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Quantitative and qualitative analysis of red deer in Somogy county between 1970 and 2006 using an age group population dynamic model

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ABSTRACT

The game managers annually complete the stock estimation of different game species. This data are the basis of the game management planning. The result of the estimation is very different from the real stock size. The population dynamic model (elaborated by the authors) use the bag size data and some ecological parameters of big game species to calculate the stock size. We calculated the red deer population stock size in Somogy county using of known bag size data since 1970. The result shows that the stock size estimated is unlike calculated. According to the model arithmetics in the ratio of female stock decreased strongly, the sex ratio has changed radically in favor of tags. The red deer stock became younger.
(Keywords: estimation, bag size, population dynamics, model, red deer (*Cervus elaphus*))

ÖSSZEFOGLALÁS

A gímszarvas mennyiségének és minőségének vizsgálata 1970 és 2006 között korcsoportos populáció-dinamikai modell segítségével Somogy megyében
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A vadgazdálkodók évente elvégzik a különböző vadfajok létszámának becslését. Ezen adatok alapján készülnek a vadgazdálkodási tervek. A becslések azonban jelentősen eltérhetnek a valós létszámtól. Az általunk kidolgozott populáció-dinamikai modell a terítékadatokat és a nagyvadfajok ökológiai jellemzőit felhasználva számítja ki a populáció létszámát. A modellel a Somogy megyében élő gímszarvas-állományt vizsgáltuk az 1970 óta rendelkezésünkre álló terítékadatok alapján. Az eredmények azt mutatják, hogy a becsült létszám lényegesen eltér a számítottól. Somogy megyében2006-ban 7 375 egyed volt a gímszarvas létszáma. A számítások szerint a tehenek aránya jelentősen csökkent, az ivararány eltolódott a bikák javára. A gímszarvas-állomány elfiatalodott.
Kulcsszavak: becslés, teríték, populáció-dinamika, modell, gímszarvas (*Cervus elaphus*)

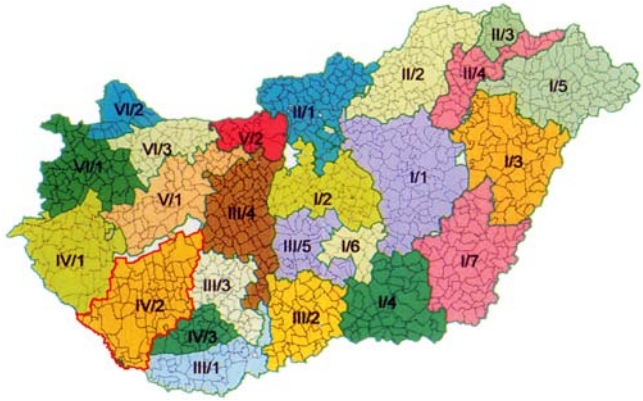
INTRODUCTION

In the examined Somogy county all the 72 game hunting areas are big game areas (*Figure 1*).

Due to its excellent quality the wise management of the Somogy county red deer stock is very important. This is verified by the fact that from the 17 Hungarian red deer trophies listed among the World's Top 10, three comes from the county studied.

Figure 1

Game management districts in Hungary



Source (*Forrás*): Hungarian Game Management Database, (*OVA*)

1. ábra: Vadgazdálkodási körzetek Magyarországon

The high ratio of medal priced trophies (643 from 1241 judged red deer trophies in the 2005/2006 hunting season) proof that the quality of the Somogy county's red deer stock is well above the world average.

In this county lives about 16-17% of the Hungarian red deer population. This number is in excess the allowable, and causes unbearable high damage in the agriculture/forestry.

For planning the annual as well as long-term reasonable harvest ratio require the knowledge of the correct stock size.

MATERIAL AND METHODS

The game managers estimate the big game stock size annually in Hungary.

To study the accuracy of estimation we examined the correlation of the big game stock estimated and the bag size in the period 1969-2004.

