhances beaver evolutionary fitness and connects ecological conditions with beaver activity and behavior. It is hoped that this paper will stimulate further research in all aspects of beaver behavioral ecology, especially food caching behavior, and generate discussion of similarities and differences between the two beaver species.

Keywords: foraging, food caching, behavioral ecology, autumn, larder-hoarder

NOTES

Diving behaviour of the Eurasian beaver (*Castor fiber*)

Graf, P. M.[1,2], Wilson, R. P.[3], Cohen Sanchez, L. G.[3], Hackländer, K.[2] and Rosell, F.[1]

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Air and water differ substantially in physical features such as density, drag and heat conductivity. Semi-aquatic endotherms such as beavers (*Castor* spp.), which spend an appreciable part of their life in water, exhibit different features which allow them to exploit both environments. However, species that have to deal with two media are generally considered to be imperfectly adapted to both. They rely on oxygen to breathe and carry large volumes of air in both the respiratory tract and trapped in their dense pelage, thereby limiting swimming and diving performance. This study examined the diving behaviour of Eurasian beavers (*C. fiber*) by investigating data derived from an animal-attached depth recorder deployed on free-living animals in Norway. Beavers dived to depths of up to 4 m and for periods exceeding 120 seconds although dives were seldom conducted serially in a manner comparable to fully aquatic endotherms. Descent, bottom and ascent duration in dives were all positively correlated with maximum depth reached during the dive. Overall dynamic body acceleration (ODBA) was highest during the descent phase of dives and decreased with increasing dive depth indicating that the animals had appreciable quantities of air associated with them. We suggest that this is primarily contained within the fur and lungs and that the air within the fur acts as an effective insulator against the cold water in which they live. ODBA during the bottom phases of dives decreased with increasing dive depth and was typical of the longer dives. Differences in the dive characteristics were observed according to dive type and inter-gender differences were also noted although the significance was not clear.

Keywords: Acceleration, *Castor fiber*, diving behaviour, Eurasian beaver, overall dynamic body acceleration, ODBA, semi-aquatic

NOTES

A comparison of the engineering activities of the Canadian and the European beaver

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[1]*Institute of Biology, Karelian Research Centre of RAS, Russia*

Surveys were carried out in Karelia and the Karelian Isthmus, Leningrad Region. Beavers have never been introduced there intentionally. However, both species appeared there nearly simultaneously, in the early 1950s – Canadian beaver dispersed from Finland, and European beaver – from the Leningrad and Vologda Regions. Engineering works are the most noticeable and remarkable feature of the ecology of these animals. They comprise all forms of their behaviour, and even elements of rational activity. We first attempted to compare the engineering works of Canadian and European beavers in the 1970s already. The findings pointed to a higher engineering activity of the Canadian beaver. This conclusion however was based on the materials gained from southern parts of Northwest Russia and the Komi Republic for the European beaver, and from Karelia and Karelian Isthmus for the Canadian beaver, i.e. from territories differing in geomorphological and hydrographic characteristics. The materials behind this paper were gathered from identical settings (colonies of the two species were sometimes just 10-15 km apart). Having assessed the expression of the construction instinct of Canadian and European beavers inhabiting natural waterbodies we found no differences between the species. Of the 128 European beaver colonies surveyed 88 (68.8%) had lodges, and 96 (75.5%) had dams. For the Canadian beaver, the proportion of colonies with lodges was 73.1%, with dams – 78.8% (n=52). Thus, engineering activities are not species-specific in beavers, but depend on the habitat. We also investigated the distinctive features of beaver engineering works on man-made waterbodies – drains of the forest (640 000 ha) and agricultural (90 000 ha) drainage networks. In Karelia, arterial forest drains alone have a combined length of 13 500 km, whereas that of natural rivers and streams is 83 000 km. Beavers inhabiting forest and agricultural drains rarely build lodges. Instead, they make burrows in the spoil piles, which rise 0.5 to 1.5 m above the drained ground surface. They are mainly made up of peat, parent soil material, interspersed with stumps of the trees logged for the excavation, and rocks of varying size. The burrows are most often located where the drains cross, and the spoil piles are higher and wider. The water level in the drains is highly variable. While quite full in spring, they would nearly dry out in summer. Hence, beavers have to build dams to raise and maintain the water level there. Beavers in most colonies on drains lived in burrows (89.7%), and 96.6% of the colonies (n=29) had dams.

Keywords: Canadian and European beavers, construction activity, lodge, dam, forest and agricultural drains

NOTES

Selected toxic metals in the European beaver (Castor fiber) tissues in north-eastern Poland

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European beaver (*Castor fiber*) is common in Poland. Currently its population is estimated at c. 50.000 individuals and represents a growing trend. As an herbivore inhabiting both the aquatic and the land environment, the beaver is exposed to heavy metals present in these ecosystems. These elements are readily available, almost non-biodegradable, circulate in the environment. The higher their content in the atmosphere, soil, water and plants, the higher is the risk of their toxic effects on animals and humans as the final link in the food chain. The full integration with the environment and the ability to adapt to it makes the beaver a specific bioindicator. The aim of this study was to determine the concentrations of lead (Pb), cadmium (Cd) and mercury (Hg) in liver, kidneys and muscle tissues of the free-living European beaver. The results obtained were compared with the standards for heavy metals in the mammals tissues recommended by the European Commission. With the Regional Directorate of Environmental Protection consent six European beavers were captured in the autumn 2011 in the north-eastern Poland. The group consisted of three females (one young, two mature) with the body weight of 6.75 kg, 15.94 kg and 16.65 kg and three males (one young, two mature) weighting 8.91 kg, 14.03 kg and 18.07 kg. Samples of liver, kidneys and muscle tissue from the biceps femoris muscle (15 g each) were collected. The quantitative determinations of the analysed metals concentrations were measured by atomic absorption spectrometry (AAS). In all individual samples of liver, kidneys and muscles the presence of analysed toxic metals was found. Their highest average concentrations were recorded in the liver and kidneys, respectively: 0.106 mg/kg and 0.061 mg/kg for Pb, 0.880 mg/kg and 7.933 mg/kg for Cd, 0.0239 mg/kg and 0.0321 mg/kg for Hg. In no sample the levels of Pb and Hg allowed in the European Union were exceeded. Amounts exceeding the norms were determined in liver and kidneys for cadmium only, which concentration increased significantly with the age of the animals. It is assumed that plants accumulating cadmium (e.g. willow) present in the beaver diet may constitute a significant cause of exposure to Cd, even in the area that does not seem to be contaminated. No significant differences in concentrations of the investigated metals in the same tissues between sexes were observed. The average contents of Pb, Cd and Hg in the muscles of free-living beavers were low, thus there is no need to raise the hygienic-toxicological concerns and with regard to nutritive values, beaver meat may be used as consumption tissue.

Keywords: heavy metals, liver, kidney, muscle, European beaver

NOTES

Endoparasites fauna of the Eurasian beaver (*Castor fiber*) in Latvia

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Eurasian beaver population of Latvia territory following the introduction has increased considerably, especially in recent years. Summarizing the literature data, the beaver at internal organs have parasites such as protozoa *Eimeria sprehni*, *Stichorchis subtriquetrus* trematodes, tapeworms *Echinococcus granulosus* cysts and nematode *Trichostrongylus axei*, *Travassosius rufus* and *Trichostrongylus capricola*. Till now data about beaver parasites in Latvia are fragmentary. Beaver population can be influenced by parasites. In hunting seasons of spring and autumn in 2010 and 2011 36 beaver internal organs, 22 intestinal contents and 51 muscle samples were harvested from different territories of Latvia. Eurasian beaver endoparasite fauna identification and characterization of invasion was done using the modified Skrjabin method of full helminthological analyses and also quantitative flotation method (FLOTAC®), fecal re-wash method and *Trichinella* sp. larval detection methods. One species of trematode - *Strichorchis subtriquetrus* was found (86.1%) and two species of nematodes *Travassosius rufus* (80.6%) and *Trichinella britovi* (1.9%). The first report of *T. britovi* larvae in Eurasian beaver in Latvian was done. In Latvia Eurasian beaver endoparasite fauna mostly consists of species-specific parasites. The study found that the Eurasian beaver, although not carnivorous, can be infected with *T. britovi*. A higher *T. rufus* infestation intensity was observed in older animals, while *S. subtriquetrus* infestation intensity was higher in younger animals. Beavers, which where hunted in the autumn season, the quantity of *S. subtriquetrus* eggs found were higher than in the spring season. Host gender, season and hunting region had an insignificant effect on the intensity of endoparasite infestation and prevalence. Overall, the study founded infection prevalence (97.2% CI 85.5 to 99.9, $\alpha = 0.05$) was high and this type of study was performed for the first time in Latvian.

Keywords: endoparasites, Eurasian beaver, Latvia

NOTES

Formation laws of helminth fauna and helminths communities of beavers (gen. *Castor*)

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Ecologic-biological signs of the owner influence formation of helminth fauna and structure of helminths communities. On the other hand each species helminths possess various degree of adaptation in relation to the owner-specificity that defines features of their joint evolution. Real specificity helminths estimate by means of occurrence indicators (an occurrence index) and number (an abundance index). In connection with specificity display two tendencies having an opposite orientation are noted. 1. At high occurrence and abundance helminths uses smaller number of species of owners. 2. At low occurrence and abundance helminths uses a great number of species of owners. Features of formation of modern helminth fauna and helminths communities of beavers (*Castor*) are more low analyses. Taking into account specificity display helminths beavers are divided into three groups: a) the *stenobiotic* species narrowly specific-5 species: 2-trematode (*Stichorchis subtriquetrus, Stephanoproraoides lawi*) and 3-nematode (*Castorstrongylus castoris, Travassosius rufus, T. americanus*), dominants are *S. subtriquetrus, C. castoris, T. rufus, T. americanus*; b) the *eurybiotic* species widely specific-22 species: 8-trematode, 5-cestodes, 9-nematode, helminths parasitize at many species and groups of mammals. Infection of beavers is at high number of these helminths in wetland; c) the *casual* species (facultative, rare)-4 species: 3-trematode, 1-acanthocephales, parasitize mainly at birds, are noted at reptiles. Infection of beavers has casual character. Comparison shows that at *C. fiber* 24 helminths species, at are noted *C. Canadensis*-14 helminths species, the general are 8 helminths species. Formation of helminth fauna and helminths communities of beavers is a difficult multifactorial process which is caused population dynamics of beavers and their variety biocenotics communications. On the basis of the analysis of helminth fauna beavers it is revealed that over 80% of helminths species concern to eurybiotic and to the casual parasites which occurrence mainly to a measure is defined by a variety biocenotics communications and features of mutual relations of beavers with other species of animals. As a part of the big group of ecological factors two leading components-trophic and topical which degree of realization substantially depends on features of course of life cycles helminths are allocated. Analyzing results of original researches, we are inclined to consider that among registered helminths the most pathogenic is nematode *Capillaria hepatica*. In certain conditions it can essentially influence on population dynamics of beavers.

Keywords: helminth fauna, helminths communities, specificity, stenobiotic, eurybiotic, trematode, cestodes, nematode, *Capillaria hepatica*

NOTES

Beaver (*Castor fiber* L.) social communities as indicator of the local species state: forest natural disturbance or contributor

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Beavers are widely recognized as a focal species in forest ecosystem. Otherwise, beaver activity could be the reason of the losses of forestry sector. Forestry encounters with numerous beaver populations and situation demand more human and financial recourses to control the negative impacts of beavers. Present situation of changes in natural and human factor motivate demand of the new studies considering animal social factor and ambivalent or multiple role in the forest ecosystem. The study was performed in the mixed spruce-deciduous forests of the Northwestern Lithuania. The number of the burrows and paths in the beaver sites shows trends in the family size and extend of the impact to vegetation. The number of paths related to the burrow number ($r = 0.30$, $\delta = 7.31$, $p<0.05$) and more weakly linked with the number of felled trees and diameter of stems ($r = 0.21$, $\delta = 3.12$, $p<0.050$). The survival of beaver sites and distribution most depend on the stand stocking, diameter of woody vegetation, undergrowth development and coverage ($r^2 = 0.88$). The increase in the number of beaver pairs and single individuals is the parameter of the potential for new family formation. It also shows a successfulness of the last reproductive year. Regularly, the area of new sites is large than area of formed family. Second year animals determine the territorial dispersal of the local population while are most vulnerable group in the population. It is important to know the social structure of the local beaver population and the main limiting abiotic factors striving to envisage possible impact on forests and open lands. The changes in the population density affect the social structure (increase in the mortality of juveniles, changes in the family composition and the escalation of the relations between families). Considering the role of beaver as natural disturbance in the forest ecosystem, the human factor assumed a natural disturbance (biotic factor) for beaver. As beavers are animals that are unable to recover the increased mortality, it is necessary to consider the present climate anomalies that are not frequent but in the local populations, the negative results occurred eventually.

Keywords: beaver, family, individual, forest, drainage, natural disturbance

NOTES

General look on translocations: patterns of morphological variability in reintroduced populations of *Castor fiber*

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Taking as an example two European beaver subspecies (*Castor fiber orientoeuropaeus* and *Castor fiber belorussicus*) with documented history of population formation, the patterns of morphological variability in translocated groups of mammals are studied. In this study were used 772 skulls of beavers from 9 local populations in frames of Russian Federation and Byelorussia. Distances between samples vary from 100 till 3500 km. We apply two directions of approaches: metric and non-metric characteristics of the skull. The variability of quantitative and qualitative traits in the formed populations is not characterized by a single direction. The main trend consists in increasing of adaptive norms diversity as related to body size. There observed a slight increase in the level of fluctuating asymmetry, reduction in polymorphism of non-metric traits, and increase in fraction of rare aberrations. All these may be caused by inbreeding taking place during the period of prapopulations formation. The results of the study allow for considering the intraspecific differentiation as a consequence of adaptive variability (adaptatiogenesis) or subspecies hybridization. As for stochastic processes (genetic drift, founder effect), they seem to not influence the morphological variability significantly. The differences between non-metric and metric traits are indicative of population groups' peculiarity. Were shown high structures of autochthonous populations. In general on the base of metric and non metric traits they distinguished by 6%. We suggest that this population can be consider as separate subspecies with Latin names *Castor fiber orientoeuropaeus* and *C.f. belorussicus*. If introduced animals do not inbreed with other populations they retain the main features of the maternal subspecies. If introduced populations are formed by mixing subspecies their morphological characters deviate from the source forms. Morphological forms present in populations with different frequencies may have certain adaptive values especially in connection with jaw apparatus and other functional significant structures of cranium. So called *C.f introductus* (A. Saveljev) or *C. f. europaeus* (G. Schwab) is the product of cross composed origin, adaptive changes and stochastic factors. So it cannot be described as separate subspecies with value diagnostically signs.

Keywords: *Castor fiber*, translocations, skulls, morphological variability

NOTES

Modeling of Eurasian beavers (*Castor fiber* L.) population dynamics in Tadenka river basin (Prioksko-Terrasnyi Nature Biosphere Reserve)

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The parametric discrete (in time) model of the beaver population dynamics from the invasion (1948) up to the present day (2011) in the Tadenka river basin is presented. It is shown that the dynamics of the population size tends to a steady state with quasi-periodic component of 14 to 26 years. The population model shows that the periodic component has a sawtooth form, with the number of beavers increasing from minimum to maximum for every 6 years, and reducing from maximum to minimum value for the rest of the period. The oscillation amplitude of the quasi-periodic component is about 6 beavers and has a slight tendency to increase. We assume that the further development of the beaver population will depend on many random events that contribute to the change in the beaver regulatory factors, such as geomorphologic features of the area, recovery rate of feed resources in abandoned habitats, the extent and rate of development of beaver settlements. Stability analysis of stationary solutions and the assessment of model adequacy suggest that the proposed discrete model can be used to quantitatively assess the dynamics of beaver populations on other territories depending on the food resources availability.

Keywords: beaver, population dynamics, food resources

NOTES

Should (and can!) the invasive North American beaver *Castor canadensis* be eradicated from Eurasia?

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Seven North American beavers *Castor canadensis* (*Cc*) were introduced to Finland in 1937 to supplement an ongoing reintroduction of the nearly extinct Eurasian beaver (*C. fiber*) (*Cf*). Many zoologists at that time recognized only one species. However, in 1973 chromosome counts (*Cf* = 48, *Cc* = 40) acknowledged two species, and *Cc* became an invasive alien. Recently, expanding populations of both species have converged on two fronts in Finland and northwest Russia. According to Gause's competitive exclusion principle, two species with identical niches cannot coexist indefinitely. The imminent question is whether coexistence or competitive exclusion will ultimately result, with the possible regional extirpation or eventual extinction of *Cf*. We reviewed published cases of interspecies contact and compared their life history, ecology and behavior. The few published incidences of contact were inconclusive with respect to competitive advantage. Body size is similar, though *Cc* litter size is slightly greater. Only minor differences in life history, ecology and behavior were found to exist, suggesting nearly complete niche overlap. Though competitive exclusion resulting in the extinction of a native mammal by an alien congener at the continental landscape scale has been rare, the process may be difficult to detect due to potential time lags of centuries. Thus there is a distinct risk that *Cc* may eventually competitively exclude *Cf* at all landscape scales. Paradoxically, should this occur, a native species might be lost, though its genetically depauperate replacement would be virtually indistinguishable from the original. Since no country in Eurasia obviously wants an invasion of *Cc*, and as most national conservation laws and international treaties forbid the spread of alien species, we advocate that the precautionary principle be adhered to and an attempt to eradicate *Cc* from Eurasia be seriously considered. Successful eradication is still possible, if the will to do so exists. Here we outline an eradication strategy.

