Ann. Zool. Fennici 27:21–27
Helsinki 4 September 1990

ISSN 0003-455X

The samson fox episode in Finland in the 1930s and 1940s, and the hypothetico-deductive method

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Received 17 June 1989, accepted 20 December 1989

This paper is a case study on long-term population events concerning the spreading and the subsequent decline of the samson character among Finnish red foxes. Three different hypotheses have been put forward to explain the phenomenon. An attempt has been made to test the hypotheses by means of a precise application of the hypothetico-deductive method. It is concluded that only one of the hypotheses generates testable predictions and that the predictions can be validated. This hypothesis associates the samson fox episode with random population genetic events in the low-density fox populations of the 1930s and 1940s. The other two hypotheses are burdened by *ad hoc* assumptions and, consequently, do not generate testable predictions.

1. Introduction

The sudden appearance and rapid increase (Fig. 1 and 2) of samson foxes in the red fox population of south Finland in the 1930s and 1940s (Lampio 1945, 1946, 1948, 1949) led to a population-genetic hypothesis explaining the episode (Voipio 1948, 1950). Subsequent analyses (Lampio 1951a, b, Voipio 1952, 1956) and the clarification of the probable genetic basis of the trait (Oksala 1954) provided an opportunity for a discussion of alternative hypotheses (Helminen 1961, Lampio 1982). The aim of this paper is to examine whether the hypotheses fulfil, in terms of the hypothetico-deductive method, the requirement of possessing an unequivocal power of prediction, rarely materialized in studies of long-term population events.

2. The facts

Samsons can be identified by hunters by the absence of the guard-hair. It seems evident that the fitness of samsons is less than that of normal individuals: samson cubs develop more slowly and have a higher mortality rate than normal ones, and the adults have proved of inferior viability on farms. The adults have an abnormally large appetite due to which they are compelled to feed mainly on carrion and cattle dung and to dig food from the soil and municipal landfills which is poorly available in winter conditions. For additional morphological and physiological details, see Lampio (1946, 1948, 1949) and Voipio (1950). Owing to their reduced fitness, the spread of samsons appears ecologically remarkable. Their history can be summed up as follows.

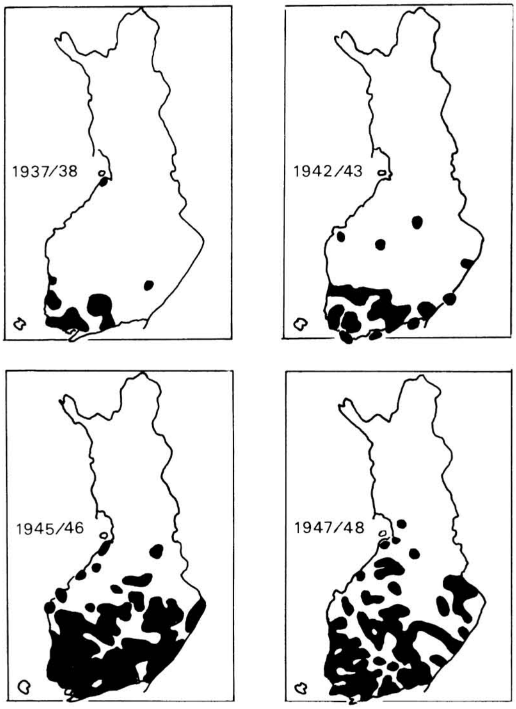

Fig. 1. Distribution of the samson fox during the winters of 1937/38, 1942/43, 1945/46 and 1947/48 (according to Lampio 1951b).

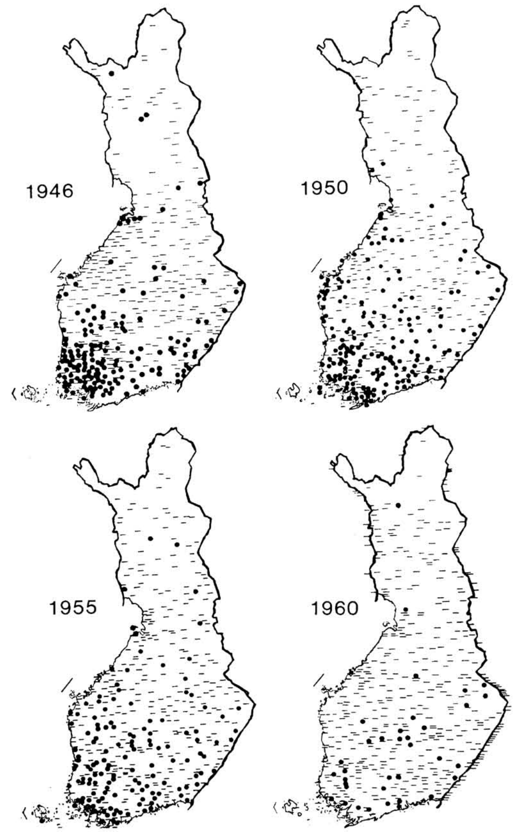

Fig. 2. Distribution of the samson fox in the early spring of 1946, 1950, 1955 and 1960. Ring, samsons observed; dash, samsons not observed (Helminen 1961).