An age-group population-dynamic model was developed. The individuals of the different age groups are reproducing, dying, hunted or poached. These factors are given in percentages. Immigration and emigration is eliminated. The quantity of the present year age group is equal to the previous year quantity minus mortality, hunting and poaching. For reproduction the different age groups are taken with their specific reproductive potential. The progeny, the 0-year age group is the sum of the calves of two year and older hind age groups. The model is testable easily having harvest data since 1970.

Input data

Time step is one year.

The initial red deer number is based upon the estimation and empirical data available.

For the value of the reproduction rate only one observation is published in Hungary (*Heltay et al*., 1986).

In the beginning the 1:1 (stag:hind) birth sex ratio was used hypotatically, but later it was changed to 1:1.5.

The calves mortality ratio used is 15% according to *Náhlik (*2005). Over one year up to 15 year of age 5% for 15 and 16 year 50%, then 90% is estimated (*Caughly,* 1966). In a 30 year period only 55 stags' trophy older than 15 year of age were judged among the 31.725 as a total.

The harvest ratios of the stag age groups were given according to the age consistence of the hunting bag, however those of the hinds were based upon estimation, respectively. The annual poaching ratio is estimated to be 3% an the average. On the basis of empirical data and personal discussions this ratio was doubled (6%) from 1992. The initial consistence is the following: stags 38.5%, hinds 38.5% and calves 23%, what is close to the theoretical 40%-40%-20% found in the literature (*Rácz,* 1979).

By the model on the basis of the bag data available since 1970 and the known reproductive and mortality characteristics the long distance configuration of the red deer population size living in examined area (Somogy county) can be estimated. The model is suitable for forecasting too. The size of the red deer bag for the next few years can be estimated and the stock's number belonging to it can be calculated. It can be calculated what hunting strategy is useful to reach the prescribed stock of red deer (about 6.400 individuals) in Somogy county and how can be supported it.

We also analyzed the quality in the region on the basis of the red deer trophy database (n=31,725) using statistical methods. The medal ratio, average trophy weight by age groups were evaluated using time series analyses. To examine the age structure changes of the red deer population $\chi 2$-test was used. The data are available from 1974 to 2007 February.

RESULTS

We can see the growth of big game stock between 1969 and 2000 on the basis of the counties bag data.

We examined the correlation between the estimated stock size and the bag. The value is 0.88 in the case of the red deer, 0.96 for fallow deer, 0.5 for roe deer, and 0.97 for wild boar. The connection is close everywhere except roe deer, accordingly the opinion is justified, whereas the estimation depends on the intended bag.

Based on this model there were 6.736 red deer in the Somogy county. That is more than double of the amount estimated by game managers. By 1989 the population raised to 24.629. After reducing the population in 1994 it fell to 19.837. Then by 2000 it climbed to the maximum of 25.479. Because the numbers have been being strongly reduced since then, today there are as few as 7.375 animals estimated (*Figure 2*).

Calculations based on the model show that the original 1:1.5 sex ratio has changed radically as a result of the forced killing of females. Today there are more stags than females (*Figure 3*). This fact is supported by the field observation results too.

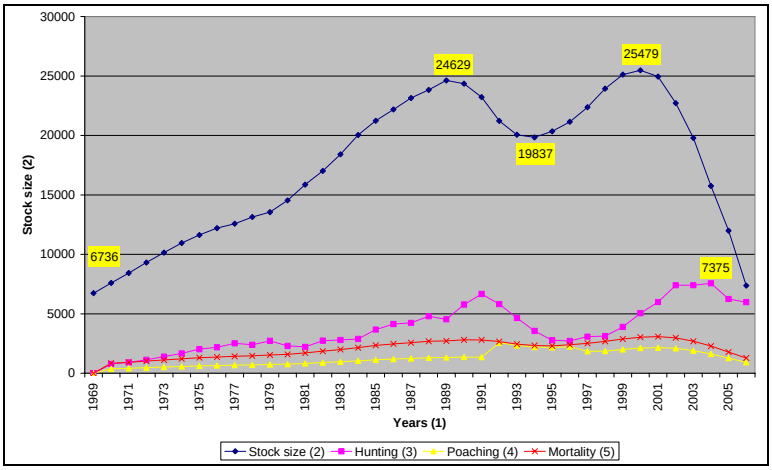
The rate of the medal priced is 39.8% of the judged trophies, consisting of 19.8% bronze, 15.0% silver and 5.0% gold medal in the analysed period, what shows an excellent stock quality.