Keywords: alien species, *Castor canadensis*, *Castor fiber*, competition, competitive exclusion, eradication, invasion

NOTES

Management and eradication of the North American beaver *Castor canadensis* in Western Europe

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In 2009 we demonstrated the presence of allochtonous North American beavers *Castor canadensis* in Rhineland-Palatinate (Germany), in Wallonia (Belgium) and in Luxembourg. This led to a major concern over the conservation of the native Eurasian beaver *Castor fiber* in this region of Europe. Following this discovery, we produced recommendations on how to deal with this situation. Thereafter, we carried out a trans-boundary research project which involved further genetic analyses over a large area in order to get a better view on the scale of the problem. North American beavers were also detected in North Rhine-Westphalia (Germany). In all four political units management decisions were taken with a view of eradicating the North American beaver in the greater region. However, the actions taken differed between countries and went from systematic culling to a capture, sterilisation and re-release programme. Here we present the preliminary results of this ongoing conservation action and also highlight potential problems of such trans-boundary management in relation to its outcome.

Keywords: *Castor fiber*, *Castor canadensis*, trans-boundary management, eradication

NOTES

Farm breeding of European beaver (*Castor fiber* L.) in the Research Station of the Polish Academy of Sciences at Popielno

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After the Second World War the beaver has become a rare species in Europe. Therefore, a beaver farm was established in 1958 year at Popielno (NE of Poland, Mazury) as an experimental section of the Polish Academy of Science in order to study biology of beaver and its reintroduction into natural habitat. After several trial and error runs many technical obstacles have been eliminated and a farm comfortable for the animals has been created. One of the factors taken into consideration while establishing the farm was the beaver territorialism. The beaver lodge was constructed in such a way that the animals would have direct access to the water whilst the feeding area between the beavers' families was separated by brick walls. That type of arrangement allows proper feeding of the animals and helps to maintain clean water in the reservoirs without interference into the existence and nocturnal activity of the animals. The farm has 16 sections (beaver lodge + water reservoir + feeding area), one section per one family. The animals are fed with branches of tree leaves, mainly willow, grains, dry bread, grass, Jerusalem artichoke, carrots, beets and occasionally apples). The average dose of grain and grass is 267 g and 417 g per animal per day, respectively. The freshly cut branches of the trees are the source of material for the beavers' lair whereas chewing the branches helps the animals to prevent the excessive growth of the teeth. Farm breeding of the beavers does not require a direct contact with the animals. However, the frequent contact of young beavers with the humans affects their behavior and makes it easier to manipulate them when they are adult and mature. The free living beavers are selective eaters and consume over 200 different plants, however our feeding program is sufficient to maintain a high number of young in a litter. Between 1959 and 2006, 459 young beavers were born, on average 2.8 per pair (4 cases of 6 young beavers). Apart from studying male and female physiology the beaver farm in Popielno plays an important role in the reintroduction of the beaver species in Poland. Since 1974 newborn beavers have been used to create new families that were then introduced into the natural habitat in different parts of Poland in order to increase the total population of beavers (the project-"Active protection of the European beaver"). Our experiences in the areas of feeding, and the maintenance of the animals, technical and behavioral aspects as well as farm management practices might be applicable in commercial beaver farming or and in ZOO environment. Beavers accommodate to farm conditions very easily and may become a source of low cholesterol meat, pelts and fat that has healing properties. Beaver is an animal that can be easily farmed, similarly to e.g. ostrich, red deer and fallow deer.

Keywords: European beaver, *Castor fiber*, farming

NOTES

The new water protection act in Switzerland: a chance for the beaver and a model for Europe?

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After 150 years of absence due to overhunting, 141 beavers have been reintroduced in Switzerland between 1956 and 1977. With almost stagnating numbers in the first decades after the reintroductions the beaver population has grown very rapidly in the last 15 years and the population estimate today is about 2000 individuals. During the beaver's absence, Switzerland has turned into one of the most heavily populated countries in Western Europe with the majority of the population living very densely on the Swiss plateau-the main area where beaver find suitable habitat. In the meantime, man has altered the watercourses dramatically, especially on the Swiss plateau: almost the last marsh has been drained and water bodies have been rectified and squeezed by infrastructure such as roads, buildings or intensively used agricultural areas. More than 50 % of the watercourses are in a heavily altered condition and 42 % don't have enough space to fulfil their ecological and flood control functions. All this lead to a degradation of the water ecosystems in Switzerland and about 10'000 km of watercourses should be restored on the Swiss plateau. The recently published synthesis report of the red lists showed, that water organisms suffer the most of all faunistic and floristic groups, especially the fishes. Due to this situation the Swiss fishery federation started an initiative in 2006 to force the government to restore watercourses on a national level. As the initiative has foreseen only nature conservation measurements, the Swiss government established a counter proposal which included both conservation and utilisation measurements of watercourses (Switzerland produces 55 % of its energy out of hydroelectricity and will extend the production in the future due to the nuclear power phase-out decision). This counter project has lead to a revision of the act of water protection in a democratic process in the parliament. The new act of water protection includes the 5 main points: restoration of 4'000 km of watercourses within the next 80 years, guarantee the space requirements for all watercourses by enlarging riparian strips, restore hydropeaking, hydro load and fish migration in hydroelectric power stations. The most important point for beaver conservation is the larger riparian strips that are contemplated: 5-15 m each side of every watercourse, depending on the width of the water body, which is more or less the foraging distance of the beaver. This sounds great but as always the devil is in the details. Even if the water protection act has been worked out in a democratic process by the Swiss parliament and entered in force in 2011, it is already under high political pressure by different stakeholders under which especially agriculture. Nevertheless the act is forward-looking for the management and restoration of watercourses and it can contribute and foster the coexistence between man and beaver in a densely populated country such as Switzerland. And, furthermore, the act can be a model for western European countries.

Keywords: water protection act, riverine strip, beaver management

NOTES

Monitoring and maintaining beaver populations on hydropower system of North Croatia

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Along the hydropower system on Drava River, which is part of Croatian Electrical Utility, there are habitats of beaver populations. Beaver immigrate upstream the Drava River bed and settle on armband. Area of their movements even includes hydroelectric power plant reservoir, lakes and drainage canals. From the first official observations of their activities next to power plants in 2008., maintain measures of monitoring distribution and habitats, their strength and activities which affect on functioning drainage canals. In aspects of beaver protection, yet hydropower facilities, laying wire on drainage canals and service roads. Monitoring effect will affirm construction justifiability off laying steel wire on the others habitations where is endanger livelihood of beaver.

Keywords: hydropower system, habitation, monitoring, protection, power plant reservoir, drainage canals, wire

NOTES

Beaver hunting success using whole family hunt-out method

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Data collected from authors made field trials in six regions in Latvia using legal hunting methods and in legal terms. Hunting mainly performed by removing the beaver-made dams on drainage system channels and using trained breed hunting dogs, less with Conibear traps or individually approaching using firearms. In total 78 beaver settlements 287 animals hunted (in average 3.67 per settlement). 28% of settlements consisted of 1-2 animals (1.31 per settlement), other of 3 and more (4.60 per settlement). In 59 settlements hunting done using breed hunting dogs (West-Siberian laika)-in 54 days 241 beaver hunted (84% of all and 4.46 beaver per hunting day). In 17 settlements hunting done using 3-4 Conibear traps per settlement-in 41 day 43 beavers hunted (in aver. 1,05 beaver per day). Using fireams hunting done 11 times in 2 settlements, hunted 3 animals. Settlements consisting of 1-2 beavers were located closer (185 m) to accessible roads than bigger ones (338 m) and that could be a result of previous half-successful hunting pressure. 58% of all hunted beavers were males giving female-male relationship 1:1.39. Most of females under age of 2 years got hunted in spring time (01.02.-30.04.). Animals older than 2.5 years were 50.5% af all hunted. Sex-age distribution of all hunted 287 beavers given in table.

Seasonal changes in age-sex structure of hunted beavers

Age groups, years	Hunted beavers (number / % from total)				
	males		females		Total
	autumn	spring	autumn	spring	
> 3,5	26 / 9%	30 / 11%	18 / 6%	17 / 6%	91 / 32%
2,5 - 3,0	14 / 5%	11 / 4%	20 / 7%	9 / 3%	54 / 19%
1,5 - 2,0	19 / 6%	24 / 8%	8 / 3%	17 / 6%	68 / 23%
< 1	31 / 11%	12 / 4%	9 / 3%	22 / 8%	74 / 26%
Total	90 / 31%	77 / 27%	55 / 19%	65 / 23%	287 / 100%

Keywords: *castor fiber*, age–sex structure, beaver hunting

NOTES

The pros and cons in the use of camera traps to study a spreading beaver population in Flanders (Belgium). A practical guide and results.

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After the extinction of the beavers in Flanders (Northern Belgium) in 1848, there were no beavers for over 150 years. In 2000, the first traces of beavers were found on Flemish territory, a consequence of an illegal reintroduction in Wallonia (Southern Belgium) which started in 1998 and lasted until 2001. During this period 101 beavers were released in Wallonia at many different sites. In 2003 the Walloon example was followed in Flanders and 20 beavers from Bavaria were released without knowledge of the authorities. In the mean time, there was also an official reintroduction in the Netherlands province of Limburg, close to the northeastern Belgian border. The beavers were back, but there was no systematic follow-up by the public authorities or a scientific institution. As shown in the Netherlands, camera traps can be useful to monitor beaver populations. The major advantages about camera traps is that they are non-invasive (the animals are not disturbed) and they have a high autonomy. The goals of the camera traps in Flanders are: identify if beavers are (still) present in recently colonized territories, determine how many beavers are active within a territory, determine if there is reproduction and use the footage to determine activity patterns. After a testing period of two months, 12 Bushnell Trophy cams were purchased (Bushnell Outdoor Products, 9200 Cody, Overland Park, Kansas 66214. Model 119436c). These have been in use since January 2012. The settings used for this study are standardized (Video Length: 15 seconds, Video Size: 720x480, Interval: 1 second, Time Stamp: On, Field Scan: Off, Video Sound: On). The first preliminary results (January 2012-August 2012) will be presented. At the moment, only data from the first 3 months is available and processed and is shown to give an idea about the sampling size. The cameras were in the field during 598 trapping days. 2636 separate recordings of animals were done of which 28.5% (n=751) of the recordings captured at least one beaver. In 14% of the cases more than 1 beaver was visible in the recording. These data already show clear patterns in activity that will be presented during the lecture.

Keywords: camera traps, reintroduction, activity patterns, reproduction, population estimation, methods

NOTES

Biodiversity and ecosystem restoration: Beavers bring back balance to an unsteady world

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Many agencies and organizations cite the loss of biodiversity as one of today's most pressing issues. Some studies estimate that global extinction rates are 1,000 times faster than natural rates and that human-caused habitat loss, environmental degradation, over-exploitation and climate change are to blame. What if we could not only slow the loss of biodiversity, but also achieve a net gain in habitat quality and ecological resilience in some areas? Much of the research following successful reintroductions of beavers in North America, Great Britain, Europe and parts of Asia indicates that we can do just that. The positive effects beavers have on everything from water storage to groundwater recharge and drought mitigation reveal a species that can transform environments into biodiversity hotspots. My presentation explores the changing attitudes about beavers over time and how advances in science and management are helping us to include beavers into broader ecological restoration goals. Renowned ecologist E.O. Wilson states in his book the Diversity of Life "We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity". Perhaps allowing beavers to help us in that cause can bring us closer to restoring species diversity and ecosystem health at a crucial time in our ecological history.

Keywords: beavers, biodiversity, ecological restoration, ecosystem health

NOTES

Beaver and alien mammals: could invaders be promoted by impacts of ecosystem engineer?

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Beaver (*Castor fiber* and *C. canadensis*) is widely acknowledged natural disturbance factor of ecosystems. Generally, beaver sites are specific habitats, which have significantly increased quantitatively in a landscape ecosystem during recent decades. Beaver sites usually tightly intersperse with other habitats, thus, making an opportunity to be inhabited or used by species of various ecological groups. The beaver-made disturbances result in massive secondary allogenic successions on the land-water interface zone and predict certain instability of riparian ecosystems, which can be positive for alien species invasion success. Fourteen species of mammals inhabiting ecosystems in Lithuania can be regarded as alien. Alien mammals incorporate five ecological groups of mammals: 1) semi aquatic mammals; 2) sinanthropic mammals; 3) the-medium-sized burrowing predators; 4) browsing and grazing forest and outskirt ungulates; 5) feral domestic carnivores. Among the most successfully acclimatized alien species are listed three species of recent introducents (muskrat *Ondatra zibethicus,* raccoon dog *Nyctereutes procyonoides,* and American mink *Neovison vison*). All three species are regarded as invasive, thus, demonstrating fast increase of abundance, short colonisation time, massive spread into various ecosystems, and significant ecological impact. All these species may benefit from beaver impact. First of all, the beaver-created patches allow invaders to colonise a landscape more evenly. Especially it is true for hydrographical network of Lithuania, which consists of about 80% of drainage ditches, and which is intensively renaturalised by beavers. These circumstances reduce positive public attitude towards beaver impacts, however generally beaver activities should be considered as a rise of ecological carrying capacity at the land-water interface zone. It could result also in buffering of negative impacts of invasive species. Abundance indices of invasive mammals show positive correlations with beaver densities at the riparian zone, however, abundance of invaders may change in time considerably probably showing the higher importance of intrinsic factors in invader populations than that of positive impacts from beaver activities. Importance of particular aspects of beaver impacts that might promote invaders is discussed.

Keywords: Beaver, beaver impacts, alien mammals, invasive mammals, invasion success

NOTES

The main factors of beaver's impact on amphibians in small river valleys

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Our work is aiming to study key factors of beaver's (*Castor fiber*) impact on amphibians. As a semi-aquatic species, amphibians can primarily influenced by the results of beaver activity.
The study was carried out in the valleys of small rivers Gorelka, Kopeynitsa (Novgorod region, NW Russia) and Tadenka (Moscow region) in 2006-2012. Amphibian species which used the rivers for breeding are *Rana temporaria*, *Rana arvalis* and *Bufo bufo*. We described all suitable habitats for amphibians in different parts of the river valleys. We determined area of water-bodies, depth, lighting of habitats, amount of dissolved oxygen, water temperature and pH. During breeding period we counted egg masses of amphibians, during larvae's stage we counted tadpoles (using dipnet), and at the end of metamorphosis we counted metamorphs (using fences with traps). Our studies revealed that the main factors of beaver's impact on amphibians were modifications of lighting and water regime. Such factors as pH and amount of dissolved oxygen in water didn't have a significant effect on amphibians. Loss of trees due to beaver activities increased lighting that made water heating more intense in spring. Thus attractiveness of habitats for amphibian breeding was higher. But lighting also had disadvantages. In May, drying up of shallow waters was intense, so a lot of egg masses died (up to 40% in abandoned beaver ponds). The drying had a significant role in the further metamorphosis. Due to the drying of most water-bodies in river valleys, tadpoles had chances to reach metamorphosis only in large beaver ponds and oxbows. In other habitats we annually observed mass death of larvae. Regulation of river flow by beavers formed a big amount of stagnant water bodies and new shallow waters. Thus, diversity of habitats in the river valleys increased. Previously unsuitable for breeding streams became suitable for amphibians. Also, water regulation reduced the risk of drying. Connections between water bodies in beaver habitats helped tadpoles to choose the best habitat for living. So we observed the maximum number of metamorphs in large beaver ponds-average 16 individuals per catching line compared to 1-2 in habitats without beaver. Beaver activities lead to permanent changes of habitats which can have a different scale. It may be appearance or disappearance of small water-bodies, but sometimes it may be great changes of whole floodplain ecosystem. Thus, usefulness of different parts of valleys for amphibians also changes. Some years, amphibians from one part of river valley have an advantage, but other years an advantage goes to another part of amphibian population.

Keywords: *Castor fiber*, beaver impact, amphibians, small rivers

NOTES

Effects of beaver dams on invertebrate drift in forest streams

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The beavers are well known for their ability to build dams. The dams are mostly built in smaller streams and here more slow-running parts are preferred. The dams are built of beaver-cut sticks and logs tightly meshed together with mud and other debris. The dams help to create a constant water level that makes it easier to transport twigs and branches and is also a protection against predators. The invertebrate community structure is affected by beaver. In beaver ponds, typical running-water taxa may be replaced by a community similar to lakes or slow-running water. Beaver activities influence the community function by increasing the absolute importance of collectors and predators, while decreasing the importance of shredders and scrapers at impounded sites. The wood and debris dams can be an important substratum for certain taxa. In running waters there is a continuous stream or drift of organisms. The drift is composed by benthic animals, emerging or emerged insects on the water and planktic species. The high numbers of drifting planktic animals from lake outlets is well known. The input of terrestrial animals in the drift can be substantial. In many running waters there is a regular alteration between riffles and pools and since pools serve as depositional regions, one might think that pools (and ponds created by beaver) could serve as a major brake on drift. The purpose of this study was to see how beaver dams affect the drift fauna in boreal forest streams. The study was conducted in central Sweden. Five streams with beaver dams were selected. Drift traps were placed upstream and downstream the beaver dams. Each stream was sampled once during the autumn. Drift densities (numbers/100 m^3 water) were calculated. The animals were determined, dried and weighed. No significant differences were noted in total drift densities or in the drift densities of pelagic species. The drift densities of benthic species were higher upstream the dam, mainly because Ephemeroptera were more abundant in the upstream part. No significant difference was observed in diversity or dry weight. The functional feeding group ratio: filtering collectors/gathering collectors was significantly higher downstream the dam.

Keywords: Beaver, dams, invertebrates, drift, stream ecology, Ephemeroptera

NOTES

Beavers boosting biodiversity - Monitoring some animal world in North-Bavarian beaver sites

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Beavers are known as landscape architects, creating habitat for many other species. Most of the studies on this topic, however, are from North America. To document the impact of beaver activities on habitat structure, birds, amphibians, reptiles, dragonflies and damselflies in Bavaria, I was monitoring beaver sites in Middle Franconia since 1999.
Until 2011, I found in the project areas (total 75 ha, 10-15 ha water, depending on water level):

116 bird species (among them 55 „important“ species, i.e. red list species or species from the EU bird directive)
12 species of amphibians and reptiles (9 important species)
38 species of dragonflies (19 important species).