There are distinct temporal coincidences between the appearance of the samsons in natural populations and the condition of the fox population from the early 1930s until the latter half of the 1940s (Fig. 3). Firstly, the emergence of the samson fox took place when the fox population was already heavily reduced due, in part, to its being in a natural phase of decline, but partly — and particularly — due to severe hunting, which at places had brought it even to the verge of extinction (Voipio 1948, 1950). Secondly, the rapid spread of the samsons over the southern part of the country occurred simultaneously with the subsequent revival of the fox population, probably aided by protection in 1938.

It is not clear where the samsons originated. Samsons either escaped or were released from fur farms (Lampio 1946, Voipio 1950), but it is possible that the samson factor may always have been present in the wild population (Voipio 1950, 1952, Lampio 1951b, Oksala 1954). As will be seen below, the uncertainty of origin is of no consequence in this context. For the same reason, the point made by Helminen (1961) and Lampio (1982) that data on the occurrence of samsons before 1945 are based on post-hoc questionnaires is of little relevance.

3. The hypotheses

Below I consider the hypotheses presented to explain the history of the occurrence of samsons in Finland from the 1930s on (Table 1).

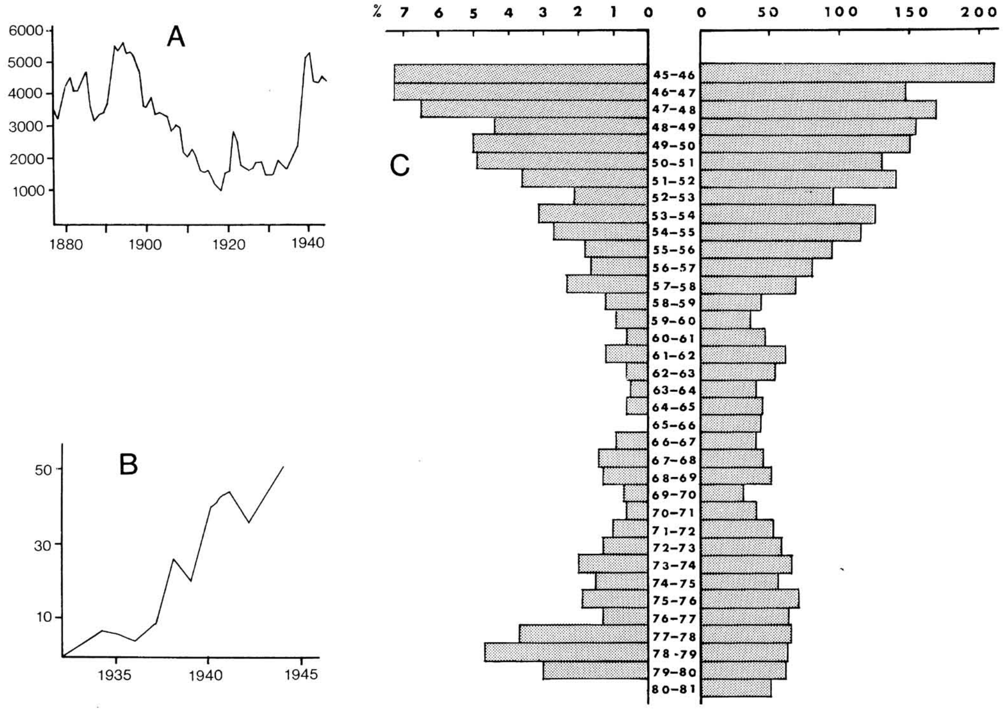

Fig. 3. Graphs showing the temporal coincidence of the growth of the red fox population (A) and the increase in the number of communes populated by the samsons (B); the relative frequency (%) of the samson foxes in the total Finnish fox kill during the 1945–46 to 1959–60 seasons (C, left); and the number of communes reporting samson foxes during the period mentioned (C, right) (A and B after Lampio from Voipio 1950; C according to Helminen 1961 from Lampio 1982). The lower part of diagram C relating to the period of 1961–1981 not considered.

3.1. Lampio's hypothesis

Lampio (1948, 1949, 1951) presented the following hypothesis (several separate versions appear in his successive papers, but the following is an attempt to present a fair synthesis of his ideas).

