**L.L. MATSEVICH EFFECTIVE AND HUMANE?**

**Introduction.**

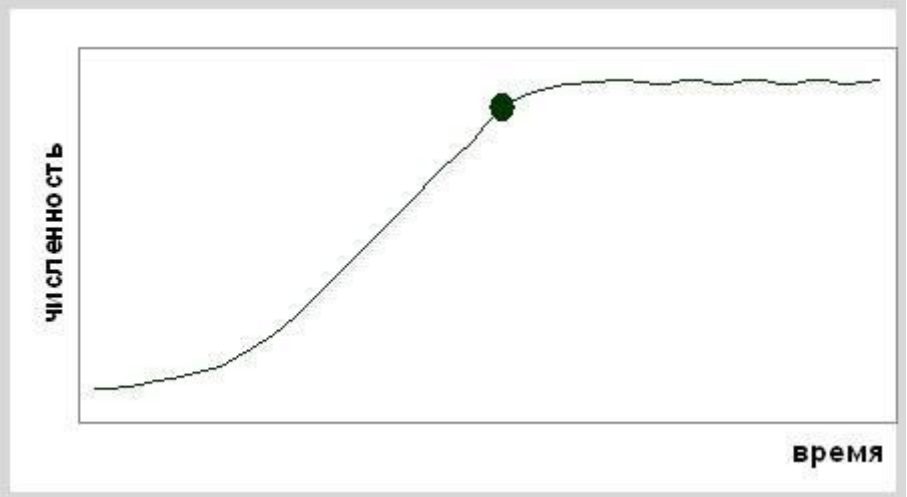
**Why the number of stray animals is not naturally regulated, or for Whom the laws of nature are not written.**

With the permission of dear readers, I will begin our conversation with a reminder of some basic laws of ecology that are important for a correct understanding of the subject of this article.

1) As you know, not every born animal survives to adulthood; and most of the animals that have successfully overcome all the dangers of childhood die without fully living out the period provided for by nature.

2) The possible number of animals of one species in a stable natural community has two limitations: "from above" and "from below". The "bottom" limit (the so-called L-point) is the threshold for the degeneration of the population: if the number of animals falls below a certain mark, then there is a high probability that the population will never be able to recover, and, in the end, will die out. The limit "from above" (aka point K) is the supporting capacity of the medium: the number of animals that can successfully feed in a given natural community.

3) The increase in the number of animals in the natural community occurs according to a nonlinear law; Schematically, it looks something like this:




The circle marks a kind of turning point in the life of the population, when its number ceases to increase rapidly, and stabilizes around a certain more or less constant level.

This stabilization occurs because the very point K – the "ceiling" of the number – has been reached. Animals continue to reproduce successfully - but their survival rate drops markedly:

- there is not enough food for all born animals - some of them die because of lack of food;

- some animals try to migrate in search of food - many in the process of moving to new places die;

- animals too often meet with their relatives, and infect each other with various diseases - as a result, epidemics arise;

- due to the increased number of this species, the food base of the natural enemies of these animals expands - thanks to this, predators begin to multiply and intensively exterminate their victims;

- At least in some animal species, another mechanism is "turned on": too much crowding reduces the fertility of females. The mechanisms of this phenomenon can be very different - from suppression of the sexual cycle to frequent eating of newborns.

As a result, a significant increase in numbers becomes impossible - the reproduction of animals is accompanied by the death of the "excess" part of them.

This is roughly what it looks like in the case of wild animals.

But for dogs and cats, this picture is somewhat different.

The dog and the cat are known to be originally domestic animals. Very far removed from their wild ancestors; in fact, man-made animals, adapted by people to live among people and in people's homes. However, these animals, no longer belonging to wildlife, unfortunately, quite often find themselves not where they are supposed to be - in the owner's house; and where they should not be at all - on the streets of large and small settlements, as stray animals.

It should be especially borne in mind that such animals reproduce much more intensively than their wild relatives: 2-3 litters per year instead of one characteristic of wild canids and cats. Theoretically, a single pair of cats or dogs together with their descendants in 5-10 years can give rise to a population whose size is measured in hundreds of thousands of individuals. Of course, in practice this does not happen - the very processes that were described at the very beginning of this article come into play. But what successfully keeps wildlife numbers at an acceptable level is not enough for dogs and cats. This happens for a number of reasons:

- Stray animals are almost independent of natural food sources: they feed on human waste, and at the expense of direct feeding by people;

- the food base of stray animals does not remain constant - but grows along with the number of such animals: a person who fed three animals will continue to feed them even when there are five of them; and when their numbers rise to fifteen and twenty-five, it is likely that several more will join the first breadwinner;

- Stray animals (especially dogs) have practically no natural enemies in the city; except in cases where the dog population is large enough - they can successfully exterminate cats (while no urban animal hunts the dogs themselves).