The average weight of antlers belonging to the age groups from 4 to 10 years increased in 2004 and reached the 32 years period maximum in 2005 (*Figure 4*). This means that the previously saved stronger stags are killed now even at a younger age. Because of this the ratio of the older stags and so the medal awarding trophies are reduced. The red deer population is becoming too young. In 2006 except the 2, 3 and 5 year age groups the trophy weight is decreased.

In the age group data of 11 to 13 years of age the annual variations are much bigger and this age group sometimes missing in the bag (*Figure 5*).

Figure 2

The changes the red deer population stock size based on the model calculation between 1969 and 2006

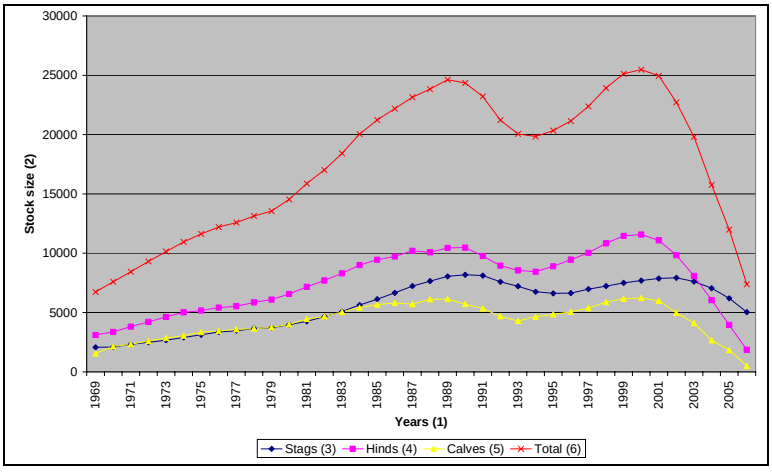


2. ábra: A gímszarvas-állomány változása a felállított modell alapján 1969-től 2006-ig

Évek(1) Létszám(2), Vadászat(3), Orvvadászat(4), Elhullás(5)

Figure 3

The structure of the red deer population based on the model calculation between 1969 and 2006 with the beginning stock size of 6.736

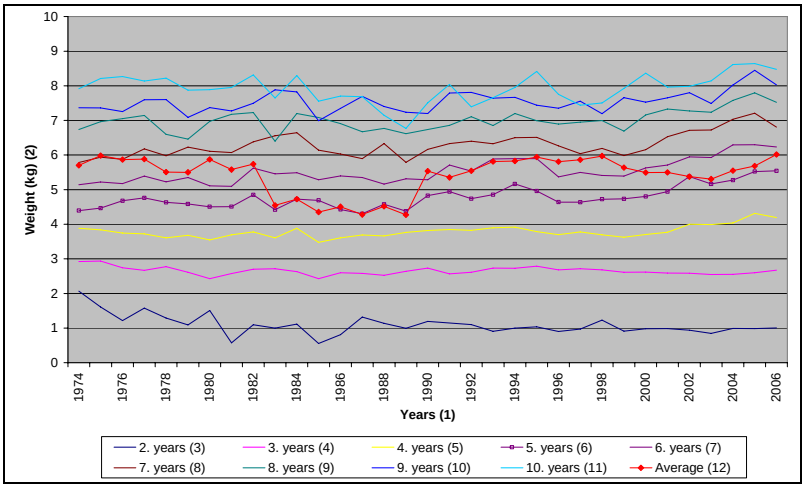


3. ábra: A gímszarvas-állomány összetétele a felállított modell alapján 1969-től 2006-ig 6736 induló létszám esetén