The silver foxes introduced into the fox populations in 1937/38 bore an unknown genetic factor (or several such factors) which, combined with some other unknown (complementary) factor in the wild population produced the characteristics typical to the samsons. The spread of the gene due to foxes accidentally escaping now and then from fox farms served to promote, in certain cases, the appearance of the samsons in scattered fox populations (Lampio 1948, 1949). In addition to these occurrences of more or less local importance, the overall influence of some unknown external factor on the manifestation of the samson characters, shown to be variable in expressivity and in penetrance (Oksala 1954), caused the overall breakout of the samson phenomenon in the 1930s and 1940s (Lampio 1982).

The independence of the spread of the trait from the population density is thought to be indicated by an ostensible new wave of the samsons taking place in the abundant fox population of the 1970s. This is however, an error based on the appearance of *scabies* (see Henriksson 1971, Valtonen 1978).

Table 1. Three hypotheses attempting to explain the history of the occurrence of samsons in Finland.

	Lampio	Helminen	Voipio (population genetic)
A. History of spread of the trait	The spread of the trait advancing from the areas of its first appearance was an overall breakout due to some general environmental factor. It was also aided by samsons escaping, now and then, from the farms by accident into the scattered red fox populations.	The trait appeared in the normal red fox populations suddenly and independently in separate areas, i.e., without normal dispersal from one population to the other.	The trait appeared first in Southwest Finland from which it spread, by normal dispersal, towards the East and North. The dispersal of the samsons from the well known area of their first appearance leading to a conspicuously uniform distribution over the whole southern part of the country can be tracked rather circumstantially.
B. Association of the spread with the population density, and scabies episode	There was a temporal coincidence between the spread of the trait and increasing population density in the 1930s and 1940s, but not in the 1970s, when the ostensible new increase of the samsons took place in the southern half of Finland. The latter, however, was a scabies epidemic.	Temporal coincidence between the spread of the trait and the population growth observed. No causal association between these two events assumed.	There was a clear association of the spread of the trait with population density: appearance of the samsons during the population minimum and their sudden increase along with the increase of the red fox population.
C. History of decline of the samson incidence	The incidence of the samsons began to decrease, in the southernmost and southwesternmost areas, in the later part of the 1940s (at the same time as it continued to increase in the peripheral areas). Later on, the incidence of the samsons began to decrease also at the periphery.	The decrease of the samson fox began in the years 1946-48 and was "slower" in the eastern and northern districts (Helminen 1961, p. 150).	The first signs of the ongoing decrease of the samson incidence within the districts of the first appearance (Voipio 1950, p. 146) were detected at a time when it was still increasing in the peripheral (i.e. eastern and northern) areas, until it finally became as rapid, or even more rapid there than in the South and Southwest.
D. The unknowns	Extrinsic factor influencing the manifestation of the trait. Genetic factor(s) combined with a complementary one hidden in the natural fox population.	Favourable extrinsic factor (supposedly temperature) turning into an adverse one. Genetic factor(s) influencing the manifestation (penetrance and/or expressivity) of the samson factor. Balanced polymorphism due to heterozygote superiority.	None
Do the known facts conform with predictions?	A. No. The scattered escaping of the samsons by chance does not conform with the general pattern of the spread of the trait.	A. No. Supposition of an independent origin of the trait in separate areas of distribution contradicts the facts.	
	B. No. Assumption of the spread of the trait in abundant red fox population and the independence of it from the population density in general does not conform with the facts.	B. No. The assumption that the spread of the trait occurred independently from the population density is in contradition with the facts and with the minute chance a genetic factor has of spreading in a large population.	
	C. Yes.	C. No. The note that the decline was "slower" in the peripheral areas contradicts with the facts: it was in fact more rapid after having started later than in the South and Southwest.	
	D. No. Two kinds of unknown factors presumed: a general extrinsic and specific genetic factor or factors in the wild.	D. No. The climatic conditions suggested do not fit in with the timetable of the changes in the samson incidence. Unknown additional genetic factor and balanced polymorphism suggested, of which the latter leads to a false prediction of a relatively high incidence of the samsons in the population at present too.	

3.2. Helminen's hypothesis

Helminen's hypothesis can be summarized as follows:

Besides the samson factor proper, there are other unknown genetic factors which, depending on conditions, can either strengthen or weaken its influence (Helminen 1961:146). Due to the positive influence (strengthening the samson characters) of some unknown extrinsic factors the samsons appeared in the normal red fox populations suddenly and independently in separate areas. Because of the negative influence of the samson factor upon viability, the rapid initial increase of the samson incidence immediately after their first appearance was able to take place because the heterozygotes were most viable, i.e., because a balanced polymorphism prevailed. The comparatively rapid *decrease* of the samsons from about 1948 onwards, on the other hand, was a consequence of the negative selection based on some unknown extrinsic factor now acting against the homozygotes, i.e., the true samsons.

