

Ludmila Zinevich, PhD (Laboratory of the developmental evolutionary genetics Koltzov Institute of the Developmental biology RAS). THE ALTAIC SAKER REINTRODUCTION AND OTHER PROJECTS OF THE RUSSIAN RAPTOR RESEARCH AND CONSERVATION NETWORK. Scientific seminar in the Department of Evolutionary Zoology and Human Biology of the University of Debrecen, Hungary, Debrecen, 24/01/2018.

Слайд 1

Dear colleagues, it's a great pleasure for me to introduce our projects and organization to such the audience.

Слайд 2

The Russian Raptor Research and Conservation Network is a non-commercial and non-governmental association of ornithologists, birdwatchers, ornithological and environmental organizations, which in cooperation seek to learn the birds of prey and owls that live in the vast territory of Russia and neighboring countries and promote their conservation. Here are some pictures of the members of the team including very different people all over from Russia, Kazakhstan and others and still we have strong cooperation with many foreign specialists from Hungary as well. Here are the chiefs and leaders of our team – Elvira Nikolenko who is the chief of one of the Russian ecological organizations – Sibecocenter, and Igor Karyakin who started and is now supervising in any way most of the RRRCN projects.

Слайд 3

The main aims of the RRRCN projects are monitoring and conservation of the birds of prey, basic studies concerned with raptors, and of course the ecological awareness. The main instruments and products of the RRRCN are the web-GIS online database Faunistica included to the GBIF from last year. It's a very powerful instrument as it's accumulating all the data about birds of prey with the coordinates, pictures of the nests and birds, data about breeding success from year to year, ringing, GPS-tagging and all things linked to certain points as from experts and basic scientists, so from birdwatchers and any who would like to upload his data. The part of this database for the results of the molecular analysis is now under construction.

Another thing is the reviewed scientific journal which is coming out in two languages: Russian and English. And of course there are some meetings, workshops and conferences our specialists are organizing or attending to, but that's would be below.

Слайд 4

As for the monitoring the specialists from different scientific organizations conduct annual field work in different parts of Russia, Kazakhstan, Ukraine and others counting all raptors species, and some birdwatchers and other volunteers are also involved, so every year the RRRCN collects a lot of data. For the certain key species there are regular monitoring and checking of the breeding success at the known breeding places with ringing and tagging. So it comes out to basic research of the distribution and breeding of the birds of prey in many territories.

Слайд 5

The other important part of the RRRCN work is raptors conservation, and there are a lot of different approaches to this goal. A program of attracting the day raptors and owls to artificial nesting sites

already succeeded in raising the saker falcon population in Tuva Republic – you can see here the saker chicks on the platform, and I'll say some more words about this program due to our Altai saker project. Also there are a lot of nestboxes for different owls, and here is the Ural owl in the nestbox in Samara region. This program nowadays is expanding from Samara and Nizhniy Novgorod regions where it started to Kostroma, Novosibirsk and other regions of Russia and shows very good results in overpowering the problem of forest cuts which led to disappearing of big trees with holes - usual nesting sites for owls. The artificial nesting platforms on trees were also used for transferring peregrine chicks from endangered nests on the ground to the more safe ones to save the broods of the rare species and form the tree-nesting stereotype in peregrines of the Volga-Urals region.

Слайд 6

The other part of conservation work is, of course, for specialists to take part in expert examinations of contraband birds and endangered territories to prevent the illegal trading and other ecological damage to Russian wild nature. Here is the nest of the Eagle owl in the Altai pine forests. This tree and certain territory around it must be excluded from any type of using. In fact we have a lot of troubles with the rare species and forest harvesting in the Altai pine forests, but still the work is in progress. Of course this work turns into the conservation legislation improvement and in forming and publishing action plans for the rare species and unique areas. For example – the strategy of the steppe eagle conservation as the result of many years project in monitoring, ringing etc. And the important part of the work is establishing of the new protected areas and ecological awareness. Here is the kind of the name plate of the protected area with the rules etc.

Слайд 7

So the typical example of how the RRRCN works is the project conducted to the problem of electrocution of the birds of prey which was supported by many organizations like the Russian Geographic Society and so on. The map of the territories with dangerous power lines, the kind of the worktable for the ecologists and power engineers, publishing some kind of the recommendations. And as the result – arming of the dangerous power lines with birds protecting devices in many regions.