Thus, some deterrents for stray animals are absent at all – and the importance of others is noticeably less than for wild animals. The ecological balance is disturbed; and it can be restored only by the conscious actions of people to regulate the number of homeless animals.

In principle, there are two main approaches to regulating the number of animals: irreversible removal and sterilization with return. They can be supplemented by other measures - such as reducing the feed base (timely garbage collection, a ban on feeding animals with people), limiting animal migration (placing them in isolated areas, combating self-walking and discarding pets), etc.; but now we will compare exactly two main strategies - irreversible capture, and sterilization with return to the former habitat.

**Part 1. Modeling the change in the number of stray animals, or a little mathematics in the urban jungle.**

I apologize to dear readers, but there will be some dry (though completely uncomplicated) mathematics in this part. This is necessary to demonstrate where all further figures and comparisons came from. However, those who do not like theoretical calculations, and do not have the desire to follow the course of my mathematical reasoning - can skip this chapter, and immediately go to part 2, in which there will be no formulas - but only beautiful pictures.

So.

To compare the influence of different ways of regulating the number of stray animals - first let's try to express the change in this number using a simple equation:

$Ni = N(i-1) + Nj - Nm$

where Ni is the number of animals in a given year, N(i-1) is the number of animals in the previous year, Nj is the increase in number due to the birth of new animals, and Nm is the decrease in number due to dead animals. In this equation, we neglected migration – that is, the resettlement of animals in adjacent territories, and the arrival of animals from outside (including those animals that were put on the street by ex-owners). This is done in order to simplify further calculations; and we can afford it, because migration will depend not on what we do with street animals – but on whether they have somewhere to migrate; and how conscientious people are about owning a pet.

In order to further simplify our mathematical model, suppose that the population of stray animals is quite far from both the point of degeneration and the supporting capacity of the medium. We also have the right to do this, since the distortions introduced by approaching the population size to one of these points will depend not on the chosen strategy – but on the density of the population (that is, the number of animals per unit area); hence, they will be approximately the same for both irreversible capture and sterilization with return.

If we accept the above simplifications, then a number of parameters of our mathematical model become constant values. These are: fertility (hereinafter we will denote it as F), survival of cubs (hereinafter referred to as V), and mortality among adult animals (hereinafter referred to as M). We will express survival and mortality in shares: that is, if 80% of all cubs and 25% of adults die annually, then the survival rate will be equal to 0.2; and the mortality rate is 0.25, respectively.

We will count females as reproductively significant individuals (keeping in mind that the number of males will be about the same).

So, the general formula for changing the size of the population, left to itself, in our mathematical model will look like this:

$Ni = N(i-1) + FVN(i-1) – MN(i-1)$

After substitution and transformation, it will become as follows:

$Ni = N0(1 + FV – M)i,$

where N0 is the number of animals at the beginning of the observation, and i is the number of years that have passed since the beginning of the observation.

However, let's say that we decide to sterilize a certain part of stray animals every year. Let's denote the proportion of sterilized animals with the letter A, and the number of unsterilized animals as NF.

In this case, our equation will look slightly different:

$Ni = N(i-1) + FV(1-A)NF(i-1) – MN(i-1)$

Substitution and transformation will give us this formula:

$N1 = N0(1+(1-A)FV-M)$ – for the first year of sterilization;

$Ni = N(i-1)(1-M) + N0FV(1-A)i(1+FV-M)(i-1)$ for later years.

But sterilization is a troublesome and organizationally difficult task – especially on a large scale. Proof of this is the state of affairs in Italy, Greece and (especially) India – countries where sterilization of stray dogs with return to their former habitat is most widely used. A very successful result is considered to be at least the achievement of a certain percentage of sterilized females, and maintaining it at a more or less constant level through the annual mass additionalization of young animals.

Modify our equation for this case:

$Ni = N(i-1) + FV(1-A)N(i-1) – MN(i-1),$

which ultimately boils down to this formula:

$Ni = N0(1+(1-A)FV-M)i$

And finally, let's see what our mathematical model will look like for a population undergoing irreversible withdrawal. The proportion of animals seized annually we will denote as C:

$Ni = N(i-1)(1-C) + N(i-1)FV(1-C) – N(i-1)M(1-C)$

, and as a result of substitutions and transformations, we get the formula:

$Ni = N0((1-C)(1+FV-M))i$

**Part 2. The effectiveness of irreversible withdrawal and sterilization with return, or Everything is known in comparison.**

And now let's try to apply the obtained formulas, substituting specific values of various quantities in them.