3.3. The population genetic hypothesis

Below I take advantage of the methodology and terminology of theory formation described by Southwood (1982) and present, according to his principles, the development of my hypothesis relating to samsons.

3.3.1. The basic hypothesis

On the basis of the data obtained, the following two hypotheses, deduced a) from the morphology and physiology of the samsons and b) from the size of the red fox population, could be presented:

a) The samson factor, a recessive, lowers the viability of its bearers and is thus selectively unfavourable in nature (Voipio 1950:144, 145).
b) The samson factor was either present in the wild stock or entered it at a moment when the fox population was heavily reduced, especially in areas densely populated by people. The specific feature of the samsons in regard to behaviour and nutrition (Lampio 1946, 1948, 1949) promoted the concentration of the samsons around human habitation (Lampio 1948, Voipio 1948, 1950) where the population, due to the heavy hunting of foxes, was particularly reduced.

3.3.2. The composite hypothesis

The rapid spread of samsons seemed, from the very first, to be a question of population genetics (Voipio 1948). The whole phenomenon bore a strong similarity to the results of random loss or fixation of genetic factors in populations small in numbers (Voipio 1950:146). This led to the following hypothesis (Voipio 1948, 1950). The samson factor gained a disproportionately high relative frequency through chance in a small population and maintained it when the fox population greatly increased in densely populated southwestern Finland. From this centre the fox and simultaneously the samson character, in spite of the latter's disadvantages, spread eastwards and northwards over the southern half of the country. The protection of foxes did not act as a weakening factor in this process.

3.3.3. The specific hypothesis

As a general rule, the goal in the hypothetico-deductive method is to derive a testable prediction, a specific hypothesis, from the composite hypothesis which then, in terms of the falsification of the theory, should be tested in the field or laboratory (Southwood 1982). The following prediction could be made (Voipio 1950:147). In the stabilized fox population that is no longer expanding, natural selection will gradually lead to a decrease in the samson factor. This will largely occur first in the oldest samson areas in the Southwest, i.e., within populations whose expansion has ended first, as shown by Voipio (1950), but due to the special habits of the samsons it will finally prove to be more rapid in the peripheral, i.e., eastern and northern, populations living under more adverse conditions. The samson fox (not the recessive factor itself!) will disappear first from the peripheral areas due to the more adverse conditions (comparatively sparce settlement, deep snow cover disadvantageous for a burrowing animal in particular).

4. Testing the hypotheses

Assessments of the hypotheses presented may be grouped as follows:

a) history of the spread of the trait,
b) correlation of this dispersal with population density,
c) history of decline of the samson incidence, and
d) the unknowns (for details, see Table 1).

The assessments of the three hypotheses presented above show that the facts, in regard to each of items a–d, conform with the predictions derived from hypothesis 3 only.

5. Discussion

As has been stated in the introduction, hypotheses fulfilling (in terms of the hypothetico-deductive (HD) method) the requirements of possessing an unequivocal power of prediction have been rarely established in long-term population studies. Though many scientists in previous centuries employed the HD method, the philosophical foundations of this method derive from a much later date (see, e.g., Dobzhansky et al. 1977, Fretwell 1972). The essence of the philosophy of "The New Ecology" (McIntosh 1982), effectively attempting to merge ecology with genetics and evolution (McIntosh 1982; see also Voipio 1988) and dominating in ecology since the 1970s (Fretwell 1972, Haila & Järvinen 1982) is the idea of hypothesis testing, generally believed to be a comparatively new method of the last few decades. The attempt in the early 1950s (Voipio 1950) to make predictions from the ecogenetic processes occurring in the natural populations thus represents a comparatively early endeavour in this field of study.

The importance of the HD method in studying long-term population events lies in its providing an opportunity for confirming predictions on the basis of new facts representing the results of population processes indicating temporally extensive natural experiments. This substantially adds to the validation of the predictions.

As has been stated so much to the point by Van Valen (1982:34), "A precisely satisfied prediction is often evidence against a variety of other possibilities, formulated or not, but they should be indicated rather than ignored; they may otherwise give the same result".

The "other possibilities", in this instance are based on several unknown environmental and genetic factors and/or mechanisms. They are burdened with *ad hoc* assumptions including contradictory elements as well in regard to the history of the preconditions of the rapid geographical progression of the trait and lead, in addition, to false predictions regarding the future incidence of the trait.

In contrast, no known facts are inconsistent with the population genetic explanation (Voipio 1950) originally presented upon the causes not only of the rapid increase (through genetic drift), but also of the predictable subsequent decrease (through natural selection) of the samson incidence.

Acknowledgements. Kari Vepsäläinen critically read the manuscript in its earlier phase. This and the valuable improvements and comments on the final manuscript by Olli Järvinen are greatly appreciated.

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