Слайд 8

Coming closer to the basic research there is a program of color ringing of many species. The color ringing is a gold standard, and nowadays there is a metal and plastic color rings production straight in Russia not only for raptors but for many big birds which made it easier to get the color rings for ornithologists in different parts of the previous USSR and still we are well-fixed ourselves. Here is the steppe eagle in Central Kazakhstan ringed with the metal color ring made especially for this population. And here are the returns of the rings from the steppe eagles from different parts of area. It was shown for the first time that the steppe eagles from the Western part can migrate to India and Pakistan for wintering as the eagles from the Altai-Sayan go to Africa as well. But as for some species the color ringing is not so powerful and widespread we still ring sometimes with usual uncolored rings – for example, here is the eagle owl.

Слайд 9

Besides ringing the tagging with GPS/GSM tags is also present in our projects and we have a lot of international collaboration in it. Here is the imperial eagle named Sakmarik tagged in the south of Russia together with specialists from Budapest, and here is his migration track.

Слайд 10

And a quite new part of the basic research is the molecular genetics part which is the most close for me as I'm a geneticist myself and started these studies about three years ago. Now we have two labs involved to the RRRCN studies – in Moscow in our lab at the Koltzov Institute of Developmental biology, where we have a kind of special shared collection of molted feathers and other genetic materials as a part of the Core Centrum. The second lab is in Novosibirsk led by Prof. Gimyulev, member of the Russian Academy of Science and of the RRRCN as well and a great fan of the birds of prey. They started just at the previous year, so this part of the RRRCN work is very young and it's very good that we are starting some international collaborations to be able to use modern techniques and provide our material and data as we hope to do now with Dr. Gabor Sramco for the saker falcon.

Here are some examples of our own work: the steppe eagle genetic diversity description by mitochondrial D-loop haplotypes compared to the closely related imperial eagle which was done in Moscow. And the *cytB* haplotypes distribution in the Russian population of black kites was made in Novosibirsk. Besides the evolutionary and population genetic studies we provide some routine analysis for other projects. Here is, for example, the trial study in molecular sexing of the ringed eagle owl nestlings – as the difference between males and females is very small, the only method to find whom you ringed is the molecular analysis.

Слайд 11

Speaking about my part of the work, the key species for us are the steppe eagle – to describe the Genetic diversity of the critically endangered species; to revise the genetic structure of closely-related *Aquila* species in Holarctics to find some ecologic and adaptation features in genotype to phenotype implementation. And still we are working on the problem of the *Aquila* species natural hybridization together with Hungarian imperial eagle specialists first of all with Marton Horvath and Szilvia Kovacs.

We have some plans for the Eagle owl work and etc., but the other key species for us is of course the saker falcon which has much questions as for conservational, so for basic research aims.

Слайд 12

The main profit of our collecting data is the fact that we can use a lot of information in analyzing the molecular data: breeding places, phenotypes, nesting stereotypes, breeding success, which somehow comes to adaptation level, feeding preferences etc.

For example, for the saker falcon we have data about more than 600 occupied breeding sites with many photos of the nests, nestlings and adult birds as well. The saker falcon area has decreased dramatically from the beginning of the XX century to nowadays for several reasons. In Europe the well-known reason was the crisis with DDT, which affected many birds of prey, but Russian part of the area had different problems. From 1990th the illegal catching and contraband turned out to be one of the main reasons of the saker disappearance. The most expensive birds are females from the eastern part of area but with western phenotype, because they usually are quite big and that is preferred for Arabic traditional falconers. But one of the most expensive type of sakers is the unique Altaic phenotype – dark, almost black birds with several specific traits.

There were a lot of discussions about the Altai saker taxonomy, from defining it as a species to putting it to the gyrfalcon morph with supposing the gyrfalcons to live in the Altai-Sayan or to the unique saker

morph, specific to this region, what now is the widespread point of view, but still some ornithologists take the Altai saker for the gyrfalcon.

Nevertheless, the Altai saker is unique and almost disappeared in the Altai because of the illegal catching.

Слайд 13

As for the saker species structure, there are two genetically confirmed subspecies – Nittinger and colleagues studied the mt D-loop and found two clearly distinct haplogroups for western and eastern sakers. But still the morphologic analysis shows more than two distinct variants – at least three which can live closely to each other but still have their phenotypes or give out some certain mixtures in cases of cross-lines breeding. Here is the map of the area of three defined morphs, and you can see that all of them meet in the Altai-Sayan region, where the unique Altaic morph appears.