Comparing total number of species, number of breeding species and number of breeding sites, I could show, that beaver activities improve areas for birds: the more beaver activities, the more impact on bird life. Removing of beaver dams, on contrary, resulted in a decrease of population size in several bird species.
Among amphibians, the common frog (Rana temporaria) was the species mostly profiting from beavers. Populations of several thousand individuals exist now in “new” beaver ponds in areas where there were no breeding possibilities at all before beavers.
So far, I found 38 species of dragonflies and damselflies in the beaver sites, among them many species highly threatened in Bavaria. In some beaver sites, we have up to 24 different species, a number only achieved in nature conservation areas with the multiple size of the beaver sites. Species diversity correlates highly with the extension for beaver induced chances in the water regime.
Positive effects of beaver activities could be found for 32 plant species, 24 bird species, 11 dragonfly and damselfly species and 6 amphibian species. As long as beavers are active, the positive effects remain for several years. Compared to manmade pond habitats, slowly degrading through silting up, ongoing beaver activities provide permanently areas of different succession stages next to each other.
The study showed that the damming activity has a positive effect on the biodiversity in the areas studied. Of major importance are highly structured areas with shallow water due to damming activities, the opening up of the forest by cutting activities, the increased amount of dead timber and vegetation free areas along beaver creeks.
Beaver activities have to be seen as the key factor providing the variety of structures necessary for biodiversity along water bodies. The fine tuned and permanent water management by beavers cannot be replaced by human planning and measures. To allow beavers boosting diversity, however, they need space. Wide buffer strips without human activities, also along smaller creeks are necessary, to take advantage of beaver’s ecosystem services - for free.

Keywords: beaver, biodiversity, birds, amphibians, reptiles, dragonflies, damselflies, Bavaria

NOTES

Significance of beaver built structures for small mammals

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Beaver-made structures, such as beaver lodges and beaver burrows, can be regarded as specific environment infrastructure components that are supposed to be important to a number of biota species due their morphological, topographical, microclimate, and temporal features. In a dense beaver population, ca. 60% of beaver sites contain beaver lodges and ca. 90%-beaver burrows. The mean density of beaver burrows in the land reclamation canals in Lithuania is 36.4 burrows/km. Beaver burrow is temporary structure that often collapses if is unused for one or two years and creates a micro relief with various sizes of holes and caves. Meanwhile majority of beaver lodges persist for more than 10 years, thus, being quite permanent structures of environment. The aim of this work was to assess the importance of beaver lodges and beaver burrows to the abundance, diversity and structure of small mammal community. A study was carried in Širvintos, Vilnius and Molėtai districts in 2007-2012 where the mean density of beaver sites is 20 per 1000 ha. Small mammals were sampled using snap traps on beaver lodges and in the control biotope of the forests once in a season four times a year and in beaver burrows in autumn of 2011 and in spring of 2012. Eleven species of small mammals were caught on beaver lodges (H'=1.14) and only 5 species in the reference biotope (H'=0.74). Differences of small mammal community composition between habitats were relatively small (CC_S=0.625). Meanwhile small mammal community structure on beaver lodges differed significantly from that in the forest in summer (χ^2=20.96, df=3, p<0.001), in autumn (χ^2=37.99, df=3, p<0.001) and in winter (χ^2=6.49, df=2, p=0.04). Bank vole (*Myodes glareolus*) prevailed over other species in both habitats. Common shrew (*Sorex araneus*) was the subdominant on the beaver lodges and the yellow-necked mouse (*Apodemus flavicollis*) in the forest. The relative abundance (RA) of small mammal community on beaver lodges was similar to that in the forest in spring, summer, autumn, and only in winter it was insignificantly greater (t=1,12, p=0.23) than in the forest. In beaver burrows were trapped eight species of small mammals (H'=0.69). Over the study period a trapping effort of 720 snap traps/ nights was achieved (360 snap traps/ nights in beaver burrows and the same in the forest). Bank vole was most common (more than 80% of caught individuals). Other species like *Sorex araneus, S. minutus, Neomys fodiens, Apodemus agrarius, A. flavicollis, A. silvaticus* and *Microtus arvalis* were rare. Small mammals were insignificantly more frequent (FO) in beaver burrows (BB) than in the forest (F) in autumn (FO_{BB}=61% vs FO_F=51.79%, p=0.34) but less frequent in spring (FO_{BB}=31% vs FO_F=37.04%, p=0.46). Also in autumn the catching effort (CE) in beaver burrows was smaller than in the forest (CE_{BB}=3.5 vs CE_F=4.54 snap traps/nights/ind.) but bigger in spring (CE_{BB}=9.6 vs CE_F=7.38 snap traps/nights/ind.).

Keywords: beaver, lodges, burrows, small mammals, abundance

NOTES

Beavers and bugs, channelling biodiversity in boreal Canada

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Habitat heterogeneity and wetland area play an important role in aquatic biodiversity; however, other biotic and abiotic factors might be equally important in the composition and distribution of ecological communities. Over a three-year period, we demonstrate how beavers physically alter isolated kettle ponds in Miquelon Lake Provincial Park, Canada, which in turn influences not only species diversity, but also the dominance of specific functional feeding groups and taxa. In particular, the digging of channels by beavers can extend aquatic habitats up to 200 m into the upland zone and creates a unique aquatic habitat that appears to be a hot-spot for predaceous macroinvertebrates. Some taxa such as Gerridae and Gyrinidae were exclusively found in channels in active beaver ponds, while Culicidae were dominant in ponds without beavers. Amphipoda (Talitridae in particular) were strongly associated with active beaver ponds in 2009 and 2010. We also determined that during extreme drought in 2009, species richness, diversity and abundance declined dramatically, but were then able to recover quickly in 2010. Although wetland area was associated with species richness, it appears that increased niche availability through the active maintenance of ponds by beavers played an important role in macroinvertebrate diversity and distribution. Understanding the role of common, but seldom surveyed within-pond habitats in boreal wetlands can expand our ability to better understand aquatic biodiversity and the importance of habitat heterogeneity and the role of other taxa in species assemblages.

Keywords: aquatic macroinvertebrates; beaver; biodiversity; boreal wetlands, *Castor canadensis*; drought; Miquelon Lake Provincial Park

NOTES

Effects of foraging by beaver (*Castor fiber* L.) on aquatic vegetation in Scotland

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Foraging behaviour of beaver (*Castor* spp.) is largely inferred from gnawing and felling of trees yet aquatic plants comprise a significant proportion of beaver diet. Compared to published literature on terrestrial foraging far less is known about aquatic feeding behaviour and dietary preferences of beaver with most studies focussed on *C. canadensis*. Due to many successful re/introductions the range and density of beaver is increasing globally; it is therefore pertinent to better understand their influence on aquatic vegetation. Studies were conducted at two sites in Scotland (Bamff and Knapdale) between 2010-2012 on ponds and lakes where beavers had been consistently observed foraging for several years. At Bamff foraging experiments were conducted on a raft of emergent vegetation by excluding of beavers from fixed areas. Over the period April to October total plant biomass was on average 45% lower in grazed areas compared to ungrazed controls. Pronounced differences in *Menyanthes trifoliata* rhizome biomass suggested that beaver were targeting this organ over leaves, possibly due to its higher nutritional value and lower digestion time. We found no evidence for increased plant species richness as a result of beaver foraging and propose that *M. trifoliata* leaf cover has a greater influence on species richness or that trampling by beavers in poorly consolidated substrates offsets reduced interspecific competition amongst plants. In cafeteria style experiments beavers selectively consumed specific organs of *Iris pseudacorus*, *Carex rostrata* and *M. trifoliata* from an array of seven species which was consistent with longer term changes in vegetation at this site over the period of beaver occupancy. At Knapdale stands of floating-leaved and emergent aquatic plants were surveyed within 11 freshwater bodies of which beavers were absent from four. Beavers selected larger than average diameter leaf pads of the dominant species, *Nymphaea alba*, and fed primarily in shallow water (<1.5m depth). At one site there was a progressive reduction over a four year period in the stem density of *Schoenoplectus lacustris* associated with beaver feeding. The influence of beaver foraging on *N. alba* flowers and consumption of other aquatic plant species will also be discussed in the context of beaver ecology.

Keywords: *Castor fiber*, Eurasian beaver, macrophyte, foraging, *Menyanthes trifoliata, Nymphaea alba*

NOTES

The composition and ecological character of flora on beaver lodges as a manifestation of beaver habitat engineering

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Beavers are one of the best known engineer animal species. Changes of hydrological conditions made by beavers enable settling of new species of flora and development of new plant communities. Beaver lodges seem to be the least studied habitat created by this animal. They are dome-shaped constructions built from branches, grass, slime and mud. Accumulation of organic matter on the surface of lodges enables their overgrowing by plants, thus they represent specific, zoogenic habitat. Their flora shows certain distinctive features differentiating it from the flora of the areas surrounding lodges. The study, covering 40 beavers lodges, was conducted in the Romincka Forest, in north-eastern Poland . Lodges and their surroundings did not differ in the total number of vascular plants recorded within their areas, but the flora of lodges had significantly higher mean species richness, even despite lower plant cover compared with their surroundings. Species from the *Lamiaceae, Polygonaceae* and *Asteraceae* families were more often present in lodges rather than in their surroundings. Within lodges there were more species tolerating disturbance (r strategy), more hemicryptophytes and therophytes, more species associated with eutrophic habitats and of neutral soil reaction. Apart from that, species from the *Alnetea glutinosae, Bidentetea tripartiti, Scheutzerio-Caricetea, Artemisietea vulgaris*, and *Stellarietea mediae* classes had a bigger share on lodges compared to their surroundings. Finally, there were also more euhemerobic species recorded on lodges. By contrast, vegetation which surrounded lodges had a higher representation of species tolerant to stress (s strategy), typical for mesotrophic and acidic habitats as well as more mesohemerobic species. The above mentioned observations allow to say that beaver lodges contribute to the increase in the diversity of habitats and subsequently may be regarded as an important factor influencing flora and vegetation biodiversity.

Keywords: *Castor fiber* L., engineering species, floral transformation, NE Poland

NOTES

The effect of concentration of beavers' vital activity products on Cladocera fertility in laboratory experiments.

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Cladocerans are an important link in organization of water ecosystems. Being a forage object of fish, Cladocera also play the crucial role in the processes of self-purification. Such species as *Daphnia magna* and *Ceriodaphnia affinis* are the test-objects both in toxicological and hydrobiological investigations. The studies that were carried out in small rivers of the Upper Volga basin demonstrated that the species diversity, the number and biomass of cladocerans increased in beaver ponds as compared to river portions of running water and man-made ponds. The similar results were obtained in the course of laboratory experiments. In water from beaver ponds the fertility of *C. affinis* increased significantly as compared to the unregulated portion of the river and man-made ponds. The conclusion can be made that the increase in abundance of Cladocera in beaver ponds was caused not only by the flow regulation but by a stimulating effect of life activity products of *Castor fiber* L. as well. But the effect of concentrations of beavers' vital activity products (BVAP) is studied poorly so this work is devoted to this issue. The beaver droppings in mixture with wood residues were collected in the beaver farm of the Voronezh State Nature Biosphere Reserve. In laboratory experiments we estimated the effect of water with different content of (BVAP): 10, 25 and 50 mg/l on the fecundity of the test-object-*Ceriodaphnia affinis* (Crustace, Cladocera). The increase in concentrations of products of beavers' vital activity led to the increase in the content of phosphorus (r=0.83, $p < 0.05$), ammonium (r=0.87) and ammonia (r=0.90). The fecundity of *C. affinis* decreased significantly at the increase of the content of phosphorus (r=-0.62), ammonia (r=-0.68), and ammonium(r=0.68) in water. Simultaneously, the increase of the content of less toxic compound of nitrogen-nitrate nitrogen-caused a significant increase in *C.affinis* fecundity (r=0.43). The maximum content of nitrate nitrogen in water (27 mg/l) was registered under the excrement concentration of 10 g/l of in water solutions. At this concentration the brood of one female of *C. affinis* increased significantly ($p < 0.05$) (15.3±0.8 sp. as compared to 8.3±0.6 control). In the water solutions with concentrations of (BVAP) of 25 and 50 g/l the content of nitrate nitrogen decreased to 9.4 и 20.4 mg/l, phosphorus and other nitrogen matters increased 2.3–9.9 times and *C. affinis* fertility reduced to 5.8±0.9 и 1.7±0.3 sp. simultaneously. Therefore the first step of experimental investigations have shown that more favourable regime for Cladocera development in beaver ponds is at the following concentrations of biogenic matters: P-3.0 mg/l, NH_4-0.9 mg/l, NH_3-0.8 mg/l, NO_3-27 mg/l. It is known, that during a year an average beaver family excretes into water no less than 500 kg of products of beaver life activity (urine and excrements) and the volume of retained water in the ponds averages ~ 1000m^3. So we can say that water quality in beaver ponds does not deteriorate, and the increase in the number of beaver ponds and densities of the colonies results in the increase in the richness of Cladocera, which contribute greatly to self-purification of water objects.

Keywords: cladocerans, beavers, vital activity, Cladocera fecundity, water quality

NOTES

Beaver pond contribution to increased global atmospheric methane

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Beavers are known to alter biogenic greenhouse gas dynamics via their physical alteration of stream channels and bordering riparian zones. In this paper we investigate how aquatic methane (CH_4) emission has changed due to fluctuations in beaver populations on three continents. In North America, we suggest a dramatic decrease in emission due to near extirpation of beaver during the period of European colonization, followed by an increase in CH_4 coincident with recovery of the population. In Europe we present historical emission estimates during population minimum as well as estimates reflecting recent efforts to (re)introduce the beaver. We also demonstrate a considerable increase CH_4 release to the atmosphere driven by an explosion in beaver population following its introduction to Argentina in the mid-twentieth century. We estimate the proportion of change in atmospheric methane concentration that may be attributed to the growth of beaver populations and their engineering of the landscape during the last century.

Keywords: Beaver ponds; *Castor fiber, Castor Canadensis*; global carbon balance; methane

NOTES

Microsatellites and mitochondrial DNA provide new insight into the origin and evolution of Eurasian beaver populations

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The formerly widespread Eurasian beaver experienced dramatic bottlenecks which led almost to species extinction. At the end of 19th century the species survived in limited number of small relict populations. Eurasian beaver populations have recovered recently due to natural range expansions and repeated reintroductions which resulted in foundation of populations experiencing various levels of admixture. The situation is particularly complex in central Europe where beavers originating from several relict populations meet and hybridize. In my talk I will review published genetic studies and results of our ongoing project based on mitochondrial DNA sequences and microsatellite data to show genetic impact of bottlenecks on relict beaver populations and to demonstrate how the genetic markers can be used to disentangle the origin and admixture level in newly founded beaver populations.

Keywords: Eurasian beaver, relict populations, mitochondrial DNA, microsatellite data, beaver populations, bottlenecks, origin

NOTES

The Battle for Britain: Beavers in the U.K.

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After spreading through mainland Europe during the 20th century, the resurgent Eurasian beaver now seems poised to re-conquer the very western edge of its former natural range. One of the last beaver-free countries in Europe-the United Kingdom is the scene of a fascinating political struggle, where *Castor fiber* is the central character. In this presentation we will give an overview of the current situation of both wild and captive beavers across the U.K. and explore some of the key arguments that will likely decide the future fate of beavers in the Britain (Scotland, Wales and England. NB. There is currently no evidence that Eurasian beavers were ever native to Ireland). Following discussions and proposals that began in the 1990s, Scotland was the first U.K. nation to legally re-introduce the Eurasian beaver back into the wild in 2009, as part of the ongoing Scottish Beaver Trial-see separate presentation 'Scottish Beaver Trial – the story so far' (Campbell-Palmer R, Jones S, & Needham R). By 2010 evidence also began to emerge of an illegally present larger population of beavers living on the River Tay catchment in eastern Scotland. Arguments and speculation surrounding the origin and status of these two neighbouring, yet conflicting populations lead to very public disagreements being played out in the national media. In 2012 the Scottish Government announced that the Tayside population would be tolerated and monitored until 2015. Whilst supporters of beaver reintroduction argue for the biodiversity benefits and ecosystem services delivered by beavers, opponents and sceptics fear for the negative impact that beavers may have on agriculture, forestry and fishing. Several large, semi-natural enclosures also exist in Scotland where breeding beavers are held by private landowners. In Wales a beaver reintroduction feasibility and desirability study was carried out in 2008. This confirmed the ecological suitability of some Welsh river and lake systems and lead to the selection of a series of proposed reintroduction sites. A national consultation exercise began in 2012 and will be considered by the Welsh Assembly Government in 2014. A pair of female, Eurasian beavers were introduced into a privately-owned semi-natural enclosure in West Wales in 2011, with the aim of supporting a longer term, wider reintroduction. However strong opposition remains and this is viewed as the main barrier to any wider scale reintroduction. In England a beaver reintroduction feasibility and desirability study was carried out in 2009. Like Wales the resulting report showed that the Eurasian beaver could thrive in many locations around England, but with high human population densities and fears regarding potential negative impacts such as the flooding of land, the return of the beaver to England faces perhaps the most difficult challenge in the U.K. However the impetus remains present and in recent years a number of small, captive populations have emerged, including those into nature reserves enclosure for habitat management purposes.