According to various sources, the life expectancy of a stray animal on the street is 3-5 years; therefore, assuming that the annual mortality rate of adult animals will be 20% - we will not be very far from reality.

So, let's take M=0.2.

The mortality rate of young stray animals is much higher, and is - again, according to various sources - up to 90%. Consequently, we will not move away from reality by assuming that 20% of the cubs survive in our model population.

That is, let's take V= 0.2.

And suppose, finally, that each female brings an average of 6 cubs per year, half of which, in turn, are females.

Thus, F=6/2=3.

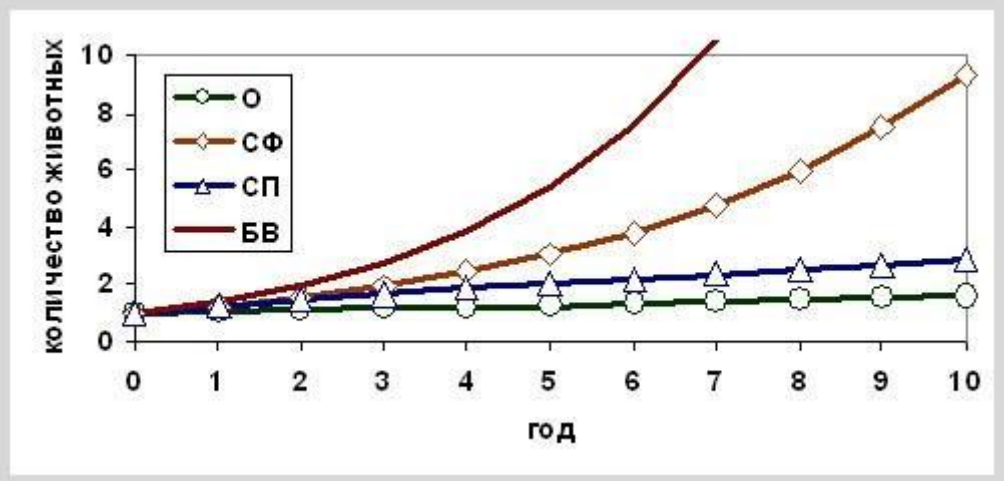
Now let's look at four variants of population dynamics – for which we have compiled equations in part 1. I'll list them again. So, the first option is to increase the population without human intervention (hereinafter - without intervention, BV); the second is the annual capture of a fixed percentage of animals (hereinafter referred to as trapping, O); the third is to maintain the percentage of sterilized animals at a certain level (hereinafter referred to as fixed sterilization, SF); the fourth is the annual sterilization of a fixed percentage of all fertile animals (hereinafter referred to as progressive sterilization, SP). Migration will be assumed to be zero, the intersex ratio is 1: 1.

Let's take the size of the population N 0 as 1 conventional unit, and the duration of our thought experiment is 10 years (where the zero year is the beginning of the "implementation" of our "program"). Well, everyone seems to have sorted out the assumptions - now let's start a mathematical narrative in five situations.

So, situation 1.

Our mathematically simulated "utilities" work through their sleeves, and capture or sterilize only 25% of the same mathematically simulated animals per year.

The results of their work - namely, the change in the number of stray animals during the implementation of the program - can be seen in the following figure:




For comparison, the growth curve of the population left to itself is given - without capture, without sterilization. In all subsequent drawings, this curve will not be - it is enough to demonstrate it at least once.

So, we see that animals, left to their own devices, successfully breed and reproduce – so successfully that by the end of the ten-year period their numbers increase by almost 30 times. We also see that no matter what measures we take, there is still nothing worse than inaction.