Évek(1) Létszám(2), Bika(3), Tehén(4), Borjú(5), Összesen(6)

Figure 4

The average trophy weight by age (2-10 year) and the annually average antler weight between 1974 and 2005

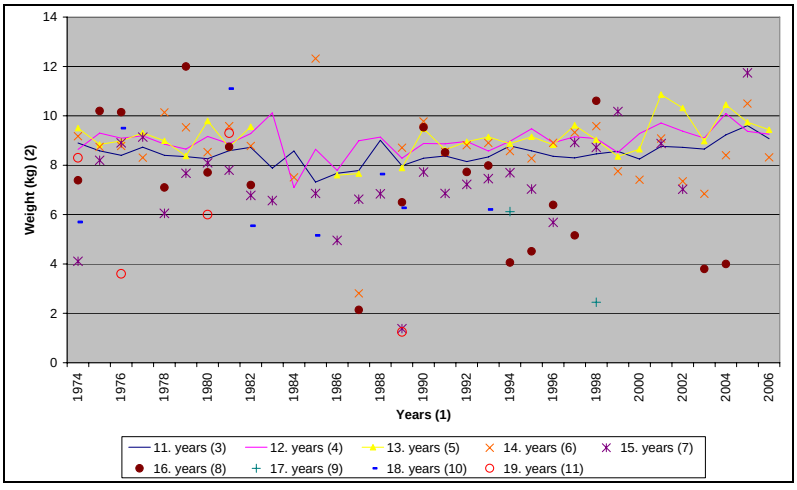


4. ábra: A korcsoportonkénti átlagos trófea tömeg (2-10 éves korig) és az éves átlagos agancs tömeg 1974 és 2005 között

Évek(1), Tömeg(kg)(2), Korcsoport(3)-(11), Átlag(12)

Figure 5

The average trophy weight by age (11 year and older) between 1974 and 2005



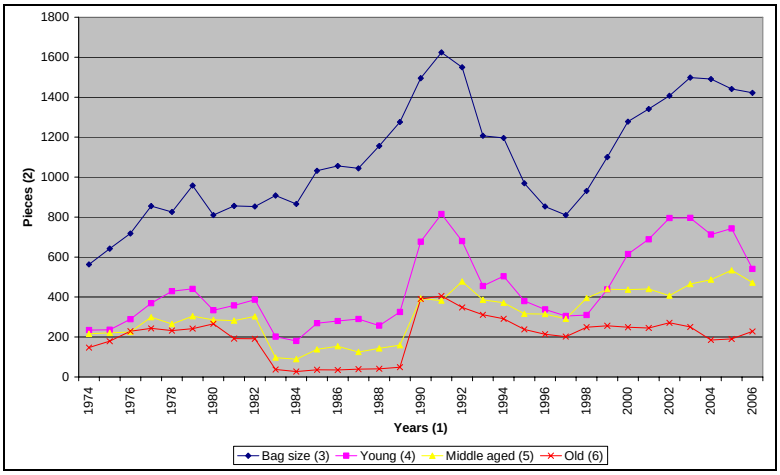
5. ábra: A korcsoportonkénti átlagos trófea tömeg (11 éves kortól) 1974 és 2005 között

Évek(1), Tömeg(kg)(2), Korcsoport(3)-(11), Átlag(12)

In the early nineties, because of the stock reduction lasting until today, the ratio of young stags in the bag increased heavily, however then the number of the middle-aged and old stags increased too, what cannot be told since 2000 (*Figure 6*). There could be two reasons of it: they spare the older stags, which can not be possible for a long time, or there are not so many old stags. The latter supposal's probability is larger.