Keywords: Eurasian beaver, wild, captive, reintroduction, introduction, breeding

NOTES

Scottish beaver trial-story so far

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The Scottish Beaver Trial is a government sanctioned, scientifically monitored, time limited trial reintroduction of Eurasian beavers into a 45 sq. Km area of mixed forest and lochs on the west coast of Argyll, Scotland. This partnership project is undertaken by the Scottish Wildlife Trust (a membership based conservation charity) and the Royal Zoological Society of Scotland (a conservation and research charity, with two zoological collections), hosted on Forestry Commission Scotland (forestry directorate of the Scottish Government) land and independently monitored by Scottish Natural Heritage (the Government funded body responsible for Scotland's nature and landscape). We are now entering the fourth year of the five year trial period, which has seen the importation and release of animals, development and implementation of the monitoring program, a range of animal management procedures and a wide range of public engagement strategies. Scientific monitoring is ongoing and will not be presented here. Key achievements to date include the production of the SBT Education Pack, which has gone to all schools in Scotland. The widespread distribution of public information leaflets (>50, 000). The trial site has seen increased visitors, indicating there is a market for guided walks and beaver related merchandise. Media interest in this project has been largely positive, and reached national and international audiences through a range of mediums including TV, radio, print and internet. The SBT team includes staff with a range of backgrounds, including veterinary, forestry, conservation, education, marketing, data handling, public relations, field work and project management. Therefore information dissemination and public engagement occurs across a number of fronts and includes outreach education programs, public talks, guided walks, peer-reviewed publications, volunteer and student placements, scientific lectures, participation at local events, website (http://www.scottishbeavers.org.uk/), blog (http://blog.scottishbeavers.org.uk/), stakeholder meetings and informational displays. Scottish Government licence conditions allowed 4 beaver families to be released (16 animals), currently trial population is 12 pending any kits born this year. Confirmed mortality in the wild has been low (3 individuals), and whilst the majority of released pairs have set up territories on or very close to their release points, dispersal of sub-adults out of the trial area has been a significant and ongoing issue requiring intervention where possible. Successful breeding has occurred in each year of the trial. Due to health screening requirements, thorough veterinary investigations have resulted in previously unpublished data. Lessons have been learnt throughout this process and ongoing flexibility and revision of procedures are vital for success. The trial will run until June 2014, and following a repeat local public consultation on the presence of beavers in Argyll and Scotland all independent monitoring partners will submit reports on their findings. Scottish Natural Heritage will present this information to the Scottish Government who will then decide on the future of beaver reintroduction to Scotland.

Keywords: beaver, Scotland, reintroduction, monitoring, population

NOTES

The Curious Tale of the Beavers of the River Tay in Scotland

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My talk will cover the story of our campaign to save the "free beavers of the Tay"-a population of Eurasian beavers that began with escapes from captivity and has now spread around the vast network of waterways in the Tay catchment in central Scotland, pre-dating and in parallel with the official Scottish beaver reintroduction trial in Knapdale, Argyll. Our campaign began on Facebook and made use of Twitter and the local and national press including the BBC. We also put in a Freedom of Information request and asked a number of parliamentary questions in the Scottish Parliament. The campaign has also lead to the founding of a new charity, Scottish Wild Beaver Group SCIO. The Scottish Government's nature agency SNH had decided in 2010 that these accidental beavers should be trapped out. The reasons given included questions about species, subspecies and animal health and welfare, but the principal reason seemed to be the lack of planning or any license, in contrast to the official trial. The campaign attracted well over 1000 supporters in the course of eighteen months, and the local newspaper, the Blairgowrie Advertiser came out firmly on the side of the beavers. However there was a great deal of opposition and indeed hostility from a number of bodies, including Scottish Land and Estates, The Scottish Gamekeepers Association and several bodies representing salmon fishermen. In March 2012 a decision was made to monitor the beavers for three years, until the end of the trial, and then decide on their future. We maintain that the beavers are protected by the Habitats Directive but the Scottish Government disagrees. Our campaign is still underway. This talk will look at some of the tensions that exist in the Scottish countryside around the subject of rewilding and wildlife policy and highlight the range of attitudes to beavers that exist, and the challenges to getting the facts out to the public, rather than prejudice and fear. It will highlight some mitigation issues that have arisen and it will also draw attention to the clash between official and informal conservation and the bureaucratic tangle that can come between a native animal and its freedom to recolonise its old range.

Keywords: Reintroduction Policy, Campaign, Social Networking, Opposition, Challenge, Attitudes, Rewilding

NOTES

Distribution and patterns of spread of recolonising Eurasian beavers in fragmented habitat, Agdenes peninsula, Norway

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The Agdenes peninsula, Sør-Trøndelag, Norway, 1060km^2, is a heavily dissected mountainous landscape with numerous small watersheds, of mainly steep gradient, flowing separately into the sea or to fjords. Suitable habitat for permanent beaver occupation occurs as isolated patches within these watersheds. Eurasian beavers were directly reintroduced to the area in 1926 and 1928. The last known individual of this population died in 1961. In 1968-69 2 pairs and a young animal were reintroduced on the Ingdalselva watershed. The current population is descended from these animals, and probably from the later 1990s by immigrants from the adjacent Orkla river system. In 2010-11 (43 years post-reintroduction), the area was surveyed and 24 beaver family group home ranges located. 20 were active and 4 abandoned; the population size was estimated at about 80 individuals within family territories plus in any year a number of dispersing individuals. Eighteen of the active territories were located on just four watersheds, Ingdalselva and three immediately adjacent to it. The remaining two territories were isolated on different watersheds distant from any other known group, requiring multiple crossings between watersheds and/or considerable movements through salt water to reach from them. Signs of vagrant individuals were found widely, including on a number of watersheds not occupied by any family group, though containing suitable habitat for permanent colonisation. The pattern of recolonisation to date is presented, and indicates a considerable barrier effect of watershed divides but rapid spread within a watershed; and probable spread both overland and through salt water. An isolated population of beavers on a distant section of the Orkla river system, first noted in 1933, has been attributed to spread from the first study area reintroductions. However, there are grounds to suspect that this population possibly had a different origin. Genetic studies would be useful to elucidate this point.

Keywords: watershed, Eurasian beaver, territories, recolonisation

NOTES

Current status of the European beaver population in Poland

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After the Second World War the first beavers appeared in Poland on the Marysza and Czarna Hancza rivers in Suwalki region and on the Hwozna and Lesna rivers in the Bialowieska primeval forest. The growth of the population was supported by migrating beavers from the neighbouring countries: Russia, Lithuania and Belorussia which facilitated increasing the number of the animals to 130 in 1958. In 1977 the estimated population of beavers was 1 thousand animals living in 254 families, mostly in Northern-Eastern part of Poland. In 1994 it was estimated that there were about 2 thousand lairs all over Poland with 7,4 thousand beavers in total. The Active Protection of the Beaver program was initiated in 1974 in order to return the species to Polish fauna, extending their habitat and improving environmental conditions. In 30 years about 2 thousand beavers were captured in Suwalskie region and moved to the Vistula and Odra river-basin. Due to the reintroduction and active protection of the animals, beavers can be found nowadays in entire Poland, except high mountain ranges of the Carpatia and Sudety mountains, and their population is estimated at 40 thousand. The most numerous population with over 18 thousand animals and the density of 20 or more animals per 100 square kilometers is in the Northern - Eastern part of Poland, namely in Podlasie, Mazowsze and Warmia and Mazury regions, with most of the animals coming from the natural migration from the Niemen and Pergola rivers. The population in Wielkopolska region, on the Warta and Notec rivers as well as in the Bieszczady mountains, Sandomierska valley and the San river-basin, the result of the earlier reintroduction (80s and 90s of the last century), as well as the oldest population in Suwalki region, are growing according to Riney-Caughley model with the progressive initial increase in the number of animals even by 20% and then the decrease to 3-5% in a year. These populations are hybrid, established with Belorussia and Woroneski beavers, nevertheless belonging to the same sub-species of *Castor fiber vistulanus*. Genetically dominant animals with brown pelts (aguti) constitute above 50% of the population. The losses in the population are small and do not exceed 1%. Most often beavers are killed by cars and during the spring migration when the young are seeking a new territory and a mate. In the Eastern parts of Poland, in the Bieszczady mountains, Augustow, Bialowieza and Knyszynska primeval forest the beavers are killed by wolves. In May-June 2010 many young animals died in floods. There are no incidents of poaching noted in the last decades. Till 2004 the European beaver was a strictly protected species in Poland. Protection was also extended over some of the habitats, thus 8 nature preserves covering the area of 5.174 hectares were created. Currently, the beaver is a partially protected species and in some circumstances, such as extensive damage done by the beavers, the animals are shot or captured and moved to other regions of Poland. No shooting or capturing can be done without the permission from the Regional Directorate of Natural Environment Protection. The use of Conbear and other traps is forbidden.

Keywords: European beaver, *Castor fiber*, status, management

NOTES

Could parasitic mites help to clarify the Eurasian beaver phylogeography?

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Fur-mites of the genus *Schizocarpus* (Acariformes: Chirodiscidae) are permanent ectoparasites inhabiting the undercoat of beavers. They are strongly specialized morphologically for living in the beaver fur: their body is subcylindrical, the cuticle between anterior legs bears striated membranes, the two anterior pairs of legs consist of only two articulated segments and have distinctly developed tarsal flaps serving as clasping organs to host hairs. More than fifty species of *Schizocarpus* have been described so far from the two extant beaver species, the Eurasian and American beavers. Although more than ten mite species could simultaneously parasitize a host individual where they inhabit different fur zones there are no *Schizocarpus* spp., there are no species common to the Canadian and European beavers. To date, fourthy five *Schizocarpus* spp. are known from Eurasian beavers belonging to different allopatric populations. Based on exploration of the four of eight extant subspecies of the Eurasian beaver (*C. f. orientoeuropaeus, C. f. albicus, C. f. belorussicus,* and *C. f tuvinicus*) it was showed that faunas of *Schizocarpus* spp. on each of these host subspecies are significantly different. The main reasons of such phenomenon are the enormous speed of the allopatric mite speciation caused by combination of two factors: the disjunctive ranges of beaver subspecies and mite adaptations to the particular microhabitats on the beaver body with the probable following synxenic speciation. The main problems being important for the conservation of the present biodiversity of Eurasian beavers are the high potency of previously isolated relict Eastern European populations for spreading and the reintroduction of beavers which has been undertaken without estimation of the phylogeography. Mites of the genus *Schizocarpus* being strongly specific to their hosts are an excellent model for coevolution investigations. The results of study of the *Schizocarpus* biodiversity on beavers in each relict population and reconstruction of phylogeny of these mites would serve as an external test for validation of beaver's phylogeography hypotheses and are potentially important the planning of the beaver reintroduction.

Keywords: fur-mites, *Schizocarpus,* Eurasian beaver, microhabitats, phylogeography

NOTES

Beaver (*Castor fiber* L.) territories in Koroška region, Slovenia

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Beaver (*Castor fiber*) returned to Slovenia in 1998, after more than two hundred years of absence. They expanded naturally from Croatia, where beavers from Bavaria were reintroduced in period of 1996-1998.
The aim of this work was to reveal beaver territories in the region of Koroška. I have also researched origin of beavers, their food selection, threats for their existence and management plan. Koroška is small region, with size just over 1000 km^2. All signs of beaver presence in the region were recorded and mapped. Two inhabited and one abandoned beaver territory were discovered. Territories were found on the biggest river in the region, river Drava, where they have occupied 36% of the river length. Two beaver families are present. Beavers originate from Croatia. To establish first settlement outside Croatia, beavers have travelled around 200 kilometres on the river Drava, across entire Slovenia and settled in Austria, near Neudenstein in 2004. Two years later, near Dravograd, first settlement in the Koroška was discovered. The most frequently browsed tree species are willows (*Salix* sp.)
No beaver presence was found on other waterways in Koroška. As most of the Koroška region consists of mountains, rivers here are fast flowing torrents on a large part of their course. Only a small part on lower course of these rivers has characteristics suitable for beaver settlements.
Beavers are importantly affected by three hydroelectric facilities on the river Drava in Koroška. They have negative impact on them on many levels. They present barriers for their migration, they cause important fluctuations of water level and several beaver deaths were recorded due to hydroelectric facilities operation. They also have positive effect on beavers. Damming of the river caused formation of new wetland habitats and islands. All found territories have been established in these newly formed habitats. No management plan for beavers in the Koroška has been accepted yet.

Keywords: *Castor fiber*, territories, distribution, management

NOTES

Beaver distribution in Bosnia and Herzegovina seven years after re-introduction

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Bosnia and Herzegovina is 26th country which conducted re-introduction of European beaver (*Castor fiber* L.), since 1920, when re-introduction of this species took place in numerous European countries. Re-introduction of beavers in Bosnia and Herzegovina started in year 2004. As a first locality for re-introduction, river Semešnica (a tributary of Vrbas River) was chosen. Re-introduction was realized in spring 2005, when total of 20 beavers was released. Next year, after successful start continuation of re-introduction follows at Pliva river area in April 2006. River Sokočnica has been chosen as second site to settle beavers. That is tributary of Pliva River at Šipovo municipality area. As in first case, total of 20 beavers was released. Before releasing all beavers were marked with microchips for easier monitoring and registration of losses. Today, seven years after first re-introduction, from these localities beavers spread to numerous new sites in other rivers in Bosnia and Herzegovina as well as they come from neighboring countries Croatia and Serbia which realized re-introduction in 1996-1998(Croatia) and 2004 (Serbia). In this paper, we discussed current distribution of beavers in Bosnia and Herzegovina as well as population status and migration directions.

Keywords: beaver, re-introduction, distribution, population

NOTES

The good, the bad, and the ragbag-differential genetic consequences of beaver reintroduction strategies in Germany

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Following severe bottlenecks and extinction events due to massive persecution, the Eurasian Beaver, *C. fiber* has reconquered large areas in central and Western Europe. In several regions reintroduction programs were started since the mid-20th century. In Germany, beavers were repeatedly reintroduced using source populations from different *C. fiber* subspecies but also Canadian Beavers (*C. canadensis*) that escaped from capacity contributed to recolonization. Additionally, individuals from relict or reintroduced beaver populations dispersed naturally. The result of these events is a complex melting pot of beavers from various origins. In order to unravel the recent reintroduction and dispersal history of beavers in Germany and adjacent regions, we applied a set of molecular markers (mitochondrial DNA haplotype analysis and microsatellites). We present genetic data obtained from tissue samples collected throughout Germany and adjacent countries. However, this type of material is usually not available from a large number of individuals. Therefore we applied non-invasive genetic monitoring with samples from barbed wire hair traps. Genetic analyses with mitochondrial sequence markers enabled us to differentiate between invasive Canadian beaver populations and indigenous Eurasian beavers, and to infer sub-specific status of the maternal lineage to provide insight into the origin of the populations (*C. f. fiber*, *C. f. albicus* and *C. f. galliae*). Additional information from nuclear markers is necessary to understand the current genetic status of beaver populations. A set of 19 microsatellite makers-most of them newly developed for the purpose of this study-clearly showed genetic traces of interbreeding of different sub-species in regions where multiple source populations were reintroduced (e.g., Bavaria). On the contrary, beaver reintroductions, e.g., in the Spessart forest region relied on a single source population (*C. f. albicus*), which is genetically still well recognizable. However, reintroduction from few founder individuals of the same source population has resulted in a further decrease in genetic diversity. We expect that currently separated populations of different origins will meet in the very near future, resulting in yet unknown grades of genetic admixture. With a combination of data on both species of beaver, as well as the Eurasian sub-species, and two types of molecular markers, we present a comprehensive overview of the geographic and population genetic structure of beavers in Western Europe.

Keywords: Eurasian beaver, *Castor fiber*, Canadian beaver, *Castor canadensis*, microsatellites, mitochondrial DNA, non-invasive sampling, barbed wire traps, population structure, reintroduction

NOTES

Finding beavers in the past: an archaeological view

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Through archaeological research in the wetlands of Britain, I became interested in the former presence of beavers in Britain and mainland Europe, and in 1980 John Coles and I published an article on their probable influence on the mid-Holocene forests of Europe. Much of the information for the article was drawn from the North American literature and from observations of beavers in Canada, as relatively little had been published on *Castor fiber*. However, by the mid-1990s the expansion of beavers in Europe made possible a field-based research project on *Castor fiber*, to increase awareness and understanding of beaver evidence in the archaeological record, and in 1996 the *Beaver Works Project* was initiated. The research presented here stems from these field studies, which I will briefly describe, and from parallel on-going archaeological projects on beavers. The archaeological evidence comes from beaver skeletal elements and gnawed wood, the remains of beaver structures and features, and more indirectly from wetland sediments and palaeohydrological indicators, as well as a rare find of beaver hairs. This evidence can be used to trace human-beaver interactions. Through the study of present-day beavers and their habitats, it has been possible to reinterpret some classic archaeological sites as a mixture of human and beaver activity, and to suggest that humans at first used the products of beaver activity and then began to develop their own environmental manipulations based on their understanding of beaver actions-one example is the human practice of felling trees to encourage new growth of long straight shoots from the stump. Early in the Holocene, it can be argued that beavers had a greater influence on the environment than did humans, but at some point the balance shifted to humans having the greater impact. I will examine briefly when this might have happened, and suggest that we have underestimated the significance of beavers in the periods when they were the chief environmental manipulators. I will also suggest that we should encourage people to look out for and report evidence for the former presence of beavers-it is more widespread and diverse than expected, and by enhancing the data-base for their former distribution we will have a better understanding of beavers themselves and of how they may react to the pressures of co-existence with humans.

Keywords: *Castor fiber*, archaeological evidence, skeletal elements, wetland sediments, palaeohydrological indicators, human inpact

NOTES

Instrumentations of wild Eurasian beavers (*Castor fiber*)

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The aim of this study was to find a reliable method to attach loggers on Eurasian beavers (*Castor fiber*) and to collect high quality data that could answer important questions about the behavioural ecology of beavers. The study was carried out from 2008-2011 on three rivers, the Straumen (Nome municipality), the Gvarv and the Sauar (both Sauherad municipality) in Telemark, southern Norway. In earlier studies, harness, collar, implant, and tail-tagging attachment methods have been used with varying results. However, a glue-on method commonly used on pinnipeds has never been tested on beavers. We therefore glued on several archival tags including Global Positioning Systems, Time-depth-recorders, tri-axial acceleration data loggers and Very High Frequency (VHF) transmitters. Units were attached to the fur of the lower back using two-component epoxy resin (5-minute quick cure epoxy) and 15 cm up from the base of the tail. In all tags deployed (except the VHF), data was stored inside the device. Therefore, recaptures were necessary to access the data. Devices were deployed on beavers (>1 year old) with 1-3 archival tags, but always in combination with a VHF transmitter. The total weight of the device never exceeded 1% of the beavers total body weight. The glue on method proved to be satisfactory for attaching tags to beavers for a short time period (up to approx. 4 weeks). We collected a large quantity of high quality data from all tags. For long-term deployments the retention time is a limiting factor, often depending on the quality of the animal's fur, with shorter retention times during moulting in spring. Other challenges involved limitations due to battery capacity, breakdown of equipment, disappearing animals and unknown breakdown of tags. From an animal welfare point of view the method is less invasive, involving no anaesthesia or breakage of the skin.