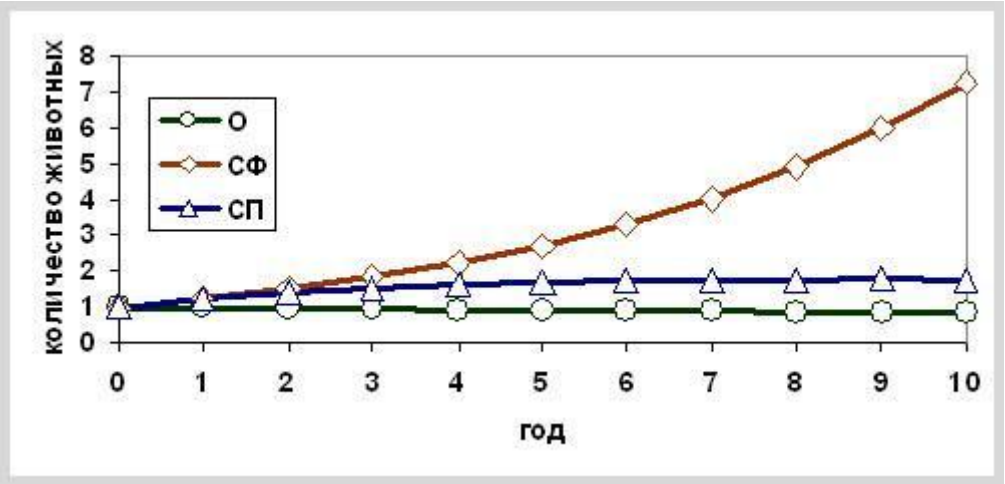
But we also see that measures are divisive.

Sterilization of a fixed percentage of animals is also completely ineffective: by the end of the ten-year "sterilization program", the number of homeless animals increased 10 times. Progressive sterilization leads to less disastrous – but, nevertheless, rather unpleasant results: to a threefold increase in numbers. The capture produced at such a low rate was also unable to fully cope with the reproduction of stray animals - but the scale of the troubles is the smallest: the animals have become only 1.6 times larger - which, against the background of the results of the application of other strategies, looks quite optimistic.

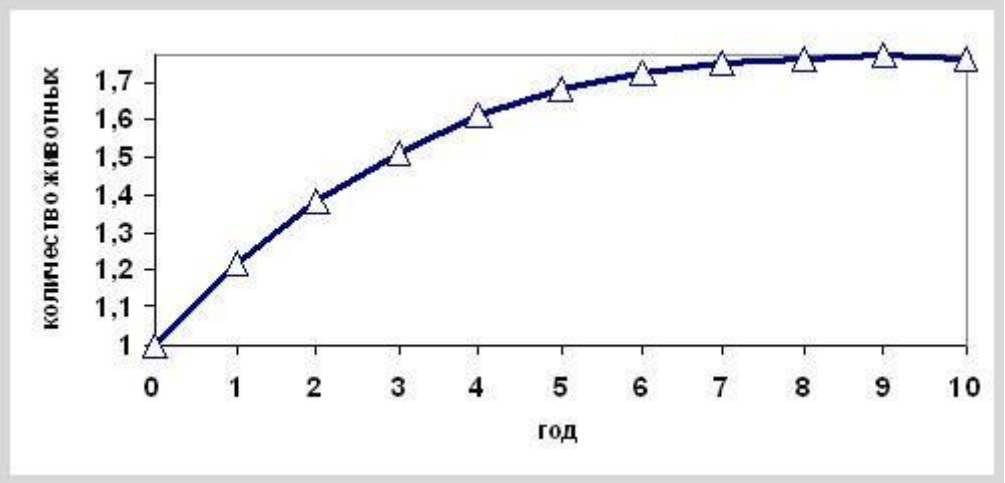
But, nevertheless, in all four cases, "utilities" deserve serious censure for clumsiness: 25% of animals that fall into the sphere of attention of communicators are not just small, but categorically insufficient.

Situation 2.

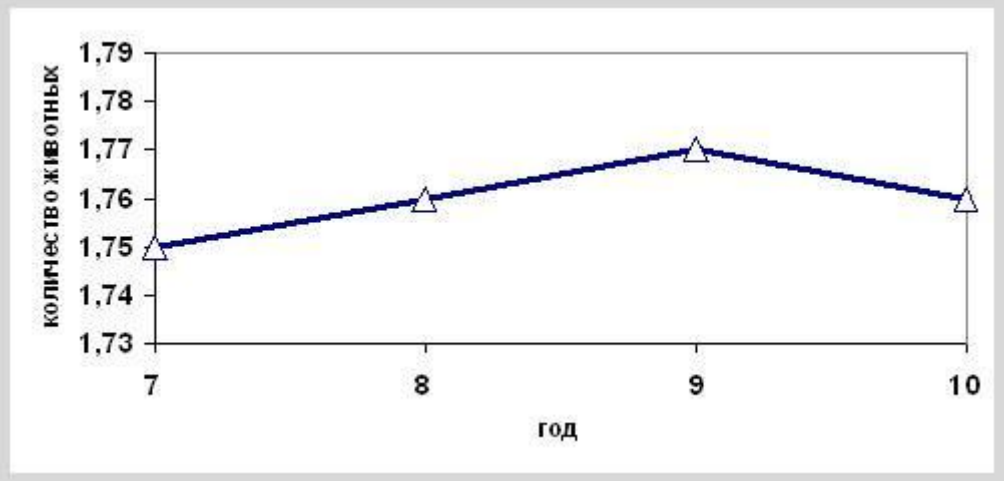
Under the pressure of a dissatisfied public, conditional utilities made a little fuss, and raised the bar to 30% of the population per year. The following came out of this:




Still the worst things went for the "sterilizers", who maintain a certain percentage of sterilized females. True, the population of stray animals by the end of the "program" increased not by more than 9, but only by 7 times - but it is unlikely that the inhabitants of our glorious mathematical city were so pleased with this. Their colleagues engaged in progressive sterilization turned out to be more successful (although they also deserved numerous complaints from conditional townspeople who were tired of flocks of homeless animals). At the same time, the picture illustrating the dynamics of the number of animals turned out to be much more interesting. Now we will show it close-up so that the ongoing processes are more visible:




- and even larger:



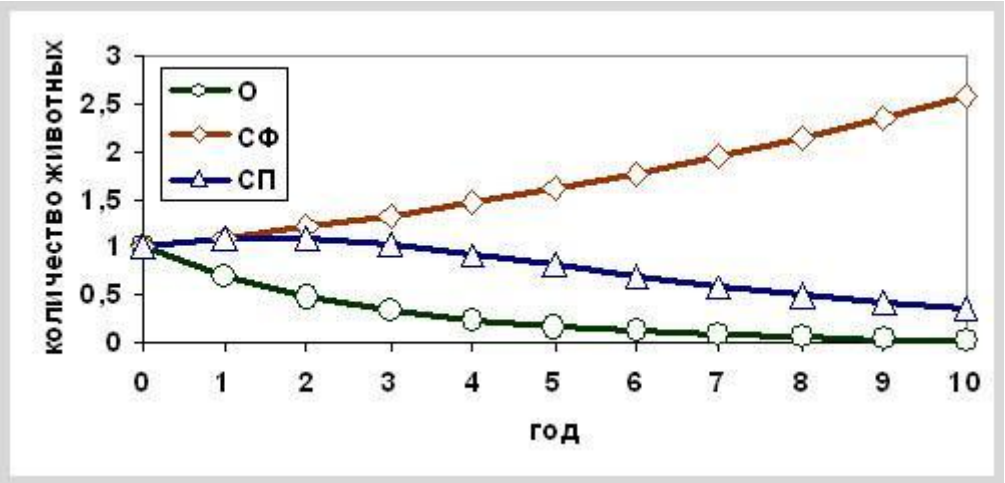

In the first year there is (naturally) an increase in numbers; well, that's understandable – the animals were sterilized, but left to live in the same place; mortality does not exceed the birth rate - everything is natural. Further, the rate of population growth slows down – and the 9th year of "program implementation" becomes a

turning point: after this year, for the first time, there is a microscopically small (0.5%) – but still a decrease in the population. But, nevertheless, this number remains high: 176% of the one that was at the beginning of the "experiment".

But the "catchers" have a slight - but still success: by the end of the "ten-year plan" (or the second five-year plan - this is who likes it more) the number of stray animals is reduced by 1/5 compared to the original. No, this, of course, is not enough, and the residents of our imaginary city have every right to express their "fe" - but, you see, compared to neighboring conventional cities, where animals are sterilized and returned to their former place, this result is quite good.

Situation 3.

The municipality was tired of the constant complaints of citizens, and the percentage of processed animals increased to 50. Just like that:

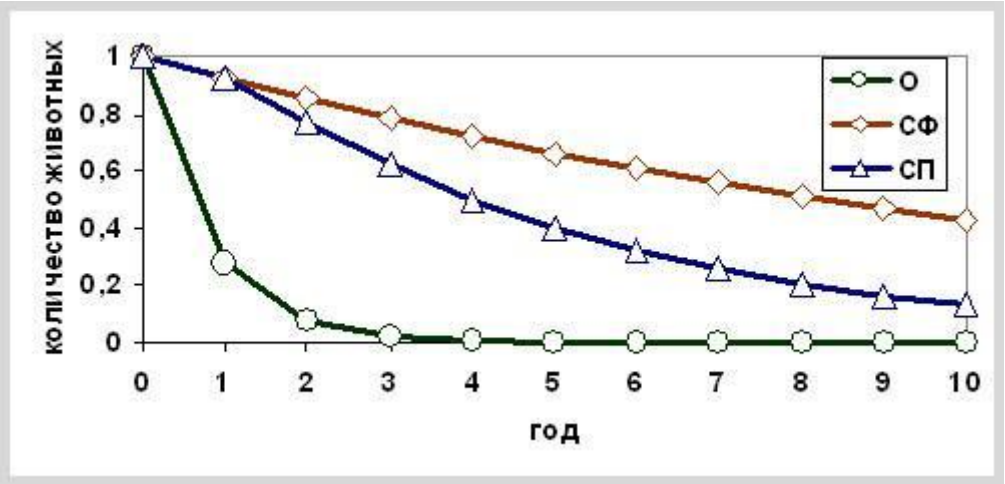



Well, that's a whole other thing! – exclaimed the inhabitants of the conditional city, in which animals were caught irretrievably. And in fact: the result of the work of the communers became more and more noticeable from year to year, and by the end of the "implementation of the program" of homeless animals there were only 3% of what was at the beginning.

The "sterilizers" were still doing noticeably worse – especially those who limited themselves to maintaining a fixed percentage of sterilized. They never managed to reverse the trend, and to achieve at least an end to the increase in the number of animals: in the 10th year, they became 2.6 times more than at first. "Progressive sterilizers" performed more successfully - the growth of the population was replaced by its reduction in the second year of work, and by the fourth year the animals became even slightly less than it was initially. By the end of the decade, only a third of them remained - but, nevertheless, compared to the results of the work of the "trappers", who almost completely liberated the city from stray dogs, it looked miserable.

Situation 4.

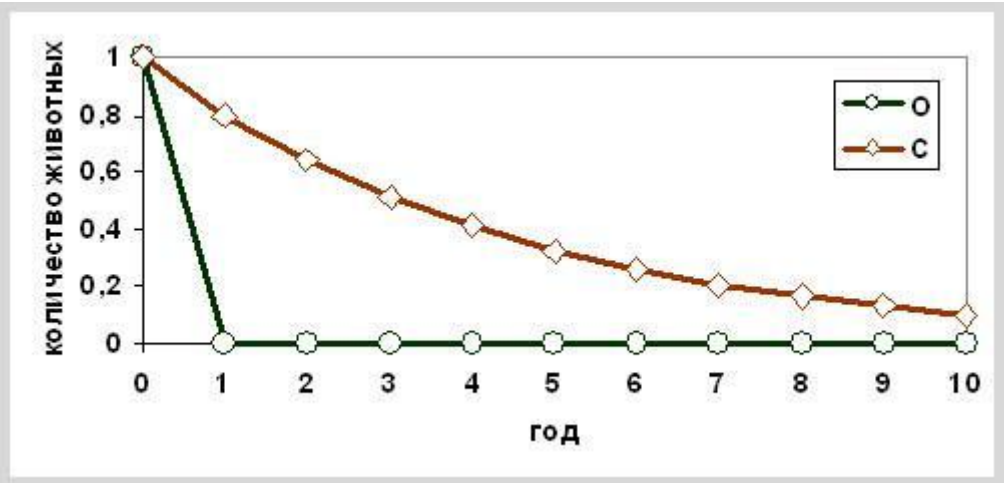
Our conditional "utilities" work hard, and the proportion of processed animals is 80%. In this case, each of the strategies used bears some results – but the difference between them remains as noticeable as before.




So, maintaining the percentage of sterilized animals at the level of 80% led to a decrease in their number - for 10 years by 60%. Not really, but still better than it was in previous situations. The result of progressive sterilization is 13% of the initial amount by the 10th year of the "program implementation". You can say that it is not bad – but only if you do not compare their achievements with the results of the activities of the "trappers". Trapping at this rate caused a sharp decline in the number of stray animals, and by the fourth year they were practically gone (0.5% of the original number) - and by the tenth year the problem of stray animals was finally solved.

Situation 5, utopian.

In the first year, absolutely all animals were treated.




The difference between the sterilization strategies under consideration, for obvious reasons, disappears - a gradual decrease in the number leads to the fact that about 10% of animals remain in the 10th year of the "program implementation". Well, since animals are still mortal, these 10% are old dogs who are no longer interested in anything but a bowl of porridge and basking in the sun: another year or two or three, and the wanderers will disappear as a class.

But.