Figure 6

The annual bag bag size in total and by age classes (1983-1989 is not complete data)



6 ábra: Az éves összes- és korosztályonkénti teríték (1983-1989 hiányos adatok)

Évek(1), Mennyiség(2), Teríték(3), Fiatal(4), Középkorú(5), Idős(6)

To examine the stock of the red deer stock becoming young χ2-test was used the, what justified statistically the changes ensued in the ratio of the age-groups. Since 2000 the rate of the old age-group has been under 20%, what has never been so low, what allows concluding that the stock became young (*Figure 7*). Now the stags are missing, which were shot as calves in the nineties.

In 2005 the penalties and monetary sanctions were revoked. The amount of the so called "negative mark" trophies is 8 times (142:17) higher than the 2004 value. This tendency to be continued in the according to the 2006/07 hunting season data.

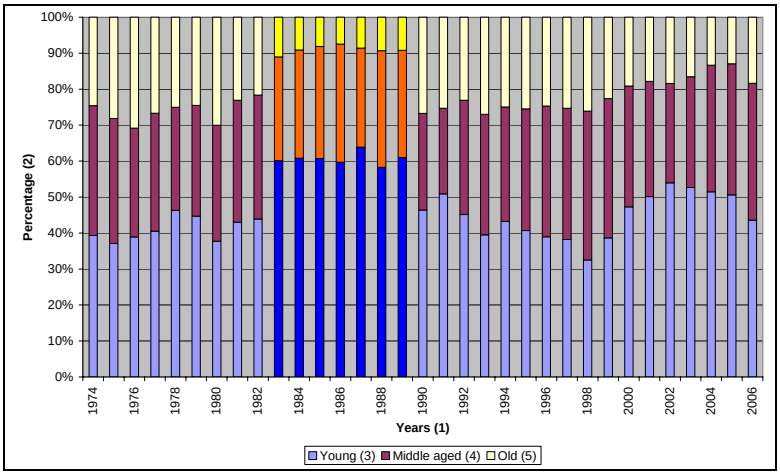
CONCLUSIONS

The stock of red deer was always underestimated by the game managers/hunters, therefore the age-group population-dynamic model is more suitable for the real estimation of the stock size information.

The composed model can be applied without modification for the population-dynamic calculations of other big game species. After granting the basic data characteristic for the given big game species (sex ratio, initial age-structure, reproduction, mortality, hunting and poaching rate), the changes in the stock size can be calculated in the given period.

Figure 7

The rate of annually and age group bag size (1983-1989 is not complete data)



7 ábra: Az éves teríték megoszlása korosztályonként (1983-1989 hiányos adatok)

Évek(1), Százalék(2), Fiatal(3), Középkorú(4), Idős(5)

According to the model arithmetics in the ratio of female stock decreased strongly, what should be stopped. If it would not happen, there will not be enough progeny, and therefore harvestable red deer, causing a decrease in the income.

The rate of the old stags together with the rate of the medal trophies has decreased in the bag. The red deer stock became younger.

Because of the stock size reduction now those stags (8-10 year of age) are shot too, what were not earlier. Nowadays the hunters had to decide not between the stags of weak and good ability, but between the good and the excellent, what needs very good professional experience.

If we want to keep the quality of red deer stock, the reduction should be done carefully. The future of the "Somogy" red deer will be determined in these years. Now the game managers have a big responsibility for assuring the same quality, with nearly the starting number of 1970. Otherwise we might loose our competitive edge versus the neighboring countries and the ramification will not be able to keep its revenue producing ability.

RECOMMENDATIONS

The big game stock size reduction should be done more carefully, because on the one hand it can alter the sex ratio, and could direct to unfavorable age-group composition, on the other hand it could result deterioration in quality, that can be put right only in twenty years. The economic effects of this are incalculable.

The age-group population-dynamic model should be used in practice too. Analyzing the results of calculation a lot of connection could be lighted, such as changing its parameters a lot of effects could be examined.

To decrease the damage caused by game methods should be found, which do not mean new burdens for the game managers. The new results of research should be nationwide introduced, so that they should be used in practice (for example with improvement of understory vegetation level the damage done by game can be decreased). The farmers should be made to be interested in preventing the game damage.

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