Keywords: Archival tags, attachment method, *Castor fiber*, Eurasian beaver, retention time, glue-on

NOTES

GIS and remote sensing data for evaluation of the Eurasian beaver (*Castor fiber*) activity in Russian natural protected areas

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The Eurasian Beaver (*Castor fiber L.*) is among those species that some consider as ecological engineers in ecosystems. Beaver's return to the ecosystems from where it was absent for a century or more, significantly changes vegetation communities and even landscape elements. By now beavers have recolonized nearly all their original range in Russia. That is why, the beaver's activity has been closely studied. With the access to high spatial resolution satellite data, it becomes possible to study beaver's activity as an ecosystem engineer remotely. Two natural reserves (Prioksko-Terrasny Nature Biosphere Reserve and Rdeysky State nature Reserve) were chosen as model areas in this study, because they represent different types of beaver habitats and have a well-known history of beaver populations on their territory. We used a series of SPOT 5, IKONOS and GeoEye images of the reserves territory, as well as GPS and GIS data on water lines in the reserves, and beaver dams and settlements locations. The results of the research demonstrate that using visual interpretation of multispectral high resolution images; it is possible to identify such elements of beaver activity, as channels and dams. Automatic classification of the images allowed us to quantitatively assess woody vegetation available for beavers in the reserves, as well as to identify the sites potentially suitable for beaver colonization.

Keywords: European beaver, natural protected areas, remote sensing techniques, GIS technologies

NOTES

Food preferences of the European beaver (*Castor fiber*) in the North Eastern Poland

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The European beaver *(Castor fiber*) is a semi-aquatic rodent. They represent strictly herbivores feeding on woody as well as non-woody plants material: bark, shoots and leaves of plants, forbs and aquatic vegetation. In their diet woody plants material dominate during the autumn and winter; whereas during the summer their diet is dominate by non-woody plants. However, amount of information about the diet composition of the European beaver is very limited. This aim of this study was to characterize a diet composition of beavers during the vegetation season. Beavers were captured in March, July and November in North East districts of Poland (Masurian Lakeland). The animals were euthanized according to procedure using in farm beavers in Research Station in Popielno. After injection beavers were weighted and sex was determined. The stomach was isolated and their contents squeezed into bakers. The 10 g samples were added to 10 ml of the equal volume of 4 % aqueous solution of formalin. The preserved sample were analyzing by microanalysis. In was observed that beaver's diet was dominated by woody material - mainly willow. The proportion of plant woody material to non woody material was changes during the year however. In the summer the beaver's diet was enriched with forbs, grasses and leaves of trees. However, in stomach of one beaver was detected a high amount of oat. The results showed that beavers possessing typical for herbivores foraging patterns.

Keywords: food composition, beaver, foraging pattern

Beavers and Bears-Oh My! Black Bear Hunting Activity at Active Beaver Sites

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The American black bear, *Ursus americanus*, and the North American beaver, *Castor canadensis*, have broad geographic distributions across North America. Bears are often found in forested areas and, when water is available, beavers also may be present. Bears are omnivores, but are reported to consume primarily herbaceous materials rarely preying on vertebrates. Bears are not considered major predators on beavers in North America although they can and do prey on beavers in an opportunistic manner. However, No direct observations of black bear hunting behavior on beavers have been reported. We observed bear hunting behavior at active beaver sites during the autumn of 2009 and 2010. Bear activity was observed with remote, time-lapse and motion sensitive cameras. No actual predation events were observed, but hunting behavior and nuisance behavior was documented. Bears were most active near beaver lodges during the early evening (1700-2000 hours) and morning (0500-0900 hours), which coincides with beaver activity times. Sniffing in and around occupied lodges was the most common behavior, while digging and alert behavior were also recorded. Two actual observations of bears hunting beavers where the bears entered the water were recorded. These observations indicate that bears can be predators on beavers, but at least during the autumn they are relatively ineffective hunters.

Keywords: Black Bear, hunting behavior

Development of the captive management guidelines for Eurasian beaver

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The trial reintroduction of beavers to Scotland (Scottish Beaver Trial) has seen a multidisciplinary approach and collaboration between organisations and persons across Europe. As a scientific, government sanctioned trial, in a country that has specific animal importation laws and health screening requirements differing from mainland Europe, this process was heavily monitored. This provided a unique opportunity to develop animal management and husbandry protocols, along with comprehensive veterinary investigations. The guidelines include contributions from beaver experts across Europe, from those working closely with beavers both in the field and captivity, along with veterinary and nutritional experts. Sections cover general beaver biology; enclosure design; nutrition; captive breeding; capture, handling, transportation and quarantine; health and veterinary care; population and conservation management. To date, no complete captive management guidelines for Eurasian beavers have been published and are aimed to provide advice to zoological and private collections, and those involved in reintroduction and translocation projects.

Keywords: Eurasian beaver**,** reintroduction, monitoring, conservation management

Expression of the prepro-orexin and orexin receptors type 1 (OXR1) and 2 (OXR2) proteins in the European beaver (*Castor fiber*) gonads and adrenal glands

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Orexins are neurohormones, synthesized predominantly in the hypothalamus. It has been demonstrated that they are involved in the regulation of appetite, arousal and wakefulness. Moreover orexins are common element for the hypothalamo-pituitary-gonadal (HPG) and hypothalamo-pituitary-adrenal (HPA) axes. Orexins A and B arise as a result of post-translational cleavage of common prepro-orexin (PPO) precursor. Orexins act through membrane receptors type 1 (OXR1) and type 2 (OXR2), which are members of the metabotropic superfamily of receptors coupled with G-proteins. Orexin A is a ligand for OXR1, whereas OXR2 binds both proteins. Prepro-orexin, orexins and their receptors were found in several tissues (including ovaries, testes and adrenal glands) in humans and different animal species, but never had been examined in the beaver. The European beaver (*Castor fiber*) is a protected species in the European Union, and its legal status is prescribed by international law. Legal protection supports species survival, but it also limits the range of scientific inquiries into biology of beavers. Although the beaver remains a poorly investigated species, it is an attractive experimental model. Beavers have never been domesticated, and their physiology has not been changed by the domestication process. Also the role of orexins hormones in the beaver remains unexplored. The presented studies will provide valuable information pertaining to the prepro-orexin and orexin receptors presence in the lowest element of HPG/HPA axes (gonads, adrenals) of the beaver. The aim of our study was to examine the expression of prepro-orexin, OXR1 and OXR2 proteins in gonads (ovaries and testes) and adrenal glands of the European beaver using Western blot. The tissues were harvested post-mortem from both male and female (including pregnant and non-pregnant) beavers, during reproductive season (April). Isolated proteins were electrophoreticaly separated and transferred to nitrocellulose membrane. Afterwards blots were incubated with relevant polyclonal primary antibodies (anti-PPO, anti-OXR1, anti-OXR2; internal control was β-actin) and secondary antibodies conjugated with alkaline phosphatase. Blots were visualised by staining with NBT/BCIP complex. Our study has shown, for the first time, the presence of prepro-orexin, OXR1 and OXR2 proteins in gonads (ovaries and testes) and adrenal glands collected from both female and male beavers during reproductive season.

Keywords: *Orexsins, Prepro-orexin, OXR1, OXR2, Beaver*

Mortality of Eurasian Beaver (*Castor fiber*) in Serbia

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Almost a century after the initial disappearance, the Eurasian Beaver was reintroduced in Serbia in 2004-2005. Total of 75 individuals was introduced to localities Zasavica and Obedska Bara. The reintroduction was immediately followed by population monitoring, which included monitoring of beaver mortality as its integral part. The used monitoring parameters included number of dead animals, cause of death, time (season) of death, age structure (juveniles, subadults or adults) and origin of each dead animal (Zasavica, Obedska Bara, or immigration from neighboring countries Hungary and Croatia). The causes of death were further classified into 5 categories: diseases (infective, parasitic or degenerative), accidents (traffic collisions, drowning in fishing nets), illegal shooting, predators and undetermined causes. Altogether there were 32 dead beavers included in this analysis. 13 out of 75 beavers reintroduced to Zasavica and Obedska Bara were found dead. There were on average 3.44 (3.44±1.33) deaths per year in the period 2004-2012. The main causes of death of beavers in Serbia were accidents (37.5%), diseases (31.2%), illegal shooting (6.2%) and predators (3.1%). Cause of death could not be precisely determined for 7 animals (21.9%). In regard to the seasonal aspects, the greatest mortality was recorded in spring (43.7%), followed by winter (21.9%) and autumn (18.7%) while the lowest mortality was recorded in summer (15.6%). In regard to the age structure, the greatest mortality was recorded in subadults (46.6%), followed by adults (36.6%) while the lowest mortality was recorded in juvenile beavers (16.6%). Out of 32 recorded dead beavers, just above one half (18) was found at Zasavica or have originated from beavers introduced to this locality (56.2%). There were 11 (34.4%) dead beavers recorded at Obedska Bara or originating from the individuals introduced to this locality. Three dead beavers (9.4%) recorded at the far north of Serbia (Bačka) had originated by immigration from neighboring countries. Analysis of mortality indicates a relatively low death rate for Eurasian Beaver in Serbia, while the causes of death were mostly natural factors (diseases, parasites, infections, predators). The anthropogenous factors (traffic accidents, drowning in fishing nets, illegal shooting) were participating in beaver mortality in smaller extent (43.7%).

Keywords: mortality, Eurasian beaver, reintroduction, natural factors, anthropogenous factors

Present day situation with Canadian and European beavers in the European North of Russia

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The European North of Russia is currently inhabited by 2 beaver species-the Canadian and the European. The Canadian beaver population, which has occupied most of Finland, Karelia and part of the Leningrad Region, descends from 7 animals brought to Finland from the USA in the 1930s. Later on, the species was released also within the above regions. European beavers have been released in all northern regions of European Russia but for Karelia. The main sources of the dispersal were the Voronezh and Smolensk Regions and Byelorussia. Current Canadian beaver abundance has been estimated at 12000 animals in Karelia, and 1000 in the Karelian Isthmus, Leningrad Region. According to our counts, European beaver abundance in Karelia is 4000 animals, the number in the Murmansk Region being only 30. Experts have estimated the abundance of this species in other regions of the study area to be: 23000 in the Leningrad Region, 25000 in the Novgorod Region, 17600 in the Pskov Region, 21000 in the Arkhangelsk Region, 32600 in the Vologda Region. In the south of Karelia European beavers now live in the sites where Canadian beavers had been released, i.e. the former species has replaced the latter. The smallest distance between colonies of the two species in the south of Karelia is 10 km. In the north-east of the republic, on the contrary, the Canadian beaver has reached into the Arkhangelsk Region, and appears to be rapidly spreading into the European beaver range. The new species has already been sighted in the Arkhangelsk Region 30-40 km east of the border with Karelia. The questions of highest importance are the processes that take place where the two beaver species meet, and the mechanism of the replacement of one species with the other.

Keywords: Canadian and European beavers, present day number, interrelations

Physiological heart murmurs in isoflurane anaesthetised Eurasian beavers

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Cardiac examinations were performed in twenty-seven European beavers (25 Norwegian and 2 Bavarian) anaesthetised with isoflurane (Isoflo® Abbott Animal Health) in 100% oxygen. A full examination of the cardiovascular system was performed in all animals, with arterial blood pressures measured using non-invasive technique, six lead electrocardiographs recorded and comprehensive Colour Doppler echocardiographic examinations according to guidelines published for other mammalian species. A high incidence of heart murmurs was evident in the examined population (26/27), with intensities of murmurs ranging from grade I/VI to grade IV/VI. The point of maximum intensity of these murmurs was on the left side of the thorax in 25/26 and was in the cranial parasternal region in 20/25 of these. In the other 5 the murmur was heard loudest over the left apex but radiated cranially to the left heart base. These murmurs were also frequently audible on the right (15/25). In a single animal the murmur was heard loudest over the right heart base. No evidence of heamodynamically significant structural heart disease was found in the majority of the examined beavers (25/27). The murmurs evident in these animals were attributed to turbulence in the main vessels exiting the heart ("flow" murmurs). The authors conclude that physiological or "flow" murmurs are common in isoflurane anaesthetised European beavers. Significant structural heart disease on the other hand was not common in the examined animals.

Keywords: Eurasian beaver, echocardiographic examinations, heart disease, murmurs

European Beaver Spring

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In 2011, conservationists of Western Europe decided to organise an event to raise awareness of the European beaver: The Beaver Spring was born (Printemps des castors, Bever Voorjaar, Biberfrühling). The event, which started with a project by the regions of northern France and Belgium, has rapidly expanded throughout France,Germany, Switzerland and Scotland. It shows the interest of conservationists for European beaver. From Scotland to Switzerland events, free lectures and field trips were organized by the specialists of the specie. The French Mammal Society (SFEPM), Pro Natura in Switzerland, The Scottish Beaver Trial and Virelles Aquascope in Belgium decided to renew the event in their Countries in 2012 for 2nd Beaver Spring. More than 60 actions were organized in 2012 throw West Europe. New partners like Naturpark Dubener Heide in Germany joined us this year. Spring activities on European beaver could be including in "Beaver Spring" everywere in Europa. A website create link with main partners. Actual website www.printempsdescastors.fr will be transferred to www.beaverspring.eu. The Beaver Spring is a new tool to inform on the preservation of the species and aquatic mammals in general all over Europe. Above all, it creates the opportunity to present the very important role that the European Beaver may have in the restoration of wetland biodiversity throughout Europe. New Europeans partners are welcome for the 3rd Beaver Spring in 2013. There's decided that every year, from 20 of March to 20 of June, all beaver's conservationists could participate across Europe to "Beaver Spring".

Keywords: European Beaver, New awareness Tool, European partnership, European event

GPS-aided mapping of Eurasian beaver (*Castor fiber*) territories in southern Norway

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Understanding how territorial animals use space through time is crucial for understanding population and territory/border dynamics. Recent studies on the spatial ecology of both marine and terrestrial vertebrates have benefited from the use of Global Positioning Systems (GPS). In this study we used GPS technology for the first time on the Eurasian beaver (*Castor fiber*). The use of GPS collars on beavers has been impeded by constraints involving the beaver's anatomy (especially their short neck) and the need for a robust and waterproof housing. Here, we used a novel glue-on technique to attach archival GPS units to beavers, which reduced the risk of injuries. We attached GPS systems on dominant individuals (males and females) in Telemark county, southern Norway. GPS systems were deployed for periods of up to four weeks with a sampling rate of 15 minutes from 7 pm to 7 am, resulting in approximately 200 to 800 locations per animal. Territory sizes and nightly distances travelled were analysed with ArcMap 10. Moreover, we investigated differences in territorial behavior within mated pairs. We discuss different methods for calculating territory sizes and territory use. Territory overlap between neighbours was small and mated pairs shared the same territories. GPS technology allowed beaver territories to be defined with high precision, thus providing a better understanding of the spatial behaviour of beavers. Remote sensing facilitates monitoring animal movements with only minor disturbance, thereby minimizing possible observer effects.

Keywords: Eurasian beaver, GIS, GPS, dominant individuals, territory size, spatial behaviour

Do beavers affect the ecological status of Swedish streams?

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In the pre-industrial period, beavers were dominant ecosystem engineers in many European running water ecosystems. However, scientific study of their environmental effects has been limited due to their continent-wide decline during the 1800s. Presently, beavers are recolonizing Sweden, following their re-introduction in the 1920s. Beaver dams alter the amplitude of water level fluctuations, and affect the continuity of waterbodies, though quantitative information on these effects is limited. The magnitude of these effects has implications for the definition of reference conditions in classification schemes of ecological status. In particular, the Water Framework Directive (WFD) aims to achieve at least good ecological status in all European waters by the 2015. Here, we compared the present ecological status of Swedish beaver streams (n=192) with the status of non-beaver systems (n=1615). Non-beaver systems were located within a 10 km distance from the beaver systems. We did not find any differences in the ecological status when comparing beaver and non-beaver systems. There was a trend for higher hydromorphological status in the non-beaver systems compared to the beaver systems. Our study stresses the importance of reconsidering the criteria for defining reference conditions according to the WFD. So far, it seems that the impact of beavers, that were important features in streams in pre-industrial periods, have not been considered in these definitions. Taking into account our results on the hydromorphological status, we suggest, that the differences and commonalities between beaver dams and small-scale hydropower dams (one of the most-important reasons for less than good hydromorphological status in Sweden) need to be studied in more detail.

Keywords: biological status, hydromorphological status, Sweden, Water Framework Directive

Animal health screening protocol for the trial reintroduction of beavers to Scotland

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As part of the government sanctioned trial reintroduction of Eurasian beavers (*Castor fiber*) to Scotland, 16 wild caught animals were imported from Norway. Importation of wild mammals to Britain is subject to strict quarantine process and given the high profile nature of the trial the animals were subjected to a thorough health screening process. Despite numerous beaver reintroduction projects across Europe there is no published information concerning recommended health surveillance for this species. The health screening protocol developed here has been based on International Union of Conservation of Nature (IUCN) and Scottish governmental guidelines for mammal imports, it also took account of concerns raised in the public consultation for example *Giardia*. Each individual underwent at least one general anaesthetic to enable thorough clinical examination, including eyes, ears and teeth, faecal and blood samples were collected. No bacterial enteric pathogens including *Salmonella* spp., *Campylobacter* spp. or *Yersinia pseudotuberculosis* were isolated, nor was *Giardia* spp. or *Cryptosporidium* spp.. Numerous helminths such as *Travassosius rufus* and *Stichorchis subtriquetrus* were detected. Five animals were seropositive for leptospirosis antibodies. Any dead animals underwent a full post mortem examination. The highest loss of animals (20%) occurred during the statutory six month rabies quarantine period; however no common cause of death was determined. After consultation with the Scottish Government rabies quarantine conditions were wavered for four further imported animals. The authors recommend a short as possible quarantine period when introducing beavers but allowing for the minimum recommended IUCN 35 days to enable examination of animals, sample collection and sample analysis.