When captured, they disappeared within the first year! hypothetical communal workers can rest on their laurels: there are no more animals, and they are not expected - and the townspeople by the end of the decade have long managed to forget what a stray animal looks like at all.

Inference? –You are welcome:

***The most effective approach to regulating the number of homeless animals is irreversible capture.***

It was understandable without mathematics – but still, some don't believe it.

## Part 3. The humanity and effectiveness of the sterilization program, or the Session of "black magic" with its complete exposure

Since our dear readers are generally interested in this article, it is unlikely that it is the first that they happened to read on this topic. And it would be truly surprising if among the previous publications he met were not a number of articles praising the many great advantages of the program for sterilizing homeless animals – both in terms of humanity and in terms of effectiveness.

One does not need to have the gift of clairvoyance to understand that some readers are already ready to object to us, relying on these texts.

However, we also read the same articles at one time – but nevertheless, they did not convince us.

Why?

Let's take turns looking at the standard "anti-trapping" arguments.

1) "Nature abhors a vacuum - the population will respond to trapping with a surge in reproduction."

Natural processes occur not by magic, but by the triggering of quite specific and material mechanisms. The main "response methods" were briefly described in the Introduction. A population does not respond to trapping or extermination: it responds to a decrease in the number of animals per unit area and to the amount of available food resources. That is, a decrease in the number due to the sterilization of some animals will similarly cause an increase in the annual population growth, as it would cause a decrease in number by irrevocable removal.

However, such a compensatory surge in reproduction will not lead to a complete recovery of the population if the rate of decline is high enough. Hunting specialists have long known about this; they even have a special term – "overfishing". Overfishing is the extraction of too many animals; it leads to the fact that the population does not have time to recover, and the number of animals of this species begins to fall steadily.

Thus, the realities of life will indeed make adjustments to our theoretical calculations – the real number curves will be slightly higher than we calculated in the previous part of our article; and the real thresholds for the effectiveness of the methods in question will also be higher. However, these amendments will concern not only trapping – but also sterilization.

Or let's put it a little differently: something that will reduce the efficiency of trapping will also reduce the effectiveness of sterilization.

2) " New animals will take the place of captured animals "

Animals are very conservative creatures. They do not like to change the usual order of things. Naturalists know that wild animals, moving around a fairly large area, try to adhere to the same route all the time: just as we humans trample paths and walk along them - so animals have their own paths, along which they walk constantly.

Naturally, migrations – that is, a complete change of habitat – are not made without good reason. If the animal came from somewhere to "fill the vacant place" - it means that for some reason it became difficult for him to survive in the old place. And if he is not allowed to this new place - then the animal, with a high degree of probability, will die.

Another important aspect is the lack of absolute territoriality in dogs and cats: new, alien members may well join the already established "team". I don't want to say that any outsider will be accepted unconditionally – I want to say that not every outsider will be unconditionally rejected.

Thus, the statement "old dogs will not let in newcomers" can be viewed from two sides.

If in any particular case it turns out to be correct, and the "old" animals really do not let the "new" ones in, then for these "new" animals this will mean a quick and difficult death. And if that's the case, then the sterilization program has no advantage in humanity.

If "new" animals are allowed into the "occupied" territory, and are able to survive thanks to this, then the sterilization program will not have advantages in efficiency.

3) " Sterilization will be cheaper: no need to spend money on long-term keeping of animals in a shelter . "

First, who said that animals should be kept in shelters for a long time "at public expense"? In the civilized world, shelters of long-term and lifelong maintenance are usually charitable institutions maintained at the expense of voluntary donations. The more such donations the shelter manages to collect, the more animals it will be able to keep at the same time, and the fewer "extra" animals will become, which will not be able to shelter due to lack of funds.

Secondly, any calculations of the cost-effectiveness of catching with return and without return do not take into account one simple thing.

The fact is that during sterilization with return, it turns out that throughout the life of the animal, its maintenance and treatment occur mainly at the expense of the guardians. Hence the apparent "cheapness" of CNVR: only budget funds spent on sterilization are taken into account there, but the personal costs of guardians are not displayed in any way - the costs are both monetary and time and effort (and if the guardian's animal does not have - then returning it to the street will simply be a cruel and inhumane act).

But why, then, not give all these people the opportunity to spend the same money, time and effort on keeping their captured wards in a shelter? Why not do in our country the same thing that exists in the rest of the civilized world?