Слайд 14

On this picture you can see how complicated the morphological analysis of sakers can be without any differences in their mt-genome. It's a usual thing for Hierofalcos, but the modern molecular genetic methods showed the good conformity between morphologically and geographically defined morphs of the peregrine falcon. The other thing is that the falcons population numbers could be increased by the reintroduction which was showed in Germany and Poland for the peregrine but as for the saker we still need some evidence of containing the natural population structure. The disappearance of the Altai saker surely can lead to the genetic diversity decrease and losing of the unique alleles if they exist. As some birds were legally caught there in previous years and their descendants are living now in falcon hatcheries and rehabilitation centers, the reintroduction turns to be the good way to avoid changes in the Altaic population structure due to extinction of the Altai saker.

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So last year we took from the Moscow falcon hatchery "Vitasphera" 10 chicks of 20-27 days old which ancestors were caught at the Altai-Sayan region and had the Altaic phenotype. We took the chicks by plane and by car to the Altai-Sayan region and put them to the successful natural nests of sakers of other phenotypes. 7 chicks were released in Tuva at our experimental area with a lot of artificial nesting platforms we built. After several years all the platforms were inhabited by the upland buzzards and black kites and then sakers came to their nests. Nowadays raptors species started to move to the trees making natural nests, so the population of the buzzards, black kites, kestrels and of course saker falcons significantly increased in this area because of our platforms, and we have enough natural nests in this new artificial population to reintroduce original genotypes of birds which had inhabited the Tuva Republic before the saker population collapsed there.

Слайд 16

It was videomonitoring and some extra feeding for all the breeding season at one nest in Altai, and we looked how the natural stepparents took the new chicks with GoPro cameras for the first 24 hours at all the others. Of course all chicks were ringed and 1 released one and two natural ones were tagged with the GPS/GSM tags. And we collected the DNA samples.

You can see here the black nestling between natural ones with the tag on his back. And here is the adult natural female wounded by an eagle owl. She is of mixed so called saceroides phenotype with some

Altaic traits, so you can see the differences in color. Unfortunately we were not able to take this bird to the rehabilitation center immediately because she was feeding chicks and later we had many problems with getting the permissions and all this paper stuff. When we came for monitoring she was absent and most probably she died but still she raised up 3 natural chicks which fledged successfully, so some partly Altaic birds are still present in our Tuva artificial population.

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Here you can see the natural saker female with the nestlings and black ones are the released Altaic ones. So all the stepparents took the new chicks absolutely patiently and started feeding them in an hour after we put them to the nests. The behavior of the released nestlings did not differ from the natural ones, and all of them fledged successfully besides one who was predated by the eagle owl with one of the natural chicks from this nest.

Unfortunately we obtained no data about the migration of the released birds because the tag on our nestling went out of order. But still putting the chicks to natural nests for them being brought up by wild birds and learned how to hunt and so on, looks a very perspective way to upraise any sakers population if there are the natural nests of any saker phenotype. And of course very powerful to restore the Altai saker population in the Altai-Sayan region.

Слайд 18

As for the genetic background of the project we still have only mitochondrial DNA markers to give out any conclusions about the genetic diversity between populations because the microsatellite markers analysis conducted by Nittinger and her colleagues didn't show any clear differences between samples with different origins. Still the close ancestors of our released birds were caught at the Altai-Sayan. So we analyzed the same mitochondrial marker Nittinger did – the D-loop – to compare results. In the part of analyzing natural broods we had the same results: the Altai-Sayan population is a mixture of the eastern and western sakers. But also are the Altai sakers themselves: the birds with the same phenotype turned to have as the eastern, so the western D-loop haplotypes.

So the hypothesis that the Altai saker appearance is the result of the cross-line breeding of some of the eastern and western sakers is highly supported by our results, and we are clearly reintroducing the original genotypes, but the real question is...

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What in fact the Altai saker is?

Clearly it's not a gyrfalcon population living in the Altai-Sayan – there were a lot of other evidences for this but now the question is closed at all, because the gyrfalcons don't have the B-haplogroup of the D-loop.

But still the question is interesting because on the one hand the line crossbreeding leads to heterosis – and presumably for the raptors it really leads to the better adaptiveness. On the other hand the long-distance crossbreeding leads to the ancestral traits segregation. So the questions “is the Altai saker the best saker for the Altai-Sayan region and is it how the ancient hierofalcons looked like” stay waiting for the detailed genome analysis, phylogeographic and phylogenetic reconstruction and QTL mapping of certain traits.

And the Altai saker is not only a very rare morph of a highly endangered species, which needs special protection, but also a good model for basic research in the raptors species evolution and genetic origins of the phenotypic traits.