Keywords: Eurasian beaver, Scotland, reintroduction, health screening, helminths, leptospirosis, rabies

A cultural history of beaver restoration in Britain

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The Eurasian beaver (*Castor fiber*) was once distributed throughout the British Isles. Bounty records suggest that the last individuals may have survived until 1780. The idea of reintroducing beaver to Britain is not new and has been recommended by various individuals or organisations over the last 100 years. The most modern nature conservation programme to reintroduce the beaver began in 1994 and took until 2008 to obtain a licence. Several enclosed populations of beavers were established between these times and some of these escaped to form what is now the largest free-living population of beavers in Britain, on the Tayside catchment, east Scotland. The whole process although in part driven by legislative process has also in part been moved on by accident, political and public pressure. It has commonly been affected profoundly by random events some of which have provoked widespread humour from the media. Lobbying against beaver restoration by land-use pressure groups, political collusion with their interests, and internal opposition from sectors of government have all presented major barriers to progress. A lack of resolution from government conservation agencies and conservation charities has also slowed this process. Public support has been strong and this has been accompanied by popular media coverage. Actual progress has been slow and recognition that practical relationship building with other land-users has been lacking in parts. Despite this beavers are now gradually establishing in Britain in part from clandestine releases as a result of frustration with official progress. This poster will explore the themes, issues and humorous history associated with the process of bring the beaver back to Britain.

Keywords: Eurasian Beaver, Reintroduction, Britain

Analysis of beaver losses in Croatia

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Losses of individuals from a population that lives free in natural habitats are a common thing. Number of registered mortalities is also increasing, proportionally to the increase in population numbers and spatial spread. Tracking and recording losses was constituent part of beaver monitoring in Croatia through past 15 years. In the first 10 years losses were insignificant and numbered from 1 to 4 cases in a year. After first 10 years with population increase the number of beaver losses rapidly increased to 17 recorded cases in 2008. According to conducted analysis most beaver losses have happened to anthropogenic influences, where traffic is dominant (running down beavers in the roads) with 33% participation in total losses, followed by other causes (deaths from unknown causes, poisoning, predators, dogs) with 30% and consequences of illegal net fishing as well as illegal hunting with 25% participation. It is significant to say that on construction sites within the ecosystem 5 beavers were killed from working machines as well as in objects in which they fell into and stayed trapped (concrete buildings, pools, etc).
Knowing the causes of beaver deaths demands certain measures of protection. Therefore in the past period certain steps were taken with the goal of preventing beaver losses:

- setting up wire meshes to prevent beavers from entering roads
- increased fishing control with standing meshes
- setting up exit ramps on buildings in which beavers can fall into and can't manage to get out (mills, weirs, etc.)

Keywords: beaver losses, anthropogenic, mortality, prevention

The importance of beaver (*Castor fiber* L.) for preservation of small streams

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Beavers are known as one of the "greatest constructors" in animal kingdom. Their building skills don't just result in creating imposing structures (lodges and dams), but also have the impact on the habitat respectively on the ecosystem. Our first surveys of these structures and their impact on the ecosystem started when beavers (*Castor fiber* L.) made their first dams on Croatian territory. Special attention was given to dams on smaller streams, which have a very low flow or even droughts during summer.
What is the significance of structures that beavers build on small streams?
Primarily, a major contribution of beaver dams is retaining water in the lakes that are essential for the conservation of aquatic and wetland ecosystems. The second role is providing water for the entire fauna around the lake. In this way beavers provide their basic requirements essential for their staying on the same site.
Analysis of beaver dams and accumulation have shown that with very small dams (or series of dams) level 30-40 cm and a width of 5-8m, in which they incorporate only 1-2m^3 of material, beavers create a series of lakes which then generate the basic living conditions and accumulate 40-50m^3 of water. On narrow streams beavers typically raise more dams that are up to 2 m high, 8-10(15)m in width which incorporate 20-50m^3 of material while the lake reaches capacity between 400m^3 and 3000m^3 of water depending on the length, or trough decrease.
Otters appear regularly on such lakes, due to the favourable conditions that are created for fish, bivalves and crustaceans. Storks are always present along the lakes and there is also increased number of wild ducks (waterfowl in general).
Due to the very intensive stream regulation that is being done nowadays, beaver activity plays a crucial role in the survival and conservation of flora and fauna of small streams.

Keywords: small streams, beaver dams, ecosystem

Long-term dynamics of number of European beaver (Castor fiber) on the territory of Berezinsky Biosphere Reserve

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One of the priorities posed to Berezinsky Reserve (the pristine name-Hunting Reserve on the river Berezina) organised in 1925 was conservation of small indigenous population of beaver inhabiting by the beginning of 1920th the upper courses of Berezina and its inflows. The quantity of beaver settlements on the territory of the Reserve did not exceed two dozen. Less than 100 individuals inhabited them. At present by an approximate estimate on the territory of the reserve can be located up to 550-600 settlements of beavers. Number of individuals living in them estimates in 2400 - 2600 individuals. Taking as a starting point 1925, we evolve in dynamics of Berezinsky population 13 consecutive stages. Each of them can be characterised by growth, stable state of number, or its droop. The majority of dynamic changes has been caused by the economic and other human activities carried out on the territory of the Reserve and invoking structural rearrangements in key habitats of the species. The most essential anthropogenic influence on the population of beaver appeared in 1941-1944 in mass partisan warfare during the Second World War. Not less destructive were also 1951-1958 when the Reserve has been abolished, and on its former territory reacted a number of timber enterprises which were engaged in cutting of trees and their alloy across Berezina and its inflows. In these periods quantity of beaver settlements and animal number decreased more than twice. For increasing of beaver number observed since 2003 an essential role have played economic and nature protection factors and changes in forage supply structure of the species during past 10-15 years on the territory of the Reserve. In 1990th penalties for illegal extraction of beaver and ruining of its settlements have become tougher in Belarus. Actually, the status of this species has appeared to be close to the status of endangered. Simultaneously, thanks to appearance in the market of a considerable quantity of cheap Chinese production, demand for furs and a skin of animals has fallen and it has made hunting for the beaver economically inexpedient and has sharply reduced poaching. In Berezinsky reserve on which territory some human settlements are situated, after dissolution of Soviet Union the steady tendency of decrease of livestock in private farmsteads is observed. In this connection in flood plains of Berezina and its some inflows depasturage of cattle and mowing are completely stopped. An overgrowing of bottomland meadows and haymakings by bush and a young stand of trees is observed. It has raised an appraisal of beaver sites and has created new localities for animals. As a whole modern number of the beaver the Reserve's territory can be characterised as reached maximum values. The basic restrictive factor for its further growth is absence of free grounds, applicable for building of new settlements.

Keywords: Castor fiber, dynamics of number, Berezinsky Reserve

Genetic evidence for the origin of the current beaver population in Lower Austria

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More than 30 years after a successful reconquest the origin and genetic status of the recent beaver population in Austria is still under discussion. The known history of reintroduction shows that between 1976 and 1988 about forty individuals of *Castor fiber* mainly from Poland, Russia and Sweden have been released east of Vienna to the Danube watershed, but it is also mentioned that this stock included twelve North American Beavers *Castor canadensis*. Previously published results and investigations of more than 100 life trapped or dead beavers since 1997 showed no evidence that *C. canadensis* has successfully established or survived in the overall rapid expanding Austrian beaver population. During the last 10 years increasing conflicts with landowners and different interest groups (e.g. agriculture, forestry, fishponds, hydraulic engineering) forced the implementation of a beaver conflict management in Lower Austria where derogation rules from the strict protection of the species according to the European legislation (FFH, Habitats Directive) allow the trapping and killing of beavers under controlled conditions on locally restricted sites. A monitoring system was established to collect morphometric data as well as organic material from all under derogations killed individuals for further studies including genetics. So far 124 tissue samples from 47 Lower Austrian locations widely distributed over this federal state have been chosen for more detailed investigations. Based on this comprehensive sampling, our first aim is to document and to verify the genetic origin of the Lower Austrian beaver samples. Mitochondrial DNA sequence data will be used to confirm species affiliation of individual samples (i.e. *C. canadensis* or *C. fiber*), as well as to uncover regional origin of European Beavers currently present in Lower Austria. Outcome of these genetic analyses will be presented here. In the future, molecular results obtained will also be used assessing family size and for the identification of the relationships between individuals with respect to range size and patterns of dispersal.

Keywords: beaver management, *C.fiber, C.canadensis*, genetics, Lower Austria

Adaptation and behaviour of European beaver (*Castor fiber* L.) at Semešnica river conditions

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As a first locality chosen for beaver re-introduction in Bosnia and Herzegovina, Semešnica River with total flow length of 18 km belongs to category of typical Dinaric mountain rivers in Bosnia and Herzegovina. Semešnica is situated at central Bosnia and it is tributary of Vrbas River. Considering harsh climate conditions, especially during winter, altitude and typical mountain habitat surroundings, we analyzed and discussed beaver adaptation and behavior as well as families' home range and current numbers.

Keywords: Semešnica, habitat, adaptation, behavior

Impact of beaver ponds on migration of nitrogen and phosphorus via drainage ditches in agro-landscapes, Lithuania

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The drainage ditches collect and discharge water from subsurface drainage systems and surface runoff in rural territories. Thereby ditches collect the diffused source pollutants, nitrogen and phosphorus therein, and right here-in the ditches-the migration of those nutrients originates through a fluvial network. During their downstream migration, both nutrients are cycling between their organic and inorganic forms. The interaction then takes place between those processes and physical properties of the stream. When beavers dam a stream, the increase in water depth followed by slowdown in flow velocity usually occurs resulting in the more active process of deposition of suspended sediment and changes in the temperature and insolation conditions of the water column. Numerous literature sources demonstrated beaver impoundments are the spots where the organic matter is being stored and nutrients are being retained. However, a lack of knowledge exists about the migration of nutrients via the beaver obstructed drainage ditches; though the ditches differ from the natural streams drastically in their geometry, functional purposes, and ecological capacity. The concentrations of dissolved inorganic nitrogen (DIN ≈ (NO_3-N) + (NH_4-N)), and P-PO_4 as well as biochemical oxygen demand (BOD_7) were surveyed in various beaver-inhabited drainage ditches upstream and downstream of, and in the beaver ponds. The investigation was conducted all year round and lasted several years. Totally more than 400 water samples were analysed. The level of pollution of the surveyed ditches ranged widely approaching for DIN up to 26.7 mg/l (*CV*=0.72), for PO_4-P up to 2.20 mg/l (*CV*=2.22), and for BOD_7 up to 31.9 mg/l (*CV*=1.08). The results demonstrated that the seasonal dynamics of concentrations of both nutrients and values of BOD_7 in ditches, the beaver-dammed including, were virtually similar to that usually occurring in the intact natural streams: (1) after some stagnation at lower level in summer, the concentrations of both nutrients started to increase with approaching of autumn, and this increase lasted till middle of spring, then decreased again; (2) BOD_7 values, started to increase at approximately the same time as nutrients did, however maximum BOD_7 values were observed in December, then the decrease lasting till autumn followed. In beaver ponds and immediately downstream of them, the concentrations of both nutrients were less than those in ditches upstream from beaver ponds all year round. The mean yearly differences approximated to 16 % for DIN and to 40 % for PO_4-P (p<0.05). There was some increase in the mean yearly BOD_7 values in beaver ponds (14 %; p<0.05), but no significant difference by these values was found between samples immediately downstream and upstream of the beaver ponds. We estimate that the increase in either the length of dammed ditches by 10% of total fluvial network or the density of beaver-sites by 0.1 ps./km^2 could additionally stop from downstream migration about 100–120 kg of DIN and 4–6 kg of PO_4-P from every sq. kilometre of the catchment.

Keywords: beaver ponds, drainage ditch, nitrogen, phosphorus, impact

The Aigas Beaver Demonstration Project

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In April 2006 Aigas Field Centre established a beaver demonstration project. Prior to the Aigas Beaver Project, beaver reintroductions had been discussed by the UK and the Scottish governments for over 15 years. In 2005 a reintroduction trial was due to start in Knapdale, Argyll, but the licence for the trial was turned down. At the time it appeared that beaver reintroductions were going nowhere. After consulting many beaver experts and as a member of the Scottish Beaver Network, Aigas decided to release two European Beavers *Castor fiber* into a 200 acre wooded wetland and loch enclosure situated on the grounds of Aigas Field Centre. The project aims are not to reintroduce beavers, but to demonstrate to the public and authorities the benefits that beavers can bring to Scotland's natural heritage. This has been achieved through environmental education, monitoring the beavers, measuring the biodiversity and allowing visitors to observe beavers in their natural environment.

Keywords: Aigas, demonstration project, reintroduction, environmental education, biodiversity

Genetic analysis of beavers (*Castor* sp.) in the greater region of Belgium, Luxembourg, northern France and Western Germany

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After the discovery of a North American beaver (*Castor canadensis*) in Luxembourg in 2006 based on Anal Gland Secretion (AGS) colour, research was carried out to estimate the invasion level of this alien species in the greater region. Species identification on as many beavers as possible was therefore carried out throughout this area. These identifications were performed using genetic methodologies (sequencing of a fragment of the cytochrome b mitochondrial gene and autosomal microsatellites) on the basis of tissue samples collected on dead beavers and from hair sampled using non-invasive methods. The obtained results confirmed the presence of the North American beaver in Eastern Wallonia, Luxembourg and in the German regions of North Rhine-Westphalia and Rhineland-Palatinate region, but not in northern France. The prevalence of this species was particularly high in the German region of Rhineland-Palatinate, suggesting a possible origin in this region. Moreover, the genetic data also showed a very low level of genetic variability in the analyzed animals, suggesting that this North American beaver population was founded by very few individuals. Concerning the Eurasian beavers (*Castor fiber*), the analyses evidenced the presence of at least three different subspecies (*C. f. galliae*, *C. f. albicus*, *C. f. fiber*) in Belgium, Luxembourg and Western Germany whereas Northern France seems inhabited by a single one (*C. f. galliae*). The presence of different subspecies is the result of different reintroductions performed from different European regions. The results of this study are extremely useful for developing the best management measures of the greater region's beaver populations.

Keywords: *Castor canadensis*, *Castor fiber*, genetic species identification, subspecies, management

Digestion of structural and storage carbohydrates by beaver (*Castor fiber*)

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Beavers are one of the least studied rodents in Europe. Their diet consisting of plant material rich in storage and structural carbohydrates. The utilization of such food require of enzymes suitable for digestion of this saccharides. However, the lack is the information concerning the ability to digest storage and structural carbohydrates in digestion tract of (*Castor fiber*). The aim of this study was to measure the hydrolytic ability of beaver to digestion of carbohydrates. The animals used in these studies were delivered from North East districts of Poland. The beavers were euthanized according to standard procedure. The digestive tract was isolated and separated on stomach, small intestine, caecum and colon. Each of part was emptied by gentle squeezing. Contents of individual portions were weighed and stored at-20^0C. The enzymes were extracted from digesta by Huttanen and Khalili method (1992). The ability for digestion of carbohydrates was determined according to Miller et al. (1960). Digestion of disaccharides was measurement by GLUKOSE OXY kit (Pointe Scientific) or by Yem and Wu method (1976). The results studies revealed that beavers possess ability to digestion of storage carbohydrates (inulin and starch), structural carbohydrates (pectin, cellulose, xylan) and disaccharides (cellobiose, maltose, xylobiose, saccharose)-see below.

Table: the degradation rate (mg released product /g digesta per h) of the plant carbohydrates in digestive tract *Castor fiber*. Mean values (n=3).