Moreover, the shelter has those financial advantages over individual guardians that it:

- can purchase the necessary feed and everything else at wholesale prices (which is much cheaper);

- with less effort, it can organize the use of food waste from some catering establishments, removed from the sale of products with an expired implementation period (but still suitable for animal feeding), the collection of voluntary donations (both monetary and in the form of things, medicines, etc.);

- can contain its own full-time veterinarian (whose services will be cheaper than the appeals of individuals to veterinary clinics);

- can attract more additional sources of funding for the maintenance of animals (organization of charity bazaars, concerts, exhibitions; providing the population with the services of its full-time veterinarian and dog handler; etc.).

Consequently, for the same money, the shelter will be able to feed more animals than a single private person. Shelters are more effective than private care.

4) "Dogs will not let wild forest animals into the cities: they are our shield against rabies and other diseases"

Indeed, the more stray dogs there are, the fewer wild animals: this is a fact.

But to consider them as a kind of "barrier against rabies" is not necessary. If the dog is not vaccinated against rabies, then, on the contrary, it can serve as a transfer link that carries rabies from wild animals to humans. In order for the animal to have reliable immunity against this terrible disease, it must be re-vaccinated annually, or, at worst, every two years. And the annual capture and revaccination of all stray animals is not as simple as many people think.

I may be objected to: after all, special vaccines have now been developed that can not be administered in the form of an injection - but fed together with food bait; such vaccination will be much more effective than trapping and injections. But then tell me: why can't the same bait be used to vaccinate wild forest animals that live around settlements and even on their territory? This will be even easier – because the density of "populating" cities and their environs with wild animals is much less than the density that stray dog populations achieve. Let vaccinated urban foxes "protect" us from rabies brought from the forest - especially since the problems from wild foxes are much less than from stray dogs; and the protection of "their" territory from alien relatives in foxes is more pronounced than in dogs.

And, besides, if you look at the maps of the spread of rabies (such maps can be found, for example, on the WHO website), it turns out that countries in which there are no or almost no stray dogs are practically free of rabies. So, there are much more effective ways to combat this disease than attempts to scare away forest animals with the help of stray packs – right?

Consequently, stray dogs are not needed to protect people from rabies.

By the way, the question of the relationship between stray dogs and wild animals has another aspect. This is the aspect of humanity. Dogs not only and not so much - "scare away" wild animals from human settlements - as they simply exterminate them. For example, British zoologists have found that the young foxes living in London largely die from the teeth of stray dogs - although in Britain the problem of stray dogs is not the most acute. Victims of dogs, of course, are not only foxes, but also other animals - especially young and inexperienced. There’s no point in calling this state of affairs more humane than irretrievable capture.

5) " But with a working sterilization program, each animal has the opportunity to live out its life calmly - and irrevocable trapping will not do without euthanasia of healthy and viable animals! "

As already noted in the Introduction, stray animals rarely fully live out their lives: most often they die in the first years of their lives from diseases and accidents. And this spontaneous, unregulated death is no better than death as a result of euthanasia. Euthanasia, on the other hand, has two undeniable advantages over natural but untimely death:

- euthanasia of knowingly unattachable or hard-to-attach individuals increases the chances of surviving animals to find a new owner (or - to find the old one) and safely live to old age;

- normal euthanasia is a quick and painless death – whereas the natural death of a stray animal can be accompanied (and most often it is) by prolonged suffering.

**Conclusion.**

**Has the sterilization program been scientifically proven to be effective, or "Who are you?"**

"Yes, what are you telling me - after all, scientists from the Institute of Environmental Problems have long proved that stray animals in the city are necessary, and trapping is ineffective! Are you disputing their competence – or maybe you are a world-renowned zoologist yourself?" some reader might object to me.

No, not with the world and not even a zoologist. My professional interests are closer to genetics than to ecology.

But.

The Institute of Ecology and Evolution named after A.N. Severtsov did not conduct research that would prove the ineffectiveness of trapping and the effectiveness of sterilization, the need for stray animals to combat rats, the ability of stray dogs to protect people from rabies brought from the forest, and so on. These were just massively replicated in the popular press assumptions put forward by one of the scientific employees of the institute (A.D. Poyarkov), and not supported by sufficiently strong scientific evidence. Of course, he had the right to put forward any assumptions and share them with the general public – but let's still distinguish between an assumption and a proven scientific fact.

Moreover, the data of scientific studies, which were actually conducted in various countries of the world, prove, rather, the opposite: stray animals are an undesirable element of urban and, especially, wild fauna; and sterilization with return to the former habitat is a method applicable only in certain special circumstances. However, this is a separate big topic, which was analyzed in detail here by the creator of this site.

Let me finish on that.