SOME ASPECTS OF SNOW LEOPARD RESEARCH METHODOLOGY

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This report analyses some methodological aspects of snow leopard studies, primarily, on the basis of Russian scientific sources.

The present knowledge on snow leopard (Irbis) is far incomplete, and a range of principal aspects of biology and population parameters of this species are still unknown. First of all, it should be mentioned that no accurate population account have ever been performed for snow leopard. This statement seems to be quite paradoxical, since a lot of authors discuss the snow leopard population density and abundance is some sites (Sopin, 1977; Koshkerev, 1986; 1989; Smirnov et al., 1991; Poyarkov et al., 2001, etc.). Nevertheless, despite certain values are presented in many works, these are expert estimations rather than accurate quantitative parameters.

Some studies are particularly focused on the quantitative registration of the trace of the snow leopard presence and activities (Koshkarev, 1986; 1989), although no estimation was made to assess the probability for a researcher to observe these traces. This procedure (the probability estimation) is, however, absolutely necessary to make a scientific interpretation of the account and get quantitative information on the population parameters, whatever abundant and detailed field data might be obtained (Caughley, 1977). To illustrate the situation, let us turn to the most comprehensive Russian monograph on the matter – «Snow leopard in Kirgizia» by E.P. Koshkarev, (1989). The author describes the survey difficulties and method as follows: «Estimation of the Irbis population abundance was based primarily on counting the fresh footprints left by individuals when they cross the values (change the slope). The direction of the animal's movement was taken into account as well…All footprints noticed were registered in the survey daybook and on the schematic map, which made it possible to conclude whether the footprints had been left by the same or different individuals.

The survey routs in the North Tien Shan passed by the bottom of the main valleys, and in the Central Tien Shan the valley slopes were surveyed as well. All surveys were performed by no more than two observers at once (sometimes one observer only). The surveys were performed, as a rule, in the first days after snowfalls...Since snow leopards rarely cross main valleys, the number of the animals within the main basin was estimated from the number of fresh footprints counted on the entire route during one day... In doubtful cases the footprints were assumed to be left by the same individual».

This long quotation describing the survey method demonstrates the complete absence of any quantifying procedure, i.e., the formula or algorithm enabling quantitative interpretation of the field materials. The author does not estimate the probability of observation of the Irbis footprints (or other index of Irbis presence) depending on the distance of the animal daily migration and some other parameters. There are, however, many methods for estimation of the predator population density and abundance from the amount of footprints and other indices of the animal presence. One of the simplest and most frequently used formulas (in Russian literature in particular, to deal with the data of winter surveys) was developed by A.N. Formozov: **P=1,57S/dm**, where: P is the population density, S – is the number of footprint crossing on the rout, d is the average distance of daily migration of the animal (km), and m – is the survey rout distance (km). According to this formula, we need, at least the data

on the average daily moving of the investigated animal to estimate its population density. Koshkarev in his monograph (1989) mentions, however, that this distance for Irbis was not estimated. Thus, he has registered and studied the indices of Irbis activities rather than estimated its population density or abundance.

Beside of the rout surveys, various other methods of area account are of wide use. Utilizing this method, a researcher shall perform a complete account within a typical (model) area. These areas shall be considerably (at least by an order of magnitude) larger than the individual habitats in order to avoid overestimation (if the model area covers the center or an animal group) or underestimation (when the model area covers the marginal part of an animal group). This method requires establishment of an extended rout network covering the entire investigated region, and the account cannot be performed by one or two observers. Optimally, this method shall be applied to a certain region or vast area, and the account shall be made by a large observer team utilizing a preliminary designed account scheme. This type of study has been performed in the course of tiger surveys in the Russian Far East (Matyushkin, et. al., 1997).

Each registered index shall be identified separately, i.e., attributed to the individual who has left this particular index, or, at least, with the individual of the same age–sex group and originated from the same population. This ensures the survey accuracy and provides extra information on the animal activities and population density. In addition, the habitat stratification (classification) is a very useful tool to enhance the accuracy of a survey, particularly in the situation when the results obtained from the model areas are extrapolated to a vast territory. The works specially dedicated to the evaluation and classification of Irbis habitats are virtually absent, and the existing monograph on the matter (Koshkarev, 1989) is very general and cannot be used for the extrapolation purposes. We have recently made an attempt to develop such a standard habitat classification (Poyarkov, Samoilova, and Subbotin, in press). A widely used SLIMS method (Jackson, Hunter 1996), is also, in fact an approximation to quantitative estimation. Applying this method a researcher shall count the territorial markings and other indices of the animal activities and collate these with the possible population intervals. This method yields quite acceptable results when the initial data are abundant enough (which is exactly what the method designers aimed at). The marking density may depend, however, on the variation in social situation in the animal population, while the demographic pattern in itself stays relatively stable (if varies at all). For example, such a situation may be due to invasion of a stranger individual to the territory or sudden change in the social status of a resident individual, which anyway results in considerable increase in the marking activities in the territory. The results obtained using the marking index method may, therefore, be incorrect in this specific situation. Thus, the SLIMS shall be considered as a method for preliminary estimation of the Irbis population density and abundance on the basis of certain indirect indices. (Coughly, 1977).

Another method principally applicable to study snow leopard populations combines the population survey with identification of individual animals. These population/individual surveys shall be performed by an observing team within representative model areas. The animals may be identified not only from the features of their footprints (which makes it possible to assign the animal to a certain age–sex category), but using the so-called dog identification as well (Sokolov, Sulimov, Krutova, 1990; Poyarkov, Sulimov, 2001) and genetic engineering methods. The non-invasion method of dog identification is based on using a specially trained dog to compare a tested odor with some known odor sample. The dogs-detectors "work" in laboratory, under standard conditions. The odor comparison

procedure is described in detail by Sokolov, Sulimov, and Krutova, (1990). The samples are collected in the course of field activities. Common odor sources for sampling are urine, excrements, footprints, scratching and other markings, etc. The odor can be separated from the substrate, fixed, and stored for decades, which is comparable with the maximum lifetime of the investigated animals. This makes it possible to develop the odor database for the individuals inhabiting different territories and to distinguish between known and unknown odors. The odor expertise method has a range of advantages: for example, it enables analyzing various indices of activities, such as footprints and urinal markings, which are inappropriate for genetic analysis. This method is relatively cheap and may be utilized to study other aspects of snow leopard biology, in particular, the features of its marking behavior. The latter, in its turn, will make it possible to improve the SLIMS method and use it to obtain the accurate data on the population (species) abundance.

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