Carbohydrates	Degradation rate	Part of digestive tract
Inulin	2.4	caecum/colon
Starch	59.0	small intestine
Pectin	2.2	caecum/colon
Cellulose	2.7	caecum/colon
Xylan	5.7	caecum/colon
Cellobiose	0.4	caecum/colon
Maltose	22.5	small intestine
Xylobiose	9.4	caecum/colon
Saccharose	6.1	small intestine

Keywords: European beaver, digestion, digestion tract, carbohydrates

A survey on the European and International Beaver Symposiums (EBS/IBS) from 1997 to 2009

Nitsche, K.A.[1]
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1997: 1st European Beaver Symposium, Bratislava, Slovakia, September 15-19, 1997. Comenius University Bratislava, Institute of Ecology, Faculty of Natural Sciences & Slovak Zoological Society. Location: Comenius University Bratislava. Excursion: Danube flood plains. Organizers: Karol Pachinger, Karl-Andreas Nitsche. Participants: 42. Countries: 17 - Austria, Belarus, Croatia, Czech, Denmark, Finland, Germany, Hungary, Latvia,Lithuania, Netherlands, Norway, Poland, Russia, Slovakia, Switzerland, USA. Abstract papers: 34. Proceedings: 19 articles, 24 abstracts.
2000: 2nd European Beaver Symposium, Bialowieza, Poland, 27-30 September 2000. Jagiellonian University Krakow, Carpathian Heritage Society. Location: Mammal Research Institute, Polish Academy of Science, Bialowieza. Excursion: Bialowieza Primeval Forest. Organizers: Andrzej Czech, Gerhard Schwab (pre-preparation: K.-A. Nitsche). Participants: 55. Countries: 18 - Austria, Croatia, Denmark, Finland, Germany, Hungary, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Scotland, United Kingdom,Switzerland, USA, Yugoslavia. Abstract papers: 54. Proceedings: The European Beaver in a New Millenium, 19 articles, 11 abstracts, 8 short notes.
2003: 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. Excursion: Gelderse Poort. Organizers: Vilmar Dijkstra, Peter E. Busher, Ton Bosman. Participants: 105.
Countries: 23 - Argentina, Austria, Belgium, Canada, Croatia, Czech, Denmark, Finland, France, Germany, Hungary, Lithuania, Netherlands, Norway, Poland, Romania, Russia, Serbia-Montenegro, Slovakia, Sweden, Switzerland, United Kingdom, USA. Abstract papers: 66. Proceedings: Lutra-Journal of the Society for the Study and Conservation of Mammals, Volume 46, Number 2, December 2003 – Beaver Special 20 articles, 2 book reviews, 1 preview
2006: 4th European Beaver Symposium & 3rd Euro-American Beaver Congress, Freising, Germany, 11-14 September 2006. Location: University of Applied Science, Weihenstephan. Excursion: Danube river basin, Danube shiptour Kehlheim-Weltenburg. Organizers: Volker Zahner, Gerhard Schwab, Markus Schmidbauer, K.-A. Nitsche, Peter E. Busher. Participants: 86. Countries: 20 - Austria, Belarus, Belgium, Bosnia-Herzegowina, Canada, Croatia, Czech, Denmark, Germany, Lithuania, Norway, Poland, Romania, Russia, Serbia, Slovakia, Sweden, Switzerland, United Kingdom, USA. Abstract papers: 61 (23 lectures and 38 posters). Proceedings: no**t** published.
2009: 5th International Beaver Symposium, Dubingiai, Lithuania, 20-23 September 2009. Location: Seminar and Conference Centre Dubingiai. Excursion: 5 beaver sites and geographical Centre of Europe. Organizers: Alius Ulevičius, Algimantas Paulauskas, Peter E. Busher, K.-A. Nitsche. Scientific Committee: Peter E. Busher, Glynnis Hood, Alexander Saveljev, Vadim Sidorovich, Michael Stubbe. Participants:105. Countries: 22 - Austria, Belarus, Belgium, Canada, Croatia, Czech, Denmark, France, Germany, Latvia, Lithuania, Luxemburg, Netherlands, Norway, Poland, Romania, Russia, Serbia, Sweden, Switzerland, United Kingdom, USA. Abstract papers: 56 (36 lectures and 33 official posters). Proceedings: no published.
Abstracts 1997-2009: 271 Publications 1997-2009: 102 Short notes, book reviews 1997-2009: 10

New data on number of beavers in upper reaches of Sura river

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[1]*State nature reserve "Privolzhskaya lesostep"*

The studies were carried out in Penza region (Russia) in the Park "Privolzhskaya lesostep". The place is a source of the Sura river (Middle Volga basin). We used the method for determining the number of beavers on the capacity of the settlements. In recent years, as a result of building activity of beavers, many waterways of the reserve turned into a continuous cascade of ponds. In 1996, as accounted on the place, were noted seven families, and the total number of animals does not exceed 30-35. According to the calculations of beavers, performed in autumn 2008 on "Verhov'ya Sury" and its buffer zone, found 25 settlements of beavers with 165 beaver dams, and the total number of beavers in the area was estimated in 96 individuals. In 2010 the number of settlements was reduced to 19. The number of existing dams was also decreased to 158, and the beaver population was estimated by us in 72 units, which is lower by 24 than it was in 2008. In 2011 there were 18 settlements on the place with 74 animals. The number of existing dams was reduced from 158 to 129 pcs. Despite the reduction in the number of settlements from 19 to 18 (due to a one settlement on the Sura river) beaver population was slightly increased, which can be explained by favorable vegetative season in 2011. In the 2010 because of drought beavers were built dams intensively, trying to keep the water level somehow, as evidenced by the large number of dams. In the following, more favorable year construction activity was not so active, and the number of dams immediately reduced by 29 pcs. The largest number of dams discovered on Rucheleyka river in 2010 (64 pcs.) was decreased by more than 2 times in 2011. Beavers have gone from the lower reaches of the Pyatiyamnyj river. The settlement located in the upper reaches of the rivulet has been reduced. In 2009 there were 16 alive dams, in 2010-12, in 2011-only 7. There are two major factors which can reduce the number of beavers. This is an abnormally hot summer of 2010, the results of which were traced in 2011, and the declining food supply, as evidenced by the food spectrum (low-calorie alder and bird cherry are prevailing in beavers food spectrum). As indirect factor may act a press of predators. According to the inspectors, the beavers often hunted by the wolves. In the future we should expect to further reducing of the number of beavers and stabilization of its population.

Keywords: Castor fiber L. beaver, small rivers, protected areas

Finding a viable non-lethal method of screening Eurasian beavers (*Castor fiber*) for *Echinococcus multiloccularis*

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Echinococcus multiloccularis (EM) is an important pathogenic zoonotic parasite of serious health concern in Europe. There is currently no single definitive ante-mortem diagnostic test in any intermediate hosts. In human medicine, clinical diagnosis can be challenging, but relies on combinations of imaging modalities such as ultrasonography, computed tomography (CT), or magnetic resonance imaging (MRI), serology, nucleic acid detection, and histopathology. EM is established in countries in central Europe, while countries such as the UK and Norway are currently regarded as free from *EM*. The Eurasian beaver originally occurred widely throughout Britain, with the last extinctions occurred in Scotland in the 16th century. The first formal trial reintroduction of Eurasian beavers to Britain took place in Mid-Argyll, Scotland beginning in May 2009 (Scottish Beaver Trial). This trial release followed strict OIE and IUCN guidelines on quarantine and health screening prior to translocation of wildlife. Outside of this formal licensed process there have been unlicensed escapes or releases of Eurasian beavers, with wild populations now appearing established in UK. A captive Bavarian origin beaver was diagnosed at post-mortem with *EM* in England in 2010, highlighted the risk posed by beavers to the establishment of *EM* in the UK. Free ranging unlicensed beavers have already been present in the UK for many years. Founder first generation animals may have died, and it remains possible that the disease may have already been transmitted to primary hosts. Sourcing of animals for any future releases should of course ideally be from regions free of this and other notable diseases, or by only releasing second generation UK captive breed individuals, as well as following OIE and IUCN guidelines. Currently the Norwegian beaver population is officially free of *EM*, however, *EM* has recently been found in Sweden in foxes less than 65km from the Norway. It is possible that in time the Norwegian population may cease to be regarded as *EM* free. As in humans, a combination of different ante-mortem diagnostic modalities holds the best potential for efficient disease screening in beavers. In beavers reasonable ultrasonographic imaging is possible without the need for clipping of fur minimising the impact of this modality on water-proofing and insulation after release, however due to the beavers voluminous gastrointestinal tract containing gas, it may not be possible to completely visualise the liver, or parts of other abdominal organs on occasion. Minimally invasive laparoscopic examination of the liver and other abdominal organs has been performed in beavers, under field conditions. Negative visual findings also correlated with negative blood ELISA testing. In two individuals, later post-mortem examinations failed to demonstrate any gross pathology not visualised on laparoscopy. Laparoscopy only necessitated a 1-2cm x 10-15cm ventral midline fur clip, and two 3-5mm skin punctures. Ante-mortem screening of beavers, by means of combined ELISA blood testing, abdominal ultrasound, and laparoscopy, may provide a viable method of ante-mortem screening, practical in the field, in minimising the risk that beavers pose in establishing *EM* in the UK.

Keywords: Eurasian beaver, United Kingdom, *Echinococcus multiloccularis,* reintroduction

European beaver (*Castor fiber* L.) in Međimurje County, Croatia

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We have been told that the European beaver (Castor fiber L.) has returned in Međimurje so we have researched the behaviour of the European beaver in the old backwater of the river Drava near the village Otok in Međimurje County. Along with the field journal, we used the following equipment: keys to determine species, the field journal form, pencil, digital camera, meter (max. length is 5 m), GPS Etrex, rubber boots. We used the meter measured on trees with beaver damaged the height and the radius of the trees that had bite marks. The most bites were recorded on the black alder (52.34 per cent) and common willow (37.97 per cent). The number of damaged trees reduces as the distance from the shore increases, and the activity was recorded up to 17m from the shore. From all the recorded trees where the activity was noticed, three fifths were knocked down and two fifths were only damaged. On the basis of the age of the bites, we can conclude that the family was the most numerous in 2007/2008, because we have noticed the biggest activity on trees from that period. European beavers (*Castor fiber* L.) especially like to bite young trees with the diameter from 6 to 9 cm. Bites on knocked down and damaged trees are mostly at the height of 30 to 70 cm. We have not found any dams in the research area.

Keywords: European beaver, den, bite

Research of Eurasian beavers

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[1]*Voronezh biosphere reserve, Voronezh, Russia*

In 2011 were executed 100 years from the date of a birth of outstanding scientist-biologist Leonida Sergeevicha Lavrova. He has devoted all life to research of river beavers (*Castor fiber*) to Eurasia. The beaver in Russia was considered as a vanishing species to the beginning of the 20th century. Have been found out colony of river beavers by number 50 animals in the beginning 1920-ht years on the rivers Usmen and Ivnitsa (the Voronezh region, Russia). Voronezh reserve has been formed for protection of beavers in 1923. Reserve had a problem to restore number and the former area of the river beaver. In reserve have created skilled beaver's farm for studying of biology and ecology of the beaver in 1932, which functions and now.

Leonid Sergeevich Lavrov has worked in the Voronezh reserve more than 56 years (1935-1991). He became managers of the first in the country a farm of the beaver in 1939. Leonid Sergeevicha's scientific activity is devoted studying of beavers, their maintenance and cultivation in the conditions of bondage. It has developed methods of service of beavers cages of the various device. Leonid Sergeevich has studied anatomy, physiology and ecology of the beaver, features of reproduction and development of this animal. Russian and foreign scientists tudying of illnesses of beavers are spent and measures of their treatment and preventive maintenance are developed. Under the direction of Lavrov L.S. diets of feeding of the beavers taking into consideration their biological features and features of age are developed, is developed. He has described new subspecies Castor. Leonid Sergeevich has visited with research expeditions on studying of ecology of the beaver and on an exchange of experience in Western Siberia, Tuva, Belarus, Azerbaijan, Uzbekistan, Mongolia, Finland, USA. He participated in conferences, congresses, the symposiums devoted to the beaver in Russia and abroad. He has protected the master's thesis in 1954 on a theme: «The Biological and zootechnical substantiation of cultivation on beavers farm». In the Voronezh reserve was VII All-Union meetings on the beaver with 1948 for 1989. L. S. Lavrov was the organizer of these meetings. Leonid Sergeevich has more than 200 scientific works, including the monography «Beavers of Palearktiki» (1981). Leonid Sergeevich Lavrov awarded (1990) the State award of the USSR «For complex researches in the field of wildlife management». Leonid Sergeevich participated in the Great Patriotic War (1941-1945) and has been awarded by fighting awards and medals. After front he has returned to beavers to the reserve and has continued the begun business. Nadejda Ivanovna Lavrova was his wife and the true companion in life and scientific work. In their family three sons grew. Business of the father is continued by Vladimir Lavrov. Vital and Leonid Sergeevicha Lavrova's career is an example of service to favourite work, a science, the Voronezh reserve.

Keywords: Leonid Sergeevich Lavrov, beaver, Voronezh reserve, beavers farm

City beavers - history and present status of the Viennese beaver population

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Roughly 100 years after the last beaver was shot in Austria a reintroduction program was started. Between 1976 and 1988 about 40 beavers were released in the eastern part of the country where the Danube floodplain forest offered most suitable habitat for a beaver resettlement. This area, nowadays dedicated as the "Donau-Auen National Park" is partly located within Viennese city limits. During the 1990s the population size increased considerably and beavers started to colonize the close by located urban habitats including recreation areas as well as artificial watercourses in major numbers. Over time more frequent resightings and encounters between beavers and citizens took place and raised the overall awareness about potential conflicts in the public domain. An update of the available data referring to previous surveys was planned and a mapping of the recent beaver colonies in Vienna was carried out during winter 2011/2012. Data examination showed that 57 beaver territories were located in Vienna (excluding the National Park area). 41 colonies were defined to hold families and 16 territories were occupied by pairs or single beavers. Based on a number of 5 animals per family and 1.5 animals per single/pair, a total of 229 individuals was estimated. 11 beaver colonies have been the result of the first census within the city limits of Vienna in the winter 1997/98. Five years later (2002/03) the number doubled (23 territories) and until 2005/06 there was only a slight increase of 29-32 territories counted. The 2011/12 winter survey showed that during the last six years the Viennese beaver population was still expanding. Anyway, the so far available and most suitable habitats seem to be occupied nowadays, therefore any further expansion seems to be rather limited or completed.

Keywords: distribution, reintroduction, urban habitats, Vienna, *Castor fiber*

The influence of the beaver (*Castor fiber)* on the dragonfly-fauna (Odonata) of the Northern Eifel (West Germany)

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In 1981 a remarkable ecosystem-engineer, the European beaver *Castor fiber*, returned to the Hürtgenwald, a woodland within the state of North Rhine-Westphalia, West Germany. Ever since numerous mountain streams of this forest are inhabited by beavers. Due to their landscaping skills they adapted the environment and thereby created habitats for countless new plant-and animal species. In 2011, this process became evident during an investigation of the dragonfly-fauna within the Hürtgenwald. For this investigation, four different types of biotopes with specific criteria were selected: beaver-ponds (1), abandoned beaver-ponds (2), middle courses unaffected by beavers (3) and springs (4). For each type, a sampling site was chosen in three different streams and analysed on nine dates between April and September. The investigations showed that the number of species increased sixfold, while the density of individuals grew likewise. However, the most outstanding discovery was not only the increased number, but the composition of newly immigrated species. Dragonfly biocenosis with representatives of diverse origins and habitat preferences were discovered on all three investigated beaver colonies. Thus a coexistence of dragonflies requiring flowing water (such as *Cordulegaster boltonii*) and species depending on standing water bodies (e.g. *Ischnura pumilio*) could be observed in beaver ponds. Interestingly even pioneer species such as *Libellula depressa* occur as numerously as species like *Platycnemis pennipes*, which require water bodies in advanced succession stages. These mentioned species are just a few examples for the numerous species, which naturally would not appear within the same habitat, but which can be observed coexisting in beaver ponds. In this context, the oldest of these three investigated beaver colonies is particularly interesting. Here, mesotrophic conditions and a sufficient developing time led to the formation of marshes and quaking bogs (Shagnum). The fact, that four red list species (e. g. *Leucorrhinia pectoralis* and *Ceriagrion tenellum*) were verified in this specific colony, demonstrates the relevance of these particularly rare habitats. Their special significance becomes evident, if we focus on the distribution area of both species: *L. pectoralis* originally emigrated from the Baltic, while *C. tenellum's* main area of distribution lies in the Mediterranean Area. Regarding the rather brief presence of beavers within West Germany and their exceedingly positive effects on the dragonfly fauna, we can presume, that even more species will be observed at beaver ponds in the forthcoming decades.

Keywords: beaver ponds, dragonfly, Hürtgenwald, mountain streams, dragonfly biocenosis, species composition, distribution area

The Bavarian "Handbook for Beaver Management"

Schwab, G.[1]

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Beavers do the same as humans do: they shape landscape. When both species operate on the same patch of land, very often conflicts between man and beaver arise. To mitigate between wildlife actions and human ideas is the field of wildlife management. In Bavaria, in 1996 a beaver management was initiated to solve and obviate problems between the expanding beaver population and human land users. Meanwhile more than 200 trained volunteers (beaver consultants) and 2 professional beaver managers support Nature Conservation Agencies in dealing with beavers. During the course the years, many measures for solution of problems were tested and established, and legal regulations changed, as did state programs for funding measures and purchase or lease of land. To keep the people working in beaver management up to date with current developments I compiled a "Handbook for Beaver Management in Bavaria". The handbook covers not only basic knowledge on beaver biology, history or legal status, but also technical guidelines for implementing measures (e.g. protecting flood walls, beaver deceivers, fencing trees; including cost estimates and addresses of companies providing the materials), or presentations for public relations work. The handbook is a loose-leave system for easy updating. 300 hard copies are provided for Nature Conservation Agencies and local beaver consultants, further copies and updates are provided as an internet version. The handbook can easily be translated and adapted to support beaver management in other countries.

Keywords: beaver, Bavaria, management, handbook, manual

Protecting levees and river banks from beavers and other burrowing animals

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Beaver burrows in levees and flood walls can weaken the stability of these structures, in a worst case, they might break and cause flooding of the land behind the walls. A similar problem are beaver burrows in dams of fish ponds or under roads and other infrastructure next to bodies of water used by beavers, where people or vehicles might break in burrows. Removing the beavers does not solve the problem, as 1) the existing burrows still exist and 2) free beaver territories are reoccupied. Furthermore, many other species (e.g. coypu, muskrats, badgers, foxes, rabbits) can and do build their burrows in levees and dikes. To protect levees, dams and river banks effectively against beavers and other burrowing animals, different measures were develop in the Bavarian Beaver Management, mainly by water management authorities. These measures include enforcing levees with stone layers, putting on a layer of wire mesh on the river banks, putting wire mesh in trenches along the levees or reinforcing flood walls inside with metal sheets or bentonite walls. In my poster I present the different methods, discuss their applicability, advantages and disadvantages and give estimates of costs.

Keywords: beaver, Bavaria, management, levees, dikes, flood walls, water management

The Bavarian Beaver Re-Extroductions 1996-2012

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Exterminated in 1867, beavers (*Castor fiber*) were reintroduced into Bavaria from 1966 to the early 1980s. Meanwhile, the population has grown to about 13.000-15.000 animals in 3.500-4.000 territories. As Bavaria is densely populated and used by humans, conflicts between man and beaver using the same patches of land arose and increased since the mid 1980s. To mitigate between beaver and man, a beaver management was established since 1996. Among many others measures, removal of beavers form areas with high potential for damage caused by beavers (e.g. sewage plants, fish hatcheries) is one of the management options. Although nowadays almost all of beavers doomed to removal are killed, 919 animals could be exported alive between 1996 and 2012. They are the founders of new populations in many other countries, mainly in the Danube watershed. This makes Bavaria the biggest exporter of beavers in Central Europe. In my poster I document these exports as part of beaver's recent history in Europe.

Keywords: beaver, Bavaria, management, reintroductions, Danube, history, distribution Europe

Using camera traps to investigate beaver territory and family size

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Knowledge on beaver population size is one of the key data in beaver management. Territories can often be marked out using field signs, but reliable counting of the nocturnal animals requires lots of time and man power. We used camera traps in a first experimental project to test whether they will allow to facilitate beaver surveys by taking pictures of beaver tails. Tails can be individually distinguished by size, shape, scars and scale pattern. Distribution of tails among cameras set in beaver sites will therefore allow to delimit territories (same tails), and number of different tails in a territory will give family size. In the project, 12 camera traps (Cuddeback) were set above beaver paths for a total of 90 day in 2 areas in Northern Bavaria from August to November 2011. The traps took 790 pictures with beavers, on 502 (63%) of the pictures, the beaver tail could be individually recognized, mainly due to scars. On 288 (37%) of the pictures, it was not possible to identify the tails. Limitation was mainly due to picture quality, which did not allow analysis of scale pattern. A total of 29 beavers could be identified, indicating the minimum number present in the study areas. At different locations of the traps, after a maximum of 30 days, no “new” beavers were pictured, indicating that the minimum number is also at least close to the real number. The first results show, that camera traps can help and facilitate surveying beaver numbers and territories. However, there is still further work necessary to make the method efficient. Improved quality of photos would allow analysis of scale patterns and improve identification rate of photos and decrease time required to establish number of beavers in a territory.

Keywords: camera traps, beaver, Bavaria, territory, family size

Beaver games: environmental education with the beaver

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Playing is one of the most effective ways of learning. This simple fact has boosted numerous environmental education games covering a huge range of environmental issues and covering age classes from Kindergarten to golden agers. One issue of increasing environmental importance is the beaver, spreading throughout its former range after being almost exterminated from our globe only a century ago. Beavers are a fascinating species for playfully teaching not only the interesting biology of the species, but also their habitat creation capabilities and their importance for biodiversity and wise water management. In areas where beavers interfere with human land use, they provide a good example for showing the reasons for man-wildlife conflicts and solutions within a wildlife management. In Bavaria, where beaver have successfully come back, public relations are an important part of beaver management. Knowledge about beaver biology, their lifestyle and their role in the ecosystem helps to mitigate potential conflicts. A lot of knowledge transfer is done during field trips in beaver sites, and for playful learning about beavers, I have adapted existing environmental education games to beaver topics, and developed a number of new games, also in workshops with beaver people; following the principle: “I only value the things I know and I only protect the things I value”. A total of currently more than 80 games available on CD, covers all aspects of beavers, from anatomy to conflict solutions in beaver management. In my poster I give an overview over the beaver games, and present some of them and their usability for different target groups in more detail.

Keywords: beaver, Bavaria, games, environmental education, management, public relations

Future of Beavers in Scotland: Update on projects leading towards Ministerial decision in 2015

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The Scottish Beaver Trial taking place in Knapdale Forest in the west of Scotland is now well underway. The trial began in 2008 with the release of beavers in May 2009 and is being managed by the Scottish Wildlife Trust (SWT) and the Royal Zoological Society of Scotland (RZSS) on land owned by Forestry Commission Scotland (see Campbell-Palmer *et al.*). The licence granted by the Scottish Government for the Trial includes a number of conditions, one of which requires Scottish Natural Heritage (SNH) to co-ordinate the independent research, survey and monitoring of the trial. To do this we have established a monitoring programme through which beaver ecology and biology will be studied and their effects on the Scottish environment assessed. In partnership with a number of independent specialist organisations, we've set up projects that cover the main habitats and species found within the trial area. These include:

- Beaver and otter ecology (in partnership with Oxford University)
- Odonata (in partnership with the British Dragonfly Society)
- Fish (in partnership with the Argyll Fisheries Trust)
- Woodland (in partnership with the James Hutton Institute)
- Aquatic macrophytes (in partnership with the University of Stirling)
- River habitat and hydrology (in partnership with the University of Stirling)
- Socio-economics (in partnership with the Scottish Agricultural College)

Potential effects on water chemistry, public health, and archaeological features are also being assessed, and beaver health is being monitored. All the data collected are independently analysed, written up and peer-reviewed before being published and publically available on our website. The trial extends over a seven-year period with an initial pre-release year, followed by five years in which to study beavers in Knapdale, and a year to collate a final report. In east of Scotland, there are now thought to be around 80 -100 beavers living wild in a farmed lowland landscape, considered to have originated from beavers escaped from a private collection. The Scottish Government has recently decided to allow this population to remain in Tayside, but has asked SNH to establish the Tayside Beaver Group to monitor the population and identify ways of resolving conflicts with neighbouring landowners. This group represents a number of statutory bodies and NGOs with a range of views about beavers. Information from the Scottish Beaver Trial and Tayside Beaver Group, as well as other initiatives (e.g. the Beaver-Salmonid Working Group and the National Species Reintroduction Forum) will be presented to the Scottish Government in 2015 to help inform the Minister's decision on the future of beavers in Scotland.

Keywords: Scottish Beaver Trial, Scottish Natural Heritage, survey, monitoring

Examination of the Eurasian Beaver population in the river Mosoni-Danube and Szigetköz area Hungary

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The Eurasian beaver was last observed in Hungary in the middle of the 19th century, and the species has been missing from the Hungarian fauna until its re-introduction at the beginning of the 90-ies. The re-settlements in Hungary were carried out at other wetland habitats (Gemenc, Hanság etc.). The examination area in question has probably been populated by animals roaming away from Austrian colonization's. Our investigations have been started towards studying the behavior of a species that reoccupies its habitat naturally, in the absence of hunting and predation pressure. Our aim was to lay down a map of the beaver population in the given area, and to estimate the number of individuals. We applied a territory mapping method to determine the absolute density value and to estimate the total population. We have navigated over the entire river section and recorded the locations of beaver gnawing traces in the year of investigation on a digital map. The resulting sets of dots were delimited based on various aspects (central place strategy) and considered them territories. Based on the number of resulting territories the size of the beaver population in the area was deduced. The investigation was carried out between 2006 and 2009. The research was unfortunately discontinued in the autumn of 2009 due to difficulties in financing. In the autumn of 2011 we succeeded again to obtain funding for the subject. Since then the research has been supplemented with many new investigations. Our investigation in 2006 revealed 94 territories, which, based on average family sizes described by specialist literature, corresponded to approx. 330 individuals. In 2007 we found 99 territories, corresponding to approx. 350 animals, in 2008 we found 104 territories, meaning approx. 365 animals. In 2009 the number of territories found was 106, corresponding to approximately 370 individuals. In our view, the continuous growth of the beaver population is due to the fact that the area has not yet reached the limit of its supporting capacity for the species. It can be expected to a certain degree that this tendency will not change in the future. Unfortunately, because of the inaccuracies of the method used in 2009, we could hardly delimitate the territories from one another. The introduction of GPS technology became timely, yet this was unsuccessful due to lack of funds. Since 2011 we have been working using this technology.

Keywords: Moson-Danube, Szigetköz area, territory mapping, population size

Identification of internal nucleotide sequence (exon 6 and intron F) of the Pregnancy-Associated Glycoprotein gene family (PAGs) in the European beaver

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The European beaver belong to the Rodentia order and the Castoridae family that includes only two still extant species, *Castor canadensis* in North America and *Castor fiber* in Eurasia. However, several aspects of genetic knowledge of the beavers remain completely unknown. The PAGs belong to placental aspartyl proteinases superfamily (EC 3.4.23), which includes also proteolytic and lyzosomal enzymes present in vertebrates and non-vertebrates, e.g. pepsins, renin, cathepsin D, and parasite plasmepsins, as well as several other fungal and retroviral enzymes. So far, multiple complementary DNAs have been cloned in the Artiodactyla order (i.e. pig, cattle, sheep and water buffalo), whereas single genes were cloned in the Perissodactyla (horse and zebra) and the Rodentia (mouse only). In domestic species, porcine (p) and bovine (b) PAG genes encompass 9 exons and 8 introns. However in wild species, genomic sequences and exonic-intronic structure of the PAG genes have not been identified yet. The aim of this study was to identify internal nucleotide sequences of the PAG genes in the genome of the European beaver, the largest rodent in Europe. Genomic DNA (gDNA) templates were isolated from beaver's leucocytes (N=6; 3 females and 3 males) and used for PCR amplification of the PAG-like (PAG-L) genes. Beaver gDNA amplicons were produced with primers (Ex6se and Ex8as) that should amplify the region encompassing exons 6, 7 and 8 with introns F and G, according to pPAG2 and bPAG1 gene structures. These beaver gDNA amplicons were produced parallel to porcine PAG cDNAs-used as positive control plasmid templates and also negative control-with omitted templates. Produced beaver PAG-L amplicons were electrophoretically separated in agarose gels with ethidium bromide and visualized by UV light. Dominant beaver PAG-L amplicons were gel out purified, precipitated, and then subjected to nucleotide sequencing in both sense and antisense directions (3130 Genetic Analyzer, Applied Biosystems). All beaver PAG-L sequences identified in females and males were analyzed by DNASIS® MAX v3.0 software (Hitachi, USA), according to the pPAG2 gene structure. Performed sequencing of the beaver PAG-L amplicons permitted to identify nucleotide sequences of the beaver PAG genes that were named CfPAG, according to Latin nomenclature of this species. The CfPAG sequences (380–550 nucleotides of exon 6 and intron F) of males and females shared relatively high homology (71–89%), but were not similar to any other PAGs nor to any other gene sequences deposited in the GenBank database. This is the first report concerning nucleotide sequence identification of the CfPAG genes (in the region of exon 6 and intron F) in the European beaver. Our results provide a novel information about the beaver genome. Further complex studies are required to characterize entire structure of the CfPAG gene family.

Keywords: beaver, genes, PAGs

Identification of dominant placental isoforms of the Pregnancy-Associated Glycoprotein family (PAGs) in the European beaver (*Castor fiber* L.) during late gestation

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The PAGs belong to placental aspartic proteinase (AP) superfamily, which includes also various catalytically active enzymes such as pepsins A, C and F and several other lyzosomal enzymes. All members of the AP superfamily possess a two-bilobe structure with a cleft capable of binding short peptides. Proteomic studies revaled several distinct NH_2-terminal micro-sequences of native purified PAGs (35–76 kDa) in several species including pigs, cows, goats, sheep, zebu, water buffalo, and wild American and European bison. *In vitro* studies revealed also multiple secretory isoforms of the PAGs produced by chorionic explants of wild and domestic species. Other studies revealed a potential physiological importance of the PAG family products-as chorionic signaling ligands interacting with different gonadotropin receptors (gonadal and extra-gonadal) in cyclic domestic pigs and cows or early pregnant pigs. Although a role(s) of the PAGs is still unclear, several purified native or recombinant PAG proteins and specific anti-PAG sera has led to the establishment of various diagnostic tests of pregnancy based on the detection of the PAGs in maternal blood plasma, serum or milk, by radioimmunologic (RIA) and immunoenzymatic (ELISA) tests. The concentration of circulating PAGs depends on the number of well-being embryos/foetuses, is higher in females with multiple than single pregnancies and can also differ based on the sex and breed of the foetus. The aim of this pioneer study was to identify a profile of the PAG family in the European beaver placenta. Beaver placental tissues were harvested *post mortem* from late-pregnant females (N=3) bearing 1–3 foetuses. Placental explants were long-term cultured (up to 209 h) for *in vitro* production of secretory proteins. Obtained placental proteins were purified from media by ultrafiltration (>10 kDa MWCO). Also, cellular proteins were purified from placental cultured explants and frozen tissues. Placental proteome analyses included polyacrylamide electrophoresis (SDS-PAGE) and CBB-staining to identify total protein profile. Heterologous (cross-species) Western immunoblotting with polyvalent anti-porcine PAG polyclonals allowed to identify diversity of beaver placental PAG fractions. This is the first study describing dominant isoforms of the PAGs in placental proteome of the European beaver, in which the PAG family was named CfPAGs, according to Latin name of this species. The CfPAGs varied in mass (39-62 kDa) and dominant isoform profiles in all females bearing male or female foetuses from single, twin or triple pregnancy. Western analyses revealed dominant 58 kDa isoform of the CfPAGs, despite the foetus sex and the multiplicity of gestation. Our results increase general knowledge about beaver placental proteome, and presumably will be helpful to improve a possibility of the biodiversity conservation and protection of the European beaver.

Keywords: beaver, PAG, placenta, pregnancy, secretory glycoproteins

Identification of cellular expression of the Pregnancy-Associated Glycoprotein family (PAGs) immuno-localized in discoid placenta of the European beaver

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The PAG family is a large group of secretory chorionic products belonging to placental aspartic proteinases (EC 3.4.23). A role of the PAGs is still unclear, but it is believed that the PAGs are involved in proper embryo-maternal interaction and placenta. Our previous immunohistochemical studies have revealed specific and spatial cellular PAG localisation within various trophectodermal cells (mono or bi-nucleated) throughout placenta development in the pig, the European bison and the alpaca. However, heterogeneity of cellular PAG localisation has not been identified in many other wild eutherians, including endangered species of the Castoridae family. The European beaver (*Castor fiber* L.) has been classified into the Red List of Threatened Species (LC category) by International Union for Conservation of Nature. The objective of this study was to identify the cellular localization of the PAG family in the discoid placenta of the European beaver. Uteri of adult European beaver (n=5) were harvested *post mortem* from late pregnant females (15–24 kg), seasonally eliminated in the Suwalki region in Poland, with the agreements of the governmental and local ethical authorities. Placental tissues were dissected from uteri, frozen in liquid nitrogen and transported to the UWM laboratory. Two types of collected tissues from different placental regions (discoidal and extra-discoidal trophectodermal-chorionic epithelium) were cryosectioned at-20° C, and both placental tissue sections (6 μm) were fixed, dehydrated, then used for standard morphological staining with hematoxylin/eosin and subjected for cross-species (heterologous-ht) double fluorescent immunohistochemistry (htdF-IHC). The htdF-IHC was performed with primary rabbit polyvalent (1:300) and recombinant (1:50) anti-porcine PAG polyclonals. The PAG immuno-complexes in the beaver placental sections were visualized with secondary goat anti-rabbit polyclonals (1:1000) - conjugated with Alexa 488 fluorophore (green), among all nuclei of placental cells stained with propidium iodide (red). This is the first study identifying the cellular localization of the PAG family by htdF-IHC in the European beaver placenta, in which the PAG family was named CfPAGs, according to Latin name of this species. Strong immune-positive CfPAG signals were found in both placental regions, discoidal and extra-discoidal trophectodermal sections. The signal intensity, indicating level of the CfPAG expression was comparable in both placental regions. These data increase general knowledge about CfPAG expression localized in the beaver placental proteome.

Keywords: beaver, glycoproteins, PAG, placental, pregnancy

Long-term population dynamics and ecosystem engineering of Eurasian beaver (*Castor fiber*) in Tadenka river basin (Prioksko-Terrasny Nature Biosphere Reserve, Central Russia)

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This study is focused on the analysis of historical and current beaver population status in the Tadenka River basin, as well as of the long-term influence of beaver on the local habitats. We used published articles, reports and Annals of Nature of the reserve for 1946-2006 years. Field works on 13.4 km water-currents of the Tadenka River basin were carried out in 2007-2012. Two pairs of beavers were released in the Tadenka River in 1948. For the first 15 years the number of settlements increased slowly: in 1970 there were 6-9 settlements, in 1980-2000 -8-10 settlements, and in 2000-2012-9-12 ones. Before 1987, the beavers occupied new sites: after 1989, they repeatedly occupied earlier abandoned settlements. In 1950, 1962, 1965, and 1974, the location of the settlements changed considerably. During 2009-2012, the beavers continuously occupied only three settlements. On other sites, the beavers moved on 200-1500 m distance (sometimes 2 times a year) abandoning and again occupying the settlements. The settlement mobility was caused by strong degradation of forages. By the fourth year after their release, the beavers had eaten up all easily available aspens and started to feed on birches. After 1989, the first long land foraging trails were discovered; the absence of the large predators made it possible to increase trails in 1991 to 50-100 m. In 2009, the long land trails were discovered in 6 out of 11 settlements; the average length of the trails was 39.6±23.9 m, with the maximum length of 109 m. The number of beaver dams had increased as the population developed. In 1953 there were 3 dams, in 1984-146 dams, the average length-10.57±0.91 m, in 2007-2009-179, with the average length-26.0±2.8 m. In 2009, in the Tadenka River basin, there existed 4 large beaver families, 4 medium families and 3 settlements with singles. After a strong drought in 2010, there were considerable changes of the beaver population. In 2011, there was only one large family, 8 medium ones and 3 settlements with singles. In the beginning of May 2010-2012, the mapping of the scent mounds and scent marks was made. In 2010, 91 marks located regularly were found. In 2011 and 2012, the number of the marks was increased to 215 and 210 respectively, and their distribution was aggregated, differing from those in 2010. The concentration of the marks was noted on the borders and in the centres of the settlements. It was caused by mobility of settlements: for beavers it is important not only to declare rights on new territories, but also to keep occupying ones. Over the decades, the beaver activity had created the conditions favorable for the development of black alder forests. This development in the long-term scale can lead to reduction of settlements number. Simultaneously, the accumulation of building activity "monuments" improves habitats. Beavers can quickly restore big dams and fully use renewing food resources. As a result, the number recession can smooth and then stabilize.

Keywords: Eurasian beaver, population dynamics, settlements

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